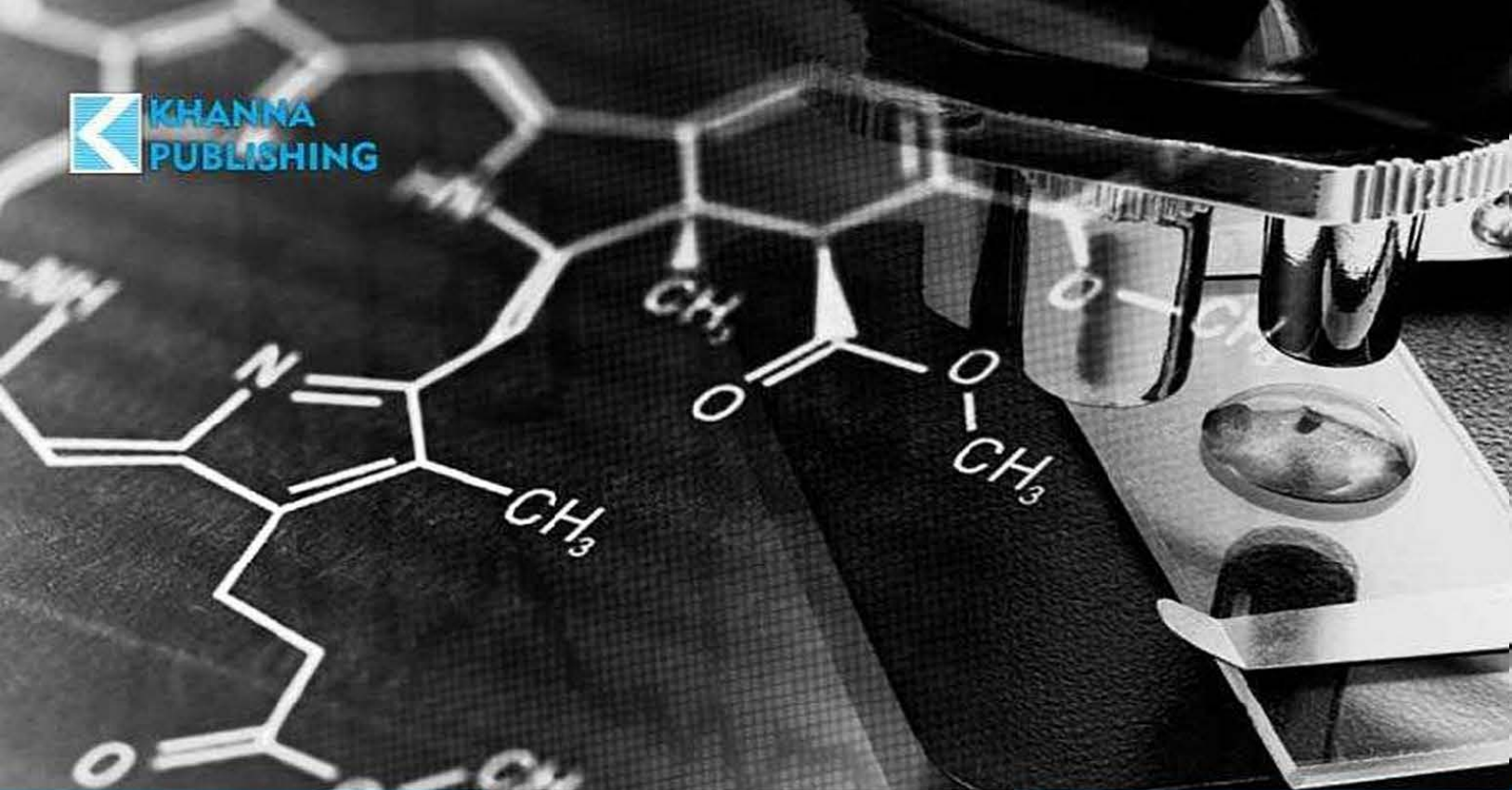




O.P. GUPTA



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Om Prakash Gupta

B.Tech. (Chemical Engg.) Ex DGM, HRD
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Steel Authority of India Limited (SAIL)

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**Objective Type Questions & Answers in CHEMICAL ENGINEERING Om
Prakash Gupta**

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Foreword

Although this book by Sh. Om Prakash Gupta is oriented primarily for the students and young Chemical Engineers, it can be of great value to any one engaged in Chemical Engineering Profession. In spite of several traditional books being available, the need of a ready means of knowledge has been long felt. Mr. Gupta has taken the trouble of filling this gap. The book's coverage is broad, the contents are well compiled, with good questions and arranged systematically.

I am sure, this book will be of great use.

Dr. S. C. Naik

Preface

This book is meant for diploma students of chemical engineering and also petroleum engineering both for their academic programmes as well as for competitive examinations. This book contains 18 chapters covering the entire syllabus of diploma course in chemical engineering and petrochemical engineering.

This book in its present form has been designed to serve as an encyclopedia of chemical engineering so as to be a ready reckoner apart from being useful for all types of written tests and interviews faced by chemical engineering and petrochemical engineering diploma students of the country. Since branch related subjects of petrochemical engineering are same as that of chemical engineering diploma students, so this book will be equally useful for diploma in petrochemical engineering students.

All the constructive and useful suggestions for the further improvement of the book will be gladly accepted and incorporated in the future editions/reprints.

— **Om Prakash Gupta**

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Fluid Mechanics

1. A fluid is the one, which **8.**

- (a) cannot remain at rest under the action of shear force.
- (b) continuously expands till it fills any container.
- (c) is incompressible.
- (d) permanently resists distortion.

2. In an incompressible fluid, the density is **9.**

- (a) greatly affected by moderate changes in pressure.
- (b) greatly affected only by moderate changes in temperature.
- (c) not affected with moderate change in temperature. With increase in the temperature, viscosity of **1** a liquid

- (a) increases
- (b) decreases
- (c) remains constant
- (d) may increase or decrease; depends on the

liquid

For water, when the pressure increases, the viscosity

- (a) also increases
- (b) decreases
- (c) remains constant
- (d) first decreases, and then increases

perature & pressure. **10.** For a fluid rotating at constant angular velocity about vertical axis as a rigid body, the pressure intensity varies as the

3. Potential flow is characterized by the (a) (a) irrotational and frictionless flow. (b) (b) irrotational and frictional flow. (c) (c) one in which dissipation of mechanical energy into heat occurs. (d) (d) formation of eddies within the stream.

11. The centre of pressure is (a) (a)

4. Newton's law of viscosity relates the (b) always below the centroid of the area. always above the centroid of the area.

(a) shear stress and velocity. (c) a point on the line of action of the resultant velocity gradient and pressure intensity. tangent force.

(c) shear stress and rate of angular deformation (d) at the centroid of the submerged area.

tion in a fluid. 12. A stream tube is that, which has.....cross-section (d) pressure gradient and rate of angular deformation entirely bounded by stream lines. formation. (a) a circular (b) any convenient

5. Dimension of absolute viscosity is (c) a small (d) a large

(a) $ML^{-1}T^{-1}$ (b) MLT^{-1} Mass velocity is independent of temperature & (c) $ML^{-1}T$ (d)

MLT 13.

square of the radial distance. radial distance linearly.

inverse of the radial distance. elevation along vertical direction.

6.

pressure, when the flow is Poise is converted into stoke by (a)

(a) multiplying with density (gm/cc). (b)

(b) dividing by density (gm/cc).

(c) Multiplying with specific gravity. (c)

unsteady through unchanged cross-section. steady through changing unchanged cross-section. steady and the cross-section is changed.

(d) dividing by specific gravity. 14. In turbulent flow, the

7. Dimension of kinematic viscosity. (a) fluid particles move in an orderly manner. (a) MLT^{-1} (b) $L^2 \cdot T^{-1}$ (b) momentum transfer is on molecular scale only. (c) L^2T (d) $L^2 \cdot T^{-2}$ (c) shear stress is caused more effectively by

cohesion than momentum transfer.

ANSWERS

1. (a) 2. (c) 3. (a) 4. (c) 5. (a) 6. (b) 7. (b) 8. (b)

9. (d) 10. (a) 11. (c) 12. (b) 13. (c) 14. (d)

(d) shear stresses are generally larger than in a similar laminar flow.

15. Turbulent flow generally occurs for cases in- volving.

- (a) highly viscous fluid
- (b) very narrow passages
- (c) very slow motion
- (d) none of these

16. An ideal fluid is

- (a) frictionless & incompressible.
- (b) one, which obeys Newton's law of viscosity. (c) highly viscous.
- (d) none of these.

17. Steady flow occurs, when the

- (a) conditions change steadily with time. (b) conditions are the same at the adjacent

points at any instant.

- (c) conditions do not change with time at any point.

(d) rate of the velocity change is constant. **18.** Which of the following must be followed by the flow of a fluid (real or ideal) ?

- (i) Newton's law of viscosity.
- (ii) Newton's second law of motion.
- (iii) the continuity equation.
- (iv) Velocity of boundary layer must be zero relative to boundary.
- (v) Fluid cannot penetrate a boundary.

(a) I, II, III (b) II, III, V

(c) I, II, V (d) II, II, V

19. The unit of velocity head is

- (a) m-Kg/Sec (b) m-Kg/m³ (c) m-Kgs/Kg (d) m-Kgs/Sec

20. Bernoulli's equation describes the

- (a) mechanical energy balance in potential flow. (b) kinetic energy balance in laminar flow. (c) mechanical energy balance in turbulent flow. (d) mechanical energy balance in boundary

layer.

21. The kinetic energy correction factor for velocity distribution of laminar flow is

(a) 0.5 (b) 1.66

(c) 1 (d) 2

22. In frictional fluid flow, the quantity,

$$\frac{P}{\rho} + \frac{V^2}{2g_c} + z$$

$$\frac{P}{\rho} + \frac{V^2}{2g_c} + z$$

(a) constant along a streamline.

(b) Not constant along a streamline.

(c) Increased in the direction of flow. (d) None of these.

23. The momentum correction factor for the velocity distribution of laminar flow is

(a) 1.3 (b) 1.66

(c) 2.5 (d) none of these **24.** The head loss due to sudden expansion is

$$\frac{V^2}{2g_c}$$

$$\frac{V^2}{2g_c}$$

$$\frac{V^2}{2g_c}$$

$$\frac{V^2}{2g_c}$$

$$\frac{V^2}{2g_c}$$

$$\frac{V^2}{2g_c}$$

(a)

(b)

$$\frac{V^2}{2g_c}$$

$$\frac{V^2}{2g_c}$$

$$\frac{V^2}{2g_c}$$

(c)

$$\frac{V^2}{2g_c}$$

(d)

$$\frac{V^2}{2g_c}$$

$$\frac{V^2}{2g_c}$$

$$\frac{V^2}{2g_c}$$

25. The head loss due to sudden contraction is proportional to (a) velocity

(c) turbulence (b) velocity head (d) none of these

26. The value of critical Reynolds number for pipe flow is
(a) 1300 (b) 10,000 (c) 100,000 (d) none of these.

27. Reynolds number for flow of water at room temperature through 2 cm dia pipe at an average velocity of 5 cm/sec is around

(a) 2000 (b) 10
(c) 100 (d) 1000

28. Shear stress in a fluid flowing in a round pipe (a) (b)

varies parabolically across the cross-section. remains constant over the cross-section.

(c) is zero at the centre and varies linearly with the radius.

(d) is zero at the wall and increases linearly to the centre.

29. Discharge in laminar flow through a pipe varies (a) (b) (c) (d)

as the square of the radius. inversely as the pressure drop. inversely as the viscosity. as the square of the diameter.

30. Boundary layer separation is caused by the reduction of pressure below vapour pressure. (a) reduction of pressure below vapour pressure. (b) reduction of pressure gradient to zero. (c) adverse pressure gradient.

(d) reduction of boundary layer thickness to

zero.

31. The friction factor for turbulent flow in a hydraulically smooth pipe

(a) depends only on Reynolds number.

ANSWERS

15. (d) 16. (a) 17. (c) 18. (b) 19. (c) 20. (a) 21. (b) 22. (b) 23. (b)

24. (b) 25. (b) 26. (a) 27. (d) 28. (c) 29. (a) 30. (c) 31. (a) (b) does not depend on Reynolds number. (c) depends on the roughness.

(d) none of these.

32. For a given Reynolds number, in a hydraulically smooth pipe, further smoothening.....the friction factor.

(a) brings about no further reduction of (b) increases

(c) decreases

(d) none of these

33. Hydraulic radius is the ratio of

(a) wetted perimeter to flow area.

(b) flow area to wetted perimeter.

(c) flow area to square of wetted perimeter. (d) square root of flow area to wetted perimeter.

34. Reynolds number is the ratio of

(a) viscous forces to gravity forces.

(b) inertial forces to viscous forces.

(c) viscous forces to inertial forces.

(d) inertial forces to gravity forces.

35. Mach number is the ratio of the speed of the (a) fluid to that of the light.

(b) light to that of the fluid.

(c) fluid to that of the sound.

(d) sound to that of the fluid.

36. Power loss in an orificemeter is.....that in a venturimeter.

(a) less than

(b) same as

(c) more than

(d) data insufficient, cannot be predicted

37. The velocity profile for turbulent flow through a closed conduit is (a)

logarithmic (c) hyperbolic

(b) parabolic (d) linear

38. For laminar flow through a closed conduit (a) $V_{max} = 2V_{av}$

(c) $V_{max} = 1.5V_{av}$

39. $f = 16/NRe$, is valid for (a) turbulent flow (b) $V_{max} = V_{av}$

(d) $V_{max} = 0.5 V_{av}$

(b) laminar flow through an open channel (c) steady flow

(d) none of these

40. Consider two pipes of same length and diameter through which water is

passed at the same velocity. The friction factor for rough pipe is f_1 and that for smooth pipe is f_2 . Pick out the correct statement.

- (a) $f_1 = f_2$
- (b) $f_1 < f_2$
- (c) $f_1 > f_2$
- (d) data not sufficient to relate f_1 & f_2

41. Bernoulli's equation for steady, frictionless, continuous flow states that the at all sec- tions is same.

- (a) total pressure (c) velocity head (b) total energy (d) none of these

42. Drag is defined as the force exerted by the (a) fluid on the solid in a direction opposite to flow. (b) fluid on the solid in the direction of flow. (c) solid on the fluid.

- (d) none of these.

43. Drag co-efficient for flow past immersed body is the ratio of.....to the product of velocity head and density.

- (a) shear stress
- (b) shear force
- (c) average drag per unit projected area (d) none of these

44. Stoke's law is valid, when the particle Reynolds number is

- (a) <1 (b) >1
- (c) <5 (d) none of these

45. Drag co-officient C_D , in Stoke's law range is given by

$$C_D = \frac{16}{Re_p} \quad (b) \quad C_D = \frac{24}{Re_p} \quad (a)$$

$$18.4 \quad (d) \quad C_D = 0.079 \quad (c) \quad C_D = \frac{0.25}{Re_p}$$

46. At low Reyn0olds number

- (a) viscous forces are unimportant.
- (b) viscous forces control.
- (c) viscous forces control and inertial forces

are unimportant.

(d) gravity forces control.

47. At high Reynolds number

(a) inertial forces control and viscous forces are unimportant.

(b) viscous forces predominate.

(c) inertial forces are unimportant and viscous forces control.

(d) none of these.

48. Pressure drop in a packed bed for laminar flow is given by the.....equation. (a) Kozney-Karman

ANSWERS

32. (a) 33. (b) 34. (b) 35. (c) 36. (c) 37. (a) 38. (a) 39. (b) 40. (c)

41. (b) 42. (b) 43. (c) 44. (a) 45. (b) 46. (c) 47. (a) 48. (a) (b) Blake-Plummer

(c) Leva's

(d) Hagen-Poiseuille's

49. Pressure drop in packed bed for turbulent flow is given by the.....equation.

(a) Kozney-Karman (b) Blake-Plummer (c) Leva's (d) Hagen-Poiseuille's **50.**

Forces acting on a particle settling in fluid are.....forces.

(a) gravitational & buoyant.

(b) centrifugal & drag.

(c) gravitational or centrifugal buoyant (d) external, drag & viscous.

51. Terminal velocity is

(a) a constant velocity with no acceleration. (b) a fluctuating velocity.

(c) attained after moving one-half of total distance.

(d) none of these.

52. Drag co-efficient in hindered settling is..... that in free settling.

(a) less than

(b) equal to

(c) not necessarily greater than

(d) always greater than

53. For the free settling of a spherical particle through a fluid, the slope of, $C_D - \log NRe$, plot is (a) 1 (b) -1

(c) 0.5 (d) -0.5

54. In continuous fluidisation

(a) solids are completely entrained.

(b) the pressure drop is less than that for

batch fluidisation.

(c) there is no entrainment of solids. (d) velocity of the fluid is very small.

55. Pressure drop in a fluidised bed reactor is.....that in a similar packed bed reactor. (a) less than (b) more than (c) same as (d) none of these

56. In a fluidised bed reactor

(a) temperature gradients are very high. (b) temperature is more or less uniform.

(c) hot spots are formed.

(d) segregation of the solids occurs.

57. Lower BWG means.....of the tube.

(a) lower thickness (b) (c) outer diameter (d) lower cross-section inner diameter

58. Cavitation occurs in a centrifugal pump when

the suction pressure is

(a) less than the vapour pressure of the liquid at the temperature.

(b) greater than the vapour pressure of the liquid at the temperature.

(c) equal to the vapour pressure.

(d) equal to the developed head.

59. Cavitation can be prevented by

(a) suitably designing the pump.

(b) maintaining the suction head sufficiently

(c)

greater than the vapour pressure. maintaining suction head = developed head. (d) maintaining suction head lower than the vapour pressure.

60. Priming is needed in a.....pump. (a) reciprocating (b) gear

(c) centrifugal (d) diaphragm

61. The general relationship between speed N , head H , power P and discharge Q

for a cen

trifugal pump is $\propto N^3$ (a) $Q \propto N : H \propto N^2 : P$

(b) $Q \propto N^2 : H \propto N^3 : P \propto N$

(c) $Q \propto N : H \propto N^3 : P \propto N^2$

(d) $Q \propto N^3 : H \propto N : P \propto N^2$

62. The maximum depth from which a centrifugal pump can draw water is

(a) dependent on the speed of the pump. (b) dependent on the power of the pump. (c) 34 feet.

(d) 150 feet.

63. Boiler feed water pump is usually a..... pump.

(a) reciprocating (b) gear (c) multistage centrifugal (d) diaphragm

64. Plunger pumps are used for

(a) Higher pressure (b) slurries (c) viscous mass (d) none of these

65. Molten soap mass is transported by a..... pump.

(a) diaphragm (c) gear

(b) reciprocating (d) centrifugal

66. To handle smaller quantity of fluid at higher discharge pressure, use a

.....pump. (a) reciprocating (b) centrifugal (c) volute (d) rotary vacuum

67. The actual velocity at vena-contracta for flow through an orifice from a reservoir is given by

ANSWERS

49. (b) 50. (c) 51. (a) 52. (d) 53. (b) 54. (a) 55. (b) 56. (b) 57. (b) 58. (a) 59. (b)

60. (c) 61. (a) 62. (c) 63. (c) 64. (a) 65. (c) 66. (a) 67. (a)

(a)

$C_v \cdot 2gH$ (b) $C_e \cdot 2gH$ (c) $C_d \cdot 2gH$ (d) $C_v V_a$

68. The fluid jet discharging from a 2" diameter orifice has a diameter of 1.75" at its vena contracta. The co-efficient of contraction is

(a) 1.3 (b) 0.766

(c) 0.87 (d) none of these

69. The discharge through a V-notch weir varies as (a) $H^{3/2}$ (b) $H^{1/2}$

(c) $H^{5/2}$ (d) $H^{2/3}$

70. The discharge through a rectangular weir varies as

(a) $H^{1/2}$ (b) $H^{5/2}$

(c) $H^{2/5}$ (d) $H^{3/2}$

71. Baffles in mixing tanks are provided to (a) reduce swirling and vortex formation. (b) increase the structural strength of tank. (c) aid in rotational flow. (d) none of these

72. Froude number is the ratio of

(a) shear stress to gravitational stress. (b) drag stress to shear stress.

(c) inertial stress to shear stress.

(d) inertial stress to gravitational stress. **73.** Most commonly use joint in the underground pipe lines is the (a) sleeve joint (c) flange

(b) coupling

(d) expansion joint **74.** The valve used for very remote and accurate control of fluid is a.....valve. (a) needle

(c) gate

75. Check valves are used (a) at high pressure. (b) in bends.

(c) for controlling water flow.

(d) for unidirectional flow.

76. Which of the following facilitates close control (b) globe

(d) butterfly

of flow of fluids? (a) Gate valve

(c) Butterfly valve (b) Globe valve (d) Check valve

77. The valve commonly used in pipes larger than

(b) plug-cock (d) check valve

2" dia is a

(a) globe valve (c) gate valve

78. A 2" gate valve fitted in a pipe is replaced by a similar globe valve. Pressure drop in gate valve was D_p . For the same discharge, the pressure drop across globe valve is

(a) D_p (b) $< D_p$

(c) $> D_p$ (d) D_p^2

79. Function of air vessel provided in a reciprocating pump is to

- (a) reduce discharge fluctuation.
- (b) reduce the danger of cavitation.
- (c) avoid the necessity of priming.
- (d) increase the pump efficiency.

80. Head developed by a centrifugal pump depends on its

- (a) speed
- (c) both (a) and (b) (b) impeller diameter (d) neither (a) nor (b)

81. The head loss in turbulent flow in a pipe varies (a) as velocity

- (b) as $(\text{velocity})^2$
- (c) inversely as the square of diameter (d) inversely as the velocity

82. One dimensional flow implies

- (a) flow in a straight line.
- (b) steady uniform flow.
- (c) unsteady uniform flow.
- (d) a flow which does not account for changes

in transverse direction.

83. In case of centrifugal fan or blower, the gas capacity varies as

- (a) speed (b) $(\text{speed})^2$ (c) $(\text{speed})^3$ (d) $(\text{speed})^{0.5}$

84. The continuity equation

- (a) relates mass flow rate along a stream tube. (b) relates work and energy.
- (c) stipulates that Newton's second law of motion

must be satisfied at every point in the fluid. (d) none of these.

85. Foot valves are provided in the suction line of a centrifugal pump to

- (a) avoid priming every time we start the

pump.

- (b) remove the contaminant present in liquid. (c) minimise the fluctuation in discharge (d) control the liquid discharge.

86. Differential manometer measures the (a) atmospheric pressure.

- (b) sub-atmospheric pressure.
- (c) pressure difference between two points. (d) none of these.

87. Velocity distribution for flow between two fixed parallel plates

ANSWERS

68. (b) 69. (c) 70. (d) 71. (a) 72. (d) 73. (a) 74. (a) 75. (d) 76. (b) 77. (c)
78. (c) 79. (a) 80. (c) 81. (b) 82. (d) 83. (a) 84. (a) 85. (a) 86. (c) 87. (a) (a)
varies parabolically across the section. (b) is constant over the entire cross-section. (c) is zero at the plates and increases linearly to the midplane.
(d) none of these.

88. While starting a centrifugal pump, its delivery' valve should be kept

(a) opened.

(b) closed.

(c) either opened or closed ; it does not make

any difference.

(d) either opened or closed; depending on the fluid viscosity.

89. A centrifugal pump designed for handling water ($\mu = 1$ cp) will deliver when pumping a thicker oil ($\mu = 30$ cp).

(a) less head & capacity

(b) more head

(c) more capacity

(d) less head & more capacity

90. Flow rate of high velocity flue gas discharged through a stack to the atmosphere can be most conveniently measured by a

(a) pitot tube (c) rotameter (b) manometer (d) none of these

91. Maximum theoretical suction lift for water at 15°C by a centrifugal pump is 34 ft. The same for water at 90°C will be.....ft.

(a) 40 (b) 34

(c) 8 (d) 37

92. Friction factor for a hydraulically smooth, pipe at $N_{Re} = 2100$ is f_1 . If the pipe is further smoothened (i.e., roughness is reduced), the friction factor at the same value of N_{Re} , will

- (a) increase.
- (b) decrease.
- (c) remain unchanged.
- (d) increase or decrease depending on the pipe material.

93. Vena-contracta formed during flow of a liquid through an orificemeter has
(a) minimum liquid cross-section.

(b) more diameter compared to orifice diameter. (c) minimum velocity of fluid stream. (d) none of these.

94. Reciprocating pumps compared to 'centrifugal pumps

(a) deliver liquid at uniform pressure. (b) can handle slurries more efficiently. (c) are not subject to air binding.

(d) can be operated with delivery valve closed.

95. A tube is specified by its

(a) thickness only

(b) outer diameter only

(c) thickness & outer diameter both

(d) inner diameter

96. For pipes that must be broken at intervals for maintenance, the connector used should be a/an (a) union (b) tee

(c) reducer (d) elbow

97. If more than two branches of pipes are to be connected at the same point, then use a/an (a) elbow (b) union

(c) tee (d) none of these.

98. The most economical flow control valve for use with large diameter pipes is a

(a) butterfly valve (b) globe valve (c) needle valve (d) none of these

99. Which of the following factors does not contribute to the pressure drop in a pipeline ? (a) Velocity of fluid

(b) Size of pipe

(c) Length of pipe and number of bends (d) None of these

100. Which of the following can be used to create a flow of gas, where no significant compression is required ?

- (a) Reciprocating compressor
- (b) Blower
- (c) Axial flow compressor
- (d) Centrifugal compressor

101. Erosion and pits formation on the impeller of a centrifugal pump may be due to

- (a) cavitation.
- (b) low speed of impeller.
- (c) its operation with delivery valve closed for

considerable time after starting the pump. (d) off centering of pump with motor.

102. Which of the following valves will incur maximum pressure drop for the same discharge of water ?

- (a) Globe valve (b) Gate valve (c) Needle valve (d) Butterfly valve

103. While starting an axial flow pump, its delivery valve should be kept

- (a) open (b) closed
- (c) either open or closed (d) none of these

ANSWERS

88. (b) 89. (a) 90. (a) 91. (c) 92. (a) 93. (a) 94. (c) 95. (c) 96. (a) 97. (c) 98. (a) 99. (d) 100. (b) 101. (a) 102. (c) 103. (a)

104. Interstage coolers are provided in a multistage compressor to

- (a) save power in compressing a given volume to a given pressure.
- (b) cool the delivered air.
- (c) achieve the exact delivery pressure. (d) none of these.

105. Surge tanks are provided in high pressure water pipelines to

- (a) store a definite quantity of water all the time. (b) reduce the water hammer.
- (c) facilitate easy dismantling of pipeline for

cleaning and maintenance.

- (d) none of these.

106. Pipes having diameter 14 inches or more are designated by their
(a) outside diameter (b) inside diameter (c) schedule number (d) none of these

107. Nominal Pipe Size (NPS) of a pipe less than 12 inches in diameter indicates its

- (a) inner diameter
- (b) outer diameter
- (c) thickness
- (d) neither inner nor outer diameter

108. The most important factor, which determines the maximum height to which water can be lifted by a pump at standard temperature is the (a) barometric pressure

- (b) speed of the impeller
- (c) diameter of the impeller
- (d) both (b) and (c)

109. Gear pump

- (a) is a positive displacement pump. (b) is a centrifugal pump.
- (c) is a non-positive displacement pump. (d) can be started with delivery valve closed.

110. When the water is warm, the height to which it can be lifted by a pump
(a) decreases due to reduced viscosity. (b) decreases due to reduced vapour pressure. (c) increases due to increased vapour pressure. (d) decreases due to increased frictional resistance.

111. Multistage centrifugal pumps are generally used for

- (a) high head.
- (b) low head but high discharge.
- (c) highly viscous liquid.
- (d) slurries of high solid concentration.

112. Nominal size of the discharge pipe of a pump is usually.....the nominal size of the inlet pipe.

- (a) smaller than (b) larger than (c) same as (d) twice

113. Horsepower requirement for given pump capacity depends upon the

- (a) specific gravity of the liquid
- (b) suction lift

- (c) discharge head
- (d) all (a), (b) and (c)

114. Which of the following is the most common pump for pumping either raw sewage or sludge ? (a) Electromagnetic pump

- (b) Centrifugal pump
- (c) Reciprocating pump
- (d) Gear pump

115. Self-priming centrifugal pump can be used for (a) booster service.
(b) pumping liquid fertilisers (e.g. liquid NH_3). (c) pumping industrial wastes.
(d) all (a), (b) and (c).

116. I.D. of 1/4" schedule 40 pipe is 0.364". I.D. of a 1/2" schedule 40 pipe would be inch (a) 4.728 (b) 0.5
(c) 0.622 (d) 0.474

117. With increase in the schedule number of a pipe of a particular nominal size, the (a) wall thickness also increases.
(b) I.D. of the pipe decreases.
(c) O.D. of the pipe remains constant. (d) all (a), (b) and (c)

118. The nominal size of a hose pipe is specified by its
(a) I.D. (b) O.D.
(c) thickness (d) none of these

119. Fanning friction factor equation applies to the.....fluid flow.
(a) non-isothermal condition of
(b) compressible
(c) both (a) and (b)
(d) neither (a) nor (b)

120. Which of the following may be termed as a variable orifice flowmeter?
(a) Rotameter (b) Pitot tube
(c) V-notch (d) All (a), (b) and (c)

121. Pressure gradient in the pipe flow is influenced by the
ANSWERS

104. (a) 105. (b) 106. (a) 107. (d) 108. (a) 109. (a) 110. 111. (a) 112.(a)

113. (d) 114. (c) 115. 116. (c) 117. 118.(a) 119. (d) 120.(a) 121. (d) (a) diameter of pipe,
(b) velocity of the fluid.
(c) density & viscosity of the fluid.
(d) all (a), (b) and (c).

122. Check in a centrifugal pump is
(a) provided in the discharge line.
(b) generally a globe valve.
(c) provided to prevent liquid from backing

up through the pump when the pump is turned off or accidentally stops running.

(d) all (a), (b) and (c).

123. Cavitation in a centrifugal pump results from
(a) high discharge pressure
(b) low barometric pressure
(c) high discharge velocity
(d) high discharge rate

124. Which of the following is used for pumping crude oil from oil well ?
(a) Single stage centrifugal pump

(b) Gear pump
(c) Screw pump
(d) Duplex/triplex reciprocating pump

125. Which of the following is most prone to pulsating discharge flow ?
(a) Centrifugal pump
(b) Reciprocating pump
(c) Gear pump
(d) Axial flow pump

126. A centrifugal pump designed to pump water is employed to pump a more viscous oil. In the later case, the pump
(a) develops a lower head.
(b) capacity is reduced.
(c) requires more power.
(d) all (a), (b) and (c).

127. With a constant diameter impeller of a centrifugal pump
(a) its capacity varies directly as the square

of speed.

(b) head varies as the square of speed. (c) horsepower input varies as the square
of

speed.

(d) head varies as the speed.

128. At a constant speed of the centrifugal pump its.....the impeller
diameter. (a) capacity varies directly with

(b) head varies as the square of

(c) horsepower varies as the cube of (d) all (a), (b) and (c)

129. Viscosity of a liquid decreases.....with rise in temperature.

(a) exponentially (b) linearly (c) logarithmically (d) none of these

130. Pick out the Hagen-Poiseuille's equation.

$\Delta p = \frac{128 \mu L Q}{\pi D^4}$

(a)

.2

$\Delta p = \frac{128 \mu L Q}{\pi D^4}$

(b) $\Delta p = \frac{128 \mu L Q}{\pi D^4}$

(c) $\Delta p = \frac{128 \mu L Q}{\pi D^4}$

(d)

$\Delta p = \frac{128 \mu L Q}{\pi D^4}$

$\Delta p = \frac{128 \mu L Q}{\pi D^4}$

$\Delta p = \frac{128 \mu L Q}{\pi D^4}$

$\Delta p = \frac{128 \mu L Q}{\pi D^4}$

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$\Delta p = \frac{128 \mu L Q}{\pi D^4}$

$\Delta p = \frac{128 \mu L Q}{\pi D^4}$

$\Delta p = \frac{128 \mu L Q}{\pi D^4}$

$$\frac{32 \mu L Q}{\pi D^4}$$

(d)

$$D =$$

$$1.75$$

$$(1$$

–

$$E$$

)

.

$$pV$$

$$\frac{2}{\rho}$$

$$L$$

$$E$$

$$\frac{3}{4} \mu L Q$$

131. Equivalent length of a pipe fitting is (a) dependent on Reynolds number. (b) independent of Reynolds number. (c) dependent on the length of the pipe. (d) none of these.

132. Creeping flow around a sphere is defined, when particle Reynolds number is

$$(a) < 2100 \quad (b) < 0.1$$

$$(c) > 2.5 \quad (d) < 500$$

133. Pressure drop (Δp) for a fluid flowing in turbulent flow through a pipe is a function of velocity (V) as

$$(a) V^{1.8} \quad (b) V^{-0.2}$$

$$(c) V^{2.7} \quad (d) V^2$$

$\frac{5}{2}$ / sec is moving at critical **134.** A fluid

cal flow condition ($N_{Re} = 2100$) through a pipe of dia 3 cms. Velocity of flow is.....cm/sec. (a) 7 (b) 700 (c) 7000 (d) 630

135. Multistage compressors are used in industry, because they

(a) reduce the cost of compressor.

(b) reduce the size requirement.

(c) resemble closely to isothermal compression. (d) are easy to control.

136. For pumping slurry, one can use a-----pump. (a) (c)

reciprocating centrifugal (b) diaphragm (d) pneumatic

137. The pressure head of a flow meter remains constant for

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122. (d) 123. (b) 124. 125. (c) 126. 127.(b) 128.(d) 129.(c) 130. (b)

131. (a) 132. (b) 133. (d) 134.(a) 135. (c) 136.(b) 137.(c)

(a) venturimeter (c) rotameter (b) orificemeter (d) pitot tube **138.** For very low pressure and high discharge rate, the compressor used is a/an..... compressor.

(a) axial (b) reciprocating (c) rotary (d) none of these **139.** Reynolds number for water flow through a tube of I.D. 5 cm is 1500. If a liquid of 5 centipoise viscosity and 0.8 specific gravity flows in the same pipe at the same velocity, then the pressure drop will

(a) increase

(b) decrease

(c) remain same

(d) data insufficient to predict pressure drop **140.** A liquid is pumped at the rate of 600 litres using 1000 rpm. If the rpm is changed to 1100, the liquid pumped is.....litres. (a) 600 (b) 660

(c) 1.1 (d) 60

141. For the same flow rate of a fluid, the pressure drop is the least for

(a) venturimeter (c) flow-nozzle (b) orificemeter

(d) Dp is same for all

142. Two fluids are flowing through two similar pipes of the same diameter. The Reynold's number is same. For the same flow rate if the viscosity of a fluid is reduced to half the value of the first fluid, the pressure drop will (a) increase

(b) decrease

(c) remain unchanged

(d) data insufficient to predict relative

143. Net positive suction head (NPSH) of a centrifugal pump must be

(a) greater than the vapour pressure of the

liquid.

(b) less than the vapour pressure of the liquid. (c) equal to the vapour pressure of the liquid. (d) less than barometric pressure.

144. A centrifugal pump used to pump water is used to pump an oil with specific gravity of 0.8 at the same rate. The power consumption will now

(a) increase

(b) decrease

(c) remain same

145. Assuming flow to be laminar, if the diameter of the pipe is halved, then the pressure drop will (a) increase (b) decrease (c) remain same (d) be quadrupled

146. For the transfer of solution of thick slurry, the pump used is

a.....pump.

(a) reciprocating (b) gear

(c) diaphragm (d) centrifugal

147. Pick out the Kozney-Karman equation (valid for low N_{Re}) for fluid flow through a packed bed of solids.

D =

4.

LV

^{2}

(a)

.2

$p Dg_c$

(b) $f^{-} = +1.75p NRe$

$-Dpg_c D^{2.3}$

(c)

pE

LV

0

.

m

(1

—

E

)
 $\rho_2 = 150$
 t
 $-D$
 p
 $\cdot$
 g
 c
 $\cdot$
 DE
 ^{3}
 $p. = 1.75(d) \quad d. 1^2 LE - o$

148. Bernoulli's equation accounts for the (a) Various momentums
 (b) Various masses
 (c) Different forms of mehanical energy (d) none of these

149. When the pipe Reynold's number is 6000, the flow is generally
 (a) viscous (b) laminar (c) turbulent (d) transition

150. Diaphragm pumps are used to transport (a) solids (b) liquids (c) fluids (d) slurries

151. Cocks are used to control
 (a) water (b) any liquid (c) solids (d) none of these

152. Check valve is used for.....flow. (a) very precise control of
 (b) unidirectional
 (c) multidirectional
 (d) none of these

153. Nominal size of a pipe is an indication of its.....diameter.
 (a) inner (b) outer
 (c) approximate (d) none of these

(d) data insufficient to predict

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138. (c) 139. (a) 140. (b) 141. (a) 142. 143. (a) 144. (b) 145.(a) 146. (c) 147. (c)
 148. (d) 149. (c) 150.(d) 151.(b) 152.(b) 153.
 (c)

du^n

154. In power law, $\tau = +AB$, if $n = 1$ and B

$\neq$

0, then the fluid is

(a) Newtonian (b) dilatant (c) thixotropic (d) rheopectic

155. Cavitation in a pump creates so many undesirable effects. Out of the following, which is not an undesirable effect created by cavitation ? (a) Decrease in effect

(b) Increase in thrust

(c) Develops noise

(d) Develops high pressure

156. A rotameter works on the principle of..... pressure drop. (a) constant

(c) both (a) & (b) (b) variable

(d) neither (a) nor (b)

157. Enamels and paints are generally.....fluid. (a) rheopectic (c)

thixotropic (b) pseudo-plastic (d) dilatant

158. For ideally incompressible fluid, the Mach number will be

(a) 1.5 (b) 1

(c) 0 (d) 5

159. Select the correct practical example of steady non-uniform flow.

(a) Motion of water around a ship in a lake. (b) Motion of river around bridge piers. (c) Steadily decreasing flow through a reducing section.

(d) Steadily increasing flow through a pipe. **160.** A streamline is

(a) the line connecting the mid-points of flow cross-sections.

(b) defined for uniform flow only.

(c) drawn normal to the velocity vector at every point.

(d) always the path of a particle.

161. The head loss in turbulent flow in a pipe varies

(a) directly as the velocity.

(b) inversely as the square of the velocity,

(c) approximately as the square of the velocity.

(d) inversely as the square of the diameter. **162.** The continuity equation in ideal

fluid flow
states that

- (a) net rate of inflow into any small volume must be zero.
- (b) energy is not constant along a streamline.
- (c) energy is constant along a streamline.
- (d) there exists a velocity potential.

163. Which of the following is a dimensionless parameter ?

- (a) Angular velocity (b) Specific weight (c) Kinematic viscosity (d) None of these

164. In laminar flow through a round tube, the discharge varies

- (a) linearly as the viscosity.
- (b) inversely as the pressure drop.
- (c) inversely as the viscosity.
- (d) as the square of the radius.

165. The Prandtl mixing length is

- (a) zero at the pipe wall and is a universal constant.
- (b) independent of radial distance from the pipe axis.
- (c) independent of the shear stress.
- (d) useful for computing laminar flow problems.

166. Boundary layer separation is caused by the (a) reduction of pressure to vapour pressure. (b) boundary layer thickness reducing to

zero.

- (c) adverse pressure gradient.
- (d) reduction of pressure gradient to zero.

167. Boundary layer separation occurs when the (a) pressure reaches a minimum.

- (b) cross-section of the channel is reduced. (c) valve is closed in a pipeline.
- (d) velocity of sound is reached.

168. The terminal velocity of a small sphere settling in a viscous fluid varies as the (a) first power of its diameter.

- (b) inverse of the fluid viscosity.
- (c) inverse square of the diameter.

(d) square of the difference in specific weights of solid & fluid.

169. The head losses in open channel flow generally vary as the

(a) inverse of the roughness.

(b) first power of the roughness.

(c) square of the velocity.

(d) inverse square of hydraulic radius.

170. In turbulent flow, a rough pipe has the same friction factor as a smooth pipe

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154. (a) 155. (d) 156. (a) 157. (b) 158. (b) 159. (c) 160. (c) 161. (c) 162. (a)

163. (d) 164. (c) 165. (d) 166. (d) 167. (b) 168. (b) 169. (d) 170. (b) (a) in the zone of complete turbulence. **178.** Choose the correct set of dimensions of viscosity when the roughness projections are of the order of magnitude much smaller than the thickness of the laminar film.

(a) $FL^{-2}T$, $ML^{-1}T^{-1}$ (b) $FL^{-2}T$, $ML^{-1}T^{-1}$ (c) $ML^{-1}T^{-3}$, $F^{-1}L^2T$ (d) $F^{-1}L^2T^{-1}$, MLT^{-3}

(c) everywhere in the transition zone.

where, F, M, L, T are dimensions for force, mass, (d) when the friction factor is independent of length and time respectively.

the Reynold's number. **179.**

171. In the complete turbulence zone (in rough pipes), the

(a) rough and smooth pipes have the same friction factor.

(b) laminar film covers the roughness projections.

If two capillary tubes of dia 0.5 mm and 1 mm are dipped in a pot containing mercury, then the rise of mercury is

(a) same in both the tubes. (b) greater in 1 mm dia tube. (c) greater in 0.5 mm dia tube. (d) zero in both the tubes.

(c) friction factor depends upon N_{Re} only. **180.** Which of the following is a Newtonian fluid?

(d) friction factor is independent of the relative roughness. (a) Rubber latex (b) Sewage sludge

172. The length of the tube necessary for the (c) Quicksand

boundary layer to reach the centre of the tube (d) Non-colloidal solution and for fully developed flow to be established

181. The schedule number of a pipe is an indication of its (a) equivalent (b) transition (a) size (b) roughness (c) Prandtl mixing (d) none of these (c) material density (d) wall thickness

173. Transition length for a turbulent fluid enters **182.** Volume of liquid displaced by a

floating body ing into a pipe is around.....times the is equivalent to its pipe diameter. (a) own weight (b)(a) 5 (b) 50 (c) own volume (d)

submerged weight submerged volume

(c) 500 (d) 1000 **183.** Pascal law is not applicable for a/an.....fluid. **174.** Purpose of relief valve

in a reciprocating

(a) accelerating frictionless pump is to (b) static (a) protect the pump against developing ex (c) uniformly moving excessive pressure. (d) none of these (b) facilitate unidirectional flow of liquid. **184.** What is the unit of kinematic viscosity SI unit ? (c) reduce the discharge pressure. (a) m^2/sec (b) $\text{N}/\text{m}^2 \cdot \text{sec}$ (d) control the rate of discharge. (c) $\text{Kg} \cdot \text{sec}/\text{m}$ (d) None of these **175.** Centrifugal compressors compared to recip **185.** One dimensional fluid flow implies the rotating compressors (a) flow in straight lines only. (a) require less space. (b) uniform flow. (b) have quieter operation. (c) steady uniform flow. (c) have lower operating costs. (d) flow in which transverse components are (d) all (a), (b) and (c). zero. **176.** Which of the following produces maximum **186.** The discharge through a semi-circular weir pressure difference for transportation of gases ? varies as (a) Vacuum pumps (b) Blowers (a) H (b) H^2 (c) Fans (d) Compressors (c) $H^{3/2}$ (d) $H^{1/2}$

177. The fluid property which matters for falling

187. A pressure of 10 m head of water is equivalent drops to acquire spherical shape is its lent to..... kN/m^2 . (a) pressure (b) height of descent (a) 98 (b) 147 (c) viscosity (d) surface tension (c) 196 (d) 49

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171.(d) 172.(b) 173. (b) 174.(a) 175. (d) 176.(d) 177.(d) 178.(a) 179.(c) 180.(d) 181.(d) 182. (a) 183.(d) 184.(a) 185.(d) 186.(b) 187.(a)

188. Differential manometer measures the (a) absolute pressure

(b) gauge pressure

(c) pressure difference

(d) pressure gradient

189. The unit of dynamic viscosity in SI unit is (a) $\text{kg}/\text{m} \cdot \text{sec}$ (b) N/m^2 (c) m^2/sec . (d) $\text{m}/\text{N} \cdot \text{sec}$.

190. Gradually varied flow in open channel is a/ an.....flow.

(a) steady uniform

(b) steady non-uniform

(c) unsteady uniform

(d) unsteady non-uniform

191. Power required by a centrifugal pump is proportional to

(a) $N^2 D^3$ (b) $N D^2$

(c) $N^2 D$ (d) $N^3 D$

Where, D = diameter, N = r.p.m.

192. What is the maximum theoretical suction lift (metres) of a reciprocating

pump ?

(a) 5 (b) 10

(c) 50 (d) 100

193. In case of a centrifugal pump, the ratio of total delivered pressure to pressure developed with the impeller is called the.....efficiency. (a) manometric (c) volumetric

194. An ideal fluid is (a) non-viscous (c) both (a) & (b) (b) mechanical (d) overall

(b) incompressible (d) neither (b)

195. What is the speed of sound (m/sec) in ordinary water ?

(a) 1500 (b) 330

(c) 1000 (d) 3000

196. A floating/submerged body is always stable, if its centre of gravity (a) lies above its centre of buoyancy. (b) and centre of buoyancy coincide. (c) lies below its centre of buoyancy. (d) lies above its meta centre.

197. The pressure at a point in a fluid is not the same in all directions, when the fluid is vis- cous and

(a) moving (b) static

(c) cold (d) hot

198. Which of the following pipe bends will incur (a) U-bend (b) 30° bend (c) 45° bend (d) 90° bend

199. Cavitation in a centrifugal pump can be avoided by keeping the

(a) inlet pressure high

(b) outlet pressure low

(c) inlet pressure low

(d) outlet pressure high

200. A relief valve

(a) provides back pressure for a cylinder, (b) unloads a pump.

(c) is a directional control valve.

(d) none of these.

201. Foot valves provided in pumps are.....valves. (a) relief (b) three/four way (c) pressure reducing (d) directional control

202. Various efficiencies of a centrifugal pump are related as
(a)

$$\frac{h_m}{h_a} = \frac{h_v}{h_m} \times \frac{h_a}{h_v}$$

(b)

$$\frac{h_m}{h_a} = \frac{h_v}{h_m}$$

$$\frac{h_m}{h_a} = \frac{h_v}{h_m} \times \frac{h_a}{h_v}$$

$$\frac{h_m}{h_a} = \frac{h_v}{h_m}$$

$$\frac{h_m}{h_a} = \frac{h_v}{h_m} \times \frac{h_a}{h_v}$$

where, η_m = mechanical efficiency, η_v = volumetric efficiency, η_h = manometric efficiency, η_o = overall efficiency

203. During ageing of fluid carrying pipes, the (a) pipe becomes smoother with use. (b) friction factor increases linearly with time. (c) absolute roughness decreases with time. (d) absolute roughness increases linearly

with time.

204. For steady ideal fluid flow, the Bernoulli's equation states that the (a) velocity is constant along a stream line. (b) energy is constant throughout the fluid (c) energy is constant along a stream line,

but may vary across stream lines (d) none of these

205. The continuity equation

(a) is independent of the compressibility of the fluid.

(b) is dependent upon the viscosity of the fluid.

(c) represents the conservation of mass.

(d) none of these.

the largest head loss ?

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188.(c) 189.(a) 190.(b) 191.(d) 192. (b) 193.(a) 194.(c) 195.(a) 196. (c) 197.(a) 198.(a) 199.(a) 200.(c) 201.(d) 202. (b) 203.(b) 204. (c) 205.(c)

206. Priming of a centrifugal pump is done to (a) increase the mass flow rate of fluid. (b) develop effective pressure rise by the

pump.

(c) avoid chances of separation inside the impeller.

(d) none of these.

207. Hydraulic diameter for non-circular ducts is equal to.....times the area of flow divided by the perimeter.

(a) two (b) three

(c) four (d) eight

208. The dimension of surface tension is

(a) ML^{-2} (b) MT^{-2}

(c) MLT^{-2} (d) $ML^{-2}T$

209. In deriving Bernoulli's equation, fluid is assumed to be

(a) incompressible, frictionless, steady, along a streamline.

(b) uniform, steady, incompressible, along a streamline.

(c) steady, density being pressure dependent, frictionless.

(d) none of these.

210. The ratio of actual discharge to theoretical discharge through an orifice is equal to (a) $C_c \cdot C_v$ (b) $C_c \cdot C_d$ (c) $C_v \cdot C_d$ (d) C_d/C_v **211.** For flow through an orifice from a reservoir, the actual velocity at the vena contracta is given by

(a) $2gh$ (b) $C_v \cdot 2gh$

(c) $C_d \cdot 2gh$ (d) $C_c \cdot 2gh$

212. The discharge through a venturimeter depends upon

(a) pressure drop only.

(b) its orientation.

(c) co-efficient of contraction only. (d) none of these.

213. The velocity distribution in direction normal to the direction of flow in plane Poiseuille flow is (a) hyperbolic (b) parabolic (c) linear (d) none of these

214. Which law is followed by the velocity distribution in the turbulent boundary layer? (a) Parabolic law (b) Linear law (c) Logarithmic law (d) None of these

215. Weber number is the ratio of inertial force to.....force.

(a) surface tension (b) gravity (c) viscous (d) elastic

PV_2

216. The energy equation, $E + \frac{1}{2} V^2 + gZ = \text{const}$, is applicable to

(a) perfect gases only. (b) isothermal flow of gases.

(c) adiabatic unsteady flow of gases. (d) all compressible fluids.

217. A pressure head of 320 metres of water in meters of CCl_4 (sp.gr = 1.6) will be

(a) 100 (b) 200

(c) 320 (d) 160

218. Mach number is important in a fluid flow problem, when the inertia and.....forces predominate.

(a) elastic (b) viscous (c) gravity (d) none of these

219. The Mach number for hypersonic flow of compressible fluid is

(a) 1 (b) >1

(c) >4 (d) <2

220. Air vessel of a reciprocating pump is initially filled with

(a) atmospheric air (c) water

(b) compressed air (d) none of these

221. What is the ratio of the velocity at the axis of the pipe to the mean velocity of flow in case of pipe flow under viscous condition ?

(a) 0.5 (b) 0.67

(c) 1 (d) 2

222. The frictional resistance in laminar flow does not depend on the

(a) area of surface in contact.

(b) flow velocity.

(c) fluid temperature.

(d) pressure of flow.

223. Bernoulli's equation is not applicable, when the flow is

(a) irrotational. (b) incompressible. (c) viscous. (d) all (a), (b) & (c).

224. Paper pulp is an example of.....fluid. (a) dilatant (c) Newtonian (b)

bingham plastic (d) pseudoplastic

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206. (c) 207. (c) 208.(b) 209. (a) 210. (a) 211.(b) 212.(a) 213. (b) 214.(c) 215.(a)
216.(d) 217.(b) 218.(a) 219.(c) 220.(b) 221.(d) 222.(a) 223.(d) 224.(b)

225. A gas

- (a) signifies absence of density.
- (b) can resist shearing action.
- (c) is incompressible.
- (d) is a supercritical vapor.

226. The flow of a liquid through tapering pipe at a constant rate is an example of.....flow. (a) steady uniform

- (b) steady non uniform
- (c) unsteady uniform
- (d) unsteady non uniform

227. Which of the following fluid forces are not considered in the Navier-Stoke's equation? (a) Gravity forces (b) Viscous forces (c) Pressure forces (d) Turbulent forces

228. Each term in Bernaulli's equation represents the.....of the fluid.

- (a) energy per unit mass
- (b) energy per unit weight
- (c) force per unit mass
- (d) none of these

229. The Prandtl pitot tube measures the (a) velocity at a point in the flow.

- (b) pressure at a point.
- (c) average flow velocity.
- (d) pressure difference in pipe flow.

230. The percentage slip in a reciprocating pump set is given by the % of

- (a) Q_1/Q_2 (b) Q_2/Q_1

--

QQ QQ

(c)

21(d) 21

Q_1 Q_2

where, Q_1 = actual discharge

Q_2 = theoretical discharge

231. Reciprocating pumps are not able to compete with the centrifugal pump for industrial use, mainly because these pumps have

(a) very low speeds.

(b) smaller discharge.

(c) higher capital & maintenance cost. (d) high vibrations.

232. Prandtl number is a measure of the (a) heat conduction to viscosity of a fluid. (b) C_p/C_v of a fluid.

(c) elastic force to pressure force in the fluid

flow.

(d) inertial force to elastic force in the fluid

flow.

233. The boundary layer thickness at a given section along a flat plate.....with increasing Reynold's number.

(a) increases

(b) decreases

(c) remains same

(d) may increase or decrease

234. Air vessel fitted to a reciprocating pump (a) increases the work done.

(b) decreases the work done.

(c) causes cavitation.

(d) results in non-uniform discharge. **235.** Water hammer in a pipeline results from the (a) bursting of pipelines due to closure by a valve.

(b) rapid pressure change due to a rapid change in the rate of flow.

(c) pressure increase due to closure of a valve resulting in decrease in rate of flow. (d) none of these.

236. Steady uniform flow is represented by flow through a/an

(a) long pipe at constant rate.

(b) long pipe at decreasing rate.

(c) expanding tube at constant rate. (d) none of these.

237. Unsteady uniform flow is represented by flow through a/an
 (a) long pipe at constant rate.
 (b) long pipe at decreasing rate.
 (c) expanding tube at increasing rate. (d) expanding tube at constant rate.

238. Unsteady non-uniform flow is represented by flow through a/an
 (a) long pipe at constant rate.
 (b) long pipe at decreasing rate.
 (c) expanding tube at increasing rate. (d) expanding tube at constant rate.

239. For pipe flows, head is proportional to----at constant capacity.
 (a) $1/D$ (b) $1/D^2$
 (c) $1/D^5$ (d) D^2

where, D = pipe diameter

240. Drag co-efficient for motion of spherical particles in a stationary fluid in the stoke's law range is

24 (b)¹⁶(a)_{NRe p} NRe p

ANSWERS

225. (d) 226.(b) 227. 228.(b) 229.(a) 230.(d) 231.(c) 232.(a) 233.(b) 234. (d)
 235.(b) 236.(a) 237.(b) 238.(c) 239.(c) 240.(a)
 (c)

⁶⁴ (d) ⁴⁸ **250.** Unit of mass velocity is

N

Re

p

N

(a) kg/hr (b) $\text{kg/m}^2 \cdot \text{hr}$ Re p

(c) kg/m^2 (d) $\text{kg/m}^3 \cdot \text{hr}$

241. In Newton's law range, the drag co-efficient **251.** For turbulent flow of Newtonian fluid in a for the motion of spherical particle in a stacircular cross-section pipe, 'the ratio of maxitionary fluid is mum to average fluid velocity is
 (a) 0.44 (b) 0.044 (a) 0.5 (b) 1 (c) 4.4 (d.) 44 (c) 0.66 (d) <0.5

242. Stoke's law is valid, when NRe.p is less than **252.** Schedule number of a pipe, which is a mea(a) 2 (b) 100 sure of its wall thickness, is given by (c) 2100

(d) 700 (a) 1000 P'/S (b) 100 P'/S

243. One poise (unit of absolute/dynamic viscosity) is equivalent to one (c) 1000 S/P (d) 10000 P'/S

ity) is equivalent to one **253.** Sewage sludge is an example of the.....fluid. (a) $gm/cm^2 \cdot sec.$ (b) $gm/cm \cdot sec.$ (a) Bingham plastic
(c) $cm^2/sec.$ (d) $m^2/sec.$ (c) pseudoplastic
(b) Newtonian (d) dilatant

244. For motion of spherical particles in a stationary fluid, the drag coefficient in hindered settling compared to that in free settling is (a) does not satisfy $PV=nRT$. (b) is incompressible and has zero viscosity. (c) has constant specific heat. (d) can't develop shear stresses. (c) equal

254. A perfect gas (a) more (c) has constant specific heat. (b) less (d) can't develop shear stresses. (c) equal
(d) more or less, depending on the type of **255.** forces act on a particle moving through a stationary fluid.

245. In the Newton's law range, the terminal velocity of a solid spherical particle falling through a stationary fluid mass is.....the (a) Gravity (b) Drag (c) Buoyant (d) all (a), (b), & (c) through a stationary fluid mass is.....the **256.** Existence of boundary layer in fluid flow is because of the fluid viscosity.
(a) directly proportional to (a) surface tension (b) fluid density (b) inversely proportional to (c) fluid viscosity (d) gravity forces

(c) inversely proportional to the square root of **257.** Manometers measure the.....pressure. (d) independent of (a) vacuum as well as the atmospheric

246. The head loss in turbulent flow in pipe is proportional to (b) difference in (c) absolute
(a) V^2 (b) $1/V^2$ (d) gage
(c) $1/V$ (d) V **258.** If Blasius or Darcy friction factor is ' f_1 ',

where, V = velocity of fluid through the pipe then the Fanning friction factor is equal to

247. Transition length for turbulent flow in smooth pipe is equal to.....times the pipe diameter. (a) $f_1^{1/4}$ (b) $4f_1^2$
(c) $2f_1$ (d) $f_1/2$

(a) 0.5 (b) 5 **259.** Slurries can be most conveniently pumped by (c) 50 (d) 100 a.....pump.

248.

With increase in temperature, the vapor (a) screw

(c) gear

(b) reciprocating

(d) centrifugal pressure of liquids

(a) increases (b) (c) decreases (d) increases linearly **260.** A fluid which has a linear relationship between the magnitude of applied shear stress

249. The continuity equation of fluid mechanics and the resulting rate of deformation is called utilises the principle of conservation of a/an.....fluid.

(a) momentum (b) mass (a) Newtonian (b) Non-Newtonian (c) energy (d) both (b) & (c) (c) ideal (d) incompressible

ANSWERS

241.(a) 242. (a) 243.(b) 244. (a) 245.(b) 246.(a) 247.(c) 248.(a) 249.(b) 250.(b) 251.(b) 252.(a) 253. (a) 254.(c) 255.(d) 256.(c) 257.(b) 258.(a) 259.(d) 260.(a)

261. As per Newton's law of viscosity, the shear stress for a given rate of angular deformation of fluid is proportional to

(a) $1 / \mu$

(c) μ^2

where, μ = fluid viscosity

262. N. second/ m^2 is

(a) the S.I. unit of dynamic viscosity. (b) the S.I. unit of kinematic viscosity. (c) equivalent to one poise.

(d) equivalent to one stoke.

263. Which of the following properties of a fluid is responsible for offering resistance to shear ? (a) Surface tension. (b) Viscosity.

(c) Specific gravity. (d) all (a), (b), and (c).

264. Rubber latex is an example of.....fluid. (a) dilatant (b) Newtonian (c) pseudoplastic (d) Bingham plastic

265. Very small pressure difference (< 5 mm water column) can be most conveniently measured by a/an.....manometer.

- (a) U-tube water.
- (b) U-tube mercury.
- (c) inclined tube mercury.
- (d) inclined tube water.

266. Kinetic energy of fluid per unit weight represented by the velocity head is given by (a) $2v^2/gc$ (b) $v^2/2gc$ (c) rv^2/gc (d) $r.v^2/2gc$

267. The equivalent diameter for pressure drop calculation for a duct of square cross-section is given by

(a) x (b) px

(c) $2x$ (d) $x/2$

where, x = each side of the square duct

268. Vane anemometer

- (a) is an area meter.
- (b) is a variable head meter.
- (c) rotates an element at a speed determined

by the velocity of the fluid in which the meter is immersed.

(d) none of these.

269. Pitot tube measures the.....of a fluid. (b) m

(d) $1/m^2$

(a) pressure

(b) average velocity (c) average flow rate (d) point velocity' **270.** Venturimeter and orifice meter measures

the.....of the fluid.

(a) pressure (b) maximum velocity (c) average velocity (d) point velocity

271. Quicksand is an example of a.....fluid. (a) bingham plastic (b) dilatant (c) Newtonian (d) pseudoplastic

272. Bernoulli's equation for fluid flow is derived following certain assumptions. Out of the assumptions listed below, which set of assumptions is used in derivation of Bernoulli's equation ?

A. Fluid flow is frictionless & irrotational. B. Fluid flow is steady.
C. Fluid flow is uniform & turbulent. D. Fluid is compressible.
E. Fluid is incompressible.

(a) A, C, D (b) B, D, E

(c) A, B, E (d) A, D, E

273. The boundary layer is that part of a moving fluid, in which the fluid velocity is

(a) affected by the fluid flow pressure. (b) constant.

(c) affected by the presence of a solid boundary. (d) all (a), (b) and (c).

274. Pick out the wrong statement pertaining to fluid flow.

(a) The ratio of average velocity to the maximum velocity for turbulent flow of Newtonian fluid in circular pipes is 0.5.

(b) The Newtonian fluid velocity in a circular pipe flow is maximum at the centre of the pipe.

(c) Navier-Stokes equation is applicable to the analysis of viscous flows.

(d) Hagen-Poiseuille equation is applicable to the laminar flow of Newtonian fluids.

275. For laminar flow of Newtonian fluid in a circular pipe, the velocity distribution is a function of the distance 'd' measured from the centre line of the pipe, and it follows a..... relationship.

(a) logarithmic (b) parabolic (c) hyperbolic (d) linear

276. The terminal velocity of a solid spherical particle falling through a stationary fluid mass in the Stoke's law range is proportional to the (a) inverse of fluid viscosity.

(b) square of particle size.

261.(b) 262.(a) 263.(b) 264.(c)

ANSWERS

265.(d) 266.(b) 267.(a) 268.(c) 269. (d) (c) difference in the densities of the particle & fluid.

(d) all (a), (b) and (c).

277. Flow measurement in an open channel is done by a/an

(a) venturimeter (b) orificemeter (c) weir (d) rotameter

278. Speed of sound in an ideal gas depends on its (a) temperature (b) pressure (c) specific volume (d) none of these

279. Which of the following equations is valid for laminar flow of a fluid through packed bed? (a) Fanning equation
(b) Kozney - Karman equation
(c) Hagen-Poiseuille equation
(d) Blake-Plummer equation

280.

Fanning equation is given by

$D =$

4.

$Lv^2 f D 2gc r$

It is applicable to.....region flow. (a) transition (c) turbulent (b) laminar (d) both (b) and (c)

281. The fluid velocity varies as the cube of the cylindrical pipe diameter in case of steady state laminar flow at constant pressure drop for.....fluid. (a) Newtonian (c) dilatant (b) pseudoplastic (d) Bingham plastic

282. Pick out the correct statement pertaining to transition/ entrance length in fluid flow. (a) The length of entrance region of pipe,

in which full development of fluid flow takes place such that velocity profile does not change downstream, is called the transition length.

(b) Transition length for laminar flow of Newtonian fluids in a pipe of diameter D is equal to $0.05 \cdot D \cdot Re$.

(c) Transition length for turbulent flow of Newtonian fluids in a smooth pipe of diameter 'd' is equal to $50 D$.

(d) all (a), (b) and (c).

283. The net positive suction head (NPSH) of a centrifugal pump is defined as the sum of the velocity head and the pressure head at the

- (a) discharge.
- (b) suction.
- (c) suction minus vapor pressure of the liquid at suction temperature.
- (d) discharge minus vapor pressure of the liquid at the discharge temperature.

284. For turbulent flow in smooth circular pipe, the velocity distribution is a function of the distance of measured from the wall of the pipe and the friction velocity V , and it follows a.....relationship.

- (a) logarithmic (b) linear
- (c) hyperbolic (d) parabolic

285. Prandtl mixing length is

- (a) applicable to laminar flow problems. (b) a universal constant.
- (c) zero at the pipe wall.
- (d) none of these.

286. All pipes of a particular nominal size have the same

- (a) inside diameter (b) outside diameter (c) thickness (d) none of these

287. Boundary layer thickness in turbulent flow over a flat plate increases as

- (a) d (b) $d^{2/3}$
- (c) $d^{4/5}$ (d) $d^{1/3}$

where, d = distance from the leading edge.

288. For turbulent flow of fluids in rough pipe, fanning friction factor does not depend upon (a) V & m (b) e

- (c) D & r (d) L

where, V , and m are fluid's velocity, density & viscosity respectively. e = roughness projection size; L and D are length & diameter of the pipe respectively.

289. Which or the following equations applies to the fluid flow through a packed bed for very large Reynolds number?

- (a) Fanning equation
- (b) Blake-Plummer equation
- (c) Hagen-Poiseuille equation
- (d) Kozney-Karman equation

290. The ratio of average fluid velocity to the maximum velocity in case of

laminar flow of a Newtonian fluid in a circular pipe is (a) 0.5 (b) 1
(c) 2 (d) 0.68

291. Rise of liquid in a capillary tube is due to (a) cohesion
(c) both (a) & (b) (b) adhesion
(d) neither (a) nor (b).

292. Hot wire anemometer is used to measure the (a) velocity of liquids.

ANSWERS

277. (c) 278.(a) 279.(b) 280.(d) 281. (b) 282.(d) 283.(c) 284.(a) 285.(c) (b)
temperature of liquids.
(c) velocity of gases.
(d) pressure of liquids.

293. Mercury is an ideal barometric fluid mainly due to its
(a) high density.
(b) low compressibility.
(c) low capillary action.
(d) very low vapor pressure.

294. Fluid flow through a packed bed is represented by the.....equation.
(a) Fanning's (b) Ergun's (c) Hagen-Poiseuille's (d) none of these

295. A pipe is defined as 'hydraulically smooth', if the friction factor
(a) is not a function of Reynolds number. (b) for a given Reynolds number
remains

constant even on further smoothening of the pipe.
(c) is zero irrespective of the Reynolds number.
(d) none of these.

296. Fanning friction factor for laminar flow of fluid in a circular pipe is
(a) not a function of the roughness of pipe wall. (b) inversely proportional to
Reynolds number. (c) both (a) & (b).
(d) neither (a) nor (b).

297. Boundary layer thickness in laminar flow over a flat plate increases as
(a) d (b) $d^{1/3}$

(c) d^2 (d) $d^{2/3}$

where, d = distance from the leading edge. **298.** Capillary rise of mercury in a small diameter

tube is proportional to

(a) d (b) $1/d$ (c) s (d) $1/s$

where, d = diameter of the tube, s = surface tension of mercury

299. Pressure drop for laminar fluid flow through a circular pipe is given by

$\frac{LV^2}{32\mu L} \frac{1}{D}$ (a) $4\mu L$ (b) $\frac{32\mu L}{D^2}$ (c) $\frac{16\mu L}{Re D}$ (d) $\frac{16\mu L}{Re D^2}$

$\frac{f L V^2}{2 D}$

(c) $\frac{16\mu L}{Re D}$ (d) $\frac{16\mu L}{Re D^2}$

300. Pressure drop for turbulent fluid flow through a circular pipe is given by

(a)

$\frac{64}{Re}$

(b)

$\frac{32 \mu L V}{g_c D^2}$

$\frac{LV^2}{32\mu L} \frac{1}{D}$ (c) $4\mu L$ (d) $\frac{32\mu L}{D^2}$

$\frac{16\mu L}{Re D}$

301. Pick out the wrong statement.

(a) Surface tension of a liquid is because of the difference in magnitude of adhesive & cohesive forces.

(b) A hydrometer used for the determination of specific gravities of liquids works on the principle of buoyant forces.

(c) In case of unsteady fluid flow, the velocity at any given point does not change with time.

(d) Turbulent fluid flow is characterised by the rapid fluctuation of instantaneous pressure & velocity at a point.

302. The friction factor is

(a) always inversely proportional to the

Reynolds number.

(b) not dimensionless.
(c) not dependent on the roughness of the

pipe.
(d) none of these.

303. flow means the flow of incompressible fluid with no shear.
(a) Potential (b) Streamline
(c) Creep (d) Boundary layer

304. Brownian movement is prominent in the particle size range of.....microns in case of settling of a particle in a fluid.
(a) 2 to 3 (b) 0.01 to 0.10 (c) 200 to 300 (d) 100 to 1000

305. The exit cone angle in case of a standard venturimeter is.....the entrance cone angle. (a) smaller than (b) greater than (c) equal to (d) either (a) or (b)

306. In case of a rotameter, the density of the float material is.....that of the liquid it replaces. (a) more than (b) less than (c) equal to (d) either (a) or (b)

307. pump is the most suitable device for discharging a liquid against a pressure of $\geq 1500 \text{ kgf/cm}^2$.
(a) Centrifugal (b) Piston
(c) Plunger (d) Vane

ANSWERS

293.(d) 294.(b) 295.(b) 296.(c) 297.(a) 298.(c) 299.(b) 300.(c) 301.(c) 302.(d)
303.(a) 304.(a) 305.(a) 306.(a) 307.(c)

308. A fluid is a substance, that
(a) has to be kept in a closed container. (b) is almost incompressible.
(c) has zero shear stress.
(d) flows when even a small shear is applied

to it.

309. Newtonian fluid is that
(a) which follows Newton's law of motion. (b) which needs a minimum shear, before it

starts deforming.

(c) for which shear & deformation are related as $\tau_{xy} = \mu \frac{\partial u}{\partial y}$

(d) none of these.

310. A streamline is a line in flow field,

(a) that is traced by all the fluid particles passing through a given point.

(b) along which a fluid particle travels.

(c) such that at every point on it, the velocity is tangential to it.

(d) none of these.

v^2

311. If in a flow field, $\frac{P}{\rho} + \frac{v^2}{2} + gz = \text{constant}$ between any two points, then the flow must be

(a) steady, incompressible, irrotational. (b) steady, compressible, irrotational. (c) steady, compressible and along a streamline. (d) unsteady, incompressible, irrotational.

312. Pascal's law is valid, only when the fluid is (a) frictionless and at rest. (b) at rest. (c) at rest and when the frictionless fluid is in motion. (d) none of these.

313. For a stable equilibrium of a submerged body (a) G is above B (b) B is above G (c) B & G coincide (d) none of these

where, G and B are centres of gravity & buoyancy respectively.

314. For an unstable equilibrium of a floating body (a) M is above G (b) M is below G (c) M & G coincide (d) none of these

where, M = metacentre.

315. C_d , C_c and C_v are related (for flow through an orifice) as

(a) $C_d = C_c/C_v$ (b) $C_d = C_v \cdot C_c$ (c) $C_d = C_c/C_v$ (d) none of these

where, C_d = discharge co-efficient

C_c = co-efficient of contraction

C_v = co-efficient of contraction

=

area of jet at vena-contracta area of opening

C_v = co-efficient of velocity

=

actual velocity at vena-contracta Theoretical velocity

316. Major loss in sudden contraction in pipe flow is due to

(a) boundary friction.

(b) flow contraction.

(c) expansion of flow after sudden contraction. (d) none of these.

317. When the head pumped against is less than the head of the fluid used for pumping, the usual device is a/an

(a) ejector (b) blower (c) injector (d) airlift

318. When the momentum of one fluid is used for moving another fluid, such a device is called a/an

(a) jet pump (b) blower (c) acid egg (d) none of these

319. The rate of shear versus the shear stress curves are time dependent

for.....fluid. (a) thixotropic (c) both (a) & (b) (b) rheopectic

(d) neither (a) nor (b)

320. For the same terminal conditions and valve size, the pressure drop in a fully opened globe valve as compared to that in a gate valve is (a) more

(b) less

(c) equal

(d) either (a) or (b); depends on the viscosity

of the fluid

321. For the same terminal conditions and fitting size, the least friction loss is incurred in a/an (a) T-joint (b) union

(c) 45° elbow (d) 90° bend

322. The equivalent diameter for fluid flow through square cross section channel of side 'x' for pressure drop calculation purpose is given by

(a) 4x (b) 2x

(c) x (d) x

ANSWERS

308.(d) 309.(c) 310. (c) 311.(a) 312.(b) 313. 314. (b) 315.(b) 316.(b) 317.(d)
318.(a) 319.(c) 320.(a) 321.(b) 322. (c)

323. Minimum fluidisation velocity for a specific system depends upon the

(a) particle size.

(b) fluid viscosity.

(c) density of both the particle & the fluid. (d) all (a), (b) and (c).

324. The range of a particular rotameter can be increased by

(a) use of floats of different densities. (b) no means.

(c) increasing the diameter of the float. (d) decreasing the diameter of the float.

325. For turbulent fluid flow in pipe, the expression for Prandtl one seventh

power law is (a) $V/V_{\max} = (x/r)^{1/7}$ (b) $V/V_{\max} = (r/x)^{1/7}$ (c) $V/V_{\max} = (x.r)^{1/7}$ (d)

none of these

where, r = pipe radius, x = distance.

326. Slugging occurs in a fluidised bed, if the bed is (a) narrow (b) deep

(c) both (a) & (b) (d) neither (a) nor (b)

327. The equivalent diameter for pressure drop calculation for a fluid flowing through a rectangular cross section channels having sides 'x' & 'y' is given by

$2xy$ (b) xy (a) xy xy

xy (c) xy

xy (d) xy

328. Laminar flow of a Newtonian fluid ceases to exist, when the Reynolds

number exceeds (a) 4000 (b) 2100

(c) 1500 (d) 3000

329. What is the shear rate at the pipe wall, in case of laminar flow of

Newtonian fluids in a pipe of diameter 'D' & length 'L' incurring a pressure drop 'Dp' with average velocity ' V_{avg} '? (a) $DDp/8L$ (b) $DDp/4L$ (c) $8 \cdot V_{\text{avg}}/D$ (d) $4 \cdot V_{\text{avg}}/D$

V_{avg}/D

330. The fluid property, due to which, mercury does not wet the glass is

- (a) steam
(c) electric motor (b) diesel engine (d) gas turbine

333. The velocity profile exhibited by laminar flow of Newtonian fluids is such that the velocity distribution w.r.t. radius of the circular pipe is a/an.....with the apex at the centre line of the pipe.
(a) hyperbola (b) parabola (c) semi-circle (d) semi-ellipse

334. The terminal velocity of a particle moving through a fluid varies as The value of n is equal to.....in Stoke's law regime. (a) 1 (b) 0.5 (c) 2 (d) 1.5

335. In question No. 655, what is the value of ' n ' for Newton's law regime ?
(a) 0.5 (b) 1 (c) 1.5 (d) 3

336. The Reynolds number for an ideal fluid flow is (a) 4 (b) 2100-4000 (c) 4000 (d) ∞

337. The pressure drop per unit length of pipe incurred by a fluid 'X' flowing through pipe is Dp . If another fluid 'Y' having both the specific gravity & density just double of that of fluid 'X', flows through the same pipe at the same flow rate/average velocity, then the pressure drop in this case will be
(a) Dp (b) $2Dp$ (c) Dp^2 (d) $Dp/2$

338. The time taken for gravity flow of a fixed volume of liquid (as in Redwood viscometer) is directly proportional to its
(a) absolute viscosity.
(b) ratio of absolute viscosity to density. (c) density.
(d) Reynolds number.

339. Rubber latex is an example of a.....fluid. (a) pseudoplastic (c) dilatant
(b) Bingham plastic (d) Newtonian

- (a) surface tension (c) cohesion
(b) viscosity (d) adhesion

331. Bernoulli's equation does not apply to the functioning of a/an (a) venturimeter (c) pitot tube
(b) orificemeter (d) none of these

332. Most of the centrifugal pumps used in chemical engineering are of the type (a) positive displacement (b) centrifugal (c) reciprocating (d) jet

340. When a fluid flows over a flat plate, the boundary layer is laminar up to a certain distance from the leading edge. This distance is (a) directly proportional to the square root of the plate length (b) directly proportional to the plate length (c) inversely proportional to the square root of the plate length (d) inversely proportional to the plate length

solid surface, the (a) velocity is uniform at any cross-section. (b) velocity gradient is zero at the solid surface. (c) resistance between the surface & the flu-

id is lesser as compared to that between the fluid layers themselves.

(d) velocity is not zero at the solid surface. cal plants are usually.....driven.

ANSWERS

323.(d) 324.(a) 325.(a) 326.(c) 327.(a) 328.(b) 329.(c) 330.(a) 331.(d) 332.(c)
333.(b) 334.(c) 335.(a) 336.(d) 337.(b) 338.(b) 339.(a) 340.(b)

341. Viscosity of water is about.....times that of air at room temperature.

(a) 15 (b) 55

(c) 155 (d) 1050

342. In case of laminar flow of fluid through a circular pipe, the

(a) shear stress over the cross-section is proportional to the distance from the surface of the pipe.

(b) surface of velocity distribution is a parabola. In the above figure, Bingham plastic is represented by the curve (a) V (b) cylinder. (c) III (d) I (c) velocity profile varies hyperbolically and

the shear stress remains constant over

(a) dilatant fluid the cross-section. (c) ideal plastic

347. Curve III in the above diagram represents a/an (b) pseudo plastic fluid

(d) average flow occurs at a radial distance (d) none of these of $0.5 r$ from the centre of the pipe ($r =$ pipe radius). **348.** Match the units of following parameters used in fluid flow.

343. In case of turbulent flow of fluid through a circular pipe, the (a) Friction factor

(a) mean flow velocity is about 0.5 times the (b) dynamic viscosity

maximum velocity. (c) Kinematic viscosity

(b) velocity profile becomes flatter and flatter (d) Specific viscosity

ter with increasing Reynolds number. List II (c) point of maximum instability exists at a I. gm/cm. second II. cm²/second distance of $2r/3$ from the pipe wall ($r =$ pipe radius). III. dimensionless IV. dimensionless

349. Match the typical examples of various types (d) skin friction drag, shear stresses, random of

fluids. orientation of fluid particles and slope of velocity profile at the wall are more.

List I

(a) Bingham plastic **344.** The maximum discharge through a circular fluid channel takes place, when the depth of the fluid flow is times the pipe diam- (b) Dilatent (c) Pseudo plastic fluid (d) Thixotropic fluid. *List II* (a) 0.25 (b) 0.5

(c) 0.66 (d) 0.95 I. Quicksand and starch suspensions in **345.**

Fluid flow at increasing rate through a di

-

water

II. Polymeric solutions/melts and suspensions diverging pipe is an example of flow. sion of paper pulp (a) steady uniform III. Drilling muds, paints and inks (b) non-steady uniform IV. Sewage sludge and water suspensions of (c) steady non-uniform rock (d) non-steady non-uniform **350. Match the**

symbols of various pumps as used **346.** During fluid flow, variation of shear stress (τ) in chemical engineering drawings.

with velocity gradient $\frac{dv}{dy}$ at constant pressure *List I*

(a) Centrifugal pump

sure & temperature is shown below in the (b) Reciprocating pump

figure.

(c) Gear pump

(d) Diaphragm pump

ANSWERS

341.(b) 342.(b) 343.(d) 344.(d) 345.(d) 346.(b) 347.(b) 348.(a) 349.(a) 350.(a)

List II

351. Venturimeters, orificemeters and nozzles are used to measure the fluid discharge from a pipeline. The average fluid velocity in a pipe- line can be measured by a/an

(a) weir

(b) hot wire anemometer

(c) cup and vane anemometer

(d) none of these

352. Pick out the correct statement.

(a) Human blood is a Newtonian fluid. (b) A Newtonian fluid obeys Newton's law of

cooling.

(c) For a non-Newtonian fluid, a straight line passes through the origin in a plot between shear stress and shear gradient. (d) Thin lubricating oil is an example of a non-Newtonian fluid.

353. In case of hydraulically smooth pipe, the resistance to flow depends only on the Reynolds number, whereas for a hydraulically rough pipe, the resistance to flow is governed by the relative roughness. Two pipes are said to have the same hydraulic roughness, when they have equal values of

- (a) relative roughness.
- (b) absolute roughness.
- (c) friction co-efficient for flows at equal

Reynold number.

- (d) all (a), (b) & (c).

354. Water hammer is caused, when water flowing in a pipe is suddenly brought to rest by closing the valve. The extent of pressure thus produced due to water hammer depends on the (a) pipe length

- (b) fluid velocity in the pipe
- (c) time taken to close the valve
- (d) all (a), (b) and (c)

355. Which of the following is an undesirable property of a manometric liquid ?

- (a) Non-sticky & non-corrosive nature. (b) High vapour pressure.
- (c) Low viscosity & surface tension. (d) Low co-efficient of thermal expansion.

356. Working principle of manometer comprises of balancing a column of liquid against the pressure to be measured. Inclined tube manometer is especially used for the measurement of.....pressure.

- (a) small differential (b) atmospheric (c) absolute (d) gage

357. Pressure difference between two points in vessels, pipelines or in two different pipelines can be measured by a differential manometer. The pressure difference measured as the mm of water column in case of mercury-water, differential manometer is equal to

- (a) H (b) $12.6 H$ (c) $13.6 H$ (d) $14.6 H$

where, H = difference in height of mercury column in mm.

358. Drag force acting on a body does not depend upon the

- (a) density of the fluid.
- (b) density of the body.
- (c) velocity of the body.
- (d) projected area of the body.

359. The buoyant force acting on a floating body is dependent on the

- (a) viscosity of the liquid.
- (b) weight of the liquid displaced.
- (c) depth of immersion of the body. (d) surface tension of the liquid.

360. Nature of fluid flow during the opening of a valve in a pipeline is (a) laminar

- (c) steady
- (b) unsteady (d) uniform

361. Two piping system are said to be equivalent, when the.....are same.

- (a) fluid flow rate & friction loss
- (b) length & friction factor
- (c) diameter & friction factor
- (d) length & diameter

362. A weir is used to measure the large water discharge rate from a river or from an open channel. A weir is not of.....shape. (a) circular (c) triangular (b) rectangular (d) trapezoidal

363. Navier-Stokes equation is useful in the analysis of.....fluid flow problems.

ANSWERS

351. (b) 352.(b) 353.(c) 354.(d) 355.(b) 356.(a) 357.(b) 358.(b) 359.(b)

360.(b) 361.(a) 362.(a) 363. (b)

(a) non-viscous (c) turbulent (b) viscous (d) rotational **364.** Permanent pressure loss in a well designed venturimeter is about.....percent of the venturi differential.

- (a) 1 (b) 10
- (c) 30 (d) 50

365. What is the approximate value of friction factor for smooth pipes with the

turbulent flow ($N_{Re} = 10^6$) ?

(a) 0.1 (b) 0.01

(c) 0.001 (d) 0.0001

366. Approximate kinetic energy correction factor for laminar and turbulent flow respectively are:

(a) 2 and 1 (b) 1 and 2 (c) 2 and 3 (d) 4 and 1

367. Navier-Stokes equation deals with the law of

(b) energy

(d) none of these conservation of (a) mass

(c) momentum

368. To replace a compound pipe by a new pipe, the pipes will be equivalent, when both the pipes have the same

(a) flow & length (b) flow & loss of head (c) flow & diameter (d) length & loss of head

369. The velocity distribution in the turbulent boundary layer follows the.....law. (a) parabolic (b) hyperbolic (c) straight line (d) logarithmic

370. Stanton diagram is a plot of

(a) f vs./ Re (b) f vs./ $\log Re$ (c) $\log f$ vs./ Re (d) $\log f$ vs./ $\log Re$

where, f = Friction factor and,

Re = Reynold's number

371. As the flow rate increases in a rotameter, the float

(a) drops in the tube

(b) rotates at lower speed

(c) rotates at higher speed

(d) rises in the tube

372. Bernoulli's equation is applicable between any two points in.....flow of an incom-pressible fluid.

(a) steady, irrotational

(b) steady, rotational

(c) any type of irrotational

(b) any type of rotational

373. The purpose of an inter cooler in a reciprocating compressor is to
(a) reduce the temperature of air before it

enters the next stage

- (b) remove the moisture in air
(c) separate moisture and oil vapour (d) none of these

374. If two similar pumps are running in series, the
(a) head is halved (c) flow is halved (b) head is doubled (d) flow is doubled

375. Which of the following is not true of air receivers?

- (a) Stores large volume of air
(b) Increases the pressure of air
(c) Smoothens pulsating output
(d) A source for draining of moisture

376. Which of the following delivers a pulsating output?

- (a) Roots blower
(b) Centrifugal compressor
(c) Screw compressor
(d) Reciprocating compressor

377. In a centrifugal pump, the velocity energy is converted into pressure energy
by

- (a) suction duct (b) discharge duct (c) impeller (d) volute

378. The friction loss in a pipe carrying a fluid is proportional to the

- (a) fluid velocity
(b) fifth power of the pipe diameter (c) fluid flow
(d) square of the pipe diameter

379. The efficiency of a pump does not depend upon the

- (a) discharge head (b) suction head (c) motor efficiency (d) fluid density

380. Net positive-suction head (NPSH) available depends upon the (a) (c)

discharge head (b) power drawn (d) inlet pipe diameter pump type

381. When the flow rate increases, NPSH (a) required increases

- (b) available increases

- (c) required decreases
- (d) available & required both increases

382. The characteristic of a positive displacement compressor for a given speed is that the remains constant.

ANSWERS

364. (b) 365.(b) 366.(a) 367.(c) 368.(d) 369.(d) 370.(d) 371.(d) 372.(a) 373.(a)
374.(b) 375.(b) 376.(d) 377.(d) 378.(b) 379.(c) 380.(b) 381.(a) 382. (b) (a)
compression ratio (c) temperature
(b) flow output (d) pressure

383. The fan characteristic curve is a plot of..... pressure vs flow.
(a) static (b) dynamic (c) total (d) suction

384. A fluid in equilibrium means that
(a) its viscosity is zero
(b) shear stresses are acting on the fluid but

no flow behaviour is manifested (c) it is free from shear stresses
(d) a hypothetical situation because fluids

are never in equilibrium.

385. A manometer is used to measure
(a) pressure difference
(b) absolute pressure
(c) both (a) and (b)
(d) neither (a) nor (b)

386. The flow of an incompressible fluid with no shear is known as.....flow.
(a) potential (c) turbulent (b) laminar (d) couette

387. A fluid is called Newtonian when the shear stress Vs shear strain plot is
(a) linear and passes through origin (b) linear but has an intercept
(c) exponential and passes through the origin (d) is a rectangular hyperbola

388. Liquid that does not flow at all until a thresh- old shear stress is attained is know as (a) Bingham plastic (b) Pseudoplastic (c) dilatant fluid (d) Newtonian

liquid

389. Kinematic viscosity (which has a unit of m^2/Sec) is a ratio of
(a) absolute viscosity to absolute pressure (b) absolute viscosity to absolute temperature (c) absolute viscosity to specific heat (d) none of these

390. Continuity equation applies to
(a) incompressible fluids
(b) compressible fluids
(c) highly viscous fluids
(d) both incompressible and compressible

fluids

391. Unit of mass velocity in S.I. unit is
(a) kg/s (b) $\text{kg/m}^3.\text{s}$ (c) kg/m.s (d) $\text{kg/m}^2.\text{s}$ **392.** A settling particle attains its terminal velocity when
(a) gravity force + drag force = buoyancy force (b) gravity force - drag force = buoyancy force (c) buoyancy force = gravity force
(d) drag force = buoyancy force

393. For laminar water flow through a tube of diameter 1 cm, the average (U_{avg}) & maximum (U_{max}) water velocity are related as (a) $u_{\text{max}} = 1.5u_{\text{av}}$ (b) $u_{\text{max}} = 2u_{\text{av}}$ (c) $u_{\text{max}} = 2.5u_{\text{av}}$ (d) $u_{\text{max}} = 3u_{\text{av}}$

394. For turbulent fluid flows through pipes, the kinetic energy & momentum correction factors are practically equal to
(a) 0.5 (b) 1 (c) 2 (d) 4

395. The terminal velocity of a sphere settling freely through a pool of liquid in Stoke's law range will.....the liquid viscosity. (a) be independent of
(b) increase linearly with
(c) decrease inversely with
(d) decrease inversely with the square of

396. If the terminal settling velocities of spheres of different sizes (settling freely through a pool of liquid) increases with the square root of particle diameter, then the settling conforms to the.....regime.
(a) Stokes' law range

- (b) intermediate
- (c) Newton's law
- (d) any one of the above, more data needed /

for correct prediction.

397. In a certain process, one needs fluid flow in a given direction and the valve is to open or close by the fluid pressure. Which of the following valve permits fluid flow in one direction only?

- (a) Gate valve (b) Globe valve
- (c) Check valve (d) Any of the above.

398. Safety valve is basically a

- (a) gate valve (b) globe valve (c) check valve (d) none of these

399. As the discharge pressure increases, the volumetric efficiency of a positive displacement pump (a) decreases

- (b) remains practically constant
- (c) increases
- (d) may decrease or increase, depending on

the size of the pump.

ANSWERS

383.(a) 384.(b) 385.(c) 386.(a) 387.(a) 388.(a) 389. (d) 390.(d) 391. (d) 392.(b)
393.(b) 394.(b) 395.(c) 396.(c) 397.(c) 398.(c) 399.(d)

stoichioMetry

1. The total number of atoms in 8.5 gm of NH_3 is..... 10^{23} .

- (a) 9.03 (b) 3.01
- (c) 1.204 (d) 6.02

2. The number of atoms of oxygen present in 11.2 litres of ozone (O_3) at N.T.P. are

- (a) 3.01×10^{22} (b) 6.02×10^{23} (c) 9.03×10^{24} (d) 1.20×10^{24}

3. Measurement of the amount of dry gas collected over water from volume of moist gas is based on the

- (a) Charle's law.

(b) Dalton's law of partial pressures. (c) Avogadro's hypothesis.
(d) Boyle's law.

4. Validity of the relationship, inputs = outputs, holds good for the system at steady state (a) with chemical reaction.

(b) without chemical reaction.

(c) without chemical reaction & losses. (d) none of these.

5. N.T.P. corresponds to

(a) 1 atm. absolute pressure & 0°C.

(b) 760 mm Hg gauge pressure & 0°C. (c) 760 torr & 15° C.

(d) 101.325 KPa gauge pressure & 0°C.

6. 1 bar is almost equal to.....atmosphere. (a) 1 (b) 10

(c) 100 (d) 1000

7. Number of gm moles of solute dissolved in one litre of a solution is called its

(a) equivalent weight (c) molality

(b) molarity (d) normality

8. 2 litres of nitrogen at N.T.P. weighs.....gms. (a) 14 (b) 2.5

(c) 28 (d) 1.25

9. 1 gm mole of methane (CH₄) contains (a) 6.02×10^{23} atoms of hydrogen.

(b) 4 gm atoms of hydrogen.

(c) 3.01×10^{23} molecules of methane. (d) 3 gms of carbon.

ANSWERS

1.(a) 2.(c) 3.(b) 4.(c) 5.(a) 6.(a) 7.(b) 8.(b) 9.(b) 10.(c) 11.(b) 12. (c) 13. (d) 14.

(b) 15.(b) 16.(b) 17.(a) 18.(a)

10. The number of water molecules present in a

drop of water weighing 0.018 gm is $6.023 \times \dots 2$

(a) 10^{26} (b) 10^{23}

(c) 10^{20} (d) 10^{19}

11. Kopp's rule is concerned with the calculation of (a) thermal conductivity.

(b) heat capacity.

(c) viscosity.

(d) surface tension.

12. Number of gm moles of solute dissolved in 1 kg of solvent is called its

(a) normality (b) molarity (c) molality (d) formality

13. The temperature of a gas in a closed container is 27°C . If the temperature of the gas is increased to 300°C , then the pressure exerted is

(a) doubled. (b) halved. (c) trebled. (d) unpredictable.

14. "The total volume occupied by a gaseous mixture is equal to the sum of the pure component volumes". This is the.....law.

(a) Dalton's (b) Amgat's (c) Gay Lussac's (d) Avogadro's

15. Equal masses of CH_4 and H_2 are mixed in an empty container. The partial pressure of hydrogen in this container expressed as the fraction of total pressure is

(a) $1/9$ (b) $8/9$

(c) $1/2$ (d) $5/9$

16. The pressure of 'V' litres of a dry gas is increased from 1 to 2 kgf/cm^2 at a constant temperature. The new volume will become

(a) $V/2$ (b) $2V$

(c) $V/4$ (d) V^2

17. equation gives the effect of temperature on heat of reaction.

(a) Kirchoff's (b) Maxwell's (c) Antonie (d) Kistyakowsky

18. Number of gram equivalent of solute dissolved in one litre of solution is called its

(a) normally

(c) molality

19. S.T.P. corresponds to (a) 1 atm. absolute pressure & 15.5°C. (b) 760 mm Hg gauge pressure & 15.5°C. (c) 760 torr & 0°C.

(d) 101.325 kPa gauge pressure & 15.5°C.

20. A gas occupies a volume of 283 c.c at 10°C. If it is heated to 20°C at constant pressure, the new volume of the gas will be.....c.c.

(a) 283 (b) 566

(c) 293 (d) 141.5

21. For a given mass of a gas at constant temperature, if the volume 'V' becomes three times, then the pressure 'P' will become

(a) $P/3$ (b) $3P$

(c) $9P^2$ (d) $9P$

22. Kinetic theory of gases stipulates that, the (a) energy is lost during molecular collisions. (b) molecules possess appreciable volume. (c) absolute temperature is a measure of the

kinetic energy of molecules.

(d) none of these.

23. The value of gas constant 'R' is.....kcal/ kg.mole. °C.

(a) 2.79 (b) 1.987

(c) 3.99 (d) none of these

24. C_v for monoatomic gases is equal to

(a) R (b) $1.5 R$

(c) $2 R$ (d) $3R$

where, R = gas constant

- 25.** With rise in temperature, the heat capacity of a substance
(a) increases
(b) decreases
(c) remains unchanged
(d) either (a) or (b) ; depends on the substance
- 26.** For an ideal gas, the compressibility factor (a) decreases with pressure rise.
(b) is unity at all temperature.
(c) is unity at Boyle's temperature.
(d) zero.
- 27.** Real gases approach ideal behaviour at (a) high pressure & high temperature.
(b) low pressure & high temperature. (c) high pressure & low temperature. (d) low pressure & low temperature. (b) molarity (d) formality
- 28.** Isotopes are atoms having the same
(a) mass number
(b) number of neutrons
(c) atomic mass
(d) none of these
- 29.** fuels require the maximum percentage of 'excess air' for complete combustion. (a) Solid (b) Liquid
(c) Gaseous (d) Nuclear
- 30.** Which of the following is followed by an ideal solution ?
(a) Boyle's law (b) Amagat's law (c) Raoult's law (d) Trouton's rule
- 31.** chart is a graph related to Antonie equation.
(a) Ostwald
(b) Cox
(c) Mollier's
(d) Enthalpy-concentration
- 32.** 1 kg/cm^2 is equal to
(a) 760 torr
(b) 1 KPa
(c) 10 metres of water column
(d) 1metre of water column

33. 1 Kg/m² is equal to.....mm water column. (a) 1 (b) 10
(c) 100 (d) 1000
34. Heat of...of a fuel is called its calorific value. (a) formation (b) combustion
(c) reaction (d) vaporisation
35. Internal energy is independent of the.....for an ideal gas.
(a) pressure
(b) volume
(c) both (a) & (b)
(d) neither (a) nor (b).
36. $C_p - C_v$, for an ideal gas is equal to
(a) R (b) $R/2$
(c) $2R$ (d) $3R$
37. Volume percent for gases is equal to the (a) weight percent.
(b) mole percent.
(c) weight percent only for ideal gases. (d) mole percent only for ideal gases.
38. equation relates latent heat and boiling point.
(a) Antonie (b) Rotational (c) Kopp's (d) Trouton's

ANSWERS

19. (a) 20.(a) 21. (c) 22.(c) 23.(d) 24.(b) 25.(a) 26. (b) 27.(b) 28.(d) 29.(a)
30. (c) 31.(b) 32.(c) 33.(a) 34.(b) 35.(c) 36.(a) 37. (d) 38.(d)
39. A bypass stream in a chemical process is useful, because it
(a) facilitates better control of the process. (b) improves the conversion.
(c) increases the yield of products.
(d) none of these.
40. Heat of reaction is a function of the
(a) pressure
(b) temperature
(c) both (a) & (b)
(d) neither (a) nor (b)
41. Recycling in a chemical process facilitates (a) increased yield
(b) enrichment of product

- (c) heat conservation
- (d) all (a), (b) & (c)

- (c) limiting the inerts.
- (d) heat conservation.

48. The heat capacity of a solid compound is calculated from the atomic heat capacities of its constituent elements with the help of the (a) Trouton's rule
(b) Kopp's rule
(c) Antonie equation
(d) Kistakowsky equation.

49. An equation for calculating vapour pressure is given by, $\log_{10} P = A - B(t + c)$. This is called the (a) Kistakowsky equation
(b) Antonie equation
(c) Kopp's rule
(d) Trouton's rule

50. Boiling point of a solution as compared to that of the pure solvent is (a) less
(b) more
(c) same
(d) fusion (d) either more or less; depends upon the solvent

- (a) formation
- (c) combustion

- (b) more
- (b) solution (c) same
- (d) fusion (d) either more or less; depends upon the solvent

43. Average molecular weight of air is about 29. Specific gravity on API scale is given by the (a) 21 (b) 29 relation.
(c) 23 (d) 79 (a) $^{\circ}\text{API} = 200(G - 1)$

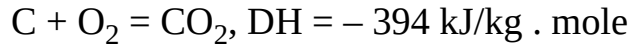
44. The vapour pressure of a solution (made by dissolving a solute in a solvent) is.....that of the pure solvent. (b) $^{\circ}\text{API} = (141.5/G) - 131.5$ (c) $^{\circ}\text{API} = (140/G) - 130$ (d) $^{\circ}\text{API} = 145 - (145/G)$

(a) less than where, G = specific gravity at 15.5°C. (b) more than (c) equal to (d) either more or less; depends upon the solvent

52. A 'limiting reactant' is the one, which decides the amount of product formed.

(d) either more or less; depends on the solvent

45. The combustion equations of carbon and carbon monoxide are as follows :



the.....in the chemical reaction. (a) equilibrium constant

(b) conversion

(c) rate constant

(d) none of these



53. Which of the following is the Clausius-

Clay The heat of formation of CO is.....kJ/kg. mole. peron equation ?(a) - 109.5 (b) + 109.5 (a) $PV =$

$$RT + B/V + y/V^2 + \dots (c) + 180 (d) + 100 (b) (P + a/V^2) (V - b) = RT$$

46. Which of the following ratios defines the re- p 5

cycle ratio in a chemical process ? (c) $\log e_{p0} = -$

(a) Gross feed stream/recycle feed stream

(b) Recycle stream/fresh feed stream RT a(c) Recycle stream/gross feed stream (d) $P = -TV$

2(d) None of these Vb

47. In a chemical process, the recycle stream is 54. Which of the following expressions defines the purged for

(a) increasing the product yield.

(b) enriching the product.

Baume gravity scale for liquids lighter than water ?

(a) $^{\circ}\text{Be} = (140/G) - 130$

39. (a) 40. (c) 41. (d) 47. (c) 48. (b) 49. (b)

ANSWERS

42. (a) 43. (b) 44. (a) 45. (a) 46. (b)

50. (b) 51. (b) 52. (b) 53. (c) 54. (a) (b) $^{\circ}\text{Be} = 200(G - 1)$ (a) vapor follows the

ideal gas law. (c) $^{\circ}\text{Be} = 145 - (145/G)$ (b) molal latent heat of vaporisation is

con(d) $^{\circ}\text{Be} = (400/G) - 400$ stant within the limited temperature

55.

For the gaseous phase reaction,

range.

(c) volume in the liquid state is negligible



$\Delta H = +80 \text{ kJ/kg} \cdot \text{mole}$; compared with that in the vapor state. the

decomposition of NO is favoured by (d) all (a), (b) & (c).

(a) increasing the concentration of N_2 . 64. Pick out the wrong statement. (b) decrease in temperature. (a)

‘Reduced temperature’ of a substance is (c) increase in pressure.

(d) decrease in pressure.

56. For a reaction, $X \rightarrow Y$, if the concentration of ‘X’ is tripled; the rate becomes nine times. The (b) order of reaction is

(a) 0 (b) 1

(c) 2 (d) 3 (c)

57. The pH value of a solution is 5.9. If the hydrogen ion concentration is decreased hundred (d)

the ratio of its existing temperature to its critical temperature, both expressed on celsius scale.

‘Reduced pressure’ is the ratio of the existing pressure of a substance to its critical pressure.

‘Reduced volume’ is the ratio of the existing molal volume of a substance to its critical molal volume.

times, the solution will be none of these.

(a) basic 65. Boiling point of a non-homogeneous mixture of (b) more acidic immiscible liquids is.....that of any one of (c) neutral its separate components.

(d) of the same acidity (a) lower than

58. Which of the following expressions defines the (b) higher than Baume gravity scale for liquids heavier than (c) equal to water ? (d) either (a) or (b); depends on the liquids

(a) $(141.5/G) - 131.5$ (b) $145 - (145/G)$ 66. Raoult’s law states that ‘the equilibrium vapor (c) $200(G - 1)$ (d) $(400/G) - 400$ pressure that is exerted by a component in a 59. Unit of mass velocity is solution is proportional to the mole fraction of (a) $\text{kg/m} \cdot \text{hr}$ (b) $\text{kg/m}^2 \cdot \text{hr}$ that component’. This generalisation is based (c) kg/hr (d) kg/m^2 on the assumption that the

60. approximately equal. The value of the gas law constant 'R' is 1.987 (a) sizes of the component molecules are approximately equal. (a) kcal/kg-mole.°C

(c) kcal/kg-mole.°K

(b) Btu/lb-mole.°R (b) attractive forces between like and unlike (d) both (b) & (c) molecules are approximately equal.

61. Pick out the wrong statement. (c) component molecules are non-polar and (a) One kg-mole of an ideal gas occupies 22.4 no chemical combination or molecular asm³ at N.T.P. sociation between unlike molecules takes (b) One lb-mole of an ideal gas occupies 359 ft³ place in the formation of the solu-tion.at N.T.P. (d) all (a), (b) & (c).(c) One gm-mole of an ideal gas occupies 22.4 67. Addition of a non-volatile solute to a solvent litres (i.e., 22400 c.c) at N.T.P. produces a.....in its solvent.(d) Density of dry air at N.T.P. is 1 gm/litre. (a) freezing point elevation

62. A vapor that exists above its critical tempera(b)ture is termed as a.....vapor. (c)

boiling point depression vapor pressure lowering (a) saturated (c) gaseous

(b) unsaturated (d) all (a),(b) & (c)(d) sub-cooled

63. Variation of vapor pressure with temperature 68. The ratio of existing moles of vapor per mole of can be calculated using Clausius- Clapeyron vapor free gas to the moles of vapor that would equation, which assumes that the be present per mole of vapor free gas, if the mix

ANSWERS

55. (b) 56. (c) 57. (a) 58. (b) 59. (b) 60. (d) 61. (d) 62. (c)

63. (d) 64. (a) 65. (a) 66. (d) 67. (c) 68. (c)

ture were saturated at the existing temperature & pressure, is termed as the

(a) relative humidity.

(b) relative saturation.

(c) percentage saturation.

(d) none of these.

69. Percentage saturation of a vapor bearing gas is always.....the relative saturation. (a) higher than

(b) smaller than

(c) equal to

(d) either (a) or (b); depends on the system

70. For water evaporating into usaturated air under adiabatic conditions and at constant pressure, the.....remains constant throughout the period of vaporisation.

(a) dry bulb temperature

- (b) wet bulb temperature
- (c) humidity
- (d) relative saturation

71. Which of the following has the least (almost negligible) effect on the solubility of a solute in a solvent ?

- (a) Temperature
- (b) Nature of solute
- (c) Pressure
- (d) Nature of solvent

72. “The equilibrium value of the mole fraction of the gas dissolved in a liquid is directly proportional to the partial pressure of that gas above the liquid surface”. This statement pertaining to the solubility of gases in liquid is the..... law.

- (a) Raoult’s
- (b) Henry’s
- (c) Amgat’s
- (d) none of these

73. Refluxing of part of the distillate in a fraction- ating column is a ‘recycling operation’, aimed primarily at

- (a) heat conservation.
- (b) yield enhancement.
- (c) product enrichment.
- (d) none of these.

74. The effect of pressure on the heat capacity of the gases.....is negligible.

- (a) at pressure below one atmosphere
- (b) below the critical temperature
- (c) both (a) & (b)
- (d) neither (a) nor (b)

75. Pick out the wrong statement.

- (a) Atomic heat capacities of the crystalline solid elements are nearly constant and equal to 6.2 kcal/kg-atom according to the law of Petit and Dulong.

(b) Atomic heat capacities of all solid elements decrease greatly with decrease in temperature, approaching a value of zero at absolute zero temperature, when in the crystalline state.

- (c) Generally, the heat capacities of com
- (d)

pounds are lower in the liquid than in the solid state.

The heat capacity of a heterogeneous mixture is an additive property, but when solutions are formed, this additive property may no longer exist.

76. The heat capacity of most substances is greater for the.....state.

- (a) solid (b) liquid
- (c) gaseous (d) none of these

77. At higher temperature, molal heat capacities of most of the gases (at constant pressure).....with increase in temperature. (a) increases

- (b) decreases
- (c) remains unchanged
- (d) increases linearly

78. Kopp's rule is useful for the determination of (a) (b) (c) (d)

molal heat capacities of gases. heat capacities of solids. activation energy.
heat capacities of gases.

79. C_p/C_v for monoatomic gases is

- (a) 1.44 (b) 1.66
- (c) 1.99 (d) 1

80. A vapor whose partial pressure is less than its equilibrium vapor pressure is called a..... vapor.

- (a) saturated (c) superheated (b) supersaturated (d) none of these

81. In case of a solution (not of a solid in a liquid), whose total volume is less than the sum of the volumes of its components in their pure states, solubility is

- (a) independent of temperature.
- (b) increases with rise in pressure.
- (c) increased with decrease in pressure. (d) unchanged with pressure changes.

ANSWERS

69. (b) 70. (b) 71. (c) 72. (b) 73. (c) 74. (c) 75. (c) 76. (b) 77. (a) 78. (b) 79. (b)
80. (c) 81. (b)

82. The heat of vaporisation.....with increase in pressure.

- (a) increases

- (b) decreases
(c) becomes zero at critical pressure (d) both (b) and (c)

83. In general, the specific heats of aqueous solutions.....with increase in the concentration of the solute.

- (a) increase
(c) remain unchanged (b) decrease
(d) none of these (a) dilute (b) ideal
(c) isotonic (d) saturated

90. Osmotic pressure exerted by a solution prepared by dissolving one gram mole of a solute in 22.4 litres of a solvent at 0°C will be..... atmosphere.

- (a) 0.5 (b) 1
(c) 1.5 (d) 2

91. Pick out the wrong conversion formula for the conversion of weight units :

84. In case of a solution (not of a solid in a liquid), whose total volume is more than the sum of volumes of its components in their pure states, solubility is
(a) independent of the temperature.
(b) increased with the increase in pressure, (c) decreased with the increase in pressure. (d) unchanged by the pressure change.

85. The heat capacity of a substance is
(a) greater for liquid state than for solid state. (b) lower for liquid state than for gaseous

state.

(c) higher for solid state than for liquid state. (d) equal for solid and liquid states below

melting point.

86. “The heat capacity of a solid compound is approximately equal to the sum of the heat capacities of the constituent elements.” This is the statement of

- (a) Law of Petit and Dulong
(b) Kopp’s rule
(c) Nearnst heat theorem
(d) Trouton’s rule

87. The atomic heat capacities of all solid elements.....with decrease in temperature. (a) increases
(b) decreases
(c) remains unchanged
(d) approach zero at 0°C

88. ‘Cox’ chart which is useful in the design of a distillation column (particularly suitable for petroleum hydrocarbons) is a plot of the
(a) temperature vs. log (vapor pressure). (b) vapor pressure vs. log (temperature). (c) log (temperature) vs. log (vapor pressure). (d) vapor pressure vs. temperature.

89. Solutions having the same osmotic pressure are called.....solutions.

(a) (b) (c)

(d)

1 tonne = 1000 kg = 22.046 lbs

1 U.S. ton = 907 kg = 0.907 tonne = 0.893 ton

1 ton = 2240 lbs = 1016 kg = 1.016 tonnes = 1.12 U.S. tons

none of these

92. Isotonic solutions must have the same (a) viscosity

(b) molar concentration

(c) normality

(d) critical temperature

93. Pick out the wrong statement. (a)

(c) (d)

Raoult’s law holds good for the solubility of polar gases in non-polar

(b) Molecules with symmetrical arrangement {e.g., CH₄ and CCl₄} are nonpolar. Most of the hydrocarbons are nonpolar. Generally, nonpolar compounds are chemically inactive, conduct electricity poorly and do not ionise.

94. A gaseous mixture contains 14 kg of N₂, 16 kg of O₂ and 17 kg of NH₃. The mole fraction of oxygen is

(a) 0.16 (b) 0.33

(c) 0.66 (d) 0.47

95. 1 centipoise is equivalent to

(a) (b) (c) (d)

1 gm/cm.second

1 centistoke

2.42 lb/ft.hr

2.42 lb/ft.second

96. Weight of 56 litres of ammonia at N.T.P. is.....gm.

(a) 2.5 (b) 42.5

(c) 56 (d) 2800

97. Atmospheric pressure corresponds to a hydrostatic head of

(a) 13.6 cms of Hg

(b) 34 ft of H₂O

(c) 1 metre of H₂O

(d) 13.6 metres of Hg

ANSWERS

82. (d) 83. (b) 84. (c) 85. (a) 86. (b) 87. (b) 88. (a) 89. (c) 90. (b) 91. (d) 92. (d)

93. (a) 94. (b) 95. (c) 96. (b) 97. (b)

98. The vapor pressure of water at 100 °C is (a) 100N/m² (b) 76 cms. of Hg (c) 13.6 cms of Hg (d) 760 mm wc

99. Viscosity of atmospheric air may be about..... centipoise.

(a) 0.015 (b) 1.5

(c) 15 (d) 150

100. The density of a liquid is 1500 kg/m³ Its value in gm/litre will be equal to

(a) 1.5 (b) 15

(c) 150 (d) 1500

101. Cp is expressed in S.I. unit as

(a) J/kg. °K (b) O °K

(c) W/m². °C (d) W/m. °K

102. C_p equals C_v at

- (a) 0°C (b) 0°K
(c) 0°F (d) 0°R

103. $^\circ\text{API}$ gravity of water at N.T.P. is about (a) 0 (b) 1

- (c) 10 (d) 100

104. Avogadro's number is equal to

- (a) 6.023×10^{23} molecules/kg.mole.
(b) 6.023×10^{23} molecules/gm.mole. (c) 6.023×10^{16} molecules/kg.mole.
(d) 6.023×10^{26} molecules/gm.mole.

105. Addition of a non volatile solute to a pure solvent

- (a) increases its freezing point.
(b) increases its boiling point.
(c) decreases its freezing point.
(d) both (b) and (c)

106. Volume occupied by one gm mole of a gas at S.T.P. is

- (a) 22.4 litres (b) 22400 litres (c) 22.4 c.c (d) 359 litres

107. The net heat evolved or absorbed in a chemical process, i.e. total change in the enthalpy of the system is independent of the

- (a) temperature & pressure.
(b) number of intermediate chemical reactions involved.

(c) state of aggregation & the state of combination at the beginning & the end of the reaction.

(d) none of these .

108. In physical adsorption, as compared to chemisorption, the

(a) quantity adsorbed per unit mass is higher. (b) rate of adsorption is controlled by the resistance to surface reaction.

(c) activation energy is very high.

(d) heat of adsorption is very large.

109. Othmer chart is useful in estimating the heat of

- (a) mixing (b) wetting

(c) adsorption (d) none of these

110. Enthalpy change resulting, when unit mass of solid is wetted with sufficient liquid, so that further addition of liquid produces no additional thermal effect, is called the heat of (a) mixing (b) adsorption

(c) wetting (d) complete wetting

111. At higher temperatures, molal heat capacities for most of the gases (at constant pressure).....with increase in temperature. (a) varies linearly (b) increases

(c) decreases (d) does not vary

112. Kopp's rule is helpful in finding the (a) heat capacities of solids.

(b) heat capacities of gases.

(c) molal heat capacities of gases.

(d) activation energy.

113. The maximum adiabatic flame temperature of fuels in air is.....the maximum flame temperature in pure oxygen .

(a) lower than (b) higher than (c) same as (d) not related to

114. 'Giga' stands for

(a) 10^9 (b) 10^{-12}

(c) 10^{12} (d) 10^{15}

115. 1 ata is equivalent to

(a) 1 atm. (b) 10 torr (c) 0.98 Pascal (d) 1 kgf/cm^2

116. pH value of H_2SO_4 (5% concentration) is (a) 5 (b) 7

(c) >7 (d) <7

117. 1 torr is equivalent to

(a) 1 mm Hg (b) 1 Pascal (c) 1 ata (d) 1 mm wc

118. pH value of an alkaline solution is (a) 7

(b) >7

(c) <7

(d) constant over a wide range

ANSWERS

98.(a) 99. (a) 100. (d) 101.(a) 102.(b) 103.(c) 104.(b) 105.(d) 106.(a) 107.(b)
108.(a) 109.(c) 110.(d) 111.(b) 112.(a) 113.(a) 114.(a) 115.(d) 116.(d) 117.(a)
118. (b)

119. pH value of a solution containing equal concentration of hydroxyl and hydrogen ions will be

- (a) 0 (b) 10
(c) 7 (d) 14

120. The quantity of heat required to evaporate 1kg of a saturated liquid is called

- (a) specific heat (c) sensible heat (b) 1 Kcal
(d) latent heat

121. A solution having a pH value of 5 is less acidic than the one having a pH value of 2 by a factor of

- (a) 3 (b) 100
(c) 1000 (d) none of these

122. The viscosity of water at room temperature may be around one

- (a) centipoise (b) poise
(c) stoke (d) both (b) & (c)

123. In a neutral solution

- (a) H^+ ions are absent.
(b) OH^- ions are absent.
(c) both H^+ and OH^- ions are present in

very small but equal concentration. (d) none of these.

124. An oxidation process is accompanied by decrease in the

- (a) number of electrons.
(b) oxidation number.
(c) number of ions.
(d) all (a), (b) & (c).

125. Atomic.....of an element is a whole number. (a) weight (b) number (c) volume (d) radius

126. A reduction process is accompanied with increase in the

- (a) number of electrons

- (b) oxidation number
- (c) both (a) & (b)
- (d) neither (a) nor (b)

127. Two solutions A_1 and A_2 have pH value of 2 and 6 respectively. It implies that the solution

- (a) A_2 is more alkaline than solution A_1 . (b) A_1 is highly acidic.
- (c) A_2 is very slightly acidic.
- (d) both (b) & (c).

128. For a neutral solution ($\text{pH} = 7$), the value of $[\text{H}^+]$ $[\text{OH}^-]$ is equal to

- (a) 0 (b) 1
- (c) <1 (d) >1

129. 1 Pascal (unit of pressure) is equal to.....N/ m^2 .

- (a) 10 (b) 1
- (c) 0.1 (d) 1000

130. Atoms of the same element, but of different masses are called

- (a) isobars (b) isotones (c) isotopes (d) none of these

131. A solution with reasonably permanent pH is called a/an.....solution.

- (a) ideal (b) non-ideal (c) buffer (d) colloidal

132. With rise in pressure, the solubility of gases in solvent, at a fixed temperature

- (a) increases
- (b) decreases
- (c) remains unchanged
- (d) decreases linearly

133. With rise in temperature, the solubility of ammonia in water at a fixed pressure (a) increases

- (b) decreases
- (c) remains unchanged
- (d) increases exponentially

134. For an ideal solution, the total vapor pressure varies.....with the composition (expressed as mole fraction). (a) inversely

- (c) linearly
(b) exponentially (d) negligibly

135. A solution is made by dissolving 1 kilo mole of solute in 2000 kg of solvent. The molality of the solution is

- (a) 2 (b) 1
(c) 0.5 (d) 0.5

136. Molality is defined as the number of gm moles of solute per.....of solvent.

- (a) litre (b) kg
(c) gm mole (d) gm

137. A very dilute solution is prepared by dissolving ' x_1 ' mole of solute in ' x_2 ' mole of a solvent. The mole fraction of solute is approximately equal to

- (a) x_1/x_2 (b) x_2/x_1
(c) $1 - (x_1/x_2)$ (d) $1/x_2$

138. Pick out the wrong statement:

- (a) Clausius-Clapeyron equation relates the

ANSWERS

119. (c) 120. (d) 121. (c) 122. (a) 123. (c) 124. (a) 125. (b) 126. (a) 127. (d) 128. (b)
129. (b)

130. (c) 131. (c) 132. (a) 133. (b) 134. (c) 135. (c) 136. (b) 137. (a) 138. (c) latent heat of vaporisation to the slope of the vapor pressure curve.

(b) At the boiling point of liquid at the prevailing total pressure, saturated absolute humidity is infinite.

(c) Percentage saturation and relative saturation are numerically equal for an unsaturated vapor gas mixture. Check equation

(c) both (a) & (b)

(d) neither (a) nor (b)

145. The increase in the temperature of the aqueous solution will result in decrease of its (a) weight % of the solute.

(b) mole fraction of the solute.

(c) molarity.

(d) molality.

(d) Clapeyron equation is given by, **146.** Concentration of a solution expressed in

dP

terms of.....is independent of temperature. l/TV^{V-L}); where, P = vapor (a) molarity (b) normality

(c) molality (d) none of these

pressure, T = absolute temperature, l = latent heat of vaporisation, V_G and V_L = position are called volumes of gas and liquid respectively. (a) ideal (b) saturated

139. Enthalpy of a vapor gas mixture may be in (c) supersaturated (d) azeotropic creased by increasing the

148. Roult's law is obeyed by a.....solution. (a) temperature at constant humidity. (a) saturated (b) molar (b) humidity at constant temperature. (c) normal (d) none of these (c) temperature and the humidity. **149.** Increasing the temperature of an aqueous so (d) all (a), (b) & (c).

lution will cause decrease in its **140.** The value of Trouton's ratio (l_b/T_b) for a (a) molality number of substances is 21 (where, l_b = mol (c) weight percent

(b) mole fraction (d) molarity **150.** The most

convenient way of expressing solu normal boiling point, KCal/kg. mole and T_b = tion

concentration is in terms of normal boiling point, $^{\circ}\text{K}$). The Kistyakowsky (a) mole fraction (b)

normality equation is used for calculation of Trouton's (c) molality (d) molarity ratio of.....liquids.

(a) polar (b) non-polar **151.** Vapor pressure of a solution is proportional (c) both

(a) & (b) (d) neither (a) nor (b) to

141. Claussius Clapeyron equation applies to (a) S_v (b) $1/S_t$ the.....process. (c)

S_t (d) $1/S_v$ (a) sublimation (b) melting where, S_v and S_t are mole fraction of solvent

(c) vaporisation (d) all (a), (b) & (c) and solute respectively.

142. Except for monoatomic gases, the molal heat **152.** A gas mixture contains 6

moles of H_2 and 2 capacity at constant volume for all gases moles of N_2 . If the

total pressure of the gasis.....Kcal/Kg mole. $^{\circ}\text{K}$. eous mixture is 4

kgf/cm^2 ; then the partial (a) 3 (b) >3 pressure of N_2 in the mixture will

be..... (c) <3 (d) $<1 \text{ kgf/cm}^2$.

The value of $(C_p - C_v)$ for a real gas obeying (a) 1 (b) 2 **143.** (c) 4 (d) 8 Vander Wall's equation is **153.**

Which of the following terms of Vander Walls (a) R (b) $>R$ equation of state for a non-ideal gas accounts (c) $<R$ (d) $0.5 R$ for intermolecular forces ?

144. Applicability of Claussius-Clapeyron equation

is subject to the condition that the (a) RT (b)

(a) vapor follows ideal gas law. (b) volume in the liquid state is negligible.

(c) $(V - b)$ (d) $1/RT$

ANSWERS

139.(d) 140.(c) 141.(d) 142.(b) 143.(b) 144.(c) 145.(c) 146.(c) 147.(d) 148.(d)

149.(d) 150.(d) 151.(a) 152.(a) 153.(a)

154. The density of a gas at N.T.P. is 'r'. Keeping the pressure constant (i.e.

760 mm Hg),

density of the gas will become $\frac{1}{3}$ 0.75 r at a temperature of.....°K . 4

162. The elevation in boiling point of a solution is proportional to the.....of the solution. (a) molal concentration

(b) reciprocal of the molal concentration (c) normality

(d) molarity

163. The OH^- concentration in a solution having pH value 3 is

(a) 10^{-3} (b) 10^{-10}

(c) 10^{-11} (d) 10^{-13}

164. The number of H^+ in 1 c.c solution of pH 13 is (a) 6.023×10^{13} (b) 6.023×10^{10} (c) 6.023×10^7 (d) 10^{-13}

(a) 273 (b) 300

(c) 400 (d) 300

155. The temperature at which real gases obey the ideal gas law over a wide range of pressure is called the.....temperature.

(a) reduced (b) Boyle

(c) critical (d) inversion

156. If the pressure of a gas is reduced to half & its absolute temperature is doubled, then the volume of the gas will

(a) be reduced to 1/4th.

(b) increase four times.

(c) increase two times.

(d) none of these.

157. A gas at 0°C is cooled at constant pressure until its volume becomes half the original volume. The temperature of the gas at this state will be

(a) -136.5°C (b) -136.5°K (c) -273°C (d) 0°K

158. At what temperature, given mass of a gas that occupies a volume of 2 litres at N.T.P. will occupy a volume of 4 litres, if the pressure of the gas is kept constant ?

(a) 273°C (b) 273°K

(c) 100°C (d) 200°C

159. 40 gms each of the methane and oxygen are mixed in an empty container maintained at 40°C. The fraction of the total pressure exerted by oxygen is

(a) $\frac{1}{2}$ (b) $\frac{1}{3}$

(c) $\frac{1}{4}$ (d) $\frac{2}{3}$

160. The density of a gas 'X' is twice that of another gas 'Y'. If the molecular weight of gas 'Y' is 'M'; then the molecular weight of the gas 'X' will be

(a) 2 M (b) $\frac{M}{2}$

(c) M (d) $\frac{M}{4}$

161. If 1 Nm³ of O₂ contains 'N' number of molecules, then number of molecules in 2 Nm³ of SO₂ will be

(a) N (b) $\frac{N}{2}$ required to form 224 c.c. of H₂ at N.T.P. on treatment with dilute H₂SO₄ will be.....gm. (c) 2N (d) 4N

ANSWERS

154.(d) 155.(c) 156.(b) 157.(a) 158.(a) 159.(b) 160.(a) 161.(c) 162.(a) 163.(c)

164.(c) 165.(a) 166.(b) 167.(b) 168.(d) 169.(a) 170.(b) 171.(b) 172.(b)

165. CaCO₃ contains.....percent of Ca by weight. (a) 40 (b) 48

(c) 96 (d) 12

166. How much O₂ can be obtained from 90 kg of water ?

(a) 32 kg (b) 80 kg

(c) 64 kg (d) 90 kg

167. kg of CaCO₃ on heating will give 56 kg of CaO.

(a) 56 (b) 100

(c) 144 (d) 1000

168. NaOH contains.....percent oxygen. (a) 1 (b) 10

(c) 16 (d) 40

169. On mixing 56 gm of CaO with 63 gm of HNO₃, the amount of Ca(NO₃)₂ formed is.....gm. (a) 82 (b) 164

(c) 41 (d) 8.2

170. A metal oxide is reduced by heating it in a stream of hydrogen. After complete reduction, it is found that 3.15 gm of the oxide has yielded 1.05 gm of the metal. It may be inferred that the

(a) atomic weight of the metal is 4.

(b) equivalent weight of the metal is 4. (c) atomic weight of the metal is 2.

(d) equivalent weight of the metal is 8. **171.** If 1.5 moles of oxygen combines with aluminium to form Al_2O_3 , then the weight of aluminium (atomic weight = 27) used in this reaction is.....gm.

- (a) 27 (b) 54
(c) 5.4 (d) 2.7

172. The amount of Zn (atomic weight = 65) re(a) 0.065 (b) 0.65
(c) 6.5 (d) 65

173. 6 gms of magnesium (atomic weight = 24), reacts with excess of an acid, the amount of H_2 produced will be.....gm.

- (a) 0.5 (b) 1
(c) 3 (d) 5

174. A compound was found having nitrogen and oxygen in the ratio 28 gm and 80 gm respectively. The formula of the compound is

- (a) N_2O_4 (b) N_2O_5
(c) N_2O_3 (d) none of these
perature of a gas and reduction of its pressure to half, will result in.....in the volume of the gas.
(a) no change
(b) doubling
(c) 1/4th reduction
(d) four fold increase

183. A gas at 0°C was subjected to constant pressure cooling until its volume became half the original volume. The temperature of the gas at this stage will be

- (a) 0°C (b) 0°K
(c) -136.5°C (d) -136.5°K

175. In the reaction, represented by
 $\text{Na}_2\text{CO}_3 + \text{HCl} \rightarrow \text{NaHCO}_3 + \text{NaCl}$, the
equivalent weight of Na_2CO_3 is

- (a) 53 (b) 5.3
(c) 106 (d) 10.6

176. If pH value of a solution is 8, then its pOH value will be

- (a) 6 (b) 1

(c) 7 (d) 10

177. As per Kirchoff's equation, the heat of reac

184. The atomic weight of helium is 4 times that of hydrogen. Its diffusion rate as compared to hydrogen will be.....times. (a) $1/2$ (b) 4 (c) 2 (d) $1/4$

185. What fraction of the total pressure is exerted by oxygen, if equal weights of oxygen and methane are mixed in an empty vessel at 25°C ?

(a) $2/3$ (b) $1/3$ tion is affected by the (a) pressure

(c) temperature (b) volume

(d) molecularity

178. Hess's law of constant heat summation is based on conservation of mass. It deals with

(a) equilibrium constant.

(b) reaction rate.

(c) changes in heat of reaction.

(d) none of these.

179. On addition of 1 c.c. of dilute hydrochloric acid (1% concentration) to 80 c.c. of a buffer solution of $\text{pH} = 4$, the pH of the solution becomes (a) 1 (b) 8 (c) 4 (d) 2

180. With increase in the temperature of pure (distilled) water, its

(a) pOH decreases and pH increases. (b) pOH and pH both decreases.

(c) pH and pOH both increases.

(d) pH decreases and pOH increases.

181. The molecular velocity of a real gas is proportional to

(a) T (b) T

(c) T^2 (d) $1/T$

182. Simultaneous doubling of the absolute tem

(c)

$1/2$

(d)

$1/3$

×
298
273

186. Heat of reaction is not influenced by

- (a) the route/method through which final products are obtained.
- (b) the physical state (*e.g.*, solid, liquid or gaseous) of reactants and products.
- (c) whether the reaction is carried out at constant temperature or constant pressure.
- (d) none of these.

187. Molar heat capacity of water in equilibrium with ice at constant pressure is

- (a) 0 (b) ∞
- (c) 1 (d) none of these

188. is an intensive property.

- (a) Temperature (b) Refractive index (c) Volume (d) none of these

189. For an endothermic reaction, the minimum value of energy of activation will be (a) DH (b) $> DH$

- (c) $< DH$ (d) 0

where, DH = enthalpy of the reaction

190. Which of the following gases is the most soluble in water ?

ANSWERS

173. (a) 174. (b) 175. (c) 176. (a) 177. (c) 178. (c) 179. (c) 180. (b) 181. (a) 182. (b) 183. (c)

184. (c) 185. (b) 186. (a) 187. (b) 188. (d) 189. (b) 190. (a)

(a) NH_3 (b) CO_2 (c) called percentage saturation. (c) H_2S (d) CH_4 (d) not a function of the nature of vapor.

191. Which of the following gravity scales is used **198.** Sometimes, in chemical processes, a part of exclusively for liquids heavier than water ? the outlet stream is rejected as waste in or

(a) Baumme scale

(c) API scale

(b) Twaddel scale der to keep the impurity level in the system (d) none of these

within limits. This phenomenon is termed as

192. Vapor pressure of water at 100°C is about.....bar. the

(a) 0.1013 (b) 1.013 (a) recycling (b) purging (c) 10.13 (d) 101.3 (c) bypassing
(d) recirculation

193. Which of the following ideal gas laws are not applicable to mixture of gases ?

(a) Amagat's law
(b) Dalton's law
(c) Boyle's law & Charles's Law
(d) none of these

194. A vapor whose partial pressure is less than its equilibrium vapor pressure is called

the.....vapor.

(a) saturated (b) superheated
(c) unsaturated (d) dry gaseous

195. According to Raoult's law, "The vapor pressure exerted by component in a solution is proportional to its mole fraction. This law is called

(a) stripping
(b) leaching
(c) differential distillation (d) absorption

Which of the following is not used for computing latent heat of vaporisation ?

(a) Clausius-Clapeyron equation (b) Reference substance plots based on Dühring & Othmer plots

(c) Kistyakowsky's equation (d) Hess's law of constant heat summation proportional to the mole fraction of that component."

201. The temperature at which a real gas obeys

Raoult's law is not applicable under the following conditions. (a) triple point (b) Boyle's temperature (c) eutectic point (d) inversion temperature and are of almost equal size.

(c) In the formation of solution, chemical combination/molecular association between unlike molecules takes place. are put together in a vessel of

1 litre capacity (d) The attractive forces between like and unlike molecules are almost equal. The final pressure of the gas mixture will be.....mm Hg.

like molecules are almost equal. be.....mm Hg.

196. The activity coefficient, of a solution, which (a) 650 (b) 700 accounts for the departure of liquid phase (c) 600 (d) 375

from ideal solution behaviour **203.** Pick out the wrong statement. (a) measures the elevation in boiling point. (a) Ten times dilution of a normal solution (b) is not dependent on the temperature.

(c) is a function of the liquid phase composition (b)

tion.

(d) measures the depression in freezing point.

197. The percentage ratio of the partial pressure (N) reduces its normality to N/10. When equal weights of oxygen and methane are mixed in an empty reactor at room temperature, then the fraction of total pressure exerted by the oxygen is 1/2.

of the vapor to the vapor pressure of the liquid (c) Volume occupied by 9.034×10^{23} atoms of oxygen in ozone (O₃) at NTP will be (a) termed as relative saturation. 11200 c.c

(b) not a function of the composition of gas (d) One kg mole of an ideal gas at N.T.P occupies 22400 Nm³.

ANSWERS

191. (d) 192. (b) 193. (c) 194. (b) 195. (c) 196. (c) 197. (a) 198. (b) 199. (b) 200. (d) 201. (b) 202. (a) 203. (d)

204. If the absolute temperature of an ideal gas

B

is tripled and simultaneously the pressure is reduced to one third; then the volume of gas

will

(a)

remain unaltered

II.

T

$b = +$

$8.75 \log_{10} T_b$ (b) increase six fold

(c) increase three fold (d) decrease three fold

205. Acidity or alkalinity of a solution is expressed by its pH value, which is defined as

$$pH = -\log_{10} a_{H^+}$$

(a) $\log_{10} a_{H^+}$

(b) $-\log_{10} a_{H^+}$

(c) $\log_{10} a_{H^+}$

(d) $-\log_{10} a_{H^+}$

206. Match the values of following stoichiometric

(a) The value of C_p/C_v for monatomic gases where, $[H^+] =$ hydrogen ion concentration in the solution. (b) The value of C_p for monatomic gases (c) The value of C_p for diatomic gases (d) The value of C_p/C_v for diatomic gases

207. Match the statements of various laws used in stoichiometry. List I

List I I. 1.5 R II. 2.5 R (a) The equilibrium value of the mole fraction of gas dissolved in a liquid is directly proportional to the partial pressure of the gas above the liquid surface. (b) accumulation (c) input (d) generation

(a) Equal volume of all gases contain the same number of molecules under the same conditions of temperature and pressure. (b) 90% approximately equal to the sum of the heat capacities of the constituent elements. (c) 95% (d) 98%

208. A fluid gas produced on burning furnace oil. (a) 80% (b) 90% (c) 95% (d) 98%

209. The rate of material is zero in case of a steady state system. (a) accumulation (b) production (c) input (d) generation

List II

I. Avagadro's law

II. Kopp's rule **210.**

III. Henry's law

IV. Amagat's law

contains 0.15 gm mole of CO_2 , 0.05 gm mole

of oxygen and 0.80 gm mole of N_2 . What is its molecular weight ?

(a) 28.6 (b) 30.0 (c) 30.6 (d) 32.6

Density of carbon dioxide is.....kg/Nm³. (a) 44/22400 (b) 44/22.4 (c) 22.4/44 (d) none of these

207. Match the following equations encountered 213. 1 gm mole of an alcohol whose molecular in stoichiometrical calculations.

List I

(a) Clayperon equation

(b) Antonie equation

(c) Kistyakowsky equation

(d) Trouton's rule

List II

weight is 74 contains 48 gms of carbon, 10 gms of hydrogen and 16 gms of oxygen. Its molecular formula is

(a) $\text{C}_4\text{H}_9\text{OH}$ (b) $\text{C}_3\text{H}_{21}\text{OH}$ (c) $(\text{C}_2\text{H}_4)_2\text{H}_2\cdot\text{OH}$ (d) $\text{C}_2\text{H}_{33}\text{OH}$

214. 1 kg of calcium carbide (CaC_2) produces about 0.41 kg of acetylene gas on treatment with water.

204.(b) 205.(a) 206.(a) 207.(a)

ANSWERS

208.(a) 209.(a) 210.(b) 211.(c) 212.(b) 213.(a) 214.(b)

38 (c) $^{\circ}\text{C} = (F - 32) 0.555$ **Objective Type Chemical Engineering**

How many hours of service can be derived (c) $^{\circ}\text{C} = (F - 32) 0.555$ from 1 kg of calcium carbide in an acetylene (d) $^{\circ}\text{F} = (^{\circ}\text{C} + 17.778) \times 1.8$ lamp burning 35 litres of gas at NTP per hour

(a) 5 (b) 10 221. Pick out the wrong unit conversion of heat (c) 15 (d) 20 transfer rate.

215. Pick out the wrong statement about the re (a) 1 kcal/hr = 1.163 Watt. cycle stream in a

process. (b) 1 Watt = 1.163 kcal/hr. (a) Recycling in a process stream helps in (c) 1

BTU/ft².hr = 2.712 kcal/m².hr. utilising the valuable reactants to the (d) 1 kcal/m².hr = 0.3687

$$\text{BTU/ft}^2\cdot\text{hr} = 1.163$$

maximum with minimum loss of reactants. Watt/m^2 .

(b) The ratio of the quantity of a reactant **222**. Pick out the wrong unit conversion of heat

present in the reactor feed of a recycling transfer co-efficient.

operation to the quantity of the same re(a) $1 \text{ kcal/m}^2\cdot\text{hr}\cdot^\circ\text{C} = 0.2048 \text{ BTU/ft}^2\cdot\text{hr}\cdot^\circ\text{F}$.

actant entering the process as fresh feed $1.163 \text{ W/m}^2\cdot^\circ\text{K}$

is called combined feed ratio. (b) $1 \text{ kcal/m}^2\cdot\text{hr}\cdot^\circ\text{K} = 1.163 \text{ W/m}^2\cdot^\circ\text{C}$ (c)

Recycling in a process does not help in (c) $1 \text{ W/m}^2\cdot^\circ\text{C} = 0.1761 \text{ BTU/ft}^2\cdot\text{hr}\cdot^\circ\text{F}$.

getting higher extent of reaction. (d) $1 \text{ BTU/ft}^2\cdot\text{hr}\cdot^\circ\text{F} = 4.88 \text{ kcal/m}^2\cdot\text{hr}\cdot^\circ\text{C} = (d)$

Recycling is exemplified by refluxing $20.44 \text{ kJ/m}^2\cdot\text{hr}\cdot^\circ\text{C} = 5.678 \text{ W/m}^2\cdot^\circ\text{C}$.

back a part of the distillate to the distil**223**. Pick out the wrong unit conversion of ther_{lation} column to maintain the quantity mal conductivity.of liquid within the column. (a) $1 \text{ BTU/ft}^2\cdot\text{hr}\cdot^\circ\text{F/ft} = 1.488 \text{ kcal/m}^2$.

216. In the reaction, $\text{Ca} + 2\text{H}_2\text{O} = \text{Ca}(\text{OH})_2 + \text{H}_2$; $\text{hr}\cdot^\circ\text{C/m}$

what volume (c.c.) of hydrogen at STP would (b) $1 \text{ BTU/ft}^2\cdot\text{hr}\cdot^\circ\text{F/inch} = 1.488$

kcal/m^2 . be liberated, when 8 gm of calcium reacts $\text{hr}\cdot^\circ\text{C/m}$

with excess water ? (atomic weight of calcium (c) $1 \text{ kcal/m}\cdot\text{hr}\cdot^\circ\text{C} = 0.672$

$\text{BTU/ft}\cdot\text{hr}\cdot^\circ\text{F} = 40) = 1.163 \text{ W/m}\cdot^\circ\text{K}$

(a) 4480 (b) 2240 (d) $1 \text{ W/cm}\cdot^\circ\text{C} = 85.985 \text{ kcal/m}\cdot\text{hr}\cdot^\circ\text{C} = 57.779$ (c) 1120 (d) $0.4 \text{ BTU/ft}\cdot\text{hr}\cdot^\circ\text{F}$

217. The unit of dynamic viscosity is **224**. One micron is equal to

(a) stoke (b) poise (a) 10^{-4} cm (b) 10^{-4} cm (b) gm/cm sec . (d) both (b) & (c) (c) 10^{-6} m (d) both (b) & (c)

218. Viscosity of 1 centipoise is equal to 1 centi**225**. Pick out the wrong unit conversion of mass stoke in case of transfer co-efficient.

(a) water (a) $1 \text{ lb/hr}\cdot\text{ft}^3$, atm. = $4.8182 \text{ kg/hr}\cdot\text{m}^2\cdot\text{bar}$ (b) mercury (b) 1

$\text{kg/hr}\cdot\text{m}^2\cdot\text{atm} = 0.98687 \text{ kg/hr}\cdot\text{m}^2\cdot\text{bar}$ (c) carbon tetrachloride (c) $1 \text{ lb/hr}\cdot\text{ft}^2 = 4.8823 \text{ kg/hr}\cdot\text{m}^2$ (d) none of these (d) $1 \text{ kg/hr}\cdot\text{m}^2 = 4.8823 \text{ lb/hr}\cdot\text{ft}^2$

219. Pick out the wrong unit conversion. **226**. Unit of power is (a) $1 \text{ atm} = 760 \text{ mm Hg} = 29.92 \text{ inch Hg} = 14.7 \text{ psi} = 1.013 \text{ bar} = 1.013 \text{ kgf/cm}^2$

(b) $1 \text{ kPa} = 100 \text{ bar}$ 227. (c) $1 \text{ mm Hg} = 1 \text{ torr} = 133.3 \text{ Pa}$
(d) none of these.

220. Pick out the wrong unit conversion of tem (a) joule (b) watt
(b) joule/Second (d) both (b) & (c)

Avogadro number is the number of molecules in one.....of a gas.
(a) gram (b) kilogram (c) gm.mole (d) litre

perature. **228.** Kinematic viscosity of $1 \text{ m}^2/\text{second}$ is equivalent (a) $^\circ\text{R} = 273 + ^\circ\text{F}$ lent
to.....stokes.

(b)
temperature difference of $1^\circ\text{K} = 1^\circ\text{C} =$

$9 ^\circ\text{F}$ (a) 10 (b) 10^2 5
(c) 10^3 (d) 10^4

ANSWERS

215. (c) 216. (a) 217. (d) 218. (a) 219. (b) 220. (a) 221. (b) 222. (b) 223. (b) 224.
(d) 225. (d) 226. (d) 227. (c) 228. (d)

229. Air contains 79% N_2 by volume which is equivalent to.....ppm.
(a) 790000 (b) 79000
(c) 7900000 (d) 79000000

230. Equality of.....in and out is involved in the material balance equation.
(a) mass (b) volume
(c) moles (d) concentration

231. Concentration in terms of $^\circ\text{Baumme}$ of a sulphuric acid solution of specific gravity 1.5 is (a) 48.33 (b) 24.16
(c) 66.33 (d) 81.24

232. Recycle ratio is defined as the ratio of recycle rate to fresh feed rate.
Decrease in recycle rate.....the output rate.
(a) increases
(b) decreases
(c) does not affect
(d) has no relation with

233. Relative humidity of air at 1 atm. pressure, which has an absolute humidity of 2.482 kg/ kg at 100°C is.....per cent

- (a) 25 (b) 50
(c) 80 (d) 95

234. Purge stream is useful for maintaining low concentration of inerts. Which of the following holds good, if recycle rate equals bypass rate?

- (a) mixed feed rate = bypass rate
(b) mixed feed rate = fresh feed rate (c) fresh feed rate = recycle rate
(d) none of these

235. Solvent evaporated in a simple evaporator in which thick liquor's weight is 50% of the feed is per cent.

- (a) 77.77 (b) 50 (c) between 50 to 100 (d) <50

236. Match the process technique used with the proper reasons for them.

List I

- (i) purge stream
(ii) recycle stream

List II

- (A) to increase the reactant conversion. (a) i - B , ii - A (b) i - B , ii - A
(c) i - C , ii - D (d) i - D , ii - A

237. Two reactants A (200 kg) and B (200 kg) are used in a chemical process. If conversion is 50% and A & B reacts in equal proportion, then the weight of the product formed is.....kg.

- (a) 100 (b) 200
(c) 300 (d) 400

238. If feed of 500 tons/hr at 5% concentration is fed to a crystalliser, the product obtained at 25% concentration is equal to tons/hr. (a) 75 (b) 100
(c) 150 (d) 200

239. The overall in and out flow rates of the sys- tem is.....stream.

- (a) not affected by the recycle
(b) affected by the purge
(c) both 'a' and 'b'
(d) neither 'a' nor 'b'

240. 18 kg of salt (NaCl) is added to 100 kg of water to make a liquid of density 1200 kg/m^3 . The concentration of salt in this solution as a weight fraction is
(a) 0.1566 (b) 0.1525 (c) 0.1850 (d) 0.2535

241. 20 m^3 of water is mixed with 20 m^3 of another liquid with a specific gravity of 1.3 kg/litre. The mass of the mixture would be..... tons.
(a) 34 (b) 41
(c) 46 (d) 54

242. If the density of a liquid fuel is 0.9 kg/m^3 , then its specific gravity is
(a) 0.09 (b) 0.9
(c) 0.45 (d) 1.45

243. A firm pays Rs. 2 for 1 kwh of fuel oil. If the c.v. of fuel oil is 10000 kcal/litre, the cost of 1 litre of fuel oil will be Rs.
(a) 23.25
(b) 26.25
(c) 11.62
(d) question does not make sense

244. The calorific value (c.v) of coal is 4200 kcal/kg. (B) to maintain inert concentration. Find out the oil equivalent of 500 kg of coal, if (C) to get highly enriched product.
(D) to enhance the production rate.
the c.v of oil is 10000 kcal/kg. (a) 180 (b) 210 (c) 410 (d) 535

229. (a) 230. (a) 231. (a) 237. (b) 238. (b) 239. (c)

ANSWERS

232. (c) 233. (c) 234. (b) 235. (c) 236. (a) 240. (b) 241. (c) 242. (b) 243. (a) 244. (b)

Mechanical operations

1. Shape factor for a cylinder whose length (b) energy absorbed by the solid to that fed to 3 equals its diameter is the machine.
(a) 1.5 (b) 0.5 (c) energy fed to the machine to the surface (c) 1.0 (d) 2.0 energy created by crushing. **2.** The ratio of the actual mesh dimension of Tay^(d) energy absorbed by the solid to the surface lor series to that of the next smaller screen is^{energy}

created by crushing.

(a) 2 (b)

2 9. Rittinger's crushing law states that (c)

1.5

(d)

3

(a) work required to form a particle of any size is proportional to the square of the surface 3.

The opening of a 200 mesh screen (Taylor se
to volume ratio of the product.

(b) work required to form a particle of a parries) is ticular size is proportional to the square (a) 0.0074 cm

(b) 0.0074mm root of the surface to volume ratio of the (c) 0.0047cm (d) 74 mili-microns product. 4. The

ratio of the area of openings in one screen (c) work required in crushing is proportional
(Taylor series) to that of the openings in the to the new surface created.next smaller screen is (d) for a given
machine and feed, crushing ef(a) 1.5 (b) 1 ficiency is dependent on the size of the feed

(c) 2

(d) none of these & product.

5. Cumulative analysis for determining surface 10. Bond crushing law

is more precise than differential analysis, be(a) calls for relatively less energy for
the cause of the

(a) assumption that all particles in a single
fraction are equal in size. (b)

(b) fact that screening is more effective.

(c) assumption that all particles in a single (c)
fraction are equal in size, is not needed.

(d) none of these.

6. Equivalent diameter of a particle is the diam

smaller product particles, than does the Rittinger law.

is less realistic in estimating the power requirements of commercial crushers.

states that the work required to form particle of any size from very large feed is
pro- portional to the square root of the volume to surface ratio of the product.

(d) states that the work required for the eter of the sphere having the same crushing is
proportional to the new surface (a) ratio of surface to volume as the actual volume. created.(b) ratio of
volume to surface as the particle.

(c) volume as the particle. 11. Work index is defined as the (d) none of these. (a)
gross energy (kWh/ton of feed) needed to

7. Soft & non-abrasive materials can be made into fines by (a) attrition (c)

cutting (b) compression (b)(d) none of these

reduce very large feed to such a size that 80% of the product passes through a 100

micron screen

energy needed to crush one tonne of feed to 200 microns.

8. Crushing efficiency is the ratio of the (c) energy (kWh/ton of feed) needed to crush (a) surface energy created by crushing to the energy absorbed by the solid.

small feed to such a size that 80% of the product passes a 200 mesh screen.

ANSWERS

1.(a) 2.(b) 3.(a) 4.(d) 5.(c) 6.(a) 7.(a) 8.(a) 9. (c) 10.(a) 11.(a) (d) energy needed to crush one ton of feed to 100 microns.

12. The operating speed of a ball mill should be.....the critical speed.

(a) less than

(b) much more than

(c) at least equal to

(d) slightly more than

13. A fluid energy mill is used for

(a) cutting (b) grinding (c) ultragrinding (d) crushing

14. Wet grinding in a revolving mill.....as compared to dry grinding.

(a) gives less wear on chamber walls

(b) requires more energy

(c) increases capacity

(d) complicates handling of the product

15. Cement clinker is reduced to fine size by a (b) ball mill

(d) hammer mill

16. Molten ammonium nitrate is mixed with ground limestone in fertilizer plant in a (a) pug mill (b) mixer-extruder (c) banbury mixer (d) muller mixer

17. For the preliminary breaking of hard rock, we use a

(a) gyratory crusher

(b) ball mill

(c) tube mill

(d) squirrel-cage disintegrator

18. Fibrous material is broken by a

(a) roll crusher

(b) squirrel-cage disintegrator

(c) ball mill

(d) tube mill

19. As the product becomes finer, the energy re- quired for grinding

(a) decreases

(b) increases

(c) is same as for coarser grinding

(d) is 1.5 times that for coarser grinding

20. Increasing the capacity of a screen.....the screen effectiveness. (a) decreases

(c) does not effect

21. Screen efficiency is (a) recovery/rejection (c) rejection

(b) increases

(d) none of these

(b) recovery

(d) none of these

22. Traces of solids are removed from liquid in a (a) classifier (b) clarifier

(c) sparkler filter(d) rotary vacuum filter

23. Vacuum filter is most suitable for the (a) removal of fines from liquid.

(b) (c) (d)

liquids having high vapour pressure. liquids of very high viscosity.
none of these.

(a) roll crusher (c) tube mill

24. Filter aid is used to

(a) increase the rate of filtration.

(b) decrease the pressure drop.

(c) increase the porosity of the cake.

(d) act as a support base for the septum.

25. Filter medium resistance is that offered by the (a) filter cloth.

(b) embedded particles in the septum. (c) filter cloth and the embedded particle col-

lectively.

(d) none of these.

26. During the washing of cake

(a) all the resistances are constant.

(b) filter medium resistance increases. (c) filter medium resistance decreases. (d) cake resistance decreases.

27. The porosity of a compressible cake is (a) minimum at the filter medium.

(b) minimum at the upstream face.

(c) maximum at the filter medium.

(d) same throughout the thickness of cake.

28. The unit of specific cake resistance is (a) gm/cm^2 (b) cm/gm (c) cm/gm^2 (d) gm/gm

29. The filter medium resistance is controlled by (a) pressure drop alone

(b) flow rate alone

(c) both pressure drop and flow rate

(d) cake thickness

30. Compressibility co-efficient for an absolutely compressible cake is

(a) 0 (b) 1

(c) 0 to 1 (d) ∞

31. In continuous filtration (at a constant pressure drop), filtrate flow rate varies inversely as the (a)

(b)

square root of the velocity.

square of the viscosity.

(c) filtration time only.

(d) washing time only.

ANSWERS

12. (a) 13. (c) 14. (c) 15. (c) 16. (a) 17. (a) 18. (b) 19. (b) 20. (a) 21. (d) 22. (b) 23. (d)

24. (c) 25. (c) 26. (a) 27. (a) 28. (a) 29. (c) 30. (b) 31. (a)

32. For separation of sugar solution from settled out mud, we use a.....filter.

- (a) sparkler
- (b) plate and frame
- (c) centrifugal
- (d) rotary drum vacuum

33. Moisture can be removed from lubricating oil using

- (a) tubular centrifuge
- (b) clarifier
- (c) sparkler filter
- (d) vacuum leaf filter

34. Dust laden air can be purified using a (a) cyclone separator

- (b) bag filter
- (c) gravity settler
- (d) tubular centrifuge

35. The most common filter aid is

- (a) diatomaceous earth
- (b) calcium silicate
- (c) sodium carbonate
- (d) silica gel

36. Removal of activated carbon from glycerine is done by

- (a) plate and frame filter
- (b) rotary vacuum filter
- (c) batch basket centrifuge
- (d) none of these

37. Filtration of water in a paper mill is done by a/

- (b) plate and frame

- (d) sparkler

an.....filter. (a) open sand

(c) vacuum leaf

38. The speed of a rotary drum vacuum filter may be about.....rpm.

(a) 1 (b) 50

(c) 100 (d) 500

39. Gelatinous solid (which plug the septum) can be filtered by a.....filter.

(a) sparkler (b) plate and frame (c) vacuum leaf (d) precoat

40. A screen is said to be blinded, when the (a) oversizes are present in undersize fraction. (b) undersizes are retained in oversize fraction. (c) screen is plugged with solid particles. (d) screen capacity is abruptly increased.

41. Size measurement of ultrafine particles can be best expressed in terms of

(a) centimetre

(b) screen size

(c) micron

(d) surface area per unit mass

42. Ultrafine grinders operate principally by (a) slow compression (b) impact (c) attrition (d) cutting action

43. Trommels separate a mixture of particles depending on their

(a) size

(b) density

(c) wettability

(d) electrical & magnetic properties

44. The energy consumed by a ball mill depends on (a) its speed.

(b) its ball load.

(c) the density of the material being ground. (d) all (a), (b) and (c.)

45. Grinding efficiency of a ball mill is of the order of.....percent.

(a) 1-5 (b) 40-50

(c) 75-80 (d) 90-95

46. Screen capacity is expressed in terms of (a) tons/hr (b) tons/ft² (c) both (a) &

(b) (d) tons/hr-ft²

47. Which of the following screens has the maximum capacity ?

(a) Grizzlies (b) Trommels (c) Shaking screen (d) Vibrating screen

48. Separation of particles of various sizes, shapes and densities by allowing them to settle in a fluid is called

(a) classification (c) thickening (b) froth floatation (d) clarification

49. For beneficiation of iron ore, the most commonly used method is (a) flocculation.

(c) jigging & tabling. (b) froth floatation. (d) none of these.

50. Froth floatation is the most suitable for treating

(a) iron ores (c) quartzite (b) sulphide ores (d) none of these

51. In case of a revolving mill, wet grinding compared to dry grinding

(a) requires more energy.

(b) has less capacity.

(c) complicates handling & classification of

the product.

(d) none of these.

ANSWERS

32. (c) 33.(a) 34.(a) 35.(a) 36.(a) 37.(a) 38.(a) 39.(d) 40.(c) 41.(d) 42.(c) 43.(a)
44.(b) 45.(a) 46.(d) 47.(d) 48.(a) 49.(c) 50.(b) 51.(d)

52. Choke crushing (in case of a Jaw crusher) compared to free crushing

(a) results in increased capacity.

(b) consumes less power.

(c) consumes more power.

(d) both (a) and (c).

53. Which is the most suitable conveyor for transportation of sticky material ?

(a) Apron conveyor

(b) Belt conveyor

(c) Screw conveyor

(d) Pneumatic conveyor

54. Ore concentration by jigging is based on the difference in the.....of the particles. (a) specific gravities (b) wettability (c) shape (d) none of these

55. Chance process is used for the

- (a) cleaning of coal.
- (b) concentration of iron ore.
- (c) concentration of pyrites.
- (d) water treatment

56. If radius of a batch' basket centrifuge is halved & the r.p.m. is doubled, then the

- (a) linear speed of the basket is doubled.
- (b) linear speed of the basket is halved.
- (c) centrifugal force is doubled.
- (d) capacity of centrifuge is increased.

57. Where the density difference of the two liquid phase to be separated is very small (as in milk cream separator), the most suitable separator is a

- (a) disc bowl centrifuge.
- (b) sharples super centrifuge.
- (c) batch basket centrifuge.
- (d) sparkler filter.

58. For sizing of fine materials, the most suitable equipment is a

- (a) trommel
- (b) shaking screen
- (c) grizzly
- (d) vibrating screen

59. Which of the following conveyors cannot be recommended for transportation of abrasive materials ?

- (a) Belt conveyor
- (b) Apron conveyor
- (c) Flight conveyor
- (d) Chain conveyor

60. In froth floatation, chemical agent added to cause air adherence is called

- (a) collector
- (b) frother
- (c) modifier
- (d) activator

61. Pine oil used in froth floatation technique acts as a/an

- (a) collector
- (b) modifier
- (c) frother
- (d) activator

62. Float and sink test determines the possibility of cleaning of coal by a process based on the,

- (a) gravity separation
- (b) wettability
- (c) particle shape
- (d) none of these

63. Which of the following is the most suitable for cleaning of fine coal dust

(<0.5 mm) ? (a) Trough washer (b) Baum jig washer (c) Spiral separator (d) Froth floatation

64. Washability curve based on float and sink test enables an assessment to be made of the possibility of cleaning a coal fraction based on the (a) density separation.

(b) differential wettability.

(c) size.

(d) volatile matter content.

65. Paddle agitator

(a) is suitable for mixing low viscosity liquids. (b) produces axial flow.

(c) moves at very high speed.

(d) none of these.

66. Highly viscous liquids & pastes are agitated by (a) propellers

(b) turbine agitators

(c) multiple blade paddles

(d) none of these

67. A propeller agitator

(a) produces mainly axial flow.

(b) is used for mixing high viscosity pastes. (c) runs at very slow speed (2 rpm).

(d) all (a), (b) and (c)

68. Helical screw agitator is used for

(a) mixing highly viscous pastes.

(b) blending immiscible liquids.

(c) mixing liquids at very high temperature (>

250 °C).

(d) none of these.

69. Which of the following may prove unsuitable for filtering volatile liquids ?

(a) Pressure filter (c) Centrifugal filter (b) Gravity filter (d) Vacuum filter

70. In washing type plate and frame filter press, the ratio of washing rate to the final filtrate rate is

(a) 4 (b) 1/4

(c) 1 (d) 1/2

ANSWERS

52. (c) 53.(c) 54.(a) 55.(a) 56.(c) 57.(a) 58.(d) 59.(c) 60.(a) 61.(c) 62.(a) 63.(d)
64.(a) 65.(a) 66. (c) 67.(a) 68.(a) 69.(d) 70.(b)

71. For efficient grinding, ball mills must be operated

(a) at a speed less than the critical speed. (b) at a speed more than the critical speed. (c) at a speed equal to the critical speed. (d) with minimum possible small balls.

72. For the transportation of ultrafine particles, the equipment used is a.....conveyor. (a) belt (b) pneumatic

(c) screw (d) none of these

73. To get ultrafine particles, the equipment used is a

(a) ball mill (b) rod mill

(c) hammer crusher (d) fluid energy mill

74. The material is crushed in a gyratory crusher

(b) compression

(d) cutting

by the action of (a) impact

(c) attrition

75. Mesh indicates the number of holes per (b) linear inch (d) linear foot (a) square inch (c) square foot

76. To get a fine talc powder from its granules, the equipment used is (a) roller crusher (c) jaw crusher (b) ball mill

(d) gyratory crusher

77. For transporting pasty material, one will use a/an

(a) apron conveyor (c) screw conveyor (b) belt conveyor (d) bucket elevator

78. Diatomaceous earth is a/an (a) explosive

(c) filter medium

79. Ball mill is used for (a) crushing

(c) fine grinding (b) filter aid (d) catalyst

(b) coarse grinding (d) attrition

80. The capacity of a belt conveyor depends upon two factors. If one is the cross-section of the load, the other is the.....of the belt.

(a) speed (b) thickness (c) length (d) none of these .

81. Dry powdery solid materials are transported by a.....conveyor.

(a) belt (b) bucket

(c) screw (d) none of these

82. Gizzlies are used for separating.....solids. (a) coarse (b) fine

(c) any size (d) none of these

83. Cyclones are used primarily for separating (a) solids (c) liquids (b) solids from fluids (d) solids from solids

84. The main differentiation factor between tube mill and ball mill is the

(a) length to diameter ratio.

(b) size of the grinding media.

(c) final product size.

(d) operating speed.

85. Fick's law relates to

(a) energy consumption

(b) final particle size

(c) feed size

(d) none of these

86. Apron conveyors are used for

(a) heavy loads & short runs.

(b) small loads & long runs.

(c) heavy loads & long runs.

(d) none of these.

87. Sphericity of raschig ring (whose length and diameter are equal) is

(a) >1 (b) <1

(c) 1 (d) 2

88. Sphericity of pulverised coal is

- (a) 1 (b) <1
(c) >1 (d) ∞

89. Solid particles of different densities are separated by (a) filters (b) thickness
(c) cyclones (d) sorting classifier

90. A straight line is obtained on plotting reciprocal of filtration rate vs. the volume of filtrate for.....flow of filtrate.

- (a) compressible cakes and laminar
(b) incompressible cake and laminar
(c) compressible cake and turbulent
(d) incompressible cake and turbulent

91. 200 mesh screen means 200 openings per (a) cm^2 (b) cm
(c) inch (d) inch^2

92. Which of the following represents the plot of filtrate volume versus time for constant pressure filtration ?

- (a) Parabola (b) Straight line (c) Hyperbola (d) Exponential curve

93. With increase in drum speed, in a rotary drum filter, the filtration rate
(a) increases (c) decreases (b) increases linearly (d) is not affected

ANSWERS

71. (a) 72.(b) 73.(d) 74.(b) 75.(b) 76.(b) 77.(c) 78.(b) 79.(c) 83.(b) 84.(a) 85.(a)
86.(a) 87.(c) 88.(b) 89.(d) 90.(b) 91.(c) 80.(a) 81.(c) 82.(b) 92.(a) 93.(a)

94. Sedimentation on commercial scale occurs in

- (a) classifiers
(b) rotary drum filters
(c) thickeners
(d) cyclones

95. The inlet pressure in a constant rate filtration (a) increases continuously
(b) decreases gradually
(c) remains constant
(d) none of these

96. Critical Speed (N_c) of a ball mill is given by

(a)

$$N_c = \frac{1}{2} \sqrt{\frac{g}{R}}$$

(b)

$$N_c = \frac{1}{2} \sqrt{\frac{g}{R}}$$

$$N_c = \frac{1}{2} \sqrt{\frac{g}{R}}$$

$$N_c = \frac{1}{2} \sqrt{\frac{g}{R}}$$

$$N_c = \frac{1}{2} \sqrt{\frac{g}{R}}$$

$$N_c = \frac{1}{2} \sqrt{\frac{g}{R}}$$

$$N_c = \frac{1}{2} \sqrt{\frac{g}{R}}$$

(c)

$$N_c = \frac{1}{2} \sqrt{\frac{g}{R}}$$

$$N_c = \frac{1}{2} \sqrt{\frac{g}{R}}$$

$$N_c = \frac{1}{2} \sqrt{\frac{g}{R}}$$

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$$N_c = \frac{1}{2} \sqrt{\frac{g}{R}}$$

$$N_c = \frac{1}{2} \sqrt{\frac{g}{R}}$$

$$N_c = \frac{1}{2} \sqrt{\frac{g}{R}}$$

(d)

$$N_c = \frac{1}{2} \sqrt{\frac{g}{R}}$$

$$N_c = \frac{1}{2} \sqrt{\frac{g}{R}}$$

$$N_c = \frac{1}{2} \sqrt{\frac{g}{R}}$$

$$N_c = \frac{1}{2} \sqrt{\frac{g}{R}}$$

97. Half the angle of nip, (α), for a roll crusher is given by

$$\alpha = \cos^{-1} \left(\frac{r}{R} \right)$$

$$\alpha = \cos^{-1} \left(\frac{r}{R} \right)$$

$$\alpha = \cos^{-1} \left(\frac{r}{R} \right)$$

$$\alpha = \cos^{-1} \left(\frac{r}{R} \right)$$

$$\alpha = \cos^{-1} \left(\frac{r}{R} \right)$$

$$\alpha = \cos^{-1} \left(\frac{r}{R} \right)$$

$$\alpha = \cos^{-1} \left(\frac{r}{R} \right)$$

98. Mass flow of granular solid (M) through a circular opening of dia, D follows

$$(a) M \propto D^2 \quad (b) M \propto D^3 \quad (c) M \propto D \quad (d) M \propto D^4$$

99. In screen analysis, the notation +5 mm/-10 mm means particles passing through (a) 10 mm screen and retained on 5 mm screen. (b) 5 mm screen and retained on 10 mm screen. (c) both 5 mm and 10 mm screens.

(d) neither 5 mm nor 10 mm screen.

100. The critical speed of a trommel (N) is related to its dia (D) as
(a)

N

a

$^1 (b) aND D$

$a (d)_N a^1(b)$

ND

D

101. The equivalent diameter of channel of a constant non-circular cross-section of 3 cm by 6 cm will be.....cms.

(a) 20 (b) 12

(c) 8 (d) 2

102. For a non-spherical particle, the sphericity (a) is defined as the ratio of surface area of a sphere having the same volume as the particle to the actual surface area of the particle.

(b) has the dimension of length.

(c) is always less than 1.

(d) is the ratio of volume of a sphere having

the same surface area as the particle to the actual volume of the particle.

103. Which of the following gives the crushing energy required to create new surface ? (a) Taggart's rule (b) Fick's law

(c) Rittinger's law (d) none of these

104. Sphericity of a cubical particle, when its equivalent diameter is taken as the height of the cube, is

(a) 0.5 (b) 1

(c) 2 (d) 3

105. For Raschig rings, the sphericity is

(a) 0.5 (b) 1

(c) <1 (d) 3

106. With increase in the capacity of screens, the screen effectiveness

- (a) remains unchanged
- (b) increases
- (c) decreases
- (d) decreases exponentially

107. The specific surface of spherical particles is proportional to

(a)

D

2

D_p (b) D_p

(c)

$1/D_p$

(d)

1

$/D$

2

P

where, D_p = diameter of particle.

108. Size reduction mechanism used in Jaw crushers is

- (a) attrition (b) compression (c) cutting (d) impact

ANSWERS

94. (c) 95. (a) 96. (b) 97. (a) 98. (c) 99. (a) 100. (a) 101. (d) 102. (a) 103. (c) 104. (b)
105. (c)

106. (c) 107. (c) 108. (b)

109. Feed size of 25 cms can be accepted by (a) ball mill (b) rod mill (c) fluid energy mill (d) jaw crusher

110. Maximum size reduction in a ball mill is done by the.....action. (a) attrition

(c) impact

(b) compression (d) cutting

111. The specific surface of spherical particles is given by

6 (b) $2(a)$ $D_p D_p$

4 (d) $12(c)$ $D_p D_p$

where D and r are diameter and density of particle.

112. Sphericity for a non-spherical particle is given by

(a) $6.V_{(b)} V$

$DS 6.DS$

$^{DS} (d) s^V(c)_{VDS..}$

where, V and S are volume and surface area respectively of one particle.
and, D = equivalent diameter of particle.

113. The reduction ratio for grinders is defined as (a) D_f/D_p (b) D_p/D_f

(c) $D_f D_p$ (d) none of these

where, D_f and D_p are average diameters of feed and product respectively.

114. The reduction ratio for fine grinders is (a) 5-10 (b) 10-20

(c) 20-40 (d) as high as 100

115. Which of the following is a continuous filter? (a) Plate and frame filter

(b) Cartridge filter

(c) Shell and leaf filter

(d) None of these

116. Addition of filter aid to the slurry before filtration is done

to.....of the cake. (a) increase the porosity

(b) increase the compressibility co-efficient (c) decrease the porosity

(d) decrease the compressibility co-efficient **117.** Pick out the material having minimum Rittinger's number.

(a) Calcite (b) Pyrite

(c) Quartz (d) Galena

118. Crushing efficiency of a machine ranges between.....percent.

(a) 0.1 to 2 (b) 5 to 10 (c) 20 to 25 (d) 50 to 70

119. Vibrating screens have capacity in the range of.....tons/ft² .mm mesh size.

(a) 0.2 to 0.8 (b) 5 to 25 (c) 50 to 100 (d) 100 to 250

120. According to Bond crushing law, the work required to form particle of size 'D' from very large feed is

(a) $(S/V)_p$ (b) $(/SV)_p$ (c) $(S/V)^2$ (d) $(S/V)f_p$

where $(S/V)_p$ and $(S/V)_f$ are surface to volume ratio of the product and feed respectively.

121. The cake resistance increases steadily with the time of filtration in a plate and frame filter employing constant.....filtration. (a) rate
(c) both (a) & (b)

(b) pressure

(d) neither (a) nor (b)

122. The controlling resistance in a rotary drum vacuum filter is the.....resistance. (a) piping (b) cake
(c) filter medium (d) none of these

123. Run of mine (ROM) coal is crushed by a.....for use in domestic ovens. (a) jaw crusher (c) ball mill
(b) hammer crusher (d) tube mill

124. During filtration operation, the filtrate encounters the resistance of the (a) filter medium.

(b) cake.

(c) channel carrying the slurry to the upstream side of the cake and filtrate away from the filter medium.

(d) all (a), (b) and (c)

125. All resistances during washing of cake

(a) increases (b) decreases

(c) remain constant (d) none of these

126. In case of a plate and frame filter press, filtrate flow through the cake follows.....flow. (a) plug (b) turbulent

(c) laminar (d) none of these

ANSWERS

109. (d) 110. (c) 111. (a) 112. (a) 113. (a) 114. (d) 115. (d) 116. (a) 117. (c) 118. (a)

119. (a) 120. (b)

121. (c) 122. (b) 123. (b) 124. (d) 125. (c) 126. (c)

127. Which one is a filter aid ?

- (a) Canvas fabric
- (b) Diatomaceous earth
- (c) Calcined lime
- (d) None of these

128. The filtrate flow rate in constant pressure filtration

- (a) continuously increases.
- (b) continuously decreases.
- (b) remains constant throughout.
- (c) may increase or decrease ; depends on

the pressure.

129. Sorting classifiers employing differential settling methods for separation of particles make use of the differences in their

- (a) particle sizes (b) (c) terminal velocities (d)

130. Screw conveyors are

- (a) run at very high rpm. (b) suitable for sticky materials.
- (c) suitable for highly abrasive materials. (d) all (a), (b) and (c)

131. A belt conveyor used for the transportation of materials can

- (a) run upto 1 km.
- (b) travel at a speed upto 300 metres/minute. (c) handle materials upto 5000 tons/hr. (d) all (a), (b) and (c).

132. The maximum slope of a belt conveyor can be (a) 15° (b) 30°

- (c) 45° (d) 60°

133. Bucket elevators are not suitable for the vertical lifting of.....materials.

- (a) fine (e.g. - 200 mesh size coal)
- (b) sticky (e.g. clay paste)
- (c) small lumpy (e.g. grains and sand) (d) free flowing

134. Reduction ratio of crushers is the

- (a) ratio of feed opening to discharge opening. (b) ratio of discharge opening to feed opening. (b) determining factor for minimum dia of

the feed and the product.

- (d) none of these.

135. Grindability of a material does not depend densities
none of these

upon its

(a) elasticity (c) toughness (b) hardness (d) size

136. Which of the following is the softest v material ? (a) Talc
(c) Corundum (b) Feldspar (d) Calcite

137. Which of the following is the hardest material ?
(a) Calcite (b) Quartz
(c) Corundum (d) Gypsum

138. Which of the following gives the work required for size reduction of coal to
–200 mesh in a ball mill most accurately ?
(a) Rittinger's law (b) Kick's law (c) Bond's law (d) none of these

139. 200 mesh seive size corresponds to mi- crons.
(a) 24 (b) 74
(c) 154 (d) 200

140. In case of grinding in a ball mill

(a) wet grinding achieves a finer product size than dry grinding.
(b) its capacity decreases with increasing fineness of the products.
(c) grinding cost and power requirement increases with increasing fineness of
the products.
(d) all (a), (b) and (c).

141. Pick out the wrong statement pertaining to
the roll crushers.

(a) Maximum feed size determines the re- quired roll diameter.
(b) For hard material's crushing, the reduction ratio should not exceed 4.
(c) Both the rolls run necessarily at the same speed.
(d) Reduction ratio and differential roll speed affect production rate & energy
consumed per unit of surface produced.

142. In case of a hammer crusher,

(a) crushing takes place by impact breaking. (b) maximum acceptable feed size
is 30 cms. (c) reduction ratio can be varied by adjusting the distance from cage
to hammers .

(d) all (a), (b) and (c).

143. A tube mill compared to a ball mill

(a) has a higher length/diameter ratio.

(b) produces a coarser product.

(c) has a higher diameter/length ratio. (d) uses much larger balls.

144. In case of a ball mill,

(a) coarse feed requires a larger ball.

ANSWERS

127. (b) 128.(b) 129.(c) 130.(b) 131.(d) 132.(b) 133.(b) 134.(a) 135.(d) 136.(a)

137.(c) 138.(a)

139.(b) 140.(d) 141.(c) 142.(d) 143.(a) 144.(a)

(b) fine feed requires a larger ball.

(c) operating speed should be more than the critical speed.

(d) none of these

145. In a roll crusher, both the rolls

(a) have the same diameter.

(b) are rotated towards each other.

(c) run either at the same or different

speeds.

(d) all (a), (b) and (c).

146. Power required to drive a ball mill with a particular ball load is proportional to (a) D (b) $1/D$

(c) $D^{2.5}$ (d) $1/D^{2.5}$

where, D = diameter of ball mill

147. Close circuit grinding by a ball mill with air sweeping employs a

(a) classifier.

(b) cyclone separator between mill & classifier. (c) both (a) & (b).

(d) neither (a) nor (b).

148. The grinding in a hammer crusher takes place due to the (a) attrition

(c) both (a) & (b)

(b) impact

(d) neither (a) nor (b) **149.** In case of a hammer crusher, the (a) feed may be highly abrasive (Moh's scale

>5).

(b) minimum product size is 3 mm. (c) maximum feed size may be 50 mm. (d) rotor shaft carrying hammers can be vertical or horizontal.

150. Which of the following size reduction equipments employs mainly attrition for ultrafine grinding ?

(a) Jet mills (c) Micronizer (b) Fluid energy mill (d) all (a), (b) and (c)

151. Wheat is ground into flour in a (a) hammer crusher

(b) roller crusher

(c) impact mill

(d) fluid energy mill

152. Limestone is normally crushed in a (a) roll crusher (c) ball mill (b) hammer crusher (d) tube mill

153. Coal is finally pulverised to 200 mesh size for (b) ball mill

(c) roll crusher

(d) gyratory crusher

154. Which of the following comes in the category of primary crusher for hard and tough stone ? (a) Jaw crusher (b) (c) Gyratory crusher (d) Cone crusher
None of these

155. Which is a secondary crusher for a hard & tough stone ?

(a) Jaw crusher (b) Cone crusher (c) Impact crusher (d) Toothed roll crusher

156. Carbon black is pulverised in a

(a) hammer crusher (b) ball mill

(c) roll crusher (d) gyratory crusher

157. Filtrate flow rate in case of a rotary drum vacuum filter (in which $R_m < R_c$) is proportional to.....and the cycle time. (a) m (b) $1/m$

(c) $1/m$ (d) $1/m^2$

where, m = filtrate viscosity

R_m = filter medium resistance

R_c = cake resistance

158. A compressible cake has the

(a) maximum porosity at the upstream side. (b) maximum porosity at the filter medium. (c) same porosity throughout the cake thickness.

(d) none of these.

159. Out of the following size reduction equipments, the maximum feed size can be accepted by the

(a) tube mill (b) ball mill (c) jaw crusher (d) jet pulveriser

160. Pick out the wrong statement.

(a) Hammer crushers operate by impact action. (b) Standard screens have circular opening.

(c) With increase in mesh number of screens, their diameter in microns decreases.

burning in boilers by a (a) hammer crusher (d) 200 mesh screen has 200 openings per linear cm.

161. Electrical energy consumed by a jaw crusher is not a function of the

(a) average feed size

(b) average product size

(c) machine capacity

(d) none of these

145.(d) 146.(c) 147.(c) 148.(c) 157.(b) 158.(a) 159.(c) 160.(d) 161.(d)

ANSWERS

149. (d) 150.(d) 151.(b) 152.(b) 153.(b) 154.(a) 155.(b) 156.(b) **162.** In a size

reduction crushing operation, feed size is 300 to 1500 mm while the product size is 100 to 300 mm. This is a case of the..... is 10 to 50 mm.

This is a case of the.....crushing.

(a) secondary

(c) primary

ing.

(b) fine (a) primary (b) secondary (d) ultrafine (c) fine (d) ultrafine 163. Xanthates are used in the froth floatation 172. Sauter mean diameter is the same as the..... process as a/an (a) conditioner (c) collector

(b) frother
mean diameter. (a) mass
(d) activator

(c) volume-surface (b) arithmetic (d) geometric

164. Screen capacity is not a function of 173. Gummy & sticky materials like molasses, (a) its openings size. sugar etc. are best transported/handled by (b) screening mechanism. using a.....conveyor.(c) screening surface. (a) drag (b) ribbon(d) atmospheric humidity. (c) screw (d) slat165. Gold ore concentration is mostly done using (a) jigging (b) tabling 174. Hot, lumpy & abrasive materials are best (c) froth floatation (d) elutriation transported by using a/an.....conveyor.

166. Activators are those chemicals which help (a) apron (b) belt buoying up one mineral in preference to the (c) screw (d) flight other in the froth floatation process. Which of 175.Which of the following is a coarse crusher? the following is an activator? (a) Smooth roll crusher
(a) Cresylic acid (b) Toothed roll crusher
(b) Copper sulphate (c) Gyratory crusher
(c) Calcium carbonate (d) Tube mill

(d) Sodium carbonate 176. mills are termed as impactors.167. Pick out the wrong statement: (a) Hammer (a) Magnetic separation method can be em(b) Cageployed to treat both dry & wet ores. (c) Rolling-compression(b) Reduction ratio in crushing operation is (d) none of these defined as the ratio of minimum feed size

to the maximum product size. 177. Stamp mills are generally used for crushing (c) Gyratory crusher is used for coarse (a) iron ores crushing. (c) talc (b) gold ores (d) diamond (d) Screens are of stationary, moving and vi178. Size reduction of fibrous materials like wood, bratory types. asbestos, mica etc. is done by a disintegrator

168. Trommels are revolving screens which norexemplified by the mally operate in the range of.....rpm. (a) Blake jaw crusher

(a) 1-2 (b) 15-20 (b) cage mill
(c) 40-50 (d) 60-75 (c) stamp mill

169. Fluid medium used in the classification tech- (d) Bradford's breaker
nique of mineral beneficiation is **179.** Balls for ball mills are never made of (a) air (a) forged/cast steel (b)
lead (b) water (c) cast iron (d) alloy steel (c) either (a) or (b) **180.** For achieving maximum
capacity of the (d) neither (a) nor (b)

170. Pine oil and cresylic acid are used as..... ball mill, the ball charge should be
equal to in the froth floatation process. about.....percent of the ball mill volume. (a)
frother (b) collector (a) 10 (b) 25 (c) depressor (d) conditioner (c) 50 (d) 75

ANSWERS

162. (c) 163. (c) 164. (d) 165. (b) 166. (b) 167. (b) 168. (b) 169. (c) 170. (a) 171. (b)
172. (c) 173. (b)

174. (a) 175. (c) 176. (a) 177. (b) 178. (b) 179. (b) 180. (c)

181. Which of the following is a fine crusher? (a) Blake jaw crusher
(b) Gyratory crusher
(c) Toothed roll crusher
(d) Dodge jaw crusher

182. For grinding of cereals, grains, spices, pigments, saw dust, cork etc., the
most extensively used size reduction equipment is a
(a) Buhrstone mill (c) crushing rolls (b) ball mill
(d) hammer mill

183. Size reduction of.....is accomplished in steam heated rollers and roll
crushers. (a) resins (b) gums
(c) hard rubber (d) waxes

184. Short distance transportation of grain, gravel, sand, ash, asphalt etc. is done
by using a.....conveyor.
(a) flight (b) slat or drag (c) ribbon (d) screw

185. centrifuge is normally used in sugar mills.
(a) Tubular bowl
(b) Disc-bowl
(c) Suspended batch basket
(d) Perforated horizontal basket continuous

186. centrifuge is the most suitable for separation of non-friable crystals.

(a) Tubular bowl

(b) Disc-bowl

(c) Perforated horizontal basket continuous (d) Suspended batch basket

187. Size reduction of moulding powders, waxes, resins & gums are done in a.....mill. (a) cage

(b) hammer

(c) both (a) & (b)

(d) neither (a) nor (b)

188. Vacuum is applied in.....zone, in case of a general type continuous rotary drum vacuum filter.

(a) filtering (b) washing (c) drying (d) all (a), (b) & (c)

189. In filtration, the use of 'filter aid' helps in (a) reducing the filtration pressure. (b) accelerating the rate of filtration. (c) deplugging the filter medium. (d) enhancing the cake porosity in case of a

dense impermeable cake.

190. is the most commonly used 'filter aid'. (a) Diatomaceous earth

(b) Fuller's earth

(c) Vermiculite

(d) Semi-plastic clay

191. is the most suitable for compounding rubber and plastic solids.

(a) Banbury mixer

(b) Pan mixer

(c) Pug mill

(d) Charge can mixer

192. are mixed using ribbon blenders. (a) Lumpy solids and low viscosity liquids (b) Dry powders

(c) High viscosity liquids

(d) Thick pastes

193. are used for the separation of coarse particles from a slurry of fine particles. (a) Thickeners (c) Hydrocyclones (b) Classifiers (d) Decanters

194. In paint industries, blending of light paste is done by using a (a) masticator (c) kneader (b) charge can mixer (d) none of these

195. A employs a set of screen across a flow channel for the separation of dirt/rust from a flowing liquid stream.

(a) thickener (c) strainer (b) classifier (d) clarifier

196. The process by which fine solids is removed from liquids is termed as

(a) decantation (b) flocculation (c) sedimentation (d) classification

197. A gravity decanter is meant for the separation of two.....density.

(a) immiscible liquids of different

(b) miscible liquids of different

(c) immiscible liquids of same

(d) miscible liquids of same

198. In a size reduction crushing operation, the feed size is 10 to 50 mm, while the product size is 2 to 10 mm. This is a case of..... crushing.

(a) primary

(c) fine (b) secondary (d) ultrafine

199. What is the reduction ratio in a fine crushing operation having following feed and product sizes?

ANSWERS

181.(c) 182.(a) 183.(c) 184.(d) 185.(c) 186.(c) 187.(c) 188.(d) 189.(c) 190.(a)

191.(a) 192.(b) 193.(b) 194.(b) 195.(c) 196.(c) 197.(a) 198.(c) 199.(b)

Parameters Unit Feed Size mm Product Size mm

(a) 0.5

(c) 5

Maximum Minimum

20 10

10 5

(b) 2

(d) 10

200. The term 'angle of nip' is concerned with the operation of the.....crushers.

- (a) jaw (b) roll
- (c) gyratory (d) none of these

201. Which of the following achieves the least reduction ratio for a given feed size?

- (a) Jaw crusher (b) Roll crusher (c) Cone crusher (d) Gyratory crusher

202. During size reduction by a jaw crusher, the energy consumed decreases with the (a) decreasing size of product at constant

size of feed.

(b) decreasing machine capacity.

(c) increasing size of feed at constant reduc-

tion ratio.

(d) none of these.

203. Filtration rate does not depend upon the (a) pressure drop & area of filtering surface. (b) resistance of the cake & the septum. (c) properties of the cake & the filtrate. (d) none of these.

204. Which of the following is not used as filter aid?

- (a) Asbestos
- (b) Diatomaceous earth
- (c) Purified wood cellulose
- (d) Rice husk

205. For removal of very small amounts of precipitate from large volume of water, the most suitable filter is the.....filter.

- (a) plate & frame (b) shell & leaf (c) sand (d) rotary vacuum

206. Use of baffles in agitators help in minimising the.....tendency.

- (a) swirling (b) vortexing
- (c) both (a) & (b) (d) neither (a) nor (b)

207. The important dimensional group involved in the power requirement calculation in mixing operation is the.....number.

- (a) Reynold's (b) Froude

(c) both (a) & (b) (d) neither (a) nor (b)

208. A mixer resembles ball mill without balls. (a) banbery (b) pug mill (c) tumbling (d) pan

209. Ultra centrifuges are used for the separation of.....solid particles.
(a) coarse (b) fine
(c) colloidal (b) dissolved

210. Additives used for promoting the flocculation of particles is a/an (a) electrolyte (c) both (a) & (b) (b) surface active agent (d) neither (a) nor (b)

211. Filtration should be stopped in a filter press, if the
(a) cake becomes very dense.
(b) liquor stops flowing out to the discharge. (c) filtration pressure rises suddenly. (d) both (b) & (c).

212. Filtration operation carried out by continuous increase of the inlet pressure of slurry, is called the.....filtration.
(a) constant rate (b) varying pressure (c) varying rate (d) constant pressure

213. The constants (K_b , K_r and K_k) used in the laws of crushing (*i.e.*, Bond's law, Rittinger's law and Kick's law) depend upon the
(a) feed material.
(b) type of crushing machine.
(c) both (a) & (b).
(d) neither (a) nor (b).

214. General mechanism of size reduction in in-termediate and fine grinder is by
(a) cutting action.
(b) compression.
(c) compression and tearing
(d) impact and attrition.

215. Which of the following is not a cutting machine?
(a) Dicers (c) Slitters (b) Knife cutters (d) Tube mills

216. Production rate.....with increased fine-ness, with a given energy input to the size reduction machine.

- (a) decreases
- (b) increases
- (c) remains unchanged
- (d) may increase or decrease; depends on the

machine

ANSWERS

200. (b) 201. (b) 202. (c) 203. (d) 204. (d) 205. (c) 206. (c) 207. (c) 208. (c) 209. (c)
210. (c) 211. (d)

212. (a) 213. (c) 214. (d) 215. (d) 216. (a)

217. Length/diameter ratio of a ball mill is (a) 1.5 (b) 1
(c) <1 (d) >1

218. The crushed material received for separation is called feed or (a) tailing
(c) concentrate (b) heading (d) middling

219. Screen capacity is proportional to
(a) S (b) $1/S$

(c) S^2 (d) S

where, S = screen aperture

220. Size reduction of asbestos and mica is done by (a) hammer mills (b) rod mills
(c) gyratory crushers (d) crushing rolls

221. Tube mill compared to ball mill

(a) produces finer products.

(b) is long in comparison with its diameter. (c) uses smaller balls.

(d) all (a), (b) & (c).

222. Ball mills and tube mills with flint or porcelain balls are used for size reduction of

(a) asbestos (b) rubber (c) non-metallic ores (d) limestone

223. Energy consumption in a crusher decreases with increase in the

(a) size of the product (at constant feed size). (b) capacity of the crushing machine. (c) size of feed (at constant reduction ratio). (d) all (a), (b) & (c).

224. Size reduction does not occur due to compression in case of (a) rod mills
(c) jaw crushers (b) gyratory crushers (d) smooth roll crushers

225. Specific surface area is the surface area of a unit.....of materials.

(a) weight (b) volume

(c) either (a) or (b) (d) neither (a) nor (b)

226. balls capable of grinding the feed in a ball mill gives the maximum efficiency. (a) Cast iron (b) Minimum size (c) Maximum size (d) Elliptical

227. The value of 'angle of nip' is generally about (a) 16° (b) 32°

(c) 52° (d) 64°

228. Use of 'grinding aids' is done in.....grinding. (a) dry (b) wet

(c) ultrafine (d) intermediate

229. Separation of materials into products based on the difference of their sizes is called (a) sizing (b) sorting (c) classification (d) flocculation

Vertical transportation of materials can be **230.**

done by a/an

(a) apron conveyor (b) pneumatic conveyor (c) bucket elevator (d) both (b) & (c)

231. Solid particles separation based on the difference in their flow velocities through fluids is termed as the

(a) clarification (c) elutriation

(b) classification (d) sedimentation

232. Sizing of very fine particles of the order of 5 to 10 microns is done by elutriation, which is a.....operation.

(a) clarification (b) sedimentation (c) flocculation (d) classification

233. Separation of materials of the same density based on their sizes by using their different rates of flow is called

(a) sorting (b) sizing

(c) flocculation (d) elutriation

234. conveyor is the most suitable for long distance transportation of cold, non abrasive granular/irregular shape/fine materials. (a) Bucket (b) Belt

(c) Screw (d) Apron

235. A widely used size reduction equipment for.....is Bradford breaker.

(a) talc (b) coal

(c) iron core (d) wheat

236. Separation of solid particles based on their densities is called
(a) sizing (b) sorting (c) clarification (d) dispersion

237. For spheres, the surface shape factor is given by
(a) $p (= A/D^2)$ (b) $p/6 (= V/D^3)$

(c) AD (d) None of these.

where, A = area, V = volume, and D = diameter.

238. For spheres, volume shape factor is given by (a) $p (= A/D^2)$ (b) $2p (= 2A/D^2)$
(c) $p/6 (= V/D^3)$ (d) AD/V

ANSWERS

217. (c) 218. (b) 219. (a) 220. (a) 221. (d) 222. (c) 223. (d) 224. (a) 225. (c) 226. (b)
227. (b) 228. (a)

229. (a) 230. (d) 231. (b) 232. (d) 233. (b) 234. (b) 235. (b) 236. (b) 237. (a) 238. (c)

239. Size reduction of ice and gypsum can be accomplished suitably by
a.....crusher. (a) Blake jaw (c) gyratory (b) toothed roll (d) none of these.

240. For spheres, the specific surface shape factor is given by
(a) AD/V (b) D/V

(c) A/V (d)
 AD/V

241. Separation of solid suspended in liquid into a supernatant clear liquid and a denser slurry employs a process termed as the
(a) coagulation (b) flocculation (c) sedimentation (d) clarification

242. Which of the following grinding mills has the horizontally arranged rods as the grinding elements thereby delivering more uniform granular products with minimum fines ? (a) Compartment mill (b) (c) Pebble mill (d) Rod mill Tube mill.

243. In ball mill operation, the feed size (D_f in meters) and the ball diameter

(D_b in metres) are related as

$$2 = KD \quad (b) \quad D = KD \quad (a) \quad D_{bf} \quad (c) \quad D$$

(c)

D

$$3 = KD \quad (d) \quad D = 22$$

KD

$bf \quad bf$

244. The optimum moisture content in solids to be crushed/ground ranges from.....percent. (a) 3 to 4 (b) 8 to 10 (c) 10 to 15 (d) 15 to 20

245. Critical speed of rotation, N (in rps - rotation per second) of a trammel is equal to

(a)

g

$2p \quad r$

$1 \quad g(b) \quad 1 \quad p \quad r$

$1.g \quad (d) \quad 2p \quad g(c)$

$2 \quad r \quad r$

where, g = acceleration due to gravity = 9.81

m/sec^2 and, r = radius of trammel, metre. **246.** Energy consumed for crushing one ton of material ranges from.....kWh.

(a) 0.01 to 0.1 (b) 0.5 to 1.5 (c) 2 to 3.5 (d) 4 to 5.

247. Capacity (in tons/hr) of jaw/gyratory crusher

where, L = length of the receiving opening, cm and S = greater width of the discharge opening, cm

248. mill is not a revolving mill. (a) Pebble (b) Compartment (c) Cage (d) Tube

249. In closed circuit grinding as compared to open circuit grinding, the

(a) specific surface of product is more. (b) product has lesser size uniformity.

(c) production rate at a given limiting size is lower.

(d) operation is economical.

250. Kick's law assumes that the energy required for size reduction is proportional to the logarithm of the ratio between the initial and the final

diameters. The unit of Kick's constant is (a) kW. sec./kg (b) kWh/kg (c) kWh/sec. kg (d) kg/sec.

251. Wet sieving is employed, when the product contains.....materials.

- (a) abrasive
- (b) large quantity of very fine
- (c) coarse
- (d) non-sticky

252. Which of the following is a batch sedimentation equipment ?

- (a) Dust catcher
- (b) Filter thickener
- (c) Dry cyclone separator
- (d) Rotary sprayer scrubber.

253. Agglomeration of individual particles into clusters (flocs) is called flocculation. To prevent flocculation, the most commonly used dispersing agents are

- (a) carbonates
- (b) sulphates
- (c) silicates & phosphates
- (d) bicarbonates

254. mean diameter of particles is given by

Σ

$\frac{x_i}{D_{pi}}$

$\sum x_i D_{pi}$

- (a) Mass (b) Arithmetic
- (c) Volume (d) Volume surface

255. Which of the following equations is Rittinger's crushing law ?
is equal to

- (a) 0.01 L.S (b) 0.087 L.S (c) $P / = m^K D_p$ (d) $\text{L.S}/0.087$

ANSWERS

239.(b) 240.(a) 241.(c) 242.(b) 243.(a) 244.(a) 245.(a) 246.(b) 247.(b) 248.(c)
249.(d) 250.(a) 251.(b) 252.(b) 253.(c) 254.(b) 255.(c)

(b) $P/k \ln =$

11^5
(c) $P/m = \frac{D_s^3 - D_p^3}{D_s^2 - D_p^2}$
 $\frac{D_s^3 - D_p^3}{D_s^2 - D_p^2}$

(d) none of these.

where P = power required by the machine, m = feed rate, k = a constant D_s & D_p = volume surface mean diameter of feed & product respectively.

256. Grinding characteristic of a material is given by its

(a) HGI (b) angle of repose (c) shatter index (d) abrasion index.

257. Which of the following relationships between coefficient of friction (μ) between rock & roll and a (half of the angle of nip) of the particle to be crushed is correct ?

(a) $\mu = \tan \alpha$ (b) $\mu = \tan 2\alpha$ (c) $\mu = \cot \alpha$
 $\mu = \cot 2\alpha$ (d) $\mu = \cot \alpha$
 $\mu = \tan 2\alpha$

258. The mechanism of size reduction by a hammer mill is by impact and attrition between the (a) grinding element & the housing. (b) feed particles.

(c) both (a) and (b).

(d) neither (a) nor (b).

259. A pebble mill

(a) is a ball mill.

(b) employs flints or ceramic pebbles as the

grinding medium.

(c) is a tube mill lined with ceramic or other non-metallic liner.

(d) both (b) and (c).

260. Which of the following is not used as a filter medium in case of corrosive liquids ? (a) Nylon

(b) Glass cloth

(c) Metal cloth of monel or stainless steel (d) Cotton fabric

261. Which of the following is the most suitable filter for separation of abrasive solids suspended in a corrosive liquid ?

- (a) Sand bed filter
- (b) Plate and frame filter press
- (c) Vacuum filter
- (d) Batch basket centrifuge.

262. Which of the following crushing laws is most accurately applicable to the fine grinding of materials ?

- (a) Bond's crushing law (b) Kick's law (c) Rittinger's law (d) None of these.

The most suitable equipment for the transportation of 200 mesh size particles is a

- (a) bucket elevator (b) pneumatic conveyor (c) screw conveyor (d) belt conveyor

264. The unit of filter medium resistance is (a) cm^{-1} (b) gm/cm^{-1} (c) cm/gm^{-1} (d) gm^{-1}

265. Higher is the mesh number, smaller will be the aperture size of the screen. It means that the aperture size of a 200 mesh screen will be smaller than that of 20 mesh screen. This is valid for

- (a) British standard screens.
- (b) German standard screens (DIN 1171) etc. (c) American standard screens (ASTM and

Taylor standard screens).

- (d) all (a), (b) and (c).

266. For Indian standard (IS) screens, the mesh number is equal to its aperture size expressed to the nearest deca-micron (0.01 mm). Aperture width of IS screen of mesh number 50 will be approximately.....microns. (a) 5 (b) 50 (c) 500 (d) 5000

267. Rittinger's number designates the new surface created per unit mechanical energy absorbed by the material being crushed. Larger value of Rittinger's number of a material indicates its

- (a) easier grindability
- (b) poor grindability
- (c) high power consumption in grinding (d) none of these

268. Angle of nip of the crushing rolls does not depend upon the

- (a) diameter of the rolls
- (b) speed of the rolls
- (c) product size
- (d) feed size

269. In bag filters, filter fabrics are never made of (a) metallic wire woven mesh

- (b) polyester fibres
- (c) cotton fibres
- (d) nylon fibres

ANSWERS

256. (a) 257.(b) 258.(c) 259.(d) 260.(d) 261.(c) 262.(c) 263.(b) 264.(a) 265.(d)

266.(c) 267.(a)

268.(b) 269.(a)

270. Separation of a suspension or slurry into a supernatant clear liquid (free from particles) and a thick sludge containing a high concentration of solid is called

- (a) classification (c) clarification (b) sedimentation (d) decantation

271. Sphericity is the ratio of the surface area of a spherical particle having the same volume as the particle to the surface area of the particle. Which of the following has the maximum value of sphericity ?

- (a) Sphere (b) (c) Cylinder ($L/D = 1$) (d) Cube
- Raschig rings

272. Reciprocal of sphericity is termed as the (a) specific surface ratio

- (b) shape factor
- (c) sauter diameter
- (d) surface area per unit mass

273. Work index is the gross energy (kWh/tonne of feed) necessary to reduce a very large feed to such a size that 80% of product particles will pass through a 0.1 mm screen. The value of work index determined for wet grinding should be multiplied with.....to get the same for dry grinding.

- (a) 1.0 (b) 0.5
- (c) 1.34 (d) 4.34

274. The value of work index does not change materially from one equipment to

another. If the value of work index determined for close circuit grinding is W_i , then the same for open circuit grinding will be

- (a) $0.5 W_i$ (b) W_i
(c) $1.34 W_i$ (d) $3.34 W_i$

275. The capacity of a gyratory crusher is.....that of a jaw crusher with the same gape, handling the same feed & for the same product size range.

- (a) same as (b) 2.5 times (c) 5 times (d) 10 times

276. Pebble mills are tumbling mills widely used for grinding in the manufacture of paints & pigments and cosmetic industries, where iron contamination in the product is highly objectionable. Pebbles used in pebble mill are made of

- (a) bronze (b) stainless steel (c) flint or porcelain (d) concrete

277. Rod mills employed for grinding

- (a) employ a steel shell having L/D ratio of

1.5 to 3.0.

- (b) is useful for handling sticky materials. (c) employ steel rods of 2-12 cms diameter

extending over full length of the mill. (d) all 'a', 'b' & 'c'.

278. Tabular bowl centrifuges as compared to disk bowl centrifuges

- (a) operate at higher speed.

- (b) employ bowl of larger diameter. (c) can not be operated under pressure/vacuum. (d) can't be used for separation of fine sus-

pended solids from a liquid.

279. Filter aids like asbestos, kieselguhr, diatomaceous earth etc. are used to increase the porosity of the final filter cake & reducing the cake resistance during filtration. Filter aid is (a) added to the feed slurry.

- (b) precoated on the filter medium prior to

filtration.

- (c) separated from the cake by dissolving solids or by burning it off.

- (d) all 'a', (b) & (c).

280. In a ball mill, the volume occupied by the balls (when the mill is stopped) is about.....percent of the volume of the mill.

(a) 35 (b) 50

(c) 70 (d) 85

281. Size reduction action involved in the operation of a 'dicer' is (a) impact

(c) cutting

(b) attrition (d) compression

282. Pick out the wrong statement.

(a) Filter aid are used for increasing the filtration rate for compressible cake

(b) Mixing index is dimensionless

(c) Ore dressing means size reduction of ores

(d) Sphericity of a cube is 0.81

283. Size reduction of asbestos is done by a (a) hammer crusher

(b) ball mill

(c) jaw crusher

(d) gyratory crusher

284. Sedimentation technique can be used for size classification of particles greater than..... m (micrometer).

(a) 1 (b) 1/1000

(c) 1/100000 (d) 1/100000000

ANSWERS

270. (b) 271. (a) 272. (b) 273. (c) 274. (c) 275. (b) 276. (c) 277. (d) 278. (a) 279. (d)

280. (b) 281. (c)

282. (c) 283. (a) 284. (a)

285. If D_1 is the size of the spherical particle passing through 400 mesh screen and D_2 is the size of the spherical particle retained on a 200 mesh screen; then which of the following statement is true?

(a) Particle of size D_1 will be retained on 200 mesh screen

(b) Particle of size D_2 will pass through 200 mesh screen

(c) Particles of both sizes will pass through 400 mesh screen

(d) Particles of both sizes will be retained on 200 mesh screen

286. Large scale sedimentation occurs in (a) rotary drum vacuum filter

- (b) cyclones
- (c) thickeners
- (d) classifiers

287. Sizing of various fine particles of the order of 5-10 microns is done by elutriation which is a.....operation.

- (a) sedimentation (b) clarification (c) flocculation (d) classification

288. Sphericity of a square prism of side 2 mm of length 4 mm is

- (a) 0.768 (b) 0.628
- (c) 0.828 (d) 0.528

289. Which of the following is a coarse crusher? (a) Disc crusher (b) Conical crusher (c) Single roll crusher (d) Jaw crusher

290. Which of the following is a fine crusher ? (a) Hammer mill (b) (c) Pin mill (d) Edge runner mill Tube mill

291. Which of the following is not a coarse crusher ? (a) Black jaw crusher (b) Disc crusher (c) Dodge jaw crusher (d) Gyratory crusher

292. The size of feed to a fine crusher is

- (a) 60 to 1 ½ inch (b) 2 to ¼ inch
- (c) 1/4 to 1/8 inch (d) less than 1/8 inch

293. Force responsible for size reduction in a hammer mill is predominantly

- (a) impact (b) shear
- (c) compressive (d) none of these

294. In Black jaw crusher, the angle between the jaws is usually

- (a) 5° (b) 15°
- (c) 30° (d) 90°

295. The characteristics of a ball mill and a tube mill are similar. Now, under otherwise uniform conditions (identical feed size, feed flow rate, etc.), a tube mill will produce a (a) finer product

- (b) coarser product
- (c) product of the same size as that produced

by a ball mill

(d) product the size of which can not be even roughly predicted.

296. The Hardinge mill is basically a

- (a) jaw crusher (c) ball mill
- (b) roll crusher (d) colloid mill

297. When a ball mill rotates at a speed higher than the critical speed, its efficiency is (a) maximum (b) minimum (c) optimum (d) none of these

298. Ball mills take feed upto about.....mm in size.

- (a) 1 (b) 50
- (c) 500 (d) 1400

299. As the product size from a ball mill decreases,

- (a) the capacity and power requirement of the mill increases .
- (b) the capacity increases, but the power requirement decreases .
- (c) the capacity and power requirement of the mill decreases.
- (d) the capacity decreases, but the power requirement increases .

300. Force responsible for size reduction in a smooth roll crusher is predominantly (a) compressive (b) impact (c) shear (d) none of these

301. Force/Forces responsible for size reduction in a toothed-roll crusher is/are

- (a) impact
- (b) shear
- (c) compressive
- (d) a combination of all (a), (b), (c)

302. If size reduction is to be accomplished by passing the material only once through the crusher,

- (a) “free crushing” is a better choice (b) “choke feeding” is a better choice (c) both “free crushing” and “choke feeding”

are equally useful

- (d) none of these

ANSWERS

285. (b) 286.(c) 287.(d) 288.(a) 289.(d) 290.(d) 291.(b) 292.(c) 293.(c) 294.(a)

295.(a) 296.(c)

297.(b) 298.(b) 299.(d) 300.(a) 301.(d) 302.(b)

303. Under otherwise uniform conditions, size 're- duction ratio obtained in a ball mill is.....that obtained in a jaw crusher .

(a) greater than

(b) smaller than

(c) equal to

(d) unpredictable more information required

304. Grinding can be carried out either wet or dry. Now, power consumption in wet grinding is (a) more than that in dry grinding and plant capacity is increased.

(b) less than that in dry grinding and plant capacity is reduced.

(c) equal to that in dry grinding and plant capacity remains almost unchanged.

(d) less than that in dry grinding and plant capacity is increased.

305. Which of the following statements about the advantage of wet grinding over dry grinding is/are incorrect?

(a) Amounts of fines produced by wet grind- ing is less than that produced by dry grinding.

(b) Removal of product is easier.

(c) Dust formation is eliminated.

(d) Plant capacity is reduced.

306. In a ball mill, the optimum diameter of the balls used for grinding is approximately proportional to.....the feed size

(a) equal to

(b) the square of

(c) the square root of

(d) the cube of

307. Standard screens always have.....apertures (a) rectangular (b) triangular

(c) square (d) circular

308. A "100 mesh" screen means that

(a) there are 100 apertures per inch . (b) each aperture of the screen has a diameter of 1/100 inch.

(c) each aperture has a diameter of 1/100 cm. (d) none of these

309. In context of separation of particles by screening, two terms are important: screen effectiveness and screen capacity. An increase in screen capacity

(a) results in an increase in screen effectiveness. (b) results in a reduction in

screen effectiveness.

(c) does not alter the screen effectiveness at

all.

(d) may alter the screen effectiveness marginally.

310. Bond crushing law states that the work required to produce particles of diameter D_p from very large feed is proportional to be

(a) surface to volume ratio of the feed. (b) surface to volume ratio of the product.

(c) square-root of the surface to volume ratio

of the feed.

(d) square-root of the surface to volume ratio of the product.

311. Size reduction in a gyratory crusher is effected primarily by

(a) impact (b) shear

(c) compression (d) attrition

312. According to Rittinger's law, crushing efficiency

(a) depends on the feed size.

(b) depends on the product size.

(c) depends on both feed and product sizes. (d) is constant and for a particular machine

and feed material, is independent of the feed and product sizes.

313. For spheres and cubes, sphericity is equal to one. For a cylinder whose length is equal to diameter, sphericity is equal to

(a) 0.28 (b) 0.65

(c) 0.73 (d) 1.0

314. Under otherwise uniform conditions, Hindered settling is.....free settling in separation of substances.

(a) more effective than

(b) less effective than

(c) as effective as

(d) none of these

315. Cyclones are usually employed to separate (a) solids from gases
(b) solids of two different substances (c) solids from liquids
(d) all (a),(b) & (c)

316. In the context of separation of dust particles from air in a separator, a term called “cut diameter” is defined. Now cut diameter is (a) an arithmetic mean of the diameters of

the largest and smallest particles present in the air stream.

(b) a logarithmic mean of the diameters of

ANSWERS

303. (a) 304.(d) 305.(d) 306.(c) 307.(c) 308.(a) 309.(b) 310.(d) 311.(c) 312.(d)
313.(d) 314.(a)

315.(a) 316.(c)

the largest and smallest particles present in the air stream.

(c) that diameter for which one-half the inlet particles, by mass, are separated and the other half retained by the air. (d) that diameter for which 80% of the inlet particles, by mass, are separated and the other half retained by the air.

317. Typical cut diameters for high efficiency cyclones are in the range of

(a) 0.1 to 1mm (b) 1 to 10 cm

(c) 2 to 10 mm (d) less than 1 mm

318. Among cyclone separator, bag filter and electrostatic precipitator (ESP),

(a) ESP can remove the finest particles. (b) bag filter can remove the finest particles. (c) cyclone separator can remove the finest particles.

(d) bag filter and cyclone separator can remove the finest particles.

319. Which of the following is the correct angle of repose?

320. Angle of repose is low when the particles are (a) sticky

(b) very fine

(c) angular

(d) smooth and rounded

321. Angle of repose is high when the particles are (a) smooth and rounded

(b) very fine and sticky

(c) very large

(d) none of these

322. In which type of impeller used in liquid agitation, flow is coaxial?

(a) Turbine (b) Propeller

(c) Paddle (d) None of these

ANSWERS 317.(c) 318.(a) 319.(b) 320.(d) 321.(d) 322.(b)

Chemical process industries 4

produce lower concentration NaOH.

(b) MgO, SiO₂, K₂O (d) CaO, MgO, K₂O

(Chemical Technology)

1. Catalyst used in the manufacture of sulphuric acid by chamber & contact processes are respectively (a) require lower initial investment. (b) require more power. (c)

(a) V₂O₅ & Cr₂O₃. (d) none of these.

(b) oxides of nitrogen & Cr₂O₃. 7. Cement mainly contains (c) V₂O₅ on a porous carrier & oxides of nitro (a) CaO, SiO₂, Al₂O₃ gen. (c) Al₂O₃, MgO, Fe₂O₃ (d) oxides of nitrogen & V₂O₅ on a porous carrier. 8. Gypsum is chemically (a) calcium chloride (b)

2. In contact process, SO₃ is absorbed in 97% (c) sodium sulphate (d) potassium sulphate calcium sulphate

H₂SO₄ and not in water, because 9. Glauber's salt is chemically (a) SO₃ gas is sparingly soluble in water. (a) calcium sulphate (b) potassium sulphate (b) water forms an acid mist, which is difficult (c) potassium chlorate (d) none of these to absorb.

(c) the purity of acid is affected. 10. Permanent hardness of water is due to the (d) scale formation in the absorber is to be presence of calcium & magnesium avoided. (a) bi-carbonates (b) sulphates & chlorides 3. Contact process of sulphuric acid manufacture (c) carbonate (d) none of these

(a) yields acid of higher concentration than 11. Widely used method for the conditioning of chamber process. boiler feed water is the

(b) yields acids of lower concentration than (a) cold lime process chamber process, is obsolete, eliminates (b) coagulation absorber. (c) hot-lime soda process

(c) is obsolete. (d) sequestration

(d) eliminates absorber. 12. Oil is a/an

4. 20% oleum means that in 100 kg oleum, there (a) mixture of glycerides. are 20 kg of (b) mixture of glycerides of fatty acids. (a) SO₃ and 80 kg of

H₂SO₄. (c) solid at normal temperature. (b) H₂SO₄ and 80 kg of SO₃. (d) ester of alcohols other than glycerine. (c) SO₃ for each 100 kg of H₂SO₄. 13. Wax is a (d) none

of these. (a) mixture of glycerides.

5. Raw materials for 'Solvay Process' for manufacture of soda ash are (a) mixture of esters of polyhydric alcohols and carbon dioxide (b) mixture of esters of polyhydric alcohols and sodium carbonate (c) mixture of esters of polyhydric alcohols and sodium hydroxide (d) mixture of esters of polyhydric alcohols and sodium chloride.

(c) ammonia limestone and coke. **14.** Unsaturated oils compared to saturated oils (d) none of these, have

6. Mercury cells for caustic soda manufacture, (a) lower melting point & higher reactivity to compared to diaphragm cells oxygen.

ANSWERS

1. (d) 2.(b) 3.(a) 4.(a) 5.(a) 6.(d) 7.(a) 8.(d) 9.(b) 10.(b) 11.(c) 12.(b) 13.(b) 14.(a)

(b) higher melting point & higher reactivity to oxygen.

(c) lower melting point & lower reactivity to oxygen.

(d) higher melting point & lower reactivity to oxygen.

15. Rancidity of the fatty oil can be reduced by its (a) decoloration (c) oxidation (b) hydrogenation (d) purification

16. Solvent used for extraction of oil is

(a) hexane (b) methyl ethyl ketone (c) furfural (d) none of these

17. Hydrogenation of oil does not

(a) remove double bonds.

(b) raise its melting point.

(c) improve its resistance to oxidation. (d) none of these.

18. Catalyst used in the hydrogenation of oil is (a) nickel (b) platinum (c) iron (d) alumina

19. Soaps remove dirt by

(a) increasing the surface tension.

(b) decreasing wettability.

(c) supplying hydrophilic group.

(d) none of these.

20. Metallic soap is.....salt of fatty acids. (a) sodium

- (b) potassium
- (c) both sodium & potassium
- (d) aluminium or calcium

21. Fat splitting catalyst is

- (a) CaCO_3 (b) ZnO
- (c) Al_2O_3 (d) Fe

22. Free alkali in a toilet soap is.....that in a

(b) more than

(d) none of these laundry soap. (a) less than (c) same

23. Soap cannot be used with hard water, because (a) hard water contains sulphate.

(b) they form insoluble calcium soaps which

precipitate.

(c) they attract back the removed dirt. (d) none of these.

24. Builders are added in soap to act as

- (a) cleaning power booster
- (b) anti-redeposition agent
- (c) corrosion inhibitor

25. Bio-degradable detergents

- (a) can be readily oxidised.
- (b) pose problem in sewerage plant. (c) have an isoparaffinic structure.
- (d) should not be used as it spoils the cloth.

26. Which of the following is a detergent ? (a) Fatty alcohol

- (b) Alkyl benzene sulphonate (ABS) (c) Fatty acids
- (d) Methylene chloride

27. Essential oils are usually obtained using (a) steam distillation

- (b) extractive distillation
- (c) solvent extraction
- (d) leaching

28. Plasticisers are added to paints to

- (a) make it corrosion resistant.
- (b) make glossy surface.
- (c) give elasticity & prevent cracking of the film. (d) increase atmospheric oxidation.

29. Which oil is preferred for paint manufacture ? (a) Drying oil
(c) Semi-drying oil (b) Non-drying oil (d) Saturated oil

30. Function of thinner in a paint is to
(a) accelerate the oxidation of oil.
(b) prevent gelling of the paint.
(c) suspend pigments & dissolve film forming

materials.

(d) form a protective film.

31. Varnish does not contain

- (a) pigment
- (b) thinner
- (c) dryer
- (d) anti-skimming agent

32. SO₂ is bubbled through hot sugar cane juice to (a) act as an acidifying agent.
(b) increase its concentration.
(c) increase the amount of molasses. (d) increase the crystal size.

33. Molasses is the starting material for the production of
(a) alcohol

(c) fatty acids (b) essential oil (d) massecuite

34. The ideal pulp for the manufacture of paper should have high.....content.
(a) cellulose (b) lignin
(c) both (a) & (b) (d) none of these

(d) fabric brightener

ANSWERS

15. (b) 16.(a) 17.(d) 18.(a) 19.(d) 20.(d) 21.(b) 22.(a) 23.(b) 24.(a) 25.(a) 26.(b)
27.(a) 28.(c) 29.(a) 30.(c) 31.(a) 32.(a) 33.(a) 34.(a)

35. In Kraft process of paper manufacture, white cooking liquor consists of caustic soda (a) sodium sulphide & sodium carbonate. (b) sodium sulphite & sodium carbonate. (c) sodium sulphite & sodium sulphide. (d) none of these.

36. Comparing sulphate process with sulphite process, we find that.....in the later. (a) both temperature & pressure in the former

is less than that

(b) both temperature & pressure in the former

is more than that

(c) temperature is more in the former whereas pressure is more

(d) pressure is more in the former whereas temperature is less

37. Cooking liquor in case of sulphite process is (a) sodium sulphite and sodium bisulphite. (b) magnesium sulphite and free SO₂ in acid medium.

(c) magnesium sulphate and magnesium bicarbonate.

(d) none of these.

38. Which is a high grade pulp ?

(a) Rag pulp (b) Mechanical pulp (c) Sulphate pulp (d) Sulphite pulp

39. Bleaching of paper pulp is done with

(a) activated clay

(b) bromine

(c) chlorine or chlorine dioxide

(d) magnesium sulphite

40. Sizing material is incorporated in paper to (a) impart resistance to penetration by liquids. (b) increase its thickness.

(c) increase its flexibility & opacity.

(d) increase its brightness.

41. Viscose rayon is

(a) cellulose nitrate.

(b) regenerated cellulose nitrate.

(c) regenerated cellulose acetate.

(d) none of these.

42. The catalyst used in shift converter is (a) nickel (b) vanadium (c) silica gel

(d) alumina

43. Acrylonitrile is mainly used in the.....industry. (a) polymer (b) printing (c) dyeing ; (d) photographic

(a) (b) (c) (d)

as a plasticiser for unsaturated polyester. in the manufacture of synthetic rubber.
as an anti-skinning agent in paint. none of these.

45. Phenol is mainly used (a) to produce benzene. (b) (c) (d)

to produce phenol formaldehyde. to produce polyester resin.
as a plasticiser for unsaturated polyester.

46. Phthalic anhydride is made by the

(a) oxidation of naphthalene.

(b) oxidation of benzene.

(c) dehydrogenation of ethyl benzene. (d) none of these.

47. Trinitrotoluene (TNT), an explosive, is made by the nitration of (a) nitrobenzene (c) nitrotoluene (b) toluene (d) benzene

48. Which is the most suitable dye for synthetic fibres ?

(a) Acid dye (b) Azoic dye (c) Pigment dye (d) Mordant dye

49. Fumigant insecticides

(a) (b) (c) (d)

kill insects, when they eat it. emit poisonous vapour.

are absorbed throughout the plant. none of these.

50. Systemic insecticides (a) (b) (c) (d)

are absorbed throughout the plant. kill insects following external bodily contact.

are stomach poisons.

emit poisonous vapour.

51. DDT stands for

(a) diethyl-diphenyl-trichloromethane. (b) dichloro-diphenyl-trichloromethane.

(c) diphenyl-dichloro-trichloromethane. (d) dichloro-diphenyl-trichloroethane.

52. BHC (Benzene hexachloride) is made by the chlorination of benzene

(a) (b) (c) (d)

which is an addition reaction. which is a substitution reaction. in absolute dark.
in presence of sunlight.

53. Molecular weights of polymers are in the range of

(a) $10^2 - 10^3$ (b) $10^5 - 10^9$ (c) $10^3 - 10^7$ (d) $10^9 - 10^{11}$

44. The major use of butadiene is

ANSWERS

35. (a) 36.(b) 37.(a) 38.(c) 39.(c) 40.(a) 41.(d) 42.(a) 43.(a) 44.(b) 45.(b) 46.(a)
47.(d) 48.(a) 49.(b) 50.(a) 51.(d) 52.(a) 53.(c)

54. Zeigler process

(a) produces high density polyethylene. (b) produces low density polyethylene.

(c) uses no catalyst.

(d) employs very high pressure.

55. Poly Vinyl Chloride (P.V.C.) is a.....material. (a) thermosetting

(b) thermoplastic

(c) fibrous

(d) chemically active

56. Poly .tetraflouro ethylene (P.T.F.E.) is known as (a) bakelite (b) teflon

(c) celluloid (d) dacron

57. The purpose of tanning in leather industry is to (a) stiffen the leather.

(b) smoothen the leather.

(c) make it flexible.

(d) impart water resistance.

58. Epoxy resin

(a) is a good adhesive.

(b) is an elastomer.

(c) cannot be used for surface coatings. (d) is a polyester.

59. Vulcanisation of rubber

(a) decreases its tensile strength.
(b) increases its ozone & oxygen reactivity, (c) increases its oil & solvent resistance. (d) converts its plasticity into elasticity.

60. Most commonly used rubber vulcanising agent is (a) sulphur
(c) platinum

61. Celluloid is chemically (a) cellulose acetate (b) regenerated cellulose (c) cellulose nitrate (d) cellulose acetate butyrate

62. Thermoplastic materials
(a) do not soften on application of heat. (b) are heavily branched molecules.
(c) are solvent insoluble.
(d) none of these.

63. Thermosetting materials
(a) are cross-linked molecules.
(b) soften on application of heat.
(c) are solvent soluble.
(d) none of these.

64. Type of glass used in optical work is the..... (b) bromine (d) alumina (a) soda-lime
(c) lead

65. Silicon carbide is a/an (a) adhesive
(c) type of glass
(b) fibre
(d) borosilicate

(b) abrasive
(d) brittle material

66. The temperature in the calcium carbide furnace is.....°C.
(a) 200 – 300 (b) 700 – 850 (c) 2000 – 2200 (d) 4000 – 4500

67. Cumene (isopropyl benzene) is made by (a) oxidation of naphthalene.
(b) propylene alkylation of benzene.
(c) polymerisation of a mixture of benzene &

propylene.
(d) none of these.

68. Glycerine can be obtained from
(a) fat
(c) cumene (b) naphthalene (d) sucrose

69. Cumene is the starting material for the production of
(a) benzoic acid
(b) phenol and acetone
(c) isoprene
(d) styrene

70. Which of the following is not responsible for causing permanent hardness of water ? (a) $\text{Ca}(\text{HCO}_3)_2$ (b) CaCl_2
(c) MgCl_2 (d) none of these

71. Zeolite used in water softening process (cation exchange) is regenerated by washing with (a) brine
(b) chloramines
(c) sodium bisulphite
(d) liquid chlorines

72. Lime and soda ash are added to water to remove
(a) bicarbonates & sulphates of calcium and

magnesium.
(b) undersirable taste and odour.
(c) bacteria.
(d) its corrosiveness.

73. Deaeration of water in its treatment is necessary, as it
(a) minimises its turbidity.
(b) helps in controlling its taste and odour. (c) minimises its corrosiveness.
(d) none of these.

glass.

ANSWERS

54. (a) 55.(b) 56.(b) 57.(a) 58.(a) 59.(a) 60.(a) 61.(c) 62.(d) 63.(a) 64.(c) 65.(b)
66.(c) 67.(b) 68.(a) 69.(b) 70.(a) 71.(a) 72.(a) 73.(c)

74. Sodium bisulphite is used for.

(a) deaeration (b) dechlorination (c) both (a) & (b) (d) neither (a) nor (b)

75. Dechlorination of treated water is necessary to (a) remove residual turbidity.

(b) reduce the bacterial load on filter. (c) control taste and odour.

(d) remove chlorinous taste.

76. The main use of activated carbon in water treatment is to control.

(a) bacterial growth (b) taste and odour (c) turbidity (d) none of these

77. Alum [$\text{Al}_2(\text{SO}_4)_3$] is used as a coagulant in water treatment to remove

(a) colour

(b) turbidity

(c) bacteria

(d) all (a), (b) and (c)

78. Pick out the wrong statement pertaining to solvent extraction of oil.

Rate of extraction

(a) decreases with decrease of thickness of the flakes.

(b) increases with the increasing flake size keeping the flake thickness constant.

(c) increases considerably with the rise of temperature.

(d) decreases as the moisture content of flakes increases.

79. Fats as compared to oils have

(a) more unsaturated glycerides of fatty acids. (b) less unsaturated glycerides of fatty acids. (c) much higher reactivity to oxygen. (d) lower melting point.

80. Salt is added in the kettle during soap manufacture to separate

(a) soap from lye.

(b) glycerine from lye.

(c) the metallic soap.

(d) the unsaponified fat from soap.

81. Hydrazine (N_2H_4) is used mainly as a/an (a) explosive (b) rocket fuel (c)

detergents additive (d) none of these

82. Oils are partially hydrogenated (not fully) to manufacture vanaspati, because fully saturated solidified oils

(a) cause cholesterol build up and blood clotting. (b) are prone to rancid oxidation.

(c) always contain some amount of nickel (as

their complete removal is very difficult). (d) have affinity to retain harmful sulphur compounds.

83. Temperature during hydrogenation of oil should not be more than 200°C, otherwise it will result in

(a) pyrolysis of oil.

(b) sintering of porous catalyst.

(c) hydrogen embrittlement.

(d) all (a), (b) and (c).

84. Synthetic glycerine is produced from

(a) toluene (b) phenol

(c) propylene (d) naphthalene

85. Presence of sodium tripolyphosphate (an additive) in synthetic detergent

(a) facilitates its use even in hard water (by

sequestering the water-hardening Ca &

Mg ions).

(b) inhibits its corrosive effects.

(c) does not allow redeposition of dirt on the

cleaned surface .

(d) none of these.

86. Carboxymethyl cellulose (CMC) is added in detergents to

(a) prevent redeposition of soil on cleaned surface.

(b) act as optical brightening agent.

(c) inhibit corrosion in washing machines made of aluminium.

(d) none of these.

87. Hydrophilic group of a soap or detergent solution is
(a) water hating (b) soil loving (c) water loving (d) none of these

88. Aryl benzene sulphonate (ABS) is a
(a) detergent.
(b) plasticiser for unsaturated polyester. (c) starting material for the synthesis of glycerine.
(d) coating ingredient for photographic film.

89. Digestion of wood-base materials (for manufacture of pulp) is done to
(a) remove lignin.
(b) produce long fibres.
(c) prevent deterioration on storage.
(d) none of these.

ANSWERS

74. (d) 75.(b) 76.(b) 77.(d) 78.(a) 79.(b) 80.(a) 81.(b) 82.(a) 83.(d) 84.(c) 85.(a)
86.(a) 87.(c) 88.(a) 89.(a)

90. The most economical pulp for the production of newsprint would be the.....pulp (a) groundwood (c) sulphite
(b) sulphate
(d) semichemical

91. Pick out the wrong statement.

(a) Kraft method of pulp manufacture can process all types of fibrous raw materials.
(b) Digestion time for bagasse is less than that for wood base materials.
(c) Both temperature and pressure in the digester is less in case of the sulphite method as compared to that in the sulphate method.
(d) none of these.

92. In sulphate pulp manufacture, the pressure and temperature in the digester is
(a) 10 atm., 800 °C
(b) 10 atm., 170–180°C
(c) 1 atm., 170–180°C
(d) 1 atm., 800 °C

93. The end bleaching agent used to move last traces of colour bodies from the pulp is (a) chlorine dioxide (ClO_2)

(b) MgO

(c) SO_2 gas

(d) mercaptans

94. Cellulose content of bamboo and ideal fibrous raw material for the manufacture of paper is.....percent.

(a) 10 (b) 50

(c) 80 (d) 95

95. Black liquor is converted into white liquor by (a) evaporation and burning the concentrate followed by causticisation of products.

(b) multi-effect evaporation only.

(c) selective liquid extraction.

(d) extractive distillation.

96. Rosin soap is added during paper manufacture to (a) impart adhesive properties.

(b) improve opacity.

(c) impart resistance to penetration by liquids.

(d) none of these.

97. Viscose rayon

(a) cannot be made from sulphite pulp.

(b) utilises H_2SO_4 , NaOH and CS_2 during its

manufacture.

(c) cannot yield textile grade fibre. (d) none of these.

98. The amount of benzene present in pure benzol

is about.....percent.

(a) 30 (b) 50

(c) 70 (d) 90

99. Carbon content of pitch (residue of coal tar distillation) is around.....percent.

- (a) 70 (b) 55
(c) 80 (d) 94

100. High magnesia lime is added to hot sugar cane juice (during the manufacture of sugar) to (a) flocculate the impurities.
(b) facilitate fast filtration.
(c) both (a) and (b).
(d) neither (a) nor (b).

101. Massecuite is
(a) used for paper making.
(b) used as a cattle feed.
(c) highly acidic in nature.
(d) none of these.

102. Sucrose content in cane sugar may be around.....percent.
(a) 50 (b) 70
(c) 80 (d) 95

103. Alcohol percentage in molasses may be around (a) 10 (b) 40
(c) 70 (d) 85

104. Production of alcohol by fermentation of molasses is an.....process.
(a) anaerobic (b) aerobic (c) endothermic (d) both (b) and (c)

105. Fermentator temperature during production of alcohol from molasses is around.....°C. (a) 5 (b) 30
(c) 150 (d) 300

106. Pure rectified spirit contains about..... percent alcohol.
(a) 45 (b) 70
(c) 95 (d) 99.5

107. Chloral is used in the manufacture of (a) DDT (b) BHC
(c) parathion (d) none of these

108. Lindane is
(a) not a fumigant.
(b) BHC (Benzene Hexa Chloride) c o n

taining 99% γ -isomer.

(c) a by-product of BHC manufacture. (d) both (b) and (c).

90.(a) 91.(d) 92.(b) 93.(a) 94.(b) 102.(d) 103.(b) 104.(b) 105.(b) 106.(c)

ANSWERS

95.(a) 96.(c) 97.(b) 98.(c) 99.(d) 100.(c) 101.(d) 107.(a) 108.(b)

109. DDT should not be allowed to come in contact with iron (during its manufacture) to (a) avoid its decomposition.

(b) prevent sulphonation of the monochlorobenzene by the acid catalyst.

(c) achieve non-hygroscopic property. (d) none of these.

110. The catalyst used in the manufacture of DDT (from chloral and chlorobenzene) is

(a) dilute H_2SO_4 (c) ultraviolet light

111. Silicone is a/an

(a) thermoplastic (b) (c) monomer (d) (b) oleum

(d) none of these

inorganic polymer none of these

112. Flexible foam (for mattresses) is usually made of

(a) PVC (b) silicone (c) polyurethanes (d) polyamides

113. Plasticisers are added to synthetic plastics to (a) impart flexibility.

(b) improve workability during fabrication. (c) develop new improved properties not

present in the original resins.

(d) all (a), (b) and (c).

114. Bakelite is

(a) same as poly tetrafluoroethylene (PTFE). (b) an inorganic polymer .

(c) same as thermosetting phenol formaldehyde. (d) not a polymer.

115. Styrene-butadiene-rubber (SBR) as compared to natural rubber has

(a) Poorer tensile strength.

(b) poorer resistance to oxidation.

(c) greater amount of heat build-up under

heavy loading.

(d) all (a), (b) and (c).

116. Pick out the wrong statement.

(a) Cold rubber (SBR) is superior as compared to hot rubber (SBR).

(b) Polymerisation temperature can modify the properties of SBR.

(c) Production of cold SBR employs lower pressure as compared to that of hot SBR.

(d) none of these.

117. The process involved in converting rubber into a thin sheet or coating it on fabric is called

(a) extrusion (b) mastication

118. Nylon -6 as compared to Nylon-66 is having higher

(a) hardness (c) melting point

119. Nylon-6 is a (a) polyamide (c) polyester (b) abrasion/resistance (d) none of these

(b) thermosetting resin (d) none of these

120. Dacron (or terylene) fibres as compared to nylon fibres have

(a) better heat & acid resistant properties. (b) poorer resistance to alkalis.

(c) poorer dyeability.

(d) all (a), (b) and (c).

121. Pick out the wrong statement.

(a) Azoic dyes are mostly applied on cotton fabrics.

(b) Basic dyes (e.g. amino derivatives) are applied mostly to paper.

(c) Mordant dyes are applied mainly to wools.

(d) none of these.

122. Absorption of SO_3 in 97% H_2SO_4 is

(a) exothermic

(c) not possible

(b) endothermic (d) none of these

123. The chamber process is

(a) preferred over contact process for producing 98 to 100% H_2SO_4 and various oleums.

(b) non-catalytic and operates only on pyrites.

(c) a batch process for directly producing high strength (98 to 100%) H_2SO_4 .

(d) none of these.

124. In the manufacture of H_2SO_4 , vanadium catalyst as compared to platinum catalyst

(a) gives higher conversion efficiency.

(b) has a longer life and is not poisoned by arsenic.

(c) handles lower SO_2 content gas (7 –10% SO_2), thus increasing the capital cost of the plant.

(d) all (a), (b) and (c).

125. Which of the following is a co-product during the manufacture of caustic soda by electrolysis of brine ?

(a) Na_2CO_3 (b) NaHCO_3

(c) H_2 (d) none of these

(c) calendering (d) vulcanisation

ANSWERS

109. (a) 110. (b) 111. (b) 112. (c) 113. (d) 114. (c) 115. (d) 116. (d) 117. (c) 118. (d)

119. (a) 120. (d)

121. (d) 122. (a) 123. (d) 124. (d) 125. (c)

126. Mercury electrolytic cells are preferred over (b) fire proofing agents.

diaphragm electrolytic cell (for production of (c) dyes and antiknock

compounds. caustic soda), as it (d) all (a), (b) and (c).

(a) has larger production capacity per unit **135.** Coke used for the production of calcium carcell. bide should have

(b) consumes less power per ton of Cl_2 pro(a) low ash content.

duced. (b) low ignition temperature. (c) produces high purity (70%) caustic soda

(c) high electrical resistivity. directly. (d) all (a), (b) and (c).

(d) all (a),(b) and (c). **136.** Carbon disulphide is mainly used in the pro

127. The main use of HCl is in the duction of

(a) drilling of petroleum wells and pickling (a) viscose rayon.

of steel sheets. (b) corundum.

(b) manufacture of cationic detergent. (c) plasticiser for unsaturated polyester.

(c) treatment of spent fuel of nuclear reactor. (d) paints.

(d) none of these. **137.** Carborundum consists mainly of

128. Which of the following may be viewed as a (a) bauxite (b) silicon carbide catalyst in the manufacture of soda ash by (c) boron carbide (d) calcium carbide Solvay process ?

138. Fire clay is.....refractory material. (a) NH_3 (b) NaCl (a) a basic (b) an acidic (c) CaO (d) Coke (c) a neutral (d) not a

129. Washing soda is chemically represented by **139.** Calcination of gypsum produces (a)

Na_2CO_3 (b) $\text{Na}_2\text{CO}_3 \cdot \text{H}_2\text{O}$ (a) plaster of paris (b) salt cake (c)

Na

2

CO

3

$\cdot 10\text{H}$

2

O

(d)

NaHCO

(c) nitre cake (d) lime ³ Highly porous refractory bricks are **130.** Dense soda ash used in the manufacture of **140.**

glass, is chemically represented by (a) less susceptible to chemical attack by (a)

Na

2

CO

3

(b)

Na

2

CO

3

$\cdot 10\text{H}$

2

O

molten fluxes and gases etc.

(b) very strong. (c) $\text{Na}_2\text{CO}_3 \cdot \text{H}_2\text{O}$ (d) Na_2HCO_3 (c) having very high thermal conductivity.'

131. In the Solvay process, the product from the (d) none of these. calciner is **141.** Alum is commercially produced from (a) light soda ash (a) gypsum (b) dense soda ash (c) galena

(b) feldspar (c) sodium bicarbonate (d) bauxite

132. Solvay process as compared to dual process (i.e. modified Solvay process) (a) can use low grade brine.

- (b) has less corrosion problems.
 (c) involves higher investment in NH_3 re143.

covery units than that for crystallisation units for NH_4Cl .

- (d) both (b) and (c).

133. Bromine content in sea water may be

around.....ppm.

- (a) 70 (b) 640 **144.** Which of the following impurities in feed wa(c) 1875 (d) 2500 ter for high pressure boiler is the most detri

134. Bromine is used in the preparation of^{emental} ?

- (a)

fire extinguishing compounds.

- (a) Silica (b) Dissolved oxygen (c) Suspended salt (d) Dissolved salt

ANSWERS

126. (d) 127.(a) 128.(a) 129.(c) 130.(c) 131.(a) 132.(d) 133.(a) 134.(d) 135.(d) 136.(a) 137.(b)

138.(b) 139.(a) 140.(d) 141.(d) 142.(c) 143.(c) 144.(a)

(d) dehydrated soda ash **142.** Which of the following is an yellow pigment ? (a) Titanium dioxide

- (b) Ferrous sulphate

- (c) Lead chromates

- (d) Zinc sulphides

Naphthalene is removed from coke oven gas by (a) adsorbing on palladium.

- (b) absorbing in ethanolamine.

- (c) scrubbing with wash oil.

- (d) passing it through electrostatic precipitator.

145. Double Contact Double Absorption (DCDA)

process is the most recent process for the manufacture of

- (a) nitric acid

- (b) sulphuric acid

- (c) ammonium sulphate

- (d) hydrochloric acid

146. Metallic soap (e.g. aluminium or calcium salts of fatty acids) can be used
(a) as a lubricant.
(b) as a rust preventive.
(c) in hard water for cleaning of cloth. (d) as a foam depressant in distillation column.

147. Oils and fats are converted to soap in a process called
(a) hydrogenation (b) esterification (c) saponification (d) none of these

148. Temporary hardness of water can be removed by
(a) addition of alum (a coagulant).
(b) boiling.
(c) filtration (through gravity sand filter). (d) addition of lime.

149. Most widely and commonly used coagulant for the removal of suspended impurities in water is
(a) bleaching powder (b) slaked lime (c) alum (d) copper sulphate

150. Permanent hardness of water can be removed by
(a) simply boiling.
(b) adding alum.
(c) passing it through cation & anion exchangers.

(d) all (a), (b) and (c).

151. Salt cake is chemically represented by
1

(a) Na_2SO_4 (b) $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$

(c) MgSO_4 (d) BaSO_4 **152.** Fourdrinier machine is used in the manufacture of

(a) sugar

(b) paper

(c) alcohol from molasses (d) phenol formaldehyde

153. Teflon is

(a) phenol formaldehyde. (b) an inorganic polymer.

(c) poly tetrafluoroethylene (P.T.F.E.). (d) a monomer.

154. Parathion and Malathion are

- (a) pesticides.
- (b) plasticisers for unsaturated polysters. (c) pain relieving drugs (analgesic). (d) tranquilisers.

155. During the absorption of HCl gas in water (to produce liquid HCl), the gas is kept above dew point to

- (a) increase the rate of absorption.
- (b) avoid corrosion.
- (c) reduce the cooling water circulation rate. (d) none of these.

156. Le-Blanc process is a primitive process for the manufacture of

- (a) caustic soda
- (b) soda ash
- (c) bromine from sea water
- (d) hydrochloric acid

157. Baking soda is chemically represented by (a) Na_2CO_3 (b) NaHCO_3
(c) $\text{Na}_2\text{CO}_3 \cdot \text{H}_2\text{O}$ (d) $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$

158. Impurities present in brine is normally removed by treatment with

- (a) NH_3 and CO_2 .
- (b) lime and soda ash.
- (c) lime, ammonia and carbon.
- (d) all (a), (b) and (c).

159. Use of water having dissolved oxygen in boilers promotes

- (a) corrosion
- (c) scale formation (b) sequestration (d) none of these

160. Which of the following is a constituent of vinegar ?

- (a) Around 10% alcohol
- (b) Around 1% acetic acid
- (c) Both (a) and (b)
- (d) Neither (a) nor (b)

161. Alcohol content in freshly prepared natural and fortified wine may be respectively around.....percent.

- (a) 7–14 and 14—30

- (b) 7–14 and 40—50
- (c) 14–30 and 40–50
- (d) 10–20 and 40–50

145.(b) 146.(a) 147.(c) 148.(b) 157.(b) 158.(d) 159.(a) 160.(c) 161.(a)

ANSWERS

149.(c) 150.(c) 151.(a) 152.(b) 153.(c) 154.(a) 155.(b) 156.(b) **162.**

Pasteurisation of milk means

- (a) removal of fatty and albuminous substance from it.
- (b) killing of organisms present in it by heating it at controlled temperature without changing its natural characteristics.
- (c) inhibiting the growth of micro-organisms without killing them.
- (d) none of these.

163. Dry ice (solidified CO₂) is used for the

- (a) storage & shipment of frozen foods and ice-creams.
- (b) liquefaction of permanent gases.
- (c) liquefaction of natural gas.
- (d) none of these.

164. Thorium is mainly used

- (a) for the manufacture of gas mantles. (b) as a fissile fuel in a nuclear reactor.
- (c) in the manufacture of hydrogen bomb. (d) in the treatment of cancer.

165. Which of the following is not an abrasive ma

- (b) Pumice
- (d) Carborundum terial ?
- (a) Bakelite (c) Corundum

166. Helium is produced on commercial scale from (a) air (b) natural gas (c) coke oven gas (d) none of these

167. Which of the following is used as a coagulant in treating turbid water ?

- (a) Chlorine (b) Ferric sulphate (c) Calcium sulphate (d) Activated carbon

168. The most commonly used substance to speed up the sedimentation of sewage is

(a) lime (b) sulphuric acid (c) chlorine (d) sodium bisulphite

169. Lubricating greases are a mixture of (a) mineral oil, soap and additives. (b) mineral oil and metallic soap.

(c) mineral oil and fatty oil.

(d) fatty oil and metallic soap.

170. Higher viscosity index of a lubricating oil denotes

(a) less changes in fluidity of oil with tem-

perature.

(b) substantially high change in fluidity of oil with temperature.

(c) its unsuitability under varying tempera**171.** Catalyst used during the manufacture of 'Vanaspati Ghee' is

(a) zinc (b) nickel

(c) platinum (d) copper

172. Cation exchanger is regenerated usually with

(a) NaOH (b) H_2SO_4

(c) hydrazine (d) alum solution

173. Anion exchanger is regenerated usually with

(a) NaOH (b) H_2SO_4 (c) Hydrazine (d) alum solution **174.** Bordeaux mixture is a/an

(a) fertiliser

(c) insecticide (b) inorganic fungicide (d) explosive

175. Frasch process is for

(a) making oxygen (b) producing helium

(c) mining sulphur (d) making nitrogen

176. Phosphoric acid is prepared from (a) cryolite

(c) rock phosphate (b) chalcopyrite (d) none of these

177. Phosphate rock is a raw material for the manufacture of

(a) phosphoric acid (b) phosphorous (c) superphosphates (d) all (a), (b) and (c)

178. Fatty material used in soap making is (a) fatty acid (c) tallow

(b) fatty alcohols (d) detergents

ture conditions . (d) none of these.

179. Coagulant is used.....filtration. (a) before (b) after
(c) during (d) to avoid

180. The manufacture of Kraft pulp is done by a/ an.....process.
(a) alkaline (b) acidic
(c) neutral (d) none of these

181. Sulphuric acid is mainly used in the.....industry.
(a) fertiliser (b) steel
(c) paper (d) paint

182. In the manufacture of viscose rayon, the raw material used industrially is
(a) recalyptious wood (b) bamboo (c) bagasse (d) fine teak wood

183. Which of the following is not required in the manufacture of soda ash by Solvay process ? (a) Ammonia (b) Limestone (c) Nitric acid (d) None of these

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162. (b) 163.(a) 164.(a) 165.(a) 166.(b) 167.(b) 168.(a) 169.(a) 170.(a) 171.(b)
172.(b) 173.(a)

174.(b) 175.(c) 176.(c) 177.(d) 178.(c) 179.(a) 180.(a) 181.(a) 182.(d) 183.(c)

184. In the production of soda ash by Solvay process, the by-product is
(a) CaCl_2 (b) NH_4Cl (c) NH_3 (d) NaOH

185. Alkyl benzene sulfonate (ABS) is a (a) detergent (c) pesticide (b) rubber (d)
polyester

186. Blue vitriol is chemically
(a) copper sulphate
(b) ferrous sulphate
(c) copper nitrate
(d) aluminium sulphate

187. Main constituents of natural rubber is (a) polystyrene (b) polyisoprene (c)
polybutadiene (d) polychloroprene

188. Molecular weight of plastics ranges from (a) 5000 to 10000 (b) 20000 to

250000 (c) 500 to 5000 (d) 10^6 to 10^9

196. Which catalyst is used in the manufacture of ethylene oxide by oxidation of ethylene ? (a) AgO (b) Al_2O_3
(c) ZnCl_2 (d) Fe_2O_3

197. Naphthols are derivatives of
(a) methyl amine (b) naphthalene (c) phenol (d) xylene

198. Ethanol amine is produced using ammonia and
(a) ethyl benzene (b) ethylene oxide (c) ethanol (d) ethane

199. Chrome tanning and vegetable tanning are done for
(a) light & heavy leather respectively. (b) heavy & light leather respectively. (c) both light & heavy leather.
(d) neither light nor heavy leather.

200. Main constituents of cotton fiber is

189. The product obtained on mixing calcium oxide with water is called (a) quicklime (b) (c) milk of lime (d)

(a) lignin (c) starch (b) cellulose (d) gelatine

slaked lime none of these

190. Bromides contained in hot mother liquor is treated with.....during manufacture of bromine from sea water.

(a) SO_3 (b) Cl_2
(c) NH_3 (d) SO_2

191. Oleum produces fumes of

(a) SO_2 (b) H_2SO_4 (c) SO_3 (d) $\text{SO}_2 + \text{H}_2\text{SO}_4$ **192.** Main product in calcium carbide-water reaction is

(a) $\text{Ca}(\text{OH})_2$ (b) C_2H_2 (c) CO_2 (d) CaCO_3

193. The catalyst used in the production of elemental sulphur from H_2S (by oxidation re

- 201.** Cellulose percentage in bamboo fibre is about (a) 10 (b) 20
(c) 50 (d) 85
- 202.** Fermentation is adversely affected by the (a) presence of air.
(b) absence of air.
(c) high concentration.
(d) presence of ammonium salts.
- 203.** All enzymes are made of
(a) fats
(c) proteins (b) carbohydrates (d) amino acids
- 204.** Catalyst used in the oxidation of benzene to produce maleic anhydride is
(a) V_2O_5 (b) Pt
(c) Ni (d) Cr
- 205.** An alkali metal salt of palmitic acid is known
(b) silica gel (d) nickel duction) is
(a) alumina (c) platinum as
(a) soap
(c) detergent (b) metallic soap (d) alkaloid
- 194.** Maleic anhydride is produced by catalytic oxidation of
(a) touene (b) ethyl alcohol (c) naphthalene (d) benzene
- 195.** Acetone is produced by catalytic dehydrogenation of
(a) phenol (b) naphthalene (c) isopropanol (d) ethyl benzene
- 206.** The basic difference between vegetable oils and fats is in their
(a) density (b) chemical properties (c) physical state (d) composition
- 207.** Na_2CO_3 is called (a) washing soda (c) plaster of paris (b) soda ash (d)
calcite

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184. (a) 185.(a) 186.(a) 187.(b) 188.(b) 189.(b) 190.(b) 191.(c) 192.(b) 193.(a)
194.(b) 195.(c)
196.(a) 197.(b) 198.(b) 199.(a) 200.(b) 201.(c) 202.(c) 203.(c) 204.(a) 205.(b)
206.(c) 207.(b)

208. $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ is called (a) washing soda (c) slaked lime (b) soda ash (d) quicklime

209. Fusion of limestone and.....produces high alumina cement. (a) sand (c) quick lime

210. $\text{Ca}(\text{OH})_2$ is called (a) quick lime (c) limestone

211. CaO is called (a) quick lime (c) limestone (b) bauxite (d) calcite

(b) slaked lime (d) gypsum

(b) slaked lime (d) calcite

212. Setting of plaster of paris is accompanied with

(a) hydration (b) dehydration (c) hydrolysis (d) loss of CO_2

213. The main component of pyrex glass is (a) zinc (b) lead

(c) boron (d) celenium

214. Glauber's salt is chemically represented by (a) $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$ (b)

$\text{CaCl}(\text{OCl})$ (c) $\text{CaSO}_4 \cdot \text{H}_2\text{O}$ (d) $(\text{NH}_4)_2\text{SO}_4$

215. Catalytic oxidation of naphthalene produces (a) styrene (b) phenol (c)

phthalic anhydride(d) none of these

216. Catalytic oxidation of toluene produces (a) styrene

(c) benzene (b) phenol

(d) tri-nitro-toluene

217. Dehydrogenation of ethyl benzene produces (a) styrene (b) naphthalene (c)

phenol (d) benzoic acid

218. Caprolactum (a raw material for nylon-6 manufacture) is produced from

(a) phenol (b) naphthalene (c) benzene (d) pyridine

219. Which of the following processes can remove both temporary as well as permanent hardness of water ?

(a) Filtration

(c) Distillation

220. Gun powder uses (a) sulphur

(c) potassium nitrate (b) Boiling

(d) None of these

(b) charcoal

(d) all (a),(b),&(c)

221. Bleaching action of bleaching powder is due to its.....properties.

(a) reducing (b) oxidizing (c) disinfecting (d) none of these

222. The type of high refractive index glass used in optical instruments is.....glass. (a) pyrex (b) flint

(c) crookes (d) none of these

223. Blue colour is imparted to glass by the addition of

(a) FeSO_4 (b) PbO

(c) CaO (d) NaOH

224. Which of the following is an explosive ? (a) Nitroglycerene

(b) Trinitrotoluene (TNT)

(c) Cellulose nitrate

(d) All (a),(b), and (c)

225. Graphite is a/an

(a) electrical insulator.

(b) allotrope of carbon.

(c) moderator used in nuclear reactor. (d) both (b) and (c).

226. Concentration of NaOH solution produced by mercury electrolytic cell is about.....percent.

(a) 10 (b) 25

(c) 50 (d) 98

227. Oxidation of SO_2 to SO_3 is favoured by (a) low temperature and low pressure. (b) low temperature and high pressure. (c) high temperature and low pressure. (d) high temperature and high pressure.

228. Concentration of NaOH solution produced by diaphragm electrolytic cell is about.....percent.

(a) 10 (b) 25

(c) 50 (d) 98

229. process is used for the commercial production of nitric acid by the catalytic oxidation of ammonia.

(a) Solvay (b) Ostwald's (c) Haber's (d) none of these

230. Chemical name of Grignard reagent is (a) sodium thiosulphate.

(b) ethyl magnesium chloride.

(c) sodium sulphite.

(d) sodium bicarbonate.

231. Argon is the third largest constituent of air (followed by N_2 & O_2). Its percentage by volume in air is

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208. (a) 209. (b) 210. (b) 211. (a) 212. (a) 213. (b) 214. (a) 215. (c) 216. (b) 217. (a) 218. (c) 219. (c)

220. (d) 221. (b) 222. (b) 223. (c) 224. (d) 225. (b) 226. (c) 227. (b) 228. (a) 229. (b)

230. (b) 231. (c) (a) 0.14 (b) 0.34 (a) Galena (b) Chalcopyrite (c) 0.94 (d) 1.4 (c) Hematite (d) Bauxite

232. Mercury electrolytic cell produces 50-70% **242.** Chemical name of soda ash is NaOH solution. Its operating temperature (a) sodium bicarbonate is.....°C. (b) sodium thiosulphate (a) 25 (b) 150–200 (c) potassium carbonate (c) 150–200 (d) 250–300 (d) none of these

233. Commercial production of soda ash by Solvay **243.** Chemical formula of oleum is process requires limestone.....as raw ma(a) H_2SO_3 (b) H_2SO_4 terials.

(c) $H_2S_2O_7$ (d) H_2SO_7 (a) coke and sand **244.** is a thermosetting plastic. (b) brine and coal (a)(c) coke and caustic soda (c)

Polyvinyl chloride (b) Polythene Bakelite (d) Teflon

(d) none of these **245.** Platinum catalyst used in the earlier days of **234.** is an ore of lead.

(a) Quartz (b) Galena

(c) Siderite (d) Chalcopyrite

235. Flux addition during smelting of ore is done to

(a) remove impurities/gangue.

(b) enhance rate of reaction. **246.** (c) accelerate reduction of ore.

(d) separate slag from metal.

236. Commercial production of Vanaspati is done

by.....of edible vegetable oils.

sulphuric acid manufacture by contact process suffers from the drawback like (a)

high cost

(b) fragile nature

(c) easy poisoning tendency (d) all (a), (b) and (c)

Heating of.....to 120°C, produces plaster of paris.

(a) blue vitriol

(b) gypsum

(c) calcium silicate

(d) calcium sulphate

(a) hydrogenation

(c) hydrolysis

(b) oxidation (d) hydrocracking **247.** Bleaching powder (chemically known as

calcium chloro hypochlorite) is commercially produced by the action of chlorine on

(a) slaked lime

(b) soda lime

(c) calcium perchlorate

(d) none of these

237. Oxidation of ortho-xylene in presence

of.....catalyst is done to produce phthal

ic anhydride on commercial scale.

(a) nickel (b) vanadium

(c) alumina (d) iron

1 is known as **248.** Hard water. $2H_2O$ **238.** $CaSO_4 \cdot \frac{1}{2}H_2O$

(a) blue vitriol (b) plaster of Paris (a) does not affect the lather formation by (c)

gypsum

(d)

zeolite

soap.

(b) is not unfit for drinking purpose. **239.** Platinum is a versatile catalyst for many (c) pollutes the water stream. processes in chemical industries. It is highly (d) all (a), (b) and (c).

prone to be poisoned by the presence of **249.** iron is the purest form of iron. (a) carbon (b) arsenic (a) Cast (b) Wrought (c) lead (d) sulphur (c) Pig (d) High silicon

240. Sulphuric acid saturated with SO₃ is called **250.** Which of the following is a disacchride ? (a) concentrated H₂SO₄. (a) Sucrose (b) Glucose (b) sulphurous acid. (c) Starch (d) Maltose (c) oleum. **251.**

.....of quicklime produces slaked lime. (d) none of these. (a) Hydration **241.** Which of the following is an ore of iron ? (c) Hydrogenation (b) Dehydration (d) None of these

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232. (d) 233. (b) 234. (b) 235. (a) 236. (a) 237. (b) 238. (b) 239. (b) 240. (c) 241. (c) 242. (d) 243. (c)

244. (c) 245. (d) 246. (b) 247. (a) 248. (b) 249. (b) 250. (a) 251. (a)

252. Sand and.....is fused at 1300°C, to produce sodium silicate.

(a) limestone (b) soda ash
(c) coke (d) sodium sulphate

253. Yeast is used in the manufacture of (a) pencillin (b) antibiotics
(c) wine (d) pasteurised milk

254. L.D. converter is used in the production of (a) pig iron (b) steel
(c) copper (d) zinc

255. Magnesium and calcium.....cause temporary hardness of water. (a) carbonates

(c) phosphates
(b) bicarbonates (d) sulphates

256. Which is the main reducing agent during production of iron from iron ore in a blast furnace ?

(a) C (b) CO
(c) CO₂ (d) H₂

257. H₂S is scrubbed from refinery gases by ab- sorption using

(a) dilute H₂SO₄

- (b) ethanol amine
- (c) chilled water
- (d) tri-butyl phosphate

258. Pick out the wrong statement.

(a) Chamber process of sulphuric acid manufacture produces pure acid of concentration $< 80\%$.

(b) Contact process of sulphuric acid manufacture produces pure acid of concentration $> 98\%$.

(c) 75% oleum can be produced by distillation of 20% oleum.

(d) Contact process of sulphuric acid manufacture uses nickel as the catalyst.

259. Sulphur removal by heating of pyrite ore in presence of air is called its

(a) reduction (b) roasting

(c) calcination (d) smelting **260.** process is used for the manufacture of sodium carbonate by ammonia soda process.

(a) Ostwald's (b) Bosch

(c) Solvay (d) Haber's **261.** Which of the following has sodium bicarbonate as its main constituent ?

(b) Baking powder (d) none of these **262.** $\text{CaCl}(\text{OCl})$ is the chemical formula of

(a) hypo

(b) bleaching powder

(c) plaster of paris

(d) aqua regia

263. Chalcopryrite is the main ore of

(a) copper (b) lead

(c) tin (d) iron

264. Hydrogenation of edible vegetable oils (a) is an exothermic reaction.

(b) increases their melting point.

(c) is done in presence of nickel catalyst. (d) all (a), (b) and (c).

265. is used as a flux in the smelting of copper ore like chalcopryrite.

(a) Coke breeze (c) Silica/quartz (b) Lime powder (d) Dolomite

(a) Baking soda (c) Washing soda

266. Iron ore hematite is concentrated using (a) electro magnetic separation mainly. (b) gravity separation.
(c) froth floatation.
(d) roasting.

267. Main constituent of limestone is
(a) CaCO_3 (b) MgCO_3 (c) Na_2CO_3 (d) CaSO_4

268. How much temperature is maintained during quicklime manufacture in the calcination zone of the vertical shaft kiln ?
(a) 500°C (b) 750°C
(c) 1000°C (d) 1500°C

269. The function of gypsum addition during cement making is to
(a) increase the density of cement.
(b) decrease the cement setting rate. (c) both (a) and (b).
(d) neither (a) nor (b).

270. Diaphragm electrolytic cell as compared to mercury electrolytic cell
(a) produces 70% NaOH solution.
(b) requires less specific power consumption

for the production of chlorine.
(c) requires lesser investment for similar capacity.
(d) all (a), (b) and (c).

271. Main constituent of dolomite is
(a) CaCO_3 (b) MgCO_3 (c) K_2CO_3 (d) Na_2CO_3 **272.** Glass is

ANSWERS

252. (b) 253.(c) 254.(b) 255.(b) 256.(b) 257.(b) 258.(d) 259.(b) 260.(c) 261.(b)
262.(b) 263.(a)
264.(d) 265.(c) 266.(b) 267.(a) 268.(c) 269.(b) 270.(c) 271.(b) 272.(c)
(a) mainly CaO
(b) subjected to galvanising
(c) a super cooled liquid
(d) all (a), (b) and (c)

273. A mineral is termed as 'ore', if

- (a) a metal can be economically extracted from it.
- (b) it contains > 40% metal.
- (c) the metal present in it is costly.
- (d) all (a), (b) and (c).

274. is used as a flux in the extraction of iron from iron ore (hematite) in blast furnace. (a) Bauxite (b) Limestone (c) Quartz (d) Manganese

275. Main constituents of portland cement are calcium aluminate and (a) gypsum
(c) sodium silicate (b) silicates (d) carbonates

276. Cement setting under water employs a/an..... process.
(a) hydration (c) oxidation (b) decomposition (d) reduction

277. Favourable conditions for the liquefaction of gases in general are
(a) high pressure & low temperature. (b) low pressure & high temperature. (c) high pressure & high temperature. (d) low pressure & low temperature.

278. Which is the most efficient absorbant for SO_3 out of the following ?
(a) 20% oleum (b) 65% oleum (c) 78% H_2SO_4 (d) 98% H_2SO_4

279. Ore concentration by froth floatation utilises the.....of ore particles.
(a) density difference
(b) wetting characteristics
(c) terminal velocities
(d) none of these

280. Fat dispersed in water is exemplified by (a) colloids
(c) butter

281. Dichloro diphenyl (an insecticide). (b) gel
(d) emulsion

is the full form of DDT

(a) tetrachloroethane (b) trichloroethane (c) tetrachloromethane (a) detergent (b) vanaspati (c) soap (d) mercaptans

283. Chemical formula of BHC, which is an insecticide is

- (a) $C_6H_6Cl_6$ (b) C_6Cl_6
(c) C_6H_5Cl (d) $C_6H_4Cl_2$

284. Phenol formaldehyde is produced by condensation polymerisation. It is also known as (a) teflon (b) bakelite (c) polyester (d) nylon-66

285. is not a constituent of gun powder. (a) Carbon (b) Charcoal
(c) Sulphur (d) Potassium nitrate

286. 90% of the caprolactum is converted to nylon-6 on its condensation polymerisation in the reactor maintained at.....°C.

- (a) <0 (b) 10–30
(c) 250–280 (d) 500–600

287. Ethylene oxide is produced by oxidation of ethylene in presence of AgO catalyst at (a) 1 atm & 100°C

- (b) 5 atm & 275°C
(c) 100 atm & 500°C
(d) 50atm & 1000°C

288. Glycerine is a by-product of the.....industry. (a) soap (b) detergent (c) oil hydrogenation (d) paint

289. Titanium dioxide is a/an colour pigment. (a) white (b) black
(c) yellow (d) blue

290. Production of one ton of dry paper pulp requires about.....tons of bamboo or wood. (a) 1 (b) 2.5

- (c) 5 (d) 10

291. Manufacture of phthalic anhydride use as a catalyst.

- (a) Ni (b) Cr
(c) V_2O_5 (d) Al_2O_3

292. Oil produced by solvent extraction

- (a) has low free fatty acid content.
(b) is odourless.
(c) both (a) & (b).

(d) neither (a) nor (b).

293. Starting material for the commercial production of ethyl alcohol in India is (d) trichloromethane^(a) rice (b) molasses Esterification reaction produces^(c) fruit of Mahua tree(d) maize**282.**

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273. (a) 274.(b) 275.(b) 276.(a) 277.(a) 278.(d) 279.(b) 280.(c) 281.(b) 282.(c) 283.(b) 284.(b)

285.(a) 286.(b) 287.(b) 288.(a) 289.(a) 290.(b) 291.(c) 292.(d) 293.(b)

294. is obtained as a by-product in the manufacture of sodium hydroxide using brine. (a) Chlorine

(b) Ammonium chloride

(c) Sodium carbonate

(d) Sodium bi-carbonate

295. Sodium chloride content in sea water is about.....gms/litre.

(a) 2 (b) 10

(c) 25 (d) 50

296. Starting material for the production of butadiene in India is (a) naphthalene

(c) ethyl alcohol (b) benzol

(d) phthalic anhydride **306.** Reaction of calcium carbide with water produces a gas, which is used

(a) as an illuminant.

(b) for metal cutting/welding.

(c) both (a) & (b).

(d) neither (a) nor (b).

307. Finely ground calcium aluminate & silicate is a/an

(a) cermet (b) cement (c) abrasive (d) explosive

308. Separation of fresh water from sea water can be done by the.....operation.

(a) osmosis (c) absorption (b) reverse osmosis (d) adsorption

297. process is used for producing soda ash. (a) Chamber (b) Chance (c) Tromp (d) Solvay

298. Varnish does not contain

- (a) thinner (b) pigment
(c) both (a) & (b) (d) neither (a) nor (b)

299. is used as a catalyst in fat splitting.

- (a) ZnO (b) Ni
(c) V_2O_5 (d) FeO

300. Reaction of an alcohol with organic acid is called the.....reaction.

- (a) saponification (c) neutralisation (b) esterification (d) acidification

301. Phthalic anhydride is used

- (a) in making PVC
(b) as plasticiser
(c) in insecticides manufacture
(d) for making nylon-6

302. Sugar content in sugarcane on cane basis is about.....percent by weight.

- (a) 1 to 5 (b) 5 to 10
(c) 15 to 20 (d) 20 to 30

303. Chemical formula of 'salt cake' is

- (a) Na_2SO_4 (b) $CaSO_4$
(c) $MgSO_4$ (d) $BaSO_4$

304. Sea water contains about ppm.....of bromine.

- (a) 5 (b) 70
(c) 500 (d) 1700

305. acid is the main constituent of cotton seed oil.

- (a) Acetic (b) Linoleic

309. Production of one ton of cement requires about.....tons of limestone.

- (a) 0.6 (b) 1.2
(c) 2.2 (d) 3.8

310. Carboxymethyl cellulose (CMC) is added in detergents to act as a/an

- (a) surfactant
(b) builder
(c) optical brightening agent

(d) anti soil redeposition agent

311. Hydrogenation of oil/fat does not

(a) improve its resistance to rancid oxidation. (b) raise its melting point.

(c) remove double bonds.

(d) none of these.

312. 10% oleum comprises of 10% free

(a) SO_2 (b) H_2SO_3

(c) SO_3 (d) H_2SO_4

313. Linde process of gas liquefaction employs (a) exchange of heat with colder stream. (b) adiabatic expansion through a throttle

valve (Joule-Thomson expansion). (c) adiabatic expansion against a piston or in a turbine.

(d) merely compressing the gas beyond its critical pressure.

314. Claude process of gas liquefaction employs

(a) merely compression of gas beyond its critical pressure.

(b) Joule-Thomson expansion cooling.

(c) heat exchange with colder stream.

(d) adiabatic expansion against a piston or

(c) Palmitic (d) Oleic^{in a turbine.}

ANSWERS

294. (a) 295. (c) 296. (c) 297. (d) 298. (b) 299. (a) 300. (b) 301. (b) 302. (b) 303. (a) 304. (b) 305. (b)

306. (c) 307. (b) 308. (b) 309. (b) 310. (d) 311. (d) 312. (c) 313. (b) 314. (d)

315. In primitive days,.....was being manufactured by Leblanc Process.

(a) alum (b) washing soda (c) soda ash (d) calcium carbide

316. Viscose rayon is chemically

(a) cellulose nitrate

(b) regenerated cellulose nitrate

(c) cellulose acetate

(d) regenerated cellulose acetate

317. More than 100 percent of.....is present in oleum.

(a) SO_3 (b) H_2SO_4 (c) H_2SO_3 (d) SO_3

318. Fusion of bauxite and.....produces high alumina cement.

(a) alum (b) limestone (c) coke (d) quartz

319. Carbon tetrachloride (CCl_4) is the starting raw material for the manufacture of (a) trichloroethylene

(b) perchloroethylene

(c) parathion

(d) methanol

320. Polycaprolactum is commercially known as (a) nylon⁻⁶ (b) nylon⁻⁶⁶ (c) dacron (d) rayon

321. is produced by the dehydrogenation of ethyl

(b) Ethyl alcohol (d) Phenol
benzene.

(a) Styrene (c) Cumene

322. Prussian blue is chemically represented by (a) $\text{FeO} \cdot \text{TiO}_2$ (b) $\text{Ca SO}_4 \cdot 2\text{H}_2\text{O}$

(c) $\text{Fe}_4 [\text{Fe} (\text{CN}_6)_{31}]$ (d) $\text{AlF} \cdot \text{NaF}_{33}$ (a) sedimentation (c) softening

(b) sedimentation (d) disinfection

327. Commonly used glass is known as the..... glass.

(a) flint (b) hard

(c) pyrex (d) soda

328. Major component of flint glass is

(a) lead oxide (b) silica

(c) alumina (d) soda

329. paper is used in the manufacture of newsprint paper.

(a) Groundwood (b) Board

(c) Tissue (d) Wrapping

330. Most easily and cheaply available fibrous raw material for paper manufacture available in India is bamboo. The yield of pulp produced from fibrous raw material by mechanical process is about.....percent.

- (a) 75 (b) <10
(c) >30 (d) 50

331. Hollander beater used during paper pulp manufacture does not facilitate the..... of fibre.

- (a) cutting (b) fibrillation (c) hydration (d) strengthening

332. The major constituent of black liquor generated during paper manufacture is sodium (a) sulphate (b) carbonate (c) hydroxide (d) bi-carbonate

333. Which of the following is not a raw material used for the manufacture of ordinary glass? (a) Iron oxide (b) Soda ash (c) Limestone (d) Silica

323. Catalytic oxidation-dehydrogenation of methyl alcohol produces

- (a) formaldehyde (b) phenol
(c) acetone (d) maleic anhydride

324. 'Synthesis gas' meant for the synthesis of organic compound is a variable mixture of

- (a) N_2 & H_2 (b) CO_2 & H_2
(c) CO & H_2 (d) C & H_2

325. Calgon used in water treatment is chemically

- (a) sodium phosphate
(b) sodium hexametaphosphate
(c) calcium phosphate
(d) tricresyl phosphate

326. Drinking (potable) water treatment does not

334. Ordinary glass is not a/an (a) amorphous isotropic material. (b) supercooled liquid.

(c) material with sharp definite melting point. (d) electrical insulator.

335. glass has the lowest co-efficient of thermal expansion and hence is more heat resistant. (a) Pyrex (b) Soda lime (c) Lead (d) High silica

336. Laboratory glass wares which reacts with hydrofluoric acid, are made of the.....glass. (a) lead (b) borosilicate (c) soda lime (d) alkali silicate

involve

ANSWERS

315. (c) 316.(c) 317.(b) 318.(b) 319.(b) 320.(a) 321.(a) 322.(c) 323.(a) 324.(c)
325.(b) 326.(c)

327.(d) 328.(a) 329.(a) 330.(b) 331.(d) 332.(b) 333.(a) 334.(c) 335.(a) 336.(b)

337. Coloured glass is obtained by mixing of colored salts. Addition of.....oxide is done to impart greenish blue color to the glass. (a) chromium (b) arsenic (c) copper (d) manganese

338. Electric bulbs are made of.....glass. (a) jena (b) flint (c) crookes (d) pyrex

339. Which of the following is the second major component of cement ?

(a) Al_2O_3 (b) SiO_2

(c) CaO (d) Fe_2O_3

340. Good quality of edible salt is obtained from brine by the process of

(a) solar evaporation

(b) vacuum evaporation

(c) freeze drying

(d) electrolysis

341. The most popular and common detergent i.e., alkyl benzene sulfonate (ABS) is a/an.....de-tergent.

(a) cationic (b) anionic (c) amphoteric (d) semi polar

342. Which of the following is a bleaching agent added in the detergents to facilitate removal of stains caused due to blood, tea etc ? (a) Sodium silicate

(b) Sodium borate

(c) Sodium tripolyphosphate (STPP) (d) Caustic soda

343. Pick out the correct statement.

(a) A fat is converted into oil by its hydrogenation.

(b) There is no difference between a fat and an oil so far as its physical properties are concerned.

(c) All vegetable oils except coconut oil, contains fatty acids having more than sixteen carbon atoms.

(d) Vegetable oils are classified as drying, non-drying and semi drying oils depending upon their fatty acids content.

344. Electrodeposition of metals i.e. electroplating

(b) alloys

(d) non metals **346.** Plaster of Paris is

(a)

1

$CaSO$

.2

$H O$

42

(b) used for setting of broken bones (c) both (a) and (b)

(d) same as gypsum

347. The major constituents of glass are (a) lime, clay and soda ash

(b) sand, lime and soda ash

(c) silica, alumina and clay

(d) silica, alumina and soda ash

348. Deacon's method is used for the manufacture of (a) glauher's salt (b) common salt (c) chlorine (d) graphite electrode

349. Which of the following is the main constituent of the mother liquor produced in salt industry ?

(a) Quicklime

(c) Saltpetre

350. Zeolite is used in the (a) water treatment. (b) glass manufacture. (c) hydrogenation of fatty oil as a catalyst. (d) development of exposed photographic

plate.

351. acid is an unsaturated fatty acid.

(a) Palmitic (b) Oleic

(c)Stearic (d) Oxalic

352. Very fine suspended and colloidal impurities are removed from water by a process called (b) Glauber's salt (d) Bromine

(a) sedimentation (c) disinfection (b) coagulation (d) softening

353. Nitric acid is not used in the manufacture of (a) detergents (c) aquaregia (b) fertilisers (d) explosives.

is never done on (a) metals

(c) refractories **354.** Conversion of SO_2 to SO_3 in Monsanto 4-pass

converter is about.....percent. (a) 80 (b) 90

(c) 98 (d) 100

355. Paper pulp produced by kraft/sulphate process is

(a) bleached easily (b) dull white in color (c) strong fibrous (d) dark colored

356. Which of the following additives/water proofing agents is added to lower the hydrophilic

(moisture loving) characteristic of cement ? **345.** Portland cement consists mainly of

(a) CaO & SiO_2 (b) SiO_2 & Al_2O_3 (a) Xanthates (c) CaO & Al_2O_3 (d) CaO & Fe_2O_3

ANSWERS

337. (c) 338.(b) 339.(b) 340.(b) 341.(b) 342.(b) 343.(c) 344.(c) 345.(a,b) 346.(c)

347.(a) 348.(c)

349.(d) 350.(a) 351.(b) 352.(b) 353.(a) 354.(c) 355.(c) 356.(c)

(b) Stearic acid

(c) Calcium & aluminium stearate (d) Formic acid

357. Salt is the basic raw material for the manufacture of

(a) cement (c) potteries (b) glass

(d) caustic soda

358. sodium carbonate (soda ash) is not used in the manufacture of

(a) fire extinguishers (b) sugar

(c) baking powder (d) detergents

359. Percentage of glycerene present in the spent lye obtained during soap manufacture is about

(a) 0.5 (b) 5

(c) 20 (d) 35

360. Hydrogenation of vegetable oils is a/an..... reaction.

(a) endothermic (c) exothermic (b) autocatalytic (d) homogenous

361. Co-efficient of thermal expansion of glass is decreased by the addition of.....during its manufacture.

(a) CaO (b) MnO₂

(c) ZnO (d) FeS

362. Of rubber decreases after its vulcanisation. (a) Resistance to the action of organic solvent

(b) Tackiness

(c) Maximum service temperature

(d) Tensile strength

363. Vegetable oils contain large quantity of glycerides of unsaturated acids.

When the vegetable oils contain high amount of saturated fatty acids, it is termed as.....oil. (a) drying (b) semi-drying (c) non-drying (d) none of these

364. Sulphuric acid completely saturated with sulphur trioxide is called

(a) concentrated sulphuric acid.

(b) oleum.

(c) sulphurous acid.

(d) dilute sulphuric acid.

365. Vegetable oils and fats basically differ in **366.** Conversion of CO to CO₂ by steam in presence of a catalyst is called

(a) steam reforming.

(b) shift conversion.

(c) steam gasification.

(d) none of these.

367. The most reactive allotropic form of phosphorus is.....phosphorus.

(a) red (b) yellow (c) violet (d) black

368. The most stable allotropic form of phosphorous is the.....phosphorous.

(a) white (b) black

(c) yellow (d) red

369. Chemical name of 'alum' is

- (a) barium sulphate.
- (b) aluminium sulphate.
- (c) aluminium chloride.
- (d) calcium sulphate.

370. Liquor poisoning generally occurs due to the presence of.....in it.

- (a) ethyl alcohol (b) impurities (c) methyl alcohol (d) carbonic acid

371. Wood charcoal is used for decolouration of sugar, because it.....the coloured materials. (a) adsorbs (c) reduces (b) oxidises (d) converts

372. Flash point of most vegetable oils is about.....°C.

- (a) 50 (b) 100
- (c) 200 (d) 300

373. The basic constituent of vegetable oils is (a) triglyceride (c) fatty alcohol (b) fatty acids (d) mono esters

374. In industrial nomenclature, alcohol means (a) butyl alcohol (c) ethanol (b) propyl alcohol (d) methyl alcohol

their

- (a) density ranges
 - (b) physical state
 - (c) chemical composition (d) chemical properties
- 375.** 120% oleum contains.....%SO₃ .

- (a) 20 (b) 80
- (c) 50 (d) 40

376. Catalyst used in the process of production of sulphur by oxidation-reduction of H₂S is (a) raney nickel

- (b) alumina
- (c) vanadium pentoxide
- (d) alumina

357.(d) 358.(d) 359.(b) 360.(c) 361.(c) 369.(b) 370.(c) 371.(a) 372.(c) 373.(a) 374.(c) 375.(a) 376.(c)

ANSWERS

362. (b) 363.(c) 364.(a) 365.(b) 366.(b) 367.(b) 368.(b) **377.** Match the following:

A. Salt cake

B. Slaked lime

C. Glauber's salt

D. Dolomite

I. $\text{Ca}(\text{OH})_2$

II. $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$

III. Na_2SO_4

IV. MgCO_3

(a) A-III, B-I, C-II, D-IV

(b) A-III, B-I, C-IV, D-II

(c) A-I, B-III, C-II, D-IV

(d) A - IV, B - III, C - II, D - I

378. Deaeration of water helps in minimising its (a) foul taste & odour (b) turbidity (c) corrosiveness (d) all a', 'b' & 'c'

379. Hydrogenation of oil does not

(a) improve its oxidation resistance (b) raise its melting point

(c) remove double bonds

(d) lower its viscosity

380. Which of the following acids is the largest volume inorganic acid in the present day? (a) Sulfuric acid (c) Nitric acid (b) Perchloric acid (d) Hydrochloric acid.

381. In the contact process for sulfuric acid manufacture, the feed gas entering the converter (where SO_2 is oxidized to SO_3) contains.....% SO_2 .

(a) 0.1 to 1 (b) 7 to 10 (c) 20 to 30 (d) 60 to 70

382. Chemical formulae for refrigerant 12 and refrigerant 21 are.....respectively.

(a) CCl_2F_2 and CHCl_2F

(b) CHClF_2 and CHCl_2F

(c) CH_2ClF and CCl_2F_2

(d) CHCl_2F and CCl_2F_2

383. Hardness of water is of two kinds: temporary hardness and permanent hardness. Temporary hardness is caused by the presence of (a) soluble bicarbonates of calcium, magnesium and iron

(b) soluble chlorides of calcium and magnesium (c) soluble sulfates of calcium and magnesium (d) soluble bicarbonates of sodium and potassium.

384. Permanent hardness is caused by the presence of.....of calcium and magnesium . (a) insoluble carbonates

(b) soluble chlorides or sulfates

(c) both a & b

(d) neither 'a' nor 'b'

385. Lime-soda treatment of hard water

(a) removes only temporary hardness (b) removes only permanent hardness (c) removes both temporary and permanent

hardness

(d) adjusts the pH of water; removes neither

temporary nor permanent hardness. **386.** The percentage available chlorine in a good commercial sample of bleaching powder is.....per cent.

(a) 15 to 17 (b) 35 to 37 (c) 53 to 56 (d) 69 to 71.5 **387.** Carbon dioxide required in the Solvay process is obtained by

(a) burning 100% pure coke

(b) burning coal

(c) heating limestone

(d) heating magnesium bicarbonate.

388. Principal constituents of rock phosphate is / are

(a) calcium chloride, calcium carbonate and

phosphorous pentoxide

(b) calcium fluoride and di-ammonium phosphate

(c) tricalcium phosphate, calcium fluoride and calcium carbonate

(d) ammonium nitrate, calcium fluoride and phosphorous pentoxide.

389. Rock phosphate used for industrial production of phosphoric acid should

contain at least.....% P₂O₅.

(a) 5 (b) 12

(c) 20 (d) 30

390. Thermal process (dry process) produces phosphoric acid of.....quality as compared to wet process.

(a) superior (b) inferior (c) the same (d) none of these

391. In the normal contact process for sulfuric acid manufacture, sulfur dioxide to sulfur trioxide conversion efficiency is around..... per cent.

(a) 20 (b) 50

(c) 75 (d) 98

ANSWERS

377. (a) 378.(c) 379.(d) 380.(a) 381.(b) 382.(a) 383.(a) 384.(b) 385.(c) 386.(b) 387.(c) 388.(c)

389.(d) 390.(a) 391.(d)

392. Extent of oxidation of ammonia to nitric oxide in the converter (in nitric acid manufacture) is usually around.....% conversion. (a) 10 to 50 (b) 25 to 30

(c) 50 to 60 (d) 97 to 98

393. Of the three processes used in chlor-alkali industries for manufacture of chlorine and **401.** Common temperatures used in converting caustic soda, the one that uses the most electricity to convert limestone into lime are.....°C. The electrical energy is (a) 300–400 (b) 1200–1300 (c) diaphragm cell process (d) 1900–2000 (e) 2800–3000

(b) mercury cell process **402.** Titanium dioxide has become the most important membrane cell process and useful white pigment in the world because of the following properties.

394. In the membrane-cell process, the caustic soda (a) High refractive index, stability and nonleaking the cell contains around.....% caustic toxicity (b) Lack of absorption of visible light (c) 5 to 10 (d) 15 to 20 (e) Ability to be produced in the correct size (f) 30 to 35 (g) 50 to 55 range

395. Purest caustic soda solution is obtained from (d) All 'a', b & c

(a) diaphragm-cell process **403.** 20% oleum is

(b) mercury-cell process (a) 20 % SO_3 in 80 % H_2SO_4 (no water) (c) membrane-cell process (b) 20 % SO_3 in 100 % H_2SO_4 (d) all produce caustic of the same purity (c) 80 % SO_3 in 100 % H_2SO_4

396. Present day mercury cells almost always em^(d) none of these

ploy.....anode. **404.** Sodium tripoly phosphate (STPP) is used as a (a) graphite (a) reinforcing agent in elastomers (b) activated carbon (b) raw material in the production of food (c) activated titanium grade phosphoric acid (d) copper (c) builder in detergents

397. Compared to the membrane cell process, the (d) all 'a', 'b' & c

major disadvantages of the mercury cell process are

(a) higher electric energy requirement
(b) environmental pollution due to mercury (c) large floor space requirement
(d) all 'a', 'b' & 'c'

398. Which of the following chlor-alkali processes requires brine of the highest purity ?

(a) Diaphragm-cell process
(b) Membrane-cell process **406.** (c) Mercury-cell process
(d) Processes in (a), (b) and (c) use brine of

the same purity

399. Among electrolytic industries ,aluminum manufacture is the largest consumer of **407.** Tolyene di-isocyanate is used in making electricity.

Manufacture of caustic soda is (a) dyestuffs

the..... largest consumer. (b) pharmaceutical products (a) second (b) third (c) flexible polyurethane foams (c) fourth (d) none of these (d) all a, b & c

ANSWERS

392. (d) 393.(b) 394.(c) 395.(b) 396.(c) 397.(d) 398.(d) 399.(a) 400.(a) 401.(b)
402.(d) 403.(a)
404.(c) 405.(d) 406.(d) 407.(c)

Below are given a number of industrial processes where lime is used. Highest use of lime is in (a) steel making
(b) chemical manufacture

- (c) water treatment
- (d) pulp and paper industry

considered as disadvantage of the membrane cell process for caustic soda production? (a) Production of more effluent and use of

costly membrane

(b) Inability to produce 48% caustic soda solution

(c) Requirement of ultrapure brine (d) All a,b & c

Which of the following compounds is made on a fairly large scale starting from toluene as a raw material?

(a) Benzoic acid (b) p-Nitrotoluene (c) Phenol (d) Toluene di-isocyanate

petroleum reFinery engineering

1. Main constituent of natural gas is (b) high smoke point.

(a) CH_4 (b) C_2H_2

(c) C_2H_4 (d) C_2H_6

2. LPG stands for

(a) liquid petroleum gas

(b) liquified petrol gas

(c) liquid petrol gas

(d) liquefied petroleum gas

3. Sweetening of petroleum product means the removal of

(a) sulphur & its compounds (b) water

(c) organic impurities (d) wax

4. Sour crude means the.....bearing crude.

(a) asphalt

(b) sulphur compounds

(c) wax

(d) nitrogen compounds

5. Octane number of gasoline is a measure of its

- (a) knocking tendency.
- (b) ignition delay.
- (c) ignition temperature.
- (d) smoke point.

6. Octane number of n-heptane is assumed to be

- (a) 100 (b) 0
- (c) 70 (d) ∞

7. Tetra-ethyl lead is added in gasoline to

- (a) increase its smoke point.
- (b) reduce gum formation.
- (c) reduce the pour point.
- (d) increase its octane number.

8. Cetane number of a diesel fuel is the measure of its

5

(c) high aromatics content. (d) low paraffins content.

10. The octane number of aviation gasoline may be (a) 79 (b) 87 (c) 97 (d) >100

11. Viscosity index of a lubricating oil (a) is the measure of its flash point. (b) is the measure of variation of viscosity

with temperature.

(c) should be low.

(d) none of these.

12. Pour point of a petrofuel is (a) multiple of 3°F.

(b) multiple of 5°F.

(c) 5°C below the temperature at which oil

ceases to flow.

(d) none of these.

13. Flash point of an oil is determined by the (a) Pensky Martens apparatus. (b) Ramsbottom apparatus. (c) Saybolt viscometer.

(d) Conradson apparatus.

14. Reid vapour pressure of gasoline is the measure of its

(a) pour point

(b) cloud point

(c) vapour locking tendency (d) carbon residue

15. Presence of sulphur in gasoline (a) leads to corrosion.

(a) ignition delay

(b) smoke point

(c) viscosity

(d) oxidation stability

9. Good quality kerosene should have

(a) low smoke point.

(b) increases lead susceptibility. (c) decreases gum formation. (d) helps during stabilisation.

16. Crude topping column operates at..... pressure.

(a) atmospheric (b) 10 atm (c) vacuum (d) 3 atm.

1.(a) 2.(d) 3.(a) 4.(b) 5.(a) 13.(a) 14.(c) 15.(a) 16.(a)

ANSWERS

6.(b) 7.(d) 8.(a) 9.(b) 10.(d) 11.(b) 12.(c)

17. The main aim of cracking is to produce (a) gasoline (c) petrolatum

18. Cracking is (b) lube oil (d) coke

(a) an exothermic reaction.

(b) an endothermic reaction.

(c) favoured at very low temperature. (d) none of these.

19. Visbreaking

(a) uses natural gas as feed.

(b) is carried out at atmospheric pressure. (c) produces fuel oil of lower viscosity.

(d) produces gasoline only.

20. In catalytic cracking, the

(a) gasoline obtained has a very low octane number.

(b) pressure & temperature is very high.

(c) gasoline obtained has very high aromatic content.

(d) gasoline obtained has very high amount of gum forming compounds.

21. Catalyst used in the catalytic cracking is (a) silica-alumina (b) silica gel (c) vanadium pentoxide (d) nickel

22. Reforming converts

(a) olefins into paraffins

(b) naphthenes into aromatics

(c) naphthenes into olefins.

(d) naphthenes into paraffin.

23. Catalyst used in catalytic reforming is (a) platinum on alumina

- (b) nickel
- (c) iron
- (d) aluminium chloride

24. Feed for reforming is generally

- (a) naphtha or straight run gasoline. (b) reduced crude.
- (c) vacuum gas oil.
- (d) atmospheric gas oil.

25. Polymerisation

- (a) produces -octane from cracked gases containing *i*-butane and butene.
- (b) causes olefins to combine with each other.
- (c) causes aromatics to combine with each other.
- (d) is aimed at producing lubricating oil.

26. Catalyst used in the catalytic polymerisation is (a) phosphoric acid on kieselghur

- (b) aluminium chloride
- (c) nickel
- (d) vanadium pentaoxide

27. Alkylation

- (a) causes olefins to combine with each other. (b) causes olefins to combine with iso-paraffins. (c) converts iso-paraffin into olefin.
- (d) converts olefin into paraffin.

28. Catalyst used in alkylation process is (a) (c)

sulphuric acid (b) nickel silica gel (d) alumina

29. Isomerisation converts the to *i*-paraffins. (a) *n*- paraffins (b) olefins

(c) naphthenes (d) none of these

30. Catalyst used in the isomerisation is

(a) aluminium chloride (b) alumina (c) nickel (d) phosphoric acid

31. Solvent used in the deasphalting process is (a) furfural (b) phenol (c)

propane (d) hexane

32. Which of the following fractions of petroleum contains maximum sulphur ?

- (a) Diesel (b) Gasoline
(c) Naphtha (d) Atmospheric residue

33. Most widely used solvent for dewaxing is (a) methyl-ethyl-ketone (MEK)

- (b) naphtha
(c) (d)

petroleum ether sodium plumbite

34. Solution used in Doctor's treatment for the removal of mercaptans is

- (a) (b) (c) (d)

sodium hydroxide

sodium plumbite

cupric chloride

potassium isobutyrate

35. In sweetening process, solutizer agent used with caustic alkali is

- (a) (b)

potassium isobutyrate sodium plumbite

(c) methanol

(d) phenol

36. Cetane number of alpha methyl naphthalene is assumed to be

(a) 0 (b) 100

(c) 50 (d) ∞

37. Clay treatment is used to remove

(a) salt from the crude oil.

ANSWERS

17. (a) 18. (b) 19. (c) 20. (c) 21. (a) 22. (b) 23. (a) 24. (a) 25. (b) 26. (a) 27. (b) 28. (a)

29. (a) 30. (a) 31. (a) 32. (d) 33. (a) 34. (b) 35. (a) 36. (a) 37. (c)

(b) colour & dissolved gases from cracked gasoline.

(c) wax from lube oil.

(d) none of these.

38. Higher viscosity of lubricating oil usually signifies (a) lower Reid vapour

pressure.

(b) higher acid number.

(c) higher flash point and fire point.

(d) lower flash point and fire point.

39. Stabilisation of gasoline (petrol) means (a) removal of dissolved gases from it. (b) increasing its oxidation stability. (c) improving its lead susceptibility. (d) increasing its vapour pressure.

40. Most commonly used crude heater before the fractionation tower in a refinery is the heater. (a) electric immersion (c) steam coil

(b) pipestill

(d) none of these

41. Gum formation in stored gasoline is mainly due to the

(a) alkylation of unsaturates.

(b) presence of sulphur.

(c) oxidation & polymerisation of unsaturates. (d) higher aromatic content.

42. Which of the following is the most important property for a jet fuel ?

(a) Cloud point (b) Pour point

(c) Colour (d) Freezing point

43. Boiling range of motor gasoline is an indication of the

(a) case of starting

(b) rate of acceleration

(c) vapour locking tendency

(d) all (a), (b) and (c)

44. Percentage of straight run gasoline in a typical crude oil may be around

(a) 6 (b) 18

(c) 38 (d) 52

45. Higher boiling fractions like atmospheric residue is distilled under vacuum at low temperature because at high temperature, there is a tendency of the predominance of

(a) thermal cracking (b) gum formation (c) coking (d) discoloration

46. Smoke point of kerosene is the

(a) time after which smoking starts on burning. (b) temperature at which smoking starts. (c) maximum height of flame (in mm) without causing smoking, when burnt in a standard lamp.

(d) none of these.

47. Smoke point of a good burning kerosene may be around.....mm.

(a) 0–5 (b) 20–25

(c) 60–65 (d) 100–120

48. Flash point of motor gasoline may be around.....°C.

(a) 10 (b) 45

(c) 100 (d) 150

49. Which of the following fractions of a crude oil will have the maximum gravity API (*i.e.* “API)?

(a) Diesel

(b) Gasoline

(c) Atmospheric gas oil

(d) Vacuum gas oil

50. The colour of gasoline is an indication of its (a) octane number.

(b) lead susceptibility.

(c) gum forming tendency & thoroughness of

refining.

(d) none of these.

51. Cetane number of diesel used in trucks may be about

(a) 5 (b) 14

(c) 35 (d) 85

52. Aniline point of the diesel is a measure of its.....content.

(a) aromatic (b) paraffin (c) olefin (d) naphthene

53. Older crude petroleum

(a) is light and better.

(b) gives more distillates.

(c) gives less tar.

(d) all (a), (b) and (c).

54. Pick out the correct statement.

- (a) Paraffins have higher octane number than corresponding iso-paraffin.
- (b) Paraffins have lower smoke point than aromatics.
- (c) Suitability of kerosene as a fuel & as an illuminant may be determined by char value test.
- (d) Aviation fuel should have very high cloud point.

55. Presence of predominantly large quantity of aromatics (polynuclear) is not desirable in aviation fuel, because it has

ANSWERS

38. (c) 39.(a) 40.(b) 41.(c) 42.(d) 43.(d) 44.(b) 45.(a) 46.(c) 47.(b) 48.(b) 49.(b)
50.(c) 51.(c) 52.(a) 53.(d) 54.(c) 55.(d)

- (a) high pour point and low smoke point. (b) low viscosity index.
- (c) high self-ignition temperature.
- (d) all (a), (b) and (c).

56. Molecular weight of crude petroleum may be around

- (a) 50 (b) 250
- (c) 1500 (d) 5000

57. Higher vapour pressure of gasoline indicates (a) low flash point

- (b) high breathing loss
- (c) both (a) and (b)
- (d) neither (a) nor (b)

58. Paraffin base crude oil as compared to asphalt base crude gives

- (a) higher yield of straight run gasoline. (b) higher octane number gasoline.
- (c) lower viscosity index lube oil.
- (d) poorer yield of lube oil.

59. Aniline point is a property of the

- (a) diesel (b) LPG
- (c) naphtha (d) gasoline

60. Dearomatisation of kerosene (by liquid sulphur dioxide extraction) is done to

- (a) increase its smoke point.
- (b) improve its oxidation stability.

- (c) decrease the breathing loss.
- (d) none of these.

61. Which of the following is the most suitable feed for platforming process (reforming) ? (a) Olefinic hydrocarbon

- (b) Naphtha
- (c) Fuel oil
- (d) Atmospheric residue

62. Hydrofining is the most recent and effective method for the

- (a) removal of sulphur.
- (b) improvement of smoke point.
- (c) reduction of breathing loss.
- (d) improvement of viscosity index.

63. Pick out the undesirable property for a solvent meant for dewaxing of lube oil.

- (a) Complete miscibility with oil.
- (b) High solubility of wax in the solvent.
- (c) Both (a) and (b).
- (d) Neither (a) nor (b).

64. Mercapsol and Unisol processes are meant for the (a) dearomatisation of kerosene

- (b) removal of mercaptans
- (c) dewaxing
- (d) decoloration

65. The characterisation factor of crude petroleum oil is around

- (a) 3 (b) 11
- (c) 22 (d) 28

66. Research octane number refers to the (a) low octane number motor fuels.

- (b) high octane number motor fuels.
- (c) high octane number aviation fuels.
- (d) unleaded motor fuels.

67. Casing head gasoline is the liquid

- (a) butane.
- (b) propane.
- (c) natural gas.
- (d) gasoline separated from wet natural gas

by compression.

68. The amount of tetraethyl lead added to improve the octane number of motor gasoline is around.....c.c per gallon of petrol.

- (a) 3 (b) 300
(c) 3000 (d) 1000

69. Liquefied petroleum Gas (LPG) used for the household cooking comprises mainly of (a) propane & butane

- (b) butane & ethane
(c) methane & ethane
(d) methane & carbon monoxide

70. Gasoline extracted from natural gas (by compression and cooling) is called the.....gasoline.

- (a) polymer (b) unleaded (c) casing head (d) straight run

71. Paraffins are desirable in lubricating oil, as it has got high

- (a) viscosity
(c) smoke point (b) viscosity index (d) pour point

72. Tetraethyl lead is added to the petrol to increase its octane number, because its octane number is

- (a) more than 100
(b) round about 100
(c) between 50 and 100
(d) less than 25

73. The catalytic cracking of heavier petroleum fraction is done to produce mainly

- (a) gasoline (b) asphalt (c) diesel oil (d) tar

ANSWERS

56. (b) 57.(c) 58.(a) 59.(a) 60.(a) 61.(b) 62.(a) 63.(a) 64.(b) 65.(b) 66.(b) 67.(d)
68.(a) 69.(a) 70.(c) 71.(b) 72.(c) 73.(a)

74. Mercaptans is represented as

- (a) R-COOH (b) R-S-H

(c) R–S–R (d) R–S–R'

where R and R' are alkyl groups

75. Which of the following additives improves the cetane number of diesel ?

(a) Amyl nitrate

(b) Ethyl mercaptan

(c) Napthenic acid

(d) Tetra ethyl lead

76. With increase in the molecular weight of aromatic present in kerosene, its smoking tendency (a) increases (b) decreases (c) remains same (d) is unpredictable

77. Penetration test and softening point tests are important for the (a) bitumen

(c) kerosene

(b) gasoline

(d) light gas oil

78. The general formula of naphthenes is (a) $C_nH_{2n}^+$

(b)

C

$^{2n \geq 6} C_nH_{2n} - 6$ (where,

(c) $C_nH_n - 4$

(d) same as that for olefins i.e. C_nH_{2n}

79. For gasoline, the flash point ($< 50^\circ\text{C}$) is determined by the

(a) Abel apparatus.

(b) Pensky-Marten's apparatus.

(c) Saybolt chromometer.

(d) none of these.

80. Flash point of diesel/kerosene ($> 50^\circ\text{C}$) is determined by the

(a) Abel apparatus

(b) Pensky-Martens apparatus

(c) Saybolt chromometer

(d) none of these

81. Which is almost absent in crude petroleum? (a) Olefins (b) Mercaptans (c) Naphthenes (d) Cycloparaffins

82. Which of the following is desirable in petrol (gasoline) but undesirable in kerosene ? (a) Paraffins (b) Aromatics
(c) Mercaptans (d) Naphthenic acid

83. Which of the following is desirable in diesel and kerosene but is undesirable in gasoline ? (a) Aromatics (c) Paraffins (b) Mercaptans
(d) Naphthenic acid

84. The yield of straight run LPG from crude oil is about.....weight percent.
(a) 20–25 (b) 1–1.5
(c) 10–15 (d) 0.1–0.2

85. Road grade bitumen is produced from vacuum residue by its
(a) aeration (b) pyrolysis
(c) hydrogenation (d) steam reforming

86. The most suitable solvent for deasphalting vacuum residue is
(a) propane
(b) methyl ethyl ketone
(c) doctor's solution
(d) methanol amine

87. Which parameter is used for the grading of paraffin waxes ?
(a) Specific gravity
(b) Melting point
(c) Viscosity
(d) Penetration number

88. In the atmospheric pressure crude distillation, the content of.....from lighter fraction to heavier ones.
(a) sulphur increases
(b) sulphur decreases
(c) nitrogen decreases
(d) none of these

89. Which of the following has the lowest flash point of all?
(a) Diesel (b) Kerosene (c) Petrol (d) Furnace oil

90. Which of the following has the highest flash point of all ?

(a) Diesel (b) Kerosene (c) Petrol (d) Furnace oil

91. Which of the following has the minimum °API gravity of all ?

(a) Diesel (b) Kerosene (c) Petrol (d) Furnace oil

92. Which of the following has the maximum °API gravity of all ?

(a) Diesel (b) Kerosene (c) Petrol (d) Furnace oil

93. With increase in density, the viscosity of petroleum products

(a) increases (b) decreases (c) remains same (d) either (a) or (b)

94. Which of the following has the highest viscosity of all (at a given temperature) ?

ANSWERS

74. (b) 75.(a) 76.(b) 77.(a) 78.(d) 79.(a) 80.(b) 81.(a) 82.(b) 83.(c) 84.(b) 85.(a)
86.(a) 87.(b) 88.(a) 89.(c) 90.(d) 91.(d) 92.(c) 93.(a) 94.(b)
(a) Naphtha (b) Fuel oil (c) Light diesel oil (d) Petrol

95. Which of the following has the lowest viscosity (at a given temperature) of all?

(a) Naphtha (b) Kerosene (c) Diesel (d) Lube oil

96. LPG when brought to atmospheric pressure & temperature will be a

(a) liquid lighter than water.

(b) liquid heavier than water.

(c) gas lighter than air.

(d) gas heavier than air.

97. Antioxidants are added in petrol to

(a) impart colour to it, for easy identification. (b) minimise the gum formation.

(c) prevent icing of the carburettor.'

(d) prevent the lead build up in engines.

98. Aromatics have the highest.....of all the hydrocarbons of same carbon atoms.

(a) smoke point (b) octane number (c) cetane number (d) viscosity

99. Which of the following hydrocarbons of same carbon atoms has minimum smoking tendency ? (a) Paraffins (c) Aromatics (b) Naphthenes (d) Iso-paraffins

100. High aniline point of diesel indicates that, it (a) is highly aromatic.
(b) has a large ignition delay.
(c) is highly paraffinic.
(d) has a low diesel index.

101. The main use of heavy gas oil produced by the vacuum distillation unit is as
a
(a) blending component for kerosene. (b) blending component for petrol.
(c) feedstock for fluid catalytic cracking unit. (d) none of these.

102. The vacuum maintained in vacuum distillation unit for reduced crude is
about..... mm Hg.
(a) 1.2 (b) 12
(c) 120 (d) 700

103. The doctor's solution comprises of sodium plumbite in
(a) alcohol (b) (c) aqueous caustic soda (d)

104. Hydrocracking employs water
soda ash

(a) high pressure & temperature. (b) low pressure & temperature. (c) high
pressure and low temperature. (d) high temperature and low pressure.

105. Petroleum coke is commercially produced by the.....process.
(a) hydrocracking
(b) visbreaking
(c) fluid catalytic cracking
(d) delayed coking

106. Phenols are added in gasoline to
(a) improve the octane number.
(b) act as an antioxidant.
(c) reduce its viscosity.
(d) increase its pour point.

107. Solvent used in Edeleanu process is (a) furfural (b) propane
(c) liquid SO₂ (d) phenol

108. C_nH_{2n} is the general formula for

- (a) olefins
- (b) naphthenes
- (c) both (a) and (b)
- (d) neither (a) nor (b)

109. Highest quality bitumen is produced from the.....crude oil.

- (a) paraffinic (b) naphthenic (c) intermediate (d) mixed

110. Fuel oil is subjected to visbreaking to reduce its (a) pour point

- (b) viscosity
- (c) pressure drop on pumping
- (d) all (a), (b) and (c)

111. Which of the following contains maximum sulphur ?

- (a) Diesel (b) Petrol
- (c) Kerosene (d) Fuel Oil

112. Presence of aromatics in

- (a) diesel increases its cetane number. (b) kerosene increases its smoke point. (c) petrol increases its octane number. (d) all (a), (b) and (c).

113. Which is the most undesirable component in kerosene ?

- (a) Aromatics (b) *i*-paraffins (c) *n*-paraffins (d) Naphthenes

114. Which of the following theories of origin of petroleum does not explain the presence of nitrogen & sulphur compounds in crude oil? (a) Modern theory (b) Carbide theory (c) Engler theory (d) all (a), (b) and (c)

ANSWERS

95. (a) 96.(d) 97.(b) 98.(b) 99.(a) 100.(c) 101.(c) 102.(c) 103.(c) 104.(a) 105.(d) 106.(b)

107.(c) 108.(c) 109.(b) 110.(d) 111.(d) 112.(c) 113.(a) 114.(b)

115. Carbon percentage (by weight) in crude petroleum may be about

- (a) 65 (b) 75
- (c) 85 (d) 95

116. Hydrogen percentage (by weight) in crude petroleum may be about

- (a) 5 (b) 15

(c) 25 (d) 35

117. A petroleum well is called 'dry', if it contains (a) very little oil.

(b) no natural gas.

(c) only natural gas.

(d) all (a), (b) and (c).

118. Mercaptans are

(a) low boiling sulphur compounds. (b) added in LPG cylinders to detect gas

leakage by its smell.

(c) undesirable in petrol, as they reduce its octane number.

(d) all (a), (b) and (c)

119. Petroleum deposits are detected by the (a) oil seepage at the surface of the earth. (b) measurement of density, elasticity and magnetic & electric properties of the rock in the crust of the earth.

(c) age & nature of rocks inside the crust of the earth.

(d) all (a), (b) and (c)

120. Water content in the crude oil as it comes out of oil well may be upto.....percent. (a) 2 (b) 5

(c) 10 (d) 25

121. Crude oil is transported inland from oil field to refineries, mainly by the

(a) road tankers

(b) rail tankers

(c) underground pipelines

(d) none of these

122. Liquefied Petroleum Gas (LPG) is mainly a mixture of

(a) propane & butane

(b) methane & ethane

(c) high boiling olefins

(d) high boiling naphthenes

123. A typical yield of diesel in straight run distillation of crude oil may be about.....percent, (a) 8 (b) 18

(c) 28 (d) 35

124. Which is the most desirable component of a good quality kerosene ?
(a) *i*-paraffins (b) Aromatics (c) *n*-paraffins (d) Naphthenes

125. Which of the following petroleum products contain minimum sulphur ?
(a) Naphtha (b) Kerosene (c) LSHS (d) Furnace oil

126. A typical yield of kerosene in straight run distillation of crude oil may be about..... percent.

- (a) 4 (b) 10
(c) 18 (d) 26

127. Naphtha yield in straight run distillation of crude oil may be about.....percent. (a) 2 (b) 6
(c) 12 (d) 18

128. Crude oil produced by Indian oil fields are predominantly.....in nature.

- (a) paraffinic (c) asphaltic
(b) naphthenic (d) mixed base

129. Crude oil is pumped by a pump.

- (a) gear (b) centrifugal (c) screw (d) reciprocating

130. Products drawn from the top to bottom of the crude oil distillation column has progressively increasing

- (a) boiling points
(b) molecular weight
(c) C/H ratio
(d) all (a),(b) and (c)

131. Crude oil is subjected to vacuum distillation in the last stage, because

- (a) high boiling point products like heavy

fuel oil & lubricating oils are heat sensitive and may decompose.

(b) lighter/low boiling products are prone to thermal decomposition.

(c) high purity products can be obtained thereby.

(d) none of these.

132. Vacuum maintained in the vacuum distillation tower of the crude distillation

plant is about.....mm Hg (absolute).

(a) 5–10 (b) 30–80

(c) 150–250 (d) 350–400

133. Which is the most ideal feed stock for ‘coking’ process used for the manufacture of petroleum coke ?

ANSWERS

115. (c) 116.(b) 117.(c) 118.(d) 119.(d) 120.(d) 121.(c) 122.(a) 123.(a) 124.(c)
125.(a) 126.(b)

127.(b) 128.(c) 129.(b) 130.(d) 131.(a) 132.(b) 133.(b)

(a) Naphtha (b) Vacuum residue (c) Light gas oil (d) Diesel

134. Catalytic cracking compared to thermal cracking of residue of vacuum distillation of crude oil

(a) gives higher yield of petrol.

(b) lower octane number of petrol.

(c) higher sulphur content in the product. (d) higher gum forming material in petrol.

135. Which of the following processes in oil refinery does not employ ‘cracking’ ?

(a) Coking (b) Visbreaking (c) Pyrolysis (d) None of these

136. Pyrolysis of kerosene or natural gasoline is done to produce mainly the

(a) olefins and aromatics

(b) lighter paraffins

(c) stabilised gasoline

(a) diesel

137. Which of the following is used as a catalyst in fluidised bed catalytic cracking ?

(a) Silica-magnesia

(b) Silica-alumina

(c) Bentonite clays

(d) All (a), (b) and (c)

138. Thermofer catalytic cracking process is a.....process. (a) fixed bed
(c) fluidised bed (b) moving bed (d) non-catalytic

139. Which of the following is the most widely used cracking process in oil refineries ? (a) Dubbs process.

(b) T. C. C. moving bed process.

(c) Fluidised bed catalytic cracking process. (d) Houdry's fixed bed process.

140. Reforming

(a) uses naphtha as feedstock.

(b) does not much affect the molecular

weight of the feed.

(c) improves the quality & yield of gasoline. (d) all (a), (b) and (c).

141. Gasoline yield in catalytic reforming of naphtha may be about.....percent by weight. (a) 85 (b) 65

(c) 50 (d) 98

142. Octane number (unleaded) of reformed gasoline may be upto

(a) 60 (b) 70

(c) 80 (d) 90

143. Feedstock for polymerisation is

(a) naphtha.

(b) cracked gases rich in C2 & C4 olefins. (c) low boiling aromatics.

(d) none of these.

144. Catalyst used in catalytic polymerisation which produces polymer gasoline is

(a) H_2SO_4 (b) H_3PO_4

(c) both (a) and (b) (d) AlCl_3

145. converts n-paraffins to i-paraffins.

(a) Alkylation (c) Isomerisation (b) Polymerisation (d) none of these

146. Catalyst used in isomerisation process is (a) H_2SO_4 (b) H_3PO_4 (c) HF (d) AlCl_3

147. Octane number (unleaded) of gasoline produced by isomerisation of butane may be about

(a) 45 (b) 55

(c) 70 (d) 90

148. Doctor's solution used for sweetening of petroleum products is

(a) sodium plumbite

- (b) sodium sulphite
- (c) sodium thiosulphate
- (d) lead sulphate

149. In solutizer sweetening process, solutizer solution used is

- (a) methanol in Unisol process.
- (b) naphthenic acid in Mercaptan process. (c) both (a) and (b).
- (d) neither (a) nor (b).

150. Catalytic desulphurisation process used for sweetening of straight run gasoline and kerosene uses as catalyst.

- (a) bauxite (b) fuller's earth (c) activated clay (d) all (a), (b) & (c)

151. Waxes present in petroleum products (a) can be separated out by distillation. (b) are not soluble in them.

- (c) crystallise out at low temperature. (d) decrease their viscosity.

152. Solvent used for dewaxing of petroleum products are

- (a) furfural
- (b) methyl ethyl ketone (MEK)
- (c) propane
- (d) both (b) & (c)

ANSWERS

134. (a) 135. (d) 136. (a) 137. (d) 138. (d) 139. (c) 140. (d) 141. (a) 142. (d) 143. (b)

144. (c) 145. (c)

146. (d) 147. (c) 148. (a) 149. (c) 150. (b) 151. (c) 152. (c)

153. Deoiling of wax is done by its

- (a) heating (b) cooling (c) solvent extraction (d) both (b) & (c)

154. Sulphuric acid treatment of petroleum products removes

- the.....materials. (a) gum forming (c) asphaltic
- (b) color forming (d) all (a), (b) & (c)

155. Which of the following is used as a solvent in deasphalting of petroleum products ? (a) Furfural

- (b) Propane
- (c) Methyl ethyl ketone
- (d) Liquid sulphur dioxide

156. Raw Kerosene has a smoke point of 15 mm. After it is subjected to dearomatisation by liquid SO₂ extraction (Edeleanu process), its smoke point may become..... mm. (a) 5 (b) 10
(c) 25 (d) 100

157. Furfural solvent extraction is used for upgrading (by dissolving aromatics) (a) naphtha (b) lubricating oils (c) wax (d) cracking feedstock

158. Solvent used in duo-sol extraction for lube oil upgradation is a mixture of (a) propane & phenol-cresol mixture. (b) methyl ethyl ketone & glycol.
(c) phenol & furfural.
(d) propane & liquid sulphur dioxide.

159. Solvent used in the Udex (glycol) extraction process for removal of light aromatics from cracked naphtha is (a) propane.
(b) diethylene glycol.
(c) aqueous solution (10% water) of diethylene glycol.

(d) methyl ethyl ketone (MEK).

160. Increase in the specific gravity of petroleum products indicates (a) decrease in paraffin content.

(b) increase in thermal energy per unit weight. (c) increase in aromatic content.
(d) higher H/C ratio.

161. Molecular weight of petrol may be about (a) 40–60 (b) 100–130
(c) 250–300 (d) 350–400

162. Petroleum liquid fuels having flash point greater than 66°C is considered as safe during storage and handling. Which of the following has flash point > 66°C ?

(a) Naphtha (b) Petrol
(c) Kerosene (d) Heavy fuel oil

163. Flash point of atmospheric distillation residue is determined by.....apparates. (a) Pensky-Martens (closed cup type). (b) Abel.
(c) Cleveland (open cup type)
(d) none of these.

- 164.** Diesel index (an alternative index for expressing the quality of diesel) is
 (a) determined by using a test engine. (b) not related to aniline point.
 (c) equal to cetane number plus 3.
 (d) all (a),(b)&(c).
- 165.** Which of the following is an additive used for improving the cetane number of diesel ? (a) Tetraethyllead
 (b) Tetramethyl lead
 (c) Ethyl nitrate or acetone
 (d) None of these
- 166.** Which of the following gasolines (unleaded) has the least octane number ?
 (a) Catalytically cracked gasoline
 (b) Straight run gasoline
 (c) Catalytically reformed gasoline
 (d) Polymer gasoline
- 167.** Maximum use of petroleum coke is in (a) adsorption refining operation.
 (b) fuel gas manufacture.
 (c) carbon electrode manufacture.
 (d) iron ore reduction.
- 168.** treatment is done for appreciable improvement in viscosity index of lubricating oil. (a) Acid (b) Solvent extraction (c) Alkali (d) Clay
- 169.** Complete removal of.....from gasoline is done by Unisol process using caustic soda and methyl alcohol. (a) waxes
 (c) asphalt
 (b) mercaptans (d) iolefins
- 170.** The most important property for a jet fuel is its
 (a) viscosity
 (c) calorific value (b) freezing point (d) flash point
- 171.** The best method of determining sulphur in crude oil is by the.....method.

ANSWERS

153. (d) 154.(d) 155.(b) 156.(c) 157.(b) 158.(a) 159.(c) 160.(a) 161.(b) 162.(d)

163.(c) 164.(c)

165.(a) 166.(b) 167.(c) 168.(b) 169.(b) 170.(b) 171.(c)

(a) Kjeldah

(b) Duma

(c) Bomb calorimeter

(d) Junkar's calorimeter

172. base crude oil is also called asphaltic crude.

(a) Paraffinic (b) Naphthenic (c) Mixed (d) Aromatic

173. Straight run naphtha is converted into high octane number petrol (gasoline) by catalytic (a) cracking (b) polymerisation (c) reforming (d) isomerisation

174. Crude oils containing more than.....kg of total salts (expressed in terms of NaCl) per thousand barrel is called a 'salty crude'. (a) 1 (b) 5

(c) 15 (d) 25

175. determination is not a very significant and important test for gasoline. (a) Gum & sulphur content

(b) Viscosity

(c) Octane number

(d) Reid vapor pressure

176. is not an important refinery process for upgrading the quality of lubricating oil. (a) Deoiling

(b) Solvent refining

(c) Clay treatment

(d) Hydrotreatment

177. 'Solvent naphtha' used mostly as a solvent in paints and perfumery is produced by the.....of virgin naphtha into small boiling range cuts.

(a) steam reforming

(b) distillation

(c) desulphurisation

(d) none of these

178. Deoiling is the process of removal of oil from wax. It is done by the.....process. (a) solvent extraction

(b) sweating

(c) resettling

(d) all (a), (b) & (c)

179. Aniline point test of an oil qualitatively indicates the.....content of an oil.

(b) olefin

(d) naphthene (a) paraffin (c) aromatic (a) anti-knocking (c) anti-gum forming

(b) anti-icing (d) dewaxing

181. Bottom product of atmospheric pressure crude oil distillation column is termed as (a) reduced crude (c) asphalt

(b) heavy ends (d) residuum

182. The.....condesate obtained on compression of wet natural gas is termed as

(a) liquefied natural gasoline

(b) natural gasoline

(c) liquid natural gas

(d) none of these

183. Waxy crudes are treated with chemical additives mainly to

(a) depress its pour point

(b) dissolve wax

(c) precipitate wax

(d) remove wax

184. The terminology used for the bottom most product from the vacuum crude distillation unit is

(a) (c)

residual crude (b) residuum reduced crude (d) petrolatum

185. Removal of light fractions from crude oil is called its

(a) sweetening (c) stabilisation (b) dehydration (d) visbreaking

186. Which is the most effective catalyst used in catalytic cracking of petroleum products ? (a) Iron oxide (b) Nickel (c) Vanadium pentoxide (d) Zeolite

187. The most commonly used feed stock for the reforming reactor is

(a) heavy fuel oil

- (b) residuum
- (c) straight run gasoline
- (d) casing head gasoline

188. Petroleum is believed to have originated from.....sources.

- (a) vegetable
- (b) animal
- (c) both (a) and (b)
- (d) neither (a) nor (b)

189. Which of the following processes is used for the production of petroleum coke ?

- (a) Stabilisation (c) Cracking
- (b) Visbreaking (d) Reforming

180. Glycol added to petrol acts as a/an.....agent.

ANSWERS

172.(b) 173.(c) 174.(b) 175.(b) 176.(a) 177.(b) 178.(d) 179.(c) 180.(b) 184.(b)
185.(c) 186.(d) 187.(c) 188.(c) 189.(c)

181. (a) 182.(b) 183.(a) **190.** Both asphalt and wax are produced by..... base crude oils.

- (a) naphthenic
- (c) paraffin (b) asphalt (d) mixed

191. Octane numbers of motor gasoline used in India and America are respectively

- (a) 87&94 (b) 94&87
- (c) 94 & 100 (d) 83 & 100

192. The first crude oil refinery of India is located at

- (a) Naharkatiya (b) Digboi
- (c) Kochin (d) Madras

193. Visbreaking process is used mainly for making

- (a) high cetane diesel
- (b) high octane gasoline
- (c) fuel oil
- (d) smoke free kerosene

194. Aniline point of high speed diesel may be about.....°C.

- (a) 35 (b) 70
- (c) 105 (d) 150

195. Natural gas recovered along with crude oil from oil wells is called wet natural gas which has a higher.....compared to the dry natural gas.

- (a) unsaturated hydrocarbon content (b) calorific value
- (c) quantity of propane
- (d) quantity of butane

196. Cetane number of high speed diesel must be $\geq$

- (a) 30 (b) 45
- (c) 75 (d) 95

197. Ethyl mercaptan is added to the Domestic LPG for facilitating the detection of its leakage (by bad odour) to the extent of about.....ppm.

- (a) 1 (b) 50
- (c) 5000 (d) 10000

198. Specific gravity of a petroleum product gives an indication of its

- (a) degree of refinement.
- (b) hydrocarbon content type (aromatic or

paraffinic).

(c) ease of atomisation. (d) sulphur content. **199.** High aniline point of a petrofuel (say diesel)

indicates that

- (a) it is highly aromatic in nature.
- (b) it is highly paraffinic in nature. (c) it has a very low diesel index.
- (d) its ignition quality is very poor.

200. Char value of Kerosene is the amount of charred oil deposition on the wick obtained after burning it in a standard wick lamp at a standard rate for 24 hours. Char value of a good quality kerosene should be less than.....mg/kg of kerosene.

- (a) 1 (b) 20
- (c) 100 (d) 500

201. Straight run petrol as compared to methyl/ ethyl alcohol has

- (a) lower calorific value.
- (b) lower octane number.
- (c) higher specific gravity.
- (d) higher ignition temperature.

202. Penetration test determines the of the grease. (a) stiffness
 (b) lubricating properties (e.g. oilness) (c) service temperature
 (d) variation in viscosity with temperature

203. Tanks used for the storage of petroleum products (which are inflammable) should be painted with a.....paint.
 (a) black (b) white
 (c) red (d) yellow

204. Pour point and freezing point is equal for (a) petrol (b) diesel
 (c) water (d) crude petroleum

205. Mercaptans are added to liquefied petroleum gas (LPG) to
 (a) reduce its cost.
 (b) narrow down its explosion limit. (c) assist in checking its leakage from cylinder. (d) increase its calorific value.

206. Detergent is added as an additive in engine lubricating oil to
 (a) reduce deposit formation.
 (b) keep contaminants in suspension. (c) increase oxidation stability.
 (d) prevent rusting.

207. Aromatics are desired constituents of (a) (c)

lubricating oil (b) diesel kerosene (d) petrol

ANSWERS

190. (d) 191.(a) 192.(b) 193.(c) 202.(a) 203.(b) 204.(c) 205.(c) 194.(b) 195.(b)
 196.(b) 197.(b) 198.(b) 199.(b) 200.(b) 201.(b) 206.(a) 207.(d)

208. Dry natural gas contains mainly

- (a) methane (plus small amount of other components)
- (b) ethane
- (c) propane
- (d) butane

209. Reformate from a catalytic reformer will have an octane number.....that of the feed hydrocarbon.

- (a) higher than
- (b) lower than
- (c) approximately equal to
- (d) unpredictable

210. Cyclohexane is made by catalytic hydrogenation of

- (a) acetylene
- (c) benzene (b) ethylene (d) phenol

211. Cyclohexanol is produced commercially by (a) hydrogenation of cyclohexanone (b) oxidation of cyclohexane

- (c) oxidation of benzene
- (d) decomposition of benzoic acid

212. Cyclohexanol & cyclohexanone, produced commercially by oxidation of cyclohexane are used in the manufacture of

- (a) nylon intermediates
- (b) terylene intermediates
- (c) polycarbonates
- (d) alkyd resins

213. Cyclohexanol/cyclohexanone mixture, on oxidation with nitric acid, produces

- (a) benzoic acid (c) adipic acid (b) terephthalic acid (d) none of these

214. Adipic acid, on reaction with ammonia in presence of a dehydrating catalyst, produces (a) ethylene diamine

- (b) caprolactum
- (c) hexamethylene diamine
- (d) adiponitrile

ANSWERS 208.(a) 209.(a) 210.(c) 211.(b) 212.(a) 213.(c) 214.(d)

Fertiliser technology

1. Urea is a.....fertiliser. (a)

- (b)

and phosphoric acid

(a) nitrogenous

(c) phosphatic

(b) potassic

(d) none of these

and coke

(c)

(d)

6

and sulphuric acid

silica and coke

2. Phosphatic fertiliser is graded based on its.....content.

(a) P_2O_3 (b) PCl_5 (c) P_2O_5 (d) H_3PO_4

3. Potassic fertiliser is graded based on its..... content.

(a) KCl (b) K_2O

(c) KNO_3 (d) K_2SO_4

4. Fertiliser value of a nitrogeous fertiliser is expressed in terms of its.....content. (a) N_2 (b) KNO_3 (c) NO_2 (d) HNO_3

5. Rock phosphate constitutes mainly of

(a) fluorapatite

(b) di-calcium phosphate

(c) mono-calcium phosphate

(d) di-ammonium phosphate

6. Superphosphate is manufactured by reacting phosphate rock with (a) acetic acid

(c) aluminium chloride (b) sulphuric acid (d) none of these

7. Triple superphosphate is made by reacting phosphate rock with.....acid.

(b) nitric

(d) hydrochloric (a) phosphoric (c) sulphuric

8. Triple superphosphate is chemically represented as

(a) $CaF_2 \cdot 3Ca_3(PO_4)_2$ (b) $3Ca_3(PO_4)_2$ (c) $Ca(PO_3)_2$ (d) $Ca(H_2PO_4)_2$

9. Phosphoric acid is produced in wet process from phosphate rock and

(a) dilute H_2SO_4

(b) concentrated H_2SO_4

(c) concentrated HNO_3

(d) concentrated HCl

10. Electric furnace method for production of **11.** NPK means a.....fertiliser.

(a) mixed (b) potassic (c) liquid (d) solid

12. Raw materials for urea production are (a) CO_2 and N_2 (b) CO_2 , H_2 and N_2 (c) NH_3 and CO (d) HNO_3 and CaCO_3

13. Catalyst used in Haber's process for ammonia production is (a) (c)

reduced iron oxide (b) nickel vanadium pentoxide (d) silica gel

14. Catalyst used in the oxidation of ammonia is (a) platinum-beryllium (b) platinum-rhodium (c) cobalt-molybdenum (d) platinum-molybdenum

15. Nitrogenous fertiliser is required (a) during the early stage of growth to promote development of stem and leaves. (b) for accelerating fruit formation in later

(c)
(d)

stage of growth.

to lessen the effect of excessive potash application.

none of these.

phosphorous uses phosphate rock **16.** Phosphatic fertilisers

(a) are useful during early stage of the plant growth.
(b) accelerate fruit formation in later stages of growth.
(c) lessen the effect of excessive nitrogen application.
(d) none of these

17. Potassic fertilisers

(a) are useful during early stage of the plant growth.
(b) stimulate early growth and accelerate seeding.

ANSWERS

1. (a) 2.(c) 3.(b) 4.(a) 5.(a) 6.(b) 7.(a) 8.(a) 9.(a) 10.(d) 11.(a) 12.(b)

13.(a) 14.(b) 15.(a) 16.(b) 17.(c)

(c) help in development of starches of potatoes and grain.

(d) none of these.

18. 5-10-5 fertilisers mean that they contain (a) 5, 10, 5% respectively of N_2 , P_2O_5 and K_2O . (b) only 5 to 10% active fertiliser constituents. (c) 5 to 10% filler & carrier of soil condition- ers.

(d) none of these.

19. Plant tranquillisers

(a) hold back stem growth and halt plants at a desired height.

(b) cause early maturation of plants.

(c) accelerate ripening of food and grain.

(d) produce seedless fruit.

20. Ammonium nitrate (is mixed with limestone) is not used as fertiliser as such, because (a) it is hygroscopic and explosive in nature. (b) it is highly acidic in nature.

(c) it is a liquid at room temperature. (d) its nitrogen content is very less.

21. Nitrogen content of urea is about.....percent. (a) 10 (b) 48

(c) 80 (d) 94

22. Nitrogen content of calcium ammonium nitrate (CAN) is.....percent.

(a) 10 (b) 25

(c) 50 (d) 80

23. Fertiliser plants get their N_2 requirements (a) by fractionation of liquified air.

(b) by dissociating oxides of nitrogen. (c) from coal gas (coke oven gas).

(d) from producer gas.

24. Ammonia synthesis reaction is

(a) exothermic (b) endothermic (c) autocatalytic (d) none of these

25. Ammonium phosphate is a.....fertiliser. (b) phosphatic (d) mixed

(a) nitrogenous (c) complex

26. Coal based fertiliser plants

- (a) use coal for heating purpose.
(b) gasify coal to get hydrogen from coal gas. (c) use coal as filler in fertiliser.
(d) use coal as conditioner in fertiliser.

27. Naphtha in a fertiliser plant is used as a source of

- (a) fuel (b) H_2

28. Catalyst used in steam reforming of naphtha is (a) nickel
(c) silica gel (b) platinum (d) rhodium

29. Temperature and pressure in converter in ammonia converter is

- (a) 200 atm, $1000^\circ C$ (b) 450 atm, $200^\circ C$ (c) 450 atm, $550^\circ C$ (d) 450 atm, $1000^\circ C$

30. Oxidation of ammonia is

- (a) exothermic (b) endothermic (c) non-catalytic (d) autocatalytic

31. Dehydration of ammonium carbamate to yield urea is a/an.....reaction.

- (a) exothermic (c) autocatalytic (b) endothermic (d) catalytic

32. Neutralisation of nitric acid with ammonia to produce ammonium nitrate is a/an.....reaction.

- (a) catalytic (b) endothermic (c) exothermic (d) autocatalytic

33. Gas based fertiliser plants use

- (a) natural gas as a source of hydrogen. (b) natural gas as heating medium.
(c) coal gas as a source of hydrogen.
(d) coal gas as heating medium.

34. Raw materials for nitric acid manufacture are (a) hydrogen peroxide, air and water. (b) anhydrous ammonia and air.

- (c) anhydrous ammonia, air and water. (d) wet ammonia, air and water.

35. Effectiveness of a fertiliser is independent of the

- (a) nature of soil (b) type of crop (c) pH of soil (d) none of these

36. NPK fertiliser is a.....fertiliser.

- (a) complex (b) mixed
(c) nitrogenous (d) phosphatic

37. Temperature and pressure in urea autoclave is

- (a) 120°C and 300 atm.
- (b) 190°C and 200 atm.
- (c) 400°C and 550 atm.
- (d) 200°C and 10 atm.

38. Calcium ammonium nitrate (CAN) is (a) a mixed fertiliser

- (b) a straight fertiliser
- (c) a complex fertiliser
- (d) not a fertiliser ; it is an explosive

(c) N₂ (d) O₂

ANSWERS

18. (a) 19.(a) 20.(a) 21.(b) 22.(b) 23.(a) 24.(a) 25.(d) 26.(b) 27.(b) 28.(a) 29.(c)
30.(a) 31.(b) 32.(c) 33.(a) 34.(c) 35.(d) 36.(b) 37.(b) 38.(c)

39. Dehydration of ammonium carbamate produces (a) urea (b) biuret

(c) ammonia water (d) none of these

40. Lower temperature and large excess of ammonia in urea melt

- (a) increases biuret formation
- (b) decreases biuret formation
- (c) is undesirable
- (d) does not effect biuret formation

41. With increases in pressure, the conversion of ammonium carbamate into urea

- (a) increases
- (b) decreases
- (c) remains unaltered
- (d) can either increase or decrease ; depends

on biuret content

42. An increase in the NH₃/CO₂ ratio in urea manufacture results in

(a) increased degree of conversion of CO₂ to

urea.

(b) decreased degree of conversion of NH₃ to

urea.

(c) decreased yield of urea.

(d) decreased specific volume of molten mass.

43. Biuret formation in urea is kept at minimum ($< 1\%$), because it is

(a) corrosive in nature.

(b) toxic and harmful to some crops.

(c) helpful in decomposition of urea. (d) explosive in nature.

44. Though liquid ammonia itself is a fertiliser (with 82% nitrogen content) yet it is commonly not used as such in a tropical country like India, because it

(a) has a pungent smell.

(b) vaporises at normal temperature. (c) is toxic and highly corrosive.

(d) is in short supply.

45. In ammonia synthesis ($\text{N}_2 + 3\text{H}_2 = 2\text{NH}_3$), there is a decrease in total volume, hence to get high equilibrium conversion, the reaction should be carried out at

(a) low pressure.

(b) high pressure.

(c) very high temperature.

(d) atmospheric pressure; as the pressure has

no effect on conversion.

46. Nitrogen content in ammonium sulphate (a fertiliser) is around.....percent.

(a) 5 (b) 20

(c) 50 (d) 65

47. Monte catini process is a widely used process for the manufacture of

(a) urea

(b) calcium ammonium nitrate

(c) triple superphosphate

(d) none of these

48. Prilling of urea should be accomplished (in a sprayer) just above the melting point of urea with minimum of retention time, otherwise it will result in

(a) low bulk density product

(b) biuret formation

(c) non-spherical prills

(d) substantially wet non-flowing and sticky

product

49. Rock phosphate used for the production of phosphatic fertiliser is mined at
(a) Amjhor (Jharkhand)
(b) Talchar (Orissa)
(c) Bailladella (M.P.)
(d) Kiriburu (Bihar)

50. Electric process as compared to wet process (for the manufacture of phosphoric acid) (a) can use only high grade phosphate rock. (b) is used less frequently.

(c) produces a valuable by-product called gypsum.

(d) is weak acid process.

51. Nitro-phosphate (manufactured at Trombay) is a.....fertiliser.

(a) mixed

(b) complex

(c) highly hygroscopic

(d) highly explosive

52. Which is the best fertiliser for paddy ? (a) Ammonium sulphate

(b) Nitro-phosphate

(c) Superphosphate

(d) Potassium nitrate

53. Which of the following is not a mixed fertiliser ? (a) Nitrophosphate

(b) Calcium ammonium nitrate (CAN) (c) Ammonium phosphate

(d) None of these

54. Commercial production of hydrogen for the manufacture of nitrogenous fertilisers is done by

ANSWERS

39. (a) 40. (b) 41. (a) 42. (a) 43. (b) 44. (b) 45. (b) 46. (b) 47. (a) 48. (b) 49. (a) 50. (b)

51. (a) 52. (a) 53. (b) 54. (d)

(a) steam reforming of naphtha and cracking of natural gas.

(b) electrolysis of water.

(c) cryogenic separation of hydrogen from coke oven gas.

(d) all (a), (b) and (c)

55. In the manufacture of urea, the intermediate chemical formed is

- (a) biuret
- (b) ammonium carbamate
- (c) ammonium carbonate
- (d) none of these

56. Maximum nitrogen percentage is in

- (a) ammonium sulphate.
- (b) calcium ammonium nitrate.
- (c) urea.
- (d) liquid ammonia.

57. Urea is a better fertilizer than ammonium sulphate, because

- (a) it is cheaper.
- (b) nitrogen content is higher.
- (c) it is not poisonous.
- (d) it is easy to manufacture.

58. P_2O_5 content in superphosphate is about..... percent.

- (a) 30–35 (b) 15–20
- (c) 65–70 (d) 85–90

59. Optimum reaction temperature in steam reforming of naphtha is.....
°C.

- (a) 700–1000 (b) 300–450 (c) 1500–1700 (d) 100–200

60. Nitrolime is

- (a) calcium nitrate.
- (b) calcium ammonium nitrate.
- (c) a mixture of nitric acid and lime.
- (d) a mixture of ammonium nitrate and calcium nitrate.

61. Which is the most suitable fertilizer for paddy ? (a) CAN

- (b) Ammonium sulphate
- (c) Ammonium nitrate
- (d) Superphosphate

62. Which nutrient in fertilizer makes the plant stems stronger and increases branching ? (a) Nitrogen (b) Phosphorous

(c) Potassium (d) Calcium **63.** P_2O_5 content in triple superphosphate is (a) 42–50
(b) 15–20
(c) 85–90 (d) 70–75

64. Nitric acid is produced on commercial scale in a fertiliser plant by
(a) oxidation of ammonia.
(b) $CaNO_3 + H_2SO_4$ reaction.
(c)
(d)

passing air through high voltage electric arc. none of these.

65. Liquid ammonia and 60% nitric acid reaction (which produces ammonium nitrate) is
(a) exothermic (c) autocatalytic (b) endothermic (d) none of these

66. Ammonia synthesis gas is produced from fuel oil by
(a) steam reforming (c) partial oxidation (b) hydrocracking (d) hydrogenation .

67. Which of the following set of conditions is favourable for the maximum yield of ammonia by Haber's process ?
(a) High pressure, low reactants concentration, high temperature.

(b) High pressure, low reactants concentration, low temperature.
(c) High pressure, high reactants concentration, low temperature.
(d) Low pressure, high reactants concentration, low temperature.

68. Ammonia synthesis gas is produced from natural gas by
(a) (c)

thermal cracking (b) steam reforming partial oxidation (d) hydrogenation

69. Which one of the following is used as a nitrogenous fertiliser, as a weed killer in the onion fields and for correcting acidic soils ?

(a) Urea
(b) CAN
(c) (d)

Ammonium sulphate Calcium cyanamide

70. Urea is represented as

(a) $\text{NH}_2\cdot\text{CO}\cdot\text{NH}_2$ (b) $\text{NH}_3\text{CO}\cdot\text{CH}_3$ (c) $\text{NH}\cdot\text{CO}_2\cdot\text{NH}$ (d) $\text{NH}_3\cdot\text{CO}_2\cdot\text{NH}_3$

71. The concentration (weight %) of nitric acid produced by the oxidation of ammonia and absorption of nitrogen oxides with water is about.....percent.

(a) 60 (b) 30

(c) 95 (d) 100

about.....percent.

ANSWERS

55. (c) 56.(d) 57.(b) 58.(b) 59.(a) 60.(b) 61.(b) 62.(b) 63.(a) 64.(a) 65.(a) 66.(c)
67.(c) 68.(b) 69.(d) 70.(a) 71.(a)

72. Which of the following nitrogenous fertilisers has the highest percentage of nitrogen ? (a) Calcium nitrate

(b) Calcium ammonium nitrate (CAN) (c) Urea

(d) Ammonium sulphate

73. Formation of ammonium carbamate by reaction of NH_3 with CO_2 is

a/an.....reaction. (a) catalytic (b) exothermic (c) endothermic (d) reversible

74. Dehydration of ammonium carbamate (to produce urea) is

a/an.....reaction.

(a) reversible (c) exothermic (b) catalytic

(d) endothermic

75. Nitrogen content of a nitrogenous fertiliser is 35%. It could be

(a) urea

(b) ammonium nitrate

(c) calcium ammonium nitrate (CAN) (d) ammonium sulphate

76. Heating a mixture of phosphate rock, coke and sand in an electric furnace produces

(a) phosphoric acid

(b) ammonium phosphate

(c) phosphorous

(d) superphosphate

77. H_3PO_4 is the chemical formula of..... phosphoric acid.

- (a) pyro (b) ortho
(c) meta (d) none of these

78. HPO_3 is the chemical formula of..... phosphoric acid.

- (a) pyro (b) ortho
(c) meta (d) none of these

79. $\text{H}_4\text{P}_2\text{O}_7$ is the chemical formula of..... phosphoric acid.

- (a) pyro (b) ortho
(c) meta (d) none of these

80. Ammonium sulphate can be produced by reacting gypsum with
(a) ammonia (b) ammonium carbonate (c) nitric acid (d) none of these

81. Low grade coal is.....to produce ammonia synthesis gas. (a)
hydrogenated (c) gasified
(b) liquefied
(d) dehydrogenated

82. Reaction of orthophosphoric acid with soda (a) sodium tripolyphosphate (STPP)
(b) tricresyl phosphate
(c) tributyl phosphate
(a) nitrophosphate

83. Reaction of nitric acid and sulphuric acid with phosphate rock produces
(a) nitrophosphate
(b) diammonium phosphate
(c) tricresyl phosphate
(d) tributyl phosphate

84. Reaction of dilute sulphuric acid with phosphate rock produces
(a) phosphoric acid
(b) superphosphate
(c) triple superphosphate
(d) gypsum

85. Reaction of orthophosphoric acid with phosphate rock produces
(a) superphosphate

- (b) triple superphosphate
- (c) metaphosphoric acid
- (d) monoammonium phosphate

86. $\text{CaH}_4(\text{PO}_4)_2$ is the chemical formula of (a) superphosphate

- (b) triple superphosphate
- (c) calcium phosphate
- (d) meta phosphoric acid

87. Main constituent of phosphate rock is (a) ammonium phosphate

- (b) fluorapatite
- (c) calcium fluoride
- (d) calcium phosphate

88. Reaction of phosphate rock with 98% H_2SO_4 produces

- (a) orthophosphoric acid (b) superphosphate (c) white phosphorous (d) none of these

89. Reaction of anhydrous liquid ammonia with orthophosphoric acid produces

- (a) ammonium phosphate
- (b) superphosphate
- (c) triple superphosphate
- (d) none of these

90. is not a fertiliser.

- (a) Calcium ammonium nitrate
- (b) Ferrous sulphate
- (c) Liquid ammonia
- (d) Ammonium sulphate

ash produces

ANSWERS

72. (c) 73.(b) 74.(d) 75.(b) 76.(c) 77.(b) 78.(c) 79.(a) 80.(b) 81.(c) 82.(a) 83.(a)
84.(a) 85.(b) 86.(b) 87.(b) 88.(a) 89.(a) 90.(b)

91. Which of the following fertilisers is needed for promoting the development of leaves and stems during early stages of plant growth ? (a) Nitrogenous fertiliser

- (b) Potassic fertiliser

(c) Phosphatic fertiliser

(d) None of these

92. Steam reforming of naphtha produces ammonia synthesis gas. This is a/an.....process. (a) autocatalytic (c) exothermic (b) endothermic (d) non-catalytic

93. Catalyst used in steam reforming of naphtha is (a) bauxite

(b) cobalt

(c) nickel oxide on alumina support

(d) chromium

94. Ammonium nitrate is

(a) having about 40% N_2 .

(b) not hygroscopic.

(c) not prone to explosive thermal decomposition. (d) mixed with limestone powder to reduce its explosive nature before using it as a fertilizer.

95. catalyst is used in the production of urea from CO_2 and NH_3 .

(a) Vanadium pentoxide (b) No

(c) Alumina (d) Nickel

96. Raw materials required for the production of CAN (Calcium ammonium nitrate) is NH_3 , (a) HNO_3 & limestone (b) CO_2 & H_2SO_4 (c) HNO_3 & NH_4Cl (d) CO_2 & KNO_3

97. The most suitable fertiliser for accelerating seeding or fruit formation in later stages of plant growth is.....fertiliser.

(a) nitrogenous (c) potassic

(b) phosphatic (d) none of these

98. Pick out the correct statement.

(a) Reaction of NH_3 with HNO_3 to produce

$(NH_4)_2NO_3$ is endothermic.

(b) With increase in NH_3/CO_2 ratio, urea yield decreases for a given temperature, pressure and total feed rate.

(c) Biuret (an intermediate during urea manufacture) is toxic to seeds and animals. (d) both (b) and (c).

99. Pick out the wrong statement.

- (a) Dehydration of ammonium carbamate to produce urea is endothermic.
- (b) Direct use of liquid ammonia as a fertiliser for a tropical country like India is suitable.
- (c) Gypsum ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$) is obtained as a by-product in the wet process for manufacture of ortho-phosphoric acid.
- (d) Phosphate rock when reacted with dilute H_2SO_4 produces superphosphate.

100. Out of the following, N_2 content is minimum in (a) urea

- (b) ammonium nitrate
- (c) ammonium sulphate
- (d) ammonium chloride

101. Which is a catalyst promoter used in catalytic ammonia synthesis reaction ?

- (a) Al_2O_3 (b) Cr_2O_3
- (c) K_2O (d) MnO

102. Which of the following fertilisers is required for the development of fibrous materials of the plants and of the sugar of vegetable & fruits ?

- (a) Nitrogenous fertilisers
- (b) Phosphatic fertilisers
- (c) Potassic fertiliser
- (d) None of these

103. Action of phosphoric acid on rock phosphate produces

- (a) superphosphate
- (b) triple superphosphate
- (c) nitrophosphate
- (d) diammonium phosphate

104. A nitrogenous fertiliser contains 20% N_2 . It could be

- (a) ammonium nitrate.
- (b) calcium ammonium nitrate (CAN).
- (c) urea.
- (d) ammonium chloride.

105. A potassic fertiliser contains 50% K_2O . It could be

- (a) potassium sulphate.
- (b) potassium chloride.
- (c) a mixture of $\text{NaCl} + \text{KCl}$.
- (d) none of these.

106. A phosphatic fertiliser contains 16% P_2O_5 . It could be

- (a) dicalcium phosphate

- (b) superphosphate
- (c) triple superphosphate
- (d) none of these

107. A fertiliser contains 82% N₂. It could be (a) urea (b) liquid NH₃ (c) ammonium nitrate (d) none of these

ANSWERS

91. (a) 92. (b) 93. (c) 94. (d) 95. (b) 96. (a) 97. (b) 98. (b) 99. (b) 100. (a) 101. (c) 102. (c)

103. (b) 104. (b) 105. (a) 106. (b) 107. (b)

108. Which of the following is the costliest method ponent necessarily to be present in fertilisfor commercial production of hydrogen for ers? ammonia synthesis ? (a) Nitrogen (a) H₂ separation from coke oven gas (c) Phosphorous (b) Potassium (d) Sulphur

(b) Steam reforming of naphtha **118.** Which of the following fertilisers contains (c) Cracking of natural gas the least percentage of nitrogen? (d) Electrolysis of water (a) Liquid ammonia

109. During nitric acid manufacture, catalytic (b) Urea oxidation of ammonia at 800°C in presence (c) Ammonium phosphate of platinum catalyst produces nitrogen oxide. (d) Ammonium sulphate Conversion of NH₃ to NO is about.....percent. **119.** Which of the following does not come under (a) 38 (b) 68 the category of 'primary nutrient' for plant (c) 82 (d) 98 growth?

110. Ammonium nitrate (a fertiliser) is coated (a) Potassium with limestone powder to (c) Phosphorous (b) Nitrogen (d) Sulphur

(a) increase its nitrogen content. **120.** is the undesirable by-product pro (b) cut down its production cost. duced in the manufacture of urea. (c) avoid the risk of explosion. (a) Ammonium carbonate (d) add extra nutrient as fertiliser. (b) Biuret

111. The essential ingradient of all the synthesis (c) Carbon dioxide gas is (d) Ammonium carbamate (a) H₂ (b) O₂ **121.** Which of the following does not come under (c) CO₂ (d) N₂ the category of 'micro-nutrient' for plant

112. Reaction of acid with phosphate rock growth? produces superphosphates. (a) Chlorine (b) Iron (a) hydrochloric (b) sulphuric

(c) Boron (d) Carbon

(c) nitric (d) phosphoric **122.** Nitrolime is chemically known as **113.** The main constituent of rock phosphate is (a) calcium nitrate

(a) mono-calcium phosphate (b) ammonium nitrate

(b) di-calcium phosphate (c) calcium ammonium nitrate (CAN)

(c) fluorspar (d) none of these

(d) none of these **123.** $(\text{CH}_3\text{C}_6\text{H}_4)_3\text{PO}_4$ is the chemical formula of **114.** Catalyst used in ammonia synthesis

uses.....as a promoter.

(a) Pt (b) K_2O

(c) Al_2O_3 (d) Ni

(a) triple superphosphate (b) tricresyl phosphate

(c) fluorapatite

(d) superphosphate

115. Which of the following fertilisers is used as a **124.** Which of the following does not come under

cattle feed? the category of 'secondary nutrient' for plant

(a) Urea growth?

(b) Calcium ammonium nitrate (a) Calcium (b) Magnesium

(c) Superphosphate (c) Sulphur (d) Oxygen

(d) Ammonium sulphate **125.** Steam reforming of naphtha is a source of **116.** Fertiliser produced during soda ash manufacture hydrogen production for nitrogenous fertilizer by dual process is ammonium fertilizer industry. What is the usual ratio of

(a) chloride

(c) nitrate

(b) sulphate steam to carbon maintained in the process (d) none of these of steam reforming of naphtha ?

117.

Which of the following is not a measure of

(a) 1.5:1 (b) 3.5:1 (c) 10:1 (d) 15:1

ANSWERS

108. (d) 109. (d) 110. (c) 111. (a) 112. (b) 113. (b) 114. (b) 115. (a) 116. (a) 117. (d)

118. (c) 119. (d)

120. (b) 121. (d) 122. (c) 123. (b) 124. (d) 125. (b)

126. Which of the following is not a commercially **135.** Commercial fertilisers

are available mostly used feed stock for the production of ammonia the form of synthesis gas? (a) powder (b) granules (a) Water (b) Naphtha (c) lumps (d) flakes

(c) Tar (d) Coal/coke oven gas **136.** Pick out the wrong statement. **127.** In the manufacture of H_3PO_4 (ortho), ; strong (a) All the nitrogenous fertilisers are not H_2SO_4 leaching wet process as compared to soluble in water.

electric furnace process (b) A straight fertiliser contains only one (a) uses lower grade phosphate rock. nutrient.

(b) requires lower capital investment in the (c) Calcium cyanamide is used as weed killer plant. in onion fields.

(c) produces lower purity acid. (d) The phosphorous nutrient makes the (d) is very costly. plant stem stronger and increases its **128.** is required more for leafy crops. branches.

(a) Nitrogen (b) Phosphorous **137.** Liquid ammonia is not used as such a fertiliser (c) Potassium (d) Carbon in tropical countries like India, because **129.** Ammonium sulphate fertiliser is (a) its N_2 content is very low.

(a) the highest concentration nitrogenous (b) it is very costly. fertiliser. (c) it will evaporate on spraying.

(b) the best fertiliser for paddy. (d) it is not available.

(c) a basic fertiliser. **138.** Bio-fertilisers are cheaper, renewable and pol (d) a neutral fertiliser. lution free. They improve the.....of the soil. **130.** Yield of urea can be increased with excess (a) nutrient supply ammonia and higher pressure & tempera (b) texture

ture, but because of....., this is not (c) water holding capacity mally not done. (d) all (a), (b) and (c)

(a) increased biuret formation **139.** Use of catalyst is a must in the ammonia man (b) high corrosion rate ufacture, because the reaction is reversible as (c) increased cost of equipment well as the heat of dissociation of N_2 & H_2 is (d) all (a), (b) & (c) high. The presence of promoter along with the

131. Yield of elemental phosphorous from rock catalyst helps in.....of the catalyst. phosphate is about.....percent. (a) stabilisation

(a) 1-2 (b) 15-25 (b) increasing the effectiveness (c) 40-45 (d) 60-65 (c) improving the strength & heat resis

132. Main component of bone ash is (d) all a, b & c (a) calcium sulphate **140.** Conversion achieved in HNO₃ synthesis with (b) calcium phosphate the use of platinum catalyst is about 95-97%. (c) calcium carbonate The rate of formation of nitrogen dioxide from (d) sodium phosphate the oxidation of nitric acid is favoured by **133.** pH value of soil is maintained at.....by (a) decreasing the pressure. the addition of fertiliser for optimum growth (b) decreasing the temperature. and health of the plant. (c) increasing the temperature. (a) 4-5 (b) 7-8 (d) none of these. (c) 9-10 (d) 12-13 **141.** Potassic fertilisers do not promote the development of

134. Which of the following is a natural inorganic fertiliser ?

(a) Chile salt petre

(c) Gobar manure

development of

(b) Oil cake (a) stems & leaves during early stage of (d)

None of these

plant growth.

(b) starches of potatoes & grains.

ANSWERS

126. (c) 127. (c) 128. (a) 129. (b) 130. (d) 131. (b) 132. (b) 133. (b) 134. (a) 135. (b)

136. (a) 137. (c)

138. (d) 139. (d) 140. (c) 141. (a)

(c) sugar of fruits & vegetables.

(d) fibrous materials of plants.

142. A fertiliser plant is classified as a gas based fertiliser plant, when it uses.....gas as a source of hydrogen for the manufacture of ammonia.

(a) coke oven (c) natural (b) producer (d) coal

143. Heating of coke, sand & phosphate rock in an electric furnace is done for the manufacture of (a) phosphoric acid.

(b) superphosphate.

(c) phosphorous.

(d) triple superphosphate.

144. P₂O₅ percentage in the phosphoric acid produced by wet process is about

(a) 10 (b) 30

(c) 50 (d) 70

145. The composition of fresh feed to the high temperature, high pressure urea autoclave is (a) excess liquid ammonia and liquefied CO₂. (b) excess liquid

ammonia and compressed

CO₂ gas.

(c) liquid ammonia and excess compressed CO₂. (d) compressed ammonia gas and excess

compressed CO₂. [GATE 2003] **146.** Ammonium sulphate

(a) is having a nitrogen content of 40% (b) is yellow granular solid fertiliser (c) leaves an acidic residue in soil after addition

(d) is blue crystalline solid fertiliser

Besides three basic elements of carbon, hydrogen and oxygen, which are common to all plants, there are sixteen other elements known to be essential for good plant growth. Of the sixteen elements, nitrogen, phosphorus and potassium are.....nutrients. (a) primary (b) secondary (c) micro (d) none of these

147. Besides three basic elements of carbon, hydrogen and oxygen, which are common to all plants, there are sixteen other elements known to be essential for good plant growth. Of the sixteen elements, nitrogen, phosphorus and potassium are.....nutrients. (a) primary (b) secondary (c) micro (d) none of these

148. Secondary nutrients in fertilizers are (a) boron, copper, manganese

(b) calcium, molybdenum, zinc

(c) iron, sulfur, molybdenum

(d) calcium, magnesium, sulfur

149. Which of the following are the micronutrients for plant ?

(a) Boron, chlorine, copper

(b) Iron, manganese, molybdenum, zinc (c) Cobalt, fluorine, iodine

(d) All a,b & c

ANSWERS 142.(c) 143.(c) 144.(b) 145.(b) 146.(c) 147.(a) 148.(d) 149.(d)

heat transFer

1. Loss of heat from unlagged steam pipe to the ambient air is by (a) conduction
(c) radiation

10. Which area is used in case of heat flow by con7- duction through a cylinder ?
(b) convection
(d) all (a), (b) & (c)

2. Fourier's law applies to the heat transfer by (b) radiation
(d) all (a), (b) & (c)

(a) convection (c) conduction 3. Unsteady state heat conduction occurs, when

(a) temperature distribution is independent of time.

(b) temperature distribution is dependent on time.

(c) heat flows in one direction only.

(d) three dimensional heat flow is concerned. 4. What is the unit of thermal conductivity ? (b) Kcal/hr.m.°C (d) Kcal/hr. °C (a) Kcal/hr. m² °C (c) Kcal/hr.m

5. The unit of heat transfer co-efficient is (a) BTU/hr. ft² °F (b) BTU/hr. °F. ft.
(c) BTU/hr. °F (d) BTU/hr. ft

6. An insulator should have

(a) low thermal conductivity.

(b) high thermal conductivity.

(c) less resistance to heat flow.

(d) a porous structure.

7. Heat flux through several resistances in series is analogous to the current flowing through several

(a) resistances in parallel.

(b) capacitors in series.

(c) resistances in series.

(d) none of these.

8. The overall resistance for heat transfer through a series of flat resistance, is the.....

(b) geometric mean

(d) sum
of the resistances. (a) average
(c) product

9. Which of the following has the highest thermal conductivity ?

(a) Brick (b) Air
(c) Water (d) Silver

(a) (b) (c) (d)

Logarithmic mean area Arithmetic mean area Geometric mean area None of these

11. For heat flow through very thick walled cylinder, use.....mean radius.

(a) arithmetic (b) logarithmic (c) geometric (d) either (a) or (c)

12. What is the logarithmic mean of r_1 and r_2 ?

--

$\frac{r_2 - r_1}{\ln \frac{r_2}{r_1}}$

(a) r_1 (b) r_2 (c) $\frac{r_1 + r_2}{2}$ (d) $\frac{r_1 r_2}{r_1 + r_2}$

$\frac{r_1 + r_2}{2}$

--

2

$\frac{r_1 + r_2}{2}$

$\frac{r_1 r_2}{r_1 + r_2}$

$\frac{r_1 + r_2}{2}$

(c)

$\frac{r_1 + r_2}{2}$

$\frac{r_1 + r_2}{2}$

$\frac{r_1 + r_2}{2}$

2 2

13. What is Nusselt number?

$\frac{h D}{k_f}$ (b) $\frac{h D}{k_s}$ (a) $\frac{h D}{k_s}$ (d) $\frac{h D}{k_f}$

$\frac{h D}{k_s}$ (d) $\frac{h D}{k_f}$ (c) $\frac{h D}{k_s}$ (b) $\frac{h D}{k_f}$

14. Prandtl number is given by

$\frac{C_p \mu}{k}$ (b) $\frac{h D}{k_s}$ (a) $\frac{h D}{k_s}$ (d) $\frac{h D}{k_f}$

$\frac{C_p \mu}{k}$ (c) $\frac{h D}{k_s}$ (d) $\frac{h D}{k_f}$

15. Thermal diffusivity is given by $\frac{k}{\rho C_p}$ (a) $\frac{k}{\rho C_p}$ (b)

$p \ k \ m \ (c)^{Cp.m} \ (d)_{hCpa}$

16. Grashhoff number is given by

ANSWERS

1.(d) 2.(c) 3.(b) 4.(b) 5.(a) 6.(a) 7.(c) 8.(d) 9.(d) 10.(a) 11.(b) 12.(a) 13.(b) 14.(c)
15.(a) 16.(a)

(a)

gD

$3..Dtp^{22}$

$bm/$

(b)

gD

$22bm$

$./$

(c)

gD

$2 \ Dtp^2$

$bm /$

(d)

gD

$3 \ Dtp^2$

$bm /$

17. If h_1 = inner film co-efficient and h_2 = outer film co-efficient, then the overall heat transfer co-efficient is

(a) always less than h

(b)

always between h_1 and

$^1 h_2$

(c) always higher than h_1

(d) dependent on metal resistance

18. Graetz number is given by

$mCp \ (b)^{kL}(a)_{kL \ mCp}$

$mCp \ (d) \ kL(c) \ m \ mCp$

k

19. In the equation $Q = UADt$; Dt is

(a) geometric mean temperature difference. (b) arithmetic mean temperature difference. (c) logarithmic mean temperature difference. (d) the difference of average bulk temperatures of hot and cold fluids.

20. Peclet number (Pe) is given by

(a) $Pe = Re.Pr$ (b) $Pe = Re/Pr$ (c) $Pe = Pr/Re$ (d) $Pe = Nu.Re$

21. Maximum heat transfer rate is obtained in.....flow. (a) laminar (b) turbulent

(c) creeping (d) transition region

22. Heat flux is the time rate of heat transfer per unit (a) length (b) area (c) volume (d) none of these

23. Fouling factor

(a) is a dimensionless quantity.

(b) does not provide a safety factor for design. (c) accounts for additional resistances to heat flow. (d) none of these.

24. Viscosity of gases.....with increase in temperature.

(a) increase very rapidly

(b) increase slowly

(c) decrease slowly

(d) remain unaffected

25. Heat transfer co-efficient (h_1) for liquids in- creases with (a) increasing temperature.

(b) decreasing temperature.

(c) decreasing Reynolds number.

(d) none of these.

26. At what value of Prandtl number, conduction is negligible in the turbulent core of a fluid flowing through a heated pipe ?

(a) 0.5 (b) <0.5

(c) >0.6 (d) <0.1

27. At $Pr > 1$, conduction in an ordinary fluid flow- ing through a heated pipe is limited to the (a) buffer zone

- (b) turbulent core
- (c) both (a) and (b)
- (d) viscous sub-layer

28. Conduction occurs in the buffer zone for a fluid flowing through a heated pipe, only when Prandtl number is

- (a) 0.1 (b) >1
- (c) <1 (d) 1

29. Natural convection is characterised by (a) Grashhoff number
 (b) Peclet number
 (c) Reynolds number
 (d) Prandtl number

30. Which of the following is unimportant in forced convection ?
 (a) Reynolds number
 (b) Prandtl number
 (c) Grashhoff number
 (d) none of these

31. In forced convection, the heat transfer depends on (a) Re, Pr (b) Re, Gr
 (c) mainly Gr (d) Re only

32. The characteristic dimensionless groups for heat transfer to a fluid flowing through a pipe in laminar flow are

- (a) Re, Gz (b) Nu, Pr
- (c) Nu, Pr, Re (d) Nu, Gz

33. At what value of Prandtl number, the hydrodynamic and thermal boundary layers of a fluid flowing over a heated plate will be identical ?

- (a) 1 (b) <1
- (c) >1 (d) none of these

34. Reynold's analogy states that

- (a) $St = f$
- (b) $St = \frac{f}{2}$
- (c) $St = \frac{f}{4}$
- (d) $St = \frac{f}{8}$

ANSWERS

17.(b) 18.(a) 19.(c) 20.(a) 21.(b) 22.(b) 23.(c) 24.(b) 25.(a) 26.(c) 27.(b) 28.(c)

29.(a) 30.(c) 31.(a) 32.(d) 33.(a) 34.(a)

(c) $St = 4f$ (d) $St = f^{1/2}$

where, St = Stanton number f = friction factor

35. For what value of Prandtl number, $St = f/2$? (a) 1.5 (b) 1
(c) >1 (d) <1

36. Which has the lowest Prandtl number ? (a) Liquid metal (b) Aqueous solution (c) Water (d) Lube oil

37. Dietus-Boelter equation used for the determination of heat transfer coefficient is valid (a) for fluids in laminar flow.

(b) for fluids in turbulent flow.

(c) when Grashoff number is very important. (d) for liquid metals.

38. For what value of Prandtl number, the Colburn analogy is valid ?
(a) 0.06 to 120 (b) 0.6 to 120 (c) 1 to 103 (d) 1 to 50

39. Pick out the correct equation.

(a) $j_H = (St) (Pr)^{2/3} = f/2$

(b) $j_H = (St) (Pr)^{1/3} = f/2$

(c) $j_H = (St)^{2/3} (Pr) = f/2$

(d) $j_H = (St)^{1/3} (Pr) = f/2$

40. Choose the correct equation.

(a) $Nu = (Re) (Pr) (Gz)$

(b) $Nu = (Re) (Pr) (St)$

(c) $Nu = (Re) (Pr)$

(d) $Nu = (Pr) (St)$

41. For a liquid in laminar flow through a very long tube, when the exit fluid temperature approaches the wall temperature, the equation to be used is

(a) $Nu = 0.023 Re^{0.8} \cdot Pr^{0.4}$

p

(b) $Nu = 2Gz$

$2Gz$ (c) $Nu =$

p

(d) $Nu = 2Gz^{0.5}$

42. If average heat transfer co-efficient is h_a and the local coefficient at the end of the plate is h_l then in case of heat transfer to a fluid flowing over a flat plate, heated over its entire length

(a) $h_a = h_l$ (b) $h_a = 2h_l$ (c) $h_a = 0.5 h_l$ (d) $h_a = 0.75 h_l$

43. When does the heat generated by fluid friction becomes appreciable compared to the heat transferred between the fluids ?

(a) At high fluid velocity

(b) At low velocity

(c) When fluid flows past a smooth surface (d) None of these

44. The heat transfer co-efficient in film type con- densation is.....that for dropwise condensation.

(a) greater than (b) lower than (c) is same as (d) half

45. Prandtl number is the ratio of

(a) momentum diffusivity to mass diffusivity. (b) momentum diffusivity to thermal diffusivity. (c) thermal diffusivity to mass diffusivity. (d) thermal diffusivity to momentum diffusivity.

46. The film co-efficient between condensing va- pour and metal wall increases with

(a) increasing temperature of the vapour. (b) decreasing temperature of the vapour. (c) increasing viscosity of the film of conden-

sate.

(d) increasing temperature drop.

47. Dropwise condensation occurs on.....surfaces. (a) clean and dirt free

(b) smooth clean

(c) contaminated cooling

(d) polished

48. Presence of a non-condensing gas in a condensing vapour

(a) increases the rate of condensation. (b) decreases thermal resistance.

(c) is desirable to increase the film co-efficient. (d) none of these.

49. Film boiling is usually not desired in commercial equipments, because
(a) the heat transfer rate is low in view of the

large temperature drop.

(b) it is difficult to maintain.

(c) it is not economic.

(d) none of these.

50. In sub-cooled boiling,

(a) temperature of the heating surface is less than the boiling point of the liquid.

(b) temperature of the heating surface is more than the boiling point of the liquid.

(c) bubbles from heating surface are absorbed by the mass of the liquid.

(d) very large vapour space is necessary.

ANSWERS

35. (b) 36.(a) 37.(b) 38.(b) 39.(a) 40.(b) 41.(c) 42.(b) 43.(a) 44.(b) 45.(b) 46.(c)
47.(c) 48.(d) 49.(a) 50.(b)

51. Heat flux increases with temperature drop beyond the Leiden frost point in the plot of heat flux vs. temperature drop for a boiling liquid, because

(a) convection becomes important

(b) conduction becomes important

(c) radiation becomes important

(d) sub-cooled boiling occurs

52. Nucleate boiling is promoted

(a) on polished surfaces

(b) on rough surfaces

(c) in the absence of agitation

(d) none of these

53. What is the emissivity of a black body ? (a) 1 (b) 0

(c) 0.90 (d) 0.5

54. What is the absorptivity of a black body ? (a) 1 (b) 0

(c) 0.78 (d) 0.95

55. The range of electromagnetic spectrum important in heat transfer by radiation is.....microns. (a) 0.38–0.78 (b) 0.5–50

(c) 100–1000 (d) 5–50

56. As per Kirchoff 's law, the ratio of the total radiating power to the absorptivity of a body depends on the

- (a) temperature of the body only.
- (b) wavelength of monochromatic radiation. (c) both (a) and (b).
- (d) nature of material of body.

57. Kirchoff 's law is applicable to

- (a) monochromatic radiation only
- (b) total radiation only
- (c) both (a) and (b)
- (d) only volumes and not to surfaces

58. The statement that “maximum wavelength of radiation is inversely proportional to the temperature” is.....law.

- (a) Stefan-Boltzman's
- (b) Planck's
- (c) Wien's displacement
- (d) none of these

59. Solid angle subtended by the finite surface at the radiating element is

- (a) called the view factor.
- (b) called the angle of vision.
- (c) proportional to the square of the distance

between surfaces.

- (d) expressed in terms of radians.

ANSWERS

51.(c) 52.(b) 53.(c) 54.(a) 55.(b) 56.(a) 57.(c) 58.(c) 59.(b) 60.(b) 61.(a) 62.(c)
63.(b) 64.(c) 65.(d) 66.(a) 67.(b) 68.(d) 69.(a)

60. The energy radiated from a surface Q at absolute temperature T is related

as $Q \propto T^2$ (a) $Q \propto T^2$ (b) $Q \propto T$

- (c) $Q \propto T^3$ (d) none of these

61. Heat sensitive materials can be concentrated in an evaporator employing

- (a) vacuum
- (b) high pressure
- (c) high residence time

(d) none of these

62. The number of kg vaporised per kg of steam fed to the evaporator is defined as

(a) capacity

(b) rate of evaporation

(c) economy

(d) rate of vaporisation

63. Fruit juice (a heat sensitive material) can be concentrated in a.....evaporator. (a) long tube

(c) high pressure (b) falling film (d) none of these

64. In a single effect evaporator, the economy is (a) 1 (b) <1

(c) > 1 (d) none of these

65. In a forward feed multiple effect evaporator unit (a) viscosity of liquid is highest in first effect. (b) transfer from effect to effect is done by

pumps.

(c) no pump is required to withdraw the product from the last effect.

(d) none of these.

66. Kg of liquid evaporated per hour in an evaporator is defined as its

(a) capacity (b) economy (c) steam load (d) none of these

67. In a backward feed multiple effect evaporator (a) feed is introduced in the first effect. (b) feed flows from low pressure to high pressure.

sure.

(c) no pumps are required between successive effects.

(d) none of these.

68. Economy of an evaporator is influenced by the (a) steam pressure

(b) feed temperature

(c) number of effect

(d) both (b)&(c)

69. For a cold viscous feed, backward feed gives.....than forward feed.

- (a) a higher capacity
- (b) a lower capacity
- (c) lower economy
- (d) none of these

70. In a multiple effect evaporator, the effect of boiling point elevation is to

- (a) reduce the capacity
- (b) reduce the economy
- (c) increase the economy
- (d) none of these

71. Which is the most suitable for cold viscous feed ?

- (a) Forward feed (c) Mixed feed (b) Backward feed (d) Parallel feed

72. Reason for operating an evaporator in multiple effect is to secure

- (a) increased steam economy.
- (b) decreased steam consumption.
- (c) both (a) and (b).
- (d) increased capacity.

73. Increasing the liquor level in the evaporator results in the

- (a) decreased capacity.
- (b) increase in liquor film co-efficient. (c) decreased effect of hydrostatic head.
- (d) increased true temperature drop.

74. In evaporators, lowering the feed temperature (a) increases the heating area required. (b) reduces the economy.

- (c) both (a) and (b).
- (d) decreases the heating area required.

75. The actual temperature drop across the heating surface in an evaporator depends on the (a) feed.

- (b) depth of liquid over heating surface. (c) pressure difference between steam chest

and vapour space.

- (d) all (a), (b) and (c).

76. The purpose of providing expansion bellows in the shell of tubular exchanger is to

- (a) increase the heating load.
- (b) impart structural strength.
- (c) account for the uneven expansion of shell

and tube bundles.

- (d) facilitate increase of shell length, if needed.

77. Multipass heat exchangers are used

- (a) because of simplicity of fabrication, (b) for low heat load.

- (c) to obtain higher heat transfer co-efficient and shorter tube,

- (d) to reduce the pressure drop.

78. Double pipe heat exchangers are used

- (a) when heat transfer area required is very high.

- (b) when heat transfer area required is very low, i.e (100-200 ft²).

- (c) because it occupies less floor area,

- (d) because it is less costly.

79. Finned tube heat exchangers

- (a) give larger area per tube.

- (b) use metal fins of low thermal conductivity. (c) facilitate very large temperature drop

through tube wall.

- (d) are used for smaller heat load.

80. Baffles in the shell side of a shell and tube heat exchanger

- (a) increase the cross-section of the shell side

liquid.

- (b) force the liquid to flow parallel to the bank. (c) increase the shell side heat transfer coefficient.

- (d) decrease the shell side heat transfer coefficient.

81. In a heat exchanger, the rate of heat transfer from the hot fluid to the cold fluid

- (a) varies directly as the area and the LMTD. (b) directly proportional to LMTD and inversely proportional to the area.

- (c) varies as square of the area.
- (d) none of these.

82. In a shell and tube heat exchanger,

(a) the temperature drops in the two fluids and the wall are proportional to individual resistances.

(b) the temperature drop is inversely proportional to the resistance across which the drop occurs.

(c) there is no relationship between temperature drop and resistance.

(d) the relationship is not generalised. **83.** In a shell and tube heat exchanger, square

pitch compared to triangular pitch.

(a) gives a higher shell side pressure drop.

(b) gives a lower shell side pressure drop.

(c) can pack more surface area into a shell of given diameter.

(d) none of these.

ANSWERS

70. (a) 71. (b) 72. (c) 73. (a) 74. (c) 75. (d) 76. (c) 77. (c) 78. (b) 79. (a) 80. (c) 81. (a)

84. Baffle spacing

(a) is not the same as baffle pitch.

(b) should be less than one fifth the diameter of the shell.

(c) should be less than the inside diameter of the shell.

(d) none of these.

85. Tube pitch is the.....of tube diameters and the clearances.

(a) sum (b) difference (c) ratio (d) none of these

86. In counter flow compared to parallel flow, (a) LMTD is greater.

(b) less surface area is required for a given heat transfer rate.

(c) both (a) and (b).

(d) more surface area is required for a given heat transfer rate.

87. A 2-4 heat exchanger involves

(a) only counter-flow of fluids.

(b) only parallel-flow of fluids.

(c) both counter and parallel-flow of the fluids. (d) smaller pressure drop compared to 1-2 exchanger.

88. The purpose of floating head in a heat ex- changer is to

- (a) avoid buckling of tubes.
- (b) provide support for tubes.
- (c) decrease the pressure drop.
- (d) facilitate its lengthening, if needed.

89. In an extended surface heat exchanger, fluid having lower co-efficient

- (a) flows through the tube.
- (b) flows outside the tubes.
- (c) can flow either inside or outside the tubes. (d) should not be used as it gives very high

pressure drop.

90. Correction is applied to LMTD for.....flow. (a) parallel (b) counter (c) cross (d) none of these

91. The equivalent diameter for pressure drop is.....that for heat transfer.

- (a) smaller than (c) equal to
- (b) greater than (d) not related with

92. Overall heat transfer co-efficient of a particu- lar tube is U_1 . If the same tube with some dirt deposited on either side has coef-ficient U_2 , then

- (a) $U_1 = U_2$ (b) $U_2 > U_1$
- (c) $U_1 > U_2$ (d) $U_1 = \text{dirt factor} - U_2$

93. In a heat exchanger, one transfer unit means (a) a section of the exchanger in which change in temperature of one stream equals the average driving force in the section.

- (b) the size of the exchanger in which heat transfer rate is 1 kcal/hr.
- (c) both (a) and (b)
- (d) none of these

94. Choose the most important factor on which the heat conducted through a wall in a unit time will depend on ?

- (a) Thickness of the wall.
- (b) Area of the wall perpendicular to heat flow. (c) Material of the wall,
- (d) Temperature difference between the two

surfaces of the wall.

95. Water always boils when its

(a) temperature reaches 100 °C.

(b) vapour pressure equals 76 cm of Hg. (c) saturated vapour pressure equals the external pressure on its surface.

(d) saturated vapour pressure is less than the atmospheric pressure.

96. Wavelength corresponding to the maximum energy is inversely proportional to the absolute temperature. This is.....law.

(a) Stefan's (b) Dalton's (c) Wien's (d) Kirchoff's

97. For concentrating an aqueous solution of a material like anhydrous Na_2SO_4 , whose solubility decreases with rise in temperature, the most suitable evaporator is a.....evaporator.

(a) high pressure (b) vacuum (c) backward feed (d) none of these

98. Boiling point elevation of a solution of NaOH (a) increases rapidly with temperature rise. (b) is almost independent of temperature. (c) is almost independent of pressure. (d) both (b) and (c).

99. Maximum water velocity in tubes of a 1-2 shell and tube heat exchanger may be around..... metres/second.

(a) 1 (b) 10

(c) 20 (d) 30

100. Rate of crystallisation does not depend upon the

ANSWERS

84. (b) 85. (a) 86. (c) 87. (c) 88. (a) 89. (b) 90. (c) 91. (a) 92. (a) 93. (a) 94. (d) 95. (c)

96. (c) 97. (b) 98. (d) 99. (a) 100. (d)

(a) extent of supersaturation.

(b) turbulence within the solution.

(c) number and active surface area of the crystals.

(d) none of these.

101. Crystal size in a continuous crystalliser depends upon the

(a) rate of heat transfer.

- (b) degree of turbulence.
- (c) degree of supersaturation.
- (d) all (a), (b) and (c).

102. The absorptivity of a grey body at a given temperature.....with increasing wavelength of radiation.

- (a) increases
- (b) decreases
- (c) remains constant
- (d) may increase or decrease ; depends on the material

103. In case of vertical tube evaporator, with increase in liquor level, the overall heat transfer co-efficient

- (a) increases
- (b) decreases
- (c) is not affected
- (d) may increase or decrease; depends on the feed

104. In case of a vertical tube evaporator, with increase in the liquor level, the

- (a) capacity of the evaporator is decreased. (b) capacity of the evaporator is increased, (c) true temperature drop increases. (d) both (b) and (c).

105. In case of a vertical tube evaporator, with increase in the liquor level, the.....is increased.

- (a) velocity of circulation
- (b) liquor-film co-efficient
- (c) both (a) and (b)
- (d) neither (a) and (b)

106. Economy of a multiple effect evaporator depends upon the

- (a) heat balance consideration
- (b) rate of heat transfer
- (c) both (a) and (b)
- (d) neither (a) nor (b)

107. The capacity of double-effect evaporator is less than half of the capacity of two single effects, each of which is operating over same terminal temperature difference, when the (a) solution has an elevation of boiling point. (b)

evaporators operate under vacuum. (c) evaporators operate at atmospheric pressure.

- (d) none of these.

108. Economy of a multiple effect evaporator is not influenced much by the

- (a) boiling point elevations
- (b) temperature of the feed

- (c) rate of heat transfer
- (d) ratio of the weight of the thin liquor to

thick liquor

109. For a cold dilute feed to produce thick viscous liquor, backward feeding as compared to forward feeding results in

- (a) increased economy
- (b) decreased economy
- (c) lower capacity
- (d) no effect on economy

110. For hot feed, forward feeding as compared to backward feeding results in.....economy. (a) increased (b) decreased

- (c) no effect on (d) none of these

111. Vent pipes are provided in a condenser to (a) remove non-condensable gases.

- (b) purge the condenser.
- (c) facilitate easy cleaning of tubes. (d) none of these.

112. Steam trap is used to

- (a) condense the steam flowing in the pipe- line.
- (b) remove water resulting from partial condensation of steam.
- (c) stop the supply of steam.
- (d) none of these.

113. Boiling point elevation of an ideal solution

- (a) increases rapidly with temperature rise.
- (b) decreases rapidly with temperature rise.
- (c) is independent of pressure.
- (d) both (b) and (c).

114. Which of the following has the lowest Prandtl number ?

- (a) Molten sodium (a coolant used in fast breeder reactor)
- (b) Water
- (c) Transformer oil
- (d) Dilute H_2SO_4

ANSWERS

101. (d) 102.(d) 103.(b) 104.(a) 105.(d) 106.(a) 107.(a) 108.(a) 109.(a) 110.(a)
111.(a) 112.(b)

115. When vaporisation takes place directly at the heating surface, it is called
(a) film boiling (b) nucleate boiling (c) vapour binding (d) none of these

116. Rate of heat transfer by vaporisation from pools of water is affected by the
(a) nature of heating surface and distribution of bubbles.

(b) surface tension of water.

(c) viscosity of water.

(d) all (a), (b) and (c).

117. An equipment which converts the latent or sensible heat of one fluid into the latent heat of vaporisation of another, is called a (a) boiler (b) heat exchanger
(c) recuperator (d) regenerator

118. In case of parallel flow heat exchanger, the lowest temperature theoretically attainable by the hot fluid is.....the outlet temperature of the cold fluid.

(a) equal to

(b) more than

(c) less than

(d) either more or less than (depending upon

the fluid)

119. LMTD for counterflow and parallel flow heat exchanger will be the same, when the (a) cold fluid is heated to a certain tempera-

ture by condensing steam (isothermal fluid).

(b) outlet temperature of both the hot and cold fluid are same.

(c) outlet temperature of hot fluid is less than the outlet temperature of the cold fluid.

(d) none of these.

120. A BTU/hr.ft.² °F is equal to

(a) 1 kcal/hr. m²°C.

(b) 4.88 kcal/hr. m.²°C.

(c) 1 kcal/hr. m².°K

(d) none of these.

121. 1BTU/hr.ft. °F is equal to.....kcal/hr. m. °C. (a) 1.49 (b) 1
(c) 4.88 (d) none of these

122. In a multipass shell and tube heat exchanger, tube side return pressure loss is equal to..... the velocity head.
(a) twice (b) four times (c) square root of (d) square of

123. The rate of heat transfer from a vertical plate by natural convection depends upon the temperature differences (DT) between wall and outside bulk. The proportionality is given as (a) $(DT)^{1/4}$ (b) $(DT)^{1/2}$
(c) $(DT)^{5/4}$ (d) $(DT)^{3/4}$

124. In a forward feed multiple effect evaporator, the pressure is
(a) highest in last effect
(b) lowest in last effect
(c) same in all effects
(d) dependent on the number of effects

125. For the same heat load and mass flow rate in the tube side of a shell and tube heat exchanger, one may use multipass on the tube side, because it
(a) decreases the pressure drop.
(b) decreases the outlet temperature of cooling medium.
(c) increases the overall heat transfer coefficient.
(d) none of these.

126. In a shell and tube heat exchanger, floating head is used for
(a) large temperature differentials. (b) high heat transfer co-efficient.
(c) low pressure drop.
(d) less corrosion of tubes.

127. Which type of heat exchanger is preferred for heavy heat loads ?
(a) Double pipe
(b) Plate fine
(c) Series and parallel set of shell and tube (d) None of these

128. Air is best heated with steam in a heat exchanger of
(a) plate type.

(b) double pipe type with fins on steam side. (c) double pipe type with fins on air side. (d) shell and tube type.

129. Three material A, B and C of equal thickness and of thermal conductivity of 20, 40 & 60 kcal/hr. m. °C respectively are joined together. The temperature outside of A and C are 30°C and 100°C respectively. The interface between B and C will be at a temperature of..... °C.

(a) 40 (b) 95

(c) 70 (d) 50

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115. (b) 116. (d) 117. (b) 118. (a) 119. (a) 120. (b) 121. (a) 122. (b) 123. (d) 124. (b)

125. (c) 126. (a)

127. (c) 128. (c) 129. (c)

130. For evaporation of viscous solution in a multiple effect evaporator, the preferred feeding scheme is

(a) forward (c) parallel (b) backward (d) none of these

131. The maximum heat transfer coefficient from steam heating will be attained when the steam is

(a) supersaturated (b) saturated (c) wet (d) none of these

132. A single pass air heater is connected to a two pass unit. For the air flow rate and other conditions remaining the same, the film heat transfer coefficient for air will vary in the ratio of

(a) 2 (b) 20.8

(c) 20.2 (d) 20.5

133. If a single tube pass heat exchanger is converted to two pass, then for the same flow rate, the pressure drop per unit length in tube side will

(a) increase by 1.8 times

(b) decrease by 22

(c) increase by 21.6

(d) remain unchanged

134. One kilogram of water at 0°C is changed to superheated steam of one atm pressure and 300°C. The major heat consumption in the process will be to

(a) heat the water from 0°C to 100 °C. (b) evaporate the water.

(c) to superheat the steam.

(d) data insufficient, can't be predicted

135. To reduce the tube side pressure drop for the same flow rate, the heat exchanger recommended is

- (a) 1–2 heat exchanger
- (b) 1–1 heat exchanger
- (c) 3–2 heat exchanger
- (d) 2–4 heat exchanger

136. Multiple effect evaporators are used to

- (a) increase the steam economy & decrease the capacity.
- (b) increase the steam economy & the capacity.
- (c) decrease the steam economy & the capacity.
- (d) decrease the steam economy & increase the capacity.

137. The steam ejector is used to

- (a) remove condensate from the steam pipelines.
- (b) create vacuum.
- (c) superheat the steam.
- (d) none of these.

138. In a shell and tube type heat exchanger, the floating tube bundle heat arrangement is used

- (a) in low range of temperature differences.
- (b) in high range of temperature differences.
- (c) because of its low cost.
- (d) to prevent corrosion of the tube bundles.

139. In a cooling tower, water becomes cool by (a) losing sensible heat.

- (b) heat transfer to surroundings.
- (c) vaporisation due to heat loss to air.
- (d) losing latent heat.

140. The rate of heat transfer is a product of overall heat transfer co-efficient, the difference in temperature and the

- (a) heating volume
- (b) heat transfer area
- (c) Nusselt number
- (d) none of these

141. Trap is used to remove.....from steam pipe lines.

- (a) steam
- (b) condensate
- (c) non-condensables
- (d) none of these

142. An ejector is used to

- (a) increase pressure
- (b) increase temperature
- (c) remove condensate
- (d) none of these

143. When warm and cold liquids are mixed, the heat transfer is mainly by

- (a) internally (b) convection
- (c) radiation (d) both (a) & (c)

144. Small scale evaporation is done in a (a) heat exchanger

- (b) condenser
- (c) multiple effect evaporator
- (d) steam jacketed kettle

145. Multiple effect evaporation accounts for (a) steam economy

- (b) lower operating costs
- (c) investment economy
- (d) none of these

ANSWERS

130. (b) 131.(b) 132.(b) 133.(c) 134.(c) 135.(b) 136.(b) 137.(b) 138.(b) 139.(a)

140.(b) 141.(b)

142.(d) 143.(b) 144.(d) 145.(a)

146. The Dietus-Boelter equation for convective

$$Nu = 0.023 Re^{0.8} Pr^{0.4} \left(\frac{\mu}{\mu_s} \right)^{0.14}$$

heat transfer $\propto D$

cannot be used for

- (a) low Reynold's number
- (b) very low Grashoff number
- (c) molten metals
- (d) all (a), (b) and (c)

147. Dietus-Boelter equation cannot be used for molten metals mainly due to its very low (a) Prandtl number

- (b) Grashoff number
- (c) thermal conductivity

(d) viscosity

148. Log mean temperature difference (LMTD) cannot be used, if

(a) heat transfer co-efficient over the entire

heat exchanger is not constant.

(b) there exists an unsteady state.

(c) the heat capacity is not constant and

there is a phase change.

(d) none of these.

149. LMTD can't be used as such without a correction factor for the

(a) multipass heat exchanger.

(b) baffled heat exchanger.

(c) condensation of mixed vapour in a condenser.

(d) all (a) (b) and (c).

150. Evaporator tubes are generally

(a) horizontal (c) inclined

(b) vertical (d) random

151. Circulation pump is located below the evaporator to

(a) avoid cavitation.

(b) avoid frequent priming.

(c) create more suction head.

(d) none of these.

152. In SI units, thermal conductivity is expressed in

(a) Watt/m. °K (b) Watt/m³. °K (c) Watt/m². °K (d) Watt/m⁴. °K

153. The equivalent diameter for the annulus of a double pipe heat exchanger, whose inner pipe has fins on the outside is.....compared to the same size pipes without fins.

(a) more (b) less

(c) same (d) unpredictable

154. In SI units, fouling factor is expressed in (a) m² °K/W (b) W/m² °K (c) m² °KW (d) m°k/W

155. Thermal diffusivity is the most important in heat transfer by

- (a) conduction
- (b) radiation
- (c) condensation
- (d) natural convection

156. The unit of heat transfer co-efficient in SI unit is

- (a) $\text{J/m}^2\text{°K}$ (b) $\text{W/m}^2 \text{ K}$ (c) $\text{W/m}^{\circ}\text{K}$ (d) J/m K

157. Conductance is given by

- (a) x/KA (b) KA/x
- (c) K/Ax (d) A/Kx

where, x = thickness, A = heat flow area, K = thermal conductivity.

158. In which mode of heat transfer, the Biot number is important ?

- (a) Transient heat conduction
- (b) Natural convection
- (c) Forced convection
- (d) Radiation

159. What is the geometric mean of two heat transfer areas A_1 and A_2 ?

+

- (a) $\sqrt{A_1 A_2}$
- (b) $\frac{A_1 + A_2}{2}$
- (c) $\frac{1}{A_1} + \frac{1}{A_2}$ (d) $\frac{2}{\frac{1}{A_1} + \frac{1}{A_2}}$

160. The heat flux in the nucleate boiling regimes is proportional to

- (a) $D()^2$ (b) $D()^4$
- (c) $D()^3$ (d) $D()$ where, DT = excess temperature

161. Radiation heat transfer rates does not depend upon the

- (a) type of absorbing surface.
- (b) distance between the heat source and the object receiving the heat.
- (c) surface area and temperature of the heat source.
- (d) none of these.

162. At what value of Prandtl number, the hydrodynamic and thermal boundary layers are

identical ?

ANSWERS

146. (d) 147.(a) 148.(d) 149.(d) 150.(b) 151.(c) 152.(a) 153.(b) 154.(a) 155.(a)
156.(b) 157.(b)
158.(a) 159.(a) 160.(c) 161.(d) 162.(b)
(a) 0.5 (b) 1
(c) 1.5 (d) 80

163. The average heat transfer co-efficient for laminar film condensation on vertical surface is inversely proportional to

(a)
 δ^2 (b) $D\delta$
(c) $D\delta^{1/4}$ (d) $D\delta^{3/2}$

where, DT = Temperature drop across condensate film

164. The thermal boundary layer at $N_{Pr} > 1$

(a) is thicker than hydrodynamic boundary layer.
(b) is thinner than hydrodynamic boundary layer.
(c) and the hydrodynamic boundary layer are identical.
(d) disappears.

165. The value of Stefan-Boltzman constant in SI unit is

(a) $5.6697 \times 10^{-8} \text{ W/m}^2 \cdot ^\circ\text{K}^4$
(b) $0.1714 \times 10^{-8} \text{ W/m}^2 \cdot ^\circ\text{K}^4$
(c) $5.6697 \times 10^{-8} \text{ kcal/m}^2 \cdot ^\circ\text{K}^4$
(d) $0.1714 \times 10^{-8} \text{ kcal/m}^2 \cdot ^\circ\text{K}^4$

166. In a shell and tube heat exchanger, the tube side heat transfer co-efficient just at the entrance of the tube is

(a) infinity.
(b) zero.
(c) same as average heat transfer co-effi-

cient for tube side.

(d) none of these.

167. Which is the best tube arrangement (in a shell and tube heat exchanger) if

the fluids are clean and non-fouling ?

- (a) Square pitch
- (b) Triangular pitch
- (c) Diagonal square pitch
- (d) None of these

168. In a 1-1 cocurrent heat exchanger, if the tube side fluid outlet temperature is equal to the shell side fluid outlet temperature, then the LMTD is

- (a) ∞
- (b) 0
- (c) equal to the difference between hot and

cold fluids inlet temperature.

- (d) equal to the difference between hot fluid inlet temperature and cold fluid outlet temperature.

169. View factor is important in heat transfer by (a) steady state conduction

- (b) natural convection
- (c) forced convection
- (d) radiation

170. In a liquid-liquid heat exchanger, for the same process temperature, the ratio of the LMTD in parallel flow to the LMTD in counter flow is always

- (a) < 1 (b) > 1
- (c) 1 (d) ∞

171. Absorptivity and reflectivity of a perfect black body are respectively

- (a) 1 and 0 (b) 0 and 1 (c) 1 and ∞ (d) 0 and 0.5

172. “The ratio of the total emissive power to the absorptivity for all bodies is same at thermal equilibrium”. This is.....law.

- (a) Kirchoffs
- (b) Planck’s
- (c) Wien’s displacement
- (d) Stefan-Boltzman

173. With increase in temperature, the thermal conductivity of a gas

- (a) increases.
- (b) decreases.
- (c) remains same.

(d) may increase or decrease depending on

the type of gas.

174. What is the thermal conductivity of a perfect heat insulator ?

(a) 0 (b) 1

(c) ∞ (d) between 0 and ∞

A body is called grey if the monochromatic **175.**

emissivity of the body is

(a) zero

(b) unity

(c) same for all wavelengths

(d) different for all wavelengths

176. Which one gives the monochromatic emissive power for black body radiation ?

(a) Planck's law

(b) Kirchhoffs law

(c) Wien's law

(d) Stefan-Boltzman law

ANSWERS

163. (c) 164. (b) 165. (a) 166. (a) 167. (b) 168. (b) 169. (d) 170. (a) 171. (a) 172. (a)

173. (a) 174. (c)

175. (c) 176. (a)

177. For specified tube outside diameter, higher BWG means higher

(a) tube thickness

(b) cross-sectional area

(c) weight per unit length

(d) none of these

178. Duhring rule is important in solving prob

(b) crystallisation (d) humidification lems on

(a) distillation (c) evaporation

179. Prandtl number for most of dry gases is about (a) 0.001 (b) 0.72

(c) 70 (d) 150

180. According to Reynolds analogy, Stanton number is equal to

- (a) $2f$ (b) f
(c) $f/2$ (d) $f/4$

where, f = Fanning friction factor

181. The Graetz number is concerned with the (a) mass transfer between a gas and a liquid. (b) absorption with chemical reaction. (c) heat transfer in turbulent flow.

(d) heat transfer in laminar flow.

182. The ratio of kinematic viscosity to thermal diffusivity is called the.....number. (a) Peclet (b) Prandtl (c) Stanton (d) Nusselt

183. ($N_{Gr} \times N_{pr}$) is called the.....number. (a) Graetz (c) Nusselt (b) Reyleigh (d) Stanton

184. The equation, (analogy.

(a) Colburn (c) Prandtl

St

NN

$2/3$

$\times =) f/2$, is the.....

Pr

(b) Reynolds

(d) none of these

185. The equation, $N_{st} = f/2$, is the.....analogy. (b) Reynolds

(d) none of these (a) Colburn (c) Prandtl

186. Prandtl and Reynolds analogy are same, when Prandtl number is

(a) 0.5 (b) 1

(c) >2 (d) 1.5

187. Colburn analogy is applicable for the value of Prandtl number from

(a) 0.001 to 1 (b) 0.6 to 120 (c) 0.5 to 5 (d) 120 to 400

188. The local surface conductance for laminar

(a)

$\propto t$ (b) $\propto 1/t$

(c) $\propto t$ (d) independent of 't' where, t = film thickness

189. In a boiling curve, the peak heat flux is called

the.....point. (a) Nusselt (c) boiling
(b) Leidenfrost (d) burnout

190. The Stefan-Boltzman constant depends on the (a) medium (c) surface (b) temperature (d) none of these

191. Electromagnetic radiations propagate in vacuum with a velocity of.....metre/second. (a) 3×10^5 (b) 3×10^8 (c) 3×10^{10} (d) 3×10^{12}

192. Controlling heat transfer film co-efficient is the one, which offers.....resistance to heat transfer.
(a) no (b) the least (c) the largest (d) lower

193. heat exchanger is used for chilling oil to be dewaxed.
(a) U-tube (b) Double pipe (c) Fixed tube (d) Floating head

194. heat exchanger is the most suitable, when the temperature of shell side fluid is much higher than that of tube side.
(a) Single pass, fixed tube sheet
(b) U-tube
(c) Three pass, fixed tube sheet
(d) none of these

195. In a shell and tube heat exchanger, putting a longitudinal baffle across the shell, forces the shell side fluid to pass.....through the heat exchanger.
(a) once (b) twice
(c) thrice (d) four times

196. Steam traps are provided in steam carrying pipelines to
(a) condense steam.
(b) release excess steam pressure by bleed

(c)
ing steam.
remove condensate and inert gases. (d) none of these.

197. Which is the most suitable for the concentration of highly concentrated solution? (a) Open pan evaporation

film condensation on vertical surface is

ANSWERS

177. (b) 178. (c) 179. (b) 180. (c) 181. (d) 182. (b) 183. (b) 184. (a) 185. (b) 186. (b) 187. (b) 188. (b)

189. (d) 190. (d) 191. (b) 192. (c) 193. (b) 194. (b) 195. (b) 196. (c) 197. (a)
(b) Long tube vertical evaporator (c) turbulence of shell side fluid. (c) Agitated film evaporator (d) all (a), (b) and (c).

(d) None of these **206.** Vibrations in the tubes of a shell and tube **198.** Which is the most suitable for the concentrated heat exchanger is induced due to the formation of foamy & frothy liquors ? (a) flow of fluid on the tube and shell sides.
(a) Agitated film evaporator (b) oscillations in the flow of shell/tube sides
(b) Long tube vertical evaporator fluid.
(c) Open pan evaporator (c) vibrations transmitted through piping
(d) None of these and/or supports due to external reasons.

199. Viscous & heat sensitive liquids are concentrated in.....evaporators. ^{(d) all (a), (b) and (c)}
207. For large heat transfer area requirement, (a) open pan (b) long tube shell and tube heat exchanger is preferred, (c) agitated film (d) none of these because it

200. Boiling point of a solution according to ^{(a) occupies smaller space.} Dühring's rule is a linear function of the..... ^{(b) is more economical.}
of water. (c) is easy to operate and maintain.

(a) boiling point (at the same pressure) ^{(d) all (a), (b) and (c).}
(b) viscosity **208.** The wavelength at which the maximum (c) density monochromatic emissive power occurs for a (d) thermal conductivity black body, is

201. It is not preferable to use superheated steam ^{(a) aT (b) $a \frac{1}{T}$} in evaporators, because of its very ^{(c) $a T^4$ (d) independent of T} (a) high temperature where, T = absolute temperature of the black body ^{(b) high pressure} **209.** With increase in temperature, the total emissivity ^{(c) low film coefficient of conductivity (d) none of these} (a) increases (b) decreases

202. The actual temperature drop across the heat (c) remains same (d) decreases linearly

ing surface of an evaporator depends on the **210.** paint has the maximum absorption co(a) liquid depth over the heating surface. efficient.(b) solution being evaporated. (a) Black (b) Yellow(c) pressure difference between the steam (c) White (d) Greychest and the vapor space above the boil**211.** paint has the minimum absorption coing liquid. efficient.(d) all (a), (b) and (c) (a) Black (b) White lead**203.** Steam side heat transfer co-efficient in an (c) Grey (d) Light creamevaporator is in the range of.....kcal/ **212.** With increase in the distance between the hr.m²°C. heat source and the object receiving the heat, (a) 10–50 (b) 100–500 the radiation heat transfer(c) 1000–1500 (d) 5000–15000 (a) decreases**204.** During crystallisation, formation of crystal (b) increasescan occur in.....solution only. (c) increases exponentially(a) saturated (d) remains unaffected(b) supersaturated **213.** The film thickness for laminar film condensation (c) undersaturated on vertical surface.....from top to bottom.(d) all (a), (b) and (c) (a) cummulatively increases**205.** Use of transverse baffles in a shell and tube (b) cummulatively decreasesheat exchanger is done to increase the (c) remains constant(a) rate of heat transfer. (d) and the surface conductance increase(b) flow velocity.

ANSWERS

198. (b) 199.(c) 200.(a) 201.(c) 202.(d) 203.(d) 204.(b) 205.(d) 206.(d) 207.(d) 208.(b) 209.(a)

210.(a) 211.(b) 212.(a) 213.(a)

214. Heat produced when a steady state current, I passes through an electrical conductor having resistance, 'R' is

- (a) IR (b) I^2R
- (c) IR^2 (d) I^2R^2

215. Which of the following has maximum thermal conductivity ? (a) Iron

- (c) Nitrogen
- (b) Coal (d) Tar

216. Crystallisation of solids from a homogeneous solution is a/an.....process.

- (a) exothermic
- (b) mildly endothermic
- (c) highly endothermic
- (d) none of these

217. For a multipass shell and tube heat exchanger, the LMTD correction factor is always (a) 1 (b) >1

- (c) <1 (d) between 1 & 2

218. The Fourier number (defined as $a \cdot t / L^2$) is used in the analysis of problem involving heat transfer by

- (a) forced convection
- (b) natural convection
- (c) transient conduction
- (d) steady state conduction

219. In the free convection regime of pool boiling, the heat flux is proportional

to

(a) $Dt^{1/2}$ (b) Dt^2

(c) $Dt^{5/4}$ (d) Dt

220. Stefan-Boltzman law which describes the radiation heat transfer states that, it is proportional to

(a) t^4 (b) T^4

(c) $1/t^4$ (d) $1/T^4$.

where, t = temperature in $^{\circ}\text{C}$

T = absolute temperature in $^{\circ}\text{K}$

221. What is the steam economy in case of a single effect evaporator system ?

(a) 1 (b) >1

(c) <1 (d) 0.1

222. Which of the following parameters is increased by use of finned tube in a multipass shell and tube heat exchanger ?

(a) Tube side pressure drop and the heat transfer rate.

(b) Convective heat transfer co-efficient. (c) Effective tube surface area for convec-

223. For small temperature difference, the heat transfer rate as per Newton's law of cooling is proportional to

(a) Dt (b) Dt^2

(c) Dt^3

(d) t where, Dt = excess temperature

$C_p \cdot m$ is termed as the.....number.**224.**_K

(a) Grashoff

(c) Prandtl

(b) Nusselt (d) Stanton

225. Pick out the wrong statement.

(a) Heat transfer from a hot body to cold body by the emission of heat waves is called radiation.

(b) Filmwise condensation takes place on non-wettable surfaces.

(c) The boiling point of a solution is affected by liquid head as well as boiling point elevation.

(d) none of these.

226. While the total emissivity of a perfect black body is unity, the same for a real body is (a) 0 (b) 1

(c) >1 (d) between 0 and 1

227. Absorptivity of a perfect black body is unity. Which of the following has maximum absorptivity ?

(a) aluminium foil (b) refractory bricks (c) iron plate (d) coke breeze

228. Convective heat transfer, in which heat is transferred by movement of warmed matter is described by

(a) Fourier's law

(b) Newton's law of cooling

(c) Fick's law

(d) none of these

229. $h.D/K$ is called the.....number. (a) Nusselt (b) Peclet

(c) Rayleigh (d) Grashoff

230. A graph between.....is called Wilson plot. (a)

11 (b) 11

$v^{0.8} U^V S U_{UVs.v^{0.8}}$

tive heat transfer. (c) $v^{0.8} V_s U$ (d) 11

V_s .

UV

(d) All (a), (b) and (c).

ANSWERS

214. (b) 215. (a) 216. (a) 217. (c) 218. (c) 219. (c) 220. (b) 221. (c) 222. (d) 223. (a)

224. (c) 225. (b)

226. (d) 227. (d) 228. (b) 229. (a) 230. (a)

231. $(N_{Re} \cdot N_{Pr}) (D/L)$ is called the.....number. (a) Peclet (b) Stanton

(c) Graetz (d) none of these

232. In a single evaporator system, the steam economy.....by creating vacuum in the evaporator.

(a) increases

(b) decreases

(c) remains constant

(d) may increase or decrease, depends on the vacuum

233. Which of the following has the minimum absorptivity ?

(a) Aluminium foil (b) Coal dust (c) Refractory bricks (d) Iron plates

234. Grashoff number, which is defined as

$bm T_{\infty})^{23} /^2$, is proportional to the $g.(T_s pL$
ratio of buoyancy force to.....force. (a) viscous (b) elastic
(c) inertial (d) none of these

235. Resistance to heat flow by conduction is pro- portional to

(a) t (b) $1/p$
(c) $1/A$ (d) all (a), (b) & (c) where, t & p are thickness & density of the material
respectively and A = area normal to the direction of heat flow.

236. Thermal diffusivity of a material

(a) has the unit m^2/sec .
(b) is defined as $K/p \cdot Cp$.
(c) is the ratio of thermal conductivity to

thermal capacity.

(d) all (a), (b) and (c).

237. Which of the following has the minimum thermal conductivity ?

(a) Nitrogen (b) Steel
(c) Carbon black (d) Tar

238. Heat transfer rate described by Fourier's law will decrease, if
the.....increases.

(a) thermal conductivity
(b) thickness
(e) temperature difference
(d) heat transfer area

239. Mode of heat transfer in which the fluid moves under the influence of
changes in fluid pressure produced by external work is called (a) radiation
(b) natural convection composition

ANSWERS

231. (c) 232.(a) 233.(a) 234.(a) 235.(d) 236.(d) 237.(a) 238.(d) 239.(c) 240.(b)
241.(b) 242.(c)
243.(a) 244.(b) 245.(b) 246.(b)

(c) forced convection

(d) conduction

240. With increase in temperature, the thermal conductivity of steel

(a) increases

(b) decreases

(c) remains unchanged

(d) increases exponentially

241. Fouling factor for a heat exchanger is given by

¹¹(a) $U_1 - U_2$ (b) $\frac{1}{U_1} - \frac{1}{U_2}$

$\frac{1}{U_1} - \frac{1}{U_2}$

¹²

(c) $\frac{1}{U_1} - \frac{1}{U_2}$ (d) $U_2 - U_1$

²¹

where, U_1 = heat transfer co-efficient of dirty surface U_2 = heat transfer co-efficient of clean surface

242. Steam economy in case of a triple effect evaporator will be

(a) 1 (b) < 1

(c) > 1 (d) between 0 and 1

243. In case of a multipass shell and tube heat exchanger, providing a baffle on the shell side.....the heat transfer rate.

(a) increases

(b) decreases

(c) does not affect

(d) may increase or decrease, depends on the

type of baffle

244. Tube expansion allowances exist in..... heat exchanger.

(a) multipass fixed tube sheet

(b) U-tube

(c) single pass fixed tube sheet

(d) none of these

245. If air (a non-condensing gas) is present in a condensing vapor stream, it will.....the condensation rate of vapor.

(a) increase (b) decrease

- (c) not affect
- (d) increase the condensing film co-efficient

as well as

246. With increase in temperature, the thermal conductivity of fresh lubricating oil

- (a) increases
 - (b) decreases
 - (c) remains unchanged
 - (d) may increase or decrease; depends on its
- 247.** Which of the following has maximum thermal conductivity at the same temperature? (a) Steel
- (b) Petrol
 - (c) Air
 - (d) All have the same conductivity

248. A backward feed multiple effect evaporator is better than forward feed for concentrating cold feed, because it provides

- (a) higher economy (b) lower capacity (c) both (a) & (b) (d) lower economy

249. Nusselt number (for forced convection heat transfer) is a function of the.....number. (a) Prandtl

- (b) Reynolds
- (c) both (a) & (b)
- (d) neither (a) nor (b)

250. Extended heat transfer surface like fins are used to increase the heat transfer rate. Fin efficiency is defined as the ratio of heat transferred across the fin surface to the theoretical heat transfer across an equal area held at the (a) surrounding temperature.

- (b) average temperature of the fin.
- (c) temperature of the fin end.
- (d) constant temperature equal to that of

the base.

251. In a co-current double pipe heat exchanger used for condensing saturated steam over the inner tube, if the entrance and exit conditions of the coolant are interchanged, then the rate of condensation will

- (a) increase

- (b) decrease
- (c) remain unchanged
- (d) either increase or decrease; depends on

the coolant flow rate

252. Fluid motion in the natural convection heat transfer between a solid surface and a fluid in contact with it, results from the

(a) existence of thermal boundary layer. (b) temperature gradient produced due to

density difference.

- (c) buoyancy of the bubbles produced at active nucleation site.
- (d) none of these.

253. The ratio of momentum diffusivity to thermal diffusivity is the.....number.

- (a) Prandtl (c) Stanton (b) Nusselt (d) Grashoff

254. For flow over a flat plate, the ratio of thermal boundary layer thickness, δ_t and hydrodynamic boundary layer thickness δ is equal to (a) N_{Pr} (b) $N_{Pr}^{1/3}$

(c)

N

$-1 -1/3$

$_{pr}$ (d) N_{pr}

where, N_{pr} = Prandtl number

255. Reynold's analogy states that

- (a) $N_{st} \propto f$ (b) $N_{st} \propto N_{Re}$ (c) $N_{Nu} \propto f$ (d) $N_{Re} \propto f$

256. Which of the following situations can be approximated to a steady state heat transfer system ?

(a) A red hot steel slab (having outside surface temperature as 1300°C) exposed to the atmospheric air at 35°C.

(b) 10 kg of dry saturated steam at 8 kgf/cm² flowing through a short length of stain- less steel pipe exposed to atmospheric air at 35°C.

(c) Boiling brine kept in open vessel when the bottom surface temperature of the vessel is maintained constant at 180°C .

(d) A sub-cooled refrigerant liquid at 8°C flowing at the rate of 6 Kg/minute through a copper pipe exposed to atmospheric air at 35°C .

257. The critical radius of insulation for a spherical shell is

(a) K/h_0 (b) $2K/h_0$

(c) h_0/K (d) $h_0/2K$

where, K = thermal conductivity of insulating material h_0 =heat transfer coefficient at the outer surface

258. The critical radius of insulation for cylindrical pipe is

(a) K/h_0 (b) $2K/h_0$

(c) h_i/K (d) $2h_i/K$

where, h_i = heat transfer coefficient at inside of the pipe

259. With increase in temperature, the thermal

conductivity of most liquids

(a) increases

(b) decreases

(c) remains same

(d) first increases upto a certain tempera-

ture and then becomes constant

260. With increase in temperature, the thermal conductivity of non-metallic amorphous solids (a) decreases

(b) increases

247.(a) 248.(a) 249.(c) 259.(b) 260.(b)

ANSWERS

250. (d) 251.(c) 252.(d) 253.(a) 254.(b) 255.(a) 256.(b) 257.(b) 258.(a) (c) remains constant

(d) first decreases upto certain temperature

and then increases

261. chart is known as transient heat conduction chart. (a) Dirhing's (c) Mollier's
(b) Heisler's (d) Cox

262. Radiator of an automobile engine is a type of heat exchanger.
(a) co-current
(c) counter-current (b) cross-current (d) direct contact

263. Nusselt number is a function of Prandtl number and.....number of fluid in natural convection heat transfer.
(a) Grashoff (c) Stanton (b) Biot (d) Reynolds

264. The absorptivity of a body is equal to its emissivity
(a) at a particular temperature.
(b) for circular bodies.
(c) under thermal equilibrium.
(d) none of these.

265. A perfect black body is a perfect.....of radiation.
(a) absorber
(c) both (a) & (b) (b) emitter
(d) neither (a) nor (b)

266. Heat flux, as defined in heat flow is analogous to.....in electricity flow.
(a) current (b) voltage (c) resistance (d) none of these

267. Film boiling occurs at.....pressure. (a) atmospheric (c) negative
(b) sub-atmospheric (d) very high

268. Boiling of milk in an open vessel is an example of.....boiling.
(a) film (b) sub-cooled (c) saturated nucleate (d) none of these

269. In Fourier's law, the proportionality constant is called the
(a) heat transfer co-efficient
(b) thermal diffusivity
(c) thermal conductivity
(d) Stefan-Boltzman constant

270. Thermal conductivity of a gas at low density,.....with increase in temperature. (a) decreases

(b) increases

(c) remains unchanged

(d) may increase or decrease; depends on the

gas

271. At constant temperature, the thermal conductivities of gases.....with rise in pressure.

(a) decrease

(b) increase

(c) remain unchanged

(d) may increase or decrease; depends on the

pressure

272. In case of heat transfer by conduction in a hollow cylinder,.....mean area is used to calculate the heat transfer rate.

(a) geometric (b) arithmetic

(c) logarithmic (d) either (a), (b) or (c)

273. Maximum heat transfer rate is achieved in.....flow. (a) co-current (c) turbulent (b) counter-current (d) laminar

274. With increase in porosity, the thermal conductivity of a solid substance

(a) increases

(b) decreases

(c) remains unchanged

(d) may increase or decrease; depends on the

solid

275. Stefan-Boltzman law applies to.....body. (a) black (b) white

(c) grey (d) any colour

276. Kirchoff 's law applies to.....radiation. (a) total

(b) monochromatic

(c) both (a) & (b)

(d) neither (a) nor (b)

277. The sum of reflectivity and absorptivity for an opaque body is equal to

(a) 0.5 (b) 1

(c) 0 (d) 2

278. Thermal conductivities of most of the liquids.....with rise in temperature. (a) increases

(b) decreases

(c) remains unchanged

(d) may increase or decrease; depends on the

liquid

279. Temperature profile in steady state heat transfer is

(a) asymptotic (b) hyperbolic

(c) parabolic (d) linear

ANSWERS

261. (a) 262.(d) 263.(a) 264.(d) 265.(c) 266.(a) 267.(d) 268.(a) 269.(c) 270.(b)
271.(a) 272.(c)

273.(c) 274.(b) 275.(a) 276.(c) 277.(b) 278.(b) 279.(d)

280. Heat transfer rate per unit area is called (a) high vacuum in the evaporator.

(a) thermal conductivity (b) high evaporation rate. (b) heat flux (c) foaming of the solution. (c) heat transfer co-efficient (d) high heat transfer rate. (d) thermal diffusivity **288.** Removal of.....heat is involved in the

281. Pick out the wrong statement: condensation of a vapor under saturated con(a) With change in temperature, the radiant ditions.

energy emitted by a black body remains (a) super (b) sensible unchanged. (c)

latent (d) both (b) & (c) (b) Absorptivity of a body approaches unity **289.** The ratio of velocity head to tube side return in case of diffuse reflection.

(c) Absorptivity of a perfectly black body is unity.

(d) Value of Stefan-Boltzman constant is

$4.876 \times 10^{-8} \text{ KCal/m}^2 \cdot \text{hr.}^\circ\text{K}^4$. **290.**

282. Electro-magnetic spectrum range, which is important for radiation varies from.....microns.

(a) 1 to 100 (b) 0.5 to 50

(c) 10 to 100 (d) 100 to 1000

loss in case of a multipass shell and tube heat exchanger is

(a) 2 (b) 1/2 (c) 4 (d) 1/4 If all the conditions and dimensions are same, then the ratio of velocity through the tubes of a double pass heat exchanger to that through the single pass heat exchanger is (a) 1 (b) 2 (c) 1/2 (d) 4 **283.** The ratio of total radiating power to the **291.** Double pipe heat exchangers are preferably absorptivity of the body depends upon

the.....as per Kirchoffs law.

- (a) wavelength of radiation
- (b) nature of the body
- (c) temperature of the body
- (d) none of these

284. Radiant energy received by a body is proportional to

- (a) d (b) d
- (c) d^2 (d) $d^{1.5}$

where, d = the distance between the object emitting radiation and that receiving it.

285. The main purpose of providing fins on heat transfer surface is to increase the useful, when

- (a) high viscosity liquid is to be cooled. (b) requirement of heat transfer area is low. (c) overall heat transfer co-efficient is very

high.

(d) a corrosive liquid is to be heated. In case of a multipass shell and tube heat exchanger, the temperature drop in the fluid (a) is inversely proportional to the resistance across which the drop occurs.

(b) and the wall are proportional to individual resistances.

(c) and the wall is not related.

(d) none of these.

293. 'Fouling factor' used in the design of a multipass (a) temperature gradient. shell and tube heat exchanger is a (b) mechanical strength of the equipment. (a) non-dimensional factor. (c) heat transfer area. (b) factor of safety. (d) heat transfer co-efficient. (c) conversion factor for individual film heat

286. Leidenfrost point is a term concerned with the transfer co-efficient to overall heat trans-

(a) condensation of the saturated vapor on a fer co-efficient.
cold surface. (d) none of these.

(b) concentration of a corrosive solution by **294.** The average heat transfer co-efficient over evaporation. the entire length of the plate (h_a) and the lo(c) heat transfer between two highly viscous cal heat transfer co-efficient (h_L), in case of liquids. heat transfer over a flat plate in Iminar zone (d) boiling of a liquid on a hot surface. is related as

287. In case of evaporators, liquid entrainment re(a) $h_a = 0.8h_L$ (b) $h_a = 2h_L$ sults primarily due to (c) $h_a = h_L$ (d) $h_a = 5h_L$

ANSWERS

280. (b) 281.(a) 282.(b) 283.(c) 284.(c) 285.(c) 286.(d) 287.(c) 288.(b) 289.(d)

290.(b) 291.(b)

292.(b) 293.(b) 294.(b)

295. Dropwise condensation is promoted on a/ an.....surface.

(a) glazed (b) oily

(c) coated (d) smooth

296. For the same heat transfer area and the terminal conditions, the ratio of the capacities of a single effect evaporator to a triple effect evaporator is

(a) 3 (b) 0.33

(c) 1 (d) 1.33

297. Which of'the following is not concerned with the heat transfer?

(a) Brinkman number

(b) Stanton number

(c) Schmidt number

(d) Peclet number

298. For a fluid flowing in an annulus space, the wetted perimeter for heat transfer and pressure drop are

(a) same (b) different (c) never different (d) linearly related

299. In a shell and tube heat exchanger, the height of 25 percent cut baffles is equal to

(a) $0.25 D$ (b) 0.75 (c) $0.50 D$ (d) none of these where, D = inside diameter of shell

300. It is not recommended to use a 1-2 shell and tube heat exchanger for a particular heat duty, whenever the LMTD correction factor is (a) >0.75 (b) <0.75 (c) < 0.50 (d) < 0.25

301. Which of the following is directly concerned with the heat transfer ?

(a) Strouhal number

(b) Sherwood number

- (c) Euler number
- (d) Grashoff number

302. Which of the following is concerned with both heat and mass transfer ?

- (a) Lewis relationship
- (b) Nusselt number
- (c) Kutateladze number
- (d) Froude number

303. Prandtl and Reynold's analogies are identical for Prandtl number value of

- (a) 0 (b) 0.5
- (c) 1 (d) 5

304. Heat transfer by.....may not necessarily require the presence of a medium.

- (a) conduction
- (b) natural convection
- (c) forced convection
- (d) radiation

305. Agitated film evaporator is suitable for con- centrating.....liquids.

- (a) foaming (b) viscous
- (c) very thin (d) corrosive

306. Terminal point temperature differences between fluids in case of a heat exchanger is termed as

- (a) approach.
- (b) log mean temperature difference. (c) arithmetic mean temperature difference.
- (d) geometric mean temperature difference.

307. Thickness of thermal boundary layer is more compared to that of hydrodynamic boundary layer, when the value of Prandtl number is (a) 1 (b) < 1 (c) > 1 (d) > 5

308. Pick out the wrong statement.

- (a) Swenson-Walker crystalliser is a batch crystalliser.
- (b) Super saturation of the solution is the driving potential for a crystal growth.
- (c) The liquor left after the removal of crystals from a solution is called mother liquor.

(d) The first stage of crystal formation is called nucleation.

309. In case of.....boiling, the bubbles formed on a submerged hot surface get absorbed in the mass of the liquid.

(a) nucleate (b) pool

(c) low pressure (d) none of these

310. Mechanical recompression evaporation is used in the production of

(a) alcohol (c) salt

(b) distilled water (d) fruits jam

311. Film condensation is promoted on a/an..... surface.

(a) oily (b) coated (c) clean & smooth (d) dirty

312. Pick out the wrong statement:

(a) The capacity of an evaporator is reduced by the boiling point elevation.

(b) Corrosive liquid is normally passed

ANSWERS

295. (b) 296. (c) 297. (c) 298. (b) 299. (b) 300. (b) 301. (d) 302. (a) 303. (c) 304. (d)

305. (b) 306. (a)

307. (b) 308. (a) 309. (b) 310. (b) 311. (c) 312. (d)

through the tubes in a shell and tube exchanger. the temperature distribution, is heat exchanger. the thermal conductivity. (c) Steam jet ejector is used for vapor (c) In unsteady state heat conduction, heat compression in a thermal recompression evaporator. rise.

(d) Heat sensitive materials should be concentrated in high pressure evaporators. Grashoff number is very important.

313. A wall has two layers of materials A and B; **320.** Minimum recommended baffle spacing in a shell and tube heat exchanger is about layers have the same thickness. The thermal (a) $0.2 D$ (b) $0.5 D$ conductivity of material A is twice that of B. (c) $0.66 D$ (d) $0.80 D$ Under the equilibrium, the temperature difference across the wall is 36°C . The temperature difference across the layer A is..... $^\circ\text{C}$.

321. The film coefficient is decreased due to the presence of non-condensing gases in the vapor. The film coefficient of superheated vapor as compared to that of saturated vapor is

314. A black body when hot, emits heat radiation (a) more of.....wavelengths. (b) less (a) small (b) large (c) same (c) all (d) one fixed (d) either more or less ; depends on the na

315. A hot body will radiate heat most rapidly, if ture of vapor its surface is (a) white & rough (c) white & polished

322. Thermal conductivity of a conducting solid

(b) black & rough material depends upon its (d) black & polished (a) temperature

316. If heat transfer rate varies with the time, it is (b) porosity termed as (c) both (a) & (b)

(a) forced convection (d) neither (a) nor (b)

(b) steady state conduction **323.** The separation of liquid droplets from the va(c) monochromatic radiation por is done by a/an.....in the evaporators. (d) none of these (a) steam ejector

317. Baffles are provided in heat exchangers to in- (b) entrainment separator crease the (c) compressor

(a) fouling factor (d) vacuum pump

(b) heat transfer area **324.** equation relates the thermal con(c) heat transfer co-efficient ductivity of a solid to its temperature. (a) heat transfer rate (a) Antonie (b) Kopp's

318. Pick out the wrong statement. (c) Lee's (d) Kistyakowski

(a) Reciprocal of the resistance to heat flow **325.** Heat transfer co-efficient (h) for a fluid is called thermal conductance. flowing inside a clean pipe is given by (b) Unit of thermal conductance is $W/^\circ K$. $5^{0.8}$ $m^{0.4}$

(c) Thermal conductance of a wall of thick h =

0.023
 KD

$\dot{C}_p$

. This is ness 'L', thermal conductivity 'k' and m heat flow area 'A' is
kL/A. valid for the value of N_{Re} equal to (d) none of these. (a) < 2100 (b) 2100 – 4000

319. Pick out the correct statement. (c) > 4000 (d) > 10000 (a) 1 kcal/hr.m. °C is equal
to 1 BTU/hr. **326.** Harmonic mean temperature difference is ft.°F. given by (b) In steady

state heat conduction, the only
property of the substance which deter

ANSWERS

313.(b) 314.(c) 315.(b) 316.(d) 317.(c) 318.(c) 319.(b) 320.(a) 321.(c) 322.(c)
323.(b) 324.(c) 325.(d) 326.(b)

(a)

$DDTT (b)^{2.DDTT}$

$_{12}$

$D - D^0_{12 \ 12}$

(c)

$D - DTT^{TT}_{12}$

$D - D$

()

$_{12}$

$2.DD12 (d) D - DTT$

$_{12}$

327. Pick out the wrong statement.

(a) The controlling resistance in case of heating of air by condensing steam is in
the air film.

(b) The log mean temperature difference (LMTD) for counter flow and parallel
flow can be theoretically same when any one of the fluids (hot or cold fluid)
passes through the heat exchanger at constant temperature.

(c) In case of a 1-2 shell and tube heat exchanger, the LMTD correction factor
value increases sharply, when a temperature cross occurs.

(d) Phase change in case of a pure fluid at a given pressure from liquid to vapor
or vice-versa occurs at saturation temperature.

328. The inside heat transfer co-efficient in case of turbulent flow of liquid in the tube side in a 1-2 shell and tube heat exchanger is increased by.....times, when the number of tube passes is increased to 8.

- (a) $2^{0.8}$ (b) $4^{0.8}$
(c) $4^{0.4}$ (d) $2^{0.4}$

In case of surface condensers, a straight line **329.** is obtained on plotting

$1/U$ vs on an ordinary graph paper.

- (a) $1/V$
(b) $V^{-0.8}$
(c) V^{-2} (d) $1/V^{-2}$

330. In a parallel flow heat exchanger, if the out-let temperature of hot and cold fluids are the same, then the log mean temperature difference (LMTD) is

- (a) minimum
(c) zero (b) maximum (d) infinity

331. The thermal radiation emitted by a body is proportional to T^n , where T is its absolute temperature. The value of 'n' is exactly 4 for (a) black painted bodies only

- (b) all bodies
(c) polished bodies only
(d) a black body

332. A body cools down from 75°C to 70°C in 10 minutes. It will cool down from 70°C to 65°C in.....minutes.

- (a) 10
(b) >10
(c) <10
(d) either (b) or (c), depends on the mass of

the body

333. A black body does not.....radiation. (a) absorb or emit (b) refract

- (c) reflect (d) both (b) & (c)

334. A hollow sphere and a solid sphere of the same material and equal radii are heated to the same temperature. In this case,
(a) the cooling rate will be the same for the

two spheres and hence the two spheres will have equal temperatures at any instant.

(b) both the spheres will emit equal amount of radiation per unit time in the beginning.

(c) both will absorb equal amount of radiation from the surrounding in the beginning.

(d) both (b) & (c).

335. Steam is routed through the tube in case of a.....evaporator.

(a) basket type

(b) horizontal tube

(c) short tube vertical

(d) long tube vertical

336. A.....evaporator employs an annular downtake.

(a) basket type (b) horizontal (c) long tube vertical (d) none of these

337. The purpose of providing bleed points in the evaporator is to

(a) admit the feed

(b) remove the product

(c) facilitate removal of non-condensable

gases

(d) create vacuum

338. Forced circulation evaporators are normally used for concentrating liquids having (a) scaling characteristics

(b) high viscosity

ANSWERS

327. (c) 328.(b) 329.(a) 330.(c) 331.(b) 332.(b) 333.(d) 334.(d) 335.(b) 336.(a)

337.(c) 338.(c) (c) both (a) & (b) **345.** Evaporation of 1kg of water from a

solu(d) neither (a) nor (b) tion in a single effect evaporator requires

339. Which of the following accessories is provided about.....kg of steam. in the vapor line of an evaporator for removal (a) 0.4 – 0.6 (b) 1 – 1.3

ing the entrained liquid ? (c) 1.8 – 2 (d) 2 – 2.4

(a) Bleed point (b) Vent **346.** In case of.....boiling, the liquid tem(c)

Catchall (d) Baffle perature is below the saturation temperature

340. Tubes are held between top and bottom tube and the boiling takes place in the vicinity of sheets in Calenderia type evaporator by the heated surface.

keeping (a) nucleate (b) local

(a) both the tube sheets fixed. (c) pool (d) saturated (b) both the tube sheets floating.

347. In a shell and tube heat exchanger, the shell (c) the top tube sheet floating and bottom side fluid velocity can not be changed by

tube sheet fixed. changing the (d) the top tube sheet fixed and the bottom (a) tube sheet floating. (c) tube layout tube pitch (b) tube diameter (d) no. of baffles

341. Which characteristic of a fluid is not impor- **348.** LMTD correction factor which is to be applied tant in deciding its route in a shell and tube for a cross-flow heat exchanger increases heat exchanger ? with increase in the number of shell passes. (a) Corrosiveness Its value for a single pass cross flow heat ex- (b) Fouling characteristic changer is

(c) Viscosity (a) 0 (b) 1 (d) None of these (c) >1 (d) < 1

342. Pick out the wrong statement. **349.** Overall thermal resistance for conductive

(a) Orifice baffles are never used in a shell heat transfer through a series of flat resis- and tube heat exchanger. tances is equal to the

(b) Pressure drop on the shell side of a heat (a) maximum resistance in the series. exchanger depends upon tube pitch also. (b) sum of all resistances.

(c) In a horizontal tube evaporator, surface (c) blanketing by air is avoided. (d) average of all resistances.

minimum resistance presents in the series.

(d) Split ring type and pull through type **350.** Pick out the wrong statement. floating heads are two commonly used (a) Superheated steam is preferably not floating heads iB heat exchangers.

used for process heating because of its

343. Black liquor generated during paper manufacture is concentrated in a (b) In a shell and tube heat exchanger, the (a) single effect evaporator.

(b) single effect evaporator followed by a

crystalliser. (c) shell pressure drop is maximum for orifice baffles.

S.I. unit of fouling factor is $\text{Watt/m}^2 \cdot \text{K}$.

(c) multiple effect evaporator. (d) Longitudinal fins are used in extended (d) multiple effect evaporators followed by a surface heat exchangers, when the direction of fluid flow is parallel to the axis of

344. Forced circulation evaporators are useful ^{the tube.}

for the concentration of viscous, salting and **351.** Steady state one dimensional heat flow by scale forming liquors. Which of the following conduction as given by Fourier's law does not is a forced circulation evaporator? assume that

(a) Long vertical evaporator (a) there is no internal heat generation. (b) Horizontal tube evaporator (b) boundary surfaces are isothermal. (c) Agitated film evaporator (c) material is anisotropic. (d) Calenderia vertical tube evaporator (d) constant temperature gradient exists.

ANSWERS

339. (c) 340.(a) 341.(d) 342.(a) 343.(c) 344.(c) 345.(b) 346.(b) 347.(b) 348.(d) 349.(b) 350.(c)

351.(c)

352. Open pan evaporators are preferred to be used, when the solution to be concentrated is (a) scaling (b) highly viscous (c) corrosive (d) salty

353. Steam consumption in kg/hr in case of an evaporator is given by

(a) C/E (b) E/C

¹(c) CE (d) CE

where, C & E are capacity the economy of the evaporator respectively

354. Pick out the wrong statement.

(a) By increasing the number of shell passes, the temperature cross in a shell and

tube heat exchanger can be prevented.

(b) An underdesigned steam trap will back up the condensate instead of discharging it out.

(c) Steam condensate is corrosive because of the presence of dissolved oxygen in it.

(d) Film boiling is desirable in commercial equipments due to high heat transfer rate at low temperature drop.

355. In case of a shell and tube heat exchanger, the minimum and maximum baffle spacing is respectively

(a) $D/5$ and D (b) $D/2$ and $2 D$ (c) $D/4$ and $2 D$ (d) D and $2 D$

where, D = inside diameter of the shell

356. Heat exchanger tubes are never made of (a) plain carbon steel (b) stainless steel (c) lead (d) copper

357. Which of the following has the lowest overall heat transfer co-efficient ?

(a) Dowtherm (b) Molten sodium (c) Water (d) Air

358. Pick out the wrong statement.

(a) The emissivity of a surface decreases, if it gets corroded by atmospheric environment. (b) The emissivity of a surface increases

with increase in surface roughness. (c) The emissivity of a polished surface is quite low.

(d) The emissivity of a non-metallic surface decreases with increase in the temperature.

359. Which of the following is generally considered as opaque surface towards radiations ? (a) Gases (b) Solids

(c) Liquids (d) Both (b) and (c)

360. Radiation energy is emitted by all the substances, which are above

(a) 0°K (b) 0°C

(c) 100°C (d) room temperature

361. Arithmetic mean area can be used in heat transfer problem to calculate the heat flow by conduction through a cylinder which is (a) thin walled having the value of $A_0/A_i < 2$. (b) thick walled.

- (c) having the value of $A_o/A_i > 2$.
 (d) both (b) and (c).

362. Pick out the wrong statement.

- (a) In case of heat transfer by purely forced convection,
 (b) The equivalent diameter of heat transfer for a duct of square cross-section (having each side as 'x') is equal to 4x.
 (c) Distillation process is not the same as evaporation.
 (d) The effectiveness of nucleate boiling depends basically on the ease with which the bubbles are formed and detached from the heating surface.

363. The thickness of condensate layer in filmwise condensation depends on the

- (a) condensation rate
 (b) surface configuration
 (c) liquid flow rate from the surface (d) all (a), (b) and (c)

364. The type of liquor circulation system to be employed in evaporators (viz. natural or forced circulation) is determined mainly by the.....of the liquid.

- (a) viscosity (b) density (c)
 (d)

thermal conductivity
 corrosive nature

365. In case of heat flow by conduction for a cylindrical body with an internal heat source, the nature of temperature distribution is (a) linear (b) hyperbolic (c) parabolic (d) none of these

366. jH factor for heat transfer is not a function of the.....number.

- (a) Reynolds (b) Nusselt (c) Grashoff (d) both (b) & (c)

367. When vaporisation takes place through a

ANSWERS

352. (b) 353.(c) 354.(d) 355.(a) 356.(c) 357.(d) 358.(a) 359.(d) 360.(a) 361.(a)

362.(b) 363.(d)

364.(a) 365.(c) 366.(d) 367.(d)

blanketting film of gas, the phenomenon is termed as.....boiling.

(a) pool (b) nucleate (c) transition (d) film

368. The outlet temperature of cooling water in a heat exchanger is generally not allowed to exceed above 50°C in industrial practice mainly to avoid

- (a) its evaporation loss
- (b) excessive corrosion
- (c) uneconomic LMTD
- (d) decrease in heat exchanger efficiency

369. Which of the following is not used as a medium for high temperature heating ? (a) Dowtherm

- (b) mercury
- (c) liquid metal (e.g. molten sodium) (d) fused salts (e.g., an eutectic mixture of 53% KNO_3 , 40% NaNO_2 and 7% NaNO_3)

370. Multiple effect evaporation is generally recommended, when the

- (a) large scale evaporation of liquor is needed. (b) corrosive liquids are to be concentrated. (c) fuel is cheaply available.
- (d) evaporation on small scale is to be done.

371. For gases, the thermal conductivity increases with temperature rise. For liquids, with increase in concentration, its thermal conductivity generally

- (a) decreases
- (b) increases
- (c) remains unchanged
- (d) increases exponentially

372. Pick out the wrong statement.

(a) The condensing film co-efficient is about 3 times lower for vertical condenser as compared to the equivalent horizontal condenser for identical situation.

(b) Film co-efficient for vaporisation decreases as a result of vapor binding.

(c) In industrial practice, sub-cooling of condensate is required, when the condensate is a volatile liquid and is to be transferred for storage.

(d) Overall heat transfer co-efficient in a heat exchanger is controlled by the value of the film co-efficient, which is higher. **373.** Nucleate boiling refers to the boiling mechanism below the critical temperature drop. The critical temperature

difference in boiling refers to a condition for which the.....is maximum. (a) heat flux attained
(c) boiling heat transfer co-efficient (d) all (a), (b) and (c)

374. The purpose of providing a 'catchall' in the vapor line of an evaporator is to
(a) create vacuum
(b) regulate the vapor flow
(c) vent the non-condensable gases
(d) arrest the entrained liquid

375. Pick out the wrong statement.

(a) The value of hydrostatic head increases with increase in vacuum in the effect in a multiple effect evaporator system.

(b) Entering velocity of the liquid in the
(c)

tubes of natural circulation evaporators is in the range of 0.3 to 0.9 metre/second. Duhring's plot is used for calculating the concentration of solution.

(d) In a multiple effect evaporation system, the number of effects is limited by the total boiling point rise.

376. LMTD for evaporators & condensers for a given terminal parameters & set of conditions for counterflow is equal to that for parallel flow. In such heat exchangers, with one of the fluids condensing or evaporating, the surface area required is the least in the..... flow.

(a) parallel
(b) mixed
(c) counterflow
(d) same in either 'a', 'b' or 'c'

377. The interchange factor for radiation heat transfer from surface 'x' to surface 'y' in case of an infinite parallel planes with emissivities e_x & e_y is given by

(a) $e_x + e_y$ (b) $e_x \cdot e_y$

(c)

$e e + - e e e e (d)_{x y x y x y}$

378. Low thermal conductivity of heat insulating materials is due to its

- (a) dense structure.
- (b) high proportion of air space.
- (c) high specific heat.
- (d) none of these.

ANSWERS

368. (b) 369. (b) 370. (a) 371. (a) 372. (d) 373. (a) 374. (b) 375. (c) 376. (d) 377. (d)

378. (b) **386.** Among liquids, water has a comparatively high value of thermal conductivity, due to its (a) low density (b) high viscosity (c) partial ionisation (d) dense structure

387. Heat transfer by conduction results due to the transfer of free electrons, kinetic energy & vibrational energy from one molecule to another. Conduction heat transfer can not take place

(a) between two bodies in physical contact

with each other.

(b) between two bodies not in physical contact with each other.

(c) from one part of a body to the another part of the same body.

(d) both 'a' & 'c'

388. Bulk of the convective heat transfer resistance from a hot tube surface to the fluid flowing in it, is

(a) in the central core of the fluid.

(b) uniformly distributed throughout the fluid.

(c) mainly confined to a thin film of fluid near the surface.

(d) none of these.

389. The main function of baffles provided in a shell and tube heat exchanger is to

(a) facilitate the cleaning of outer tube surface.

(b) enhance turbulence.

(c) hold the tubes in position.

(d) all 'a', 'b' & 'c'.

390. jH factor for heat transfer depends upon the.....number. (a) Biot

(c) Reynolds

(b) Nusselt (d) Prandtl

391. Value of Prandtl number for water ranges from

(a) 1 to 2 (b) 5 to 10

(c) 100 to 500 (d) 1000 to 2000

392. In a gas-liquid shell and tube heat exchanger, the

(a) presence of a non-condensable gas decreases the condensing film co-efficient.

(b) gases under high pressure are routed through the tube side, because high pressure gases are corrosive in nature.

(c) gases to be heated/cooled is normally **379**. Shell side pressure drop in a shell and tube heat exchanger does not depend upon the

(a) baffle spacing & shell diameter. (b) tube diameter & pitch.

(c) viscosity, density & mass velocity of shell

side fluid.

(d) none of these.

380. Water is normally used as a coolant in the heat exchange equipments

mainly because of its (a) abundance & high heat capacity (b) low density

(c) low viscosity

(d) high fluidity

381. A concentric double pipe heat exchanger as compared to the shell and tube heat exchanger for the same heat load requires

(a) less heating surface.

(b) more space.

(c) lower maintenance cost.

(d) none of these.

382. Extremely large or small volumes of fluids are generally best routed through the shell side of a shell and tube heat exchanger, because of the

(a) less corrosion problems.

(b) flexibility possible in the baffle arrange-

ment.

(c) low pressure drop.

(d) high heat transfer co-efficient.

383. Which of the following parameters of the fluid is not very important, while deciding its route in a shell and tube heat exchanger? (a) Corrosiveness & fouling characteristics (b) pressure

(c) viscosity

(d) density

384. Vacuum is generally maintained in the vapour space of an evaporator mainly to (a) get economical temperature difference by

using moderate pressure steam. (b) facilitate forward feeding in multiple effect evaporation.

(c) concentrate heat sensitive materials. (d) achieve very high concentration of the

final product.

385. The driving potential for the crystal growth during crystallisation is the.....of the solution.

(a) concentration (b) viscosity (c) super-saturation (d) density routed through the shell side, because

ANSWERS

379. (d) 380. (a) 381. (b) 382. (b) 383. (d) 384. (a) 385. (c) 386. (c) 387. (b) 388. (c)

389. (b) 390. (c)

391. (b) 392. (d)

the corrosion caused by the cooling water or steam condensate remain localised to the tubes.

(d) all 'a', 'b' & 'c'

393. Condensing film co-efficient for steam on horizontal tubes ranges from 5000 to 15000 Kcal/hr.m².°C. Condensation of vapor is carried out inside the tube in a shell and tube heat exchanger, when the

(a) higher condensing film co-efficient is desired.

(b) condensate is corrosive in nature. (c) lower pressure drop through the

exchanger is desired.

(d) temperature of the incoming vapor is very high.

394. A.....surface has the maximum thermal emissivity out of the following.

(a) black & smooth (c) white & smooth (b) black & rough (d) white & rough

395. 'Duhring's plot' is of use in

(a) extractive distillation

(b) evaporation

(c) leaching

(d) absorption

396. Dropwise condensation of steam on cooling surface is promoted

(a) on oily surface.

(b) when both the steam and the tube are clean.

(c) only in presence of air.

(d) none of these.

397. Boiling point elevation for a strong and concentrated solution is found by Duhring's rule, which states that at the same pressure, the boiling point of a solution is a linear function of the.....of pure water.

(a) boiling point

(b) dynamic viscosity

(c) kinematic viscosity

(d) density

398. A cube, sphere & a thin circular plate (all having same mass and made of same material) are all heated to 300°C and allowed to cool in natural air. Which one will cool the slowest ?

(a) Cube

(b) Plate

(c) Sphere

(d) All will cool at the same rate

399. A tank painted with which of the following coloured paints, would heat up maximum by radiation from sun ? (a) (c)

Yellow paint Black paint (b) White paint (d) Grey paint

400. The rate of emission of radiation by a body does not depend upon the

(a) wavelength of radiation.

(b) surface temperature of the body. (c) nature of the surface.

(d) shape and porosity of the body.

401. For a perfectly transparent surface (like gases), the

- (a) absorptivity = 0
- (b) transmissivity = 1
- (c) reflectivity = 0
- (d) all (a), (b) & (c)

402. Multiple effect evaporation is carried out to decrease the

(a) (c)

capital cost (b) working cost heat losses (d) evaporation time

403. Boiling point rise of a liquor in an evaporator is equal to

- (a) $T_{st} - T_f$
- (b) $T_{vap} - T_{solvent}$
- (c) $T_{solvent} - T_{solute}$

(d) $(T_{solvent} + T_{solute}) / 2$

where, T_f = Feed liquor temperature, T_{st} = Heating steam temperature T_{vap} = Vapor leaving temperature, T_{solute} = Boiling point of solute $T_{solvent}$ = Boiling point of solvent

404. Baffle spacing in a shell and tube heat ex- changer is generally kept as

- (a) shell diameter/2
- (b) 5 times tube sheet diameter
- (c) 10 times tube diameter
- (d) none of these

405. Out of the following, the best conductor of heat is

- (a) zinc (b) mercury
- (c) lead (d) sodium

406. The overall heat transfer co-efficient ' U ' for a composite wall of thicknesses x_1, x_2 & x_3 and of corresponding thermal conductivity k_1, k_2 & k_3 is given by the equation

- (a) $1/U = x_1/k_1 + x_2/k_2 + x_3/k_3$
- (b) $1/U = k_1/x_1 + k_2/x_2 + k_3/x_3$
- (c) $U = x_1/k_1 + x_2/k_2 + x_3/k_3$

(d) $U = k_1/x_1 + k_2/x_2 + k_3/x_3$

ANSWERS

393. (b) 394.(b) 395.(b) 396.(a) 397.(a) 398.(c) 399.(c) 400.(d) 401.(b) 402.(b)
 403.(b) 404.(d)
 405.(d) 406.(a)

407. Heat flows by conduction through a rod 1 m long and having a cross-sectional area of 10cm^2 . The thermal conductivity of the rod material is kW/m.K . The thermal resistance for the process is

(a) $1000/\text{K}$ (b) $\text{K}/1000$ (c) $1000 \cdot \text{K}$ (d) none of these

408. For heat transfer through a composite wall, overall resistance to heat transfer is (a) sum of the resistances

(b) product of the resistances

(c) a ratio of (sum of the resistances)/(product of the resistances)

(d) (sum of resistances)+(product of the resistances).

409. Air is

(a) an excellent heat conductor

(b) a poor heat conductor

(c) is a better heat conductor than steel (d) none of these.

410. The wall of an oven consists of two layers of insulating bricks. In between the layers there is an air gap. The presence of air gap will (a) cause an increase in heat transfer rate

through the composite wall

(b) cause a decrease in heat transfer rate

through the composite wall

(c) have no influence on the rate of heat transfer

(d) none of these

411. Forced convection is unimportant, when $(R_e \cdot P_r)^{1/2}$

(a) $\gg 1$ (b) $\ll 1$

(c) $= 1$ (d) none of these.

412. Natural convection is negligible when (a)

(
 $\frac{1}{2} \gg y (b) \left(\frac{1}{4} \right) \frac{R_p}{R_p} \gg 1$
 $(c) (R_p) \ll 1$ (d) none of these.

413. Consider heat loss through pipe insulation. At the critical radius, $r = r_c$, heat loss is
 (a) maximum (b) minimum (c) zero (d) none of these

414. The critical radius of insulation is given by the equation

$\frac{h}{a}$
 (a) $\frac{h_a}{k_i}$
 (b) $\frac{k_i}{h_a}$
 (c) $\frac{2k_i}{h_a}$
 (d) h_a

(K_i : thermal conductivity of insulation; h_a : film resistance at the external surface of insulation)

415. Prandtl number for dry gases is of the order of (a) 10^{-5} (b) 1
 (c) 100 (d) 105

416. In fin-tube heat exchanger; fins are provided on the tubes to increase heat transfer area. Now large fin effectiveness results from (a) large values of heat transfer coefficient (b) long fins (length measured in the direc-

tion of heat flow)
 (c) high values of thermal conductivity (d) all (a), (b) & (c)

417. Prandtl numbers for liquid metals are (a) higher than those for gases
 (b) higher than those for liquids
 (c) much lower than those for gases (d) in between those for gases and liquids.

418. In order to get large fin effectiveness, fins are so designed that
 (a) most of the fin operates at a surface tem-

perature very different from the fin root temperature.

(b) most of the fin operates at a surface temperature not very different from the fin root temperature.

(c) they provide large surface area for heat transfer, the operating temperature mentioned in part (a) & (b) is not important.

(d) none of these.

419. In a fin-tube heat exchanger, fins are placed on the side having

(a) maximum heat conductance

(b) minimum thermal resistance

(c) minimum heat conductance

(d) either (a) or (b).

420. Electromagnetic radiation that is of importance in heat flow has wavelength in the range of

(a) 5 to 10 m (b) 100 to 500 m (c) 0.5 to 50 μm (d) none of these

421. If the monochromatic emissivity of a body is the same for all wavelengths, the body is called a.....body.

ANSWERS

407. (a) 408. (a) 409. (b) 410. (b) 411. (b) 412. (c) 413. (a) 414. (d) 415. (b) 416. (c)

417. (c) 418. (b)

419. (c) 420. (c) 421. (a)

(a) gray (b) black

(c) white (d) none of these

422. A gray body is a substance having absorptivity (a) greater than one.

(b) less than one and independent of temperature.

(c) less than one and dependent on temperature.

(d) equal to one.

423. At temperature equilibrium, the ratio of the total radiating power of any body to the absorptivity of that body depends only on the temperature of the body. This is the statement of

(a) Planck's law

(b) Stefan-Boltzmann law

(c) Wien's displacement law

(d) Kirchhoff's law

424. A hot fluid at 150°C is to be cooled to 100°C in a double-pipe heat

exchanger by using a coolant which will be heated from 40°C to 80°C. If the hot and cold streams flow countercurrently, the driving force for heat transfer is.....°C.

(a) 52.9 (b) 64.9

(c) 75.0 (d) none of these

425. In question no.. 642, if the hot and cold streams flow cocurrently, the driving force for heat transfer is.....°C.

(a) 43.7 (b) 51.2

(c) 52.9 (d) 64.9

426. A cold fluid at 30°C is to be heated to 75°C in a double pipe heat exchanger by condensing saturated steam. The driving force for heat transfer for counter-current flow arrangement of the hot and cold streams is..... that for parallel flow.

(a) greater than

(b) less than

(c) equal to

(d) cannot be predicted, more information required

427. A hot fluid at 100°C is to be cooled to 60°C in a double pipe heat exchanger by using a coolant which will be heated from 30°C to 60°C. If the hot and cold streams flow concurrently, the driving force for heat transfer (by mean temperature difference) is equal to.....°C. (a) 0 (b) 30

(c) 40 (d) none of these

428. For a certain heat exchanger, when the dirt factor (deposited) is greater than the dirt factor (allowed), the heat exchanger

(a) delivers a quantity of heat more than

that required in the process.

(b) delivers a quantity of heat exactly equal to that required in the process.

(c) no longer delivers a quantity of heat equal to the process requirements and must be cleaned.

(d) none of the above is true; dirt factor is a fictitious thing; under no circumstances can be dirt factor (deposited) is greater than the dirt factor (allowed).

429. Which of the following tubes are most common in heat exchanger design?

- (a) 1/2 and 1½ inch OD tubes
- (b) 3/4 and 1 inch OD tubes
- (c) 1 and 2 inch OD tubes
- (d) 1 and 3 inch OD tubes

430. In a shell and tube heat exchanger, the baffle spacing is usually between

- (a) one tenth the inside diameter of the shell

and one fifth the inside diameter of the shell.

- (b) one fifth the inside diameter of the shell and the inside diameter of the shell.

(c) one half the inside diameter of the shell and twice the inside diameter of the shell.

- (d) none of these.

431. In a 1 – 2 shell and tube heat exchanger, relative to the shell fluid

- (a) one tube pass is in counterflow and the

other in parallel flow.

- (b) both tube passes are in counterflow. (c) both tube passes are in parallel flow.

- (d) none of the above is true; in a 1 – 2 shell

and tube heat exchanger, there are two passes for shell-side fluid and one pass for tube-side fluid.

432. When a temperature cross occurs in a 1 - 2 heat exchanger, the value of FT

- (a) drops sharply
- (b) increases rapidly
- (c) becomes zero
- (d) becomes negative

433. Larger temperature crosses are permissible in (a) 1-2 shell and tube exchangers

ANSWERS

422. (b) 423.(d) 424.(b) 425.(c) 426.(c) 427.(a) 428.(c) 429.(b) 430.(b) 431.(a)

432.(a) 433.(b) (b) 2-4 shell and tube exchangers

(b) same temperature crosses are permissible in both 1–2 and 2–4 exchangers; the question is, therefore, meaningless

(d) none of these

434. A 2 – 4 shell and tube heat exchanger is thermally.....two 1-2 exchangers in series. (a) superior to
(b) inferior to
(c) identical with
(d) may be any one of (a), (b), (c) depending

on the fluid flow characteristics **435.** When the temperature cross is too large to be allowed, a.....heat exchanger should be employed.

(a) 1 – 1 true counterflow shell and tube (b) 1 – 2 true shell-and tube
(c) 3 – 6
(d) 4 – 8

436. A gas at normal pressure is to be heated by steam in a 1 – 2 shell and tube heat exchanger. For this situation

(a) gas should be placed on the tube-side. (b) gas should be placed on the shell-side. (c) steam should be placed on the shell- side. (d) any one of the arrangements of (a), (b),

(c) will be equally effective and will have the same advantages/disadvantages.

437. A gas at high pressure is to be cooled by cooling water in a 1 – 2 shell and tube heat exchanger. For this situation,

(a) gas should be placed on the tube-side. (b) gas should be placed on the shell-side. (c) either of the two arrangements will be

equally effective.

(d) none of those.

438. Vapour of a pure substance is to be cooled from a certain temperature (higher than its dew point) to a temperature lower than its dew point. Heat transferred in this process (a) is only sensible heat

(b) is only latent heat

(c) are both sensible and latent heat (d) none of these

439. The heat transfer coefficient in dropwise con- densation is usually.....that in filmwise condensation.

(a) twice

- (b) four to eight times
- (c) twenty to thirty times
- (d) hundred to thousand times

440. The heat transfer coefficient for condensation of a pure vapour on a vertical tube is..... the condensing co-efficient on a horizontal tube.

- (a) more than (b) equal to (c) less than (d) unpredictable

441. For a counter-current heat exchanger the clean overall heat transfer coefficient is $500 \text{ W/m}^2\text{K}$ and the overall fouling factor is $0.00035 \text{ m}^2 \cdot \text{K/W}$. What will be the value of the design overall heat transfer coefficient $\text{W/m}^2\text{K}$

- (a) 485.6 (b) 425.5
- (c) 302.8 (d) none of these

442. Heat pipe is widely used now a days, because (a) it acts as an insulator. (b) it acts as conductor and insulator. (c) it acts as a superconductors. (d) it acts as a fin.

443. Consider two infinitely long black body con- centric cylinders with a diameter ratio $D_2/D_1 = 3$. The shape factor for the outer cylinder with itself will be

- (a) 0 (b) 13
- (c) 2/3 (d) 1

444. Which one of the following diagrams correctly shows the temperature distribution for a gas to gas counter flow heat exchanger?

445. Consider the following statements: The Fourier heat conduction equation,

$Q = kA.dT/dx$ presumes

- 1. Steady state conditions

ANSWERS

434. (c) 435.(a) 436.(a) 437.(a) 438.(c) 439.(b) 440.(c) 441.(b) 442.(b) 443.(b) 444.(a) 445.(b) 2. Constant value of thermal conductivity 3. Uniform temperature at the wall surfaces. 4. One dimensional heat flow of these state-

ments:

- (a) 1, 2 and 3 are correct

- (b) 1,2 and 4 are correct
- (c) 2, 3 and 4 are correct
- (d) 1, 3 and 4 are correct

446. If the temperature of solid surface changes from 27°C to 627°C , then its emissive power will increase in the ratio of

- (a) 3 (b) 9
- (c) 27 (d) 81

447. For the fully developed laminar flow and heat transfer in a uniformly heated long circular tube, if the flow velocity is doubled and the tube diameter is halved, the heat transfer coefficient will be

- (a) double of the original value.
- (b) half of the original value.
- (c) same as before.
- (d) four times of original value.

448. The radiative heat transfer rate per unit area (W/m^2) between two plane parallel gray surfaces (emissivity = 0.9) maintained at 400 K and 300 K is

- (a) 992 (b) 812
- (c) 464 (d) 567

449. A steel steam pipe 10 cms inner diameter and 11 cm outer diameter is covered with an insulation having a thermal conductivity of 1W/m.K . If the convective heat transfer coefficient between the surface of insulation and the surrounding air is $8\text{ W/m}^2\text{K}$, the critical radius of insulation is.....cm.

- (a) 10 (b) 11
- (c) 12.5 (d) 15

450. Air enters a counter flow heat exchanger at 70°C and leaves at 40°C . Water enters at 30°C and leaves at 50°C . The LMTD in $^{\circ}\text{C}$ is (a) 5.65 (b) 4.43

- (c) 19.52 (d) 20.17

451. In a condenser, water enters at 30°C and flows at the rate of 1500 kg/hr . The condensing steam is at a temperature of 120°C and cooling water leaves the condenser at 80°C . Specific heat of water is 4.187 kJ/kg.K . If the overall heat transfer coefficient is $2000\text{ W/m}^2\text{.K}$, the heat transfer area is..... m^2 . (a) 0.707

- (b) 7.07
- (c) 70.7 (d) 141.4

452. In case of one dimensional heat conduction in a medium with constant properties, T is the temperature at position x , at time t . Then is proportional to

- (a) T/x (b) dT/dx
(c) $d^2T/dx \cdot dt$ (d) d^2T/dx^2

Hot coil is cooled from 80 to 50°C is an oil **453.**

cooler which uses air as the coolant. The air temperature rises from 30 to 40°C. The designer uses a LMTD value of 26°C. The type of heat exchanger is (a) parallel pipe (c) counter flow (b) double pipe (d) cross flow

ANSWERS 446.(d) 447.(b) 448.(b) 449.(c) 450.(b) 451.(a) 452.(d) 453.(d)

Mass transFer

1. The unit of volumetric diffusivity is

- (a) cm^2/sec (b) cm/sec
(c) cm^3/sec (d) cm^2/sec^2

2. The diffusivity (D) in a binary gas mixture is related to the temperature (T) as

$\propto T^{0.5}$ (a) DT (b) DT

(c) $DT^{1.5}$ (d) DT^2 The diffusivity (D) in a binary gas mixture is **3.** related to the pressure (P) as

$\propto P^{0.5}$ (b) $D \propto P^1$ (a) $DP_{0.5P}$

^{1} (d) $D \propto P^1$ (c) $D \propto P^{1.5}$

4. Molecular diffusion is caused by the

- (a) transfer of molecules from low concentration to high concentration region.
(b) thermal energy of the molecules.
(c) activation energy of the molecules.
(d) potential energy of the molecules.

5. Pick out the correct statement.

- (a) Diffusivity decreases with increase in temperature.
(b) Diffusivity increases with increase in molecular weight.
(c) Diffusivity increases with the size of the individual molecule.
(d) none of these.

6. Mass transfer co-efficient is defined as

- (a) Flux = Co-efficient/concentration difference.
- (b) Co-efficient = Flux/concentration difference.
- (c) Flux=concentration difference/co-efficient.
- (d) none of these.

7. Mass transfer co-efficient (K) and diffusivity (D) are related according to film theory as

(a) KD (b) $\propto KD$

$\propto 1.5\propto$

(d) KD^2 (c) KD

8. Penetration theory relates the average mass transfer co-efficient (K) with diffusivity (D) as

$\propto$

(a) KD (b)

$\propto$

8

$$\propto (c) KD^{1.5} (d) KD$$

9. Corresponding to Prandtl number in heat transfer, the dimensionless group in mass transfer is the.....number.

(a) Schmidt (c) Peclet (b) Sherwood (d) Stanton

10. Schmidt number is given by

$$\frac{\mu}{\rho D_{AB}}$$

(b) Re.Pe

(c) Sh Pe (d) Re/Pe

11. In physical terms, Schmidt number means (a) (b) (c) (d)

thermal diffusivity/mass diffusivity. thermal diffusivity/momentum diffusivity.
momentum diffusivity/mass diffusivity. mass diffusivity/thermal diffusivity.

12. Corresponding to Nusselt number in heat transfer, the dimensionless group in mass transfer is the.....number.

(a) Sherwood (c) Peclet

(b) Schmidt (d) Stanton

13. Mass transfer co-efficient of liquid is

(a) affected more by temperature than that for gases.

(b) affected much less by temperature than

(c) (d)

that for gases.

not affected by the temperature. none of these.

14. For absorbing a sparingly soluble gas in a liquid, the

(a) gas side coefficient should be increased. (b) liquid side coefficient should be

increased. (c) gas side coefficient should be decreased. (d) liquid side coefficient should be decreased.

15. For contacting a highly soluble gas with a liquid (a) (b) (c) either (a) or (b) would suffice. (d) none of these.

bubble the gas through liquid. spray the liquid on gas stream.

ANSWERS

1. (a) 2.(c) 3.(c) 4.(b) 5.(d) 6.(b) 7.(a) 8.(b) 9.(a) 10.(a) 11.(c) 12.(a)
13.(a) 14.(b) 15.(a)

16. Wetted wall tower experiment determines (a) molal diffusivity.

(b) volumetric co-efficient.

(c) mass transfer co-efficient.

(d) none of these.

17. Lewis number (Le) is

(a) Sc Pr (b) Pr St (c) Sh Pr (d) St Sh

18. Stacked packing compared to dumped packing (a) provides poorer contact between the fluids. (b) gives lower pressure drop.

(c) both (a) and (b).

(d) gives higher pressure drop.

19. Channelling is most severe

(a) in towers packed with stacked packing. (b) in towers packed randomly with crushed

solids.

(c) in dumped packing of regular units. (d) at very high liquid flow rate.

20. Flooding results in

(a) high tray efficiency

(b) low tray efficiency

(c) high gas velocity

(d) good contact between the fluids

21. Operating velocity in a packed tower is usually.....the flooding velocity.

(a) half (b) twice

(c) equal to (d) more than

22. At the same gas flow rate, the pressure drop in a packed tower being irrigated with liquid..... that in dry packed tower.

- (a) is greater than
- (b) is lower than
- (c) is same as
- (d) cannot be predicted as data are insuffi-

cient

23. Berl saddle made of carbon cannot be used for (a) alkalis

(b) SO_2 (c) H_2SO_4

(d) oxidising atmosphere

24. Flooding in a column results due to

(a) high pressure drop

(b) low pressure drop

(c) low velocity of the liquid

(d) high temperature

25. The operating line for an absorber is curved, when plotted in terms of

(a) mole fractions (b) mole ratios (c) partial pressure (d) mass fractions

26. In case of an absorber, the operating

(a) line always lies above the equilibrium curve. (b) line always lies below the equilibrium curve. (c) line can be either above or below the equilibrium curve.

(d) velocity is more than the loading velocity.

27. For an absorber, both equilibrium and operating line will be straight for

(a) concentrated solution and non isothermal

operation.

(b) dilute solution and non isothermal operation. (c) dilute solution and isothermal operation. (d) concentrated solution and isothermal operation.

28. In case of a desorber (stripper), the

(a) operating line always lies above the equilibrium curve.

(b) operating line always lies below the equilibrium curve.

(c) temperature remains unaffected.

(d) temperature always increases.

29. The minimum liquid rate to be used in an absorber corresponds to an operating line (a) of slope = 1

(b) of slope = 0.1

(c) tangential to the equilibrium curve (d) none of these

30. Absorption factor is defined as

(a) S_2/S_1 (b) S_1/S_2

(c) $S_1 - S_2$ (d) $S_1 \times S_2$

where, S_1 = slope of the operating line

S_2 = slope of the equilibrium curve

31. If G = insoluble gas in gas stream and L = non-volatile solvent in liquid stream, then the slope of the operating line for the absorber is

(a) L/G (b) G/L

(c) always < 1 (d) none of these **32.** Raschig ring made of porcelain cannot be used

for treating concentrated

(a) hydrochloric acid (b) nitric acid

(c) alkalis (a) sulphuric acid **33.** For absorbers, high pressure drop results in

(a) increased efficiency.

(b) decreased efficiency.

(c) high operating cost.

(d) better gas liquid contact.

ANSWERS

16. (c) 17.(a) 18.(c) 19.(a) 20.(b) 21.(a) 22.(d) 23.(d) 24.(a) 25.(c) 26.(a) 27.(c)

28.(b) 29.(c) 30.(b) 31.(a) 32.(c) 33.(c)

34. Which of the following is an undesirable property for an absorbing solvent ?

(a) Low vapour pressure

(b) Low velocity

(c) Low freezing point

(d) None of these

35. Out of the following properties of a solvent for absorption, which combination of properties provides a good solvent ?

- I. High viscosity
- II. Low viscosity
- III. High vapour pressure
- IV. Low vapour pressure
- V. High gas solubility
- VI. High freezing point
- VII. Low freezing point

Choose from the following combinations :

(b) I, IV, V, VI (d) I, IV, V, VII (a) II, IV, V, VII (c) II, IV, V, VI

36. When both the fluids flow concurrently in an absorber, the slope of the operating line is (a) – ve (b) + ve

(c) 1 (d) – 1

37. In an absorber, HETP does not vary with the (a) flow rate of liquid

(b) flow rate of gas

(c) type and size of packing

(d) none of these

38. Which of the following is an undesirable property in a tower packing ?

(a) Large surface per unit volume.

(b) Large free cross-section.

(c) Low weight per unit volume.

(d) Large weight of liquid retained.

39. Very tall packed towers are divided into series of beds to

(a) reduce the overall pressure drop

(b) avoid channelling

(c) reduce liquid hold-up

(d) avoid flooding

40. For the same system, if the same liquid used in an absorber is decreased, the tower height will (a) increase

(b) decrease

(c) remain unaffected

(d) decrease or increase ; depends on the type

of liquid

41. HETP is numerically equal to HTU, only when the operating line

(a) lies below the equilibrium line.

(b) lies above the equilibrium line.
(c) and equilibrium lines are parallel. (d) is far from the equilibrium line.

42. Desirable value of absorption factor in an absorber is

- (a) 1 (b) <1
(c) >1 (d) 0.5

43. Co-current absorbers are usually used when the gas to be dissolved in the liquid is

- (a) sparingly soluble (c) a pure substance (b) highly soluble (d) a mixture

44. Humidification involves mass transfer between a pure liquid phase and a fixed gas, which is

- (a) insoluble in the liquid
(b) soluble in the liquid
(c) non-ideal in nature
(d) at a fixed temperature

45. At a fixed total pressure, humidity depends only on the

- (a) partial pressure of vapour in the mixture. (b) heat capacity of the vapour.
(c) density of the vapour.
(d) none of these.

46. In saturated gas, the

- (a) vapour is in equilibrium with the liquid at the gas temperature.
(b) vapour is in equilibrium with the liquid at the room temperature.
(c) partial pressure of vapour equals the vapour pressure of the liquid at room temperature.
(d) none of these.

47. Relative humidity is the ratio of the

- (a) partial pressure of the vapour to the vapour pressure of the liquid at room temperature.

(b) partial pressure of the vapour to the vapour pressure of the liquid at gas temperature.

(c) actual humidity to saturation humidity. (d) none of these

48. The percentage humidity is less than the relative humidity only at.....percent humidity. (a) zero
(b) hundred
(c) both zero and hundred
(d) none of these

ANSWERS

34. (d) 35.(a) 36.(a) 37.(d) 38.(d) 39.(b) 40.(a) 41.(c) 42.(c) 43.(c) 44.(a) 45.(a)
46.(a) 47.(b) 48.(c)

49. Heat in BTU necessary to increase the temperature of 1 lb of gas and its accompanying vapour by 1°F is called the
(a) latent heat (b) humid heat (c) specific heat (d) sensible heat

50. Humid volume is the total volume in m³ of 1 kg of
(a) vapour laden gas at 1 atm. and room temperature.

(b) gas plus its accompanying vapour at 1 atm. and room temperature.

(c) gas plus its accompanying vapour at 1 atm. and gas temperature.

(d) vapour laden gas at 1 atm. and gas temperature.

51. The temperature to which a vapour gas mixture must be cooled (at varying humidity) to become saturated is called the.....

57. The most efficient cooling tower out of the following is (a) (c)

induced draft natural draft (b) forced draft (d) atmospheric

58. In distillation, overhead product contains (a) (b) (c) (d)

only one component

two components

any number of components only saturated liquid

59. Boiling point diagram is (a) (b) (c) (d)

not affected by pressure.

affected by pressure.

a plot of temperature vs. liquid composition. a plot of temperature vs. vapour composition.

60. Raoult's law is applicable to the

temperature. (a) dew point (c) dry bulb (b) wet bulb
(d) none of these

(a) (b) (c) (d)

ideal solutions

real solutions

mixture of water and alcohol non ideal gases

61. Raoult's law applies to the

52. The dew point of a saturated gas phase equals the.....temperature. (a) gas
(c) wet bulb
(b) room
(d) none of these

(a) (b) (c)

all liquid solutions. non ideal solution only. non volatile solute.

53. Steady state temperature reached by a small amount of liquid evaporating into a large amount of unsaturated vapour-gas mixture is called the.....temperature.

(a) dry-bulb

(b) wet-bulb

(c) dew point

(d) adiabatic saturation

54. Dry bulb temperature of the gas is.....the (d) solvents.

62. Henry's law states that the (a)

(b)

(c)

partial pressure of a component over a solution is proportional to its mole fraction in the liquid.

partial pressure of a component over a solution is proportional to the mole fraction in the vapour.

vapour pressure is equal to the product of the mole fraction and total pressure.

wet bulb temperature. (a) less than

(c) equal to

(b) more than (d) none of these

55. When the temperature and humidity of air is low, we usually use.....draft cooling tower. (a) natural (c) induced (b) forced

(d) none of these

56. The equipment frequently used for adiabatic humidification-cooling operation with recirculating liquid is

(a) natural draft cooling tower (b) induced draft cooling tower (c) spray chamber

(d) none of these

(d) partial pressure is equal to the product of the mole fraction and total pressure.

63. Flash distillation is

(a) same as differential distillation.

(b) used for multicomponent systems like

crude refining.

(c) same as simple distillation.

(d) most useful for handling binary systems.

64. When the liquid phase and vapour phase of a binary system obeys Raoult's and Dalton's law respectively, the relative volatility is the ratio of (a)

(b)

vapour pressure of component A to that of component B.

vapour pressure of component A to the total pressure.

ANSWERS

49. (c) 50. (c) 51. (d) 52. (a) 53. (b) 54. (b) 55. (a) 56. (c) 57. (a) 58. (c) 59. (b) 60. (a)

61. (d) 62. (a) 63. (b) 64. (a)

(c) vapour pressure of component A to the partial pressure of A.

(d) partial pressure of component A to the total pressure.

65. Relative volatility does not change appreciably with the change in

(a) temperature

(b) vapour pressure of either component (c) total pressure

(d) none of these

66. In a binary system, separation is very efficient, when the relative volatility is

(a) 1 (b) >1

(c) <1 (d) 0.5

67. If a_1 and a_2 are the relative volatilities when the pressure in the distillation column is 1 and 2 atm respectively. Pick out the correct statement.

(a) $a_1 = a_2$ (b) $a_1 = 2a_2$ (c) $a_1 = 0.5 a_2$ (d) none of these

68. Positive deviation from Raoult's law means a mixture whose total pressure is

(a) greater than that computed for ideality. (b) less than that computed for

ideality. (c) less than the sum of the vapour pressure of

the components.

(d) none of these.

69. In azeotropic mixture, the equilibrium vapour composition is

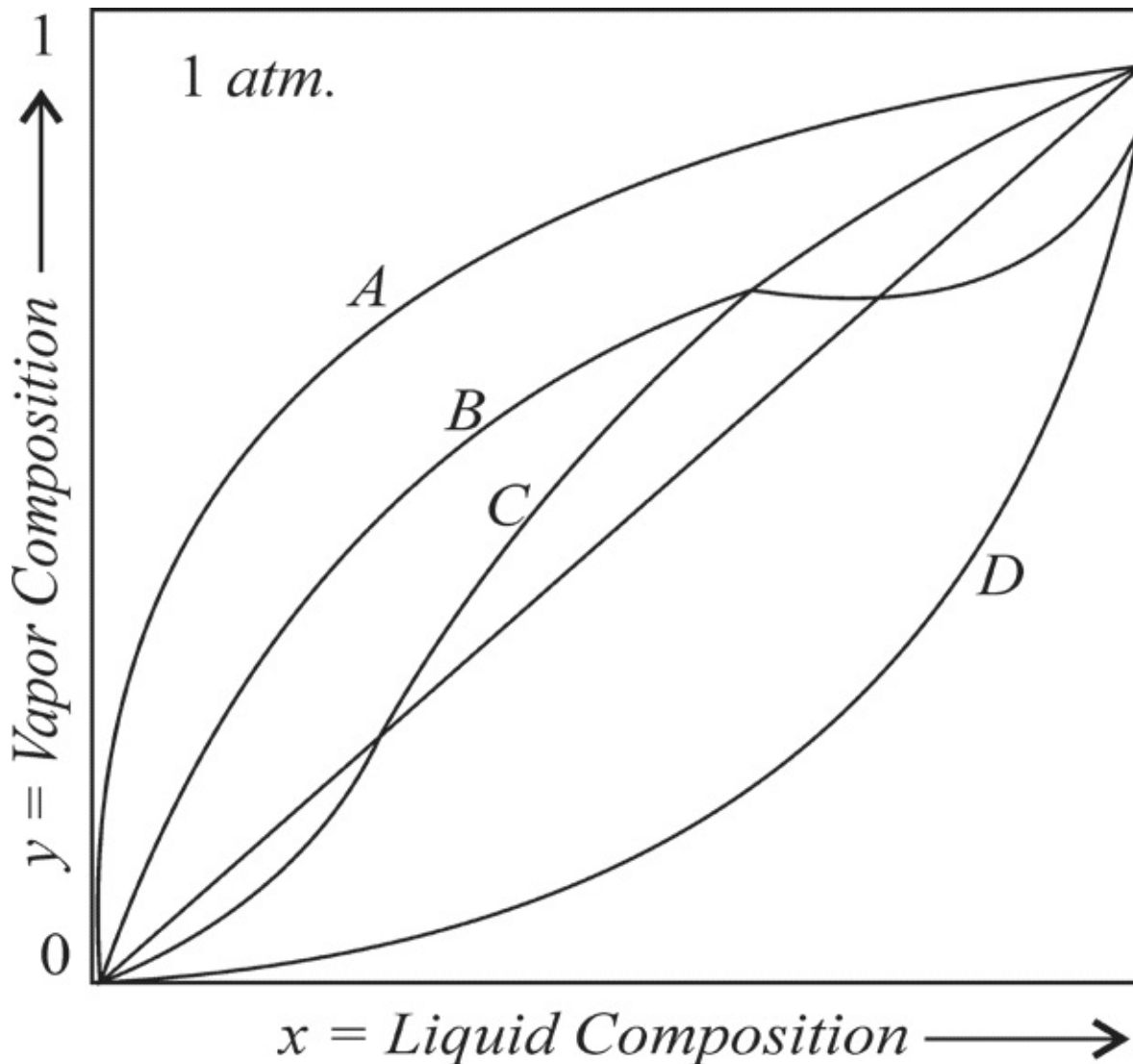
(a) more than liquid composition.

(b) less than liquid composition.

(c) same as liquid composition.

(d) independent of pressure.

70. Which of the following curves represents a minimum boiling azeotrope ?



71. In batch distillation with constant reflux, over- head product composition.....with time. (a) increases

(b) decreases

(c) does not vary

(d) may increase or decrease, depends on the

system.

72. In rectifying section of a continuous distillation column, the

(a) vapour is enriched with low boilers. (b) vapour is enriched with high boilers.

(c) liquid is stripped of high boilers.

(d) none of these.

73. For a binary mixture with low relative volatility, continuous rectification to get pure products will require

- (a) low reflux ratio
- (b) less number of trays
- (c) small cross-section column
- (d) high reflux ratio

74. Azeotropic distillation is employed to separate (a) constant boiling mixture.

- (b) high boiling mixture.
- (c) mixture with very high relative volatility. (d) heat sensitive materials.

75. For a binary mixture with low relative volatility, (a) use steam distillation.

- (b) use molecular distillation.
- (c) use high pressure distillation.
- (d) an azeotrope may be formed during distil-

lation.

76. Entrainer used in azeotropic distillation should

- (a) form a low boiling azeotrope with one of

the constituents of the mixture.

- (b) form a new azeotrope of low relative volatility with one of the constituents of the mixture.

(c) have high latent heat of vaporisation. (d) have high viscosity to provide high tray efficiency.

77. Alcohol is dehydrated using.....distillation. (a) extractive (c) steam

- (b) azeotropic (d) molecular

78. Rose oil is extracted from rose leaves using.....distillation.

- (a) high pressure (b) low pressure (c) extractive (d) steam

ANSWERS

65. (a) 66.(b) 67.(d) 68.(a) 69.(c) 70.(b) 71.(b) 72.(b) 73.(d) 74.(a) 75.(d) 76.(a) 77.(b) 78.(d)

79. In extractive distillation, solvent is

- (a) added to alter the relative volatility of the mixture.
- (b) of high volatility.

- (c) present in overhead stream.
- (d) of high viscosity to give high tray efficiency.

80. Molecular distillation is

- (a) high temperature distillation
- (b) for heat sensitive materials
- (c) very low pressure distillation
- (d) both (b) and (c)

81. In steam distillation, the

- (a) temperature is 100°C .
- (b) temperature is more than 100°C .
- (c) product must be immiscible with water, (d) temperature is higher than the boiling

point of either component.

82. Steam distillation is used to separate (a) azeotropes.

- (b) high boiling substances from nonvolatile

impurities.

- (c) heat sensitive materials.
- (d) mixtures of low relative volatility.

83. If the amount of the steam used in steam distillation is increased, the temperature of distillation

- (a) increases
- (b) decreases
- (c) remains unchanged
- (d) depends on relative volatility

84. High pressure at the bottom of a distillation tower handling heat sensitive materials results in

- (a) thermal decomposition of bottoms. (b) increased relative volatility.
- (c) erosion of the tower.
- (d) very efficient operation.

85. Components, having widely different boiling point in a binary mixture, can be separated using.....distillation.

(a) molecular (b) extractive (c) steam (d) simple

86. Which of the following assumes constant molal heat capacity?

(a) uses molal units for material and energy balance.

(b) uses weight fractions to express liquid and vapour composition.

(c) can use any type of units.

(d) is more accurate than Ponchan-Savarit method.

88. In stripping section of continuous distillation column, the

(a) liquid is stripped of high boiler.

(b) liquid is enriched with high boiler.

(c) vapour is stripped of low boiler.

(d) none of these.

89. Which of the following same diameter columns gives lowest pressure drop per unit height ?

(a) Bubble cap column

(b) Sieve plate column

(c) Packed column (stacked)

(d) Randomly packed column

90. The reflux to a distillation column is 100 moles/hr, when the overhead product rate is 50 moles/hr. The reflux ratio is

(a) 2 (b) 0.5

(c) 50 (d) 150

91. If f = moles of vapour present per mole of feed, then the slope of feed line is (McCabe-Thiele method)

$\frac{1-f}{f}$ (b) f^{-1} (a) f

—

1

f

(d) $-\frac{f}{1-f}$ (c) $\frac{1}{f}$

al vaporisation and overflow ? (a) McCabe-Thiele method

(b) Ponchan-Savarit method (c) Enthalpy concentration method (d) Plate absorption column

92. If f is defined as above, then which of the fol-

lowing applies to a feed at dew point ? (a) $f = 1$ (b) $f < 1$
 (c) $f > 1$ (d) $0 < f < 1$

93. When the feed to a distillation column is a saturated liquid, slope of the feed line is (a) zero (b) unity
 (c) infinity (d) none of these

94. Which of the following provides maximum contact surface for a liquid vapour system? (a) Packed tower
 (b) Bubble cap plate column
 (c) Sieve plate column
 (d) Wetted wall column

79.(a) 80.(d) 81.(c) 82.(b) 83.(b) 91.(c) 92.(a) 93.(c) 94.(a)

ANSWERS

84.(a) 85.(d) 86.(a) 87.(a) 88.(b) 89.(c) 90.(a) **95.** Which of the feed lines in the following diagram is for superheated vapour feed ?

96. If x_D = overhead product molal composition and R_D = reflux ratio, then slope and intercept of the operating line for rectifying section are respectively

$\frac{x_R}{R_D}$
 (b)
 $\frac{R}{R+1}$
 $\frac{x_D}{R+1}$
 (d) (c) (d)
 +
 ,
 $\frac{R}{R+1} \frac{x_D}{R+1}$

97. What is the reflux ratio at total reflux? (a) Zero (b) Infinity
 (c) Unity (d) Data insufficient

98. As the reflux ratio increases, the slope of the operating line for rectifying section
 (a) increases
 (b) decreases
 (c) remains constant

(d) data insufficient, cannot be predicted

99. In McCabe-Thiele method, at infinite reflux ratio (a) number of plates is maximum.

(b) overhead product is maximum.

(c) both the operating lines coincide with the

diagram.

(d) none of these.

100. Fenske equation determines the

(a) maximum number of ideal plates. (b) height of the distillation column. (c) minimum number of theoretical plates. (d) optimum reflux ratio.

101. At minimum reflux ratio for a given separation (a) number of plates is zero.

(b) number of plates is infinity.

(c) minimum number of the theoretical

plates is required.

(d) separation is most efficient.

102. For water-ethanol system, the minimum reflux ratio

(a) is computed from the slope of the upper

operating line that is tangent to the equilibrium curve.

(b) is computed from the intercept of the operating line.

(c) cannot be computed.

(d) is the optimum reflux ratio.

103. As the reflux ratio decreases, the

(a) separation becomes more efficient. (b) number of plates decreases.

(c) column diameter increases.

(d) none of these.

104. Absorption factor method is used to calculate the number of ideal stages, when

(a) operating line lies above the equilibrium

line.

(b) operating line lies below the equilibrium line.

(c) both operating and equilibrium lines are parallel.

(d) pressure drop in the column is very high.

105. Ponchan-Savarit method analyses the fractional equipment based on

(a) enthalpy balance only.

(b) material balance only.

(c) both enthalpy and material balances. (d) the assumption of constant molal overflow.

106. Reboiler is considered as one theoretical plate, because

(a) of the assumption that vapour and liquid

leaving the reboiler are in equilibrium. (b) vapour is recycled to the column. (c) reboiler itself contains one plate. (d) none of these.

107. To get high tray efficiency

(a) interfacial surface between liquid and gas phase should be large.

(b) time of contact between the two phases should be less.

(c) gas velocity should be very low.

(d) liquid entrainment should be severe.

ANSWERS

95. (a) 96. (b) 97. (b) 98. (a) 99. (c) 100. (c) 101. (b) 102. (a) 103. (b) 104. (c) 105. (c)

106. (a)

107. (a)

108. Overall efficiency of the distillation column is **116.** Channelling in a packed tower results from (a) the ratio of number of ideal plates to actual plates.

(b) the ratio of number of actual plates to ideal plates.

(c) same as the Murphree efficiency.

(d) always more than the point efficiency. **117.**

109. Priming in a distillation column

(a) results from very low gas velocity.

(b) is desirable from point efficiency consid- **118.** At what value of reflux ratio, number of

theo-

eration. retical plates in a distillation column is mini(c) is characterised by the presence of foam mum?
throughout the space between trays. (a) 0 (b) 1(d) reduces the overall pressure drop. (c) ∞

(d) <1110. Plate efficiency 119. Heat sensitive materials with very high la(a) is a function of the mass
transfer betent heat of vaporisation may be economitween liquid and vapour. cally separated using(b)
increases due to foaming. (a) liquid extraction(c) increases due to liquid entrainment. (c) evaporation
(b) distillation

(d) increases due to weeping and dumping of (d) absorption the

(a) high pressure drop

(b) maldistribution of liquid

(c) non uniformity of packing

(d) both (b) and (c)

Rayleigh equation applies to.....distillation. (a) differential (b) flash
(c) equilibrium (d) molecular

liquid. 120. Fractional solvent extraction 111. When the liquid over a plate is of
uniform concentration, then

(a)Murphree efficiency > point efficiency. (b)Murphree efficiency < point
efficiency. (c) Murphree efficiency = point efficiency. 121. (d)Murphree
efficiency $\neq$ point efficiency.

112. Tower diameter may be decreased by (a) using higher reflux ratio.

(b) use of increased tray spacing.

(c) increasing the liquid flow rate.

(d) increasing the vapour flow rate.

113. If the path of liquid across the plate is very long as in case of large diameter
tower, Murphree efficiency can be.....percent. (a) 100 (b) >100

(c) <100 (d) none of these

114. Back trapping in a distillation column (a) employs only one solvent

(b) employs two solvents

(c) results in low interfacial tension (d) none of these

Choose the best combination of properties for a good solvent for extraction out
of the following: (i)

(ii) (iii) (iv) (v) large distribution co-efficient (vi) small distribution co-efficient

(vii) (viii) (a) (i), (iv), (v), (vii) (b) (i), (iii), (v), (vi) (c) (i), (iii), (v), (vii) (d) (i),

(ii), (iv), (vii)

high selectivity low selectivity high viscosity low viscosity

high interfacial tension low interfacial tension

(a) increases tray efficiency. **122.** Selectivity of the solvent used in solvent ex(b) decreases tray efficiency.

(c) reduces pressure drop.

(d) is desirable, as it provides improved vapour liquid contact.^{123.}

115. Weeping in a distillation column

(a) increases tray efficiency.

(b) provides large interfacial surface for

mass transfer.

(c) results due to very high gas velocity. (d) results due to very low gas velocity. traction should be

(a) 1 (b) >1

(c) <1 (d) 0

In liquid extraction, if the selectivity is unity, then

(a) separation of the constituents is the most

effective.

(b) no separation will occur.

(c) amount of solvent required will be minimum. (d) solvent flow rate should be very low.

ANSWERS

108. (a) 109.(c) 110.(a) 111.(c) 112.(b) 113.(b) 114.(b) 115.(d) 116.(d) 117.(a) 118.(c) 119.(a)

120.(b) 121.(a) 122.(b) 123.(b)

124. When the solvent dissolves very little of solute, then

(a) solvent of low latent heat of vaporisation should be used.

(b) solvent of low freezing point should be used.

(c) large quantity of solvent is required to extract the solute.

(d) very small quantity of solvent is required.

125. Which of the following is the most suitable for extraction in a system having very low density difference?

- (a) Mixer settler extractor
- (b) Centrifugal extractor
- (c) Pulsed extractor
- (d) Packed extraction tower

126. The apex of an equilateral-triangular coordinate (in ternary liquid system) represents a/an (a) pure component
(b) binary mixture
(c) ternary mixture
(d) insoluble binary system

127. In a counter-current extractor, as the axial mixing increases, the extraction efficiency (a) increases
(b) decreases
(c) remains unchanged
(d) depends on the pressure of the system

128. The solvent used in liquid extraction should not have high latent heat of vaporisation, because (a) the pressure drop and hence the pumping cost will be very high.

(b) it cannot be recovered by distillation.

(c) its recovery cost by distillation may be prohibitively high.

(d) it will decompose while recovering by distillation.

129. In a counter current liquid extractor

(a) both liquids flow at fixed rate.

(b) both liquids can have any desired flow rate.

(c) only one of the liquids may be pumped at any desired rate.

(d) liquid's flow rate depends upon the temperature and pressure.

130. Sides of equilateral triangular co-ordinates (on which ternary liquid system is plotted) (a) a pure component.

(b) a binary mixture.

(c) a ternary mixture.

(d) partially miscible ternary system.

131. As the reflux ratio, in a continuous countercurrent extraction is increased, the number of stages

(a) increase

- (b) decrease
- (c) remain unchanged
- (d) can either increase or decrease, depends

on the system

132. Bollman extractor

(a) is a static bed leaching equipment. (b) is used for extraction of oil from oilseed.

(c) is a centrifugal extractor.

(d) employs only counter-current extraction.

133. Which of the following operations does not involve leaching ?

(a) Dissolving gold from ores.

(b) Dissolving pharmaceutical products

from bark or roots.

(c) Dissolving sugar from the cells of the beet.

(d) Removing nicotine from its water solution by kerosene .

134. Tea percolation employs

(a) liquid-liquid extraction

(b) leaching

(c) absorption

(d) none of these

135. Rate of leaching increases with increasing (a) temperature (c) pressure

(b) viscosity of solvent (d) size of the solid

136. Stage efficiency in a leaching process depends on the

(a) time of contact between the solid and the

solution .

(b) rate of diffusion of the solute through the solid and into the liquid.

(c) both (a) and (b)

(d) vapour pressure of the solution.

137. Physical absorption is

- (a) an irreversible phenomenon.
(b) a reversible phenomenon.
(c) accompanied by evolution of heat. (d) both (b) and (c)

represent

ANSWERS

124. (c) 125. (b) 126. (a) 127. (b) 128. (c) 129. (c) 130. (b) 131. (b) 132. (b) 133. (d)
134. (b) 135. (a)
136. (c) 137. (d)

138. Chemisorption (chemical adsorption) is (a) same as “Van der Waals” adsorption. (b) characterised by adsorption of heat. (c) an irreversible phenomenon.
(d) a reversible phenomenon.

139. Rate of adsorption increases as the
(a) temperature increases.
(b) temperature decreases.
(c) pressure decreases.
(d) size of adsorbent increases.

140. Which of the following adsorbent is used to decolourise yellow glycerine ?
(a) Silica gel (b) Alumina
(c) Fuller’s earth (d) Activated carbon

141. Freundlich equation applies to the adsorption of solute from
(a) dilute solutions, over a small concentration range.

(b) gaseous solutions at high pressure. (c) concentrated solutions.
(d) none of these.

142. The caking of crystals can be prevented by (a) maintaining high critical humidity. (b) maintaining low critical humidity. (c) coating the product with inert material. (d) both (a) and (c)

143. Powdery materials can be guarded against caking tendency on storage by
(a) providing irregular grain size.
(b) providing minimum percentage of voids. (c) having maximum possible points of contact. (d) none of these.

144. Critical humidity of a solid salt means the humidity
 (a) above which it will always become damp. (b) below which it will always stay dry. (c) both (a) and (b).
 (d) above which it will always become dry

and below which it will always stay damp.

145. Swenson-Walker crystalliser is a.....unit. (a) continuous
 (b) batch
 (c) semi-batch
 (d) cooling (adiabatic)-cum-evaporation

146. The vapour pressure exerted by the moisture contained in a wet solid depends upon the (a) nature of the moisture.
 (b) temperature.
 (c) nature of the solid.
 (d) all (a), (b) and (c).

147. To remove all the moisture from a wet solid , it requires exposure to.....air.
 (a) perfectly dry (b) (c) high temperature (d)

148. Milk is dried usually in a (a) freeze (b) spray
 (c) tray (d) rotary

149. Detergent solution is dried to a powder in (a) spray dryer
 (b) spouted bed dryer
 (c) tunnel dryer
 (d) pan open to atmosphere

150. If moisture content of solid on dry basis is X, then the same on wet basis is (a)

$X + 1$

$X_{(b)} X$

$1 - X$

$1 + X_{(d)} 1 - X_{(c)} X X$

151. In paper industry, paper is dried in a..... highly humid none of these

dryer.

dryer.

(a) tunnel (c) conveyor (b) heated cylinder (d) festoon

152. Moisture content of a substance when at equilibrium with a given partial pressure of the vapour is called the.....moisture. (a) free (b) unbound (c) equilibrium (d) bound

153. Calcium ammonium nitrate (a fertiliser) is dried in a.....dryer.
(a) rotary (b) vacuum (c) tunnel (d) tray

154. Moisture in a substance exerting an equilibrium vapour pressure less than that of pure liquid at the same temperature is called the.....moisture.
(a) bound (b) unbound (c) critical (d) none of these

155. Rotary dryers cannot handle.....materials.
(a) free flowing (b) dry
(c) sticky (d) granular

156. Moisture in a solid exerting an equilibrium vapour pressure equal to that of the pure

ANSWERS

138. (c) 139.(b) 140.(d) 141.(a) 142.(d) 143.(d) 144.(c) 145.(a) 146.(d) 147.(a)
148.(b) 149.(a)

150.(a) 151.(b) 152.(c) 153.(a) 154.(a) 155.(c) 156.(a)

liquid at the same temperature is called the.....moisture. (a) unbound
(c) free

(b) critical (d) bound

157. Refractory bricks are usually dried in a..... dryer.

(a) tray (b) tunnel (c) conveyor (d) festoon

158. Heat sensitive materials like certain pharmaceuticals and food stuffs can be dried in a/ an.....dryer.

(a) indirect tray (b) spray
(c) freeze (d) none of these

159. Moisture contained by a substance in excess of the equilibrium moisture is called the..... moisture.

(a) unbound (c) critical (b) free

(d) bound

160. Below is given an equilibrium moisture curve of a substance. State which regions represent free moisture and unbound moisture respectively.

- (a) II, III (b) II, IV
(c) IV, III (d) IV, II

161. Flights in a rotary dryer are provided to (a) lift and shower the solids thus exposing it thoroughly to the drying action of the gas.

(b) reduce the residence time of solid. (c) increase the residence time of the solid. (d) none of these.

162. In the constant rate period of the rate of drying curve for batch drying, (a) cracks develop on the surface of the solid. (b) rate of drying decreases abruptly. (c) surface evaporation of unbound moisture

occurs.

(d) none of these.

163. The falling rate period in the drying of a solid is characterised by

- (a) increase in rate of drying.
(b) increasing temperatures both on the surface and within the solid.
(c) decreasing temperatures.
(d) none of these.

164. Dryer widely used in a textile industry is.....dryer.

- (a) festoon (b) cylinder (c) conveyor (d) tunnel

165. Sticky material can be dried in a..... dryer.

- (a) tray (b) rotary
(c) fluidised bed (d) none of these

166. In case of steam distillation, the steam leaving the liquid is not completely saturated with distillate vapour, because

- (a) temperature is less.
(b) total pressure is less.

(c) mixing of steam with the material being vaporised is not so intimate as to result in equilibrium condition.

(d) saturated steam is used for steam distillation.

167. Percentage saturation is.....the relative saturation.

(a) always smaller than

(b) always greater than

(c) not related to

(d) none of these

168. Wet bulb and dry bulb temperatures becomes identical at.....percent saturation curve.

(a) 100 (b) 50

(c) 78 (d) none of these

169. Which of the following solutions will follow Raoult's law most closely ?

(a) A solution of benzene, toluene and o- xylene. (b) 35% solution of camphor in water. (c) 35% solution of NH₃ in water.

(d) A solution of polar organic compounds

(not of homologs of a series).

170. During sensible cooling process

(a) relative humidity decreases

(b) relative humidity increases

(c) wet bulb temperature decreases (d) both (b) and (c)

ANSWERS

157. (b) 158. (c) 159. (b) 160. (a) 161. (a) 162. (c) 163. (b) 164. (a) 165. (a) 166. (c)

167. (a) 168. (a)

169. (a) 170. (d)

171. Dew point of a gas-vapour mixture

(a) increases with temperature rise. (b) decreases with temperature rise. (c)

decreases with decrease in pressure. (d) increases with increase in pressure.

172. The relative saturation of a partially saturated mixture of vapour and gas can be increased by.....of the mixture.

(a) reducing the total pressure

(b) increasing the total pressure

- (c) reducing the temperature
- (d) both (b) and (c)

173. Condensation of a vapour-gas mixture just begins, when

- (a) $p = P$ (b) $p \gg P$
- (c) $p < P$ (d) $p \ll P$

where, p = partial pressure of the vapour P = vapour pressure of the liquid

174. Unsaturated air (with dry and wet bulb temperatures being 35 and 25°C respectively) is passed through water spray chamber maintained at 35°C. The air will be

- (a) cooled (b) humidified (c) both (a) & (b) (d) dehumidified

175. In case of unsaturated air

- (a) dew point < wet bulb temperature (b) wet bulb temperature < dry bulb temperature

- (c) both (a) and (b)
- (d) neither (a) nor (b)

176. Unsaturated air (with dry bulb temperature and dew point being 35°C and 18°C respectively) is passed through a water spray chamber maintained at 15°C. The air will be cooled (a) and humidified.

(b) and dehumidified with increase in wet

bulb temperature.

- (c) at the same relative humidity.
- (d) and dehumidified with decrease in wet

bulb temperature.

177. Which of the following parameters remains almost constant during adiabatic saturation of unsaturated air ?

- (a) Dry bulb temperature
- (b) Dew point
- (c) Wet bulb temperature
- (d) None of these

178. Which of the following parameters remains constant during chemical

dehumidification ? (a) Dry bulb temperature
(b) Partial pressure of vapour
(c) Wet bulb temperature
(d) None of these

179. Which of the following psychrometric processes is followed by water vapour laden unsaturated air, when it is passed through solid or liquid adsorbent ?

(a) Cooling and dehumidification.
(b) Heating and dehumidification at almost

constant wet bulb temperature. (c) Dehumidification with dry bulb temperature remaining constant.

(d) None of these.

180. In case of cooling towers, the ratio of the rates of heat and mass transfer is indicated by the.....number.

(a) Lewis (b) Grashoff (c) Sherwood (d) none of these

181. Can a cooling tower cool water below the wet bulb temperature of inlet air ?

(a) yes
(b) no
(c) yes ; but height of cooling tower will be

prohibitively high.

(d) yes ; but the air flow rate should be excessively high.

182. The cooling effect in a cooling tower can be speeded up by

(a) increasing the air velocity and area of exposed wet surface.

(b) reducing the barometric pressure. (c) reducing the humidity of the air. (d) all (a), (b) and (c).

183. The term “approach” in a cooling tower refers to the difference in the temperature of the (a) cold water leaving the tower and the wet

bulb temperature of the surrounding air. (b) hot water entering the tower and the wet

bulb temperature of the surrounding air. (c) hot water entering and the cooled water leaving the cooling tower.
(d) none of these

184. The term “cooling range” in a cooling tower refers to the difference in the temperature of (a) cold water leaving the tower and the wet

bulb temperature of the surrounding air. (b) hot water entering the tower and the wet bulb temperature of the surrounding air.

ANSWERS

171. (c) 172.(d) 173.(a) 174.(b) 175.(c) 176.(d) 177.(c) 178.(a) 179.(b) 180.(a) 181.(b) 182.(d) 183.(a) 184.(c)
(c) hot water entering the tower and the cooled water leaving the tower.
(d) none of these

185. Heat load in a cooling tower
(a) means the amount of heat thrown away

(KCal/hr.) by the cooling tower.
(b) is equal to the number of kg, of water circulated times the cooling range. (c) both (a) & (b).
(d) neither (a) nor (b).

186. Drift in a cooling tower is
(a) the water entrained by the circulating air. (b) dependent on the water lost by evaporation. (c) desirable.
(d) all (a), (b) & (c).

187. Blowdown in a cooling tower
(a) means discarding a small fraction of circulating water to prevent and limit the concentration of salt and impurities.

(b) increases the scale forming tendencies of water.
(c) is undesirable.
(d) all (a), (b) & (c).

188. Make up water is required in a cooling tower to replace the water lost by
 (a) evaporation
 (b) drift
 (c) blowdown and leakage
 (d) all (a), (b) and (c)

189. Diameter of raschig rings used in packed tower in industry is normally around..... inches.
 (a) 2 (b) 8
 (c) 12 (d) 18

190. Low viscosity absorbent is preferred for reasons of
 (a) rapid absorption rates and good heat

transfer characteristics.

(b) improved flooding characteristics. (c) low pressure drop on pumping.
 (d) all (a), (b) and (c).

191. Which of the following plays an important role in problems of simultaneous heat and **192.** Which of the following is not a unit of mass transfer co-efficient ?
 (a)
 (b)
 (c)

Moles transferred
(time)(area)(mole fraction) *Moles transferred*
(time)(area)(pressure)
Moles transferred
(time)(area)(mass A/mass B)

mass transfer ?

(a) Lewis number (b) Schmidt number (c) Prandtl number (d) Sherwood number
 (d) None of these

193. In case of absorption with exothermic reaction, for fluids having
 (a) $Pr = Sc$; percentage change in heat and

mass transfer flux will be the same for a given change in the degree of turbulence.

(b) $Pr = Sc = 1$; total mass, momentum and thermal diffusivity will be the same.

(c) both (a) and (b)

(d) $Pr = Sc$; there won't be any change in heat and mass transfer flux with changes in degree of turbulence.

194. In case of liquid-liquid binary diffusion, diffusivity of one constituent into another is not

dependent on the

(a) temperature and pressure

(b) concentration

(c) nature of the constituents

(d) none of these

195. Steady state equimolar counter diffusion is encountered in

(a) separation of a binary mixture by distillation.

(b) absorption of NH_3 from air by water. (c) all liquid-liquid diffusion systems.

(d) all liquid-solid diffusion systems.

196. Which of the following has the same dimension as mass diffusivity ?

(a) Momentum flux

(b) Kinematic viscosity

(c) Thermal diffusivity

(d) Both (b) and (c)

197. The value of Lewis number ($Le = Sc/Pr$) for air water vapour system is around (a) 1 (b) 0.24

(c) 3.97 (d) 600

185.(c) 186.(a) 187.(a) 188.(d) 189.(a) 197.(a)

ANSWERS

190. (d) 191.(a) 192.(d) 193.(c) 194.(d) 195.(a) 196.(d) **198.** Out of the following gas-liquid contacting devices, for a given set of operating conditions, gas pressure drop is the least in.....tower. (a) wetted wall (b) bubble cap (c) perforated tray (d) packed

199. Only small amount of evaporation of water produces large cooling effects because of its (a) large latent heat (b) low viscosity (c) small latent heat (d) none of these

200. Absorption (liquid-gas system) with evolution of heat as compared to isothermal absorption results in

- (a) decreased solute solubility.
- (b) large minimum liquid to gas (L/G) ratio. (c) large number of trays.
- (d) all (a), (b) and (c).

201. In case of binary distillation, increasing the reflux ratio above optimum does not result in the increase of

- (a) area between operating line and 45° diagonal x-y diagram.
- (b) condenser and reboiler surfaces. (c) tower cross-section.
- (d) none of these.

202. If R_m is the minimum reflux ratio, the optimum reflux ratio may be around..... R_m . (a) 1.2 to 1.5 (b) 2.5 to 3 (c) 3 to 4 (d) 5

203. Which of the following mixtures does not form an azeotrope at atmospheric pressure? (a) Water-alcohol

- (b) Methyl alcohol-acetone
- (c) Butyl acetate-water
- (d) None of these

204. Unit of molal diffusivity is

- (a) $\text{cm}^2/\text{sec gm. mole}$
- (b) $\text{gm moles}/\text{cm}^2 \cdot \text{sec}$
- (c) $\text{gm moles}/\text{cm. sec}$
- (d) $\text{gm moles}/\text{cm}^2 \cdot \text{sec}$

205. In case of non-ideal gases and liquids, the molal diffusivity

- (a) varies inversely as the pressure. (b) varies directly as the pressure.
- (c) is independent of pressure.
- (d) is equal to the volumetric diffusivity.

206. Fenske's equation for determining the minimum number of theoretical stages in distillation column holds good, when the

- (a) relative volatility is reasonably constant. (b) mixture (to be separated) shows negative

deviation from ideality.

- (c) mixture (to be separated) shows positive deviation from ideality.
- (d) multicomponent distillation is involved.

207. McCabe-Thiele method of binary distillation does not assume that the
(a) sensible heat changes are negligible compared with latent heat changes.

- (b) molar latent heats of all components are equal.
- (c) heat of mixing is negligible.
- (d) none of these

208. Cox chart is useful in the design of
(a) distillation column (b) evaporator (c) dryer (d) crystalliser

209. Drying of a solid involves.....transfer. (a) only heat
(b) only mass
(c) both heat and mass
(d) none of these

210. Pick out the correct statement.
(a) For identical gas flow rates, less pressure drop occurs through a plate tower than through a packed tower.

(b) Plate column can handle greater liquid loads without flooding than packed column, but the liquid hold up is more in the case of plate column.

(c) For the same duty, plate columns weigh less than packed columns.
(d) all (a), (b) and (c).

211. A solid material shows case hardening properties while drying. Which of the following should be controlled to control the drying process ?

- (a) Flow rate of inlet air
- (b) Relative humidity of outlet air
- (c) Humidity of inlet air
- (d) Temperature of the solid

212. Capacity of a rotary dryer depends on its

- (a) r.p.m
- (b) inclination with ground surface
- (c) both (a) and (b)

(d) neither (a) nor (b)

213. For ethanol-water system, the lowering of distillate quality from 95% to 92% will cause.....plate requirement.

ANSWERS

198. (a) 199.(a) 200.(d) 201.(a) 202.(a) 203.(d) 204.(c) 205.(c) 206.(a) 207.(d)
208.(a) 209.(c)

210.(d) 211.(d) 212.(c) 213.(b)

(a) no change in theoretical

(b) marginal decrease in the number of (c) major decrease in the number of (d)
none of these

214. The relative volatility of a binary mixture at constant temperature.....the total pressure.

(a) decreases with increase in

(b) increases with increase in

(c) is independent of

(d) none of these

215. The overall mass transfer co-efficient for the absorption of SO₂ in air with dilute NaOH solution can be increased substantially by (a) increasing the gas film co-efficient. (b) increasing the liquid film co-efficient, (c) increasing the total pressure.

(d) decreasing the total pressure.

216. Steam distillation is used to

(a) reduce the number of plates.

(b) avoid thermal decomposition of a component. (c) increase the efficiency of separation. (d) increase the total pressure of distillation.

217. The feed to fractionating column is changed from saturated vapour to saturated liquid. If the separation and reflux ratio remains un- changed, the number of ideal stages will (a) increase

(b) decrease

(c) remains same

(d) depend on saturated boiling point; may

increase or decrease

218. Air at a particular humidity is heated in a furnace. The new dew point

- (a) decreases
- (b) increases
- (c) depends on the extent of heating
- (d) remain unchanged

219. The critical moisture content in case of drying indicates the.....rate period. (a) beginning of falling

- (b) beginning of constant
- (c) end of falling
- (d) none of these

220. The wetted wall tower is used to determine (a) individual mass transfer coefficient

(M.T.C.) in gaseous system.

(b) M.T.C. of individual components in a liquid (c) M.T.C. of liquid in liquid-gas system. (d) the overall M.T.C. of the system.

221. Under conditions of flooding in packed tower, the gas pressure drop

- (a) decreases rapidly
- (b) increases rapidly
- (c) remains constant
- (d) is maximum

222. Can the efficiency of a plate in the distillation tower be greater than 100% ?

- (a) Yes
- (b) Normally not; but is possible if infinite

number of plates are put.

- (c) Never
- (d) Yes ; if the reflux ratio is maximum.

223. A slurry is to be dried to produce flaky solid. Which dryer would you recommend ? (a) Spray dryer (b) Drum dryer (c) Rotary dryer (d) Dielectric dryer

224. With decrease in the throughput (compared with the design capacity) for a bubble cap distillation column, its efficiency

- (a) increases
- (b) decreases
- (c) remains same
- (d) may increase or decrease ; depends on individual design

225. The relation, $Sc = Pr = 1$, is valid, when the mechanism of.....transfer is same. (a) heat and mass
 (b) mass and momentum
 (c) heat and momentum
 (d) heat, momentum and mass

226. Which of these columns incurs the lowest pressure drop ?
 (a) Packed column (with stacked packing) (b) Packed column (with dumped packing)
 (c) Bubble plate column
 (d) Pulse column

227. For the same feed, feed quality and separation (in a distillation column), with the increase of total pressure, the number of ideal plates will
 (a) increase
 (b) decrease
 (c) remain same
 (d) data insufficient, can't be predicted

uid-liquid system.

ANSWERS

214. (a) 215.(a) 216.(b) 217.(a) 218.(b) 219.(a) 220.(a) 221.(d) 222.(c) 223.(a)
 224.(a) 225.(a)
 226.(a) 227.(a)

228. In McCabe-Thiele method, at infinite reflux ratio
 (a) the overhead product is minimum. (b) both the operating lines coincide with diagonal.
 (c) both (a) and (b).
 (d) neither (a) nor (b).

229. In the absorption of ammonia in water, the main resistance to absorption is by the..... phase.
 (a) liquid
 (b) gas
 (c) both (a) & (b)

(d) neither (a) nor (b)

230. In the desorption of highly soluble gas from the liquid, the main resistance will be in the.....phase.

(a) gas

(b) liquid

(c) both (a) & (b)

(d) neither (a) nor (b)

231. At constant pressure, with increase of temperature, the dew point will

(a) increase

(b) decrease

(c) remain unchanged

(d) increase/decrease ; depends on the temperature

232. Nitrobenzene (boiling point = 210.6°C) is steam distilled at 1 atm pressure. Nitrobenzene will distill off..... $^{\circ}\text{C}$.

(a) at < 100

(b) at > 210.6

(c) between 100 and 210

(d) none of these

233. For a distillation column operating at minimum reflux, the

(a) concentration of liquid and vapour leaving a plate will be same.

(b) reflux ratio will be maximum.

(c) number of plates required will be maximum.

(d) none of these.

234. In a packed bed absorption column, the channelling will be noted by the

(a) increase in flow rate.

(b) sharp drop in pressure drop.

(c) sharp rise in pressure drop.

(d) none of these.

235. The efficiency of a plate column will be maximum, when the flow is ideal.....the plate.

(a) across

(b) above

(c) both (a) & (b)

(d) neither (a) nor (b)

236. When the mixture to be distilled has a very high boiling point and the product material is heat sensitive, the separation technique to be used is.....distillation.

(a) continuous (b) steam

(c) azeotropic (d) none of these

237. Extraction of coffee from its seed is done by (a) liquid-liquid extraction.

(b) leaching.

(c) extractive distillation.

(d) steam distillation.

238. Steam distillation is used for separation of high boiling

(a) substances from non-volatile impurities. (b) volatile impurity from still higher boiling

substances.

(c) both (a) and (b).

(d) neither (a) nor (b).

239. An azeotropic mixture is a.....mixture. (a) binary

(b) ternary

(c) constant boiling point

(d) none of these

240. Diameter to height ratio for a Raschig ring is (a) 1 (b) 0.5

(c) 2 (d) 8

241. Which of the following is considered equivalent to one theoretical stage in McCabe Thiele's method ?

(a) Partial condenser

(b) Total condenser

(c) Reboiler

(d) Both (b) and (c)

242. For continuous drying of granular or crystalline material, the dryer used is the..... dryer.

(a) tunnel (b) tray

(c) rotary (d) none of these

243. Small dia distillation column can be a (a) packed column (b) sieve tray (c) bubble cap (d) any of these

ANSWERS

228. (a) 229.(b) 230.(b) 231.(a) 232.(a) 233.(c) 234.(b) 235.(c) 236.(b) 237.(b) 238.(c) 239.(c)

240.(a) 241.(d) 242.(c) 243.(a)

244. The binary diffusivity in gases does not depend upon the

(a) pressure

(b) temperature

(c) nature of the components

(d) none of these

245. The binary diffusivity in gases at atmospheric conditions is about

(a) 10^{-9} cm/sec (b) 10^{-1} cm/sec (c) 10^{-3} sec/cm (d) 10^{-4} cm²/sec²

246. The diffusivity, D_{AB} (for component A diffusing in B) is equal to the diffusivity D_{BA} (for component B diffusing in A) for a binary mixture of

(a) Newtonian liquids

(b) non-Newtonian liquids

(c) ideal gases

(d) real gases

247. The Kundsén diffusivity is proportional to

(a) T (b) T^2

(c) T (d) T_4

where, T = absolute temperature

248. In a solution containing 0.30 Kg mole of solute and 600 kg of solvent, the molality is

(a) 0.50 (b) 0.60

(c) 2 (d) 1

249. The dimension of diffusivity is same as that of the

(a) density

(b) molal concentration

(c) kinematic viscosity

(d) velocity head

250. The binary diffusivity in gases and liquids vary respectively as

(a) $T^{3/2}$ and T (b) T and $T^{3/2}$

(c) T and $T^{3/2}$ (d) $T^{3/2}$ and T

251. The mass diffusivity, the thermal diffusivity and the eddy momentum diffusivity are same for, $N_{pr} - N_{sc} = \dots\dots\dots$

(a) 1 (b) 0.5

(c) 10 (d) 0

252. The cooling effect in a cooling tower can not be increased by

(a) increasing the air velocity over the wet

surfaces.

(b) reducing the humidity of entering air. (c) lowering the barometric pressure.

253. If mass diffusivity in a mixture is equal to the

thermal diffusivity, then the Lewis number is (a) 0 (b) 1

(c) < 1 (d) > 1

254. Schmidt number and Lewis number for pure air at atmospheric conditions are respectively (a) < 1 and $= 1$ (b) 1 and 0

(c) > 1 and $= 1$ (d) 0 and $= 1$

255. The adiabatic saturation curve for a vapour-gas mixture is

(a) straight line.

(b) slightly concave upward.

(c) slightly concave downward.

(d) none of these.

256. At the boiling point of the liquid at the prevailing pressure, the saturated absolute humidity becomes

(a) 1 (b) 0

(c) ∞ (d) none of these

257. The wet and dry bulb temperature for a vapour-gas mixture are 25°C and 30°C respectively. If the mixture is heated to 45°C at constant pressure, the wet bulb temperature will be..... $^\circ\text{C}$.

(a) 25 (b) > 25

(c) < 25 (d) $- 25$

258. In continuous distillation, the internal reflux ratio (R_i) and the external reflux ratio (R_e) are related as

$$(a) R_i = R_e (b) R_i = 1 - R_e (c) R_i = 1 + R_e (d) R_i = 1 - R_e$$

R

(c)

R

i

$= R$

e

(d)

R

i

$= 1 + R_e$

259. In a distillation column, with increase in the reflux ratio, the heat removed in the cooler (a) increases.

(b) decreases.

(c) remains unaffected.

(d) and the heat required in reboiler decreases.

260. Flooding in a distillation column is detected by a sharp

(a) increase in Murphree plate efficiency. (b) decrease in pressure drop.

(c) decrease in liquid hold up in the column. (d) increase in pressure drop.

(d) none of these.

ANSWERS

244. (d) 245. (b) 246. (c) 247. (a) 248. (a) 249. (c) 250. (a) 251. (a) 252. (d) 253. (b)

254. (a) 255. (b)

256. (c) 257. (b) 258. (d) 259. (a) 260. (d)

261. For a single component absorber, the operating line is straight only when plotted in term of.....units.

(a) partial pressure (c) mole fraction (b) mole ratio (d) none of these

262. The value of $N_A/(N_A+N_B)$, for steady state molecular diffusion of gas 'A' through nondiffusing gas 'B' is ∞ (a) 1 (b)

(a) 0.5 (d) 2

263. The value of $N_A/(N_A + N_B)$ for steady state equimolar counter diffusion of two gases 'A' and 'B' is ∞ (a) 1 (b)

(a) 0.5 (d) 2

264. In case of gases the binary diffusivity is proportional to (a) P

(c)

1 P

where, P = Pressure (b) $1/P$ (d) P

265. In case of liquids, the binary diffusivity is proportional to

(a) T (b) T

(c) T^2 (d) $1/T$

266. Mass transfer co-efficient is directly proportional to $D^{0.5}$, according to.....theory_{AB}

(a) penetration (b) surface renewal (c) film (d) none of these

267. Make up water is supplied during cooling tower operation to compensate for water losses due to

(a) evaporation (c) entrainment (b) blowdown

(d) all (a), (b) & (c)

268. When the the relative humidity of air decreases, despite an increase in the absolute humidity.

(a) temperature rises (b) (c) temperature falls (d) pressure rises pressure falls

269. The relative volatility of a binary mixture at the azeotropic composition is

(a) 1 (b) > 1

(c) 0 (d) ∞

270. Fenske-Underwood equation used for calculating the minimum number of theoretical plates in distillation column is valid for (a) constant molal overflow

(b) total reflux

(c) constant relative volatility

(d) all (a), (b) and (c)

271. For gas absorption, low viscosity solvents are preferred, because of their

(a) better flow characteristics.

(b) low pumping pressure drop.

- (c) rapid absorption rates.
(d) all (a), (b) and (c).

272. Absorption factor, for a fixed degree of absorption from a fixed amount of gas should be (a) 1 (b) > 1
(c) < 1 (d) < 1

273. To increase the absorption factor,
(a) increase both 'G' and 'S'.
(b) decrease both 'G' and 'S'.
(c) increase 'S' and decrease 'G'.
(d) increase 'G' and decrease 'S'.

where, G = gas flow rate, S = solvent flow rate **274.** Acetic acid will be most economically separated from a dilute solution of acetic acid in water by
(a) solvent extraction

- (b) continuous distillation
(c) evaporation
(d) absorption

275. Leaching of sugar from sugar beets is done by (a) hot water (b) hexane (c) dilute H_2SO_4 (d) lime water

276. Leaching of coffee from coffee beans is done by
(a) hot water (b) hexane
(c) lime water (d) dilute H_2SO_4 (hot)

277. With increase in temperature, the leaching rate increases due to
(a) decreased liquid viscosity
(b) increased diffusivity
(c) both (a) and (b)
(d) neither (a) nor (b)

278. Molecular sieves are regenerated by heating to..... $^{\circ}\text{C}$.
(a) < 150 (b) 200 – 330 (c) > 500 (d) > 1000

279. CO_2 can be absorbed by
(a) hot cupric oxide (b) heated charcoal (c) cold $\text{Ca}(\text{OH})_2$ (d) alumina

280. Molecular sieves are porous

(a) alumina.

ANSWERS

261. (b) 262.(a) 263.(b) 264.(b) 265.(a) 266.(a) 267.(d) 268.(a) 269.(a) 270.(d)

271.(d) 272.(b)

273.(c) 274.(a) 275.(a) 276.(a) 277.(c) 278.(b) 279.(b) 280.(c)

(b) silica.

(c) synthetic zeolites crystals/metal alumi- no-silicates.

(d) none of these.

281. The process employing desorption of the absorbed solute by a solvent is called

(a) elution (b) osmosis (c) reverse osmosis (d) sublimation

282. All moisture in a non-hygroscopic material is the.....moisture.

(a) free (b) equilibrium (c) unbound (d) bound

283. During constant rate..... period, the rate of drying decreases with the

(a) decrease in air temperature

(b) increase in air humidity

(c) both (a) and (b)

(d) neither (a) nor (b)

284. Leaching rate is independent of the (a) agitation (b) temperature (c) particle size (d) none of these

285. Paper industry employs driers. (a) cylinder (b) rotary

(c) spray (d) fluidised bed

286. Sand is dried in foundaries in a drier. (a) rotary (b) fluidised bed (c) vacuum (d) spray

287. Free flowing granular materials can be best dried in a.....drier.

(a) rotary (b) cylinder (c) drum (d) freeze

288. On addition of solute in the solvent, the..... of the solution decreases.

(a) boiling point (b) freezing point (c) vapour pressure (d) both (b) and (c)

289. Which of the following is a suitable absorbent for removal of H₂S from

natural gas ? (a) Vetrocoke solution
(b) Monoethanol amine (MEA)
(b) Dilute
(d) Hot water

290. The most economical range of absorption factor is
(a) 0 to 0.5 (b) 0 to 3
(c) 1.25 to 2 (d) 5 to 15

291. If the overall efficiency and Murphree plate efficiency are equal, then both the equilib- (a) straight (b) parallel
(c) both (a) & (b) (d) neither (a) nor (b)

292. Solvent used in extractive distillation

(a) changes the relative volatility of the original components.
(b) should be of high volatility.
(c) should form azeotropes with the original components.
(d) all (a), (b) and (c)

293. Inside the distillation columns, the

(a) highest temperatures is near the feed plate.
(b) driving force for the liquid flow is its weight.
(c) vapors are not always at their dew points.
(d) all (a), (b) and (c)

294. Inside the distillation column, the

(a) driving force for the vapour flow is the pressure drop.
(b) liquids are not always at their bubble points.
(c) pressure increases gradually from bottom to the top of the column.
(d) none of these

295. The operating cost of a distillation column at minimum reflux ratio is

(a) minimum (b) maximum
(c) infinite (d) zero

296. The fixed cost of a distillation column at minimum reflux ratio is

(a) minimum (b) infinite

(c) optimum (d) none of these **297.** Total reflux in a distillation operation requires minimum

(a) reboiler load (b) number of plates

(a) condenser load (b) all (a), (b) and (c) **298.** Pick out the system with maximum boiling

azeotrope at 1 atm.

(a) acetone chloroform

(b) ethyl alcohol-water

(c) benzene-ethyl alcohol

(d) none of these

299. Pick out the system with minimum boiling azeotrope at 1 atm.

(a) benzene-toluene

(b) ethyl alcohol-water

(c) hydrochloric acid-water

(d) all (a), (b) and (c)

rium and operating lines are

ANSWERS

281. (a) 282. (c) 283. (c) 284. (d) 285. (a) 286. (b) 287. (a) 288. (d) 289. (b) 290. (c)

291. (c) 292. (a)

293. (b) 294. (a) 295. (a) 296. (b) 297. (b) 298. (a) 299. (b)

300. Flash distillation is suitable for the separation of components

(a) having very close boiling points. (b) which form maximum boiling azeotrope. (c) having very wide boiling points. (d) which form minimum boiling azeotrope.

301. Separation of two volatile liquids by distillation makes use of their

(a) selectivity (c) solubility (b) relative volatility (d) density difference

302. Mass transfer co-efficient is directly proportional to DAB according to the.....theory. (a) film (b) penetration (c) surface-renewal (d) none of these

303. Mass transfer co-efficient varies as $DAB^{0.5}$, according to the.....theory.

(a) film (b) surface renewal (c) penetration (d) none of these

304. Lewis number, which is important in problems involving simultaneous heat and mass transfer, is the ratio of

(a) mass diffusivity to momentum diffusivity. (b) thermal diffusivity to mass diffusivity. (c) momentum diffusivity to thermal diffusivity.

(d) none of these.

305. Separation of a mixture of two gases by absorption in the liquid solvent depends upon the difference in their

(a) viscosity (b) density

(c) solubility (d) relative volatility

306. With increase in temperature, the mutual solubility of two liquids

(a) increases

(b) decreases

(c) remains unchanged

(d) decreases exponentially

307. In which of the following unit operations, the selectivity is an important parameter ? (a) Distillation (c) Absorption (b) Solvent extraction (d) None of these

308. At a given equilibrium pressure, with increase in temperature, the concentration of adsorbed gas on solid adsorbant

(a) increases

(b) decreases

(c) remains unchanged

(d) increases exponentially

309. Molarity is defined as the number of gm moles of solute per.....of solvent. (a) litre (b) kg

(c) gm (d) c.c

310. Molality is defined as the number of gm moles of solute per.....of solvent. (a) litre (b) gm

(c) Kg (d) m₃

311. N_{SC}/N_{Pr} is called the

(a) psychrometric ratio

(b) Lewis number

(c) Sherwood number

(d) Stanton number

312. The Schmidt number which is defined as, ...DAB, is the ratio of the

(a) momentum diffusivity to the mass diffusivity.

(b) thermal diffusivity to the mass diffusivity.

(c) momentum diffusivity to the thermal diffusivity.

(d) none of these.

313. According to Chilton-Colburn analogy for mass transfer,

N

ST

$-N$

$2/3$

s_C is equal to (a) f (b) $f/2$

(c) $2f$ (d) $1/f$

314. With increase in the liquid flow rate at a fixed gas velocity in a randomly packed counter current gas-liquid absorption column, the gas pressure drop

(a) decreases (b) remains unchanged (c) increases (d) decreases exponentially

315. With increase in temperature, the rate of extraction in leaching (solid-liquid extraction system)

(a) increases

(b) decreases

(c) remains unaffected

(d) increases linearly

316. With the lowering of equilibrium pressure, at a given temperature, the amount of adsorbate on the adsorbent

(a) increases.

(b) decreases.

(c) remains same.

(d) either (a) or (b), depends on the system.

317. With increase in pressure, the relative volatility for a binary system

(a) increases.

ANSWERS

300. (c) 301.(b) 302.(a) 303.(b) 304.(b) 305.(c) 306.(a) 307.(d) 308.(b) 309.(a)
310.(c) 311.(b)

312.(a) 313.(b) 314.(c) 315.(a) 316.(b) 317.(b)

(b) decreases.

(c) remains same.

(d) either (a) or (b), depends on the system.

318. With increase in temperature, the solubility of gases in liquids, at fixed pressure

(a) increases

(b) decreases

(c) remains same

(d) either (a) or (b), depends on the system

319. With increase in the mass velocity of the gas, the rate of drying during the constant rate period.....if the conduction and radiation through the solid are negligible, (a) increases

(b) decreases

(c) remains same

(d) increases linearly

320. The minimum number of theoretical plates is required for achieving a given separation in distillation column with

(a) no reflux

(b) total reflux

(c) zero reflux ratio

(d) minimum reflux ratio

321. In case of an unsaturated mixture of gas and vapor, the percentage saturation is.....its relative saturation.

(a) lower than

(b) higher than

(c) equal to

(d) either (a) or (b), depends on the mixture

composition

322. ($N_{Re} \cdot N_{Sc}$) is termed in mass transfer operation as the.....number. (a)

Stanton

(c) Peclet

(b) Sherwood (d) none of these

323. In case of an ideal solution, the total vapor pressure varies.....with the composition expressed as mole fraction.

(a) inversely (b) linearly (c) exponentially (d) none of these

324. In an absorption coloumn, the flooding velocity for random packing is.....that for stacked/regular packing.

(a) greater than

(b) smaller than

(c) equal to

(d) either (a), or (b) ; depends on the type of

packing

325. Pressure drop through plate tower as compared to that through packed tower, for the same duty will be

(a) less

(b) more

(c) equal

(d) either (a) or (b); depends on the packing

height

326. temperature is the steady state temperature attained by a small amount of liquid evaporating into a large quantity of

unsaturated gas-vapor mixture.

(a) Dry bulb (b) Wet bulb (c) Dew point (d) none of these

327. The-relative volatility for separation of a nonideal binary mixture by distillation should be (a) 0 (b) 1

(c) > 1 (d) < 1

328. Water-ethyl alcohol solution can be concentrated (in respect of alcohol concentration) by.....distillation.

(a) atmospheric (b) vacuum (c) high pressure (d) none of these

329. The relation among various mass transfer coefficients (M.T.C) for ideal gases is given by (a) $K_C = K_P = K_m$

(b) $K_C = K_p/RT = K_m \cdot RT/P$

(c) $K_C = K_p \cdot RT = K_m \cdot RT/p$

(d) none of these

where, K_C & K_m are M.T.C. for equimolar counter diffusion with concentration & mole fraction respectively as the driving force, and, K_p = M.T.C. for diffusion of a gas through a stagnant inert gas with pressure as driving force.

330. If a two phase system is in physical equilibrium; then it means that, the
(a) escaping tendency of each component

from the liquid phase to the vapor phase is exactly equal to that from vapor phase to liquid phase.

(b) temperature of the liquid phase is equal to that of the vapor phase.

(c) total pressure throughout the liquid phase is equal to that throughout the vapor phase.

(d) all (a), (b) and (c).

331. Which of the following is an undesirable characteristic for the solvent used in gas absorption ?

ANSWERS

318. (b) 319. (a) 320. (b) 321. (a) 322. (c) 323. (b) 324. (b) 325. (b) 326. (b) 327. (c)

328. (b) 329. (c)

330. (d) 331. (d)

(a) Low vapor pressure

(b) Low viscosity

(c) High gas solubility

(d) None of these

332. is the temperature at which a gas-vapor mixture becomes saturated, when cooled at constant total pressure out of contact with a liquid.

(a) Dew point

(b) Bubble point

(c) Dry bulb temperature

(d) Wet bulb temperature

333. The slope of the operating line for a single component co-current absorber

when plotted in terms of mole ratio units is

(a) 0 (b) ∞

(c) – ve (d) + ve

334. Pick out the correct statement.

(a) In case of liquid-liquid extraction, no separation is possible, if the selectivity of the solvent used is unity.

(b) With increase in temperature, the selectivity of the solvent used in solvent extraction decreases.

(c) The selectivity of solvent used in solvent extraction is unity at the plait point.

(d) all (a), (b) and (c).

335. Bound moisture is that liquid which exerts an equilibrium vapor pressure.....that of the pure liquid at the given temperature. (a) less than

(b) more than

(c) equal to

(d) either (a) or (b); depends on the solid

336. During constant rate drying period, vaporisation rate per unit drying surface area (a) decreases with time.

(b) increases with time.

(c) does not change with time.

(d) does not affect the moisture content of

the wet solid.

337. The temperature of water cooled in cooling tower is always.....temperature of enter

338. Which is not concerned directly with mass transfer ?

(a) Schmidt number

(b) Sherwood number

(c) Lewis relationship

(d) Froude number

339. Which of the following is directly concerned with psychrometry ? (a) (c)

Lewis relationship (b) Weber number (d) Galileo number Dean number

340. is concerned with the adsorption equilibria.

(a) (c)

Fick's law (b) Gibb's equation Freundlich equation (d) none of these

341. Danckwerts developed the.....theory. (a) penetration

(c) film (b) surface renewal (d) none of these

ing air.

(a) more than the wet bulb (b) less than the wet bulb (c) equal to the wet bulb (d)

equal to the dry bulb **342.** Liquid diffusivity is of the order of.....

cm²/second.

(a) 0.01 (b) 0.1

(c) 10⁻⁵ to 10⁻⁶ (d) > 1

343. is the separation technique used for desalination of sea water.

(a) Thermal diffusion

(b) Reverse osmosis

(c) Adsorption

(d) Absorption

344. Large scale drying of sugar is done in a..... dryer.

(a) spouted bed (b) tray

(c) rotary (d) truck

345. At.....reflux, theoretical number of plates in a distillation column is calculated using Fenske-Underwood equation.

(a) operating

(b) total

(c) minimum

(d) maximum permissible

346. Gaseous diffusivity at atmospheric pressure is of the order of.....cm²/second. (a) 1 (b) 1 to 5

(c) 5 to 10 (d) > 10

347. During the constant rate period of drying of a solid,

332. (a) 333.(c) 334.(d) 335.(a) 336.(c)

344.(c) 345.(b) 346.(a) 347.(c)

(a) increased air humidity decreases the rate of drying.

(b) increasing the air temperature decreases the drying rate.

ANSWERS

337.(a) 338.(d) 339.(a) 340.(c) 341.(b) 342.(c) 343.(b)

(c) surface evaporation of unbound moisture occurs.

(d) none of these.

348. In McCabe-Thiele method of theoretical plate calculation for a distillation column, the operating lines of stripping and rectifying sections coincide with the diagonal at.....reflux.

(a) total

(b) minimum

(c) operating

(d) maximum permissible

349. Dimension of mass diffusivity is the same as that of

(a) kinematic viscosity

(b) dynamic viscosity

(c) surface tension

(d) pressure

350. Gaseous diffusion co-efficient increases with increase in the (a) pressure

(c) both (a) & (b) (b) temperature

(d) neither (a) nor (b)

351. In a packed tower, the value of HETP equals HTUOG, when the equilibrium and the operating lines are (a) straight

(c) both (a) & (b) (b) parallel

(d) neither (a) nor (b)

where, HETP = height equivalent to a theoretical plate HTUOG = overall gas phase height of a transfer unit

352. With increase in temperature, the leaching

rate increases because of the

(a) increased diffusivity.

(b) decreased viscosity of liquid.

- (c) both (a) and (b).
- (d) neither (a) nor (b).

353. Decoction refers to the use of solvent (a) at ambient temperature
(b) at its boiling point
(c) in its vapor form
(d) none of these

354. Which of the following gas-liquid contacting devices incurs the least pressure drop for a particular duty ?
(a) Grid tray tower
(b) Perforated tray tower
(c) Wetted wall tower
(d) Bubble cap tower

355. Which of the following liquid-vapor contacting devices provides maximum contact surface area for a particular duty ?
(a) Sieve plate column
(b) Bubble cap column
(c) Randomly packed column
(d) Wetted wall column

356. Steady state equimolar counter diffusion occurs in case of
(a) leaching
(b) absorption
(c) binary phase distillation
(d) liquid-liquid extraction

357. columns are used for liquid dispersion in a continuous gas phase.
(a) Packed (b) Pulse
(c) Bubble cap (d) Sieve plate

358. Which of the following is not a batch drier? (a) Truck drier
(b) Agitated pan drier
(c) Fluidised bed drier
(d) Vacuum shelf drier

359. Which of the following is not a continuous drier ?
(a) Drum drier (c) Tunnel drier (b) Spray drier (d) Tray drier

360. The drying time between fixed moisture content within diffusion controlled 'falling rate period' is proportional to (assuming that drying occurs from all surfaces of the solid)

- (a) T (b) T
(c) T^2 (d) T^3

where, T = thickness of the solid

361. The drying time between fixed moisture contents within the 'constant rate period' is proportional to (assuming that drying occurs from all surfaces of the solid)

- (a) T (b) T
(c) $T^{1.5}$ (d) T^3

where, T = thickness of the solid

362. Hydrogenation of oil is carried out in a/an.....in Vanaspathi manufacturing plant.

- (a) agitated vessel
(b) sieve tray column
(c) bubble cap column
(d) packed tower

363. The main reason for dividing a tall packed tower into series of small towers is to

ANSWERS

348. (a) 349. (a) 350. (b) 351. (c) 352. (c) 353. (b) 354. (d) 355. (d) 356. (c) 357. (a)
358. (c) 359. (d)

360. (c) 361. (b) 362. (a) 363. (d)

- (a) minimise the overall pressure drop. (b) avoid flooding.
(c) reduce liquid hold up.
(d) avoid channeling.

364. Large scale drying of wheat is done in a..... dryer.

- (a) fluidised bed (b) spouted bed (c) tray (d) vacuum rotary

365. Rayleigh's equation applies to.....distillation.

- (a) continuous (b) steam
(c) differential (d) flash

366. Boiling point diagram is not affected by the ambient
(a) pressure (b) humidity (c) temperature (d) both (b) and (c)

367. equation applies to diffusivities in liquids.
(a) Gilliland (b) Hirschfelder (c) Wilke and Chang (d) none of these

368. The expression, $y(1 - x)/x(1 - y)$ is for (a) absorption factor
(b) relative volatility
(c) selectivity
(d) Murphree efficiency

369. In liquid-liquid extraction, the number of phases at plait point is
(a) 1 (b) 2
(c) 3 (d) 4

370. developed the film theory.
(a) Higbie (b) Fick
(c) Ergun (d) Levenspiel

371. The equilibrium liquid composition compared to the vapor composition in case of azeotropic mixture is
(a) more
(b) less
(c) same
(d) either more or less; depends on the system

372. With lapse of time, the overhead composition of light component in case of batch distillation with constant reflux
(a) increases
(b) decreases
(c) remains same
(d) may increase or decrease ; depends on

system.

373. Design calculation for multiple component distillation is done by
(a) Ponchon-Savarit method
(b) McCabe-Thiele method
(c) enthalpy concentration method (d) tray to tray calculations.

374. Large quantity of silica gel is normally dried in a.....dryer.

- (a) freeze
- (b) thorough circulation
- (c) rotary vacuum
- (d) tray

375. An ideal tower packing should not

- (a) have low weight per unit volume. (b) have large surface area per unit volume. (c) have large free cross-section. (d) hold up large amount of liquid in the

packing..

376. When the psychometric ratio is.....then the adiabatic saturation temperature and wet bulb temperature becomes equal.

- (a) 1 (b) < 1
- (c) > 1 (d) ∞

377. L/mG is the expression for

- (a) absorption factor
- (b) Brinkman number
- (c) slope of operating line in absorber (d) slope of operating line in stripper.

DP

378.

The equation,

N

$AB t$

A

$RTZ P$

$= -$

$P_{AA2} BM$

is for check the equation

(a) Fick's second law of diffusion.

(b) steady state diffusion for stagnant case. (c) liquid M.T.C. by Higbie penetration theory. (d) none of these.

379. Which of the following is not a continuous leaching equipment ?

- (a) (b) (c)

Pachuka tank

Kennedy extractor Bollman extractor

(d) Hydrocyclones

380. Reverse osmosis is also called

(a) dialysis (b) electrodilysis (c) diffusion (d) ultrafiltration.

381. Ordinary diffusion process is also called..... diffusion.

(a) pressure (b) thermal (c) concentration (d) forced.

ANSWERS

364. (b) 365.(c) 366.(d) 367.(a) 368.(b) 369.(a) 370.(a) 371.(c) 372.(b) 373.(d)

374.(b) 375.(d)

376.(a) 377.(a) 378.(b) 379.(a) 380.(d) 381.(c)

382. In case of absorption, both the operating and equilibrium lines will be straight for (a) isothermal operation.

(b) dilute solutions.

(c) dilute solutions and isothermal operation. (d) none of these.

383. When the gas to be dissolved in liquid is a/ an.....,then normally co-current adsorber are used.

(a) mixture of two gases

(b) pure gas

(c) ideal gas

(d) sparingly soluble gas

384. Chemisorption compared to physical adsorption has

(a) lower adsorption rate.

(b) lower capacity of the solvent for the solute gas.

(c) increased utilisation of stagnant zones of the liquid phase.

(d) none of these.

385. Packed column distillation is limited to the column.....metres.

(a) height < 6 (b) diameter < 0.6 (c) both (a) & (b) (d) neither (a) nor (b).

386. Langmuir equation is associated with (a) leaching

(b) adsorption

(c) steam distillation

(d) multicomponent absorption.

387. Calculation of mass transfer co-efficient is mostly/normally done

using.....theory. (a) surface renewal
 (b) film
 (c) penetration
 (d) none of these

388. The value of L/mG ratio for economical absorption operation ranges from
 (a) 0.5 to 0.8 (b) 0.8 to 1.2 (c) 1.25 to 2.0 (d) 2.5 to 3.5

389. Drying of refractory is normally carried out in a.....dryer. (a) open pan
 (c) rotary vacuum (b) tray
 (d) truck/tunnel.

390. The rough value of diffusion co-efficient of water vapor into air at 25°C may be about..... cm^2/sec .
 (a) 0.25 (b) 2.5

391. Minimum possible diameter of a packed coloumn is decided mainly by the
 (a) flooding (b) gas viscosity (c) liquid density (d) liquid hold up

392. In a vapor-liquid contacting equipment, the overall gas phase mass transfer co-efficient (M.T.C.), K_G is related to individual co-effi- cients (K_G and K_L) as
 $\frac{1}{K_G} = \frac{1}{K_G} + \frac{m}{K_L}$

$\frac{1}{K_G} = \frac{1}{K_G} + \frac{m}{K_L}$

(c)

1

$\frac{1}{K_G} = \frac{1}{K_G} + \frac{m}{K_L}$

(d)

K_G

K_L

$\frac{1}{K_G} = \frac{1}{K_G} + \frac{m}{K_L}$

K_G

$\frac{1}{K_G} = \frac{1}{K_G} + \frac{m}{K_L}$

393. For experimental determination of mass transfer co-efficient by wetted wall tower, the mass transfer area is
 (a) calculated (b) unknown (c) known (d) not required

394. A good solvent used for absorption should not have very high

(a) viscosity (b) vapor pressure (c) freezing point (d) all (a), (b) & (c)

395. Which of the following equipments is not used in liquid-liquid extraction ?

- (a) Pachuka tank
- (b) Agitated vessels
- (c) Centrifugal extractors
- (d) Packed towers

396. Penetration model (theory) for mass transfer was enunciated by (a)

- Danckwerts (c) Higbie
- (b) Toor and Marchello (d) Kissinevskii

397. Surface renewal model of mass transfer was enunciated by

- (a) Toor and Marchello (b) Fick (c) Danckwerts (d) Stefan

398. The film penetration model of mass transfer was enunciated by

- (a) Gilliland (b) Toor and Marchello (c) Stefan (d) Fick

399. The solvent used in liquid-liquid extraction should have.....less than one. (a) selectivity

- (b) distribution co-efficient
- (c) both (a) and (b)
- (d) neither (a) nor (b).

- (c) 1.25 (d) 0.0025

ANSWERS

382. (c) 383.(b) 384.(c) 385.(c) 386.(b) 387.(b) 388.(c) 389.(d) 390.(a) 391.(a)

392.(b) 393.(c)

394.(d) 395.(a) 396.(c) 397.(c) 398.(b) 399.(d)

400. A packed tower compared to a plate tower for a particular mass transfer operation (a) incurs smaller pressure drop.

(b) allows installation of cooling coils. (c) is less costly when built in large sizes/diameters.

(d) is more suitable, if suspended solids are present in fluid streams.

401. The reciprocal of stripping factor is termed as (a) selectivity index

- (b) relative volatility
- (c) absorption factor
- (d) Murphree efficiency

402. The slope of q-line is determined by the (a) reflux ratio
(b) plate efficiency to be achieved
(c) thermal condition of the feed
(d) relative volatility.

403. On moving the feed line (q-line) from saturated liquid feed (vertical position) to saturated vapor feed (horizontal feed), if the slope of both the operating lines are to be increased, then it will result in
(a) greater degree of separation with a fixed

number of trays
(b) increased reboiler load
(c) increased reflux ratio
(d) None of these

404. For.....drying, the effects of velocity, temperature and humidity of the gas and the thickness of the solid are the same.
(a) unsaturated surface
(b) constant rate
(c) both (a) and (b)
(d) neither (a) nor (b).

405. During drying of a solid, the critical moisture content increases with
(a) decreased drying rate
(b) increased thickness of the solid
(c) increased drying rate
(d) both (b) and (c).

406. column is used in gas absorption process.
(a) Wetted wall
(b) Seive/perforated tray
(c) Bubble cap
(d) Packed

407. In a moderately sized packed absorption tower, channeling (which is most severe with stacked packings) can be minimised by taking the ratio of tower diameter to packing diameter
(a) $> 4 : 1$ (b) $< 8 : 1$
(c) $> 8 : 1$ (d) $< 6 : 1$

408. Pick out the correct statement.

- (a) Bound moisture is removed during constant rate drying period.
- (b) Free moisture is removed during falling rate drying period.
- (c) The sum of free moisture and equilibrium moisture in a solid is called the critical moisture.
- (d) The driving force for mass transfer in a wet solid is its free moisture content.

409. number indicates the ratio of the rates of the heat and mass transfer in case of a cooling tower.

- (a) Sherwood (b) Stanton (c) Lewis (d) Peclet

410. Water entrained by circulating air in cooling towers is termed as

- (a) drift (b) blow down (c) vapor load (d) none of these.

411. In case of distillation, a solvent is added to alter the relative volatility of the mixture to be separated.

- (a) molecular (b) azeotropic (c) extractive (d) flash.

412. Drying operation under vacuum is carried out to

- (a) dry those materials which have very

high unbound moisture content. (b) reduce drying temperature.

- (c) increase drying temperature.

(d) dry materials having high bound moisture content.

413. As the reflux ratio in a distillation column is increased from the minimum, the

- (a) slope of the operating line in stripping

section decreases.

- (b) number of plates decreases very slowly

first and then more and more rapidly. (c) total cost first decreases and then increases.

- (d) liquid flow increases while the vapor flow decreases for a system.

414. For the same process conditions, the reflux ratio of an unlagged distillation column

ANSWERS

400. (a) 401.(c) 402.(c) 403.(c) 404.(c) 405.(d) 406.(d) 407.(c) 408.(d) 409.(c)
410.(a) 411.(c)

412.(b) 413.(c) 414.(b)

(a) decreases in winter

(b) increases in winter

(c) increases in summer

(d) none of these

415. Cox chart, which is useful in the design of distillation column particularly for petroleum hydrocarbons, is a plot of

(a) $\log P$ vs. T (b) $\log P$ vs. $\log T$ (c) T vs. P (d) P vs. $\log T$ where, P = vapor pressure, T = temperature

416. Unit operation involved in the prilling of urea is

(a) evaporation (b) drying

(c) crystallisation (d) both (b) and (c)

417. The most common packing used in industrial operations is.....rings.

(a) raschig (b) lessing (c) cross-partition (d) single spiral

421. Even though bubble cap towers are very effective for humidification operation, they are not used commonly in industries, because of the (a) high evaporation losses of water. (b) high pressure drop of the gas.

(c) difficulty in its fabrication.

(d) none of these.

422. A plait point is the point on the solubility curve, where the tie line reduces to a point. What is the number of plait point for a ternary system containing two pairs of partially miscible liquids ?

(a) 0 (b) 1

(c) 2 (d) 3

423. Mechanism of moisture removal in case of freeze drying of food stuff is by

(a) evaporation (c) dehydration (b) sublimation (d) adsorption

418. Experimental determination of.....is **424.** Equilibrium moisture of a solid is equal to the done by wetted wall column method. total moisture minus free moisture. Which of

the following substances will have maximum equilibrium moisture ?

(a) Anthracite coal (b) Rag paper (c) Bamboo (d) Inorganic solids

425. Humid volume, at a given temperature is a/ an.....function of humidity. (a) diffusion co-efficient

(b) mass transfer co-efficient

- (c) NTU
- (d) none of these

419. Plate towers are preferred to packed towers, when large temperature changes are involved, because of the reason that the

- (a) packing may be crushed due to thermal

expansion/contraction of the components of the equipments.

- (b) pressure drop in the equipment will be very high.
- (c) viscosity variation of the fluids may cause channeling/flooding.
- (d) none of these.

420. Pick out the wrong statement.

- (a) Packed towers are preferred for vacuum operation, because the pressure drop through the packing is less and they (packings) also lessen the possibility of tower wall collapse.

- (b) Packed towers are preferred over plate towers for handling corrosive and foamy liquids.

- (c) Diameter of randomly packed tower is normally more than 1.2 metres.

- (d) Due to uneven supply and improper distribution of liquid, problem of channeling, loading & flooding is generally encountered in packed towers.

(a) inverse (c) linear (b) exponential (d) logarithmic **426.** Azeotropism for ethyl alcohol-water system disappears by

- (a) increasing temperature

- (b) decreasing pressure

- (c) increasing pressure

- (d) no means

427. During drying operation, it is easier to remove the.....moisture.

- (a) equilibrium (b) critical (c) unbound (d) bound

428. A natural draft cooling tower is filled with wooden grids, which covers about..... percent of the tower height.

- (a) 10 – 15 (b) 30 – 40 (c) 70 – 80 (d) 90 – 100

429. Drying of a wet solid under constant drying conditions means the exposure of the wet solid to the air of constant

- (a) humidity (b) velocity (c) temperature (d) all (a),(b)&(c)

ANSWERS

415. (a) 416.(d) 417.(a) 418.(b) 419.(a) 420.(c) 421.(b) 422.(a) 423.(b) 424.(c)
425.(c) 426.(b)
427.(c) 428.(a) 429.(d)

430. Which of the following adsorbant is used in the refining of sugar ? (a)
Bone charcoal (b) (c) Silica gel (d) Wood charcoal Activated clay

431. For achieving rapid drying rate in a spray dryer, the diameter of the particles in the feed should be in the range of.....microns (1 mm = 1000 microns).

(a) 1 – 5 (b) 10 – 60 (c) 200 – 300 (d) > 500

432. For which of the following unit operations, Lewis number is of significance ?

(a) Adsorption (b) Binary distillation (c) Gas absorption (d) Humidification

433. Which of the following is the most commonly used leaching solvent in vegetable oil industry ?

(a) Phenol (b) Hexane (c) Furfurol (d) Liquid SO₂

434. extractor uses centrifugal force for separating the two phases.

(a) Treybal (b) Schiebel (c) Podbielniak (d) None of these

435. Pick out the wrong statement pertaining to the rotary dryer.

(a) Flights (located in the inside shell of rotary dryer) lift the material being dried and shower it down through the current of hot air/gases. It extends from the wall to a distance which is about 8-12% of the inside diameter of shell.

(b) Hold up of a rotary drier is defined as the fraction of the dryer volume occupied by the solid at any instant. The best performance for rotary drier is obtained, when the hold up is in the range of 0.05 to 0.15.

(c) Rotary dryer is suitable for drying sticky material.

(d) Recommended peripheral speed of a rotary drier is in the range of 10 to 30 metres/minute.

436. Occurrence of ‘case hardening’ during drying of a high moisture solid cake.....the drying rate.

(a) increases

(b) decreases

(c) does not affect

(d) exponentially increases

437. Psychrometry deals with the properties of gas-vapor mixture. Humidity can be determined by the measurement of the.....of a fibre.

- (a) electrical resistance
- (b) thermal conductivity
- (c) strength
- (d) none of these.

438. Most important factor to be considered in the selection of packings for absorbers is the.....of packing.

- (a) size (b) durability (c) porosity (d) cost

439. Mass transfer rate between two fluid phases does not necessarily depend on the.....of the two phases.

- (a) chemical properties
- (b) physical properties
- (c) degree of turbulence
- (d) interfacial area

440. Separation of two or more components of a liquid solution can not be achieved by (a) fractional crystallisation

- (b) liquid extraction
- (c) absorption
- (d) evaporation

441. In most of the mechanically agitated liquid-liquid extractors, baffles or horizontal compartmental plates are provided, which helps in

- (a) reducing the axial mixing.
- (b) increasing the rate of extraction. (c) maintaining the concentration difference

between the two phases.

- (d) all 'a', 'b' & 'c'.

442. Advantage of continuous drying over batch drying is that the

- (a) drying cost per unit weight of dried product is less.

(b) product with more uniform moisture content is produced.

(c) equipment size required is smaller.

- (d) all 'a', 'b' & 'c'

443. Stefan's law describes the mass transfer by (a) diffusion (b) bulk flow (c) both 'a' & 'b' (d) neither 'a' nor 'b'

444. During bottling of cold drinks (e.g. Pepsi), the main resistance to mass transfer for the absorption of carbon dioxide in water lies in the (a) gas film (b) liquid film (c) liquid-gas interface (d) none of these

ANSWERS

430. (a) 431. (b) 432. (d) 433. (b) 434. (c) 435. (c) 436. (b) 437. (a) 438. (c) 439. (a) 440. (c) 441. (d)

445. Solvent extraction is the terminology applied to the liquid-liquid extraction, which is preferred for the separation of the components of liquids, when

(a) extracting solvent is cheaply & abundantly available.

(b) one of the liquid components is heat sensitive.

(c) viscosity of liquid components is very high.

(d) one of the liquid components has very high affinity towards the solvent.

446. column is the most suitable for achieving the best performance for mass transfer operations involving liquid with dis

(b) Packed (d) Spray perised solids. (a) Wetted wall (c) Plate

447. In a gas-liquid absorption coloumn, for obtaining the maximum absorption efficiency (a) liquid stream should be distributed uniformly.

(b) gas stream should be distributed uniformly.

(c) both gas as well as liquid streams should be distributed uniformly.

(d) by passing should be completely avoided.

448. Perforated plate towers are unique for solvent extraction because, they provide (a) higher contact area.

(b) better contact of the phase.

(c) repeated coalescence & redispersion of

the drop phase.

(d) none of these.

449. Dried finished product sampled from various parts of a.....dryer exhibits non-uniformity in the moisture content.

(a) rotary (b) tray

(c) freeze (d) none of these

450. Use of packed towers for distillation is generally limited to the

- (a) small sizes.
- (b) multicomponent distillation.
- (c) high pressure operation.
- (d) vacuum distillation.

451. Batch tray dryers suffers from the disadvantage of

- (a) high maintenance cost.
- (b) non-uniform & low production rate.
- (c) high labour cost & low heat economy.
- (d) all 'a', 'b' & 'c'.

452. Dry bulb temperature of unsaturated air is more than

its.....temperature. (a) dew point (c) both 'a' & 'b' (b) wet bulb
(d) neither 'a' nor 'b'

453. Use of natural draft cooling tower is practised, when the air has low

- (a) humidity (c) both 'a' & "b' (b) temperature
- (d) neither 'a' nor 'b'

454. Diffusion co-efficient generally depends upon the temperature, pressure & the nature of the components of the system. Its dimension is not the same as that of the

- (a) mass transfer co-efficient.
- (b) thermal diffusivity.
- (c) kinematic viscosity.
- (d) volumetric diffusivity.

455. Weight of 1 m³ of humid air as compared to 1 m³ of dry air, under the same conditions, is (a) less (b) more

- (c) same (d) unpredictable

456. Pick out the wrong statement.

- (a) Constant pressure distillation can not separate an azeotropic mixture.
- (b) Relative volatility of a binary mixture changes appreciably with the minor change in temperature.
- (c) The relative volatility of a binary mixture at azeotropic composition is unity.
- (d) Flash distillation is practised on wide spread scale in petroleum refinery. **457.**

Flash distillation is suitable for separating the constituents of a binary system, which

- (a) form minimum boiling azeotrope.
- (b) have very wide boiling points.
- (c) have very close boiling points.
- (d) form constant boiling azeotrope.

458. Plate efficiency in a distillation column is reduced due to the.....of liquid.

- (a) entrainment
- (b) foaming
- (c) weeping & dumping
- (d) all (a), (b) & (c)

459. At what percentage (by volume) of alcohol composition, it forms an azeotrope with water ? (a) 90 (b) 91.5 (c) 95 (d) 99

ANSWERS

445. (d) 446. (c) 447. (c) 448. (c) 449. (b) 450. (a) 451. (c) 452. (c) 453. (c) 454. (a) 455. (a) 456. (b)

460. In most of the vacuum crystalliser, vacuum is generally produced by means of a

- (a) suction pump
- (b) compressed air jet
- (c) steam jet ejector with a barometric condenser
- (d) none of these

461. At a fixed pressure, the humidity depends upon the partial pressure of vapor in the mixture. Humidity of a vapour free gas is..... percent.

- (a) 100 (b) 0
- (c) 50 (d) between 0 and 100

462. In an operating distillation column, the

- (a) vapors and liquids are at their dew point and bubble point respectively.
- (b) driving force for the liquid flow is its specific weight.
- (c) driving force for the vapor flow is the pressure drop, as the pressure decreases gradually from the bottom to the top of the column.

(d) highest temperature is encountered at the top of the column.

463. column is preferred to be used, when a high liquid hold up is required in a reactor for gas-liquid reaction.

(a) Packed (b) Bubble (c) Spray (d) Tray

464. In a forced draft cooling tower, water is cooled from 95 to 80°F by exposure to air with a wet bulb temperature of 70°F. In this case, the (a) range is 15°F.

(b) approach is 10°F.

(c) both (a) & (b).

(d) neither (a) nor (b).

465. Mass transfer flux in gases is generally..... times more than that in liquids.

(a) 10 (b) 10²

(c) 10³ (d) 10⁴

466. Boundary layer theory predicts that the mass transfer co-efficient varies as.....for high Schmidt number.

(a)

D

v

(b)

D

$\frac{2}{3}$

v

(c)

D

$\frac{3}{2}(d) D^{1/3}$

$v v$

467. Both the operating line and the equilibrium lines are straight in case of absorption, if it (a) concentrated solutions

(b) dilute solutions

(c) isothermal conditions

(d) both b & c

468. If, $NPr > NSc$, then the thermal boundary layer is

(a) having same thickness as the concentration boundary layer.

(b) above the momentum boundary layer. (c) below the concentration boundary layer. (d) above the concentration boundary layer.

469. Distillation under reduced pressure is used to purify these liquids, which
(a) decomposes below their boiling points. (b) have high boiling point.
(c) are highly volatile.
(d) are explosive.

470. Which of the following is not obtained by steam distillation? (a) Alcohol
(c) Essential oil (b) Turpentine oil (d) Aniline

471. Azeotropic mixtures of liquids

(a) can not be separated by selective absorption.
(b) obeys Raoult's law.
(c) does not boil at constant temperature.
(d) can be separated by fractional distillation.

472. Which of the following ambient conditions will evaporate minimum amount of water in a cooling tower?

(a) 35°C DBT & 25°C WBT
(b) 38°C DBT & 37°C WBT
(c) 35°C DBT & 28°C WBT
(d) 40°C DBT & 36°C WBT

Where, DBT = dry bulb temperature & WBT = wet bulb temperature

473. Lewis number = 1, signifies that

(a) $NRe = NSc$ (b) $NRe = NPr$ (c) $NPr = NSc$ (d) $NSc = NSh$ **474.** From humidity chart, the value of humidity

is obtained in terms of the.....humidity (a) molal (b) absolute (c) relative (d) percentage

475. Molecular mass transfer is analogous to (a) conduction heat transfer
(b) convection heat transfer
(c) convective mass transfer
(d) none of these

involves

ANSWERS

460. (c) 461.(b) 462.(c) 463.(b) 464.(c) 465.(b) 466.(c) 467.(d) 468.(c) 469.(a)
470.(a) 471.(a)

472.(b) 473.(a) 474.(d) 475.(a)

476. Pick out correct statement about fractional distillation column operation.
Inside the distillation column, the

(a) temperature is same throughout the distillation column.

(b) driving force for the vapor flow is the pressure drop.

(c) driving force for the liquid flow is its weight. (d) liquids & vapors are always at their bubble point & dew point respectively.

477. Rate of solid-liquid extraction increases with increasing temperature due to

(a) increased liquid viscosity & diffusivity. (b) decreased liquid viscosity &

diffusivity. (c) increased liquid viscosity & decreased diffusivity.

(d) decreased liquid viscosity & increased diffusivity.

478. As the “approach” increases while other parameters remaining constant, the effectiveness of a cooling tower

(a) increases

(b) decreases

(c) remains unchanged

(d) none of these

479. If the flow rate is 10m³ /hr and the range is 10°C for a cooling tower, then its heat load will be.....kcal/hr.

(a) 1000 (b) 10000

(c) 100000 (d) 1000000

480. The L/G ratio of a cooling tower does not depend upon

(a) outlet WBT (b) enthalpy of inlet air (c) DBT (d) range

481. The lowest temperature to which water can be theoretically cooled in a cooling tower is of.....the atmosphere air.

(a) DBT

(b) WBT

(c) average of DBT & WBT

(d) difference of DBT & WBT

482. In a cooling tower, water circulation rate is 200m³/hr , blow down load is 2% and the evaporation & drift losses are 1%. The make up water requirement will be.....m³/hr. (a) 3 (b) 6

(c) 9 (d) 12

483. If wet bulb temperature is 28°C and cooling water at 28°C is required, then the most appropriate cooling tower would be

- (a) cross flow tower
- (b) hyperbolic tower
- (c) induced draft counter flow tower with fills (d) none of these

484. Which of the following is true to estimate the range of cooling tower?

- (a) Range = Cooling water inlet temperature - Wet bulb temperature
- (c)

(b) Range = Cooling water outlet temperature - Wet bulb temperature
 Range = Heat load in kcal/hr / Water circulation rate in litres/hr

- (d) none of these

485. A cooling tower is said to be performing well, if

- (a) range is closer to zero
- (b) approach is closer zero
- (c) range is equal to approach
- (d) approach is more than design value

486 . The term permeability is defined as

- (a) permeability = solubility diffusivity (b) permeability = solubility / diffusivity
- (c) permeability = diffusivity / solubility (d) permeability=diffusivity/(solubility) ²

487. Rate of absorption of a sparingly soluble gas in liquid can be increased by.....mass transfer coefficient.

- (a) increasing the gas side
- (b) decreasing the gas side
- (c) increasing the liquid side
- (d) decreasing the liquid side

488. A stage is a device

- (a) in which mass transfer between two immiscible phases occurs.
- (b) in which two immiscible phases are brought into intimate contact.
- (c) at the exit of which both phase are in equilibrium.
- (d) where all (a) ,(b) and (c) occur.

489. Multistage contacting is preferred over single stage contacting in CPI (Chemical process industries) , because

(a) solvent requirement is less in multistage

contacting.

(b) multistage contactor provides more than one stage in a contactor.

(c) equipment size is smaller in multistage contacting .

(d) (a) and (c)

ANSWERS

476. (b) 477.(a) 478.(b) 479.(c) 480.(c) 481.(b) 482.(b) 483.(d) 484.(c) 485.(b)
486.(a) 487.(c)
488.(d) 489.(d)

490. Kremser equation may be used to determine the number of stages in a staged column, when

(a) the operating and equilibrium lines are straight.

(b) the operating line is straight, but the equilibrium line is curved.

(c) the operating line is curved, but the equilibrium line is straight.

(d) both the operating and equilibrium lines are curved.

491. Mole fraction, y , is related to the mole ratio, Y by the relation

(a) $y = Y/(1 - Y)$ (b) $y = Y/(1+Y)$ (c) $y = 1 - Y/(1+Y)$ (d) $y = (1 - y)/Y(1 + Y)$

492. Height of transfer unit gives an idea about the.....the separation.

(a) ease of

(b) degree of

(c) difficulty in achieving

(d) both (b)&(c)

493. H_{tOG} is equal to H_{tG} , when

(a) the gas phase resistance is negligible (b) the liquid phase resistance is negligible (c) both gas and liquid phase resistances are

equally important

(d) none of these

494. Number of transfer unit gives us an idea about the.....of separation.

- (a) degree (b) difficulty
- (c) ease (d) none of these

495. Absorption accompanied by heat evolution results in

(a) increased solubility of gas in the liquid. (b) larger number of plates (than that required for isothermal absorption) for the same degree of separation.

(c) increased capacity of the absorber. (d) none of these ./

496. Adiabatic saturation temperature is attained by the

- (a) gas
- (b) liquid
- (c) both gas and liquid
- (d) none of these

497. Relative humidity is the ratio of the

- (a) actual humidity to the saturation humidity at the gas temperature.
- (b) partial pressure of the vapour to the vapour pressure of the liquid at the gas temperature.
- (c) mass of vapour to the mass of vapour free gas.
- (d) none of these.

498. At all humidities other than 0 and 100 percent, the percentage humidity is.....the relative humidity.

(a) (c)

more than (b) equal to less than (d) none of these

499. The dew point of a saturated gas is equal to the.....temperature.

- (a) gas
- (c) wet bulb (b) adiabatic saturation (d) none of these

500. The lowest temperature to which water can be cooled in a cooling tower throughout the year depends on the

- (a) summer dry bulb temperature
- (b) dew point
- (c) maximum wet bulb temperature (d) none of these

501. Adiabatic saturation line and wet bulb temperature line are the same for the system (a) air – water
(b) nitrogen – benzene
(c) nitrogen – toluene
(d) air – benzene

502. If P_A is the partial pressure of vapor A in a vapour-gas mixture and P_s is the saturation vapour pressure of liquid A, condensation of vapour-gas mixture just begins, when (a) $P_A > P_s$ (b) $P_A < P_s$
(c) $P_A = P_s$ (d) none of these

503. During adiabatic saturation of unsaturated air the parameter that remains substantially constant is
(a) dry bulb temperature
(b) wet bulb temperature
(c) dew point
(d) humid volume

504. The relative volatility
(a) is independent of pressure
(b) decreases with increasing pressure (c) increases with increasing pressure (d) increases with increasing pressure and

temperature

505. An example of an ideal solution is a mixture of

ANSWERS

490. (a) 491. (b) 492. (a) 493. (b) 494. (b) 495. (b) 496. (a) 497. (b) 498. (c) 499. (d)

500. (c) 501. (a)

502. (c) 503. (b) 504. (b) 505. (a)

(a) benzene, toluene and xylene (a) decreases

(b) water and ethanol (b) increases

(c) acetone, ethanol and n-butanol (c) remains constant

(d) none of these (d) may increase or decrease, depending on

506. Minimum boiling azeotrope occurs when the total pressure curve at a constant temperature passes through a saturated liquid, the slope of the feed line is (a) maximum (a) 0 (b) 1 (b) minimum (c) ∞ (d) 0.5 (c) maximum followed by a

minimum

(d) minimum followed by a maximum

507. Steam distillation is usually employed for

(a) insoluble liquids

(b) a component which is heat sensitive

(c) miscible liquids

(d) both (a) & (b) **515.**

508. In azeotropic mixture, the equilibrium vapour composition at the azeotropic point is.....the liquid composition.

514. The distillate flow rate from a distillation column is 100 kmol/hr and the reflux ratio is 2. The flow rate of vapour from the top plate in kmol / hr is

(a) 100 (b) 200 (c) 300 (d) 50 When saturated vapour is fed to a distillation

column, the slope of the feed line is (a) 0 (b) 1 (c) between 0 and 1 (d) infinity

(a) less than **516.** The ratio of “slope of the enriching section (b) equal to operating line corresponding to minimum (c) more than reflux” to “slope of the operating line corresponding to reflux larger than minimum” (depends upon the nature of the system) (a) < 1 (b) > 1

509. In batch distillation with constant reflux, the (c) 1 (d) 0 overhead

purity.....with time. **517.** When feed to a distillation column is a mixture of 50% vapour and 50% liquid, the slope (c) does not vary (d) none of these of the feed line is

510. In order to obtain an overhead product of constant composition from a batch distillation (c) – 1 (d) 0.5 column, the reflux ratio should be **518.** There is a

relationship between the reflux ratio (a) held at a large and constant value used in a distillation column and the column diameter. As the reflux ratio increases, (c) decreased gradually the column diameter (d) minimum (a) increases

511. At total reflux, (b) decreases

(a) the enriching section operating line (c) remains constant

merges with the diagonal, but the exhausting section operating line does not. the system.

(b) the exhausting section operating line **519.** Solvent extraction should preferably be carried out at temperatures.....the critical solution temperature. (c) both the enriching and the exhausting section operating lines merge with the diagonal. (d) unpredictable **520.** On a distribution curve a plait point is that

(d) the enriching section operating line reduces to a point. (a) $y > x$ (b) $y < x$ **512.** As the reflux

ratio increases the slope of the (c) $y = x$ (d) $y = 2x$ enriching section operating line

ANSWERS

506. (a) 507. (d) 508. (b) 509. (a) 510. (b) 511. (c) 512. (b) 513. (c) 514. (c) 515. (a)
516. (a) 517. (d)

518. (a) 519. (a) 520. (c)

521. At the plait point, selectivity is

(a) 0 (b) 1

(c) 10 (d) infinity

522. There is a direct relationship between the distribution coefficient and the solvent requirement. As the distribution coefficient increases, the solvent requirement for a given separation

(a) decreases

(b) increases

(c) remain unchanged

(d) may increase or decrease, depending on the system

523. The apex of an equilateral triangular coordinate (in ternary liquid system) represents a (a) binary mixture (b) ternary mixture (c) pure component (d) none of these

524. In equilateral triangular coordinate, a point on any side of the triangle represents a (a) pure component (b) binary mixture (c) ternary mixture (d) none of these

525. Which of the following is/are correct? A spray tower is a.....extractor.

(a) multistage (b) single-stage (c) differential contact (d) none of these

526. For liquid-liquid systems that form emulsions, the most suitable contactor is a

(a) mixer-settler

(b) RDC

(c) centrifugal extractor

(d) pulsed packed column

527. Adsorption of a gas onto a solid

(a) is an exothermic process.

(b) is an endothermic process.

(c) does not produce any heat effect. (d) may be exothermic or endothermic, depending on the system.

528. Adsorption of a gas onto a solid can be conducted most efficiently at
(a) high pressure and low temperature (b) low pressure and high temperature (c) low pressure and high temperature (d) high pressure and high temperature

529. For bulk separations, adsorption becomes competitive with distillation, when the relative volatility is
(a) less than about 1.25
(b) between 1.5 and 2.0
(c) more than 2.0
(d) between 2 and 2.5

530. A good adsorbent should have a
(a) high selectivity for the solute
(b) sufficiently high capacity
(c) long life
(d) all *a*, *b* & *c*

531. The separation factor in adsorption varies with
(a) temperature only
(b) adsorbent only
(c) both '*a*' & '*b*'
(d) adsorbent and often also with composition

532. The forces involved in physical adsorption are
(a) Vanderwaals forces
(b) electrostatic interactions
(c) chemical interactions
(d) both *a* & *b*

533. The hypersorption process is a.....adsorption process.
(a) cocurrent
(c) cross current (b) counter current (d) fixed bed

534. When the average moisture content of a solid is equal to the critical moisture content, the drying rate is the rate at constant rate period.
(a) equal to (b) less than (c) more than (d) none of these

535. A continuous rotary drier is filled with material to.....% of the shell volume. (a) 1 to 2 (b) 10 to 15 (c) 70 to 75 (d) 95 to 97

536. In countercurrent rotary driers, the exit gas temperature is usually.....the product temperature.

(a) higher than (b) lower than (c) equal to (d) unpredictable

537. For drying a heat sensitive material in a rotary drier, the gas flow should be

(a) cocurrent

(b) countercurrent

(c) cocurrent or countercurrent; does not

matter

(d) unpredictable

538. With increasing liquid viscosity, liquid holdup in a packed column.

ANSWERS

521. (b) 522.(a) 523.(c) 524.(b) 525.(c) 526.(c) 527.(a) 528.(a) 529.(a) 530.(c)

531.(c) 532.(d)

533.(b) 534.(a) 535.(b) 536.(b) 537.(a) 538.(a)

(a) increases (b) (b) decreases (c) Side streams can be withdrawn easily.

Frequent cleaning can be done. (c) remain unchanged (d) Provides substantially smaller liquid (d) unpredictable hold-up.

539. Under otherwise uniform conditions, the ca**547.** In a binary distillation column, if the feed purity of a packed column of a given diameter contains 40 mol% vapour, the q line will have will be a slope of

(a) higher for cocurrent operation (a) 1.5 (b) -0.6 (b) lower for cocurrent operation (c) -1.5 (d) 0.6

(c) independent of the mode of operation **548.** Which of the following may be the unit of

sur (d) unpredictable face renewal rates?

540. As compared to a liquid-film controlled op- (a) m/s (b) m^2/s eration, the value of (KGa) for a gas-film con- (c) s^{-1} (d) none of these trolled operation will be

549. The Sherwood number, (Sh).....the (a) much lower (b) much higher Reynolds number.(c) almost the same (d) unpredictable (a)

541. The presence of foam in a packed bed (c) is independent of

decreases with

(b) increases with (d) unpredictable.

causes.....in pressure drop. **550.** The colburn factor, (JD).....the Reynolds (a) a marked decrease number.(b) a marked increase (a) increases with(c) practically no change (c) is independent of

(b) decreases with (d) unpredictable.

(d) unpredictable **551.** Overall liquid phase mass transfer coefficient, k_L has the same unit as that of scrubbers. Which of the following points are

extensively used in (a) momentum (b) velocity applicable for plastic packings? (c) acceleration (d) force (a) They have light weight and are cheap. **552.** The individual gas phase mass transfer coefficient, k_g , has the same unit as that of them. (a) diffusivity (c) They are resistant to mechanical

damage (b) molal concentration gradient and attack by acids & alkalis. (c) molal flux (d) All a, b & c. (d) momentum. **543.** For Reynolds analogy to hold, Schmidt number

553. In a chilled water spray pond, the temperature of water is lower than dew point temperature (a) 0 (b) 1 degree of entering air. The air passing through (c) 100 (d) 1000 the spray undergoes

544. In the event of severe weeping, no liquid (a) cooling and humidification reaches the downspouts. This phenomenon is known as

(a) priming

(c) dumping

(b) cooling and dehumidification

(c) sensible cooling (b) coning (d) dehumidification (d) none of these **554.** In saturated air water

vapor mixture, the **545.** Which of the following is an exaggerated condition (a) dry bulb temperature is higher than the condition of liquid entrainment?

(a) priming

(c) dumping

wet bulb temperature. (b) coning (b) dew point temperature is lower than the (d) weeping wet bulb temperature.

546. Which of the following statements is true for (c) dry bulb, wet bulb and dew point temperature packed column (as compared to plate column)? (d) dry bulb temperature is higher than the (a) Requires larger pressure drop. dew point temperature.

ANSWERS

539.(a) 540.(b) 541.(b) 542.(d) 543.(b) 544.(c) 545.(a) 546.(d) 547.(c) 548.(c) 549.(b) 550.(a) 551.(b) 552.(c) 553.(a) 554.(c)

process control and instrumentation

1. What is the Laplace transform of $\sin t$? (c) same as dead time.

1 s

⁹(d) time required by the measured variable to (a)_{s2+1} (b)_{1+ s2} reach 63.2% of its ultimate change.

(c)

s-1

1 (d) s **8.** For two non-interacting first order systems s-1

2. Transfer function of a first order system is

(a)

¹ (b)¹

$Ts+1$ Ts_9 .

(c)^s

connected in series, the overall transfer function is the.....of the individual transfer functions.

(a) product (b) ratio (c) sum (d) difference The transfer function of a second order system is

(d) none of these

$Ts+ 1$

3. Pick out the first order system from among the following.

(a) Damped vibrator.

(b) Mercury in glass thermometer kept in

(a)

1 1

Ts Ts_{Ts}

²² 2^{++1} (b) ²² $++21$

(c)¹ (d) none of these₂₂

Ts $++21$

boiling water. **10.** When the damping co-efficient is unity, the (c) Interacting

system of two tanks in series. system is

(d) Non-interacting system of two tanks in series (a) Overdamped. (b) Critically damped.

ries. (c) Underdamped. (d) Highly fluctuating.

4. Response of a system to a sinusoidal input is 11. Phase lag of the frequency response of a second order system is.....response.

(a) impulse

(c) frequency

order system to a sinusoidal forcing function

(b) unit step (a) is 30°

(d) none of these (b) is 90° at the most

5. What is the ratio of output amplitude to input (c) approaches 180° asymptotically amplitude for a sinusoidal forcing function in (d) is 120° a first order system ? 12. Dead zone is the

(a) 1 (b) > 1 (a) same as time constant. (c) < 1 (d) none of these (b) same as transportation lag. 6. Phase lag of the sinusoidal response of a first order system is change in the variable that does

not change the reading of the instrument. (d) none of these (a) 120° (b) 30°

(c) 180° (d) 90° 13. Transfer function of transportation lag is 7. Time constant is the (a) e^{-TS} (b) e^{-TS} (a) time taken by the controlled variable to (c)

1 (d) none of these reach 63.2% of its full change. $TS + 1$

(b) same as transportation lag.

ANSWERS

1. (a) 2. (a) 3. (b) 4. (c) 5. (c) 6. (d) 7. (a) 8. (a) 9. (a) 10. (b) 11. (c) 12. (c) 13. (b)

14. Response of a linear control system for a change in set point is called

(a) frequency response

(b) transient response

(c) servo problem

(d) regulator problem

15. If response of a control system is to be free of offset and oscillation, the most suitable controller is

(a) proportional controller.
 (b) proportional-derivative (PD) controller. (c) proportional-integral (PI) controller. (d) proportional-integral-derivative (PID) controller.

16. In second order underdamped system, (a) decay ratio = overshoot
 (b) decay ratio = (overshoot)²
 (c) overshoot increases for increasing damping co-efficient.

(d) large damping co-efficient means smaller damping.

17. What is the overall transfer function (C/R) of the following block diagram , if $G = G_1 \cdot G_2 \cdot G_3$ and $H = H_1 \cdot H_2$.

$$\frac{1}{1+GH} \cdot \frac{1}{1+GH} \cdot \frac{1}{1+GH}$$

(c)

$$\frac{1+GH}{1+GH}$$

$$\frac{H}{G} \cdot \frac{1}{1-GH}$$

A stable system is the one **18.**

(a) for which the output response is bounded for all bounded input.
 (b) which exhibits an unbounded response to a bounded input
 (c) which satisfies the conditions for a servo problem.
 (d) none of these.

19. Stability of a control system containing a transportation lag can be best analysed by

(a) (b) (c) (d)

Routh test

root locus methods

frequency response methods none of these

20. Conversion formula for converting amplitude ratio (AR) into decibels is

(a) (b) (c) (d)

$$\text{Decibel} = 20 \log_{10} (AR) \quad \text{Decibel} = 20 \log_e (AR) \quad \text{Decibel} = 20 \log_{10} (AR)^{0.5}$$

$$\text{Decibel} = 20 \log_e (AR)^{0.5}$$

21. “A control system is unstable, if the open loop frequency response exhibits an amplitude ratio exceeding unity at the crossover frequency.” This is.....criterion.

(a) Bode stability (b) Nyquist (c) Routh stability (d) none of these **22.** Typical specifications for design stipulates the

gain margin and phase margin to be respectively

(a) > 1.7 and $> 30^\circ$ (b) < 1.7 and $> 30^\circ$ (c) < 1.7 and $< 30^\circ$ (d) > 1.7 and $< 30^\circ$

23. The frequency at which maximum amplitude ratio is attained is called the..... frequency.

(a) corner

(c) cross-over (b) resonant (d) natural

24. A negative gain margin expressed in decibels means a/an.....system.

(a) stable (b) unstable (c) critically damped (d) none of these

25. Bode diagram is a plot of

(a) $\log(AR)$ vs. $\log(f)$ and f vs. $\log(f)$. (b) $\log(AR)$ vs. f and $\log f$ vs. f .

(c) AR vs. $\log(f)$ and f vs. $\log(f)$.

(d) none of these.

26. For measuring the temperature of a red hot furnace, which is the most suitable instrument ? (a) Platinum resistance thermometer (b) Thermocouple

(c) Optical pyrometer

(d) Bimetallic thermometer

27. Degree to which an instrument indicates the changes in measured variable without dynamic error is called its

(a) speed of response

(b) reproducibility

(c) fidelity

(d) static characteristics

ANSWERS

14. (c) 15. (d) 16. (b) 17. (b) 18. (a) 19. (c) 20. (a) 21. (a) 22. (a) 23. (b) 24. (b) 25. (a)
26. (c) 27. (c)

28. Which of the following is a desirable characteristic of an instrument ?

- (a) High drift
- (b) High fidelity
- (c) High measuring lag
- (d) Poor reproducibility

29. Which of the following shows maximum dip effect (indicating reverse direction of temperature change) ?

- (a) Mercury thermometer
- (b) Radiation pyrometer
- (c) Bimetallic thermometer
- (d) Thermocouple

30. Pick out the most suitable instrument for measuring temperature in the range of -40 to 425°C .

- (a) mercury thermometer
- (b) bimetallic thermometer
- (c) radiation pyrometer
- (d) none of these

31. Thermocouple is suitable for measuring (a) liquid temperatures only.

- (b) very high temperatures only.
- (c) very low temperatures only.
- (d) both high and low temperatures

32. Which of the following relates the absorption & evolution of heat at the junctions of a thermocouple to the current flow in the circuit ? (a) Seebeck effect

- (b) Peltier effect
- (c) Joule heating effect
- (d) Thomson effect

33. Thermal wells are used in the temperature measurement to

- (a) guard against corrosive and oxidising action on thermocouple materials
- (b) reduce measuring lag.
- (c) increase the fidelity.
- (d) increase the sensitivity.

34. Gas analysis is commonly done using the (a) thermal conductivity cell

- (b) X-ray diffraction

- (c) mass spectrometer
- (d) emission spectrometer

35. Psychrometer determines the

- (a) humidity of gases
- (b) moisture content of solids
- (c) water of crystallisation
- (d) hygroscopic nature of solids

36. Continuous measurement of moisture content of paper in paper industry is done by measuring the

- (a) (b) (c) (d)

thermal conductivity through the paper
electrical resistance through the paper
magnetic susceptibility
none of these

37. A simple pitot tube measures the (a) (a) (b) (d)

average velocity
maximum velocity
point velocity
static pressure

38. Pirani gauge is used for the measurement of (a) (b) (c) (d)

very high pressure.
high vacuum.
liquid level under pressure.
liquid level at atmospheric pressure

39. A barometer measures the.....pressure. (a) absolute

- (b) gauge
- (c) absolute as well as gauge
- (d) dynamic

40. The level of a liquid under pressure can be determined using

- (a) (b) (c) (d)

bubbler system
differential pressure manometer
diaphragm box system
air-trap system

41. Continuous measurement of specific gravity of a liquid is done by

(a) hydrometer

(b) (c)

contact-type electric indicators displacement meter

(d) both (a) and (c)

42. Hot wire anemometer is used for the measurement of

(a) flow rates of fluids.

(b) flow rates of granular solids.

(c) very high temperature.

(d) thermal conductivity of gases.

43. Flow rate through an orifice is.....the pressure differential.

(a) (b) (c) (d)

proportional to

inversely proportional to the square root of proportional to the square root of

inversely proportional to the square of

44. Which of the following flow-metering instruments is an areameter ?

ANSWERS

28. (b) 29.(a) 30.(b) 31.(d) 32.(b) 33.(a) 34.(a) 35.(a) 36.(b) 37.(b) 38.(b) 39.(a)

40.(b) 41.(d) 42.(a) 43.(c) 44.(b)

(a) Venturimeter

(b) Rotameter

(c) Pitot tube

(d) Hot wire anemometer

45. Pick out the symbol for “locally mounted instrument” in instrumentation diagram.

46. Which is the symbol for “pneumatic control valve” ?

47. The symbol for “capillary line” in instrumentation diagram is

(a) —————(b)

(c) _____ (d) _____

48. Instrumentation in a plant offers the advantage of **49.** Minute depression of freezing point of a liquid solvent on addition of a solid solute can be best measured by a

- (a) Beckman thermometer
- (b) dilatometer
- (c) mercury thermometer
- (d) bimetallic thermometer

50. Gain margin is equal to the

- (a) amplitude ratio
- (b) reciprocal of amplitude ratio
- (c) gain in P controller (d) gain in $P-I$ controller

51. Phase margin is equal to (a) $180^\circ - \text{phase lag}$ (b) (c) $\text{phase lag} + 180^\circ$ (d) $\text{phase lag} - 180^\circ$ (e) $\text{phase lag} + 90^\circ$

52. Bode stability method uses.....function. (a) open (b) closed (c) either (a) or (b) (d) neither (a) nor (b)

53. Routh stability method uses.....transfer function.

- (a) open
- (b) closed
- (c) either (a) or (b)
- (d) neither (a) nor (b)

54. Nichol's chart deals with

- (a) A.R. vs. phase lag of first order.
- (b) A.R. vs. phase lag of second order. (c) closed loop values vs. open loop values. (d) frequency response values of controllers.

55. The fluid used in hydraulic controller is (a) water (b) steam (c) air (d) oil

56. Number of poles in a system with transfer function

$\frac{1}{s^2 + 2s + 1}$

- (a) 2 (b) 5
- (c) 3 (d) 1

57. Which of the following controllers has maximum offset ?

- (a) P controller (c) $P-D$ controller (b) $P-I$ controller (d) $P-I-D$ controller

tage of

(a) greater safety of operation (b) better quality of product (c) greater operation economy (d) all (a), (b) and (c)

58. Process degree of freedom indicates

number of controllers to be used.

(a) the maximum

(b) the minimum

(c) both maximum and the minimum (d) nothing about the

ANSWERS

45. (a) 46.(a) 47.(d) 48.(d) 49.(a) 50.(b) 51.(a) 52.(a) 53.(b) 54.(c) 55.(b) 56.(c) 57.(a) 58.(a)

59. In an exothermic chemical reactor, the manipulated variable is the flow rate of

(a) coolant (c) product (b) reactants

(d) none of these

60. Use of *I*-control along with *P*-control facilitates (a) elimination of offset

(b) reduction of offset

(c) reduction of stability time

(d) none of these

61. Cascade control means

(a) feed forward control.

(b) more than one feed-back loop.

(c) on-off control.

(d) one feed-back loop.

62. Which of the following controllers has the least maximum deviation ?

(a) *P*-controller (b) *P-I* controller (c) *P-I-D* controller (d) *P-D* controller

63. Measurement of pressure in ammonia reactor is done by

(a) Bourdon gauge

(b) U-tube manometer

(c) Inclined tube manometer

(d) Pirani gauge

64. Pressure of 0.01 psi (absolute) can be measured by.....gauge.

(a) ionisation (b) Pirani
(c) Mcloid (d) none of these

65. Continuous measurement of moisture in paper is done by

(a) sling psychrometer.
(b) hair-hygrometer.
(c) weighing.
(d) high resistance Wheatstone's bridge circuit.

66. Pressure of 0.0001 absolute psi can be measured by.....gauge. (a)
Mcloid (b) (c) thermocouple (d) Pirani
none of these

67. E.m.f. generated by thermocouples is of the order of (a) millivolts (b)
microvolts (c) volts (d) kilo volts

68. Measurement of sub-zero Celcius temperature in industry is done most
commonly by (a) thermocouples

(b) resistance thermometers

(c) gas thermometers

(d) bi-metallic thermometers

69. Starting temperature of optical radiation pyrometer is..... °C.

(a) 800 (b) 400

(c) 1200 (d) 1500

70. Which thermocouple can be used to measure a temperature of around
1400°C ?

(a) Copper-constantan

(b) Aluminium-chromel

(c) Platinum-platinum+rhodium

(d) None of these

71. Interfacial level in pressure vessel is measured by

(a) float

(b) manometers of float type

(c) (d)

U-tube manometer none of these

72. Flow rate of sludge is measured by a (a) V-notch
(c) circular pipe (b) rectangular notch (d) Kennison nozzle
73. Composition of natural gas can be determined by the
(a) chromatograph (c) spectrometer
74. Bellows are made of (a) leather
(b) paper
(c) plastic
(d) thin copper sheet (b) orsat apparatus (d) none of these
75. Flapper nozzle is a/an.....controller. (a) pneumatic (b) hydraulic (c) electronic (d) none of these
76. Weir valve is used for
(a) slurries (b) acids
(c) neutral solutions (d) bases
77. Valve used to supply fuel oil to the burner is a valve.
(a) gate (b) butterfly (c) rotary plug (d) none of these
78. Mode used for transmitting signal for one kilometer distance is
(a) hydraulic (b) pneumatic (c) electronic (d) none of these
79. Use of pilot in transmission (pneumatic) is to (a) speed up the signal.
(b) change the flow of air.
(c) (d)

adjust the signal. none of these.

ANSWERS

59. (a) 60.(a) 61.(b) 62.(d) 63.(a) 64.(c) 65.(d) 66.(a) 67.(a) 68.(b) 69.(a) 70.(c)
71.(b) 72.(d) 73.(a) 74.(b) 75.(a) 76.(a) 77.(c) 78.(c) 79.(b)

80. Final control element is a
(a) valve (b) switch
(c) signal (d) none of these

81. Example of a second order instrument is a (a) mercury-glass thermometer with covering. (b) bare mercury-glass thermometer.
(c) pressure gauge.

(d) none of these.

82. Offset

- (a) varies with time.
- (b) varies exponentially with time.
- (c) does not vary with time.
- (d) varies as square of the time.

83. Regulator problem mean that

- (a) set point is constant
- (b) load is constant
- (c) both set point and load are constant (d) neither set point nor load is constant

84. Servo problem means that the.....is constant.

- (a) set point (b) load
- (b) both (a) & (b) (d) neither nor (b)

85. Critically damped system means that the damping co-efficient is

- (a) 1 (b) <1
- (c) >1 (d) 0

86. In Bode stability criterion, amplitude ratio at 180° should be

- (a) 1 (b) < 1
- (c) >1 (d) 0

87. Phase plane method is used for.....behaviour.

- (a) linear (b) non-linear (c) both (a) & (b) (d) neither (a) nor (b)

88. Laplace transform method is used for..... behaviour.

- (a) linear (b) non-linear (c) both (a) & (b) (d) neither nor (b)

89. Phase lag of first order system is

- (a) $\tan^{-1}(T)$ (b) $-\tan^{-1}(T)$ (c) $p/2$ (d) 0

90. P-I controller as compared to P-controller has a (a) higher maximum deviation.

- (b) longer response time.
- (c) longer period of oscillation.
- (d) all (a), (b) and (c).

91. Difference at any instant between the value of controlled variable and the set point is called the

(a) deviation (b) derivative time (c) error ratio (d) differential gap

92. The time difference by which the output of a P-D controller leads the input, when the input changes linearly with time is called

(a) error ratio
(b) derivative time
(c) proportional sensitivity
(d) gain

93. Steady state deviation resulting from a change in the value of the load variable is called the (a) offset (b) error ratio (c) deviation (d) static error

94. Time required for the output of a first order system to change from a given value to within 36.8% of the final value, when a step change of input is made, is called the

(a) time constant (b) settling time (c) rise time (d) derivative time

95. A controller action in which, there is a continuous linear relation between value of the controlled variable and rate of change of controlled output signal is called the.....action.

(a) proportional (b) integral (c) derivative (d) none of these **96.** A controller action in which there is a continuous relation between value of the controlled variable and the value of the output signal of

the controller is called the.....action. (a) proportional (b) derivative (c) integral (d) none of these

97. Steady state ratio of the change of proportional controller output variable and the change in actuating signal is called the

(a) (b)

proportional sensitivity reset rate

(c) rangeability
(d) none of these

98. In case of flow measurement by an orifice, the

pressure difference signal is proportional to

(a) Q^2 (b) Q

1

(c) Q (d) Q

where, Q = volumetric flow rate.

ANSWERS

80. (a) 81. (a) 82. (c) 83. (a) 84. (b) 85. (a) 86. (b) 87. (b) 88. (a) 89. (b) 90. (d) 91. (a)

92. (b) 93. (a) 94. (a) 95. (b) 96. (a) 97. (a) 98. (a)

99. Thermistor is a

(a) semiconductor whose resistance decreases with temperature rise.

(b) metal whose resistance increases linearly with temperature rise.

(c) metal whose resistance does not vary with temperature.

(d) device for measuring nuclear radiation.

100. Which of the following factors does not influence the measurement accuracy ?

(a) Static & dynamic error

(b) Reproducibility

(c) Dead zone

(d) None of these

101. Which of the following is suitable for measuring the temperature of a red hot moving object (e.g. steel ingots on roller table) ? (a) Thermocouple (b) (c) Thermistor (d)

102. Thermocouples

(a) have very slow speed of response. (b) can't be connected to the measuring instrument remotely located.

(c) need cold junction compensation. (d) are much less accurate compared to bimetallic or vapour pressure thermometer.

103. Radiation pyrometers

(a) have very slow speed of response. (b) need not "see" the temperature source; it

is measuring.

(c) can't measure temperature of objects

without making physical contact. (d) none of these.

104. V-notch is used to measure the flow rate of a liquid in a/an

(a) open channel.

(b) non circular cross-section closed channel. (c) vertical pipeline.

(d) none of these.

105. Which of the following is not a head flow meter? (a) Segmental orifice plate

(b) Pitot tube

(c) Rotameter

(d) Flow nozzle

106. Flow rate of a liquid containing heavy solids (e.g. sand) can be best measured by a/an (a) pitot tube (b) concentric orifice Radiation pyrometer None of these

107. Orifice plates for flow measurement (a) incurs very low permanent pressure loss. (b) has poor accuracy on high orifice ratios

(above 0.75).

(c) can't be easily interchanged.

(d) is best for very large liquid flows and big

pipelines.

108. Pitot tube is used

(a) for highly accurate flow measurement. (b) when the fluid contains lot of suspended

materials.

(c) when the line is large and the velocity is high.

(d) none of these.

109. In an areameter (e.g. rotameter), the flow rate is

(a) proportional to the square root of the differential pressure.

(c) eccentric orifice (d) rotameter (b) inferred from the changes in area of an orifice in the flow line across which the pressure differential is constant.

(c) inferred from change in flow cross section across which the pressure differential is zero.

(d) none of these.

110. A rotameter

(a) incurs constant and small permanent pressure drop.

(b) incurs constant but very large permanent pressure drop.

(c) is inaccurate for low flow rates.

(d) need not be mounted always vertically.

111. On-off control

(a) fully opens the final control element when the measured variable is below the set point.

(b) fully closes the final control element when the measured variable is above the set point.

(c) is a two position (fully open or fully closed) control adequate to control a process with slow reaction rate and minimum dead time or transfer lag.

(d) none of these

112. Floating control action

(a) moves the final control element at constant speed in either direction in response of an error signal.

(b) changes the position of the final control

99. (a) 100. (d) 101. (b) 102. (c) 103. (d)

111. (c) 112. (a)

element from on to off.

ANSWERS

104. (a) 105. (c) 106. (c) 107. (b) 108. (c) 109. (b) 110. (a) (c) is used to counteract rapid load changes. (d) none of these

113. Cascade control is

(a) the continuous adjustment of the set point index of an automatic control loop

by a primary (master) controller.

(b) used when changes in process conditions cause serious upsets in controlled variable.

(c) useful to control flow from temperature. (d) all (a), (b) and (c).

114. The mechanism which changes the value of the manipulated variable in response to the output signal from the control unit is called the (a) final control element

(b) on-off control

(c) floating control action

(d) none of these

115. Pneumatic control valves are generally designed for pressure upto.....kgf/cm². (a) 10 (b) 100
(c) 150 (d) 350

116. Hydraulic control valves are generally designed for pressure upto.....kgf/cm². (a) 3.5 (b) 7 (c) 35 (d) 350

117. The most suitable flow measuring device for a gas stream flowing at a the rate of 50 li- tre/minute in a 3 cm I.D. stainless steel tube would be a/an

(a) rotameter

(b) pitot tube

(c) venturimeter

(d) segmental orificemeter

118. Specify a suitable flow measuring device out of the following for a slurry flowing at 3 litre/ minute in a 2 cm I.D. horizontal glass tube (a) segmental orificemeter

(b) pitot tube

(c) magnetic flowmeter

(d) rotameter

119. For the control of gas flow with a P.I.D. con- troller, it is essential to use a.....valve. (a) gate (b) needle

(c) shut off (d) none of these

120. If, $L(Y)$ =Laplace transform of output variable and $L(X)$ = Laplace transform

of input variable, then transfer function is defined as

(a)

$\frac{LY(s)}{LX(s)}$

$\frac{LX(s)}{LY(s)}$

(c) $L(X).L(Y)$ (d) $L(X) - L(Y)$ **121.** The time constant of a first order system is

defined as the time for system to reach following a step input change.....% of its final value.

(a) 63.2 (b) 99.8

(c) 85.4 (d) 18.8

122. Standard air pressure range for pneumatic controller is between.....psi.

(a) 0 to 12 (b) 5 to 25 (c) 4 to 30 (d) 3 to 15

123. The analysis of a component by chromatography is based on the principle of relative absorption of various components

(a) over a solid surface.

(b) in a liquid.

(c) in a carrier gas at different times. (d) none of these.

124. A critically damped system is the one, whose response to an abrupt stimulus is

(a) slow without overshoot.

(b) as fast as possible without overshoot. (c) very fast with overshoot.

(d) none of these.

125. Iron-constantan thermocouple can be used within a temperature range of.....°C. (a) – 200 to 300 (b) – 30 to 350 (c) – 30 to 1100 (d) – 30 to 1500

126. Frequency response of a second order system will be sinusoidal, when

(a) it is underdamped

(b) it is overdamped

(c) it is critically damped

(d) damping coefficient is zero

127. The emf (mV) of a thermocouple maintained at two junctions at different temperature is as follows :

Hot end temp., °C Cold end temp., emf °C

1000°C 0°C 41.32

30°C 0°C 1.20

1000°C 30°C ?

(a) 41.32 (b) 40.12

(c) 21.26 (d) 42.56

ANSWERS

113. (d) 114.(a) 115.(a) 116.(d) 117.(a) 118.(c) 119.(d) 120.(a) 121.(a) 122.(b)

123.(b) 124.(a)

125.(c) 126.(d) 127.(b)

128. Very high temperature (1200-1700°C) will be measured most precisely by
a/an

(a) radiation pyrometer

(b) optical pyrometer

(c) thermocouple

(d) bi-metallic thermometer

129. The basic principle involved in the measurement of temperature by thermocouple is the.....effect.

(a) Raman

(b) Seebeck

(c) Peltier and Seebeck

(d) Thomson and Peltier

130. Pitot tube is used to measure (directly) the (a) viscosity

(b) flow rate of fluids

(c) surface tension of fluid

(d) none of these

131. Temperature rise in the bomb calorimeter is usually measured by a.....thermometer. (a) Beckman (b) bimetallic (c) platinum resistance (d) vapor pressure

132. Humidity is most commonly measured by (a) partial vapor pressure determination. (b) dry and wet bulb temperature measurement.

(c) physical expansion.

(d) evaporation.

133. Working of a constant volume gas thermometer is based on the

- (a) Archimedes principle
- (b) Pascal's law
- (c) Charle's law
- (d) Boyle's law

134. Choose the one whose resistance decreases with increase in temperature.

- (a) platinum
- (b) carbon
- (c) constantan
- (d) aluminium

135. Oxygen percentage in flue gas is determined by the

- (a) electrical conductivity cell
- (b) zirconia probe
- (c) polarimeter
- (d) polarograph

136. Thermocouple in a temperature recorder is an example of.....element.

- (a) functioning
- (c) secondary
- (b) manipulating
- (d) primary

137. Tube side temperature in a shell and tube heat exchanger is normally measured by a (a) constant volume hydrogen thermometer. (b) mercury in glass thermometer.

- (c) thermocouple.
- (d) radiation pyrometer.

138. The vapor pressure thermometer bulb should have

- (a) large specific heat
- (b) large area
- (c) large mass
- (d) low thermal conductivity

139. Thermopile measures the

- (a) flow rate
- (b) voltage
- (c) current
- (d) none of these

140. On-off control is a special case of..... control.

- (a) proportional (P)
- (b) proportional-Integral-erivative(PID)
- (c) proportional-derivative (PD)

(d) proportional-integral (PI)

141. Which one is a controlled variable in a heat exchanger ?

(a) Flow rate of cooling fluid

(b) Outlet temperature of cooling fluid (c) Inlet temperature of cooling fluid (d) Inlet temperature of heating fluid

142. In a vapor pressure thermometer, the corrector plate is the.....element.

(a) manipulating (b) primary (c) functioning (d) secondary

143. An amplitude ratio (AR) of unity corresponds to.....decibel.

(a) 0 (b) 1

(c) 10 (d) 20

144. For which of the following controllers, the offset is zero and it has the highest maximum deviation ?

(a) PI-controllers (b) PD-controllers (c) P-controllers (d) PID-controllers

145. Under which of the following conditions, the ratio of geometric mean to the arithmetic mean of time constants T_1 and T_2 is unity ?

(a)

$\frac{1}{2}(T_1 + T_2)$ (b) $T_1 = T_2$

(c) $\frac{1}{2}T_1 T_2$ (d) $T_1 = 2T_2$

ANSWERS

128. (c) 129. (c) 130. (d) 131. (a) 132. (b) 133. (c) 134. (b) 135. (b) 136. (d) 137. (c)

138. (b) 139. (d)

140. (a) 141. (b) 142. (a) 143. (a) 144. (a) 145. (b)

146. Mercury filled U-type manometer is an example of.....type of second order system. (a) critically damped (c) overdamped

(b) underdamped (d) undamped

147. Which of the following controllers requires minimum stabilising time ?

(a) P-I controller (c) P-controller (b) P-D controller (d) P-I-D controller

148. Solenoid valve operates like a/an.....controller.

(a) P (b) on-off

(c) P-D (d) P-I-D

149. Which of the following is the most suitable for controlling operating parameters upto a distance of 1.5 kilometers ?

- (a) Hydraulic controller
- (b) Pneumatic controller
- (c) Electronic controller
- (d) None of these

150. In a heat exchanger, outlet temperature of heating/cooling fluid is the.....variable. (a) load (b) manipulated (c) controlled (d) none of these

151. Which of the following has got the smallest maximum deviation among P, P-I, P-D and PI-D controllers?

- (a) P (b) P-I
- (c) P-D (d) P-I-D

152. $-\tan^{-1}(T)$ represents the.....of first (a) load (b) controlled (c) manipulated (d) none of these

157. Feed temperature in case of exothermic CSTR is a.....variable. (a) load (b) controlled (c) manipulated (d) none of these

158. Flow rate of cooling fluid in exothermic CSTR is a.....variable. (a) load (b) controlled (c) manipulated (d) none of these

159. Continuous shell temperature measurement in a liquid-liquid heat exchanger is done by a (a) thermocouple

- (b) resistance thermometer
- (c) mercury in glass thermometer
- (d) vapor pressure thermometer

160. Composition of natural gas is determined by (a) Haldane apparatus

- (b) mass spectrometer
- (c) chromatograph
- (d) both (b) and (c)

161. Laplacian form of measuring lag is

- (a) e^{-LS}
- (c) e^{-L^2S}

where, L = Lag time

162. $(180 + f)$ represents (a) gain margin (c) phase lag

where, f = phase angle

(b) e^{LS} (d) e^{L2S}

(b) phase margin (d) none of these

(b) amplitude ratio (d) phase margin order system. (a) phase lag (c) gain margin

153. What is not present in self operated controller? (a) Controlling element

(b) Input signal

(c) Final control element

(d) None of these

154. Flow rate of sludge is best measured by a/an (a) orificemeter (b) open weir
(c) Kennison nozzle (d) both (b) and (c)

155. Laplace transform of impulse input of magnitude 'A' is

(a) A (b) A^2

(c) $1/A$ (d) 0

156. Reactor temperature in case of exothermic CSTR (a chemical reactor) represents the.....variable.

163. $1/A.R.$ at 180° phase lag represents

(a) gain margin

(b) phase margin

(c) phase lag of first order system

(d) none of these

164. Which of the following has maximum offset among P, P-I, P-D and P-I-D controllers? (a) P (b) P-I

(c) P-D (d) P-I-D

165. Flow rate of heating or cooling fluid in a heat exchanger is the.....variable.

(a) manipulated (b) load

(c) controlled (d) none of these

166. Entering hot or cold fluid temperature in heat exchanger is the.....variable. (a) manipulated (b) load (c) controlled (d) none of these

ANSWERS

146. (b) 147.(b) 148.(b) 149.(c) 150.(c) 151.(c) 152.(a) 153.(c) 154.(d) 155.(a) 156.(b) 157.(a)

158.(c) 159.(a) 160.(d) 161.(a) 162.(b) 163.(a) 164.(a) 165.(a) 166.(b)

167. Which controller has zero offset?

(a) P (b) P-I

(c) P-I-D (d) both (b) and (c)

168. Which of the following has the highest maximum deviation?

(a) P (b) P-I

(c) P-D (d) P-I-D

169.

$1 / ($

ω

$2T^2 1)^{1/2}$

+ represents

(a) A.R. of first order system

(b) phase lag of first order system

(c) frequency input

(d) none of these

170. In ammonia reactor, continuous pressure measurement is done by a

(a) Bourdon gauge of pressure spring type (b) mercury manometer

(c) Mcleoid gauge

(d) alphanatron

171. Liquid levels in autoclaves are measured by (a) simple float

(b) differential float type manometer (c) glass gauge

(d) none of these

172. In case of a water heater, the inlet temperature of water is

a.....variable.

(a) manipulated (b) controlled (c) load (d) none of these

173. In case of a water heater, outlet water temperature is a.....variable.

(a) manipulated (b) controlled (c) load (d) none of these

174. Heat input in case of a water heater is a.....variable. (a) controlled (c) load

175. The symbol

(b) manipulated (d) none of these **176.** The symbol in a block diagram stands for

(a) multiplier

(b) dynamic function

(c) summing function

(d) none of these

177. Time constant of mixer is given by

(a) $V Q$ (b) V/Q

(c) Q/V (d) none of these

where, V = volume of mixer, Q = flow rate of solution **178.** Pick out the wrong statement.

(a) Ziegler-Nichols method is not theoretical. (b) Transfer function can not be derived for

highly non-linear system.

(c) Bode plot can not be used for non-linear behaviour.

(d) none of these.

179. Continuous acidity measurement in the fertiliser neutraliser is done by

(a) chromatograph

(b) spectrometer

(c) pH meter

(d) thermal conductivity cell

180. Pressure of the order of 0.01 psi (absolute) can be best measured by a/an

(a) manometer (using CCl_4 as manometric

fluid)

(b) Mcleoid gauge

- (c) alphanon
- (d) both (b) and (c)

181. Pressure of the order of 0.0001 psi (absolute) can be best measured by

- (a) Mcleoid gauge
- (b) alphanon
- (c) thermocouple gauge
- (d) none of these

182. Which of the following controllers has the maximum stabilizing time ?

- (a) P (b) P-I
- (c) P-D (d) P-I-D

183. Final control element is exemplified by a/an (a) pneumatic controller

- (b) electronic controller
- (c) solenoid valve
- (d) hydraulic controller

184. Solenoid valve works like.....controller. in a block diagram stands for

- (a) multiplier
- (b) dynamic function

(c) summing function (a) P (b) P-D (d) none of these (c) P-I-D (d) on-off

ANSWERS

167. (d) 168.(b) 169.(a) 170.(a) 171.(b) 172.(c) 173.(b) 174.(b) 175.(c) 176.(b)
177.(b) 178.(d)

179.(c) 180.(d) 181.(c) 182.(b) 183.(c) 184.(d)

185. Laplace transform of unit step change is (a) 1 (b) 1/S

(c) 1/S² (d) 0

186. Polarograph is used for the analysis of (a) solids (b) liquids

(c) gases (d) all (a), (b) and (c)

187. Polarimeter is used for the analysis of (a) any liquid (b) any solid (c) any gas (d) sugar solution

188. Emf developed by a thermocouple while measuring a temperature of 600°C is about 5.5 mV. The type of thermocouple used is (a) chromel-alumel

(b) iron-constantan

(c) platinum-platinum+rhodium

(d) either (a), (b) or (c)

189. Emf developed by a thermocouple while measuring a temperature of 800°C is about 31 mV. The type of thermocouple used is (a) chromel-alumel

(b) iron-constantan

(c) platinum-platinum + rhodium

(d) none of these

190. Emf developed by a thermocouple while measuring a temperature of 400°C is 22 mV. The type of thermocouple used is

(a) chromel-alumel

(b) iron-constantan

(c) platinum - platinum + rhodium

(d) none of these

191. Transportation lag.....parameter system.

(a) is a lumped

(b) is a distributed

(c) approaches lumped

(d) none of these

192. Which of the following controllers is used for level control in industries ?

(a) P (b) PI

(c) PD (d) PID

193. Dynamic error for linear input (KT) in first order instrument is

(a) KT (b) $2KT$

(c) KS^2 (d) K

194. U-tube manometer is an example of order system.

(a) 1st (b) 2nd

(c) 3rd (d) none of these

195. $1 \tan^{-2} WT$ represents the

W

(a) lag time in first order instruments. (b) Laplace transform of a ramp input. (c) Laplace transform of sinusoidal input. (d) time constant in first order process.

196. Laplace transform of time lag of L time unit is (a) e^{-Ls} (b) e^{-Lt}

(c) e^{LS} (d) e^{Lt}

197. Laplace transform of a ramp input of slope K is (a) K/S (b) K/S^2
(c) $1/S$ (d) K/S^3

198. Laplace transform of sinusoidal input of magnitude 'A' is
(a) $A/S^2 + W^2$ (b) $AW/S^2 + W^2$ (c) $W/S^2 + W^2$ (d) none of these

199. $R(1 - e^{-t/T})$ represents the output equation for first order system with
(a) unit step input.
(b) sinusoidal input of magnitude 'A'. (c) impulse input of magnitude 'A'.
(d) none of these.

200.
 $AR e^{eT}$ represents the output equation for

T
first order system with
(a) unit step input.
(b) sinusoidal input of magnitude A. (c) impulse input of magnitude A.
(d) none of these.

$AR \sin[Wt - \tan^{-1}(WT)]$ represents **201.**

1

+

$\frac{2}{2}$

WT

output equation for first order system with (a) unit step input.
(b) sinusoidal input of magnitude A. (c) impulse input of magnitude A.
(d) none of these.

202. Composition of alloys can be determined by (a) polarograph
(b) chromatograph
(c) refractrometer
(d) none of these

203. Liquid flow rate in a small channel is best measured by a
(a) weir (b) pitot tube (c) vane meter (d) venturimeter

ANSWERS

185. (b) 186.(a) 187.(d) 188.(c) 189.(a) 190.(b) 191.(c) 192.(a) 193.(a) 194.(b)
195.(a) 196.(a)

197.(b) 198.(b) 199.(a) 200.(c) 201.(b) 202.(a) 203.(b)

204. The symbol - ||| — in an instrumentation diagram represents the.....measurement. (a) temperature (c) pressure
(b) flow
(d) none of these

205. The symbol - || - || - || - represents the.....line.
(a) pipe (b) electric (c) pneumatic (d) none of these

206. The symbol.....represents the
(a) pipe line (b) electric line (c) pneumatic line (d) none of these

207. For low loads, the suitable controller is a/ an.....controller.
(a) on-off (b) PID
(c) P (d) PI

208. For high loads, the suitable controller is a/ an.....controller.
(a) on-off
(b) positioning (P, PI, PD, PID controllers

etc.)
(c) both (a) and (b)
(d) neither (a) nor (b)

209. Thermistors are made of
(a) ultra pure metals
(b) metal oxides
(c) iron-copper alloys
(d) nickel-chromium alloys

210. Zirconia probe is used for the continuous measurement of.....flue gases going out of the chimney.
(a) oxygen in
(b) carbon dioxide in
(c) carbon monoxide in
(d) temperature of

211. Mass spectrometer is used for composition

- (b) solids
- (d) none of these analysis of (a) alloys (c) isotopes

212. Thermal conductivity measurement comprises the working principle of a
(a) CO₂ analyser (b) polarimeter (c) spectrometer (d) chromatograph

213. Which is the most suitable for measuring pressure below 3 microns ?
(a) Mcleoid gauge
(b) Alphatron

214. Alphatron measures the pressure..... microns.
(a) <1 (b) < 3
(c) >3 (d) <0.1

215. Generation of an emf when two solutions of different hydrogen ion concentration are separated by a thin glass wall forms the working principle of
(a) CO₂ analyser (c) pH meter
(b) spectrometer (d) polarograph

216. Liquid column manometers are used for measuring pressure
(a) > 2 kg/cm² (gauge)
(b) < 2 kg cm² (gauge)
(c) < 10 kg/cm² (gauge)
(d) < atmospheric

217. Mcleoid gauge measures.....pressure. (a) positive
(b) pressure below atmospheric
(c) very high
(d) atmospheric

218. Bourdon gauges are used for measuring.....pressure .
(a) < atmospheric
(b) > 2 kg / cm² (guage)
(c) < 2 kg/cm² (gauge)
(d) > 10 kg/cm²

219. Cascade control employs
(a) two feed forward
(b) two feed backs

(c) one feed back and one feed forward (d) none of these

220.

$$\frac{1}{W} \left[\frac{1}{2\xi WT^{1/2}} \right]$$

—+ represents the)]
.....of a second order system.

- (a) magnitude ratio
(b) overshoot
(c) general form of transfer function (d) none of these

221. Derivative control is used

- (a) alone
(b) along with proportional control
(c) along with integral control
(d) none of these

222......stability method uses open loop transfer function for stability analysis. (c)

Ionisation gauge

- (a) Bode (b) Root locus (c) Nyquist (d) all (a), (b) and (c) (d) Bourdon gauge

ANSWERS

204. (b) 205. (c) 206. (b) 207. (a) 208. (b) 209. (b) 210. (b) 211. (a) 212. (a) 213. (c)
214. (c) 215. (c)

216. (b) 217. (b) 218. (b) 219. (b) 220. (a) 221. (b) 222. (d)

223. stability method uses closed loop transfer function for stability analysis. (a) Ruth

- (b) Mikhalov
(c) both (a) & (b)
(d) neither (a) nor (b)

224. stability method uses characteristic equation for stability analysis.

- (a) Ruth
(b) Mikhalov
(c) both (a) & (b)

(d) neither (a) nor (b)

225. Open loop gain is obtained by substituting (a) $s = 0$ (b) $s = \infty$
(c) $s = 1$ (d) $s = -1$

226. Amplitude ratio of time lag is
(a) 0 (b) 1
(c) ω (d) none of these

227. Working phase lag in Bode method is (a) -90° (b) -120°
(c) -135° (d) -150°

228. Overall amplitude ratio (A.R.) is given by (a) $AR_1 \cdot AR_2 \cdot AR_3 \dots$
(b) $AR_1 + AR_2 + AR_3 + \dots$
(c) $AR_1 - AR_2 + AR_3 - \dots$
(d) none of these

229. Overall phase angle is given by
(a) $\sum \phi_i$
(b) $\sum \phi_i$
(c) $\sum \phi_i$
(d) none of these

230. Phase lag of P-controller is
(a) 0° (b) -90°
(c) 90° (d) K_C

231. At phase lag, cross over frequency is equal to (a) -90° (b) -120°
(c) -150° (d) -180°

232. Distributed parameter approach gives..... differential equation.
(a) ordinary
(b) partial
(c) either (a) or (b)
(d) neither (a) nor (b)

233. A controlling element is exemplified by a (c) pneumatic controller + valve
(d) none of these

234. A self operated controller is exemplified by a (a) pneumatic controller
(b) thermostatic valve
(c) pneumatic controller + valve
(d) none of these

235. The term analogous to voltage in case of a single tank is
(a) flow rate
(b) liquid volume in the tank
(c) level
(d) none of these

236. The term analogous to electric current in thermal control system is
(a) temperature
(b) enthalpy of the system
(c) heat flow rate
(d) none of these

237. Which positioning controller has the smallest maximum deviation ?
(a) P (b) PD
(c) PI (d) PID

238. Addition of derivative control to proportional controller reduces the
(a) stabilising time
(b) maximum deviation
(c) offset
(d) none of these

239. Addition of integral control to proportional controller eliminates the
(a) stabilising time
(b) maximum deviation
(c) offset
(d) none of these

240. How many poles, the transfer function, $1/(s^3 + 2s^2 + 1)$ has got ?
(a) 0 (b) 1
(c) 2 (d) 3

241. Gain margin at 180 phase lag is given by (a) $A.R$ (b) $(A.R)^2$
(c) $1/A.R$ (d) $1/(A.R)^2$

(a) pneumatic controller (b) control valve

242. For a given duty, which is the costliest controller ?

(a) pneumatic

(b) hydraulic

(c) electronic

(d) all have the same cost

223.(d) 224.(c) 225.(a) 226.(b) 227.(c) 235.(c) 236.(c) 237.(b) 238.(a) 239.(c)

ANSWERS

228.(a) 229.(b) 230.(a) 231.(b) 232.(b) 233.(a) 234.(b) 240.(d) 241.(c) 242.(b)

243. Purpose of a pilot in a pneumatic controller is to (a) decrease the flow of air.

(b) increase the flow of air.

(c) give direct motion on final control element. (d) none of these.

244. Diaphragm control valve is used for (a) fluids of high viscosity.

(b) corrosive chemical liquids.

(c) granules of solid materials.

(d) none of these.

245. Feed forward controller is used to account for.....changes.

(a) load

(b) set point

(c) manipulated variable

(d) none of these

246. Photoelectric pyrometers are suitable in the temperature range

of..... °C. (a) 400 – 1600 (b) 800 – 1600 (c) 800 – 2500 (d) 400 – 1000

247. Which of the following is not suitable for measuring temperatures in the range of 800

–1600°C ?

(a) Optical pyrometer

(b) Radiation pyrometer

(c) Photoelectric pyrometer

(d) Thermocouples

248. Helium gas constant volume thermometer is suitable for measuring.....
°C.

(a) < 100 (b) < 0

(c) > 0 (d) > 800

249. Nitrogen gas constant volume thermometer is suitable for
measuring.....°C. (a) $0 - 100$ (b) < 0

(c) > 100 (d) > 500

250. Range of hydrogen gas constant volume thermometer is..... °C.

(a) -10 to 20 (b) 0 to 100 (c) $100 - 500$ (d) $400 - 1000$

251. Which of the following can measure temperatures in the range of -20 to 300°C ? (a) Mercury in glass thermometer

(b) Vapor pressure thermometer

(c) Resistance thermometer

(d) All (a), (b) and (c)

252. Bellows are made of thin sheets of

(a) metal (b) plastic (c) leather (d) all (a), (b) & (c)

253. f VS W plot in Bode plot is made on a/an..... graph paper.

(a) ordinary (b) semi-log (c) log-log (d) triaxial

254. $A.R.$ vs W plot in Bode plot is made on a/ an.....graph paper.

(a) ordinary (b) semi-log (c) log-log (d) triaxial

255. Shell and tube heat exchanger is an example of.....parameter
system.

(a) lumped (c) non-linear (b) distributed (d) none of these

256. Mixer is an example of.....parameter system.

(a) lumped (c) non-linear (b) distributed (d) none of these

257. Phase plane method has been introduced by (a) Ziegler-Nichols (b) Bode
(c) Pioncare (d) none of these

258. Describing functions can be used upto..... variables.

- (a) one (b) three
(c) five (d) any number of

259. Phase plane analysis is limited upto..... variables.

- (a) one (b) two
(c) three (d) five

260. A non-linear system will have.....steady state values.

- (a) 2 (b) 3
(c) 5 (d) many (> 1).

261. Most commonly used controller for controlling the flow rates in industries is a..... controller.

- (a) P (b) PI
(c) PD (d) PID

262. Most commonly used controller for controlling the temperature is a.....controller. (a) P (b) PI

- (c) PD (d) PID

263. Radiation pyrometers measure temperature in the range of..... °C.

- (a) 300 to 1200 (b) 800 to 2000 (c) –40 to 1000 (d) 0 to 2000

264. Temperature in °F and °C are the same at (a) 320 (b) 0°

- (b) 212° (d) –40°

ANSWERS

243. (b) 244.(b) 245.(a) 246.(b) 247.(d) 248.(b) 249.(c) 250.(b) 251.(d) 252.(d) 253.(b) 254.(c)

255.(b) 256.(a) 257.(c) 258.(d) 259.(b) 260.(d) 261.(b) 262.(d) 263.(b) 264.(d)

265. Which is the most suitable instrument for measuring a temperature of 2000°C ? (a) Mercury thermometer

- (b) Radiation pyrometer
(c) Bi-metallic thermometer
(d) None of these

266. The thermocouple (iron-constantan) measures temperature in the range of.....°C. (a) 0 to 2000 (b) 0 to 600 (c) – 40 to 1500 (d) 800 to 2000

- 267.** Pneumatic controllers are used to control upto a distance of.....meters. (a) 30 (b) 300
(c) 1000 (d) 2500
- 268.** Disadvantage of mercury as manometric liquid, is that it (a) amalgamates/corrodes many metals. (b) is poisonous.
(c) is expensive.
(d) all (a), (b) and (c).
- 269.** Mercury in glass thermometer measures temperature in the range of.....°C. (a) – 30 to 350 (b) –100 to 450 (c) 100 to 400 (d) 0 to 550
- 270.** Emf. produced in the thermocouples is of the order of (a) millivolts (c) microvolt (b) volts
(d) kilovolt
- 271.** Electronic controllers are used to control upto a distance of.....metres. (a) 30 (b) 300
(c) 1500 (d) 3000
- 272.** Functioning of radiation pyrometer is based on the (a) Seebeck effect
(b) Stefan-boltzman law
(c) both (a) and (b)
(d) neither (a) nor (b)
- 273.** Thermopile measures the (a) emf (b) current (c) temperature (d) flow rate
- 274.** % CO in flue gas is determined by the (a) spectrometer
(b) thermal conductivity cell
(c) polarimeter
(d) polarograph
- 275.** Which property of thermocouple is undesirable in its industrial use ? (a) Non-linear relation of emf to temperature. (b) Resistance to oxidation.
(c) Very large thermal emf. generation. (d) Precision of calibration.
- 276.** Bimetallic thermometers measure temperature in the range of.....°C. (a) 0 to 400 (b) – 40 to 1000 (c) 50 to 500 (d) 800 to 1600

277. is commonly used to measure the tube side temperature in a shell and tube heat exchanger ?

- (a) Thermocouple
- (b) Radiation pyrometer
- (c) Mercury thermometer
- (d) Constant volume helium thermometer

278. Hydraulic controllers are used to control upto a distance of.....meters.

- (a) 30 (b) 300
- (c) 1000 (d) 3000

279. Which is the most suitable instrument for measuring a temperature of – 250°C ? (a) Mercury thermometer

- (b) Optical pyrometer
- (c) Platinum resistance thermometer (d) Constant volume helium thermometer

280. Bourdon gauges measure pressure

- (a) above 2 kgf/cm² (abs.)
- (b) below 2 kgf/cm² (abs.)
- (c) below 1 kgf/cm² (abs.)
- (d) below 1000 mm water gage

281. Sludge flow rate is determined by a/an (a) rotameter

- (c) orificemeter (b) venturimeter (d) open weir

282. Humidity of air is measured by a (a) polarimeter (c) hygrometer (b) polarograph (d) none of these

283. Vapor pressure thermometer measures the temperature in the range of.....°C. (a) – 20 to 300 (b) – 40 to 1000 (c) 200 to 1000 (d) 800 to 2000

284. Thermocouples employ two

- (a) dissimilar metal strips
- (b) dissimilar metal wires
- (c) similar metal strips
- (d) none of these

285. Mcleoid gage measures

- (a) $> 2 \text{ kgf/cm}^2$ (abs.)
(b) $< 2 \text{ kgf/cm}^2$ (abs.)

ANSWERS

265. (b) 266. (b) 267. (b) 268. (d) 269. (a) 270. (a) 271. (c) 272. (c) 273. (c) 274. (b)
275. (a) 276. (a)

277. (a) 278. (a) 279. (d) 280. (a) 281. (d) 282. (c) 283. (a) 284. (b) 285. (c)

(c) high vacuum

(d) atmospheric pressure

286. A constant volume gas thermometer using nitrogen measures the temperature.....°C. (a) $< 0^\circ\text{C}$ (b) $< 100^\circ\text{C}$ (c) $> 100^\circ\text{C}$ (d) $> 1000^\circ\text{C}$

287. Polarograph is used for the analysis of (a) solids (b) liquids (c) gases (d) both (b) and (c)

288. Ionisation gauge measures the

(a) pressure (b) flow rate

(c) vacuum (d) alloy composition

289. is the most frequently used device for measuring the furnace temperature. (a) Bimetallic thermometer

(b) Resistance thermometer

(c) Radiation pyrometer

(d) none of these

290. Emf generation in thermocouples is explained by the

(a) Joules heating effect.

(b) Stefan-Boltzman law.

(c) Ohm's law.

(d) none of these.

291. is a desirable static characteristics of (a) ramp input of slope A .

(b) unit step change.

(c) impulse function of magnitude A . (d) none of these.

297. 'A' represents the Laplace transform of check this line

(a) a ramp input of slope A'.

(b) impulse function of magnitude 'A'. (c) unit step change.

(d) none of these.

298. input increases linearly with time. (a) Step (b) Ramp
(c) Impulse (d) Sinusoidal

299. Time taken for the system output to reach 63.2% of its ultimate value after a/an..... change in input is the time constant of a first order system.
(a) ramp (b) sinusoidal (c) impulse (d) step

300. For a first order system, the rate of response is proportional to
(a) T (b) $1/T$
(c) $1/T^2$ (d) T^2

where, T = time constant

301. Step response of a first order system is

(b) Dead Zone
(d) Reproducibility instruments. (a) Drift
(c) Static error

292. is an undesirable static characteristics

(b) Reproducibility (d) Sensitivity
of instruments. (a) Drift
(c) Accuracy

293. Thermocouple ($Pt/Pt - Rh$) measures the temperature in the range of..... °C. (a) 0 to 1600 (b) 600 to 1600 (c) 0 to 2200 (d) 400 to 1300

294. One time constant represents the.....of a first order instrument. (a) time lag (b) (c) dynamic error (d) measuring lag none of these

295.

$(1 / \omega) \tan^{-1}(\omega T)$ represents the.....of a
 T

first order instrument.

(a) time lag (b)
(c) dynamic error (d)
measuring lag none of these

where, ω = radian frequency T = time constant of instrument

- 296.** $1/s$ represents the Laplace transform of a/an (a) underdamped (b) (c) overdamped (d) critically damped undamped
- 302.** System having a damping co-efficient of zero is (a) underdamped (b) critically damped (c) overdamped (d) undamped
- 303.** Phase lag of a second order system is (a) 60° (b) 120° (c) 90° (d) 180°
- 304.** Offset which does not vary with time is defined as the.....error in controlled variable. (a) unsteady state (b) steady state (c) highest maximum deviation (d) lowest maximum deviation
- 305.** What is the phase lag of a sinusoidal response of a first order system ? (a) 60° (b) 120° (c) 90° (d) 180°
- 306.** Damping co-efficient is equal to 1 for..... second order response. (a) underdamped (b) (c) overdamped (d) critically damped none of these

ANSWERS

286. (c) 287.(a) 288.(c) 289.(c) 290.(d) 291.(d) 292.(a) 293.(b) 294.(b) 295.(a) 296.(b) 297.(b) 298.(b) 299.(d) 300.(b) 301.(c) 302.(d) 303.(d) 304.(b) 305.(c) 306.(b)
- 307.** Damping co-efficient is greater than 1 for.....second order response.
- 319.** The.....of a vapor pressure thermometer is a primary element. (a) underdamped (b) (c) overdamped (d) critically damped none of these (a) pointer (c) bulb (b) Bourdon tube (d) none of these
- 308.** Damping co-efficient is less than 1 for..... second order response. (a) underdamped (b) (c) overdamped (d) critically damped none of these
- 309.** controller has the smallest maximum deviation. (a) P-I (b) P-I (c) P-D (d) P-I-D

310. controller has the maximum offset. (a) P (b) P-I
(c) P-D (d) P-I-D

311. controller requires the maximum stabilising time.
(a) P (b) P-I
(c) P-D (d) P-I-D

312. The heat input rate is the variable in an endothermic CSTR. (a) load
(c) controlled
(b) manipulated (d) none of these

313. The reactor temperature is the.....variable in an endothermic CSTR.
(a) load (b) manipulated (c) controlled (d) none of these

314. The inlet temperature of the reactants is the.....variable in an
endothermic CSTR. (a)load (b) manipulated (c) controlled (d) none of these

315. The unit of 'time constant' of a system is the

(b) time
(d) none of these same as that of (a) velocity (c) (time)⁻¹

316. Mercury manometer (U-tube type) exemplifies a.....order system.
(a) zero (b) first
(c) second (d) third

317. The.....of a vapor pressure thermometer is a secondary element. (a)
pointer (b) (c) bulb (d) Bourdon tube none of these

318. The.....of a vapor pressure thermometer is a functioning element.
(a) pointer (b) bourdon tube (c) bulb (d) none of these

320. Pick out the one which is a first order instru- ment.
(a) Mercury in glass thermometer (without

any covering or air gap).
(b) Bare metallic thermometer.
(c) Bare vapor pressure thermometer. (d) all (a), (b) and (c).

321. In a shell and tube heat exchanger, the inlet temperature of heating/cooling

fluid is the.....variable. (a) load
(c) controlled
(b) manipulated (d) none of these

322. The amplitude ratio for the sinusoidal response of a.....is 1.
(a) first order system
(b) second order system
(c) transportation lag
(d) none of these

323. An amplitude ratio of 0.1 corresponds to..... decibels.
(a) 20 (b) – 20
(c) 10 (d) – 10

324. A mercury barometer measures the..... pressure.
(a) atmospheric (b) gauge
(c) vacuum (d) absolute

325. Which of the following relates the emf. generated in a single homogeneous wire to the temperature difference ?
(a) Peltier effect (c) Seebeck effect (b) Thomson effect (d) none of these

326. In a shell and tube heat exchanger, the outlet temperature of heating/cooling fluid is the.....variable. (a) load
(c) controlled
(b) manipulated (d) none of these

327. Emf generated in a thermocouple depends on the temperature
(a) of cold junction only.
(b) of hot junction only.
(c) difference between hot and cold junctions.

(d) difference between cold junction and atmospheric temperature.

ANSWERS

307. (c) 308.(a) 309.(c) 310.(a) 311.(b) 312.(b) 313.(c) 314.(a) 315.(b) 316.(c)
317.(b) 318.(a)
319.(c) 320.(d) 321.(a) 322.(c) 323.(b) 324.(a) 325.(b) 326.(c) 327.(c)

328. Thermocouple in a thermal well behaves as a true
(a) first order system.

- (b) second order system (overdamped). (c) multiple first order system.
(d) second order system (underdamped).

329. With increase in temperature, the electrical conductivity of the platinum used in the resistance thermometer

- (a) increases
(b) decreases
(c) remains constant
(d) increases exponentially

330. Which of the following judges the accuracy of an instrument ?

- (a) Dead zone (c) Static error
(b) Drift
(d) None of these

331. Relationship between absorption/evolution of heat at the thermocouple junctions and the current flow in the circuit is given by.....

- (b) Thomson
(d) none of these effect.
(a) Peltier (c) Seebeck

332. A manometer measures the.....pressure. (a) atmospheric (b) absolute
(c) gauge (d) none of these

333. The amplitude ratio for the sinusoidal response of.....is <1 .

- (a) transportation lag
(b) first order system
(c) second order system
(d) none of these

334. In a shell and tube heat exchanger, the flow rate of heating/cooling fluid is the.....variable. (a) load (b) controlled (c) manipulated (d) none of these

335. Working principle of bimetallic thermometers is difference in linear co-efficient of thermal expansion of two strips of different metals welded together. Which of the following has the maximum thermal co-efficient of linear expansion? (a) Nickel

- (c) Chromel
(b) Brass (d) Invar

336. An aneroid barometer measures the..... pressure.

- (a) atmospheric (c) vacuum
- (b) absolute (d) gage

337. Operating range of a temperature measuring instrument is 800 to 1600°C. It could be a/an.....pyrometer.

- (a) radiation (b) optical (c) photoelectric (d) none of these

338. thermometer can not measure subzero ($< 0^{\circ}\text{C}$) temperature.

- (a) Mercury in glass
- (b) Bimetallic
- (c) Vapor pressure
- (d) Resistance

339. Volumetric expansion is the working principle of the.....thermometers .

- (a) mercury in glass
- (b) constant volume gas
- (c) vapor pressure
- (d) bimetallic

340. Compositional analysis of.....is done using mass spectrometer. (a) an isotope (b) (c) a solid (d) natural gas an alloy

341. Compositional analysis of flue gas coming out of a furnace in respect of O_2 and $\text{CO}_2\%$ can be continuously done by a/an

- (a) orsat apparatus
- (b) thermal conductivity cell
- (c) zirconia probe
- (d) chromatograph

342. “An emf of the order of mV is generated when two solutions of different hydrogen ion concentration are separated by a thin glass wall”. This is the working principle of a (a) pH meter

- (c) chromatograph (b) polarimeter (d) polarograph

343. Which of the following does not figure in the list of seven substances selected for international temperature scale ?

- (a) Ice (F.P) and steam (B.P)
- (b) Oxygen and sulphur (B.P)

- (c) Antimony and silver (F.P)
- (d) Zinc (B.P) and mercury (F.P)

344. Working principle of mercury in glass thermometer is

- (a) volumetric expansion.
- (b) pressure rise with temperature. (c) linear expansion.
- (d) none of these.

ANSWERS

328. (c) 329.(b) 330.(c) 331.(a) 332.(c) 333.(b) 334.(c) 335.(b) 336.(b) 337.(c)
338.(b) 339.(b)

340.(a) 341.(b) 342.(a) 343.(d) 344.(a)

345. All the thermocouples used for temperature measurement use dissimilar metal

- (a) strips (b) bars
- (c) wires (d) beads

346. A constant volume gas thermometer employing.....is used to measure sub-zero (i.e., $< 0^{\circ}\text{C}$) temperature. (a) helium

- (c) nitrogen
- (b) hydrogen
- (d) none of these

347. Working principle of radiation pyrometer is based on the

- (a) Wien's law
- (b) Kirchoff's law
- (c) Stefan-Boltzmann law
- (d) Seebeck effect

348. temperature scale assigns 0° to the ice point' and 80° to the 'steam point'. (a) Celsius (b) Rankine (c) Reumer (d) Fahrenheit

349. The thermal emf-temperature relationship of most thermocouples is

- (a) linear (b) parabolic (c) exponential (d) square root

350. Thermal well made of.....gives the fastest speed of response, while measuring temperature by thermocouples.

- (a) steel (b) vycor (a glass) (c) nichrome (d) inconel

351. Thermal wells used in temperature measurements should have

- (a) very thick walls.
- (b) low emissivity.
- (c) polished surface.
- (d) high transmissivity of radiation.

352. Paramagnetism method is not used for the composition determination of.....in gases. (a) oxygen

- (b) oxides of nitrogen
- (c) carbon dioxide
- (d) any of these

353. Flame photometry is used for the determination of compositional analysis of

- (a) solids (b) alkali metals (c) natural gas (d) isotopes

354. Reset rate, is the another term used for..... time.

- (a) dead (b) integral (c) derivative (d) none of these

355. Flapper nozzle is used in a/an.....con- troller.

- (a) electronic (b) hydraulic (c) pneumatic (d) none of these

356. Which of the following is not a mechanical pressure sensing element ?

- (a) Bellows (b) Diaphragm (c) Bourdon tube (d) U-tube

357. Temperature measuring instruments are standardised mostly with.....points of pure substances.

- (a) melting
- (b) boiling
- (c) both (a) & (b)
- (d) neither (a) nor (b)

358. Sub-zero temperature ($< 0^{\circ}\text{C}$) can be measured by a constant volume gas thermometer employing

- (a) helium (b) nitrogen (c) hydrogen (d) none of these

359. Which of the following instruments is not used for measuring sub-zero ($< 0^{\circ}$) temperatures ?

- (a) Platinum resistance thermometer (b) Mercury in glass thermometer
- (c) Vapor pressure thermometer

(d) Radiation pyrometer

360. Dead zone in an instrument must be less than.....percent of the scale.

(a) 0.2 (b) 1.5

(c) 4 (d) 8

361. What is the Laplace transform of impulse input having magnitude 'X' ?
check

(a) X (b) X^2

(c) $1/X$ (d) 1

362. controller has the maximum stabilising time.

(a) P (b) PD

(c) PI (d) PID

363. Positioning controllers are used for

(a) low loads (b) temperature changes (c) high loads (d) flow rate changes

364. On-off controllers are normally used for (a) low loads

(b) temperature changes

(c) flow rate changes

(d) none of these

ANSWERS

345. (c) 346.(a) 347.(c) 348.(c) 349.(b) 350.(b) 351.(d) 352.(c) 353.(b) 354.(b)

355.(c) 356.(d)

357.(c) 358.(a) 359.(d) 360.(a) 361.(d) 362.(c) 363.(c) 364.(a)

365. In Bode plot, ω is plotted on a/an..... graph paper. (a) log-log (c) semi-log (b) ordinary (d) triangular (a) Response (b) Time lag (c) Drift (d) dynamic error

375. Which of the following is the dynamic characteristics of an instrument ?

366. The term analogous to the electrical current in a thermal system is the

(a) temperature difference

(b) heat flow rate

(c) heat content in the system

(d) none of these

367. A non-linear system will have.....steady state values.

(a) one (b) more than one (c) two (d) three

368. In Bode plot, A.R. vs. ω is plotted on a/an.....graph paper.
(a) log-lag (b) triangular (c) ordinary (d) semi-log

369. Feed forward controller accounts for the..... changes.
(a) set point (b) load
(c) both (a) & (b) (d) neither (a) nor (b)

370. stability method uses open loop transfer function. (a) Nyquist
(c) Ruth
(b) Mikhailov
(d) none of these (a) Reproducibility (c) Dead zone (b) Sensitivity (d) Fidelity

376. The Laplace transform of a sinusoidal function (eg; $\sin at$) is represented by the curve

377. Thermistors which have a very high temperature co-efficient of resistivity belong to the

371. Characteristic equation is the denominator of.....loop transfer function.
(a) open
(b) closed
(c) both (a) and (b)
(d) neither (a) nor (b)

372. Thermal conductivity cell is the primary element of a/an.....analyser.
(a) oxygen
(b) carbon dioxide
(c) carbon monoxide
(d) sulphur dioxide

373. Which of the following is not a second order instrument ?
(a) Mercury in glass thermometer with covering.

(b) Bare mercury in glass thermometer.

(c) Pressure gauge with one bellow, two tubes and a tank.
(d) None of these.

374. is the static characteristics of an instrument.
class of solid called (a) dielectrics

(c) semi conductors (b) insulators (d) conductors

378. Flow rate measurement of hostile acids and alkalis can be most suitably done by a/an (a) venturimeter

(b) orificemeter

(c) magnetic flow meter

(d) hot wire anemometer

379. Out of the following thermocouple wire insulating material, the highest temperature rating is for

(a) teflon (c) asbestos (b) ceramic fibre (d) fibre glass

380. Continuous shell temperature measurement in a liquid-liquid heat exchanger is done by a (a) thermocouple

(b) resistance thermometer

(c) mercury in glass thermometer

(d) vapor pressure thermometer

381. Composition of natural gas is determined by the

ANSWERS

365. (a) 366. (b) 367. (b) 368. (a) 369. (b) 370. (a) 371. (b) 372. (b) 373. (b) 374. (c)

375. (d) 376. (a)

377. (c) 378. (c) 379. (b) 380. (a) 381. (b)

(a) Haldane apparatus

(b) mass spectrometer

(c) chromatograph

(a) both (b) and (c)

382. Liquid levels in autoclaves are measured by (a) simple float

(b) differential float type manometer (c) glass gauge

(d) none of these

383. Liquid flow rate in a small channel is best measured by a/an (a) weir

(c) vane meter (b) pitot tube (d) venturimeter

384. Thermistors are made of

(a) ultra pure metals

(b) metal oxides

(c) iron-copper alloys

(d) nickel-chromium alloys

385. Thermal conductivity measurement comprises the working principle of a
(a) CO₂ analyser (b) polarimeter (c) spectrometer (d) chromatograph

386. Liquid column manometers are used for measuring the
pressure.....kgf/cm².
(a) >2 (gage) (b) <3 (gage) (c) < 10 (gage) (d) < atmospheric

387. Meleoid gauge measures the.....pressure. (a) positive (c) very high (b) sub-atmospheric (d) atmospheric

388. Bourdon gauges are used for measuring pressure (kg/cm²)
(a) < atmospheric (b) > 2 (gauge) (c) < 2 (gauge) (d) > 10 (absolute)

389. Photoelectric pyrometers are suitable in the temperature range of.....
°C.
(a) 400 – 1600 (b) 800 – 1600 (c) 800 – 2500 (d) 400 – 1000

390. Helium gas constant volume thermometer is suitable for the measurement
of a temperature of.....°C.
(a) <100 (b) <0
(c) >0 (d) >800

391. Nitrogen gas constant volume thermometer is suitable for measuring a
temperature of.....°C.
(a) 0 – 100 (b) < 0
(c) > 100 (d) > 50

392. Range of hydrogen gas constant volume thermometer is.....°C.
(a) – 10 to 20 (b) 0 to 100 (c) 100 – 500 (d) 400 – 1000

393. Which of the following can measure temperatures in the range of – 20 to
300 °C? (a) Mercury in glass thermometer
(b) Vapor pressure thermometer
(c) Resistance thermometer
(d) None of these.

394. Which of the following thermocouple materials does not contain nickel ?
(a) Alumel (b) Chromel (c)Constantan (d) None of these.

395. Which of the following thermocouples has the widest temperature measurement range ? (a) Iron-constantan

(b) Chromel-alumel

(c) Copper-constantan

(d) Platinum-platinum/rhodium

396. Which of the following thermocouples has the least temperature measurement range? (a) Copper-constantan

(b) Chromel-alumel

(c) Platinum-platinum/rhodium

(d) Iron-constantan

397. Which of the following is a 'contact' pyrometer? (a) resistance pyrometer

(b) optical pyrometer

(c) radiation pyrometer

(d) infra red pyrometer

398. Temperature of molten pig iron (1450°C) and molten slag (1500°C) flowing out of a blast furnace is measured by a/an

(a) chromel-alumel thermocouple

(b) optical pyrometer

(c) radiation pyrometer

(d) either (b) or (c).

399. Thermodynamic celcius scale of temperature measurement is

(a) defined on the basis of melting point of

ice and evaporation temperature of water vapor.

(b) defined on the basis of melting point of ice and condensation temperature of water vapor.

(c) having an interval of 100° between ice point to steam point.

(d) both (b) and (c).

ANSWERS

382. (b) 383. (b) 384. (b) 385. (a) 386. (b) 387. (a) 388. (a) 389. (b) 390. (b) 391. (c)

392. (b) 393. (d)

394. (d) 395. (d) 396. (a) 397. (a) 398. (d) 399. (d)

400. The temperature range for which copper resistance thermometer can be used is.....°C . (a) 0 to 150 (b) – 200 to 150 (c) 350 to 750 (d) 500 to 900

401. Nickel percentage in invar which is an ironnickel alloy, and is used as a thermocouple material is

(a) 12 (b) 36

(c) 54 (d) 68

402. Which of the following is not a differential pressure flow meter ? (a)

Rotameter

(c) Orificemeter (b) Flow nozzle (d) Venturimeter

403. Which of the following is not a variable area flow meter ?

(a) Piston type meter

(b) Rotameter

(c) Magnetic flow meter

(d) Orifice and tapered plug meter

404. A magnetic flowmeter is

(a) based on the principle of Faraday's law. (b) capable of measuring the flow rate of

slurries and electrolytes.

(c) based on the linear relationship between the fluid flow rate and the induced voltage.

(d) all (a), (b) and (c).

405. The maximum service temperature for fibre glass used as thermocouple wire insulation material is.....°C.

(a) 250 (b) 500

(c) 750 (d) 1000

406. Which of the following is never used as an element of industrial resistance thermometer ? (a) Lead

(b) Nickel

(c) Copper

(d) 30% iron + 70% nickel

407. The pressure sensing element of elastic type pressure gauge is never made

in the form of a (a) bellows (b) diaphragm (c) strip (d) Bourdon tube

408. Liquid flow rate in an open channel can not be measured by a/an (a) orifice meter (c) rectangular weir (b) Cipolletti weir (d) V-notch

409. Configuration of Bourdon spring tube is never made of.....shape.
(a) circular (b) semi-circular (c) helical (d) spiral

410. Thermistor, which has high temperature coefficient of resistivity, is used as the sensing element in resistance thermometer. It is a/an (a) insulator (b) conductor (c) solid semi-conductor (d) liquid semi-conductor

411. Which is the strongest paramagnetic gas? (a) CO_2 (b) O_2 (c) NO (d) NO_2

412. type of element is normally not used in the bimetallic thermometers.
(a) Flat spiral (b) Bourdon tube (c) Single helix (d) Multiple helix

413. Smoke density of the flue gas going out of the chimney is measured by a
(a) polarograph (b) thermal conductivity meter (c) photo electric cell (d) chromatograph

414. Which of the following thermocouples can measure the maximum temperature ? (a) Platinum-rhodium (b) Tungsten-molybdenum (c) Chromel-alumel (d) Iron-constantan

415. Working principle of disappearing filament type optical pyrometer is based on the (a) Wien's law (c) Kirchhoff's law (b) Seebeck effect (d) Peltier effect

416. Silver point temperature is..... $^{\circ}\text{C}$. (a) 760.5 (b) 860.5 (c) 960.5 (d) 1060.5

417. Load cells are used for the measurement of (a) stress (b) weight (c) strain

(d) velocity

418. Bourdon tube is never made of

(a) phosphor bronze (b) monel metal (c) stainless steel (d) cast iron

419. The function of a transducer is to

(a) modify the input signal.

(b) amplify the input signal.

(c) convert the primary signal into a more

useful quantity, usually an electric impulse.

(d) codify/decodify the input signal.

ANSWERS

400. (b) 401.(b) 402.(c) 403.(a) 404.(b) 405.(b) 406.(a) 407.(c) 408.(a) 409.(a)
410.(c) 411.(b)

412.(b) 413.(c) 414.(b) 415.(a) 416.(c) 417.(b) 418.(d) 419.(c)

420. Which of the following temperature..... measuring instruments need not touch the object whose temperature is being measured ? (a)

Radiation/infrared pyrometer

(b) Filled system thermometer

(c) Mercury in glass thermometer

(d) Thermo electric pyrometer

421. Which of the following can not measure a temperature of 1600°C ?

(a) Platinum resistance thermometer (b) Thermocouple

(c) Photo-electric pyrometer

(d) Radiation pyrometer

422. What is the normal percentage of rhodium in platinum + rhodium element used in the thermocouple ?

(a) 0.1 (b) 3

(c) 13 (d) 29

423. Which of the following fluid flow measuring devices can measure the largest flow rate ? (a) V-notch (b) Rotameter (c) Orificemeter (d) Weir

424. Dilute wine was used as a thermometric liquid initially to develop temperature scale. First empirical temperature scale developed was the.....scale. (a) Kelvin

(c) Fahrenheit

(b) Centigrade (d) Reaumer

425. Which of the following thermocouples is incapable of measuring sub-zero (i.e., $< 0^{\circ}\text{C}$) temperature ?

- (a) Chromel-alumel
- (b) Iron-constantan
- (c) Platinum-platinum+rhodium
- (d) Copper-constantan

426. Reference points i.e., ice point and steam point in Reaumer temperature scale are respectively

- (a) -273° & 80° (b) 0° & 80° (c) 32° & 460° (d) 32° & 80°

427. Which of the following is an undesirable dynamic characteristic of an instrument ? (a) Reproducibility (c) Time lag

- (b) Dead zone (d) Static error

428. Working principle of mercury in glass thermometer is based on the.....of mercury with increase in temperature. (a) increase of pressure (b) increase of thermal conductivity (c) volumetric expansion (d) differential linear expansion

429. Stabilising time for the controllers is the time required for the response to reach.....percent of its ultimate value.

- (a) 63.2 (b) 87.5
- (c) 95 (d) 100

430. On-off control which is a special case of proportional control, has a band width of about.....percent.

- (a) 100 (b) 75
- (c) 25 (d) 0

431. What is the dynamic error in a critically damped second order instrument for a ramp input (AT) ?

- (a) 0.5 AT (b) 2 AT

(c) AT

(d) 1.5 AT

432. Very low pressure is expressed in microns (m), which is equal to.....mm

of Hg column (absolute) at 0°C.

(a) 0.0001 (b) 0.001

(c) 0.01 (d) 0.1

433. A mercury thermometer can not be used to measure the temperature below the freezing point of mercury, which is.....°C.

(a) – 38.9 (b) – 11.9

(c) – 60.9 (d) – 80.9

434. The deflection of the free end of the bimetal- lie strips in a bimetallic thermometer with temperature is nearly

(a) linear (b) non-linear (c) parabolic (d) hyperbolic

435. A bimetallic thermometer as compared to industrial mercury in glass thermometer has almost the same

(a) temperature measuring range (- 40°C to

450°C).

(b) accuracy (± 1% of span).

(c) speed of response.

(d) all a,b & c.

436. Radiation pyrometers as compared to thermocouples

(a) has a slower speed of response.

(b) can measure higher temperature. (c) can't measure the temperature of moving objects.

(d) is more affected by corrosive atmosphere.

420.(a) 421.(a) 422.(c) 423.(d) 424.(c) 432.(b) 433.(a) 434.(a) 435.(d) 436.(b)

ANSWERS

425. (c) 426.(b) 427.(c) 428.(c) 429.(c) 430.(d) 431.(b) **437.** Out of the following temperature measuring instruments, the measurement accuracy will be minimum for the

(a) mercury in glass thermometer.

(b) optical pyrometer.

(c) iron-constantan thermocouple.

(d) alcohol filled thermometer.

438. Zirconia probe is used for the measurement of (a) humidity of air.

- (b) % CO₂ in flue gas.
- (c) % O₂ in flue gas.
- (d) speed of a submarine.

439. Mercury thermometer can be used to measure the temperature upto.....
°C. (a) 100 (b) 250
(c) 350 (d) 750

440. Specific gravity of a liquid can not be measured by a/an
(a) anemometer
(b) specific gravity bottle
(c) pycnometer
(d) hydrometer

441. Liquid discharge from a tank or reservoir can not be measured by (a)
orificemeters (c) mouthpieces (b) weirs (d) notches

447. Air velocity in duct can be measured by.....using manometer.
(a) orificemeter (b) pitottube (c) Bourdon gauge (d) anemometer

448. Inclined tube manometer connected to a pitot tube is
sensing.....pressure in a gas stream
(a) static (b) velocity (c) atmospheric (d) total

449. The transfer function of a process is $1/(16^2s + 8s + 4)$. If a step change is introduced into the system, then the response will be
(a) underdamped
(b) critically damped
(c) overdamped
(d) none of these

450. In any process application feedback control requires a/an.....loop.
(a) remote (b) open
(c) closed (d) internal.

451. A proportional controller has a proportional band of 380%. The gain will be
(a) 7.60 (b) 0.263
(c) 3.80 (d) 0.132.

452. Automatic controllers operate on the difference between set point and measurement, which is called:

- (a) feedback (b) bias
- (c) error (d) offset.

453. All control systems that fit into the usual pattern are:

- (a) non self-regulating (b) on / off (c) closed loop open-loop.

454. The most common combination of control modes found in the typical process plant is: (a) proportional plus integral

- (b) on/off
- (c) proportional only
- (d) proportional, plus integral and derivative.

455. The response of derivative action to a step input is a

- (a) step (b) sinewave (c) ramp (d) spike

456. Transfer function is defined as the ratio of Laplace transforms of

- (a) output deviation variable to input deviation

442. If the time constant is.....the dynamic lag is high for a control valve.

- (a) zero (b) small
- (c) large (d) -2

443. U-tube type manometer is.....order system.

- (a) zero (b) half
- (c) first (d) second

444. Magnetic flow meter can not measure the flow rates of

- (a) electrolytes
- (b) slurries
- (b) hostile acids & alkalies
- (d) non-electrolytes

445. A pneumatic valve is said to contribute negligible dynamic lag, if the time constant of the valve is

- (a) 1 (b) ∞
- (c) very high (d) very small

446. The steady state output of the transfer function $S/(s + 1)(s + 2)$ for a unit

slope ramp input is (a) $1/2$ (b) $3/4$
(c) $1/4$ (d) 0^{tion variable}

ANSWERS

437. (b) 438.(c) 439.(c) 440.(a) 441.(a) 442.(c) 443.(d) 444.(d) 445.(d) 446.(a)
447.(b) 448.(b)

449.(a) 450.(c) 451.(b) 452.(c) 453.(b) 454.(a) 455.(d) 456.(a)

(b) controlled variable deviation to forcing function

(c) controller output deviation to disturbance deviation

(d) none of these.

457. Response due to a sinusoidal input is: (a) exponentially increasing

(b) exponentially decreasing

(c) sinusoidal

(d) an impulse function

458. Amplitude ratio for a 1st or 2nd order system is

(a) 1 (b) > 1

(c) < 1 (d) none of these.

459. The time constants for a fractionating column in a process industry are of the (a) seconds (c) minutes (b) fraction of a second (d) hours.

460. Match the opposite characteristics of items in List I with that of List II

List I

(i) Lag

(ii) Static and dynamic error

(iii) Draft

(iv) Sensitivity

List II

(A) speed of response

(B) fidelity

(C) reproducibility

(D) precision

(a) i - A, ii - B, iii - C, iv - D

(b) i - D, ii - C, iii - B, iv - A

(c) i - C, ii - B, iii - A, iv - D

(d) i - D, ii - B, iii - A, iv - C.

461. Process instrumentation diagram provides (a) process flow diagram
(b) schematic layout of the process and plant

equipment with or without technical

(c) requisites for process system analysis and equipment specifications
(d) schematic layout without specification of the process and plant equipment but together with instrumentation equipment.

462. Piezo- electric effect is

(a) conversion of a changing pressure into electrical voltage signal
(b) creation of a voltage by the movement of a coil within a magnetic field
(c) generation of an emf or current through the use of photo-electric effect
(d) none of these.

463. Which thermocouple would you choose for use in an oxidising environment?

(a) Copper - constantan
(b) Iron-constantan
(c) Chromel-alumel
(d) None of these.

464. The brightness of a hot object is the basis of temperature measurement in

(a) optical pyrometer
(b) radiation pyrometer
(c) pyrometric cones
(d) resistance pyrometers.

465. The low expansion and high expansion materials of a bimetallic strip are respectively (a) chromel and alumel

(b) invar and brass
(c) brass and invar
(d) aluminium and invar.

466. What gauge would you recommend for measuring pressure in the range of 10^{-4} to 10^{-6} mHg?

(a) Alphatron

- (b) Cold cathode gauge
- (c) Ionization gauge
- (d) None of these.

specifications

ANSWERS

457.(c) 458.(c) 459.(d) 460.(a) 461.(d) 462.(a) 463.(c) 464(a) 465.(b) 466.(a)

chemical engineering thermodynamics

1. Which of the following is an extensive property of a system ?

- (a) Heat capacity
- (b) Molal heat capacity
- (c) Pressure
- (d) Concentration

2. Which of the following is a thermodynamic

(a) two temperatures only. ¹⁰(b) pressure of working fluid.

(c) mass of the working fluid. (d) mass and pressure both of the working fluid.
What is the degree of freedom for a system comprising liquid water in equilibrium with property of a system ?

(a) Concentration

(c) Temperature
its vapour ?

(b) Mass

(d) Entropy

(a) 0 (b) 1 (c) 2 (d) 3

3. First law of thermodynamics is mathematically stated as temperatures T_1 and T_2 ($T_1 < T_2$) is

—

(a) $dQ = dE + dW$ (b) $dQ = dE - dW$ (c) $dE = dQ + dW$ (d) $dW = dQ + dE$ (a) 21 (b) T_1

4.

First law of thermodynamics deals with the
 T_2

—

(a) direction of energy transfer. (c) 12 (d) 12

(b) reversible processes only. T_2 T_1 (c) irreversible processes only.

(d) none of these. **11.** For a constant pressure reversible process, the ΔH

irreversible process enthalpy change (ΔH) of the system is (a) is the analog of linear frictionless motion (a) $C_v dT$ (b) $C_p dT$

in machines. (c) $\int^C dT$ (d) $\int^C dT$ (b) is an idealised visualisation of behaviour $p-v$ of a system. **12.** Internal energy of an ideal gas

(c) yields the maximum amount of work. (a)

(d) yields an amount of work less than that of (b) a reversible process. (c)

6. In an adiabatic process, the^(d) increases with increase in pressure. decreases with increase in temperature. is independent of temperature. none of these.

(a) heat transfer is zero. 13. Equation which relates pressure, volume and (b) temperature change is zero. temperature of a gas is called the (c) work done is a path function. (a) (d) enthalpy remains constant. (b)

7. Enthalpy 'H' is defined as^(c) (a) $H = E - PV$ (b) $H = F - TS$ ^(d)

equation of state

Gibbs Duhem equation ideal gas equation

none of these

(c) $H - E = PV$ (d) none of these 14. Isobaric process means a constant.....

8. Efficiency of a heat engine working on Carnot^{process}. cycle between two temperature levels depends^(a) temperature upon the (c) volume

ANSWERS

1. (a) 2.(b) 3.(a) 4.(a) 5.(d) 6.(a) 7.(c) 8.(a) 9.(b)

13.(a) 14.(b)

(b) pressure (d) entropy

10.(a) 11.(c) 12.(d)

15. Isentropic process means a constant..... process.

(a) enthalpy (b) pressure (c) volume (d) none of these

16. Throttling (Joule-Thomson effect) process is a constant.....process. (a) enthalpy

(c) pressure

(b) entropy

(d) none of these

17. The point at which all the three (solid, liquid and gas) phases co-exist, is known as the.....point.

(a) freezing

(c) boiling

(b) triple (d) Boyle

18. For an isothermal process, the internal energy of a gas

- (a) increases
- (b) decreases
- (c) remains unchanged
- (d) data insufficient, can't be predicted

19. $PV^g = \text{Constant}$ (where, $g = C_p/C_v$) is valid for a/an.....process. (a) isothermal

- (c) isobaric
- (b) isentropic (d) adiabatic

(c) (d)

pressure to pseudocritical pressure. pseudocritical pressure to pressure. **24.** Number of components (C), phase (P) and

degrees of freedom (F) are related by Gibbs phase rule as

- (a) $P + F - C = 2$ (b) $C = P - F + 2$ (c) $F = C - P - 2$ (d) $P = F - C - 2$.

25. Degree of freedom at triple point will be (a) 0 (b) 1

(c) 2 (d) 3

26. $C_p - C_v = R$ is valid for.....gases. (a) ideal

- (b) all
- (c) very high pressure
- (d) very low temperature

27. An isolated system can exchange.....with its surroundings.

- (a) matter
- (b) energy
- (c) (d)

neither matter nor energy both matter and energy

28. Heat of formation of an element in its standard state is

- (a) 0 (b) < 0
- (c) > 0 (d) a function of pressure

29. Heat of reaction is

- (a) (b) (c) (d)

dependent on pressure only.

dependent on temperature only.

dependent on both pressure and temperature independent of temperature changes.

30. Second law of thermodynamics is concerned with the

(a) (b) (c) (d)

amount of energy transferred. direction of energy transfer. irreversible processes only. non-cyclic processes only. **20.** For an isothermal reversible compression of

an ideal gas

(a) only $\Delta E = 0$ (b) only $\Delta H = 0$ (c) $\Delta E = \Delta H = 0$ (d) $dQ = dE$

21. Boyle's law for gases states that

(a)

$P \propto 1$, when temperature is constant. P

(b) 1 , when temperature & mass of the $P \propto P$

gas remain constant.

(c) $P \propto V$, at constant temperature & mass of the gas.

(d) $P = \text{constant}$, for any gas. V

The equation, $PV = nRT$, is best obeyed by gas **22.**

es at

(a) low pressure & high temperature. (b) high pressure & low temperature. (c) low pressure & low temperature. (d) none of these.

23. Reduced pressure of a gas is the ratio of its (a) pressure to critical pressure.

(b) critical pressure to pressure.

H H

ANSWERS

15.(c) 16.(a) 17.(b) 18.(c) 19.(d) 20.(c) 21.(b) 22.(a) 23.(a) 24.(a) 25.(a) 26.(a) 27.(c) 28.(a) 29.(c) 30.(b) 31.(a) 32.(b)

31. The absolute entropy for all crystalline substances at absolute zero temperature is (a) zero

(b) negative

- (c) more than zero
- (d) indeterminate

32. Joule-Thomson co-efficient is defined as

- (a) $m = \frac{\partial T}{\partial P} \frac{1}{T}$
- (b) $m = \frac{\partial T}{\partial P} \frac{1}{T^2}$
- (c) $m = \frac{\partial T}{\partial P} \frac{1}{T}$
- (d) $m = \frac{\partial T}{\partial P} \frac{1}{T^2}$

33. Mollier diagram is a plot of

- (a) temperature vs. enthalpy
- (b) temperature vs. enthalpy
- (c) entropy vs. enthalpy
- (d) temperature vs. internal energy

34. Near their critical temperatures, all gases occupy volumes.....that of the ideal gas. (b) same as (d) half

- (a) less than (c) more than

35. Charles' law for gases states that

- (a) $V = \text{Constant}$
- (b) $V \propto T$
- (c) $V \propto T^2$
- (d) $PV = \text{Constant}$

36. Absolute zero temperature signifies the (a) minimum temperature attainable, (b) temperature of the heat reservoir to which

a Carnot engine rejects all the heat that is taken in.

- (c) temperature of the heat reservoir to which a Carnot engine rejects no heat.
- (d) none of these.

37. Entropy is a measure of the.....of a system.

- (a) disorder
- (b) orderly behaviour
- (c) temperature changes only
- (d) none of these

38. For spontaneous changes in an isolated system (S = entropy)

(a) $ds = 0$ (b) $ds < 0$

(c) $ds > 0$ (d) $ds = \text{Constant}$

39. For equilibrium process (i.e. reversible) in an isolated system

(a) $ds = 0$ (b) $ds < 0$

(c) $ds > 0$ (d) $ds = \text{Constant}$

40. The four properties of a system viz. P, V, T, S are related by.....equation.

(b) Gibbs-Helmholtz (d) none of these

41. For a constant volume process (a) $dE = C_v .dT$

(c) $dQ = dE + p.dV$

42. In a reversible process (a) $Tds = dE + dW$ (b) $dE - dW = Tds$ (c) $dW - dE = Tds$ (d) $Tds - dW + dE > 0$ (b) $dE = C_v .dT$ (d) $dW = p.dV$

43. In an irreversible process (a) (b) (c) (d) $Tds = dE - dW = 0$ $dE - dW - Tds = 0$ $Tds - dE + dW < 0$ $Tds - dT + dW < 0$

44. C_v is given by

(a) $\left(\frac{\partial E}{\partial T} \right)_v$

(b) $\left(\frac{\partial E}{\partial T} \right)_P$

(c) $\left(\frac{\partial E}{\partial T} \right)_P$

(d) $\left(\frac{\partial E}{\partial T} \right)_v$

$\left(\frac{\partial E}{\partial T} \right)_P$

45. Third law of thermodynamics is concerned with the

(a) (b) (c) (d)

value of absolute entropy. energy transfer.

direction of energy transfer. none of these.

46. Which of the following equations is obtained on combining 1st and 2nd law of thermodynamics, for a system of constant mass ? (a) (b) (c) (d) $dE = Tds - PdV$ $dQ = C_v dT + PdV$ $dQ = C_p dT + Vdp$ $Tds = dE - PdV$

47. The equation $Tds = dE - PdV$ applies to (a) single phase fluid of varying composition. (b) single phase fluid of constant composition. (c) open as well as

closed systems.

(d) both (b) and (c)

48. For an exothermic reaction

(a) (b)

only enthalpy change (ΔH) is negative. only internal energy change (ΔE) is negative.

(a) Gibbs-Duhem (c) Maxwell's (c) both H and ΔE are negative.

(d) enthalpy change is zero

49. If different processes are used to bring about the same chemical reaction, the enthalpy change is same for all of them". This is.....law. (a) Hess's

(b) Kirchhoff's

(c) (d)

Lavoisier and Laplace. none of these

50. Change of heat content when one mole of compound is burnt in oxygen at constant pressure is called the

(a) calorific value

(b) (c) (d)

heat of reaction heat of combustion heat of formation

ANSWERS

33. (c) 34.(a) 35.(a) 36.(c) 37.(a) 38.(c) 39.(a) 40.(c) 41.(b) 42.(a) 43.(c) 44.(a)
45.(a) 46.(a) 47.(d) 48.(c) 49.(a) 50.(c)

51. Melting of wax is accompanied with..... entropy.

(a) increase (c) no change (b) decrease

(d) none of these

52. Helmholtz free energy (A) is defined as (a) $A = H - TS$ (b) $A = E - TS$ (c) $A = H + TS$ (d) none of these

53. Gibbs free energy (F) is defined as (a) $F = E - TS$ (b) $F = H - TS$ (c) $F = H + TS$ (d) $F = E + TS$

54. Gibbs-Helmholtz equation is

5

(a) $D = D + \frac{\partial}{\partial T} \left(\frac{D}{T} \right)$

5

61. Pick out the Clausius-Clapeyron equation from the following:

(a)

$\frac{dP}{dT} = \frac{D_H}{T^2 \Delta V}$

$D_H = D$

$= D$

$\frac{dP}{dT} = \frac{D_H}{T^2 \Delta V}$

(b) $\ln P = \frac{D_H}{RT} + \text{constant}$

$\frac{\partial D}{\partial T}$

5

(c)

$D = D + \frac{\partial}{\partial T} \left(\frac{D}{T} \right)$

$\frac{\partial D}{\partial T}$

T

$\frac{\partial}{\partial P}$

(b) $\frac{dP}{dT} = \frac{D_H}{T^2 \Delta V}$

(c) $d(E - TS) = T dS - S dT + V dP - P dV$

$\frac{dP}{dT} = \frac{D_H}{T^2 \Delta V}$

(d) none of these

62. Free energy changes for two reaction mechanism 'X' and 'Y' are respectively - 15 and - 5 units. It implies that X is

(a)

(b)

(c)

(d)

slower than Y

faster than Y

three times slower than Y

three times faster than Y

63. Chemical potential is a/an

55. For a reversible process involving only pressure-volume work

(a) $(dF)_T, p < 0$ (b) $(dF)_T, p > 0$ (c) $(dF)_T, p = 0$ (d) $(dA)_T, v < 0$

56. For an irreversible process involving only pressure-volume work

(a) $(dF)_T, p < 0$ (b) $(dF)_T, p = 0$ (c) $(dF)_T, p > 0$ (d) $(dA)_T, v > 0$

57. Pick out the correct equation relating 'F' and 'A'. (a) $F = A + PV$ (b) $F = E +$

A (c) $F = A - TS$ (d) $F = A + TS$

58. A chemical reaction will occur spontaneously at constant pressure and temperature, if the

(a) (b) (c)

extensive property.

intensive property.

force which drives the chemical system to equilibrium.

(d) both (b) and (c).

64. The chemical potential for a pure substance

is.....its partial molal free energy.

(a) (c)

more than (b) less than equal to (d) not related to **65.** Partial molal quantities are important in the study of

free energy is (a) zero

(c) negative

(a) (b) (c) (d)

ideal gases

ideal solutions

non-ideal mixtures a pure component

(b) positive

(d) none of these **66.** Fugacity and pressure are numerically equal, when the gas is

59. Clayperon equation deals with the

- (a) rate of change of vapour pressure with temperature.
- (b) effect of an inert gas on vapour pressure.
- (c) calculation of DF for spontaneous phase change.
- (d) temperature dependence of heat of phase transition.

60. In any spontaneous process,

- (a) only F decreases
- (b) only A decreases
- (c) both F and A decrease
- (d) both F and A increase

(a) (b) (c) (d)

in standard state at high pressure at low temperature in ideal state

67. The relation connecting the fugacities of various components in a solution with one another and to composition at constant temperature and pressure is called the, ...equation.

(a) Gibbs-Duhem (b) Van Laar (c) Gibbs-Helmholtz (d) Margules **68.** Which of the following is not affected by temperature changes ?

ANSWERS

51. (a) 52.(b) 53.(b) 54.(a) 55.(c) 56.(a) 57.(a) 58.(c) 59.(a) 60.(c) 61.(b) 62.(b) 63.(a) 64.(c) 65.(c) 66.(d) 67.(a) 68.(d)

(a) Fugacity (b) Activity co-efficient (c) Free energy (d) None of these

69. The activity of an ideal gas is numerically..... its pressure.

- (a) more than
- (b) less than
- (c) equal to
- (d) data insufficient, can't be predicted

70. Maximum work that could be secured by expanding the gas over a given pressure range is the.....work.

- (a) isothermal (c) isentropic
- (b) adiabatic
- (d) none of these

71. The temperature at which both liquid and gas phases are identical, is called the.....point. (a) critical (c) freezing (b) triple (d) boiling

72. Equilibrium constant of a reaction varies with the (a) initial concentration of the reactant. (b) pressure.
(c) temperature.
(d) none of these.

73. For an ideal solution, the value of activity coefficient is
(a) 0 (b) 1
(c) <1 (d) >1

74. Fugacity co-efficient of a substance is the ratio of its fugacity to (a) mole fraction

(c) pressure
(b) activity
(d) activity co-efficient

75. Van Laar equation deals with the activity coefficients in
(a) binary solutions
(b) ternary solutions
(c) azeotropic mixture only
(d) none of these

76. In Joule-Thomson porous plug experiment, the (a) enthalpy does not remain constant. (b) entire apparatus is exposed to surroundings.

(c) temperature remains constant.
(d) none of these.

77. Equilibrium constant decreases as the temperature
(a) increases, for an exothermic reaction. (b) decreases, for an exothermic reaction. (c) increases, for an endothermic reaction. (d) none of these.

78. Ideal refrigeration cycle is
(a) same as Carnot cycle.
(b) same as reverse Carnot cycle.
(c) dependent on the refrigerant's properties. (d) the least efficient of all refrigeration pro-

cesses.

79. Fundamental principle of refrigeration is based on the.....law of thermodynamics. (a) zeroth (b) first (c) second (d) third

80. Co-efficient of Performance (COP) of a refrigerator is the ratio of the (a) work required to refrigeration obtained. (b) refrigeration obtained to the work required.

(c) lower to higher temperature.
(d) higher to lower temperature.

81. In a working refrigerator, the value of COP is always (a) 0 (b) < 0 (c) < 1 (d) > 1

82. One ton of refrigeration capacity is equivalent to the heat removal rate of (a) 50 k cal/hr (b) 200 BTU/hr (c) 200 BTU/minute (d) 200 BTU/day

83. An ideal liquid refrigerant should (a) not have a sub-atmospheric vapour pressure at the temperature in the refrigerator coils.

(b) not have unduly high vapour pressure at the condenser temperature.
(c) both (a) and (b).
(d) have low specific heat.

84. Heat pump (a) accomplishes only space heating in winter. (b) accomplishes only space cooling in summer. (c) accomplishes both (a) and (b). (d) works on Carnot cycle.

85. Which of the following is not a common refrigerant? (a) Freon-12 (b) Ethylene (c) Ammonia (d) Carbon dioxide

86. Domestic refrigerator usually works on the.....refrigeration cycle. (a) Carnot (b) air (c) absorption (d) vapour-ejection

87. Refrigerants commonly used for domestic refrigerators are

ANSWERS

69. (c) 70. (a) 71. (a) 72. (c) 73. (b) 74. (c) 75. (a) 76. (d) 77. (a) 78. (b) 79. (c) 80. (b)

81. (d) 82. (c) 83. (c) 84. (c) 85. (b) 86. (c) 87. (a)

(a) ethyl chloride or methyl chloride

(b) freon-12

(c) propane

(d) NH_3 or CO_2 .

88. Air-refrigeration cycle

(a) is the most efficient of all refrigeration cycles.

(b) has very low efficiency.

(c) requires relatively large quantities of air to achieve a significant amount of refrigeration.

(d) both (b) and (c).

89. Co-efficient of performance for a reversed Carnot cycle working between temperatures T_1

and T_2 ($T_1 > T_2$) is

$\frac{T_2}{T_1 - T_2}$ (b) $\frac{T_1}{T_1 - T_2}$ (a) $\frac{T_1}{T_2}$ (c) $\frac{T_2}{T_1}$

$\frac{T_1}{T_2}$

$\frac{T_2}{T_1}$

$\frac{T_1}{T_2}$

$\frac{T_2}{T_1}$

(c)

$\frac{T_2}{T_1}$ (d) $\frac{T_1}{T_2}$

$\frac{T_1}{T_2}$

90. Work done in an adiabatic process between two states depends on the

(a) rate of heat transmission

(b) initial state only

(c) end states only

(d) none of these

91. Which of the following is a widely used refrigerant in vapour compression refrigeration system (using large centrifugal compressor)? (a) Freon

(b) Liquid sulphur dioxide

- (c) Methyl chloride
- (d) Ammonia

92. Pick out the undesirable property for a good refrigerant.

- (a) high thermal conductivity
- (b) low freezing point
- (c) large latent heat of vaporisation
- (d) high viscosity

93. Extensive properties of a thermodynamic system depend upon the.....of the system. (a) specific volume (b) temperature (c) mass (d) pressure

94. Measurement of thermodynamic property of temperature is facilitated by.....law of thermodynamics.

- (a) 1st (b) zeroth
- (c) 3rd (d) none of these

95. The Carnot co-efficient of performance (COP) of a domestic air conditioner compared to a household refrigerator is

- (a) less (b) more
- (c) same
- (d) dependent on climatic conditions

96. In case of steady flow compression polytropic process ($PV^n = \text{constant}$), the work done on air is the lowest, when

- (a) $n = \gamma = 1.4$ (b) $n = 0$
- (c) $n = 1$ (d) $n = 1.66$

97. In vapour compression refrigeration system, if the evaporator temperature and the condenser temperatures are -13°C and 37°C respectively, the Carnot COP will be

- (a) 5.2
- (b) 6.2
- (c) 0.168
- (d) data insufficient, can't be found out

98. Lowering of condenser temperature (keeping the evaporator temperature constant) in case of vapour compression refrigeration system results in

(a) (b) (c)

increased COP. same COP.

decreased COP.

(d) increased or decreased COP ; depending upon the type of refrigerant.

99. The change in entropy for a gas following $PV = nRT$ is given by

(a)

S_2

$- S_1$

$= - R \ln$

$\frac{p_2}{p_1}$

p_1

p_2

$(b) S_2 - S_1 = R \ln \frac{v_2}{v_1}$

$(c) S_2 - S_1 = R \ln \frac{v_2}{v_1}$

(d)

S_2

$- S_1$

$= R \ln$

$\frac{p_2}{p_1}$

$p_1 p_2$

100. Which of the following is not an intensive property ?

(a) Volume (b) Density (c) Temperature (d) Pressure

101. Enthalpy of a gas depends upon its

(a) temperature (b) mass

(c) volume . (d) pressure

ANSWERS

88. (d) 89.(a) 90.(c) 91.(a) 92.(d) 93.(c) 94.(b) 95.(a) 96.(c) 97.(a) 98.(a) 99.(a)

100.(a) 101.(a)

102. In case of a reversible process (following $p v^n$), work obtained for trebling the volume is.....across the boundaries. volume ($v_1 = 1 \text{ m}^3$ and $v_2 = 3 \text{ m}^3$) is maximum, (a) no heat and mass transfer when the value of 'n' is (b) no mass transfer but heat transfer (a) 0 (b) 1 (c) mass and energy transfer (c) $\gamma = 1.44$ (d) 1.66 (d) none of these

103.

In case of vapour compression refrigeration

112.

In polytropic process ($PV^n = \text{constant}$), if $n = \infty$, it means

PV^n

n

= constant), if $n = \infty$, it means (a) adiabatic (b) reversible (c) isothermal (d) none of these

(a) enhanced COP. **113.** Pick out the extensive property out of the following. (b) decreased COP. (c) no change in the value of COP. (a) Surface tension (b) Free energy (d) increased or decreased COP ; depending upon the type of refrigerant. (c) Specific heat (d) Refractive index

114. If two gases have same reduced temperature and reduced pressure, then they will have the

- (a) property of the system same
- (b) path function (a) volume
- (c) point function (b) mass
- (d) state description of a system (c) critical temperature

105. Which law of the thermodynamics provides (d) none of these

basis for measuring the thermodynamic property ? **115.** "Law of corresponding states" says that property ?

- (a) First law
- (c) Third law
- (a) two different gases behave similarly, if

(b) Zeroth law their reduced properties (i.e. P, V and T) (d) Second law are same.

106. 1st law of thermodynamics is nothing but the (b) the surface of separation (i.e. the meniscus) law of conservation of

(a) momentum
(c) energy
cus) between liquid and vapour phase

(b)
mass
disappears at the critical temperature. (c) no gas can be liquified above the
critical (d) none of these temperature, howsoever high the pres

107. Entropy change in case of reversible adiabatsure may be.
ic process is

(a) minimum
(c) maximum
(d) the molar heat of energy of gas at con(b) zero stant volume should be nearly
constant (d) indeterminate (about 3 calories).

108. Critical temperature is defined as the tem- **116.** The energy of activation of
exothermic reacperature above which a gas will tion is

(a) not liquify (barring exceptions). (a) zero.
(b) immediately liquify. (b) negative.
(c) never liquify however high the pressure (c) very large compared to that for
endothermay be. mic reaction.

(d) none of these. (d) not possible to predict. **109.** Work done in case of free
expansion is **117.** The principle applied in liquefaction of gases is

(a) indeterminate
(c) negative
(b) zero (a) adiabatic expansion. (d) none of these (b) Joule-Thomson effect.

110.

Refrigeration capacity of a household refrig

(c) both (a) and (b).

(d) neither (a) nor (b).erator may be round about.....tons.**118.** During adiabatic expansion
of gas(a) 0.15 (b) 1.5 (a) pressure remains constant.(c) 4.5 (d) 6.5 (b) pressure is increased.

ANSWERS

102. (a) 103.(a) 104.(c) 105.(b) 106.(c) 107.(b) 108.(c) 109.(b) 110.(a) 111.(b)
112.(c) 113.(b)

114.(d) 115.(a) 116.(d) 117.(c) 118.(d)

(c) temperature remains constant.

(d) none of these.

119. Internal energy of an element at 1 atm and 25°C is.....kcal/kg.mole.

(a) 0 (b) 273

(c) 25 (d) none of these

120. Work done may be calculated by the expression

p

dA for.....processes.

(a) non-flow reversible

(b) adiabatic

(c) both (a) and (b)

(d) neither (a) nor (b)

121. Heat requirement for decomposition of a compound into its elements is.....that is evolved during the formation of that compound from its elements.

(a) the same (b) less than (c) greater than (d) different than

122. “When a system in equilibrium is subjected to a change in temperature, pressure or concentration, the equilibrium is displaced in a direction which tends to undo the effect of the change.” This is called the

(a) Le-Chatelier principle.

(b) Kopp’s rule.

(c) law of corresponding state.

(d) Arrhenius hypothesis.

123. Choose the condition that must be specified in order to liquify CO₂ (triple point for CO₂ is – 57 °C and 5.2 atm).

(a) Pressure must be kept below 5.2 atm. (b) Temperature must be kept above – 57°C. (c) Pressure must be kept below 5.2 atm. and

temperature must be kept above 57°C. (d) Pressure and temperature must be kept below 5.2 atm. and – 57 °C respectively. **124.** Free energy change at equilibrium is

(a) zero (b) positive

(c) negative (d) indeterminate

125 Pick out the correct statement.

- (a) A real gas on expansion in vacuum gets heated up.
- (b) An ideal gas on expansion in vacuum gets cooled.
- (c) An ideal gas on expansion in vacuum gets heated up.
- (d) A real gas on expansion in vacuum cools down whereas ideal gas remains unaffected.

126. For a spontaneous process, free energy (a) is zero

- (b) increases
- (c) decreases whereas the entropy increases (d) and entropy both decrease

127. Free energy

- (a) decreases in all spontaneous (or irreversible) processes.
- (b) change during a spontaneous process has a negative value.
- (c) remains unchanged in reversible processes carried at constant temperature and pressure.
- (d) all (a), (b) and (c).

128. Variation of equilibrium pressure with temperature for any two phases of a given substances is given by the.....equation.

- (a)
- (c)

Gibbs-Duhem (b) Maxwell's Clayperon (d) none of these

129. Solid and liquid phases of a substance are in equilibrium at the

- (a) critical temperature
- (b) melting point.
- (c) freezing point.
- (d) both (b) and (c),

130. At triple point (for one component system), vapour pressure of solid as compared to that of liquid will be

- (a) more
- (b) less
- (c) same
- (d) more or less ; depending on the system.

131. For a multicomponent system, the term chemical potential is equivalent to the (a) molal concentration difference.

- (b) molar free energy.

- (c) partial molar free energy.
- (d) molar free energy change.

132. Fugacity is most helpful in

- (a) representing actual behaviour of real gases.
- (b) representing actual behavior of ideal gases.
- (c) the study of chemical equilibria involving gases at atmospheric pressure.
- (d) none of these

ANSWERS

119. (a) 120. (c) 121. (a) 122. (a) 123. (d) 124. (a) 125. (d) 126. (c) 127. (d) 128. (c)
129. (d) 130. (c)
131. (c) 132. (a)

133. For a given substance at a specified temperature, activity is.....to fugacity.

- (a) directly proportional
- (b) inversely proportional
- (c) equal
- (d) none of these

134. For an ideal gas, the activity coefficient is (a) directly proportional to pressure. (b) inversely proportional to pressure. (c) unity at all pressures. (d) none of these.

135. The chemical potential of any constituent of an ideal solution depends on the....of the solution.

- (a) temperature (c) composition (b) pressure
- (d) all (a), (b) and (c)

136. “At the absolute zero temperature, the entropy of every perfectly crystalline substance becomes zero”. This follows from the (a) third law of thermodynamics

- (b) second law of thermodynamics
- (c) Nernst heat theorem
- (d) Maxwell’s relations

137. As the temperature is lowered towards the absolute zero, the value of

∂D
(F), then ∂T

proaches

(a) unity

(b) zero

(c) that of the heat of reaction

(d) infinity

138. At absolute zero temperature, all substances have the same

(a) heat capacity

(b) crystalline structure

(c) entropy

(d) none of these

139. Third law of thermodynamics is helpful in

(a) prediction of the extent of a chemical reaction.

(b) calculating absolute entropies of substances at different temperature.

(c) evaluating entropy changes of chemical reaction.

(d) both (b) and (c)

$\pi \pi \pi \pi$

140. In the reaction; $N_2 + O_2 \rightleftharpoons 2NO$, increasing the pressure will result in

(a) shifting the equilibrium towards right.

(b) shifting the equilibrium towards left.

(c) no change in equilibrium condition.

(d) none of these.

$\pi \pi \pi \pi$

In the reaction, $H_2 + I_2 \rightleftharpoons 2HI$, addition of an inert gas will

(a) increase the partial pressure of H_2 .

(b) increase the partial pressure of I_2

(c) increase the total pressure and hence

shift the equilibrium towards the right.

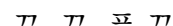
(d) not effect the equilibrium conditions

142. In case of the decomposition of hydroiodic

$\pi \pi \pi \pi$

acid ($2\text{HI} \rightleftharpoons \text{H}_2 + \text{I}_2$), addition of H_2 (at equilibrium condition) will
 (a) increase the partial pressure of I_2 . (b) decrease the partial pressure of HI . (c)
 diminish the degree of dissociation of HI . (d) none of these.

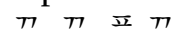
143. In the decomposition of PCl_5 represented by,



$\text{PCl}_5 \rightleftharpoons \text{PCl}_3 + \text{Cl}_2$, decrease in the pressure of the system will.....the
 degree of dissociation of PCl_5 .

(a) increase (b) decrease (c) not alter (d) none of these

144. Pick out the wrong statement pertaining to the decomposition of PCl_5
 represented by,



$\text{PCl}_5 \rightleftharpoons \text{PCl}_3 + \text{Cl}_2$.

Degree of dissociation of PCl_5 will

(a) decrease on addition of Cl_2 .

(b) increase on addition of an inert gas at

constant pressure.

(c) decrease on increasing the pressure of
 the system.

(d) none of these

145. In the ammonia synthesis reaction, $\text{N}_2 + 3\text{H}_2$



$\Delta H = -22.4 \text{ kcal}$, the formation of NH_3 will be favoured by

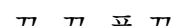
(a) high temperature.

(b) low pressure.

(c) low temperature only.

(d) both low temperature and high pressure.

146. In the reaction, represented by, $2\text{SO}_2 + \text{O}_2$



$\rightleftharpoons 2\text{SO}_3$; $\Delta H = -42 \text{ kcal}$; the forward reaction will be favoured by
 (a) low temperature
 (b) high pressure

ANSWERS

133. (a) 134. (c) 135. (d) 136. (a) 137. (b) 138. (a) 139. (d) 140. (c) 141. (d) 142. (c)
 143. (a) 144. (d)
 145. (d) 146. (c)
 (c) both (a) and (b)
 (d) neither (a) nor (b)
147. The ammonia synthesis reaction represented



by $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$; $\Delta H = -22.4 \text{ kcal}$, is
 (a) endothermic
 (c) isothermal
 (b) exothermic (d) adiabatic

148. A domestic refrigerator has a/an.....cooled condenser.
 (a) water (b) air
 (c) evaporative (d) gas

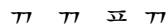
149. Henry's law is closely obeyed by a gas, when its.....is extremely high.
 (a) pressure (b) solubility (c) temperature (d) none of these

150. At a given temperature, the volume of a gas dissolved in a solvent.....with increase in pressure.
 (a) increases
 (b) decreases
 (c) remains unchanged
 (d) may increase or decrease; depends on the

gas

151. The most important application of distribution law is in
 (a) evaporation (c) drying
 (b) liquid extraction (d) distillation

152. For the reversible exothermic reaction, $N_2 +$



increase of pressure would (a) shift the equilibrium towards right. (b) give higher yield of NH_3 . (c) both (a) and (b). (d) neither (a) nor (b).

153. Solubility of a substance which dissolves with an increase in volume and liberation of heat will be favoured by the (a) low pressure and high temperature. (b) low pressure and low temperature. (c) high pressure and low temperature. (d) high pressure and high temperature.

154. Degree of freedom of the system ice-watervapour will be (a) 0 (b) 1 (c) 2 (d) 3

155. Degree of freedom of a system consisting of a gaseous mixture of H_2 and NH_3 will be (a) 0 (b) 1 (c) 2 (d) 3

156. The minimum number of phases that can exist in a system is (a) 0 (b) 1 (c) 2 (d) 3

157. The temperature at the eutectic point of the system is the.....temperature that can be attained in the system. (a) lowest (b) highest (c) average (d) none of these

158. Gibbs-Duhem equation

(a) states that $\sum_{i=1}^n x_i d\mu_i = 0$ for a system of definite composition at constant temperature and pressure.

(b) applies only to binary systems.

(c) finds no application in gas-liquid equilibria involved in distillation. (d) none of these

159. At constant temperature and pressure, for

one mole of a pure substance, the ratio of the free energy to the chemical potential is

(a) zero (b) one

(c) infinity (d) negative **160.** If the vapour pressure at two temperatures of a solid phase in equilibrium with its liquid phase are known, then the latent heat of fusion can be calculated by the

(a) Maxwell's equation

(b) Clayperon-Claussius equation

(c) Van Laar equation

(d) Nernst Heat Theorem

161. As the temperature is lowered towards the absolute zero, the value of the quantity

∂D

$\frac{\partial D}{\partial T}$

approaches

(a) zero (b) unity

(c) infinity (d) none of these

162. If two pure liquid constituents are mixed in any proportion to give an ideal solution, there is no change in (a) volume

(c) both (a)&(b) (b) enthalpy

(d) neither (a) nor (b)

163. Fugacity is a measure of the

(a) escaping tendencies of the same substance in different phases of a system.

(b) relative volatility of a mixture of two miscible liquids.

(c) behaviour of ideal gases.

(d) none of these.

ANSWERS

147. (b) 148. (b) 149. (d) 150. (c) 151. (b) 152. (d) 153. (b) 154. (a) 155. (d) 156. (b)

157. (a) 158. (a)

159. (b) 160. (b) 161. (a) 162. (c) 163. (a)

164. What is the value of $\ln \gamma$ (where γ = activity coefficient) for ideal gases ?

(a) Zero (b) Unity

(c) Infinity (d) Negative

165. “The fugacity of a gas in a mixture is equal to the product of its mole fraction and its fugacity in the pure state at the total pressure of the mixture”.

This is

- (a) the statement as per Gibbs-Helmholtz (b) called Lewis-Randall rule
- (c) Henry’s law
- (d) none of these

166. The standard state of a gas (at a given temperature) is the state in which fugacity is equal to

- (a) unity (b) activity
- (c) both (a) & (b) (d) neither (a) nor (b)

167. The amount of heat required to decompose a compound into its elements is.....the heat of formation of that compound from its elements.

- (a) less than (b) more than
- (c) same as (d) not related to

168. Compound having large heat of formation is (a) more stable.

(b) less stable.

(c) not at all stable (like nascent O₂). (d) either more or less stable ; depends on the compound.

π π π π

169. Consider the reaction, $C + O_2 \rightarrow CO_2$; $\Delta H_f^\circ = -94 \text{ kcal}$.

What will be the value of ΔH for the reaction $CO_2 \rightarrow C + O_2$?

- (a) -94 kcal (b) $+94 \text{ kcal}$ (c) $> 94 \text{ kcal}$ (d) $< -94 \text{ kcal}$

170. In the reaction, $C + O_2 \rightarrow CO_2$; $\Delta H = -94 \text{ kcal}$. What is the heat content (enthalpy) of O₂? (a) -94 kcal (b) $> -94 \text{ kcal}$ (c) $< -94 \text{ kcal}$ (d) zero

171. If the molar heat capacities (C_p or C_v) of the reactants and products of a chemical reaction are identical, then, with the increase in temperature, the heat of reaction will

- (a) increase
- (b) decrease
- (c) remain unaltered
- (d) increase or decrease ; depends on the

particular reaction

172. In reactions involving solids and liquids (where change in volume is negligible), the heat of reaction at constant pressure as compared to that at constant volume is

- (a) more
- (b) less
- (c) same
- (d) unpredictable; depends on the particular reaction

173. Heat of reaction at constant volume is identified with.....change.

- (a) enthalpy
- (b) internal energy
- (c) either (a) or (b)
- (d) neither (a) nor (b)

174. Those solutions in which there is no volume change upon mixing the components in the liquid state and which, when diluted do not undergo any heat change (*i.e.* heat of dilution is zero), are called.....solutions. (a) ideal (b) real

- (c) isotonic (d) none of these

175. A solute distributes itself between two nonmiscible solvents in contact with each other in such a way that, at a constant temperature, the ratio of its concentrations in two layers is constant, irrespective of its total amount". This is

- (a) the distribution law.
- (b) followed from Margule's equation. (c) a corollary of Henry's law.
- (d) none of these.

176. "The rate at which a substance reacts is proportional to its active mass and the rate of a chemical reaction is proportional to the product of active masses of the reacting substances". This is the

- (a) Lewis-Randall rule.
- (b) statement of Vant-Hoff equation. (c) Le-Chatelier's principle.
- (d) none of these.

177. The quantitative effect of temperature on chemical equilibrium is given by the (a) Vant-Hoff equation.

- (b) Le-Chatelier's principle.
- (c) Arrhenius equation.

(d) none of these.

178. A cylinder contains 640 gm of liquid oxygen. The volume occupied (in litres) by the oxygen,

ANSWERS

164. (a) 165. (b) 166. (c) 167. (c) 168. (a) 169. (b) 170. (d) 171. (c) 172. (c) 173. (b)

174. (a) 175. (a)

176. (d) 177. (a) 178. (a)

when it is released and brought to standard conditions (0°C , 760 mm Hg) will be.....litres. (a) 448

(b) 224

(c) 22.4

(d) data insufficient; can't be computed

179. Grams of butane (C_4H_{10}) formed by the liquefaction of 448 litres of the gas (measured at STP) would be

(a) 580

(b) 640

(c) 1160

(d) data insufficient; can't be computed

180. Clausius-Clayperon equation gives accurate result, when the

(a) vapour pressure is relatively low and the

temperature does not vary over wide limits. (b) vapour obeys the ideal gas law and the

latent heat of vaporisation is constant. (c) volume in the liquid state is negligible compared with that in the vapour state. (d) all (a), (b) and (c).

181. If we increase the pressure on a substance (which is at its triple point), then the triple point

(a) increases

(b) decreases

(c) remains unchanged

(d) may increase or decrease ; depends on

the substance

182. The value of C_p & C_v respectively for monoatomic gases in Kcal/kg Mole.

°K are

(a) 5 & 3 (b) 3.987 & 1.987 (c) 1.987 & 0.66 (d) 0.66 & 1.987

183. For an ideal gas, the enthalpy

(a) increases with rise in pressure.

(b) decreases with rise in pressure. (c) is independent of pressure.

(d) is a path function.

184. If the pressure on 100 c.c. of air is halved, then its volume (at the same temperature) would be.....c.c.

(a) 100 (b) 50

(c) 205 (d) 200

185. A gas has a volume of 27.3 c.c. at 0°C. Its volume at 10°C (if pressure remains unchanged) will be.....c.c.

(a) 2.73 (b) 28.3

(c) 273 (d) 283

186. The value of gas constant 'R' is

(a) 1.987 cal/gm mole °K

(b) 1.987 BTU/lb. mole °R

(c) both (a) and (b)

(d) neither (a) nor (b)

187. One ton of refrigeration is defined as the heat rate corresponding to melting of one ton of ice in one

(a) hour (b) day

(c) minute (d) second

188. Pick out the wrong statement.

(a) A closed system does not permit exchange of mass with its surroundings but may permit exchange of energy.

(b) An open system permits exchange of both mass and energy with its surroundings.

(c) The term microstate is used to characterise an individual, whereas macrostate is used to designate a group of micro-states with common characteristics.

(d) none of the above.

189. The extensive properties are

(a) volume, mass and number of moles.

(b) free energy, entropy and enthalpy.

(c) both (a) and (b).

(d) none of these.

190. The intensive properties are

(a) molar volume, density, viscosity and boiling point.

(b) refractive index and surface tension.

(c) both (a) and (b).

(d) none of these.

191. A system is said to be isopiestic, if there is no.....change.

(a) temperature (b) pressure (c) volume (d) none of these

192. For a cyclic process, a fixed ratio between heat and work

(a) always exists

(b) may exist

(c) never exists

(d) is difficult to predict

193. Entropy change for an irreversible process taking system and surrounding together is (a) 0 (b) > 0

(c) < 0 (d) none of these

194. When a system is in equilibrium for all possible processes, the differential or finite change of entropy is

ANSWERS

179. (c) 180.(d) 181.(c) 182.(a) 183.(c) 184.(d) 185.(b) 186.(c) 187.(b) 188.(d)

189.(c) 190.(c)

191.(b) 192.(a) 193.(b) 194.(a)

(a) < 0 (b) > 0

(c) > 0 (d) none of these

195. The variation of heat of reaction with temperature at constant pressure is given by the.....law.

(a) Kelvin's (b) Antonie's (c) Kirchoff s (d) none of these

196. Joule-Thomson co-efficient for a perfect gas is (a) zero (b) positive (c) negative (d) none of these

197. Enthalpy changes over a constant pressure path are always zero for.....gas. (a) any

- (b) a perfect
- (c) an easily liquefiable
- (d) a real

198. In jet refrigerators, the refrigerating fluid is practically always

- (a) water (b) ammonia (c) freon (d) brine

199. Vapour which is at a pressure smaller than the saturation pressure for the temperature involved is called a vapour

- (a) superheated
- (b) desuperheated
- (c) non-condensable
- (d) none of these

200. A liquid under pressure greater than its vapour pressure for the temperature involved is called a.....liquid.

- (a) subcooled
- (b) saturated
- (c) non-solidifiable
- (d) none of these

201. The third law of thermodynamics states that the

- (a) heat capacity of a crystalline solid is zero at absolute zero temperature.
- (b) heat transfer from low temperature to high temperature source is not possible without external work.
- (c) gases having same reduced properties behave similarly.
- (d) none of these.

202. Activity co-efficient is a measure of the (a) departure from ideal solution behaviour. (b) departure of gas phase from ideal gas law. (c) vapour pressure of liquid.

- (d) none of these.

203. Fugacity and pressure are numerically not equal for the gases

- (a) at low temperature and high pressure. (b) at standard state.
- (c) both (a) and (b).
- (d) in ideal state.

204. Which of the following is affected by the temperature ?

(a) Fugacity (b) Activity co-efficient (c) Free energy (d) All (a), (b) & (c)

205. The work done in isothermal compression compared to that in adiabatic compression will be

- (a) less
- (b) more
- (c) same
- (d) more or less depending upon the extent

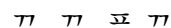
of work done

206. After throttling, gas temperature

- (a) decreases
- (b) increases
- (c) remains same
- (d) may increase or decrease ; depends on

the nature of the gas

207. Forward reaction will be favoured for the exothermic reaction, represented by $\text{CO} +$



$\text{H}_2\text{O} \rightleftharpoons \text{CO}_2 + \text{H}_2$, by

- (a) low temperature and high pressure. (b) low temperature and low pressure. (c) high temperature and high pressure. (d) high temperature and low pressure.

208. Which is a state function ?

- (a) Specific volume (b) Work
- (c) Pressure (d) Temperature

209. The number of degrees of freedom at the triple point of water is

- (a) 0 (b) 1
- (c) 2 (d) 3

210. At absolute zero temperature, the.....of the gas is zero.

- (a) pressure (b) volume (c) mass (d) none of these

211. Any substance above its critical temperature exists as

- (a) saturated vapour (b) solid

(c) gas (d) liquid

ANSWERS

195. (c) 196.(a) 197.(b) 198.(a) 199.(a) 200.(a) 201.(a) 202.(a) 203.(c) 204.(d)
205.(b) 206.(a)

207.(a) 208.(b) 209.(a) 210.(b) 211.(c)

212. The specific heat of saturated water vapour at 100°C is

(a) ∞ (b) – ve

(c) 0 (d) + ve

213. Sound waves propagation in air exemplifies an.....process. (a)
adiabatic

(c) isometric

(b) isothermal (d) none of these

214. In a P-V diagram (for an ideal gas), an isothermal curve will coincide with an adiabatic curve (through a point), when

(a) $C_p < C_v$ (b) $C_p = C_v$ (c) $C_p > C_v$ (d) $C_p \geq C_v$

215. Mollier chart is a plot.

(a) pressure Vs. enthalpy

(b) pressure Vs. volume

(c) enthalpy Vs. entropy

(d) temperature Vs. entropy

216. The temperature at which a real gas obeys the ideal gas laws over a wide range of pressure is called.....temperature. (a) Boyle (b) inversion (c) critical (d) reduced

217. For the gaseous phase chemical reaction, $C_2H_4(g) + H_2O(g) \leftrightarrow C_2H_5OH(g)$, the equilibrium conversion does not depend on the (a) steam to ethylene ratio.

(b) temperature.

(c) pressure.

(d) none of these.

218. Joule-Thomson co-efficient depends on the (a) pressure. (b) temperature. (c) both (a) & (b). (d) neither (a) nor (b).

219. Joule-Thomson Co-efficient at any point on the inversion curve is

- (a) ∞ (b) + ve
(c) 0 (d) - ve

220. Out of the following refrigeration cycles, which one has the minimum COP (Co-efficient of performance)?

- (a) Air cycle
(b) Carnot cycle
(c) Ordinary vapour compression cycle (d) Vapour compression with a reversible expansion engine

221. In an ideal refrigeration cycle, the change in internal energy of the fluid is

- (a) + ve
(b) - ve
(c) 0
(d) either of the above three ; depends on the

nature of refrigerant.

222. The standard Gibbs free energy change of a reaction depends on the equilibrium (a) pressure (b) temperature (c) composition (d) all (a), (b) and (c)

223. For an ideal liquid solution, which of the following is unity ?

- (a) Activity
(b) Fugacity
(c) Activity co-efficient
(d) Fugacity co-efficient

224. Gibbs-Duhem equation relates composition in liquid phase and the.....at constant temperature & pressure.

- (a) fugacity
(b) partial pressure
(c) activity co-efficient
(d) (a), (b), and (c)

225. A nozzle is a device, which

- (a) increases kinetic energy and decreases pressure.
(b) reduces kinetic energy and increases pressure.
(c) reduces both kinetic energy and pressure.
(d) increases both kinetic energy and pressure. **226.** Throttling process is a/an

process.

- (a) reversible and isothermal
- (b) irreversible and constant enthalpy
- (c) reversible and constant entropy
- (d) reversible and constant enthalpy

227. With increase in compression ratio, the efficiency of the otto engine

- (a) increases
- (b) decreases
- (c) remains constant
- (d) increases linearly

228. Out of the following refrigeration cycles, which one has maximum COP ?

- (a) Air cycle
- (b) Carnot cycle
- (c) Ordinary vapor compression cycle
- (d) Vapor compression with a reversible expansion engine

229. What is the value of Joule-Thomson co-efficient for an ideal gas ?

ANSWERS

212. (b) 213. (a) 214. (b) 215. (c) 216. (a) 217. (d) 218. (c) 219. (c) 220. (a) 221. (c)
222. (b) 223. (c)
224. (d) 225. (a) 226. (b) 227. (a) 228. (b) 229. (c)
(a) + ve (b) - ve
(c) 0 (d) ∞

230. Which is an example of closed system ? (a) Air compressor

- (b) Liquid cooling system of an automobile
- (c) Boiler
- (d) None of these

231. The internal energy of an ideal gas is a function of its.....only.

- (a) molecular size
- (b) volume
- (c) pressure
- (d) temperature

232. Keeping the pressure constant, to double the volume of a given mass of an ideal gas at 27°C, the temperature should be raised to.....°C.

- (a) 270
- (b) 327
- (c) 300
- (d) 540

233. Specific volume of an ideal gas is

- (a) equal to its density.
- (b) the reciprocal of its density.
- (c) proportional to pressure.
- (d) none of these.

234. Which of the following behaves most closely like an ideal gas ?

- (a) He (b) N_2
- (c) O_2 (d) H_2

235. A gas can be liquified by pressure alone only, when its temperature is.....its critical temperature.

- (a) less than
- (b) more than
- (c) equal to or higher than
- (d) less than or equal to

236. At the critical point of a substance

- (a) the surface tension vanishes.
- (b) liquid and vapour have the same density. (c) there is no distinction between liquid

and vapour phases.

- (d) all (a), (b) and (c).

237. The equation, $C_p - C_v = R$, is true for.....gas. (a) no (b) any real (c) only ideal (d) both (b) and (c)

238. C_p of a gas at its critical temperature and pressure

- (a) becomes zero.
- (b) becomes infinity.
- (c) equals 1 kcal/kmol $^{\circ}K$.
- (d) equals 0.24 kcal/kmol $^{\circ}K$.

239. Specific heat of a gas for a reversible adiabatic process is

- (a) negative (b) zero
- (c) infinity (d) none of these

240. Which of the following is not correct for a reversible adiabatic process ?

(a) (b) (c)

$$TV^{-1} \text{ constant }^{1-\gamma} = \text{constant}_P$$

$$^{\gamma} = \text{constant}_P$$

(d) none of these

241. Adiabatic compression of a saturated water vapour makes it

(a) supersaturated

(b) superheated

(c) both (a) and (b)

(d) neither (a) nor (b)

242. The internal energy of a gas obeying $P(V - b) = RT$ (where, b is a positive constant and has a constant C_v), depends upon its

(a) pressure (b) volume (c) temperature (d) all (a), (b) & (c).

243. The expression for the work done for a reversible polytropic process can be used to obtain the expression for work done for all processes, except reversible.....process. (a) isobaric (b) isothermal (c) adiabatic (d) none of these

244. Entropy of a substance remains constant during a/an.....change.

(a) reversible isothermal

(b) irreversible isothermal

(c) reversible adiabatic

(d) none of these

245. The entropy change in a reversible isothermal process, when an ideal gas expands to four times its initial volume is

(a) $R \log_e 4$ (b) $R \log_{10} 4$ (c) $C_v \log_{10} 4$ (d) $C_v \log_e 4$

246. Which is not constant for an ideal gas ?

$$\partial \left(\frac{T}{P} \right) / \partial V$$

(a)

(b)

$$\partial \left(\frac{T}{P} \right) / \partial V$$

(c) (d) all (a), (b) & (c). V

247. The difference between isothermal compress

ANSWERS

230. (b) 231.(d) 232.(b) 233.(b) 234.(a) 235.(d) 236.(d) 237.(c) 238.(b) 239.(b)
240.(d) 241.(b)

242.(c) 243.(b) 244.(c) 245.(a) 246.(a) 247.(b)

ibility and adiabatic compressibility for an ideal gas is

(a) 0 (b) + ve

(c) – ve (d) ∞

248. For an incompressible fluid, the.....is a function of both pressure as well as temperature. (a) internal energy (c) entropy

(b) enthalpy

(d) all (a), (b) & (c)

249. Specific.....does not change during a phase change (e.g. sublimation, melting, vaporisation etc.). (a) entropy

(c) enthalpy (b) internal energy (d) Gibbs free energy

250. Trouton's ratio of..... liquids is calculated using Kistyakowsky equation.

(a) polar (b) non-polar

(c) both (a) & (b) (d) neither (a) nor (b)

251. Gibbs free energy of a pure fluid approaches.....as the pressure tends to zero at constant temperature.

(a) infinity (b) minus infinity (c) zero (d) none of these

252. Isotherm on an enthalpy-concentration diagram, for an ideal solution will be a (a) straight line (c) parabola

(b) sine curve (d) hyperbola

253. The unit of equilibrium constant of a chemical reaction is the same as that of

(a) molar concentration

(b) temperature

(c) internal energy

(d) none of these

254. All gases during throttling process at atmospheric temperature and pressure

show a cooling effect except

(a) CO_2 (b) H_2

(c) O_2 (d) N_2

255. All gases above its inversion temperature, in a throttling process will show

(a) a heating effect.

(b) no change in temperature.

(c) a cooling effect.

(d) either (a) or (c).

256. A refrigeration cycle is the same as a.....cycle. (a) turbine

(b) heat engine

(c) reversed heat engine

(d) none of these

257. A refrigerator works on the principle of.....law of thermodynamics.

(a) zeroth (b) first

(c) second (d) third

258. On opening the door of an operating refrigerator kept in a closed room, the temperature of the room will

(a) increase

(b) decrease

(c) remain same

(d) increase in summer and will decrease in

winter

259. COP of a refrigerator drawing 1 kW of power per ton of refrigeration is about

(a) 0.5 (b) 3.5

(c) 4.5 (d) 8.5

260. For a stable phase at constant pressure and temperature, the fugacity of each component in a binary system.....as its mole fraction increases.

(a) decreases (b) increases

(c) remains same (d) decreases linearly

261. Gibbs free energy of mixing at constant pressure and temperature is always

(a) 0 (b) ∞

(c) +ve (d) - ve

262. $PV^Y = \text{constant}$, holds good for an isentropic process, which is

- (a) reversible and isothermal.
- (b) isothermal and irreversible.
- (c) reversible and adiabatic.
- (d) adiabatic and irreversible.

263. In the equation, $PVn = \text{constant}$, if the value of $n = 1$, then it represents a reversible..... process.

- (a) isothermal (b) isobaric (c) polytropic (d) adiabatic

264. During the phase transition.....changes. (a) pressure (b) volume
(c) temperature (d) all (a), (b) and (c)

265. Kopp's rule is used to calculate the heat capacity of

- (a) solids (b) liquids
- (c) gases (d) all (a), (b) & (c)

266. The compressibility factor of a gas is given by (a) V_1/V_2 (b) V_2/V_1

- (c) $V_1 - V_2$ (d) $V_1 \cdot V_2$

where, V_1 = actual volume of the gas, V_2 = gas volume predicted by ideal gas law

ANSWERS

248. (b) 249. (d) 250. (b) 251. (b) 252. (a) 253. (d) 254. (b) 255. (a) 256. (c) 257. (b)
258. (a) 259. (b)

260. (b) 261. (d) 262. (c) 263. (a) 264. (b) 265. (a) 266. (a)

267. In the equation, $PVn = \text{constant}$, if the value of n is in between 1 and γ (i.e. C_p/C_v), then it represents a reversible.....process. (a) isometric (b) polytropic (c) isentropic (d) isobaric

268. A system in which there is exchange of energy but not of mass, is called a/an.....system. (a) isolated (b) open
(c) insulated (d) closed

269. Number of degrees of freedom for a three phase system in equilibrium comprising of three non-reacting chemical species is (a) 2 (b) 0

(c) 1 (d) 3

270. A gas shows deviation from ideal behaviour at (a) low pressure and high temperature. (b) low pressure and low temperature. (c) low temperature and high pressure. (d) high temperature and high pressure.

271. γ = specific heat ratio of an ideal gas is equal to

(a) C_p/C_v (b) $C_p/(C_p - R)$

(c) $1 + (R/C_v)$ (d) all (a), (b) and (c)

272. What happens in a reversible adiabatic expansion process ?

(a) Heating takes place.

(b) Cooling takes place.

(c) Pressure is constant.

(d) Temperature is constant.

273. In the equation, $PV^n = \text{Constant}$, if the value of $n = 0$, then it represents a reversible process.

(a) isobaric (b) isothermal (c) isentropic (d) isometric

274. The internal energy of an incompressible fluid depends upon its (a) pressure

(c) both (a) & (b) (b) temperature

(d) neither (a) nor (b)

275. Translational kinetic energy of molecules of an ideal gas is proportional to

(a) T (b) T

(c) T^2 (d) $1/T$

where, T = absolute temperature of the gas

276. What is the ratio of adiabatic compressibility to isothermal compressibility ?

(a) 1 (b) < 1

(c) > 1 (d) $> > 1$

277. At.....point, all the three phases (i.e. solid, liquid and gas) co-exist.

(a) eutectic (b) triple

(c) plait (d) critical

278. Entropy, which is a measure of the disorder of a system is

- (a) independent of pressure.
- (b) independent of temperature.
- (c) zero at absolute zero temperature for a

perfect crystalline substance.

- (d) all (a), (b) & (c)

279. Claude gas liquefaction process employs cooling (a) at constant pressure.

- (b) by throttling.
- (c) by expansion in an engine.
- (d) none of these.

280. In the equation $PV^n = \text{constant}$, if the value of $n = \gamma = C_p/C_v$, then it represents a reversible.....process.

- (a) isothermal (b) adiabatic (c) isentropic (d) polytropic

281. Compressibility factor for almost all the gases are approximately same at the same

- (a) pressure and temperature.
- (b) reduced pressure and reduced temperature. (c) critical pressure and critical temperature. (d) none of these.

282. Boiling of liquid is accompanied with increase in the

- (a) vapor pressure.
- (b) specific Gibbs free energy.
- (c) specific entropy.
- (d) all (a), (b) and (c).

283. The efficiency of an Otto engine compared to that of a diesel engine, for the same compression ratio will be

- (a) more
- (b) less
- (c) same
- (d) data insufficient to predict

284. The value of Joule-Thomson co-efficient, in case where cooling occurs after the throttling process is

- (a) 0 (b) ∞
 (c) + ve (d) - ve

285. Linde gas liquefaction process employs cooling (a) by throttling
 (b) by expansion in an engine

ANSWERS

267. (b) 268. (b) 269. (a) 270. (c) 271. (d) 272. (b) 273. (a) 274. (b) 275. (a) 276. (b)
 277. (b) 278. (c)

279. (c) 280. (c) 281. (b) 282. (a) 283. (a) 284. (c) 285. (a)

(c) at constant pressure **294.** What happens in a reversible adiabatic compression?
 (d) none of these

$pV^n = \text{constant}$, if the value of $n = \pm \infty$ Heating occurs

286. In the equation,

value of $n = \pm \infty$ process.

(a) adiabatic

(c) isentropic

(b) Cooling occurs, then it represents a reversible process (c) Pressure is constant

(b) isometric (d) Temperature is constant

(d) isothermal **295.** With increase in pressure (above atmospheric pressure), the C_p of a gas an ideal gas, the entropy change is (a) increases

(a) + ve (b) 0 (b) decreases

(c) - ve (d) ∞ (c) remains unchanged

288. The compressibility factor for an ideal gas is (d) first decreases and then increases 1.

Its value for any other real gas is **296.** The heat capacities for the ideal gas state depend upon the

(b) < 1 (a) pressure

(c) > 1 (c) both (a) & (b)

(b) temperature (d) neither (a) nor (b) (d) either (b) or (c), depends on the nature of **297.** In an ideal solution, the activity of a component equals its

289. In a homogeneous solution, the activity coefficient of a component depends upon (a) mole fraction.

(b) fugacity at the same temperature and

(a) pressure (b) composition pressure.
(c) temprature (d) all (a), (b) and (c) (c) partial pressure.

290. In a homogeneous solution, the fugacity of a (d) none of these.
component depends upon the **298.** Requisites of a reversible process is that the
(a) pressure (b) composition (a) system and surroundings pressure be (c)
temperature (d) all (a), (b) and (c) equal.

291. Pick out the wrong statement. (b) friction in the system should be absent. (a) Activity
co-efficient is dimensionless. (c) system and surroundings temperature

(b)
In case of an ideal gas, the fagacity is
be equal.

(d) none of these. equal to its pressure.

(c) In a mixture of ideal gases, the fugacity **299.** With increase in temperature,
the atomic
of a component is equal to the partial
pressure of the component.

(d) The fugacity co-efficient is zero for an
ideal gas.

292. The change in.....is equal to the revers
ible work for compression in steady state flow **300.**
process under isothermal condition.

(a) internal energy

(b) enthalpy

(c) Gibbs free energy

heat capacities of all solid elements (a) increases

(b) decreases

(c) remains unchanged

(d) decreases linearly

The unit of fugacity is the same as that of the (a) pressure

(b) temperature

(c) volume

(d) molar concentration

(d) Helmholtz free energy **301.** A/an.....system is exemplified by a vessel **293.**

Which of the following non-flow reversible containing a volatile liquid in contact with its compression processes require maximum vapor. work ? (a) isolated (b) closed (a) Adiabatic process (c) open (d) none of these

(b) Isothermal process **302.** Internal energy is equal to the heat absorbed (c) Isobaric process in case of a/an.....process. (d) All require same work

ANSWERS

286. (b) 287. (a) 288. (d) 289. (d) 290. (d) 291. (d) 292. (c) 293. (a) 294. (a) 295. (a) 296. (b) 297. (a) 298. (b) 299. (a) 300. (a) 301. (c) 302. (a) (a) constant volume (a) Chemical potential (b) polytropic (b) Surface tension (c) adiabatic (c) Heat capacity (d) constant pressure (d) None of these

1

∂ 5

system is the mathematical expression for **312.** Entropy change for an irreversible isolated **303.** VT P (a) $\propto$ (b) 0

(a) Joule-Thomson co-efficient. (c) < 0 (d) > 0 (b) specific heat at constant pressure (C_p).

313. For a real gas, the chemical potential is given by (c) co-efficient of thermal expansion. (a) $RT \ln P$ (b) $RT \ln f$ (d) specific heat at constant volume (C_v). (c) $R \ln f$ (d) none of these

304. Free energy change for a reversible process **314.** For an ideal gas, the chemical potential is taking place at a constant temperature and given by pressure is (a) $RT \ln P$ (b) $R \ln P$ (a) $\propto$ (b) 0 (c) $R \ln f$ (d) none of these (c) 0 (d) 0 An ideal gas is taken around the cycle ABCA **305.** Gibbs free energy at constant pressure and **315.**

temperature under equilibrium conditions is as shown in P-V diagram below : (a) $\propto$ (b) 0 (c) maximum (d) minimum

306. law of thermodynamics ascertains the direction of a particular spontaneous process.

(a) Zeroth (b) First (c) Second (d) Third

307. functions are exemplified by heat and work.

- (a) Path (b) Point
(c) State (d) none of these

$\partial \xi$ is the mathematical expression for Fig. 10.1308.

^H The work done by the gas during the cycle is (a) specific heat at constant pressure (CP). equal to
(b) specific heat at constant volume (CV).
(c) Joule-Thompson co-efficient.
(d) none of these. 316.

309. Which of the following is not a reversible process ?

- (a) Expansion of an ideal gas against con
(a) $12 P_1 V_1$ (b) $6 P_1 V_1$ (c) $3 P_1 V_1$ (d) $P_1 V_1$ A thermodynamic system is taken from state A to B along ACB and is brought back to A along BDA as shown below in the P-V diagram.

stant pressure.

- (b) Atmospheric pressure vaporisation of water at 100°C.
(c) Solution of NaCl in water at 50 °C.
(d) None of these.

310. Which of the following is not an extensive property ?

- (a) Free energy (b) Entropy
(c) Refractive index (d) None of these

311. Which of the following is not an intensive property ? Fig. 10.2

ANSWERS

303. (c) 304. (b) 305. (d) 306. (c) 307. (a) 308. (c) 309. (c) 310. (c) 311. (c) 312. (d)
313. (b) 314. (a)
315. (c) 316. (c)

The net work done during the complete cycle is given by the area covered by

- (a) $P_1 A C S P_2 P_1$ (b) $A C B B^1 A^1 A$ (c) $A C B D A$ (d) $A D B B^1 A^1 A$

317. Joule-Thomson experiment is

- (a) isobaric (b) adiabatic (c) isenthalpic (d) both (b) & (c)

318. The enthalpy change when ammonia gas is dissolved in water is called the heat of

325. The gas law ($PV = RT$) is true for an..... change.

- (a) isothermal (b) adiabatic
- (c) both (a) & (b) (d) neither (a) nor (b)

326. Generation of heat by friction is an example of a/an.....change. (a) isothermal

- (c) adiabatic
- (b) irreversible (d) reversible

327. Which of the following has the least thermal (b) formation (d) combustion (a) solution (c) dilution

319. An ideal monoatomic gas is taken round the cycle $ABCD$ as shown below in the P - V diagram

Fig 10.3

The work done during the cycle is

- (a) PV (b) $2PV$
- (c) $PV/2$ (d) 0

320. The work done in an adiabatic change in a particular gas depends upon changes in the.....only.

- (a) temperature (b) specific heat (c) volume (d) pressure

321. The first law of thermodynamics is a restate- ment of the law of conservation of

- (a) mass (b) energy (c) momentum (d) none of these

322. Internal energy change of a system over one complete cycle in a cyclic process is

- (a) zero (b) + ve
- (c) – ve (d) dependent on the path

323. Heating of water under atmospheric pressure is an.....process.

- (b) isobaric (d) isothermal (a) isochoric (c) adiabatic

324. A gas performs the maximum work, when it expands

(a) non-uniformly (c) isobarically (b) adiabatically (d) isothermally efficiency ?
(a) Steam engine (c) Diesel engine (b) Carnot engine (d) Otto engine

328. A refrigerator may be termed as a
(a) heat pump (b) heat engine (c) Carnot engine (d) none of these

329. When a gas in a vessel expands, its internal energy decreases. The process involved is (a) reversible (c) isothermal (b) irreversible (d) adiabatic

330. The melting point of paraffin wax (which contracts on solidification).....with pressure rise.
(a) increases
(b) decreases
(c) remains unchanged
(d) decreases linearly

331. No work is done by the system, when a reaction occurs at constant (a) volume
(c) pressure
(b) temperature (d) none of these

332. explains the equilibrium constant for any chemical reaction.
(a) Henry's law
(b) Law of mass action
(c) Hess's law
(d) none of these

$\partial \Phi$ is the mathematical expression for **333.**

P

(a) C_v
(b) entropy change
(c) Gibbs free energy
(d) none of these

334.

$\partial \Phi$ is the mathematical expression for v

- (a) C_v
 (b) enthalpy change
 317.(d) 318.(a) 319.(a) 329.(a) 330.(a) 331.(a)

ANSWERS

320. (a) 321.(b) 322.(a) 323.(b) 324.(c) 325.(c) 326.(b) 327.(a) 328.(a)
 332.(b) 333.(d) 334.(d)
 (c) free energy change
 (d) none of these

- 335.** Standard temperature and pressure (S.T.P.) is (a) 0°C and 760 mm Hg
 (b) 25°C and 760 mm – Hg
 (c) 0°C and 1 kgf/cm^2
 (d) 15°C and 1 kgf/cm^2

(c)
 $K_P = -D -$
 $11 \text{ } \mathfrak{S}$
 $K_P T T_{21}$
 K
 P
 $1 \ 1$
 $2 = - -1 \mathfrak{S} (d)_{K P R T T}$
 $1 \ 21$

- 336.** Normal temperature and pressure (N.T.P.) corresponds to
 (a) 0°C and 760 mm Hg.
 (b) 15°C and 760 mm Hg.
 (c) 25°C and 760 mm Hg.
 (d) 0°C and 1 kgf/cm^2 .

- 337.** For a constant volume process.....by the system is used only to increase the internal energy.
 (a) heat absorbed (b) work done
 (c) both (a) & (b) (d) neither (a) nor (b)

- 338.** Chemical engineering thermodynamics is concerned with the.....in/of chemical processes.
 (a) reaction mechanism
 (b) calculation of rates

(c) energy transformation from one form to

the another

(d) none of these

339. Pick out the wrong statement:

(a) The expansion of a gas in vacuum is an irreversible process.

(b) An isometric process is a constant pressure process.

(c) Entropy change for a reversible adiabatic process is zero.

(d) Free energy change for a spontaneous process is negative.

340. The free energy change for a chemical reaction is given by

(a) $RT \ln K$ (b) $-RT \ln K$ (c) $-R \ln K$ (d) $T \ln K$

where, K = equilibrium constant

341. The equilibrium constant for a chemical reaction at two different temperatures is given by

$$\ln \frac{K_2}{K_1} = -\frac{\Delta H^\circ}{R} \left(\frac{1}{T_2} - \frac{1}{T_1} \right)$$

342. Pick out the wrong statement.

(a) Phase rule variables are intensive properties.

(b) Heat and work are both state functions.

(c)

(c)

(d)

The work done by expansion of a gas in vacuum is zero.

(d) C_p and C_v are state function .

343. A system is said to be at equilibrium, if the entropy of the system has reached.....value. (a) minimum (b) zero

(c) maximum (d) none of these

344. Thermal efficiency of a Carnot engine can approach 100%, only when the temperature of the (a) cold reservoir approaches zero.

(b) hot reservoir approaches infinity. (c) either (a) or (b).

(d) neither (a) nor (b).

345. In an ideal gas mixture, fugacity of a species is equal to its

- (a) vapor pressure
- (b) partial pressure
- (c) chemical potential
- (d) none of these

346. The adiabatic throttling process of a perfect gas is one of constant enthalpy
 (a) in which there is a temperature drop. (b) which is exemplified by a non-steady

flow expansion.

which can be performed in a pipe with a constriction.

in which there is an increase in temperature.

347. decreases during adiabatic throttling of a perfect gas. (a) Entropy
 (c) Enthalpy (b) Temperature (d) Pressure

DH_{11}° (a) **348.** Pick out the correct statement. $K_p RT_{21}$ (a) Entropy and enthalpy are path func₁

(b)

$K_{P_2} D = -11^{\circ}$ (b) In a closed system, the energy can be K tions.

P_{RT} T exchanged with the surrounding, while $_{21}$ matter can not be exchanged.

ANSWERS

335. (b) 336. (a) 337. (a) 338. (c) 339. (b) 340. (b) 341. (a) 342. (b) 343. (c) 344. (c)
 345. (b) 346. (c)
 347. (d) 348. (c)

(c) All the natural processes are reversible in nature.

(d) Work is a state function.

349. Which of the following is clausius-Clayperon equation for vaporisation of an ideal gas under the condition that the molar volume of liquid is negligible compared to that of the vapor ?

$d \ln p$

=

H

$_{vap}$

(b)

$$d \ln p = \frac{H_{vap}}{RT^2} dt$$

$$dp = \frac{H_{vap}}{RT^2} p dt$$

$$\int \frac{dp}{p} = \int \frac{H_{vap}}{RT^2} dt$$

350. The ratio of equilibrium constants (K_{P2}/K_{P1}) at two different temperatures is given by $R \int_{T_1}^{T_2} \frac{DH}{T^2} dT$ -

$$RT \ln \frac{K_{P2}}{K_{P1}} = \int_{T_1}^{T_2} \frac{DH}{T^2} dT$$

(c)

$$DH = \int_{T_1}^{T_2} \frac{1}{T^2} dT$$

T

-

$$RT \ln \frac{K_{P2}}{K_{P1}} = \int_{T_1}^{T_2} \frac{DH}{T^2} dT$$

351. What is the value of maximum COP in case of absorption refrigeration, if refrigeration provided is at temperature, TR ?

-

(a)

T

TR

$$R \times 12$$

-

TR

T_1

TR

T_1

(b)

$T_2()$

R

- $\times$ -

TR

T

TR

$$R \times 12(c) -$$

TT

T

11

(d) none of these

where, T_1 and T_2 are source & surrounding temperatures respectively.

352. dW and dq are not the exact differential, because q and W are

(a) state functions

(b) path functions

(c) intensive properties

(d) extensive properties

353. Clausius – Clayperon equation is applicable to.....equilibrium processes.

(a) solid-vapor (b) solid-liquid

(c) liquid-vapor (d) all (a), (b) and (c) **354.** Gibbs free energy per mole for a pure substance is equal to the

(a) latent heat of vaporisation

(b) chemical potential

(c) molal boiling point

(d) heat capacity

355. The expression, $nRT \ln$

$\frac{P_1}{P_2}$, is for P_2

the.....

of an ideal gas.

(a) compressibility

(b) work done under adiabatic condition (c) work done under isothermal condition (d) co-efficient of thermal expansion

356. The expression for entropy change given by, $\Delta S = nR \ln (V_2/V_1) + nC_v \ln (T_2/T_1)$ is valid for (a) reversible isothermal volume change. (b) heating of a substance.

(c) cooling of a substance.

(d) simultaneous heating and expansion of

an ideal gas.

357. The expression for entropy change given by, $\Delta S = -nR \ln (P_2/P_1)$, holds

good for

(a) expansion of a real gas.

(b) reversible isothermal volume change.

(c) heating of an ideal gas.

(d) cooling of a real gas.

358. The expression, $nC_v (T_2 - T_1)$, is for the..... of an ideal gas.

(a) work done under adiabatic condition (b) co-efficient of thermal expansion (c) compressibility

(d) none of these

359. The expression for entropy change, $\Delta S = n C_p \ln (T_2/T_1)$, is valid for the.....of a substance.

(a) simultaneous pressure & temperature

change

(b) heating

(c) cooling

(d) both (b) and (c)

360. Gibbs free energy (G) is represented by, $G = H - TS$, whereas Helmholtz free energy, (A) is given by, $A = E - TS$. Which of the following is the Gibbs-Helmholtz equation ?

(a)

$$\left(\frac{\partial A}{\partial T} \right)_V = -H$$

$$\left(\frac{\partial^2 A}{\partial T^2} \right)_V = -\frac{H}{T^2}$$

ANSWERS

349.(a) 350.(b) 351.(a) 352.(b) 353.(d) 354.(b) 355.(c) 356.(d) 357.(b) 358.(a) 359.(d) 360.(c)

(b)

(a) $\left(\frac{\partial A}{\partial T} \right)_V = -E$ **367.** When a gas is subjected to adiabatic expansion, it gets cooled due to (a) decrease in velocity.

(c) both (a) and (b) (b) decrease in temperature. (d) neither (a) nor (b) (c) decrease in kinetic energy. (d) energy spent in doing work. **361.**

The expression,

$$\Delta P = \rho v^2$$

G , gives the free energy change of a component in an ideal gas mixture is equal to the partial pressure of that component. The fugacity of

- (a) with pressure changes at constant temperature each component in a stable homogeneous solution at constant pressure and temperature
 (b) under reversible isothermal volume change as its mole fraction increases.
 (a) decreases
 (c) during heating of an ideal gas. (b) decreases exponentially
 (d) during cooling of an ideal gas. (c) increases

(d) remains constant
362. The coefficient of performance (COP) of a refrigerating system, which is its index of performance, is defined as the ratio of useful refrigeration to the net work. The units (b) Refrigeration cycle is normally reversed and COP are the same.
 (a) kinematic viscosity (b) work (c) temperature (d) none of these

363. For a thermodynamic system containing 'x' chemical species, the maximum number of phases that can co-exist at equilibrium is sent by a temperature vs. entropy plot. In a refrigerator, work required decreases as the temperature of the refrigerator and the temperature at which heat is rejected increases.

(d) One ton of refrigeration is equivalent to (a) x (b) $x + 1$ the rate of heat absorption equal to 3.53 (c) $x + 2$ (d) $x + 3$ kW.

364. Pick out the correct statement. **370.** Joule-Thomson coefficient which is defined (a)
 Compression ratio of an Otto engine is

$\frac{\partial h}{\partial T}$
 $=$
 $\frac{\partial h}{\partial T}$
 $-\frac{\partial h}{\partial T}$ is comparatively higher than a diesel engine.
 as,

$\frac{\partial h}{\partial T}$

, changes sign at (b) Efficiency of an Otto engine is higher P^{HP} than that of a diesel engine for the same a temperature known as inversion temperature. The value of Joule-Thomson co-efficient

(c) Otto engine efficiency decreases with the at inversion temperature is rise in compression ratio, due to decrease (a) 0 (b) ∞ in work produced per quantity of heat. (c) + ve (d) – ve

(d) Diesel engine normally operates at lower **371.** Entropy of the system decreases, when compression ratio than an Otto engine for an equal output of work.

365. Entropy is a/an

(a) state function

(b) macroscopic property

(c) extensive property **372.**(d) none of these

366. 4 kg moles of an ideal gas expands in vacuum spontaneously. The work done is

(a) snow melts into water. (b) a gas expands spontaneously from high

pressure to low pressure. (c) water is converted into ice. (d) both (b) & (c).
Compressibility factor (i.e., the ratio of actual volume of gas to the volume predicted by ideal gas law) for all gases are (a) always greater than one.

(a) 4 J (b)

∞

(c) 0 (d) 8 J

(b)

(c)

same at the same reduced temperature. same at the same reduced pressure. (d) both (b) & (c).

ANSWERS

361. (a) 362.(d) 363.(c) 364.(b) 365.(d) 366.(c) 367.(d) 368.(c) 369.(a) 370.(a)
371.(d) 372.(d)

373. Which of the following exemplifies an adia- batic process ?

(a) Melting of ice.

(b) Condensation of alcohol vapor.

(c) Sudden bursting of a cycle tube. (d) Evaporation of water.

$d \log$

$p_A d \log$

374. The equation, $\frac{p_A}{p_B} = \frac{A}{B} \frac{d \log p}{d \log x_B}$ applied to a binary solution of components. A and B in equilibrium with their vapors at constant temperature and pressure is called the.....equation.

(a) Van Laar

(b) Margules

(c) Gibbs-Duhem

(d) Gibbs-Duhem-Margules

375. The internal energy of an ideal gas does not change in a reversible.....process. (a) isothermal (c) isobaric
(b) adiabatic (d) isometric

376. Joule-Thomson effect i.e., a throttling process is a constant.....process.

(a) entropy (b) temperature (c) internal energy (d) enthalpy

377. An isentropic process is carried out at constant

(a) volume

(b) pressure

(c) temperature

(d) all (a), (b) and (c)

378. The total change in the enthalpy of a system is independent of the

(a) number of intermediate chemical reactions involved.

(b) pressure and temperature.

(c) state of combination and aggregation in the beginning and at the end of the reaction.

(d) none of these.

379. Melting of ice is an example of an.....process. (b) isothermal (d) none of these (a) adiabatic (c) isometric **380.** High..... is an undesirable property for a good refrigerant.

(a) specific heat

(b) latent heat of vaporisation

(c) viscosity

381. Which of the following is not a unit of the equilibrium constant K_p ?

(a) $(\text{atm})^{D_x}$, when D_x is negative

(b) $(\text{atm})^{D_x}$, when D_x is positive

(c) Dimensionless, when $D_x = 0$

(d) $(\text{atm})^{D_x^2}$, when $D_x > 0$

where, $D_x = \text{number of moles of products} - \text{number of moles of reactants}$

382. If an ideal solution is formed by mixing two pure liquids in any proportion, then the of mixing is zero.

(a) enthalpy (b) volume

(c) both 'a' & 'b' (d) neither 'a' nor 'b'

383. Claude's liquefaction process employs the cooling of gases by

(a) expansion in an engine

(b) following a constant pressure cycle (c) throttling

(d) none of these

384. Pressure-enthalpy chart is useful in refrigeration. The change in internal energy of an ideal fluid used in ideal refrigeration cycle is (a) positive

(c) zero (b) negative (d) infinity

385. Dryness fraction of wet steam is defined as the ratio of mass of vapour in the mixture to the mass of mixture.....calorimeter is not used for measuring the dryness fraction of steam.

(a) Bomb (c) Bucket (b) Separating (d) Throttling

386. There is a change in.....in phase transition.

(a) volume (b) pressure (c) temperature (d) all a,b & c

387. Heat evolved/absorbed during conversion of a substance from one allotropic form to another is termed as the heat of (a) fusion

(c) transition

(b) vaporisation (d) none of these

388. Two substances are in equilibrium in a reversible chemical reaction. If the concentration of each substance is doubled, then the value of the equilibrium constant will be (a) same

(b) doubled

(c) halved

(d) one fourth of its original value

(d) specific vapor volume

ANSWERS

373. (c) 374.(d) 375.(a) 376.(d) 377.(a) 378.(a) 379.(b) 380.(b) 381.(d) 382.(c)
383.(a) 384.(c)

385.(a) 386.(a) 387.(c) 388.(a)

389. The efficiency of a Carnot heat engine operating between absolute temperatures T_1 and T_2 (when $T_1 > T_2$) is given by $(T_1 - T_2)/T_1$. The co-efficient of performance(C.O.P.) of a Carnot heat pump operating between T_1 and T_2 is given by

(a) $T_1/(T_1 - T_2)$ (b) $T_2/(T_1 - T_2)$ (c) T_1/T_2 (d) T_2/T_1

390. does not change during phase transformation processes like sublimation, melting & vaporisation.

(a) Entropy (b) Gibbs free energy (c) Internal energy (d) all (a), (b) & (c).

391. In case of an.....process, the temperature of the system increases.

(a) isothermal compression

(b) isothermal expansion

(c) adiabatic expansion

(d) adiabatic compression

392. Change of state namely evaporation, condensation, freezing and melting is an..... process.

(a) isothermal (c) isobaric

(b) adiabatic (d) isochoric

393. Partial molal free energy of an element A in solution is same as its

(a) chemical potential

(b) activity

(c) fugacity

(d) activity co-efficient

394. In any spontaneous process, the.....free energy decreases.

(a) Helmholtz (b) Gibbs

(c) both a & b (d) neither 'a' nor 'b'

395. Match the various values of 'n' with the type of processes in polytropic process ($PV^n = \text{constant}$) for ideal gas.

List I

- (a) $n = 0$
- (b) $n = \infty$
- (c) $n = 1$
- (d) $n = \gamma = C_p/C_v$

List II

- I. Reversible adiabatic process
- II. Constant temperature process
- III. Constant volume process
- IV. Constant pressure process

396. At the critical point, the latent heat of vaporisation is

- (a) zero (b) unity
- (c) infinity (d) unpredictable

397. From which of the following Maxwell's relation, we can directly get the Clapeyron equation?

- (a) $(\partial T / \partial V)_S = - (\partial P / \partial S)_V$
- (b) $(\partial T / \partial P)_S = - (\partial V / \partial S)_P$
- (c) $(\partial S / \partial V)_T = (\partial P / \partial T)_V$
- (d) $(\partial T / \partial P)_S = (\partial V / \partial S)_P$

398. For a gas, the highest value of $\gamma (= c_p/c_v)$ can be (a) 1.44 (b) 1.66
(c) 1.88 (d) 2.40

399. Phase rule for finding the degree of freedom is, $F = C - P - R + 2$. Here 2 stands for (a) temperature & pressure variables of the

system.

- (b) two reacting components (since at least two reactants are required for the reaction to occur).
- (c) two dependent equations (e.g., a component balance and the overall mass balance).
- (d) temperature & the equation $y_1 + y_2 + \dots = 1$

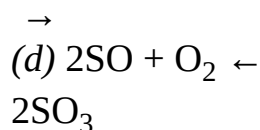
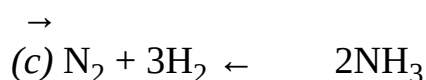
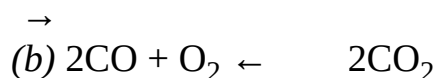
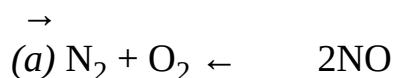
400. The chemical potential of any constituent of an ideal solution does not

depend upon the.....of the solution.

(a) pressure

(c) composition (b) temperature (d) viscosity

401. In which of the following chemical reactions, the value of reaction equilibrium K_p & K_c have the same value?



402. As a refrigerant, carbon dioxide

(a) is more suitable for low temperature refrigeration.

(b) has a very high critical pressure. Mark the answer of this question

(c) may work in conjunction with other refrigeration systems.

(d) all *a*, *b* & *c*

ANSWERS

389. (a) 390. (b) 391. (d) 392. (a) 393. (a) 394. (c) 395. (a) 396. (a) 397. (c) 398. (b)

399. (a) 400. (d)

401. (a) 402. (a)

403. All gases near their critical temperature occupy volume 'n' times that of ideal gas. The value of 'n' is

(a) 0.5 (b) 1

(c) > 1 (d) < 1

404. If 30,000 kcal/hr of heat is removed from a room, then the refrigeration tonnage will be nearly equal to.....TR (tons of refrigeration) . (a) 5 (b) 10 (c) 20 (d) 30

405. The refrigerant used in vapour absorption systems is

(a) pure water

(c) lithium bromide (b) steam (d) freon

406. Match the following values of R (universal gas constant) with proper units:

(i) litre,atm / mole.K⁰

(ii) litre atm/mole . K⁰C

(iii) cal / mole. ⁰K

(iv) atm ft³/lb mole . ⁰R

A. 0.0821

B. 10.73

C. 1.987

D. 0.7302

(a) I – A, II – B, III – C, IV – D

(b) I – D, II – C, III – B, IV – A

(c) I – A, II – B, III – D , IV – C

(d) I – B, II – A, III – C, IV – D

407. Match the following :

A. Boyles'law

B. Charle's law (Isobaric)

C. Charles law (Isometric)

D. General law

(i) $PV / T = \text{constant}$

(ii) $VT = \text{constant}$

(iii) $PT = \text{constant}$

(iv) $PV - \text{constant}$

(a) i – D, ii – B, iii – C, iv – A

(b) i – D, ii – C, iii – B, iv – A

(c) i – D, ii – A, iii – B, iv – C

(d) i – A, ii – B, iii – C, iv – D.

408. Match the following:

A. Avagadro's hypothesis

B. Gay Lussac's law

C. Gibbs-Dalton's law

D. Graham's law

(i) Total pressure of a mixture of gases that

do not react with each other is equal to the partial pressures of each of the con

(ii) At a fixed temperature and pressure reacting gases combine with each other in simple whole number of proportions of volume .

(iii) Equal volume of gases at the same temperature and pressure contain the same number of gas molecules .

(iv) At the same temperature and pressure , the rates of diffusion of gases are inversely proportional to the square roots of their densities.

(a) i – A, ii – B, iii – C, iv – D

(b) i – A, ii – B, iii – D, iv – C

(c) i – D, ii – C, iii – B, iv – A

(d) i – C, ii – B, iii – A, iv – D.

409. What is the amount of work done by a compressor (kJ / kmol) to compress an ideal gas isothermally at a temperature of 25°C from 1 bar to 10 bars?

(a) 5707.7 (b) 3293

(c) 57.07 (d) 4520

410. For an ideal gas the C_v and C_p are functions of (a) temperature only

(b) pressure only

(c) both temperature and pressure

(d) none of these.

411. A compressor with a cooling jacket compresses air from 1 bar to 50 bar at a constant temperature of 406 K. The difference in enthalpy (kJ/mol) between the inlet and outlet gas ($C_p = 30 \text{ J/mol.K}$) is

(a) 0 (b) 13.20

(c) 2.80 (d) 6.55.

412. The triple point of most fluids is close to (a) boiling point (c) critical point

(b) melting point (d) none of these.

413. The law of corresponding states is that all fluids at the same

(a) critical temperature and pressure will

have the same critical volume

(b) reduced temperature and pressure will

have the same reduced volume

(c) temperature and pressure will have the

same specific volume
(d) none of these.

414. Compressibility factor (Z) of an ideal gas is.....at all temperature and pressure . (a) = 1 (b) > 1
(c) < 1 (d) = 0.

stituent gases.

ANSWERS

403. (d) 404.(b) 405.(a) 406.(a) 407.(a) 408.(d) 409.(a) 410.(a) 411.(a) 412.(b)
413.(b) 414.(a)

415. The compressibility factor of a gas is equal to the ratio of the
(a) pressure of a real gas to its vapour pressure at the same temperature .
(b) pressure of a real gas to its critical pressure .
(c) molar volume of real gas to that of an ideal gas at the same temperature and pressure .
(d) none of these.

416. Critical pressure of a substance is defined as the
(a) pressure at which saturated liquid and

vapour are in equilibrium .

(b) pressure at which an azeotrope is formed
when mixed with steam .

(c) pressure above which the state of a substance may not be distinguished
between

liquid and vapour .

(d) none of these.

417. Critical compressibility factor of a real gas is the value of compressibility
factor

(a) at critical temperature and pressure TC ,

PC

(b) when the compressibility factor becomes
unity.

(c) when the compressibility factor becomes
infinite.

(d) none of these.

418. Critical compressibility factor for permanent gases (N_2 , O_2 etc.,) is approximately equal to (a) 0.28 (b) 0.35 (c) 1 (d) 1.5

419. 98% quality of wet steam means (a) 0.02 kg water/ kg steam-water mixture (b) 0.98 kg water/kg steam-water-mixture (c) 0.02 kg steam / kg steam-water mixture (d) 0.98 kg water/kg of steam.

420. For a multi component system, chemical potential is equivalent to (a) molal concentration difference. (b) molar free energy of the pure compounds. (c) partial molar free energy. (d) change in molar free energy due to phase

change.

421. At constant temperature and pressure, for a pure substance, the ratio of specific Gibbs free energy to the chemical potential is equal to (a) 0 (b) 1 (c) ∞ (d) < 0

422. Which of the following is Antonie equation? (a)

$\ln p$

$\ln p_{vap}$

B

$= - +_{TC}$

B

(b) $\ln p_{vap} = + +_{TC}$

B

(c) $\ln p_{vap} = + +_{TC}$

B

(d) $p_{vap} = ++_{tC}$

$dP = DH$ **423.** The Clapeyron equation, $\partial T_{gl-gv} T DV$

can be used for

(a) VLE (vapour liquid equilibrium) only. (b) SLE (solid-liquid equilibrium) only. (c) SVE (solid-vapour equilibrium) only (d) equilibrium between any two coexisting

phases.

424. The Clausius-Clapeyron equation,

$$\frac{d \ln p}{dT} = \frac{\Delta H_{vap}}{RT^2}$$

is applicable for

- (a) VLE (vapour liquid equilibrium only) (b) SLE (Solid-liquid equilibrium only)
(c) SVE (Solid vapour equilibrium only) (d) equilibrium between any two coexisting

phases

425. Raoult's law applies to

- (a) any liquid solution
(b) ideal liquid solution only
(c) non-ideal liquid solutions
(d) ideal gas mixture

426. A phase is defined as a

- (a) completely homogeneous and uniform state of matter.
(b) state of matter, which may not be homogeneous but consists of a single component.
(c) multicomponent state of matter, which may be homogeneous or heterogeneous.
(d) none of these.

427. The fugacity of a solid is approximately equal to

ANSWERS

415. (c) 416. (c) 417. (a) 418. (a) 419. (a) 420. (c) 421. (b) 422. (a) 423. (d) 424. (a)
425. (b) 426. (a)
427. (a)
(a) 1 (b) 0
(c) 10 (d) 100

428. What is the change in fugacity when a saturated liquid on heating is

converted to saturated vapor?

- (a) 0 (b) 1
- (c) 3 (d) ∞

429. For an ideal gas, fugacity

- (a) is equal to pressure
- (b) coefficient is equal to pressure
- (c) is always equal to 1
- (d) none of these

430. In an ideal gas mixture, the fugacity of a component in the mixture is equal to

- (a) mole fraction
- (b) total pressure
- (c) partial pressure
- (d) chemical potential

431. For a cyclic process, which of the following statement is true?

- (a) Only mechanical energy can be completely converted to thermal energy .
- (b) Only thermal energy can be converted completely to mechanical energy.
- (c) Both (a) & (b) are true.
- (d) Both (a) & (b) are false.

432. The partial pressure (p_1) of a specie in a gas mixture is defined as product of mole fraction of the specie (y_1) and the total pressure of the system (p) ($p_1 = y_1 P$). This definition is valid for

- (a) ideal gas mixture only.
- (b) non-ideal gas mixture only.
- (c) both ideal and non-ideal gas mixtures.
- (d) none of these.

433. A mixture of ideal gases is an ideal solution

- (a) Never
- (b) Only at low pressure
- (c) Only at low pressure & temperature well above critical point
- (d) Always

435. The degrees of freedom for a binary azeotrope is (a) 0 (b) 1

- (c) 2 (d) 3

436. The upper consolute temperature for two partially miscible liquids is the temperature at which

- (a) two conjugate phase coexist.
- (b) a homogeneous single phase solution is formed.
- (c) the vapor pressure of the two phases become equal.
- (d) none of these.

437. The reheat cycle in steam power plant is mainly adopted to

- (a) improve thermal efficiency.
- (b) decrease the moisture content in low pressure stages to a safe value.
- (c) decrease the capacity of condenser.
- (d) recover waste heat of the boiler.

438. Which of the following relationships is valid only for reversible processes undergone by a closed system of single compressible substance (neglect changes in potential and kinetic energy)?

- (a) $dQ = du + dW$
- (b) $Tds = dU + pdV$
- (c) $Tds = dU + dW$
- (d) $dQ = dU + pdV$

439. Which combinations of the following statements is correct?

P. A gas cools upon expansion only when its

Joule-Thomson coefficient is positive in the temperature range of expansion. Q. For a system undergoing a process, its

R. entropy remains constant only when the process is reversible.

The work done by a closed system in an adiabatic process is a point function.

434.

For the gas phase reaction A

K

$\rightleftharpoons B, B^K C \text{ and } A^K$

$\rightleftharpoons \rightleftharpoons$

C, where the equilib

rium constants are K_1 , K_2 and K_3 ; Which of the following is true?

(a) $K_1 K_2 K_3 = 1$

(b) $K_1 K_2 / K_3 = 1$

(c) $K_1 K_2 + K_2 K_3 + K_1 K_3 = 1$

S. A liquid expands upon freezing when the slope of its fusion curve on pressure– temperature diagram is negative.

(a) R and S (b) P and Q (c) Q, R and S (d) P, Q and R

440. If a closed system is undergoing an irreversible process, the entropy of the system (a) must increase

(b) always remains constant

(c) must decrease

(d) can increase, decrease or remain constant.

(d) $K_1 / K_2 = K_2 / K_3$

ANSWERS

428.(a) 429.(a) 430.(c) 431.(a) 432.(c) 433.(d) 434.(b) 435.(b) 436.(b) 437.(a)

438.(c) 439.(c) 440.(d)

Chemical reaction engineering and

Rate of a chemical reaction is independent of the concentration of the reactants for

11 reactor design

1. Chemical kinetics can predict the.....of a

a..... reaction. (a) zero order
(c) consecutive
(b) third order (d) none of these

2. Which of the following is not a unit of reaction rate ? 8. (a) Moles formed/(surface of catalyst) (time) (b) Moles formed/(volume of reactor) (time)
(c) Mole formed/(volume of catalyst) (time) (d) None of these

3. If 'n' is the order of reaction, then unit of rate constant is

1

9. (a) $(\text{time})(\text{concentration})^{-1})^n$

(b) $(\text{time})^{-1} (\text{concentration})^{n-1}$ (c) $(\text{time})^{n-1} (\text{concentration})$ chemical reaction.
(a) rate
(b) feasibility
(c) both (a) & (b)
(d) neither (a) nor (b)

Velocity of a chemical reaction

(a) decreases with increase in temperature. (b) increases with increase of pressure of reactants for all reactions.

(c) decreases with increase of reactant concentration.
(d) none of these.

Sum of the powers of the concentration terms in the rate equation is called the.....of the reaction.

(a) order
(c) molecularity (b) overall order (d) none of these

(d) none of these **10.** Molecularity of a reaction **4.** Which of the following is a controlling factor in (a)

very fast heterogeneous reaction ? (b)

(a) Heat and mass transfer effects (c)

(b) Pressure (d) both (b) and (c).

(c) Temperature **11.** Concentration of the limiting reactant (with (d) Composition of reactant initial concentration of a moles/litre) after

5. Variables affecting the rate of homogeneous reaction are (a) $(a - x)$. Then 't' for a first order reaction is given by

(a)
pressure and temperature only.

a

x

$kt = -\ln \frac{a-x}{a}$ (c) pressure and composition only. = $-\ln \frac{a-x}{a}$ (b) temperature and composition only. (a) $k t$

aa

(d)

pressure, temperature and composition.

—

(c)

k t

=

In

$a x_{(d) kt} = a a - ()$ **6.** Rate determining step in a reaction consisting a x

of a number of steps in series is the.....step. Half life period of a chemical reaction is (a) fastest **12.**

(b) slowest (a) the time required to reduce the concentration of the reacting substance to half its (c) intermediate value. (d) data insufficient; can't be predicted initial value.

ANSWERS

1. (a) 2. (d) 3. (a) 4. (a) 5. (d) 6. (b) 7. (a) 8. (d) 9. (b) 10. (d) 11. (a) 12. (a) is always equal to the overall order of reaction. may not be equal to the order of reaction. can't have a fractional value.

13.

(b) half of the space time of a reaction. 20. Rate constant 'k' and absolute temperature 'T' are (c) half of the residence time of a reaction. related by collision theory (for bimolecular) as

(d)

none of these

$\propto$

(a) $kT^{1.5}$

Half-life period for a first order reaction (b) $k \propto -E / RT$ is.....the initial concentration of the reactant

tant. (c) kT (a) directly proportional to $\propto$

(d) kT (b) inversely proportional to

(c) independent of 21. Transition state theory relates the above (d) none of these quantities as

$\propto -E / RT$ (b) $k \propto Te^{-E / RT}$ 14. In a first order reaction, the time required to (a) k reduce the concentration of reactant from 1

(c)

k

$\propto$

T

$\propto$

(d) kT

1.5

mole/litre to 0.5 mole/litre will be.....that

required to reduce it from 10 moles/litre to 5 22. Reactions with high activation energy are moles/litre in the same volume. (a) (a) more than (b) (b) less than (c) (c) same as (d) very temperature sensitive temperature insensitive always irreversible

always reversible

(d) data insufficient; can't be predicted. **23.** In autocatalytic reactions,

15. Specific rate constant for a second order reaction (a) (a) is independent of temperature. (b) (b) varies with temperature. (c) (c) depends on the nature of the reactants. (d) one of the reactants acts as a catalyst. one of the products acts as a catalyst. catalysts have very high selectivity. no catalyst is used.

(d) both (b) and (c). **24.** With increase in temperature, the equilibrium **16.** The reaction in which the rate equation corresponds to a stoichiometric equation, is called (a) decreases a/an.....reaction.

(a) elementary
(c) parallel
(b) increases
(b) non-elementary (c) remains unaffected
(d) autokinetic (d) decreases linearly with temperature

(a) elementary

(c) parallel

(b) increases

(b) non-elementary (c) remains unaffected

(d) autokinetic (d) decreases linearly with temperature

17. For a zero order reaction, the concentration of **25.** With decrease in temperature, the equilibrium product increases with the conversion of a reversible endothermic reaction (a) increase of reaction time. tion

(b) increase in initial concentration. (a) decreases

(c) total pressure. (b) increases

(d) decrease in total pressure. (c) remains unaffected

18. Arrhenius equation shows the variation (d) increases linearly with temperature of.....with temperature. **26.** The equilibrium constant of chemical reaction rate.....in the presence of catalyst. (b) rate constant (a) increases

(c) energy of activation (b) decreases

(d) frequency factor (c) remains unaffected

(c) energy of activation (b) decreases

(d) frequency factor (c) remains unaffected

19. The energy of activation of a chemical reaction (d) can either increase or decrease (depends

(a) is same as heat of reaction at constant on the type of catalyst) pressure. **27.**

Conversion increases with increase in temperature

(b) is the minimum energy which the molecules must have before the reaction can (a) autocatalytic

take place. (b) irreversible

(c) varies as fifth power of the temperature. (c) reversible endothermic
(d) both (b) and (c). (d) reversible exothermic

ANSWERS

13. (c) 14.(c) 15.(d) 16.(a) 17.(a) 18.(b) 19.(b) 20.(c) 21.(b) 22.(a) 23.(b) 24.(a)
25.(a) 26.(c) 27.(c)

28. The heat of reaction

(a) depends on the pressure only.

(b) depends on the mechanism of reaction only.

(c) depends on both pressure and mechanism of reaction.

(d) is independent of the mechanism of reaction.

29. Exposure of a photographic plate to produce a latent image is an example of.....reaction. (a) very slow (b) very fast (c) photochemical (d) both (b) and (c)

30. A trickle bed reactor is the one, which

(a) has altogether three streams either entering or leaving.

(b) processes three reactants at different flow rates.

(c) processes three reactants with same flow rate.

(d) employs all the three phases {i.e.. solid, liquid and gas}.

31. According to Arrhenius equation of temperature dependency of rate constant for an elementary reaction

(a)

k

$\propto$

$\propto$

T (b) $ke^{-E/RT}$ (c) $k \propto Te^{-E/RT}$ (d) none of these

32. With increase in temperature, the rate constant obeying Arrhenius equation

(a) increases.

(b) decreases.

(c) decreases exponentially.

(d) can either increase or decrease ; depends

on the frequency factor.

33. A batch reactor is characterised by

(a) constant residence time.

(b) variation in extent of reaction and proper

ties of the reaction mixture with time. (c) variation in reactor volume.

(d) very low conversion.

34. A plug-flow reactor is characterised by (a) high capacity.

(b) presence of axial mixing.

(c) presence of lateral mixing.

(d) constant composition and temperature of

reaction mixture.

35. In a semi-batch reactor

(a) velocity of reaction can be controlled. (b) maximum conversion can be controlled, (c) both the reactants flow counter-currently. (d) residence time is constant.

36. A backmix reactor

(a) is same as plug-flow reactor.

(b) (c) (d)

is same as ideal stirred tank reactor. employs mixing in axial direction only. is most suitable for gas phase reaction.

37. In a continuous flow stirred tank reactor, the composition of the exit stream

(a) is same as that in the reactor.

(b) is different than that in the reactor. (c) depends upon the flow rate of inlet stream. (d) none of these.

38. In an ideal tubular-flow reactor

(a) (b) (c)

there is no mixing in longitudinal direction. mixing takes place in radial direction. there is a uniform velocity across the radius.

(d) all (a), (b) and (c).

39. Space velocity,

(a) describes the extensive operating

- (b)
- (c)

characteristics of a tubular flow reactor. is the maximum feed rate per unit volume of reactor for a given conversion.
is a measure of the ease of the reaction.

- (d) all (a), (b) and (c)

40. A high space velocity means that a given

- (a) reaction can be accomplished with small reactor.
- (b) conversion can be obtained with a high feed rate.
- (c) both (a) and (b).
- (d) none of these.

41. Space time in flow reactor is

- (a)
- (b)
- (c)

usually equal to the residence time. the reciprocal of the space velocity. a measure of its capacity.

- (d) both (a) and (b).

42. A space time of 3 hours for a flow reactor means that

- (a) the time required to process one reactor

volume of feed (measured at specified conditions) is 3 hours.

- (b) three reactor volumes of feed can be pro
- (c)

cessed every hour.

it takes three hours to dump the entire volume of the reactor with feed.

- (d) conversion is cent per cent after three hours.

ANSWERS

28. (d) 29.(d) 30.(d) 31.(b) 32. (a) 33.(b) 34.(c) 35.(a) 36.(b) 37.(a) 38.(d) 39.(d)
40.(c) 41.(d) 42.(a)

43. Space time equals the mean residence time (a) when the density of the

reaction mixture is constant.

(b) for large diameter tubular reactor. (c) for narrow diameter tubular reactor. (d) for CSTR.

44. A batch reactor is

(a) suitable for gas-phase reactions on commercial scale.

(b) suitable for liquid phase reactions involving small production rate.

(c) least expensive to operate for a given rate.

(d) most suitable for very large production rate.

45. Which of the following is the most suitable for very high pressure gas phase reaction ? (a) Batch reactor

(b) Tubular flow reactor

(c) Stirred tank reactor

(d) Fluidised bed reactor

46. For nearly isothermal operation involving large reaction time in a liquid-phase reaction, the most suitable reactor is a.....reactor.

(a) stirred tank (b) tubular flow (c) batch (d) fixed bed

47. For the same residence time, which one will give the maximum conversion ?

(a) Single stirred tank ($v = 5$ litres).

(b) Two stirred tank (each of 2.5 litres) in series.

(c) Stirred tank followed by tubular flow reactor (each of 2.5 litres).

(d) Single tubular flow reactor ($v = 5$ litres). **48.** Oil is hydrogenated using nickel catalyst in

a.....reactor.

(a) batch (b) slurry

(c) fluidised bed (d) fixed bed

49. A second order reaction of the form $A + B$

$\rightarrow$

C is called a pseudo-first order reaction, when (a) $C_{AO} = C_{BO}$ (b) $C_{AO} > C_{BO}$ (c) $C_{BO} > C_{AO}$ (d) $C_{BO} > C_{AO}$

50. A first order irreversible reaction, $A \rightarrow B$ is carried out separately in a constant

volume as well as in a variable volume reactor for a particular period. It signifies that.....in the two reactors.

(a) both conversion as well as concentration

are same

(b) conversion in both will be the same but concentrations will be different

(c) both the conversion as well as concentra

(d)

tions will be different none of these.

51. A space velocity of 5 hr^{-1} means that (a) five reactor volumes of feed (at specified conditions) are being fed into the reactor per hour.

(b) after every 5 hours, reactor is being filled

(c)

with the feed.

cent per cent conversion can be achieved in at least 5 hours.

(d) a fixed conversion of a given batch of feed takes 5 hours.

52. In a CSTR, varies with time.

(a) reaction rate (c) both (a) & (b) (b) concentration (d) neither (a) nor

53. For all positive reaction orders for a particular duty,

(a) mixed reactor is always larger than the plug-flow reactor.

(b) ratio of the volume of the mixed reactor to that of the plug-flow reactor decreases with order.

(c) reactor size is independent of the type of flow.

(d) density variation during reaction affects design.

54. With the same reaction time, initial concentration and feed rate, the reaction $2A \rightarrow B$ is carried out separately in CSTR and P.F. reactor of equal volumes. The conversion will be

(a)

(b)

(c)

higher in P.F. reactor higher in CSTR
same in both the reactors

(d) data insufficient; can't be predicted 55. For an autocatalytic reactor, the suitable reactor set up is

(a)

(b) (c) (d)

P.F. reactors in series.

CSTR in series.

CSTR followed by P.F. reactor. P.F. reactor followed by CSTR.

56. A first order reaction requires two unequal sized CSTR. Which of the following gives higher yield ?

(a) Large reactor followed by smaller one. (b) Smaller reactor followed by larger one. (c) Either of the arrangement (a) or (b) will

give the same yield.

(d) Data insufficient, can't be predicted.

ANSWERS

43. (a) 44. (b) 45. (b) 46. (a) 47. (d) 48. (b) 49. (d) 50. (b) 51. (a) 52. (d) 53. (a) 54. (a) 55. (c) 56. (c)

57. A first order reaction requires two equal sized CSTR. The conversion is

(a) less when they are connected in series. (b) more when they are connected in series. (c) more when they are connected in parallel. (d) same whether they are connected in series or in parallel.

58. The concentration of A in a first order reaction, $A \rightarrow B$, decreases

(a) linearly with time.

(b) exponentially with time.

(c) very abruptly towards the end of the reaction.

(d) logarithmically with time.

59. Which of the following is the most suitable for isothermal operation ?

(a) Batch reactor (b) Back-mix reactor (c) Plug-flow reactor (d) Fixed bed reactor

60. With increase in the space time of an irreversible isothermal reaction being

carried out in a P.F. reactor, the conversion will

- (a) increase
- (b) decrease
- (c) remain same
- (d) data is insufficient; can't be predicted

61. The optimum performance for reactors operating in parallel is obtained when the feed stream is distributed in such a way, that the (a) space time for each parallel line is same. (b) space time for parallel lines is different. (c) larger reactors have more space time compared to smaller ones.

(d) none of these.

62. Backmixing is most predominant in

- (a) a well stirred batch reactor.
- (b) a plug-flow reactor.

(c) a single CSTR.

(d) CSTR's connected in series.

63. The ratio of moles of a reactant converted into the desired product to that converted into unwanted product is called

- (a) operational yield
- (b) relative yield
- (c) selectivity
- (d) none of these

64. The performance of a cascade of CSTR's can be improved by adding

- (b) a P.F. reactor in parallel.
- (c) more CSTR's in series.
- (d) more CSTR's in parallel.

65. An autothermal reactor is

(a) most suitable for a second order reaction. (b) most suitable for a reversible reaction. (c) completely self-supporting in its thermal

energy requirements.

(d) isothermal in nature.

66. For series reaction, the relative yield

(a) is always greater for plug-flow reactor than for the single CSTR of the same

volume.

(b) statement in (a) is wrong.

(c) decreases with increasing conversion. (d) both (a) and (c) hold good.

67. For reactions in parallel viz $A \rightarrow P$ (desired product) and $A \rightarrow Q$ (unwanted product), if the order of the desired reaction is higher than that of the undesired reaction, a

(a) batch reactor is preferred over a single

CSTR for high yield.

(b) tubular reactor is preferred over a single

CSTR for high yield.

(c) both (a) and (b).

(d) single CSTR is the most suitable.

68. In question no. 78, high yield will be favoured (for gas phase reactions)

(a) at high pressure.

(b) at low pressure.

(c) by the presence of inert gases in the reactant stream.

(d) both (b) and (c).

69. When all the limiting reactant is consumed in the reaction, the operational yield.....the relative yield.

(a) is greater than

(b) is smaller than

(c) equals

(d) can be either greater or smaller than (depends on the type of reaction)

70. Pick out the wrong statement.

(a) A catalyst does not alter the final position of equilibrium in a reversible reaction.

(b) A catalyst initiates a reaction.

(c) A catalyst is specific in reaction.

(d) A catalyst remains unchanged in chemical composition at the end of the reaction.

ANSWERS

57. (b) 58.(b) 59.(b) 60.(a) 61.(a) 62.(c) 63.(c) 64.(c) 65.(c) 66.(d) 67.(c) 68. (a) 69.(c) 70.(b)

71. Catalyst is a substance, which.....chemical reaction.

- (a) increases the speed of a
- (b) decreases the speed of a
- (c) can either increase or decrease the speed of a
- (d) alters the value of equilibrium constant in a reversible

72. Catalyst carriers

- (a) have very high selectivity.
- (b) increase the activity of a catalyst. (c) provide large surface area with a small amount of active material.
- (d) inhibit catalyst poisoning.

73. Catalyst promoter

- (a) improves the activity of a catalyst. (b) acts as a catalyst support.
- (c) itself has very high activity.
- (d) all (a), (b) and (c).

74. A catalyst inhibitor

- (a) lessens its selectivity.
- (b) may be useful for suppressing undesirable

side reactions.

- (c) is added in small quantity during the catalyst manufacture itself.
- (d) all (a), (b) and (c).

75. A chemical reaction, $A \rightarrow 3 B$, is conducted in a constant pressure vessel. Starting with pure A, the volume of the reaction mixture increases 3 times in 6 minutes. The fractional conversion is

- (a) 0.33
- (b) 0.5
- (c) 1
- (d) data insufficient, can't be predicted

76. The most suitable reactor for carrying out autothermal reaction is a

- (a) batch reactor
- (b) CSTR
- (c) semi-batch reactor

(d) plug-flow reactor

77. Which of the following factors control the design of a fluid-solid reactor ?

(a) Reaction kinetics for single particle. (b) Size distribution of solids being treated. (c) Flow patterns of solids and fluid in the re-

actor.

(d) All (a), (b) and (c).

78. Kinetics of a solid catalysed reaction can best be studied in a.....reactor.

(a) batch (b) plug-flow (c) mixed (d) none of these

79. For high conversion in a highly exothermic solid catalysed reaction, use a.....bed reactor. (a) fixed

(b) fluidised bed reactor followed by a fixed (c) fixed bed reactor followed by a fluidised (d) fluidised

80. Which of the following will give maximum gas conversion ?

(a) Fixed bed reactor.

(b) Fluidised bed reactor.

(c) Semi-fluidised bed reactor.

(d) Plug-flow catalytic reactor.

81. BET apparatus is used to determine the (a) specific surface of a porous catalyst. (b) pore size distribution.

(c) pore diameter.

(d) porosity of the catalyst bed.

82. BET apparatus

(a) measures the catalyst surface area directly. (b) operates at very high pressure.

(c) is made entirely of stainless steel. (d) none of these.

83. Helium-mercury method can be used to determine the.....of the catalyst particle. (a) pore volume (b) solid density (c) porosity (d) all (a), (b), & (c).

84. Velocity of a reaction depends upon the (a) nature of the reactants.

(b) concentration of the reactants.

(c) temperature at which the reaction is carried. (d) all (a), (b) and (c).

85. If the time required to complete a definite frac- tion of reaction varies

inversely as the concentration of the reactants, then the order of reaction is

(a) 0 (b) 1

(c) 2 (d) 3

86. If the time required for half change is inversely proportional to the square of initial concentration and the velocity depends on the units in which the concentration term is expressed, then the order of reaction is

(a) 1 (b) 2

(c) 3 (d) 0

ANSWERS

71. (c) 72.(c) 73.(a) 74.(d) 75.(c) 76.(b) 77.(d) 78.(c) 79. (b) 80.(c) 81.(a) 82.(d) 83.(d) 84.(d) 85.(c) 86.(c)

87. Mean residence time is equal to the space time, when

(a) the feed rate is measured at temperature and pressure in the reactor.

(b) the temperature, pressure and the density of reaction mixture remains constant throughout the reactor.

(c) there is no change in number of moles in gaseous reaction.

(d) all (a), (b) and (c).

88. A catalyst loses its activity due to

(a) loss in surface area of the active component. (b) agglomeration of metal particles caused by thermal sintering of the solid surface. (c) covering of the catalytic active sites by a foreign substance.

(d) all (a), (b) and (c).

89. Higher free energy of activation of a chemical reaction (at a given temperature) implies (a) slower rate of reaction.

(b) higher rate of reaction.

(c) higher equilibrium conversion.

(d) both (b) and (c).

90. Promoter

(a) initiates a chemical reaction and is a catalyst by itself.

(b) alters the position of equilibrium in a reversible reaction.

(c) increases the number of active centres by increasing the unevenness of catalyst surface and by creating discontinuities in the crystals.

(d) all (a), (b) and (c).

91. If, n = overall order of a chemical reaction. a = initial concentration of reactant. t = time required to complete a definite fraction of the reaction. Then pick out the correct relationship.

(a)

t

$\propto$

$t \propto 1$

$a^{-1}a^n$

(c) $t \propto a^{n+1}$ (d) $ta^{n+1} \propto$

n

92. Semibatch reactor is preferred, when a/an

(a) a highly exothermic reaction is to be controlled.

(b) undesirable side reaction (at high concentration of one of the reactants) is to be avoided.

(c) a gas is to be reacted with liquid (e.g. hydrogenation of fat).

(d) all (a), (b), and (c).

93. The rate of reaction does not decrease appreciably as the reaction proceeds in case of..... reactions.

(a) autocatalytic (b) exothermic (c) endothermic (d) autothermal **94.** The most unsuitable reactor for carrying out

reactions in which high reactant concentration favours high yields is (a) backmix reactor (c) series of CSTR (b) plug flow reactor (d) PFR in series

95. The rate of a homogeneous reaction is a function of

(a) temperature and pressure only.

(b) temperature and composition only. (c) pressure and composition only.

(d) all temperature, pressure and composition.

96. Which of the following is an independent variable for a batch tank reactor with uniform concentration and temperature ?

(a) Time

(b) Useful volume of the tank

(c) Diameter of the reactor

(d) None of these

97. For a tubular flow reactor with uniform concentration and temperature, the independent variable is

- (a) time (b) length
(c) diameter (d) none of these

98. The value of steric factor ' P ' in the equation $k = PZe^{E/RT}$ usually ranges from
(a) 1.0 to 10^{-8} (b) 1.1. to 102 (c) 0.1 to 0.9 (d) none of these

99. A catalyst is said to be a negative catalyst, if it (a) retards the rate of reaction.
(b) reduces the value of equilibrium constant. (c) does not initiate the reaction.
(d) all (a), (b) and (c).

100. Which of the following is not a chemical step in a fluid solid catalytic reaction ?

- (a) Surface chemical reaction
(b) Adsorption
(c) Desorption
(d) None of these

101. When the reaction is dominated by intraparticle diffusion, the apparent order of reaction (n_D) as measured is related to the true order (n) as

ANSWERS

87.(a) 88.(d) 89.(a) 90.(c) 91.(b) 92.(d) 93.(a) 94.(a) 95.(d) 96.(a) 97.(b) 98.(a)
99.(a) 100.(d) 101.

(a)

(a)

n

$+ n$ 1 (b) $n_D = n^{D=2} = 2$ (c) $Dn = +1$ (d) none of these

102. Which of the following is not a dimensionless group used in catalysis ?

(a) Reactor dispersion number (D/vL)

(b)

$\frac{5}{k}$

Reduced time

$\frac{5}{k}$

(c)

Thiele modulus

L

(d) None of these

where, D = dispersion co-efficient, cm^2/sec . D_1 = diffusion co-efficient; cm^2/sec

L = length of the reactor, cm , t = time, sec ., v = volumetric flow rate, cm^3/sec .

V = volume, cm^3 .

103. A first order homogeneous reaction of the type $X \rightarrow Y \rightarrow Z$ (consecutive reaction) is carried out in a CSTR. Which of the following curves respectively show the variation of the concentration of X , Y and Z with time?

Fig. 11. 1

(a) I, II, III (b) III, II, I (c) III, I, II (d) II, III, I

104. Half life period of a first order irreversible reaction $A \rightarrow B$ is

(a) $k/2$ (b) $\ln 2$

(c) $\ln 2/k$ (d) $\ln 0.5/k$

105. An irreversible first order reaction is being carried out in a CSTR and PFR of same volume. The liquid flow rates are same. The relative conversion will

(a) be more in CSTR than in PFR. (b) be more in PFR than in CSTR. (c) be same in both cases.

(d) depend on the temperature.

106. Half life period of a chemical reaction is proportional to CA_0^{-1} , if the reaction is of..... order.

(a) first (b) zero

(c) second (d) third

107. The knowledge of initial concentration and rate constant is necessary to determine the half life time of a reaction of.....order. (a) zero (b) first

(c) second (d) none of these

108. If ΔG (free energy change) for a chemical reaction is very large and negative, then the reaction is

(a) not feasible.

- (b) just feasible.
- (c) very much feasible.
- (d) unpredictable as is no measure of feasibility of a reaction.

109. The rate of the chemical reaction $A \rightarrow B$ doubles as the concentration of A i.e., C_A is doubled. If rate of reaction is proportional to

C^n , then what is the value of n for this reaction?

- (a) 0.5 (b) 1 (c) 0 (d) 2

110. Rate of a chemical reaction is not influenced by the

- (a) catalyst
- (b) temperature
- (c) reactants concentration
- (d) number of molecules of reactants taking

part in a reaction

111. The rate constant of a chemical reaction decreases by decreasing the

- (a) pressure
- (b) concentration of reactants
- (c) temperature
- (d) duration of reaction

112. Which one is the rate controlling step in a solid-gas non-catalytic reaction occurring at very high temperature?

- (a) Pore diffusion
- (b) Film diffusion
- (c) Ash layer diffusion
- (d) Chemical reaction

ANSWERS

102. (d) 103. (b) 104. (c) 105. (b) 106. (c) 107. (c) 108. (c) 109. (b) 110. (d) 111. (c) 112. (b)

113. When a catalyst increases the rate of chemical reaction, the rate constant

- (a) decreases (b) increases (c) remains constant (d) becomes infinite

114. Half life period of decomposition of a liquid 'A' by irreversible first order

reaction is 12 min- utes. The time required for 75% conversion of ' A' is.....minutes.

(a) 18 (b) 24

(c) 6 (d) 12

115. The rate constant of a reaction depends on the (a) initial concentration of reactants. (b) time of reaction.

(c) temperature of the system.

(d) extent of reaction.

116. The rate at which a chemical substance reacts is proportional to its

(a) active mass

(b) molecular weight

(c) equivalent weight

(d) atomic weight

117. The reaction in which one of the products of reaction acts as a catalyst is called a/an..... reaction.

(a) biochemical (c) catalytic (b) photochemical (d) autocatalytic

118. For identical flow rate and feed composition, X plug flow reactors (PER) in series with a total volume V gives the same conversion as single

(a) CSTR of volume V

(b) PFR of volume V

(c) CSTR of volume V/X

(d) PFR of volume V/X

119. The catalyst in a first order chemical reaction changes the

(a) equilibrium constant

(b) activation energy

(c) heat of formation of the product (d) heat of reaction

120. The catalyst in a second order reversible reaction increases the rate of the forward reaction

(a) and decreases that of backward reaction. (b) and backward reaction equally.

(c) only.

(d) to a greater extent than that of the backward reaction.

121. The performance equations for constant density systems are identical for

(a) P.F.R. and backmix reactor.

(b) P.F.R. and batch reactor.

(c) P.F.R, batch reactor and backmix reactor. (d) batch reactor and backmix reactor.

122. In an ideal mixed reactor (at steady state), the

(a) space time is equivalent to holding time for constant density systems.

(b) composition throughout the reactor remains same.

(c) exit stream has the same composition as the fluid within the reactor.

(d) all (a), (b) and (c).

123. The ratio of volume of mixed reactor to the volume of P.F.R. (for identical flow rate, feed composition and conversion) for zero order reaction is

(a) ∞ (b) 0

(c) 1 (d) > 1

124. A catalyst

(a) initiates a reaction.

(b) lowers the activation energy of reacting molecules.

(c) is capable of reacting with any one of the reactants.

(d) can not be recovered chemically unchanged at the end of a chemical reaction.

125. The reaction between oxygen and organic material is a/an.....reaction.

(a) exothermic (b) endothermic

(c) biochemical (d) photochemical **126.** The order of the reaction,

H

2

+ Cl

sunlight

2 $\rightarrow$

2HCl, is

(a) 0 (b) 1

(c) 2 (d) 3

127. The order of the chemical reaction,

2A + B

$\rightarrow$

C, whose rate equation is given as –

$$\frac{r_A}{K C_A^2}$$

$r_A \cdot C_B$ is
 (a) 0 (b) 1
 (c) 2 (d) 3

128. A rise in temperature

- (a) normally tends to increase the reaction rate.
 (b) does not affect a catalysed reaction. (c) does not affect photo-chemical reaction rates.
 (d) all (a), (b) and (c).

ANSWERS

113. (d) 114. (b) 115. (c) 116. (a) 117. (d) 118. (b) 119. (b) 120. (b) 121. (b) 122. (d)
 123. (c) 124. (b)
 125. (a) 126. (a) 127. (d) 128. (d)

129. The value of 'n' for a chemical reaction $A \rightarrow B$,

whose reaction rate is

$$\frac{r}{C_A^n}$$

r_A , will be.....if the rate of the reaction increases by a factor of 8, when the concentration of A is doubled. (a) 0 (b) 1
 (c) 2 (d) 3

130. What is the order of chemical reaction $A + B +$

C

$\rightarrow D$, if it is found that the reaction rate doubles on doubling the concentration of B and also the reaction rate doubles when the concentrations of both A & B were doubled and quadrupled when the concentrations of both B & C were doubled ?
 (a) 1 (b) 2

(c) 3 (d) 4

131. The half life period of a first order reaction is given by

- (a) $1.5 K$ (b) $2.5 K$
(c) $0.693/K$ (d) 6.93

where, K = rate constant.

132. For a.....order chemical reaction ,

$A \rightarrow$ products, the half life period is independent of the initial concentration of the reactant A.

- (a) zero (b) first
(c) second (d) third

133. For a.....order chemical reaction,
 K

$A + B \rightarrow C$, the fractional conversion of reactant 'A' is proportional to time,

- (a) zero (b) first
(c) second (d) third

134. In case of a consecutive unimolecular type first order reaction,
 $K K$

$A \rightarrow R \rightarrow S$, the concentration of component.....increases continuously with time.

- (a) S (b) R
(c) A (d) none of these

135. 'N' plug flow reactors in series with a total volume 'V' gives the same conversion as a single plug flow reactor of volume 'V' for..... order reactions.

- (a) first (b) second
(c) third (d) any

136. The equilibrium constant for the revers

K
 $\rightleftharpoons$

ible reaction,

A
 K_2

P , is affected by the check it

- (a) temperature of the system.
- (b) presence or absence of inerts.
- (c) pressure of the system.
- (d) kinetics of the reaction.

137. For identical flow rate, feed composition and for elementary first order reactions, 'N' equal sized mixed reactors in series with a total volume 'V' gives the same conversion as a single plug flow reactor of volume 'V' for constant density systems. This is true, when the value of.....check it

- (a) 1 (b) > 1
- (c) ∞ (d) > 1

138. The vessel dispersion number(/ L) for plug flow is

- (a) 0 (b) 500
- (c) 750 (d) ∞

139. The dispersion number of perfect mixed flow is

- (a) 0 (b) > 150
- (c) ∞ (d) < 2100

140. The exit age distribution of fluid leaving a vessel is used to know the

- (a) activation energies of a reaction.
- (b) reaction mechanism.
- (c) extent of non-ideal flow in the vessel. (d) none of these.

141. A first order reaction is to be treated in a series of two mixed reactors. The total volume of the two reactors is minimum, when the reactors are

- (a) equal in size.
- (b) of different sizes.
- (c) of such size that the ratio of their vol-

umes is < 5 .

- (d) none of these.

142. With increase in K_2/K_1 in case of a unimolecular type elementary reactions

A

K_R^K

→ → S, the fractional yield of 'R' in mixed reactor (for a given conversion of 'A') (a) decreases
 (b) increases
 (c) increases linearly
 (d) remains same

ANSWERS

129. (d) 130. (b) 131. (c) 132. (b) 133. (a) 134. (a) 135. (d) 136. (c) 137. (a) 138. (a)
 139. (c) 140. (c)
 141. (a) 142. (a)

143. The conversion in a mixed reactor accomplishing a reaction $A \rightarrow 3R$ is 50% when gaseous reactant 'A' is introduced at the rate of 1 litre/second and the leaving flow rate is 2 litres/second. The holding time for this operation is.....second.
 (a) 0.5 (b) 1
 (c) 2 (d) 3

144. The space time for Q. No. 184 is....second. (a) 0.5 (b) 1
 (c) 2 (d) 3

145. The fractional volume change of the system for the isothermal gas phase reaction, $A \rightarrow 3B$, between no conversion and complete conversion is
 (a) 0.5 (b) 1
 (c) 2 (d) 3

146. A chemical reaction is of zero order, when the reaction rate is
 (a) $\propto C_A$.
 (b) $\propto 1/C_A$.
 (c) independent of temperature.
 (d) none of these.

where, C_A = concentration of reactant

147. The half life period 't' of a zero order reaction,

$A \rightarrow$ products, is equal to
 (a) $C_{AO}/2K$ (b) C_{AO}/K
 (c) $0.693/K$ (d) $1/K$

148. Time taken for a first order reaction,

$A \rightarrow$ products, to be 90% complete is (a) $2.303/K$ (b) $0.9/K$
(c) $1.1 K$ (d) $1.1/K$

149. From Arrhenius law, a plot of $\log_e K$ versus $1/T$ gives a straight line with a slope of $(-E/R)$. The unit of E/R is
(a) k cal (b) k cal/ $^{\circ}\text{K}$ (c) $^{\circ}\text{K}$ (d) k cal. $^{\circ}\text{K}$

150. What is the order of a chemical reaction, $A + 2B$

K

$\rightarrow$ C, if the rate of formation of 'C', increases by a factor of 2.82 on doubling the concentration of 'A' and increases by a factor of 9 on trebling the concentration of 'B' ? (a) $7/2$ (b) $7/4$
(c) $5/2$ (d) $5/4$

151. A photochemical reaction is.....light. (a) initiated by
(b) accompanied with emission of
(c) catalysed by
(d) used to convert heat energy into

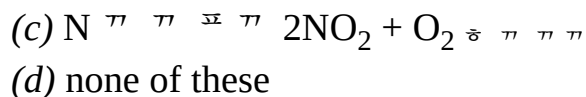
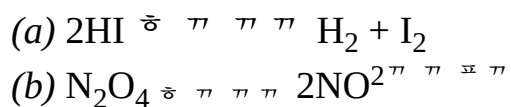
152. Photochemical reaction rate does not depend significantly on temperature, because (a) it is a reversible reaction.
(b) it is an exothermic reaction.
(c) the energy of reacting molecules exceeds

the activation energy by absorption of light.
(d) none of these.

153. In an exothermic reaction, the energy of the reacting substances as compared to that of products is
(a) more
(b) less
(c) same
(d) either (a) or (b), depends on order of reaction.

154. Which of the following chemical reactions will be favoured by low pressure ?

143. (a) 144. (b) 145. (c) 146. (d) 147. (a) 148. (a) 149. (c) 150. (a) 151. (a) 152. (c)



155. If the time required to change the concentration of reactant to half its original value is independent of the initial concentration, the order of reaction is
 (a) zero (b) one
 (c) two (d) three

156. For a homogeneous reaction of nth order, the dimension of the rate constant is given by
 (a) $\text{l}/(\text{time})^n$
 (b) $(\text{concentration})^{1-n}/(\text{time})$
 (c) $(\text{concentration})^{n-1}/(\text{time})$
 (d) none of these

157. Collision theory gives the rate constant for bimolecular reaction as

$\frac{A}{\sqrt{2\pi}} \left(\frac{2\pi m k T}{h^2} \right)^{3/2} e^{-E_a/RT}$ (a) $K e^{E_a/RT}$
 (b) $K e^{-E_a/RT}$
 (c) $K e^{E_a/RT}$
 (d) none of these

158. The rate constant of a reaction is a function of the
 (a) time of reaction.
 (b) temperature of the system.
 (c) extent of reaction.
 (d) initial concentration of the reactants.

ANSWERS

143. (a) 144. (b) 145. (c) 146. (d) 147. (a) 148. (a) 149. (c) 150. (a) 151. (a) 152. (c)
 153. (a) 154. (b)
 155. (b) 156. (b) 157. (a) 158. (b)

159. A Catalyst

(a) increases the equilibrium concentration of the product.

- (b) changes the equilibrium constant of the reaction.
 (c) shortens the time to reach the equilibrium. (d) none of these.
- 160.** Threshold energy in a reaction is equal to the (a) activation energy
 (b) normal energy of reactants
 (c) sum of (a) & (b)
 (d) neither (a) nor (b)
- 161.** An imbalanced chemical reaction equation is against the law of
 (a) multiple proportion
 (b) conservation of mass
 (c) constant proportion
 (d) none of these
- 162.** Rate of a chemical reaction is not affected by the (a) catalyst.
 (b) temperature.
 (c) reactant's concentration.
 (d) number of molecules of reactants taking part in the reaction.
- 163.** Transition state theory gives the rate constant as

(a) $K e^{-E/RT}$ (b) $K e^{E/RT}$

(c) $K a^{-E/RT}$ (d) $K a T e^{-E/RT}$

- 164.** A catalyst in a chemical reaction
 (a) decreases the activation energy.
 (b) alters the reaction mechanism.
 (c) increases the frequency of collisions of reacting species.
 (d) all (a), (b) and (c).
- 165.** The rate constant of a chemical reaction increases by increasing the
 (a) temperature
 (b) pressure
 (c) reactant's concentration
 (d) none of these
- 166.** If C_A is the quantity of reactants initially present, the quantity left after 'n' half periods will be equal to

(a) $\frac{C_A}{2^n}$ (b) $\frac{C_A}{n}$

167. As the chemical reaction proceeds, the rate of reaction

- (a) increases.
- (b) decreases.
- (c) remains same.
- (d) may increase or decrease depending on

the type of reaction.

168. Catalytic action in a catalytic chemical reaction follows from the ability of catalyst to change the

- (a) activation energy
- (b) equilibrium constant
- (c) heat of reaction
- (d) none of these

169. If a solid-gas non-catalytic reaction occurs at very high temperature, the rate controlling step is the.....diffusion.

- (a) film (b) ash layer
- (c) pore (d) none of these

170. The excess energy of the reactants required to dissociate into products is known as the..... energy.

- (a) thermal (c) threshold (b) activation (d) binding

171. A chemical reaction occurs when the energy of the reacting molecules is.....the activation energy of the reaction.

- (a) less than
- (b) equal to
- (c) more than
- (d) equal to or more than

172. The temperature dependence of reaction rate constant (K) by Arrhenius law is given by (a)

$K e$

a

$-E/RT$ (b) $K e^{E/RT}$ (a)

(c)

K

a

$$-E/RT(d) K a_{Te}^{-E/RT} T e$$

173. Pick out the correct statement.

(a) A chemical reaction accompanied by absorption of heat is called an exothermic reaction.

(b) A chemical reaction accompanied by evolution of heat is called an endothermic reaction.

(c) The rate constant for a first order reaction does not change on changing the concentration units.

(d) Chemical equilibrium state is dynamic

(c) (d) $A^{1/2} n$

in nature.

ANSWERS

159. (c) 160. (c) 161. (b) 162. (d) 163. (c) 164. (d) 165. (a) 166. (b) 167. (b) 168. (a) 169. (a) 170. (b)

171. (d) 172. (a) 173. (c)

174. The effectiveness factor for large value

of Thiele modulus

(LK/D_1) of a solid catalysed first order reaction is equal to

(a) (LK/D_1) (b) $1/(LK/D_1)$ (c) 1 (d) ∞

where, L = length of the reactor, cm, D_1 = diffusion co-efficient, $\text{cm}^2/\text{second}$

175. A batch reactor suffers from following disadvantage.

(a) Poor product quality control.

(b) High labour and handling cost.

(c) High shutdown time requirement for

emptying, cleaning and refilling. (d) All (a), (b) and (c).

176. Pick out the wrong statement pertaining to space velocity of flow reactors.

(a) The unit of space velocity is $(\text{time})^{-1}$. (b) The space velocity of 3 hr^{-1} means that

three reactor volumes of feed at specified conditions are being fed into the reactor every hour.

(c) The space velocity of 3 hr^{-1} means that one third reactor volume of feed at specified conditions are being fed into the reactor.

(d) none of these.

177. A balanced chemical reaction equation conforms to the law of

(a) conservation of mass

(b) Avagadro's hypothesis

(c) gaseous volumes

(d) none of these

178. For a first order chemical reaction, the rate constant

(a) changes on changing the concentration

units.

(b) is not a function of the unit of time. (c) has unit of time^{-1} .

(d) none of these.

179. The rate of forward reaction, at chemical equilibrium is.....the rate of backward reaction.

(a) more than (b) equal to (c) less than

(d) either (b) or (c) (ii) rate of formation of 'P' is quadrupled on

doubling the concentration of 'Y' (iii) doubling the concentration of 'Z' does not affect the rate of formation of 'P'.

What is the order of the above chemical reaction? (a) (c)

Zeroth order Second order (b) First order (d) Third order

181. In a chemical reaction, represented by, A

$\rightarrow$

B, it is observed that the

(i) rate of reaction increases by a factor of 4 on doubling the concentration of the reactant.

(ii) rate of reaction increases by a factor of 9 on trebling the concentration of the reactant. Then the rate of the reaction is proportional to

(a)

C_A

C_A

(b) C_A

C_A^2

C_A

(c) C_A^3

C_A^4

(d) C_A

where, C_A = concentration of the reactant

182. Pick out the correct statement.

(a) In catalytic reactions, the catalyst reacts with the reactants.

(b) A catalyst initiates a chemical reaction.

(c) A catalyst lowers the activation energy of the reacting molecules.

(d) A catalyst can not be recovered chemically unchanged at the end of the chemical reaction.

183. Which of the following holds good for an el

K

ementary reaction, $X + 2Y \rightarrow$

$3Z$?

(a) The rate of disappearance of 'Y' is equal to the rate of appearance of 'Z'.

(b) The rate of disappearance of 'Y' is equal to the rate of disappearance of 'X'.

(c) Three times the rate of disappearance of 'X' is equal to the rate of appearance of 'Z'.

(d) The rate of disappearance of 'Z' is equal to the rate of appearance of 'Z'.

184. The molecularity and the order of reaction respectively, for the hydrolysis of methyl acetate in presence of acids are

(a) 2 & 1 (b) 1 & 2

(c) 2 & 2 (d) 1 & 1

The size of plug flow reactor (PFR) for all pos-**185.**

180.In a chemical reaction, $X + Y + Z$

→

P, it is observed that the

is.....that of mixed reactor. (a) greater than (i) rate of formation of 'P' is doubled on dou (b) equal to the concentration of 'X'.

ANSWERS

174. (b) 175.(d) 176.(c) 177.(a) 178.(c) 179.(c) 180.(d) 181.(b) 182.(c) 183.(c) 184.(a) 185.(c) (c) smaller than (d) unpredictable from the data

186. is the controlling step in a highly temperature sensitive fluid-solid non cata- lytic reaction.

(a) Gas film diffusion (b) (c) Chemical reaction (d) Ash diffusion none of these

187. Rate of an autocatalytic chemical reaction is a function of

(a) temperature only. (b) pressure only. (c) composition only. (d) all (a), (b) and (c).

188. Which of the following is a characteristic of an ideal plug flow reactor ?

(a) Axial dispersion (b) Flat velocity profile (c) Uniform mixing (d) None of these

189. Autocatalytic reactions are best carried out in a

(a) CSTR (b) CSTR in series (c) plug flow reactor (d) recycle reactor

190. What is the dispersion number for a plug flow reactor ?

(a) 0 (b) ∞

(c) 1 (d) -1

191. If Thiele modulus is....., then the pore diffusion resistance in a catalyst may be considered as negligible.

(a) 0 (b) ∞

(c) < 0.5 (d) > 0.5

192. Exothermic reactions are best carried out in (a) a CSTR.

(b) CSTR in series.

(c) a plug flow reactor followed by CSTR. (d) CSTR followed by a plug flow reactor.

193. In a/an.....vessel, the fluid enters and leaves following plug flow.

(a) open (b) closed

(c) open-closed (d) close-opened

194. What is the dispersion number for a CSTR? (a) 0 (b) 1

(c) <1 (d) ∞

195. In case of a.....reactor, the composition in the reactor and at the exit of the reactor is the same.

(a) semi-batch (b) tubular (c) batch (d) back-mix

196. Thermodynamic equilibrium constant system is affected by

(a) inerts (b) pressure

(c) temperature (d) all (a), (b) & (c)

197. The equilibrium constant of a catalytic chemical reaction.....due to the presence of a catalyst.

(a) increases

(b) decreases

(c) remains unaffected

(d) unpredictable from the data

198. Promoter is added to the catalyst to improve its (a) porosity

(c) surface area (b) sensitivity (d) none of these

199. The unit of frequency factor in Arrhenius equation is

(a) same as that of rate constant.

(b) same as that of activation energy. (c) dimensionless.

(d) none of these.

200. Effectiveness factor of a catalyst pellet is a measure of the.....resistance.

(a) pore diffusion

(b) gas film

(c) chemical reaction

(d) none of these

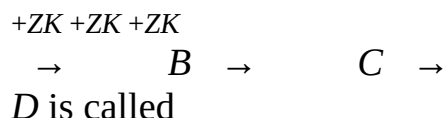
201. With an increase in pressure in gaseous phase chemical reactions, the fractional conversion.....when the number of moles decreases.

- (a) increases
- (b) decreases
- (c) remains unaffected
- (d) unpredictable from the data

202. With increase in initial concentration, the fractional conversion of a first order reaction in a given time

- (a) increases (b) decreases (c) remains constant (d) unpredictable

203. A non-catalytic chemical reaction of the A



a.....reaction.

- (a) parallel (b) series
- (c) series-parallel (d) none of these

204. Maximum equilibrium conversion for endothermic reaction is obtained at the.....temperature.

- (a) highest possible (b) lowest possible (c) intermediate (d) room

ANSWERS

186. (c) 187.(d) 188.(b) 189.(d) 190.(a) 191.(c) 192.(d) 193.(b) 194.(d) 195.(d)
196.(c) 197.(c)
198.(d) 199.(a) 200.(a) 201.(a) 202.(c) 203.(c) 204.(a)

205. Fractional conversion.....for an exothermic reversible chemical reaction, when the temperature is maximum.

- (a) increases
- (b) remains unchanged
- (c) decreases
- (d) unpredictable from the data

206. Carrier in a catalyst increases its

- (a) surface area (c) performance (b) activity
- (d) none of these

207. Fractional conversion.....with increase in pressure for ammonia synthesis reaction *i.e.*, N

2

+ 3H

2

$\pi \pi \pi \pi$

$\pi \pi \pi \pi$

2 NH₃.

(a) increases

(b) decreases

(c) remains unchanged

(d) unpredictable from the data

208. What is the order of a chemical reaction whose rate is determined by the variation of one concentration term only ?

(a) zero (b) first

(c) second (d) third

209. The role of a catalyst in a chemical reaction is to change the

(a) equilibrium constant

(b) activation energy

(c) final products

(d) heat of reaction

210. A gaseous reactant is introduced in a mixed reactor of 3 litres volume at the rate of 1 litre/ second. The space time is.....seconds. (a) 1 (b) 3

(c) 1/3 (d) 32

211. Effectiveness factor (*E*) of a catalyst pellet is defined as,

actual rate within pore of the catalyst $E = \frac{\text{rate if not showed by pore diffusion}}{\text{rate if not showed by pore diffusion}}$

Effectiveness factor for a first order reaction is given by

(a) $\tan hT/T$ (b) $\tan T/T$ (c) $\tan hT/\tan T$ (d) none of these

where, T = Thiele modulus

212. Bulk diffusion in catalyst pore.....with increase in pressure.

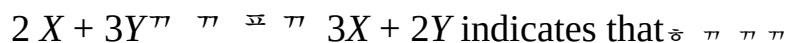
(a) increases

- (b) decreases
- (c) remains unchanged
- (d) increases exponentially

213. gas is normally employed in B.E.T. method of finding out the surface area of cat- alyst.

- (a) N_2 (b) H_2 (c) CO_2 (d) He

214. The effect of increasing pressure on the gaseous equilibrium of the reaction



- (a) pressure has no effect.
- (b) backward reaction is favoured.
- (c) forward reaction is favoured.
- (d) none of these.

215. Which of the following will favour the reverse reaction in a chemical equilibrium reaction ? (a) Increasing the concentration of one of

the reactants.

- (b) Increasing the concentration of one or more of the products.
- (c) Removal of at least one of the products at regular interval.
- (d) None of these.

216. During manufacture of H_2SO_4 , the oxidation of SO_2 to SO_3 by oxygen is an endothermic reaction. The yield of SO_3 will be maximised, if the

- (a) temperature is increased.
- (b) pressure is reduced.
- (c) temperature is increased and pressure is reduced.
- (d) temperature is reduced and pressure is increased.

217. Rate of a gaseous phase reaction is given by,

dp

2 The unit of rate constant is $\text{dt} K_p A..$

(a) $(\text{atm})^{-1}$ (b) $(\text{hr})^{-1}$ (c) $(\text{atm})^{-1} \cdot (\text{hr})^{-1}$ (d) $\text{atm} \cdot (\text{hr})^{-1}$ **218.** 'n' number of plug flow reactors (P.F.R) in se-

ries with a total volume 'V' gives the same conversion as one P.F.R. of volume

(a) V/n (b) V
(c) $V \cdot n$ (d) $1/V$

219. The irreversible reaction, X

$\rightarrow Y$, is the special case of the reversible reaction,

$X \rightleftharpoons Y$

Y, in which the

(a) equilibrium constant is infinite.

ANSWERS

205.(c) 206.(a) 207.(a) 208.(b) 209.(b) 210.(b) 211.(a) 212.(b) 213.(a) 214.(a)
215.(b) 216.(d)

(b) fractional conversion of 'A' at equilibrium is unity.

(c) concentration of 'A' at equilibrium is zero.

(d) all (a), (b) and (c).

220. For a first order reaction carried out in a plug flow reactor, the space time is

$\frac{1}{k} \ln \frac{C_0}{C}$ (b) $\frac{1}{k} \ln \frac{C}{C_0}$ (a) $\frac{1}{k} \ln \frac{C_0}{C}$

(c) $\frac{1}{k} \ln \frac{C}{C_0}$ (d) $\frac{1}{k} \ln \frac{C_0}{C}$

221. In a/an.....reactor, there is exchange of heat with the surroundings with sizeable temperature variation.

(a) adiabatic (b) isothermal (c) non-adiabatic (d) none of these.

222. With increase in temperature, the equilibrium.....rises in case of endothermic reaction.

(a) constant

(c) both (a) & (b) (b) conversion

(d) neither (a) nor (b)

223. Helium-mercury method is used for the measurement of the.....of the

catalyst. (a) surface area (c) pore volume (b) porosity
(d) both (b) & (c).

224. Radioactive decay follows.....order kinetics.
(a) first (b) second (c) third (d) zero.

225. Which of the following resistances is not involved in a gas phase catalytic (gas-solid) reaction ?

(a) Ash resistance.

(b) Gas film and pore surface diffusion resis-

tances for reactants.

(c) Surface phenomenon resistance. (d) Gas film and pore surface diffusion resis-

tances for products.

226. Kinetics of a catalytic reaction can be best studied on a/an.....reactor.

(a) mixed

(b) integral (plug flow)

(c) differential (flow)

(d) either (a), (b) and (c).

227. Time required for 50% decomposition of a liquid in an isothermal batch reactor following first order kinetics is 2 minutes. The time re- quired for 75% decomposition will be about minutes.

(a) 3 (b) 4

(c) 6 (d) 8

228. Holding time for flow reactors is.....the space time, for constant fluid density. (a) double (b) triple

(c) equal to (d) none of these.

229. The reactions with low activation energy are (a) always spontaneous

(b) slow

(c) fast

(d) non-spontaneous

230. The half life period of a first order reaction is (a) always the same irrespective of the reaction. (b) dependent on initial concentration of the

reactants.

(c) proportional to the initial concentration of reactants.

(d) half the specific rate constant.

231. The rate of the reaction, X

→ F , quadruples when the concentration of ' X ' is doubled. The

rate expression for the reaction is, $r = K C^n$, the value of ' n ' in this case will be

(a) 0 (b) 1

(c) 2 (d) 3

232. The reaction rate almost gets doubled for 10°C rise in temperature. This is due to the fact that the

(a) increased temperature reduces the activation energy.

(b) fraction of molecules having threshold energy increases.

(c) collision frequency increases.

(d) value of threshold energy decreases.

233. Which of the following does not produce a change in the value of rate constant of a reaction? (a) Pressure

(b) Temperature

(c) Concentration and catalyst

(d) None of these.

234. Pick out the wrong statement.

(a) Visible radiation provides the necessary activation energy in photochemical reactions.

(b) The order and molecularity of a complex reaction may not be the same.

(c) For a second order reaction, the slope of

ANSWERS

220. (a) 221. (c) 222. (b) 223. (d) 224. (a) 225. (a) 226. (d) 227. (b) 228. (c) 229. (c)

230. (b) 231. (c) the graph/plot between rate and concentration, the equilibrium of the reaction is equal to the rate constant (k). remains unaffected by pressure changes ?

(d) Molecularity of the reaction is always a whole number greater than zero.

203

235. In the gaseous phase ammonia formation reaction $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$, the value of the equilibrium constant depends on the

(a) total pressure of the system. (b) volume of the reactor. (c) temperature. (d) initial concentration of N_2 and H_2 .

236. $2\text{SO}_2 + \text{O}_2 \rightleftharpoons 2\text{SO}_3$ dissociates, then the number of molecules at equilibrium is

(a) $2(1+x)$ (b) $2(1-x)$ (c) $2(1+x)^2$ (d) $2(1-x)^2$

237. In a reversible chemical reaction having two reactants in equilibrium, if the concentration of the reactants are doubled, then the equilibrium constant will

(a) remain the same (b) be halved (c) also be doubled (d) become one fourth

238. In which of the following gaseous phase reactions, the equilibrium constant depends on the total pressure of the system?

(a) $\text{N}_2 + \text{O}_2 \rightleftharpoons 2\text{NO}$ (b) $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$ (c) $2\text{SO}_2 + \text{O}_2 \rightleftharpoons 2\text{SO}_3$ (d) $\text{N}_2\text{O}_4 \rightleftharpoons 2\text{NO}_2$

In the reversible reaction of the type,

equilibrium will be

(a) $(1+x)$ (b) $(1-x)$

$A + B$

$\rightleftharpoons C + D$

At equilibrium, the concentration of A is x and the concentration of B is y .

AB, in general (c) $(1+x)^2$ (d) $(1-x)^2$. (a) both forward and backward reactions are exothermic. (b) neither

Reverse reaction in a chemical equilibrium is (a) removal of one of the products regularly. (b) increase in the concentration of one of the reactants. (c) increase in the concentration of one of the products. (d) the combination reaction will be exothermic, while the dissociation reaction will be endothermic. (e) none of these.

237. In a reversible chemical reaction having two reactants in equilibrium, if the concentration of the reactants are doubled, then the equilibrium constant will

(a) higher temperature (b) more energy (c) less energy (d) same energy.

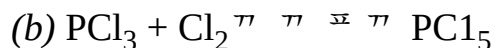
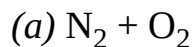
238. In which of the following gaseous phase reactions, the equilibrium constant depends on the total pressure of the system?

(a) $\text{N}_2 + \text{O}_2 \rightleftharpoons 2\text{NO}$ (b) $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$ (c) $2\text{SO}_2 + \text{O}_2 \rightleftharpoons 2\text{SO}_3$ (d) $\text{N}_2\text{O}_4 \rightleftharpoons 2\text{NO}_2$

244. In a zero order reaction, reactant concentration does not change with time and the (a) time for half change is half the time taken for completion of the reaction. (b) time for half change is independent of the initial concentration of the reactant. (c) time for half change is double the time taken for completion of the reaction. (d) time for half change is one-fourth the time taken for completion of the reaction.

(b) time for half change is independent of the initial concentration of the reactant. 238. In which of the following gaseous phase reactions, the equilibrium constant depends on the total pressure of the system?

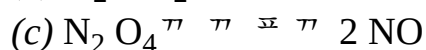
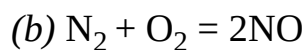
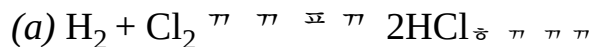
versible reactions, the product yield can not be increased by the application of high pressure ?



the initial concentration. (c) time for completion of the reaction is independent of the initial concentration



(d) $2SO_2 + O_2 \rightleftharpoons 2SO_3$ **245.239.** In which of the following reactions, the equilibrium will shift to the right, if the total pressure is increased ?



(d) reaction rate is trebled when the initial concentration is trebled.

For a gaseous phase reaction, rate of reaction is equal to $K \cdot CA \cdot CB$. If the volume of the reactor is suddenly reduced to 1/4th of its initial volume, then the rate of reaction compared to the original rate will be.....times. (a) 8 (b) 16 (c) 1/8 (d) 1/16

246. A catalyst in a chemical reaction.....free (d) $H_2 + I_2 \rightleftharpoons 2HI$

energy change in the reaction. **240.** In which of the following gaseous phase (a) increases

ANSWERS

235. (c) 236.(c) 237.(a) 238.(a) 239.(b) 240.(b) 241.(a) 242.(b) 243.(b) 244.(a) 245.(b) 246.(c) (b) decreases (c) either (a) or (b); depends on the type of

catalyst

(d) neither (a) nor (b).

247. In case of.....reactions, the reaction rate does not decrease appreciably as the reaction proceeds.

- (a) catalytic (b) parallel
- (c) series (d) auto catalytic

248. In a semi-batch reactor,

- (a) mixing takes place in axial direction only. (b) velocity of reaction can be controlled. (c) condition similar to plug flow reactor exists. (d) residence time is constant.

249. An isothermal irreversible reaction is being carried out in an ideal tubular flow reactor. The conversion in this case will.....with decrease in space time.

- (a) increase
- (b) increase exponentially
- (c) decrease
- (d) remain unchanged

250. For a zero order chemical reaction, the

- (a) half life period is directly proportion to the initial concentration of the reactants.
- (b) plot of products concentration with time is k straight line through the origin.
- (c) products concentration increases linearly with time.
- (d) all (a), (b) and (c).

251. Rate constant for a first order reaction does not depend upon reaction time, extent of reaction and the initial concentration of reactants ; but it is a function of reaction temperature. In a chemical reaction, the time required to reduce the concentration of reactant from 100 gm moles/litre to 50 gm moles/litre is same as that required to reduce it from 2 gm moles/litre to 1 gm mole/litre in the same volume. Then the order of this reaction is (a) 0 (b) 1

- (c) 2 (d) 3

252. Arrhenious equation represents graphically the variation between the.....and temperature.

- (a) rate of reaction
- (b) frequency factor

253. The exit age distribution of a fluid leaving a vessel (denoted by E) is used to study the ex

∞

tent of non-ideal flow in the vessel. The $\int_a^E$

value of $\int_a^E dt$ is

(a) 0 (b) 1

(c) ∞ (d) $2p$

254. The rate of an autocatalytic reaction,

$A + B \rightarrow B + B$, is given by $-r_A = k.C_A.C_B$. In this case, the

(a) plot of $-r_A$ Vs C_A is a straight line with

slope k .

(b) plot of $-r_A$ VS C_A is a hyperbola. (c) rate of disappearance of reactant A is

maximum, where $C_A = C_B$

(d) both 'b' & 'c'

255. Limiting reactant in a chemical reaction decides the

(a) rate constant

(b) conversion

(c) reaction speed

(d) equilibrium constant.

256. Overall rate of reaction in a heterogenous catalytic reaction depends upon the mass and energy transfer from the fluid to solid surface and its rate of reaction is usually.....the concentration of catalyst, if it does not entail a chain mechanism.

(a) proportional to

(b) independent of

(c) inversely proportional to

(d) proportional to the square of

257. Pick out the wrong statement.

(a) In a batch reactor, which is exclusively used for liquid phase reactions; temperature pressure and composition may vary with time.

(b) In a semi-batch reactor, one reactant is charged batchwise, while the other

reactant is fed continuously.

(c) In a continuous flow reactor, uniform concentration can not be maintained throughout the vessel even in a well agitated system.

(d) In a continuous flow reactor, both the

(c) rate constant (d) activation energy reactants and the products flow out continuously.

ANSWERS

247. (d) 248.(b) 249.(c) 250.(d) 251.(b) 252.(c) 253.(b) 254.(d) 255.(b) 256.(a) 257.(c)

258. Photo-chemical reactions occur in presence of (a) sunlight.

(b) darkness.

(c) solid catalysts.

(d) monochromatic radiation only.

259. Sometimes, batch process is preferred over continuous process, when the product (a) quality & yield can not be achieved in

continuous processes, because of long residence time.

(b) sales demand is fluctuating.

(c) both (a) & (b).

(d) neither (a) nor (b).

260. The excess energy of reactants in a chemical reaction required to dissociate into products is termed as the.....energy.

(a) activation (c) binding (b) potential (d) threshold (c) Litre/mole

(d) Litre/second

266. The rate of a chemical reaction is almost doubled for every 10 °C rise in temperature. The rate will increase.....times, if the temperature rises from 10 to 100 °C.

(a) 256 (b) 512

(c) 112 (d) 612

267. The rate of a gas phase reaction is given by, $K \cdot CA \cdot CB$. If the volume of the reaction vessel is reduced to 1/4th of its initial volume, then the reaction rate

compared to the original rate will be.....times.

- (a) 4 (b) 16
- (c) 8 (d) 2

268. The order of a chemical reaction is

(a) an experimentally determined quantity. (b) always equal to the total stoichiometric

(c)

number of reactants. never fractional.

261. In case of a/an.....chemical reaction, conversion increases with the rise in temperature.

- (a) reversible exothermic
- (b) irreversible exothermic
- (c) irreversible endothermic
- (d) reversible endothermic

262. Shift conversion reaction

- (a) converts N_2 and H_2 into NH_3 .
- (b) converts CO to CO_2 with steam. (c) is non-catalytic.
- (d) is highly exothermic.

263. According to the 'law of mass action', the rate of reaction is directly proportional to the (a) equilibrium constant.

- (b) volume of the reaction vessel.
- (c) nature of the reactants.
- (d) molar concentration of the reactants.

264. A batch reactor is suitable for

- (a) achieving cent percent conversion of reactants into products.
- (b) large scale gaseous phase reactions.
- (c) liquid phase reactions.
- (d) obtaining uniform polymerisation products in highly exothermic reactions.

265. What is the unit of the rate constant in a chemical reaction in which 10% of the reactant decomposes in one hour, 20% in two hours, 30% in three hours and so on ? (a) Litre/mole, second

(b) Moles/litre, second

0 0

ANSWERS

258. (a) 259. (c) 260. (a) 261. (d) 262. (b) 263. (d) 264. (c) 265. (a) 266. (b) 267. (b)
268. (a) 269. (a)
270. (a) 271. (c) 272. (b) 273. (a)
(d) none of these.

269. For a.....order reaction, the units of rate constant and rate of reaction are the same. (a) zero (b) first
(c) second (d) fractional

270. What is the order of a chemical reaction in which doubling the initial concentration of the reactants doubles the half life time of the reaction ?
(a) 0 (b) 1
(c) 2 (d) 3

271. The fluidised bed reactor can be categorised as a.....type of reactor.
(a) plug flow (b) batch
(c) mixed flow (d) none of these

272. The mean residence time for an ideal PFR with space time 't' is equal to
(a)
 $t/2$ (b) t
(c) $t/4$ (d) $t/4$

273. The mean residence time of the fluid in a reactor from exit age distribution reading is given by $t =$

$\int_0^\infty t \cdot E \cdot dt$

(a) $\int_0^\infty t \cdot E \cdot dt$ (b) $\int_0^\infty t \cdot E \cdot dt$

0 0

$\int_0^\infty t \cdot E \cdot dt$

(c) $\int_0^\infty t \cdot E \cdot dt$ (d) $\int_0^\infty t \cdot E \cdot dt$ **274.** The performance equations for constant density systems are identical for PFR and batch reactor

(a) and backmix reactor (b) and batch reactor

Consider the rate expression $r_A = -k C_A^{1.5}$ (c) batch reactor & backmix reactor

279.

(d) none of these. $- = kC_A^{0.7} C_B^{0.3}$. The overall order of the reaction is

7D, which one of the following is correct?

(a) $r_A = -\frac{1}{5} \frac{dA}{dt}$ (b) $r_B = -\frac{1}{3} \frac{dB}{dt}$ (c) $r_C = \frac{1}{5} \frac{dC}{dt}$ (d) $r_D = \frac{1}{7} \frac{dD}{dt}$

(a) $r_A = -\frac{1}{5} \frac{dA}{dt}$ (b) $r_B = -\frac{1}{3} \frac{dB}{dt}$ (c) $r_C = \frac{1}{5} \frac{dC}{dt}$ (d) $r_D = \frac{1}{7} \frac{dD}{dt}$

rr

BC

11 1 rD (c) 0.4 (d) 1.0₃₅ 7

(b) $r_A = -\frac{1}{5} \frac{dA}{dt}$ (c) $r_B = -\frac{1}{3} \frac{dB}{dt}$ (d) $r_C = \frac{1}{5} \frac{dC}{dt}$ (e) $r_D = \frac{1}{7} \frac{dD}{dt}$

For a zero order reaction, the plot of fractional conversion Vs. time is a straight line (a) parallel to the time axis (X-axis) (b) passing through the origin (c) which does not pass through the origin and (d) is not parallel to the time axis (X-axis).

(a) parallel to the time axis (X-axis) (b) passing through the origin (c) which does not pass through the origin and (d) is not parallel to the time axis (X-axis).

(c) which does not pass through the origin and (d) is not parallel to the time axis (X-axis).

(d) none of these.

281. For an autocatalytic reaction between H_2 and Br_2 to produce HBr

$H_2 + Br_2 \rightarrow 2HBr$

k

$[H] [Br_2]^{1/2}$

rate =

12

$k_2 [H] [Br_2]$

$A + R \leftrightarrow R + R$, the plot of fractional conversion of A Vs. time is

(a) a straight line parallel to the time axis. (b) a straight line passing through the origin. (c) an S-shaped curve passing through the origin. (d) none of these.

(a) a straight line parallel to the time axis.

(b) a straight line passing through the origin. (c) an S-shaped curve passing through the origin. (d) none of these.

The reaction is

(a) Stoichiometric

(c) elementary

(d) an S-shaped curve that does not pass

(b) fundamental through the origin.

(d)

non-elementary

282. For an autocatalytic reaction

$\rightarrow R + R$, the rate Vs. concentration of **277.** For a certain gas phase reaction, $A + R$

$- =$

A profile is

kC

n . The rate of reaction in (a) linear

dt^A (c) parabolic

(b) exponential $d a$ terms (d) none of these of partial pressure may be expressed

283. A reaction of the type $- = kC^n A^{K(\text{first order})} B^{K(\text{first order})} C$ conducted a) $dt A$

$\rightarrow \rightarrow$

(in a batch reactor is characterized by a maxi-

$- =$

$kRT P$

n

mum in the concentration of.....with

b) $dt A$ time. ((a) B (b) C

$- = kRT)1-nn$ (c) both (a) & (b) (d) neither (a) nor (b)c) $dt^P A$ **284.** For a certain reaction, $A \rightarrow$

B, the rate is first (

$- =$

kRT

)

nn order in A at low concentration of A, but zero P_A order at high concentration

of A. The possible (d) dt rate expression for such a case is **278.** For an elementary reaction,

$2A$

K

$\rightarrow$

$2B$

$k C^2$

(a)

$- = +$

$1 A$

kC

(a)

r

$$-r_A = k C_A^2 C_B$$

$$r_A = k C_A^2 C_B$$

(b)

r_A

r_B

r_C

r_D

r_E

r_F

(b)

$$-r_A = +r_B$$

$$-r_A = k C_A$$

$$k C_A^2$$

$$2 A$$

ANSWERS

274.(b) 275.(a) 276.(d) 277.(c) 278.(a) 279.(d) 280.(b) 281.(c) 282.(c) 283.(a)

284.(d)

$$k C_A^2 (c) \quad -r_A = -\frac{1}{2} r_B = -\frac{1}{2} r_C = -\frac{1}{2} r_D = -\frac{1}{2} r_E = -\frac{1}{2} r_F$$

(d)

$$-r_A = +r_B$$

$$1 A$$

$$1$$

$$k C_A^2$$

285. Batch reactors are industrially used (a) for production of fine chemicals . (b) for production of heavy chemicals. (c) when relatively small amount of materials are to be treated.

(d) for conducting fermentation.

286. An ideal plug flow reactor should have the following characteristics:

(a) No back mixing of the reactants and

products.

(b) Complete back mixing of the reactants and products

(c) Uniform temperature, pressure and composition across any section normal to the fluid motion

(d) Uniform temperature, pressure and composition at any location in the longitudinal direction.

287. If “space time” is denoted by ‘t’ and “space velocity” by ‘s’, then $t.s =$

- (a) 0 (b) 1
- (c) 0.1 (d) > 0

288. A zero order reaction is conducted in a CSTR. If, under otherwise uniform conditions, the reactant concentration in the fluid entering the reactor is halved, the fractional conversion of the reactant will

- (a) decrease by a factor of two.
- (b) increase by a factor of two.
- (c) remain unaffected because rate of a zero

order reaction is independent of concentration.

(d) do not agree with the problem statement; a zero order reaction is never conducted in a CSTR. A PFR should be employed for this purpose.

289. In a recycle reactor, the recycle ratio is zero. This means the reactor is basically a

- (a) PFR
- (b) CSTR
- (c) PFR with zero radial mixing
- (d) PFR with substantial axial dispersion.

290. An autocatalytic reaction, $A + R \leftrightarrow R + R$ is best conducted in a CSTR provided the

- (a) level of conversion is high
- (b) level of conversion is low
- (c) feed flow rate is low
- (d) feed flow rate is high.

291. An autocatalytic reaction, $A + R \leftrightarrow R + R$ is to be conducted in a CSTR. Now minimum CSTR volume result when the fractional conversion of A is

- (a) 0.25 (b) 0.50
- (c) 0.75 (d) 0.90.

292. For an autocatalytic reaction $A + R \leftrightarrow R + R$, maximum rate is realized at a conversion level of.....percent.

- (a) 25 (b) 50
(c) 75 (d) 90

293. For multiple reactions, $2A \leftrightarrow R, 2R \leftrightarrow S$, the number of moles of S' present when the number of moles of A and R are 0.4 and 0.5 respectively (initially 2 moles of A are present only), are

- (a) 0.125 (b) 0.150
(c) 0.200 (d) 0.400.

294. A series chemical reaction, A

K_1 (first order) $R \xrightarrow{K_1} A \xrightarrow{K_2} K$ (first order)

$\rightarrow \rightarrow$ S is con

ducted in a batch reactor and C_R as a function of time is given by the following equations :

$C_R = \frac{C_0 k_1}{k_2 - k_1} (e^{-k_1 t} - e^{-k_2 t})$. If $k_1 = k_2$, then $C_R / C_0 = k_1 t e^{-k_1 t}$

AO 21

is equal to

$e^{-k_1 t} - e^{-k_2 t}$ (a) $k_1 t$

(b) $t e^{-k_1 t}$

(c)

$$k_1 e^{-\frac{hT}{d}} \quad k_1 e^{-\frac{hT}{1}}$$

t^e

295. If the total enthalpy of products is less than the total enthalpy the reactants, the reaction is (a) endothermic

(b) exothermic

(c) either (a) or (b); more information required for correct prediction

(d) neither (a) or (b)

296. Consider the reversible reaction, $A \rightleftharpoons B$. Both reactions are of first order. If the equilibrium constant for the reaction at any temperature is K , the equilibrium conversion is equal to

ANSWERS

285. (d) 286. (c) 287. (b) 288. (b) 289. (a) 290. (b) 291. (b) 292. (b) 293. (b) 294. (d)

295. (b) 296. (d) perature is K , the equilibrium conversion is equal to

(a) K (b) $K - 1$ (c) $K + 1$

(c)

$k - 1$

$K_{(d)}$ K

$k + 1$

297. For the gas-phase reaction, $3A \rightarrow 4D$, which of the following relations is correct ?

(a) $K_P = K_C (RT)^4$ (b) $K_P = K_C (P_t)^4$

(c) $K_P = K_C$ (d) $K_C = K_P$

298. The thermodynamic equilibrium constant for a gas-phase reversible reaction is influenced by the

(a) kinetics of the reaction

(b) presence of inerts

- (c) total pressure
- (d) temperature

299. Consider a reversible gas-phase reaction, $A \leftrightarrow 2B$. The reaction is exothermic. If the system pressure is increased, equilibrium conversion of the reactant

- (a) decreases
- (b) increases
- (c) remains unaffected by pressure changes
- (d) may increase or decrease, depending on

the magnitude of heat of reaction

300. For a gas-phase reaction, $A + B \rightarrow 2B$, if some inerts are added into the system under otherwise uniform conditions, conversion of A will (a) decrease (b) increase (c) remain unaffected (d) unpredictable

301. For a reversible endothermic reaction, with increase in temperature.

- (a) rate of reaction increases
- (b) equilibrium conversion increases
- (c) both rate and equilibrium conversion increases
- (d) neither rate nor equilibrium conversion increases

302. For a reversible exothermic reaction, with increase in temperature

- (a) rate of reaction increases
- (b) equilibrium conversion increases
- (c) rate of reaction decreases
- (d) equilibrium conversion decreases

303. The exit age distribution function is denoted by E . Now $E \cdot dt$ means

- (a) fraction of the molecules within the vessel having age less than t .
- (b) fraction of the molecules in the outlet stream having age between t and $t + dt$.
- (c) number of molecules in the outlet stream having age less than t .
- (d) none of these.

∞

304. $\int_0^m E \cdot dt$ between the limits of 0 and m is

0

equal to

(a) 0 (b) 0.1

(c) 1.0 (d) 10

305. In order to realize high effectiveness factor of a catalyst particle, one should employ (a) small catalyst particles

(b) low reaction temperature

(c) catalyst having large pores

(d) all a, b & c

ANSWERS

297.(d) 298.(d) 299.(a) 300.(b) 301.(c) 302.(c) 303.(b) 304.(c) 305.(d)

Fuels and coMbustion 12

1. In flue gas analysis by Orsat's apparatus, carbon monoxide is absorbed by

(a) cuprous chloride

(b) potassium hydroxide

(c) alkaline pyrogallol solution

(d) none of these.

2. Calorific value as determined by bomb calorimeter is the

(a) higher calorific value at constant volume.

(b) gross calorific value at constant pressure.

(c) lower calorific value at constant pressure.

(d) net calorific value at constant volume.

3. Incomplete combustion of a fuel is characterised by the high.....in the flue gas.

(a) smoke (b) temperature

(c) oxygen (d) carbon monoxide

4. Oxygen percentage (by weight) in atmospheric air is

(a) 19 (b) 21

(c) 23 (d) 29

5. As time passes, the calorific value of stored coal

- (a) decreases
- (b) increases
- (c) remains unaltered
- (d) may increase or decrease (depends on the

method of storage).

6. Use of pulverised coal in boiler furnace provides

- (a) high calorific value.
- (b) better combustion.
- (c) smokeless burning.
- (d) less erosion on furnace walls

7. Which of the following fuels is the best for burning on chain grate stoker ?

- (a) Non-caking coal
- (b) Caking coal
- (c) Coking coal
- (d) Pulverised coal.

8. “Overfire burning” in a furnace is a phenomenon characterised by the

- (a) supply of excess fuel.
- (b) supply of excess air.
- (c) burning of carbon monoxide and other incombustibles in upper zone of furnace by supplying more air.
- (d) none of these.

9. When steam is passed over coal resulting in the endothermic reaction, it is represented by $C + H_2O = CO + H_2$, it is called the.....of coal.

- (a) carbonisation (b) oxidation (c) coalification (d) gasification

10. Fischer-Tropsch method aims at the (a) gasification of coal.

- (b) synthesis of gasoline (from water gas). (c) hydrogenation of coal to produce gasoline. (d) none of these.

11. In case of pulverised coal fired steam boiler, the secondary air serves the

main purpose of (a) transportation of coal.
(b) drying of coal.
(c) combustion of coal by supplying it around

the burner.

(d) preheating the primary air.

12. The main function of primary air in pulverised coal fired burner is to

(a) burn CO to CO₂.

(b) dry and transport the coal. (c) have proper combustion by supplying it

around the burner.

(d) preheat the tertiary air used for complete

combustion of CO to CO₂. **13.** The advantage of firing pulverised coal in the

furnace lies in the fact, that it (a) permits the use of high ash content coal, (b)

permits the use of low fusion point ash coal. (c) accelerates the burning rate and

economises on fuel combustion. (d) all (a), (b) and (c).

14. Orsat apparatus is meant for

ANSWERS

1. (a) 2.(a) 3.(d) 4.(c) 5.(a) 6.(b) 7.(a) 8.(c) 9.(d) 10.(b) 11.(c) 12.(b)

13.(c) 14.(d)

(a) gravimetric analysis of flue gas.

(b) finding out combustion efficiency. (c) direct determination of nitrogen in flue gas by absorbing it in ammoniacal cuprous chloride.

(d) none of these.

15. Pick out the wrong statement.

(a) Theoretical flame temperature is the temperature attained by the products of combustion, when the fuel is burned without loss or gain of heat.

(b) Burning the fuel with theoretically required amount of pure oxygen results in attainment of maximum adiabatic flame temperature.

(c) Burning the fuel with excess pure oxygen results in maximum theoretical flame temperature.

(d) Adiabatic flame temperatures of actual combustions are always less than the

maximum values.

16. The maximum adiabatic flame temperature in air as compared to that in pure oxygen is (a) much lower.

(b) much higher.

(c) same.

(d) either lower or higher, depends on the type

of fuel.

17. Preheating of.....the flame temperature. (a) the gaseous fuel before combustion decreases (b) combustion air decreases

(c) either the fuel or the air or both, increases (d) either the fuel or the air does not affect

18. A fuel containing carbon and carbon monoxide (but containing no hydrogen or its compounds) is burnt in pure oxygen at constant pressure. Its gross calorific value as compared to net calorific value will be

(a) more

(b) less

(c) same

(d) data insufficient; can't be predicted.

19. With increase in calorific value of fuels, their adiabatic flame temperatures

(a) increase

(b) decrease

(c) remain unchanged

(d) may increase or decrease ; depends on the

quantity of products of combustion_{gravity}).

ANSWERS

15.(c) 16.(a) 17.(c) 18.(c) 19.(d) 20.(c) 21.(a) 22.(a) 23.(d) 24.(b) 25.(a) 26.(b) 27.(b) 28.(d)

20. Grindability index of a coal is 100. It implies that the

(a) coal can be pulverised with great difficulty. (b) coal can't be pulverised.

(c) coal can be easily pulverised.

(d) power consumption in grinding the coal

will be very high.

21. 'Calorific value of dry wood may be around.....Kcal/kg.

- (a) 5 (b) 50
- (c) 500 (d) 5000

22. A coal containing high amount of volatile matter will have

- (a) low ignition temperature
- (b) very little ash content
- (c) high fusion point of its ash
- (d) low adiabatic flame temperature

23. Steam is intermittently admitted into the fuel bed during the production of producer gas to (a) convert CO to CO₂.

- (b) increase the combustion rate.
- (c) increase the gas production rate.
- (d) minimise the chances of clinker formation.

24. Which of the following is called "blue gas" ? (a) coke oven gas (b) water gas

- (c) natural gas (d) producer gas

25. Use of excess of combustion air in the combustion of fuels results in

- (a) heat losses.
- (b) long flame.
- (c) condensation of water vapour from the fuel

gas.

- (d) none of these.

26. Preheating of a gaseous fuel results in increased

- (a) flame length
- (b) flame temperature
- (c) quantity of flue gas
- (d) ignition temperature

27. Quantity of coke oven gas produced by high temperature carbonisation of one ton of dry coal may be around.....Nm³ .

- (a) 30 (b) 300
- (c) 3000 (d) 30,000

28. Coke oven gas is a better fuel than blast furnace gas, because of its higher
(a) calorific value, cleanliness and relatively

low distribution cost (due to its low specific (b) adiabatic flame temperature.

(c) heat release rate (thus requiring smaller

combustion chamber).

(d) all (a), (b) and (c).

29. Which of the following constituents of a fuel does not contribute to its calorific value on combustion ?

(a) Hydrogen (c) Carbon

(b) Sulphur

(d) None of these

30. Combustion of pulverised coal as compared to that of lump coal

(a) develops a non-luminous flame.

(b) develops a low temperature flame. (c) can be done with less excess air.

(d) provides a lower rate of heat release.

31. Pulverised coal used in boiler firing need not have

(a) less moisture content

(b) high fusion point of its ash

(c) high bulk density

(d) lower ash content

32. Dry air required to burn 1 kg of carbon completely may be around.....kg.

(a) 11 (b) 2

(c) 20 (d) 38

33. Dry air requirement for burning 1 Nm³ of CO to CO₂ may be around.....Nm³.

(a) 2.4 (b) 1.75

(c) 0.87 (d) 11.4

34. Washing of coal

(a) reduces its sulphur and ash content. (b) controls its ash fusibility and increases its

calorific value.

(c) improves its coking properties.

(d) all (a), (b) and (c).

35. Which of the following has the highest gross calorific value ?

(a) Blast furnace gas

(b) Coke oven gas

(c) Carburetted water gas

(d) Oil refinery gas

36. Most of the coking coals are

(a) anthracite (c) lignite

(b) bituminous (d) none of these

37. High excess air in combustion of fuels results in (a) increased fuel consumption

(b) incomplete combustion

(a) smoky flame

(d) none of these

38. Atomising steam to fuel oil ratio in a burner should be around

(a) 0.5 (b) 1.5

(c) 2.5 (d) 3.5

39. For every 10% increase in the excess air; the fuel consumption increases by.....percent. (a) 0.1 (b) 2

(c) 5 (d) 10

40. Ash content in the coke produced from a coking coal having 20% ash may be around percent.

(a) 6 (b) 12

(c) 18 (d) 24

41. Spontaneous combustion of coal on storage results due to

(a) inadequate ventilation.

(b) low temperature oxidation.

(c) storage in large heaps with small surface to volume ratio.

(d) all (a), (b) and (c).

42. Low temperature oxidation of coal resulting from bad storage conditions

does not decrease its (a) caking power
(b) calorific value
(c) hydrogen content
(d) oxygen content

43. Efficient burning of anthracite coal requires (a) low preheat of air.
(b) fine grinding.
(c) high excess air.
(d) all (a), (b) and (c).

44. Rate of low temperature oxidation of coal due to bad storage conditions
(a) decreases with increase in surface area. (b) does not vary with increase in surface

area.
(c) is more for low volatile Coal compared to high volatile coal.
(d) is accelerated by storage in large heaps with small surface to volume ratio.

45. Fusion point of coal ash increases with increase in its.....content.
(a) iron sulphate
(b) iron silicate
(c) lime and magnesia
(d) all (a), (b) and (c)

ANSWERS

29. (d) 30.(c) 31.(b) 32.(a) 33.(a) 34.(d) 35.(d) 36.(b) 37.(a) 38.(a) 39.(a) 40.(d)
41.(d) 42.(d) 43.(b) 44.(d) 45.(d)

46. Which of the following accentuates clinkering trouble on furnace grate burning coal ? (a) Low reactivity of carbonised residue containing high proportions of iron & sulphur. (b) Low forced draught and fuel bed temperature. (c) Thick fire bed and preheated primary air. (d) All (a), (b) and (c).

47. Which of the following can be made into briquettes without the use of a binder ?

(a) Lignite (b) Bituminous coal (c) Anthracite coal (d) None of these

48. Presence of free moisture in coal is most disadvantageous during
(a) its pulverisation (as it requires more power). (b) combustion of fire slacks on

the grates. (c) handling (e.g. when emptying wagons). (d) none of these.

49. Which of the following is not a binder for coal briquetting ?

(a) Coal tar (b) Bitumen (c) Molasses (d) None of these

50. Highly caking coals

(a) produce weak coke.

(b) produce strong coke.

(c) may damage the coke oven walls during

carbonisation.

(d) both (b) and (c).

51. Increase in ash content of blast furnace coke (a) reduces its consumption in the furnace. (b) increases its consumption in the furnace. (c) does not affect its consumption in the furnace. (d) decreases its hardness and abrasion resistance.

52. High sulphur content in a fuel.....of the flue gases.

(a) decreases the dew point

(b) increases the dew point

(c) reduces the combustion efficiency by limit-

ing the permissible temperature reduction (d) both (b) and (c)

53. With increase in carbonisation temperature (a) coke oven gas yield increases.

(b) tar yield increases.

(c) hydrogen percentage in the coke oven gas

decreases.

(d) methane percentage in the coke oven gas

increases.

54. With increase in the time of carbonisation at a particular temperature (say 1000°C), the..... percentage in coke oven gas increases. (a) hydrogen

(b) methane

(c) unsaturated hydrocarbons

(d) all (a), (b) and (c)

55. Producer gas containing least amount of tar is produced by the

(a) partial combustion of coal.

(b) partial combustion of large size (< 50 mm)

coke.

(c) high pressure gasification of coal (e.g. in Lurgi gasifier).

(d) atmospheric pressure gasification of coal (e.g., in Kopper-Totzek gasifier).

56. High temperature in gasification of coal fa- vours

(a) high production of CO_2 .

(b) low production of CO_2 .

(c) high production of CO.

(d) both (b) and (c).

57. Lurgi gasifier (high pressure gasifier) as com- pared to Kopper Totzek gasifier (atmospheric pressure gasifier) produces

(a) higher amount of methane.

(b) lower amount of hydrogen.

(c) both (a) and (b).

(d) higher amount of both methane and hydrogen.

58. Which of the following constituents of coal is the most important in the production of coke? (a) Moisture (b) Ash

(c) Volatiles (d) Carbon

59. A coal that softens and fuses on heating is (a) classified (c) caking

(b) carbonised (d) non-caking

60. Purity of coke means that, it is high in carbon and low in

(a) volatiles (b) ash

(c) iron (d) moisture

61. Calorific value of coke oven gas is around.....

Kcal/Nm³.

(a) 900 (b) 4200

(c) 7500 (d) 2000

62. Calorific value of blast furnace gas is around.....KCal/Nm³.

(a) 850 (b) 1800 (c) 4200 (d) 6500

ANSWERS

46. (d) 47.(a) 48.(a) 49.(d) 50.(d) 51.(b) 52.(d) 53.(a) 54.(a) 55.(b) 56.(d) 57.(c) 58.(d) 59.(c) 60.(a) 61.(b) 62.(a)

63. Blast furnace gas is a very poisonous gas because of its predominantly high.....content. (a) H_2O (b) CO_2
(c) CO (d) CH_4

64. Percentage of carbon monoxide in blast furnace gas may be around
(a) 8 (b) 14
(c) 22 (d) 52

65. Percentage of hydrogen in coke oven gas may be around
(a) 10 (b) 25
(c) 45 (d) 60

66. Percentage of methane in coke oven gas may be around
(a) 5 (b) 15
(c) 25 (d) 50

67. Coke oven gas compared to blast furnace gas is (a) more explosive and inflammable.
(b) less poisonous.
(c) lighter.
(d) all (a), (b) and (c).

68. Which of the following fuel gases will require maximum amount of air for combustion of 1 (d)

(a) (b) (c) (d)

potassium hydroxide.
dilute potassium carbonate. cuprous chloride.
alkaline pyragllol solution.

74. The sequence of absorption in flue gas analysis by Orsat's apparatus is respectively
(a) CO_2 , O_2 , CO (b) CO, O_2 , CO_2 (c) CO_2 , CO, O_2 (d) O_2 , CO_2 , CO

75. Which of the following has the highest calorific value ?

(a) Lignite (b) Sub-bituminous coal (c) Anthracite (d) Peat

76. The main product of high temperature carbonisation of coal is

(a) coke (b) ammonia (c) tar (d) coke oven gas

77. High temperature carbonisation of coal produces

inferior coke compared to low temperature carbonisation.

less of gases compared to liquid products. large quantity of tar compared to low temperature carbonisation.

none of these.

Nm^3 gas ?

(a) Blast furnace gas (c) Producer gas (b) Natural gas (d) Water gas

69. Which of the following will generate maximum volume of product of complete combustion (Nm^3/Nm^3 of fuel) ?

(a) Carburetted water gas

(b) Blast furnace gas

(c) Natural gas

(d) Producer gas

70. 'Fuel' can be defined as a substance which produces heat by

(a) combustion. (c) nuclear fusion. (b) nuclear fission. (d) all (a), (b) & (c).

71. Catalyst used in Fischer-Tropsch process is (a) nickel (b) zinc oxide (c)

alumina (d) thorium oxide

72. In flue gas analysis by Orsat's apparatus, oxygen is absorbed by

(a) potassium hydroxide.

(b) cuprous chloride.

(c) alkaline pyragllol solution.

(d) none of these.

73. In flue gas analysis by Orsat's apparatus, carbon dioxide is absorbed by

(a)

(b) (c)

78. High temperature carbonisation of coal takes place at.....°C.

(a) 2000 (b) 600

(c) 1100 (d) 1600

79. Low temperature carbonisation of coal takes place at.....°C.

(a) 300 (b) 1100

(c) 700 (d) 150

80. Proximate analysis of coal determines its.....content.

(a) moisture, ash, sulphur & volatile matter (b) moisture, volatile matter, ash & fixed carbon (c) moisture, sulphur, nitrogen & fixed carbon (d) none of these

81. Ultimate analysis of coal determines its.....content.

(a) (b) (c) (d)

carbon, hydrogen, nitrogen & sulphur carbon, ash, sulphur & nitrogen carbon, sulphur, volatile matter & ash carbon, volatile matter, ash & moisture

82. Washing of coal is done to reduce the (a) (b) (c) (d) both (b) and (c) inherent impurities adhering impurities mineral matter

ANSWERS

63. (c) 64.(c) 65.(d) 66.(c) 67.(d) 68.(b) 69.(c) 70.(d) 71.(a) 72.(c) 73.(a) 74.(a) 75.(c) 76.(a) 77.(d) 78.(c) 79.(c) 80.(b) 81.(a) 82.(d)

83. A good quality coal should have

(a) low fusion point of ash

(b) high ash content

(c) high sulphur

(d) none of these

84. Coke oven gas consists mainly of

(a) H₂, & CH₄ (b) CO, & CO₂ (c) H₂, & CO (d) CH₄, & CO

85. Lurgi coal gasifier is a pressurised.....bed reactor.

(a) moving

(c) fluidised

86. In Lurgi coal gasifier, (a) coking coals cannot be used.

(b) low carbon conversion efficiency is achieved. (c) entrainment of solids is higher.

(d) larger quantity of coal can be processed.

87. The combustion reaction, $C + O_2 = CO_2$, is (a) exothermic (b) endothermic (c) autocatalytic (d) none of these

88. The gasification reaction represented by, (b) fixed (d) entrained

$C + H_2O = CO + H_2$, is (a) exothermic (c) catalytic (b) endothermic (d) autocatalytic

89. The combustion reaction, $C + O_2 = CO_2$, is (a) exothermic (b) endothermic (c) autocatalytic (d) none of these

90. Kopper-Totzek coal gasifier (a) can give ammonia synthesis gas ($H_2 + N_2$). (b) is a moving bed reactor. (c) cannot use coking coal. (d) operate at very high pressure.

91. A good metallurgical coke (a) should have high porosity. (b) should be brittle. (c) must contain moderate quantities of ash,

moisture, sulphur and volatile matters. (d) should have low fusion point of its ash. **92.** Gross heating value of coal is.....the net

heating value. (a) higher than (b) lower than (c) same as (d) none of these

93. The maximum adiabatic flame temperature in air is.....the maximum flame temperature in pure oxygen.

(a) lower than (b) higher than (c) same as (d) not related to

94. Junkar's calorimeter is used to determine the calorific value of (a) pulverised coal (c) fuel oil (b) gaseous fuels (d) none of these

95. The average molecular weight of a flue gas having the composition by volume as $CO_2 = 25\%$, $O_2 = 25\%$, $N_2 = 50\%$ will be

- (a) 27.6 (b) 23
(c) 47.3 (d) 42.9

96. Which of the following is a poisonous fuel gas ? (a) Coke oven gas (b) (c) Natural gas (d) Blast furnace gas None of these

97. Which of the following fuel gases is heavier than air ?
(a) Blast furnace gas (c) Natural gas
(b) Coke oven gas (d) Water gas

98. Net calorific value is the gross calorific value less the.....heat of water in the product of combustion when cooled to 15°C.

- (a) sensible (b) latent
(c) sensible and latent (d) none of these **99.** A liquid/gaseous fuel containing hydrocarbons

and high amount of sulphur is burnt with 40% excess air. The flue gas still contains large amount of carbon monoxide. This may be due to the

- (a) presence of large quantity of hydrogen in
the fuel.
(b) low calorific value of the fuel.
(c) high sulphur content in the fuel.
(d) lack of thorough mixing of fuel with air.

100. Which of the following would require least amount of secondary air for combustion ? (a) Coke breeze containing 25% ash and 2%

volatile matter.

- (b) Anthracite containing 10% volatile matter and 8% ash.
(c) Bituminous coal containing 20% ash and 25% volatile matter.
(d) Semi-bituminous coal containing 25% ash and 20% volatile matter.

101. A coal gasifier operating at 20 atm. (e.g. Lurgi gasifier) as compared to one operating at atmospheric pressure (e.g. Kopper-Totzek or Winkler gasifier) will produce a gas having (a) higher methane content and thus higher calorific value.

- (b) higher carbon monoxide content. (c) lower carbon dioxide content.
(d) none of these

ANSWERS

83. (d) 84.(a) 85.(a) 86.(d) 87.(a) 88.(b) 89.(a) 90.(a) 91.(a) 92.(a) 93.(a) 94.(b)
95(b) 96.(b) 97.(a) 98.(c) 99.(d) 100.(a) 101.(a)

102. Blast furnace gas burns with a bluish flame, because of the presence of

(a) CO (b) CH₄

(c) CO₂ (d) S

103. Coke oven gas burns with an yellowish flame, because of the presence of

(a) CO₂ (b) CH₄

(c) H₂ (d) NH₃

104. Fixed carbon in coal is defined as

(a) that present in volatile matters. (b) the total quantity of carbon present in

the coal.

(c) hundred minus the percentage of volatile matter, ash and moisture.

(d) the one which is present in the residue after combustion.

105. Natural draught produced by a chimney depends upon the

(a) density of the chimney gases.

(b) height of the chimney.

(c) both (a) and (b).

(d) neither (a) nor (b).

106. The liquid used for the washing of coal in an industrial coal washery is a mixture of water and

(a) carbon tetrachloride.

(b) sand (40%).

(c) mineral oil of high viscosity & specific

gravity (1.6)

(d) none of these.

107. The optimum percentage of excess air for combustion depends upon

the.....of the fuel. (a) type (solid, liquid or gaseous)
(b) calorific value
(b) sulphur content
(d) ignition temperature

108. Percentage of nitrogen in blast furnace gas may be around
(a) 5 (b) 25
(c) 55 (d) 80

109. Coalification means the

(a) process of conversion of lignite into anthracite.
(b) underground gasification of coal.
(c) complete combustion of coal.
(d) direct hydrogenation of coal.

110. Calorific value of bituminous coal may be around.....Kcal/kg.

(a) 500 (b) 1500
(c) 6500 (d) 20000

111. Blast furnace gas constitutes mainly of (a) N_2 & CH_4 (b) N_2 & H_2 (c) N_2 & CO (d) CH_4 & CO_2

112. The maximum percentage of CO_2 in a flue gas (from a carbonaceous fuel) can be

(a) 21 (b) 77
(c) 79 (d) 29

113. Water gas constitutes mainly of

(a) CO & H_2 (b) CO & N_2 (c) CO_2 & H_2 (d) CH_4 & H_2

114. Gobar gas constitutes mainly of

(a) CH_4 & CO_2 (b) CO & CO_2
(c) CH_4 & N_2 (d) CO & N_2

115. Gray-King Assay and Roga Index of coal is a measure of its

(a) abrasability.
(b) grindability.
(c) weathering properties.
(d) caking and swelling properties.

116. Efficiency of the combustion of a fuel is judged by the.....the flue gas.
(a) % of CO₂ in (b) % of O₂ in (c) temperature of (d) colour of

117. A carbonaceous fuel (containing no H₂ or hydrocarbons) is burnt and the resulting flue gas contains 21% CO₂. It means that (a) 21% excess air has been used for combustion. (b) 21% excess oxygen has been used for

combustion.

(c) complete combustion of fuel has taken place.

(d) no excess air has been used for combustion. **118.** Oxygen content in a flue gas was found to be 4%. It implies that excess air used for combustion was around.....percent. (a) 4 (b) 96

(c) 20 (d) 40

119. Quantity of coke produced from metallurgical coal may be around.....percent. (a) 30 (b) 50

(c) 75 (d) 95

120. Volatile matter content of metallurgical coke may be around.....percent.

(a) 1–2 (b) 10–15

(c) 22–26 (d) 30–33

ANSWERS

102. (a) 103. (b) 104. (c) 105. (c) 106. (b) 107. (a) 108. (c) 109. (a) 110. (c) 111. (c)

112. (a) 113. (a)

114. (a) 115. (d) 116. (b) 117. (c) 118. (c) 119. (c) 120. (a)

121. Lignite is

(a) a high rank coal.

(b) a coking coal.

(c) can be used for gasification and steam generation.

(d) a black banded coal which burns with a non-smoky yellowish flame.

122. Anthracite coal

(a) contains more volatile matter than bituminous coal.

(b) ignites more easily than bituminous coal. (c) is essentially a coking coal.

(d) burns with short, bluish, yellow-tipped flame producing very little smoke.

123. Bituminous coal

(a) ignites less easily than anthracite. (b) is generally coking.

(c) burns with smoky yellow flame. (d) both (b) and (c).

124. Calorific value of a typical dry anthracite coal may be around.....Kcal/kg.

(a) 1000 (b) 4000

(c) 8000 (d) 15000

125. Which of the following petrological constituents is responsible for bright and lustrous black band of bituminous coal ?

(a) Clarain (c) Durain

126. Fussain

(b) Vitrain (d) Fussain

(a) is friable, charcoal like substance. (b) has highest fixed carbon and lowest volatile matter content of all the four banded components of coal.

(c) is non-coking, but when blended with highly coking coal, controls its swelling and produces high strength coke on carbonisation.

(d) all (a), (b) and (c).

127. A coal containing very high percentage of durain is called.....coal.

(a) bright (b) splint

(c) non-banded (d) boghead **128.** Cannel coal

(a) is non-coking.

(b) has a high volatile matter content and burns with a luminous smoky flame.

(c) is a non-banded coal which can be ignited easily with a match stick or candle flame, hence is so named.

129. To avoid fire by spontaneous combustion of coal due to its low temperature oxidation, it should be stored in

(a) shallow and small piles.

(b) fine sizes without the presence of any lump.

(c) closed space without any ventilation facility.

(d) large heaps with small surface to volume ratio.

130. LOW temperature oxidation of stored coal results in the

(a) decrease in its caking power & calorific

value.

(b) decrease in its carbon & hydrogen content.

(c) increase in its oxygen content.

(d) all (a), (b) and (c).

131. A coal having high amount of volatile matter (a) would require smaller combustion chamber. (b) produces very little of tar and gas on carbonisation.

(c) ignites easily and burns with long smoky flame.

(d) all (a), (b) and (c).

132. A coal with high.....content, would ignite most easily.

(a) fixed carbon (b) volatile matter

(c) ash (d) oxygen **133.** A coal with high ash content is undesirable, as

(a) it is abrasive to the coal pulveriser (e.g. ball mill) and the combustion chamber.

(b) the ash in molten condition gets absorbed in the pores of the refractory lining of the furnace and causes its spalling due to different co-efficient of expansion/contraction of the refractory and the ash.

(c) the ash retains the sulphur & phosphorus and thus affects the quality of products in metallurgical furnace apart from increasing the slag volume. Besides, it may fuse and stick to the boiler tubes thereby reducing the heat transfer.

(d) all (a), (b) and (c).

134. Which of the following has the highest flame speed ?

(a) CO (b) H₂

(c) CH₄ (d) C₂H₆

(d) all (a), (b) and (c).

ANSWERS

121. (c) 122.(d) 123.(d) 124.(c) 125.(a) 126.(d) 127.(b) 128.(d) 129.(a) 130.(d)

131.(d) 132.(b)

133.(d) 134.(b)

135. Gross calorific value will be equal to the net calorific value for

(a) H₂ (b) C₂H₂

(c) CO (d) C₂H₆

136. Caking coal is desirable for

(a) burning on travelling grate.

(b) coke making.

- (c) burning on firebars.
- (d) all (a), (b) and (c).

137. As the equilibrium moisture content of the coal increases, its

- (a) calorific value increases.
- (b) swelling number decreases.
- (c) swelling number increases.
- (d) bulk density decreases.

138. Froth floatation is used for

- (a) washing fine coal dust (< 0.5 mm size).
- (b) washing lump coal (> 80 mm size).
- (c) removing ash from the coal based on difference in specific gravity of coal and ash.

- (d) all (a), (b) and (c).

139. Sulphur in metallurgical coal

- (a) contributes to its heating value.
- (b) affects the quality of steel produced as

cracks develop on the surface while rolling the steel.

- (c) both (a) and (b).

- (d) neither (a) nor (b).

140. Presence of phosphorous in metallurgical coal

- (a) is not undesirable.
- (b) reduces its calorific value.
- (c) badly affects the quality of steel.
- (d) increases its caking power.

141. Nitrogen in coal

- (a) is present upto 1-2%.
- (b) comes from protein in parent vegetable

matter.

- (c) is recovered as ammonia during its carbonisation.

- (d) all (a), (b) and (c).

142. Pick out the correct statement.

- (a) Oxygen content decreases from lignite to bituminous coal as the coalification

in- creases.

(b) The less the oxygen content, better is the coal, as it reduces the calorific value.

(c) With increase in oxygen content, moisture holding capacity of coal increases and the caking power decreases. (d) all (a), (b) and (c)

143. Anthracite can be used for

(a) recarbonising steel.

(b) making carbon electrodes.

(c) blending with highly coking coal to check

its swelling which helps in saving coke even walls from damage and to produce high strength coke.

(d) all (a), (b) and (c).

144. In high temperature carbonisation of coal compared to low temperature carbonisation

(a) yield of ammonia is less.

(b) aromatic content of tar is low.

(c) H_2 content in the coke oven gas is more. (d) calorific value of the coke oven gas is lower. **145.** Low temperature carbonisation

(a) is mainly for producing the smokeless domestic coke.

(b) is meant for the production of 'metallurgical coke'.

(c) produces higher quantity of gas than high temperature carbonisation.

(d) produces less quantity of tar than high temperature carbonisation.

146. During the carbonisation of coal

(a) all tar is evolved at $< 600^\circ C$.

(b) evolution of H_2 and formation of methane

and aromatics occur at $> 700^\circ C$. (c) hard semi-coke starts shrinking at $600^\circ C$. (d) all (a), (b) and (c).

147. Traces of tar fog present in the coke oven gas is removed by

(a) cyclone separator.

(b) wet packed scrubber.

- (c) electrostatic precipitator.
- (d) washing with monoethanolamine.

148. Which is the most matured coal ?

- (a) Lignite
- (c) Semi-anthracite (b) Bituminous (d) Anthracite

149. Which will have the least volatile matter and hence will be the most difficult to ignite? (a) Bituminous coal (b) Coke (c) Semi-bituminous coal (d) Anthracite

150. High ash containing coke

- (a) produces more slag when used in the blast furnace.

ANSWERS

135. (c) 136.(b) 137.(b) 138.(b) 139.(c) 140.(c) 141.(d) 142.(d) 143.(d) 144.(c)
145.(a) 146.(d)

147.(c) 148.(b) 149.(b) 150.(a)

(b) has poor strength and abrasion resistance.

(c) is desirable in producer gas manufacture. (d) none of these.

151. High amount of sulphur and phosphorous in coke causes

(a) decrease in its calorific value.

(b) increase in its strength.

(c) brittleness of steel made by using it. (d) none of these.

152. The cooling medium used in dry quenching of coke is

(a) nitrogen (b) air

(c) phenolic water (d) carbon dioxide

153. Coke having higher porosity has

(a) lower bulk density.

(b) lower strength.

(c) higher reactivity.

(d) all (a), (b) and (c).

154. A good coking coal should have high..... content.

(a) ash

(b) sulphur & phosphorus

(c) moisture

(d) none of these

155. A coal having high volatile matter content will

(a) give less yield of tar and gas on carbonisation.

(b) burn with a small non-smoky flame. (c) have a very high calorific value. (d) none of these.

156. Tar yield in the low temperature and high temperature carbonisation of dry coal may be respectively.....percent.

(a) 3 & 10 (b) 10 & 3

(c) 10 & 20 (d) 15 & 8

157. Coking time in narrow by-product coke ovens is around.....hours.

(a) 18 (b) 48

(c) 8 (d) 80

158. Beehive coke oven

(a) facilitates by-products recovery. (b) takes 2–3 days for coking of coal but requires no external fuel for heating.

(c) gives larger yield of coke (around 90 %) as compared to by-product ovens.

(d) produces coke with very poor strength. **159.** Size of blast furnace grade coke is.....mm. (a) 25–80 (b) 0–15

(c) 15–25 (d) > 100

160. Caking index of the coal blend used for the manufacture of metallurgical coke should be around

(a) 5 (b) 21

(c) 40 (d) 48

161. Critical Air Blast (CAB) value of coke is a direct measure of its

(a) reactivity (b) hardness (c) Strength (d) none of these

162. “Micum Index” of a coke is a measure of its (a) reactivity. (b) porosity.

(c) bulk density. (d) hardness & strength.

163. Desirable “Micum Index” values of metallurgical coke are

(a) $M_{40} > 78\%$ and $M_{10} < 10\%$.

(b) $M_{40} > 4\%$ and $M_{10} < 80\%$.

(c) $M_{40} > 10\%$ and $M_{10} < 78\%$.

(d) $M_{40} > 98\%$ and $M_{10} < 2\%$.

164. Prime coking coal is always blended with medium or non-coking coal before carbonisation (a) to check against its excessive swelling

during heating, which may exert high pressure and damage coke oven walls. (b) because, it alone produces unreactive

coke.

(c) both (a) and (b).

(d) neither (a) nor (b).

165. High ash coals

(a) are soft & friable (poor strength and size stability).

(b) require longer time of carbonisation as ash offers resistance to heat transfer.

(c) produce larger quantity of coke oven gas.

(d) none of these.

166. In high temperature carbonisation (as compared to low temperature carbonisation) of coal

(a) coke oven gas yield is more.

(b) tar yield is less but free carbon in tar is

more.

(c) calorific value of coke oven gas is less. (d) all (a), (b), and (c).

167. Shatter index of the coke is a measure of its (a) strength (b) (c) reactivity

(d) bulk density none of these

ANSWERS

151. (c) 152. (a) 153. (d) 154. (d) 155. (d) 156. (b) 157. (a) 158. (b) 159. (a) 160. (b)

161. (a) 162. (d)

163. (a) 164. (c) 165. (b) 166. (d) 167. (a)

168. Shatter index of metallurgical coke on 2 inches and 0.5 inch screen should be respectively around.....percent.

(a) 80 and 97 (b) 95 and 100 (c) 40 and 70 (d) 25 and 97

169. Abrasion index of blast furnace coke should be around.....percent.

(a) 20 (b) 35

(c) 55 (d) 80

170. Gray King Assay and Swelling Index of a coal is a measure of its

(a) swelling characteristics.

(b) abrasability.

(c) agglutinating properties.

(d) resistance to impact breakage.

171. Caking index of a coal is a measure of its (a) abrasability

(b) Reactivity

(c) Agglutinating (binding) properties (d) porosity

172. With increase in the temperature of carbonisation of coal

(a) hydrogen content of coke oven gas increases due to cracking of hydrocarbons.

(b) methane content in the coke oven gas decreases and carbon monoxide content increases.

(c) calorific value of the coke oven gas decreases due to cracking of hydrocarbons which is not compensated by increase in CO & H₂ content.

(d) all (a), (b) and (c)

173. Ionisation potential applied across the electrodes of electrostatic tar precipitator is (a) 230 V AC (b) 60 KV AC (c) 230 V DC (d) 60 KV DC

174. Main constituents of benzol are

(a) benzene, toluene & xylene.

(b) tar creosote.

(c) ammonia & phenol.

(d) anthracene & phenol.

175. Which of the following fertilisers is produced in the by-products recovery (from coke oven gas) plant attached to an integrated steel plant ? (a) Ammonium sulphate

(b) Ammonium nitrate

(c) Ammonium phosphate

(d) None of these

176. Naphthalene is removed from coke oven gas by

(a) scrubbing with wash oil (a petroleum product).

(b) adsorbing on bog iron bed.

(c) absorbing in vetro-coke solution.

(d) none of these.

177. Coke oven gas is stripped of its H_2S and mercaptans content by

(a) absorption in wash oil.

(b) adsorption on bog iron bed.

(c) bubbling it through dilute sulphuric acid.

(d) adsorption on silica gel.

178. Which of the following is not a product of tar distillation ?

(a) Phenol & naphthalene

(b) Benzol & pitch

(c) Anthracene & creosote

(d) None of these

179. Benzene is used

(a) as a motor fuel.

(b) as an explosive.

(c) for making insecticides (e.g., DDT, BHC etc.), detergent & rubber (SBR).

(d) as a perfume.

180. Which of the following is used for making the explosive TNT' ?

(a) Benzol (b) Toluene

(c) Pyridine (d) Cerosote **181.** Hard pitch is used for making

(a) pulverised fuel

(c) insecticides **182.** Benzol is used

(a) as a motor fuel blend.

(b) for producing benzene, toluene & xylene by its distillation.

(c) both (a) & (b).

(d) neither (a) nor (b).

183. Yield of pitch from distillation of high temperature tar is around.....percent. (a) 10 (b) 25

(c) 65 (d) 90

184. Naphthalene is used for making
(a) insecticides (e.g. moth balls).
(b) unsaturated polyesters.
(c) drug intermediates e.g. naphthol. (d) all (a), (b) and (c).

185. Calorific value of coal middling generated in coal washeries during washing of coal may be around.....Kcal/kg.
(b) perfumes (d) plastics

ANSWERS

168. (a) 169.(d) 170.(a) 171.(c) 172.(d) 173.(d) 174.(a) 175.(a) 176.(a) 177.(b)
178.(d) 179.(c)
180.(b) 181.(a) 182. (c) 183.(c) 184.(d) 185.(b)
(a) 1000 (b) 4000
(c) 6000 (d) 8000 **233.**

186. Calorific value of tar is about.....Kcal/kg. (a) 8800 (b) 12000
(c) 5000 (d) 16000

187. Calorific value of furnace oil is about..... Kcal/kg.
(a) 10000 (b) 15000
(c) 5000 (d) 20000

188. Tar is a better fuel than furnace oil, because of its
(a) higher calorific value.
(b) lower sulphur content.
(c) higher emissivity (0.8 – 0.9) resulting in

higher radiation heat transfer rate. (d) both (a) and (b).

189. Washing of coal
(a) reduces its ash & sulphur content. (b) improves its coking properties.
(c) increase the fusion point of its ash by removing chlorine compounds.

(d) all (a), (b) and (c).

190. Gross and net calorific value of a fuel will be the same
(a) if its ash content is zero.
(b) if its carbon content is very low. (c) if its hydrogen/hydrogen compound content is zero.

(d) under no circumstances.

191. With increase in moisture content of coal, its (a) calorific value increases sometimes. (b) bulk density always decreases.

(c) clinkering tendency during combustion

increases.

(d) none of these.

192. Low temperature oxidation and spontaneous combustion of freshly mined coal is accentuated, if

(a) it contains large amount of volatile matter. (b) it is stored in tall heaps.

(c) smaller fines are stored in large quantity. (d) all (a), (b) and (c).

193. Yield of blast furnace gas is about..... Nm^3/ton of pig iron.

(a) 300 (b) 2000 (c) 5000 (d) 10000

194. Largest constituent of blast furnace gas is (a) N_2 (b) CO

(c) CO_2 (d) H_2

195. Largest constituent of coke oven gas is (a) N_2 (b) H_2

(c) CH_4 (d) CO_2

196. Blast furnace gas compared to coke oven gas has

(a) lower ignition temperature.

(b) narrower limit of inflammability. (c) higher calorific value.

(d) lower theoretical flame temperature.

197. Tolerable concentration of toxic carbon monoxide in atmospheric air is about..... PPM.

(a) 50 (b) 1000

(c) 5000 (d) 10000

198. L.D. converter gas (produced in steel plant) comprises mainly of

(a) CO (upto 65%) & CO_2

(b) CO_2 & H_2

(c) CO & O_2

(d) CO_2 & O_2

199. The calorific value of L.D. converter gas is about.....Kcal/Nm³.

- (a) 1800 (b) 800
(c) 4500 (d) 10000

200. Which of the following is the most poisonous gas ?

- (a) Coke oven gas
(b) Producer gas
(c) Blast furnace gas
(d) L.D. converter gas

201. The calorific value of producer gas is around.....kcal/Nm³ .

- (a) 1300 (b) 500
(c) 4500 (d) 9000

202. Main constituent of natural gas is

- (a) CH₄ (upto 90%) (b) C₂H₆ (c) C₃H₈ (d) H₂

203. The calorific value of natural gas is about.....kcal/Nm³.

- (a) 10,000 (b) 2500
(c) 25,000 (d) 35,000

204. The calorific value of 'LPG' (50% propane + 50% butane) is about.....kcal/Nm³. (a) 5000 (b) 25,000

- (c) 25,000 (d) 15,000

ANSWERS

186. (a) 187. (a) 188. (d) 189. (d) 190. (c) 191. (d) 192. (d) 193. (b) 194. (a) 195. (b)
196. (d) 197. (a)

198. (a) 199. (a) 200. (d) 201. (a) 202. (a) 203. (a) 204. (b)

205. Ignition temperature decreases progressively from anthracite to lignite, because

- (a) volatile matter content increases. (b) carbon content decreases.
(c) moisture content increases.
(d) ash content increases.

206. Coke compared to the coal from which it has been made, contains

- (a) less volatile matter.
(b) more carbon.

- (c) greater percentage of ash.
(d) all (a), (b) and (c).

207. Which of the following is not a by-product fuel? (a) Producer gas (b) Blast furnace gas (c) Coke oven gas (d) Refinery gas

208. Which of the following is not a manufactured fuel ?
(a) Furnace oil (c) Semi-coke (b) Bagasse (d) Kerosene

209. The calorific value is the highest out of the following for
(a) producer gas
(b) water gas
(c) coke oven gas
(d) blast furnace gas

210. In Orsat's apparatus, ammoniacal cuprous chloride is used for selectively absorbing (a) CO (b) CO₂
(c) O₂ (d) H₂O

211. Eschka mixture, which is used for the determination of sulphur in coal, is a mixture of (a) MgO & Na₂CO₃
(b) MgSO₄ & BaCl₂
(c) BaSO₄ & NaCl
(d) MgCO₃ & NaCl

212. Abel apparatus is used for those oils, whose flash points are.....°F.
(a) < 120 (b) > 120
(c) < 280 (d) 300–600

213. Pensky-Marten apparatus is used for those oils, whose flash points are.....°F.
(a) <120 (b) >120
(a) <90 (d) 90-110

214. Pick out the wrong statement.

- (a) Cokes of high reactivity are obtained from weakly coking coals.
(b) Cokes of high reactivity are obtained from strongly coking coals.
(c) Reactivity of coke is inversely proportional to its absolute density.

(d) Abrasion index of the coke is a measure of its hardness.

215. Which of the following is not endothermic? (a) Cracking (b) Reforming (c) Gasification (d) Partial oxidation

216. Ratio of primary air to secondary air increases with increase in the rank of coal, because the (a) high rank coals have higher amount of

volatile matter.

(b) ratio of fixed carbon to volatile matter increases.

(c) oxygen content progressively decreases. (d) calorific value of the coal increases.

217. 'Fat' coal means a coal having

(a) low calorific value.

(b) high volatile matter.

(c) low ash content.

(d) non smoking tendency.

218. Which of the following will be unsuitable for dust cleaning from flue gas at 400°C from a pulverised coal fired boiler ?

(a) Multicyclones (b) Bag filter (c) Wet scrubber (d) Hydrocyclones.

219. For long flame and easy ignition, the coal used should have

(a) high volatile matter (b) low ash (c) high calorific value (d) high ash

220. Mineral matter, 'M' and ash percentage 'A' in coal are roughly related as

(a) $M = 1.8 A$ (b) $M = 0.5 A$ (c) $M = 1.1 A$ (d) $M = A$

221. Coal tar (produced by high temperature carbonisation) is the main source of

(a) aromatic compounds

(b) aliphatic compounds

(c) paraffins

(d) olefins

222. The pyragallol solution used in orsat apparatus can absorb

(a) only O_2

(b) both O_2 and CO_2

- (c) both O_2 and CO
- (d) all CO, CO_2 and O_2

223. The cuprous chloride used in orsat apparatus can absorb

ANSWERS

205. (a) 206. (d) 207. (a) 208. (b) 209. (c) 210. (a) 211. (a) 212. (a) 213. (b) 214. (b)
 215. (d) 216. (b)
 217. (b) 218. (b) 219. (a) 220. (c) 221. (a) 222. (b) 223. (d)
 (a) only CO
 (b) both CO and CO_2 (c) both CO and O_2
 (d) all CO, CO_2 , and O_2 .

224. As the C/H ratio of the fuel increases, the amount of CO_2 formed on combustion..... for the same percentage of excess air. (a) decreases

- (b) increases
- (c) remains same
- (d) may increase or decrease depending on

the type of fuel

225. KOH solution used in orsat apparatus absorbs

- (a) CO_2 (b) SO_2
- (c) both (a) & (b) (d) neither (a) nor (b)

226. If CO_2 is not fully absorbed by the KOH solution meant for its absorption in the orsat apparatus, it will appear as

- (a) O_2 (b) CO
- (c) N_2 (d) SO_2

227. The maximum adiabatic flame temperature is attained, when the fuel is burnt with (a) theoretically required amount of air. (b) more than theoretically required amount

of air.

- (c) less than theoretically required amount
- of air.

(d) theoretically required amount of oxygen. **228.** Too much of excess air in

combustion results in high

(a) fuel consumption for the same heat load. (b) stack gas temperature.

(c) percentage of oxygen in flue gases. (d) all (a), (b) and (c).

229. Oxygen required for theoretically complete combustion of 1 Nm³ methane is.....Nm³. (a) 2 (b) 4

(c) 6 (d) 1

230. One kg of carbon for theoretically complete combustion requires.....kg of air.

(a) 11.5 (b) 0.5

(c) 23 (d) 12

231. When the coal is heated in absence of air, it is called its

(a) deoxidation (b) gasification (c) coalification (d) carbonisation

232. Coke ovens in steel plant are heated by (a) electricity (b) coke oven gas (c) mixed gas (d) both (b) & (c)

233. Coking time in a commercial high temperature coal carbonisation plant is about..... hours.

(a) 6 (b) 18

(c) 28 (d) 36

234. Coking time in beehive coke oven is about (a) 12 hours (b) 2–3 days (c) one week (d) two weeks

235. Fuel combustion is never cent per cent efficient due to

(a) incomplete combustion

(b) dry gas/stack gas loss

(c) moisture loss

(d) all (a), (b) and (c)

236. When incomplete combustion loss is high, the flue gas analysis shows large amount of (a) CO₂ (b) CO

(c) O₂ (d) C

237. If oxygen content in the flue gas rises too high, fuel is being wasted by

(a) incomplete combustion.

- (b) dry gas/stack gas loss.
- (c) moisture loss.
- (d) none of these.

238. The ratio of % total carbon obtained in the ultimate analysis of coke and % fixed carbon obtained in the proximate analysis is always (a) 1 (b) <1 (c) > 1 (d) unpredictable

239. Actual flame temperature is always lower than the adiabatic flame temperature, because there is (a) no possibility of obtaining complete combustion at high temperature.

- (b) always loss of heat from the flame. (c) both (a) and (b).
- (d) neither (a) nor (b).

240. The ratio of maximum adiabatic flame temperature in air to that in pure oxygen is always (a) 1 (b) <1 (c) > 1 (d) unpredictable

241. C/H ratio is the maximum in case of (a) coal (c) natural gas (b) furnace oil (d) naphtha

ANSWERS

224.(b) 225.(c) 226.(d) 227.(d) 228.(d) 229. (a) 230.(a) 231.(d) 232.(d) 236.(b) 237.(b) 238. (c) 239.(c) 240.(b) 241.(a)

233. (b) 234.(b) 235. (d) **242.** C/H ratio is the minimum in case of (a) furnace oil (b) natural gas (c) coal (d) naphtha

243. Which of the following is not a 'manufactured' fuel? (a) LPG (b) Coal briquettes (c) Tar (d) Colloidal fuels

244. Which of the following is not a by-product fuel? (a) Pitch (b) Blast furnace gas (c) Petrol (d) Refinery gas

245. Carbon Content by weight in air dried wood may be about.....percent. (a) 10 (b) 25 (c) 50 (d) 80

246. Yield of charcoal in high temperature carbonisation of wood is about.....percent. (a) 10 (b) 25 (c) 50 (d) 75

247. The most matured coal out of the following is (a) lignite (b) semi-anthracite (c) sub-bituminous (d) bituminous

248. Coking coals are invariably
(a) lignites
(b) bituminous coals
(c) semi-anthracites
(d) anthracites

249. A coal having higher volatile matter content, has lower
(a) smoking tendency on burning.
(b) coke oven gas yield on carbonisation. (c) chance of catching fire during storage in

open space.
(d) ignition temperature.

250. A coal with high ash content
(a) has higher calorific value.
(b) is harder and stronger.
(c) is not subjected to washing.
(d) has low quantity of mineral matter.

251. The difference between total carbon and fixed carbon of coal will be minimum in case of (a) lignite (b) bituminous coal (c) anthracite (d) high temperature coke (V.M < 0.5%)

252. Assam coals suffers mainly from the disadvantage of high.....content.
(a) ash (b) volatile matter (c) sulphur (4-6%) (d) moisture
253. Which of the following petrographic constituents of coal is non-coking ?
(a) Vitrain (c) Durain (b) Clarain (d) Fussain

254. Washing of coal does not reduce its (a) S & P content. (b) (c) fusion point of ash.(d) heating value. none of these.

255. Low temperature oxidation of coal during storage does not decrease its
(a) oxygen content (c) calorific value (b) caking power (d) none of these

256. Low temperature oxidation of coal is accelerated by the
(a) storage in large heaps.
(b) storage in compressed piles.
(c) absence of porous or friable particles. (d) all (a), (b) and (c).

257. Mineral matter content (M) and ash content (A) in coal are approximately related as (a) $M = 1.1 A$ (b) $M = A$
(c) $M = 1.5 A$ (d) $M = 2 A$

258. During combustion of coal on grate, clinker formation is increased by the
(a) use of thick fire bed.
(b) low fusion point of ash ($< 1100^{\circ}\text{C}$). (c) use of preheated primary air.
(d) all (a), (b) & (c).

259. Weathering of coal during storage causes (a) reduction in coal size.
(b) increase in its friability.
(c) decrease in its caking capacity.
(d) all (a), (b) and (c).

260. Hardgrove grindability index of four coal samples are given below. Which of them is the easiest to grind ?
(a) 50 (b) 70
(c) 85 (d) 100

261. Caking index of coal blend used for blast furnace coke making is about
(a) 8 (b) 12
(c) 22 (d) 36

262. 'Fat coals' are those coals which have very high
(a) caking capacity.
(b) volatile matter content.
(c) fusion point of its ash.
(d) inherent moisture content.

ANSWERS

242. (b) 243.(c) 244.(c) 245.(c) 246.(b) 247.(b) 248.(b) 249.(d) 250.(b) 251.(d)

252.(c) 253.(d)

254.(d) 255.(d) 256.(a) 257.(a) 258.(d) 259.(d) 260.(d) 261.(c) 262.(a)

263. Bulk density of pulverised coal may be about.....kg/m³.

(a) 100 (b) 500

(c) 1000 (d) 1500

264. In low temperature carbonisation of coal, the

(a) yield of coke oven gas is 290 Nm³/ton dry coal.

(b) volatile matter in coke is zero,

(c) temperature maintained is 700°C.

(d) yield of tar is about 3% of dry coal.

265. Combustion reaction of fuels is a/an..... reaction.

(a) auto catalytic (c) endothermic (b) exothermic (d) none of these

266. Gobar gas is produced by the.....of 'gobar' (cow dung).

(a) hydrolysis (c) oxidation (b) fermentation (d) dehydration

267. Theoretical flame temperature of a fuel is that temperature which is attained, when the fuel is completely burnt 'using theoretical amount of

(a) air

(b) oxygen

(c) either (a) or (b)

(d) either (a) or (b) without gain or loss of

heat

268. Calorific value of wood gas is about..... kcal/Nm³.

(a) 1500 (b) 3300

(c) 5400 (d) 8500

269. Main component of sewage gas produced during aneorobic decomposition of organic waste (by suitable bacteria) during sewage disposal is

(a) H₂ (b) CH₄

(c) CO₂ (d) N₂

270. Which of the following has the highest heat of combustion ?

(a) H₂ (b) CO

(c) CH_4 (d) C_2H_6

271. Flue gas obtained on complete combustion of pure acetylene (a hydrocarbon fuel) will contain (a) CO (b) CO_2

(c) H_2O (d) both (b) & (c)

272. About..... Nm^3 of air will be required for the complete combustion of 2 Nm^3 of CO. (a) 2 (b) 3

(c) 5 (d) 1

273. Pick out the wrong statement.

(a) High concentration of oxygen in flue gas means high stack loss.

(b) Gaseous fuels require the least % excess air for complete combustion.

(c) The ratio of fixed carbon to volatile matter percentage in coal is called its 'fuel ratio'.

(d) Calorific value of natural gas is more than that of LPG.

274. Pick out the wrong statement.

(a) Main constituents of LPG are propane and butane.

(b) C.V. of natural gas is about 10000 KCal/ Nm^3 .

(c) C.V. of LPG is about 26000 kcal/ Nm^3 (11500 kcal/kg).

(d) L.P.G. is lighter than air.

275. Which of the following is unsuitable fuel for producer gas manufacture ?

(a) Coke.

(b) Anthracite.

(c) Coal having low fusion point of its ash. (d) Coal having high fusion point of its ash.

276. Supply of excess air for complete combustion of fuel is necessitated to facilitate

(a) its thorough mixing with air.

(b) attainment of chemical equilibrium. (c) attainment of high temperature. (d) none of these.

277. The function of secondary combustion air is to

(a) pneumatically convey the pulverised

coal.

(b) completely burn the volatile matter. (c) burn the lumpy coal.
(d) none of these.

278. The main advantage of forced draft over natural draft is that
(a) combustion of fuel is complete.
(b) smaller height chimney can be used. (c) furnace control is easier.
(d) all (a), (b) & (c).

279. Explosion limit of blast furnace gas is 37 to 71% gas in gas-air mixture. It means that the blast furnace gas will explode when burnt in

ANSWERS

263. (b) 264.(c) 265.(b) 266.(b) 267.(d) 268.(b) 269.(b) 270.(d) 271.(d) 272.(c)
273.(d) 274.(d)

275.(c) 276.(a) 277.(b) 278.(d) 279.(c)

a confined space, if its concentration in the gas-air mixture is.....percent.

(a) < 37

(b) > 71

(c) in between 37 & 71

(d) none of these

280. Turndown ratio of a gas burner is equal to (a) maximum to minimum heat input ratio. (b) maximum to minimum permissible gas

flow rate.

(c) both (a) & (b).

(d) minimum to maximum heat input ratio.

281. Bunsen burner is an example of a/an..... burner.

(a) inside mixing/premix type

(b)outside mixing/diffusion flame/nozzle mix

type

(c) rotary cup

(d) submerged combustion

282. Advantages of fluidised bed combustion are (a) reduced NO_x formation in flue gas. (b) lower furnace operating temperature. (c) high heat transfer rate.

(d) all (a), (b) & (c).

283. Main use of soft coke is as fuel.

- (a) domestic
- (c) foundary
- (b) blast furnace (d) none of these

284. process is meant for direct hydrogenation of coal to produce liquid fuel. (a) Fischer-Tropsch (b) Bergius (c) Lurgi (d) None of these

285. Calorific value of both the solid & liquid fuels can be determined by using.....calorimeter.

- (a) Junker's (b) Bomb
- (c) Boy's (d) none of these

286. A travelling grate stoker is meant for the efficient burning of.....coal.

- (a) caking (b) pulverised
- (c) non-caking (d) high ash

287. Volumetric ratio of N_2 to O_2 in dry atmospheric air is

- (a) 0.21 (b) 3.76
- (c) 4.76 (d) 0.79

288. Which of the following is the maximum coal producing state in India?

- (a) Orissa (b) West Bengal (c) Jharkhand (d) Assam

289. Pick out the wrong statement. :

- (a) Carburetted water gas is also called blue gas.
- (b) Coals are divided in four species according to their carbon content in Seylor's classification.
- (c) Carbonisation time in a by-product coke oven is about 16 hours.
- (d) Gross and net calorific value of a fuel is the same, if it does not contain hydrogen or hydrocarbons.

290. Coal is pulverised before burning in large capacity boiler furnaces mainly to

- (a) ensure its complete combustion. (b) facilitate easy ash removal.
- (c) enhance its calorific value.
- (d) provide trouble free operation.

291. Which of the following coal gasification pro- cesses will produce gas having maximum methane content ?

- (a) Winkler process.
- (b) Lurgi process.
- (c) Kopper-Totzek process.
- (d) All can produce same methane content.

292. High pressure coal gasification is employed in.....process. (a) Lurgi
 (c) Winkler
 (b) Kopper-Totzek (d) none of these

293. By-products are.....recovered in 'Beehive ovens'.
 (a) fully (b) partially (c) not at all (d) negligibly

294. of the coal is the basis for Seylor's coal classification.
 (a) Proximate analysis
 (b) Ultimate analysis
 (c) Caking index
 (d) Calorific value

295. By-products recovery process from coal carbonisation is termed as direct, indirect and semi direct process depending upon the method of recovery of
 (a) tar (b) benzol
 (c) ammonia (d) none of these

296. Out of the following, which is the most important parameter for the blast furnace grade coke?
 (a) CSR&CRI
 (b) Ash content

ANSWERS

280. (c) 281.(a) 282.(d) 283.(a) 284.(b) 285.(b) 286.(c) 287.(b) 288.(c) 289.(a)
 290.(a) 291.(b)
 292.(a) 293.(c) 294.(b) 295.(c) 296.(a)

- (c) Moisture content
- (d) Volatile matter content

297. In high temperature carbonisation (as compared to low temperature carbonisation) of coal, the
 (a) gas yield is less.
 (b) tar yield is more.
 (c) ignition temperature of coke produced is less.

(d) aromatic content of tar produced is more.

298. Optimum preheating temperature for pitch creosote mixture (PCM) which is also termed as C.T.F.–200, before atomisation through burners is

(a) 200 °F (b) 200 °C (c) 200 °K (d) 200 °R

299. Pitch creosote mixture (PCM) as compared to furnace oil is a better fuel, because its (a) emissivity factor is higher.

(b) sulphur content is lower.

(c) flue gas has lower dew point thereby fa-

cilitating more waste heat recovery. (d) all (a), (b) and (c).

300. Ash content in the middling coal (a byproduct of coal washeries) in India ranges between.....percent.

(a) 15 to 25 (b) 35 to 45 (c) 55 to 75 (d) 75

301. Calorific value of pitch creosote mixture (PCM) i.e., C.T.F.–200 is about

(a) 8800 kcal/m³

(b) 8800 kcal/kg

(c) same as that of coal middling

(d) 25000 kcal/kg

302. ‘Mixed gas’ used in steel plants is a mixture of

(a) B.F. gas and coke oven gas.

(b) coke oven gas and converter gas. (c) coke oven gas and L.P.G.

(d) blast furnace gas and naphtha vapor.

303. With increase in C/H ratio of a fuel, the amount of CO₂ formed on its complete combustion

(a) increases

(b) decreases

(c) remains same

(d) either (a) or (b), depends on other factors

304. Stack heat losses can be minimised by (a) controlling the excess air.

(b) oxygen enrichment of combustion air. (c) using low c.v. fuels.

(d) maintaining proper draft in the furnace.

305. Gas yield in the Kopper-Totzek coal gasifier is about.....Nm³/ton coal (ash = 35%). (a) 150 (b) 1500
(c) 3500 (d) 5000

306. 'Wind loss' resulting from unscientific storage of coal may be the order of about..... percent.
(a) 2.5 (b) 7.5
(c) 10.5 (d) 14.5

307. A certain thickness of the coal, if stored unscientifically on soft (katcha) ground having no metallic/concrete flooring gets sunked into the ground, which is termed as the 'carpet loss'. The carpet loss may be of the order of.....cms.
(a) 1 to 2 (b) 3 to 4
(c) 5 to 15 (d) 20 to 40

308. Which of the following oil gasification processes is non-catalytic?
(a) Semet-Solvay process
(b) Segas process
(c) Onia-Gegi process
(d) Steam reforming of naphtha

309. Number of macrocomponents present in coal according to Stopes are
(a) four (b) five
(c) six (d) two

310. present in coal is not determined in its ultimate analysis.
(a) Fixed carbon (c) Hydrogen (b) Total carbon (d) Nitrogen

311. Use of preheated air for combustion of fuel in the furnace, increases the
(a) scale losses of the furnace stock. (b) calorific value of the fuel.
(c) flame temperature.
(d) none of these.

312. Washing of coal decreases its
(a) caking index.
(b) mineral matter content.
(c) ash content.
(d) both (b) and (c).

313. High sulphur (4–6%) coal in India are found in (a) Assam (c) Bengal (b)

Andhra Pradesh (d) Madhya Pradesh

ANSWERS

297.(d) 298.(a) 299.(d) 300.(b) 301.(b) 302.(a) 303.(a) 304.(a) 305.(b) 309.(a)
310.(a) 311.(c) 312.(b) 313.(a)
306.(a) 307.(c) 308.(a) **314.** Soft coke is not

(a) produced by low temperature carbonisation of coal.
(b) a domestic fuel.
(c) used in blast furnaces.
(d) none of these.

315. Insitu theory and drift theory are related to the
(a) origin of petroleum oil.
(b) origin of coal.
(c) coalification.
(d) variation of coal quality with depth.

316. The temperature at which plastic layer ‘ formation takes place during carbonisation of coal varies from.....°C.
(a) 100 to 150 (b) 350 to 450 (c) 550 to 650 (d) 700 to 850

317. Which of the following is a lean fuel gas? (a) Coke oven gas (b) LPG
(c) Blast furnace gas (d) Natural gas

318. Which of the following is a rich fuel gas? (a) Producer gas.
(b) Coal gas from underground gasification

of coal.
(c) Refinery gases.
(d) None of these.

319. The shift conversion reaction taking place during water gas manufacture is given by (a) $C + H_2O \leftrightarrow CO + H_2$
(b) $C + 2H_2O \leftrightarrow CO_2 + 2H_2$
(c) $CO + H_2O \leftrightarrow CO_2 + H_2$
(d) none of these

320. Which of the following is a primary fuel? (a) Blast furnace coke

- (b) Gasoline
- (c) Natural gas
- (d) Wood charcoal

321. is used as jet engine fuel.

- (a) Petrol (b) Diesel
- (c) Kerosene (d) LPG

322. Laboratory gas is obtained by the cracking of (a) gasoline (c) fuel oil (b) diesel (d) kerosene

323. Stoichiometric combustion of 12kg of carbon requires.....of oxygen.

- (a) 1 kg mole (b) 22.4 Nm^3
- (c) 32 kg (d) all (a), (b) and (c)

324. Fossil fuels mean

- (a) solid fuels
- (b) liquid fuels
- (c) those fuels which are found in the crust

of earth.

- (d) premature fuels with low calorific value.

325. A good metallurgical coke should have very low

- (a) sulphur & phosphorous content
- (b) porosity
- (c) fusion point of its ash
- (d) hardness & strength

326. Gobar gas is produced by the.....of cow dung.

- (a) fermentation (b) oxidation
- (c) hydrogenation (d) none of these

327. Main constituent of the gas produced from a gobar gas plant is

- (a) CO_2 (b) CH_4 (c) H_2 (d) CO

328. The lowest temperature, at which a solid fuel produces enough vapors to support continuous combustion, is called

- (a) fire point
- (b) smoke point

- (c) burning temperature
- (d) kindling temperature

329. Hard coke is manufactured from

- (a) lignite
- (b) bituminous coal
- (c) semi-anthracite
- (d) anthracite

330. Fusion point of coal ash generally varies from 1000 to 1700° C. Ash having fusion point less than.....°C is liable to form clinker. (a) 1100 (b) 1250 (c) 1350 (d) 1400

331. Naphthalene recovered from coke oven gas is used

- (a) as moisture proof coating on fibres. (b) as moth balls (insecticides).
- (c) as a fuel in furnaces.
- (d) for making electrodes.

332. Differences of gross calorific value and net calorific value of a fuel indicates the..... content in the fuel.

- (a) carbon (b) hydrogen (c) moisture (d) volatile matter

ANSWERS

314. (c) 315.(b) 316.(b) 317.(c) 318.(c) 319.(c) 320.(c) 321.(c) 322.(d) 323.(d) 324.(c) 325.(a)

326.(a) 327.(b) 328.(c) 329.(b) 330.(a) 331.(b) 332.(c)

333. Which parameter of coal gives a rough estimate of its calorific value?

- (a) Ash (b) Hydrogen (c) Fixed carbon (d) Total carbon

334. Gross calorific value of fuel oil, diesel & pet- rol is of the order of.....MJ/kg.

- (a) 20 (b) 30
- (c) 40 (d) 50

335. Gross calorific value of a good coal is 26000 MJ/ton, which is equivalent to kcal/kg. (a) 621 (b) 6210

- (c) 62100 (d) 621000

336. In a flue gas, the theoretical CO₂ is 15.5% and measured CO₂ is 11% by the

volume. The percentage of excess air will be

- (a) 40.9 (b) 20.5
(c) 80.8 (d) 145.2

337. Which of the following is not measured in ultimate analysis of coal?

- (a) Sulphur (b) Nitrogen (c) Ash (d) Total carbon

338. With increase in the percentage of excess air for combustion of fuel oil, the percentage of CO_2 in flue gas. (a) increases

- (c) remain same (b) decreases
(d) unpredictable

339. Combustion of large size & irregular lump coal does not result in higher

- (a) excess air requirement.
(b) stack loss.
(c) unburnts in the ash.
(d) thermal efficiency.

340. Natural gas

- (a) is heavier than air.
(b) produces heavy smoke & soot on burning. (c) practically contains no sulphur.
(d) contains about 10% hydrogen.

341. Fluidised bed combustion takes place in the temperature range of.....
 $^{\circ}\text{C}$.

- (a) 500–600 (b) 800–900 (c) > 1000 (d) < 5000

342. Complete combustion of 8 kg of methane produces.....Kg of CO_2 .

- (a) 16 (b) 22
(c) 44 (d) 56

343. When 100 kg of fuel containing 60% carbon is burnt with theoretical air, the weight of CO_2 produced will be.....kg.

ANSWERS

333. (d) 334.(c) 335.(b) 336.(a) 337.(c) 338.(b) 339.(d) 340.(c) 341.(b) 342.(b)
343.(a) 344.(c)
345.(c) 346.(d) 347. (d) 348.(d) 349.(a) 350.(c) 351.(d) 352.(b) 353.(b)

- (a) 220 (b) 320
(c) 440 (d) 4400

344. The country which has the largest share of coal reserve is

- (a) India (b) China
(c) U.S.A (d) Russia

345. For coal fired system, flame length is dictated by
(a) fixed carbon (c) volatile matter (b) ash content (d) moisture
346. In pure stoichiometric combustion of furnace oil, which of the following will be absent in flue gas?

- (a) SO₂ (b) CO₂
(a) N₂ (d) O₂

347. When pure hydrogen is burnt with theoretical air, the volume percentage of N₂ in flue gas on dry basis will be

- (a) 0 (b) 21
(c) 79 (d) 100

348. The factor that influences the atomisation of fuel oil the most, is its

- (a) pour point (b) density (c) flash point (d) viscosity

349. Which of the following will require minimum excess air for combustion?

- (a) Pulverised coal fired boiler.
(b) Manually fired boiler.
(c) Fluidised bed boiler.
(d) Spreader stoker boiler.

350. Which of the following fuels uses the lowest amount of excess air during combustion process ?

- (a) Bagasse (b) Fuel oil (c) Natural gas (d) Pulverised coal

351. Chances of NOX formation is the least in (a) pulverised coal fired boiler.

- (b) spreader stoker fired boiler.
(c) chain grate stoker fired boiler.
(d) fluidised bed combustion boiler.

352. The amount of theoretical air required for complete combustion of one ton of coal as compared to that required for one ton of natural gas is

- (a) higher (b) lower
(c) equal (d) none of these

353. kg of CO₂ produced on complete combustion of 1 kg of furnace oil

containing 84% carbon is (a) 2.4 (b) 3.1
(c) 3.8 (d) 4.2

354. Highest % of sulphur is present in
(a) kerosene.
(b) light diesel oil (LDO).
(c) furnace oil.
(d) LSHS (low sulphur heavy stock).

355. Pour point of LSHS is.....°C.
(a) 26 (b) 52
(c) 25 (d) 85

356. 1 kg of wood contains 20% moisture and 5% hydrogen by weight. How many gms of water is evaporated during complete combustion of 1 kg of wood?
(a) 250 (b) 450
(c) 650 (d) 800

357. The largest heat loss in the heat balance of a coal fired boiler is due to
(a) radiation loss.
(b) dry flue gas loss.
(c) moisture in the air.
(d) hydrogen in the fuel.

358. Three 'T's for good combustion are

(a) through mixing, total air and temperature.
(b) time, temperature and turbulence.
(c) total air, true fuel and turbulence.
(d) total air, time and temperature. **359.** The balance draft furnace is the one using.....for exiting the flue gas out of the furnace.
(a) forced draft fan and chimney
(b) induced draft fan and chimney
(c) induced draft fan and forced draft fan
(d) only chimney

360. Pulverised coal is crushed upto...percent below 200 mesh (74 microns).
(a) 45 (b) 55
(c) 75 (d) 95

361. Under optimum combustion condition for

fuel oil, the % of oxygen in flue gas will be in the range of

- (a) 0.1–0.5 (b) 2–3
- (c) 5–8 (d) 10–12

362. Heat generated in combustion on per kg basis, is the highest for

- (a) carbon
 - (c) sulphur
 - (b) hydrogen (d) oxygen
- 363.** By higher octane number of SI fuel, it is meant that the fuel has

- (a) higher heating value
- (b) higher flash point
- (c) lower volatility
- (d) longer ignition delay

364. The amount of CO_2 produced by 1 kg of carbon on complete combustion is.....kg. (a) $\frac{3}{11}$ (b) $\frac{3}{8}$

- (c) $\frac{8}{3}$ (d) $\frac{11}{3}$

365. An example of shaft furnace is the

- (a) L.D. converter
- (b) glass melting tank
- (c) blast furnace
- (d) soaking pit

366. Shaft furnaces are used for

- (a) smelting (b) calcining
 - (c) roasting (d) all (a), (b) and (c)
- 367.** If the flame is produced under the hearth and then sweeps up into the heating chamber, this is called a/an.....furnace.

- (a) sidefired (b) underfired (c) covered (d) recirculating
- 368.** Tunnel kilns are usually used for

- (a) roasting of pyrites.
- (b) drying/tempering of refractories. (c) reheating of slabs.
- (d) melting of glass.

369. Which is a continuous furnace ?

- (a) Coke ovens
- (b) Annealing furnace
- (c) Glass tank furnace
- (d) None of these

370. Which one shows the diagrammatic heat balance in a furnace ?

- (a) (c)

Sankey diagram (b) Cox chart Ostwald chart (d) None of these

371. Specific heating capacity of a furnace is expressed as

- (a) weight heated/hr
- (b) weight heated/furnace volume
- (c) weight heated/hr/furnace volume (d) none of these

372. If fuel and air are mixed ahead of the burner, it is called a/an.....burner.

- (a) premix
- (b) outside mixing type
- (c) rotary
- (d) diffusion

ANSWERS

354. (c) 355.(c) 356.(c) 357.(b) 358.(b) 359.(c) 360.(c) 361.(b) 362.(b) 263.(d)

364.(d) 365.(c)

366.(d) 367.(b) 368.(b) 369.(c) 370.(a) 371.(c) 372.(a)

373. Reheating furnace steel is used for heating steel.

- (a) ingots (b) slabs
- (c) coils (d) sheets

374. Maximum thermal efficiency of boiler may be about.....percent.

- (a) 10 (b) 25
- (c) 65 (d) 90

375. Soaking pits are meant for heating steel (a) ingots (b) coils

- (c) sheets (d) slabs

376. To reduce the stack heat loss, heat recovery from flue gas can be done by

- (a) preheating of cold stock.
- (b) preheating of combustion air.
- (c) steam generation in waste heat boilers. (d) all (a), (b) and (c).

377. Furnace pressure is normally controlled by regulating the

- (a) air pressure
- (b) fuel gas pressure
- (c) speed of I.D. fan
- (d) damper

378. Blast furnace stoves are meant for heating (a) air (b) blast furnace gas (c) steam (d) none of these

379. Rotary kilns are used in the
(a) calcination of limestone & dolomite (b) cement manufacture.
(c) both (a) and (b).
(d) neither (a) nor (b).

380. Regenerators are normally provided in the (a) glass melting furnace,
(b) open hearth furnace.
(c) by product coke ovens,
(d) all (a), (b) and (c).

381. Forced recirculation of furnace gases is practised
(a) to increase heat transfer by convection. (b) to ensure uniform temperature. (c) in furnaces operating below 750°C. (d) all (a), (b) and (c).

382. Unit of furnace loading is
(a) ton stock/hr/m² hearth area
(b) ton stock/hr
(c) ton stock/m² hearth area
(d) both (b) and (c)

383. Heat balance of furnace provides means of determining the
(a) thermal efficiency the process.
(b) sources of heat losses.
(c) scope of reduction of heat losses. (d) all (a), (b) and (c).

384. In order to maintain an oxidising atmosphere in a furnace, it should have
(a) more of excess air
(b) less of excess air
(c) more of CO in flue gas
(d) more of CO₂ in flue gas

385. Very high pressure boilers are usually..... boilers.
(a) fire tube
(b) water tube
(c) waste heat
(d) natural circulation

386. The function of an economiser in a boiler is to preheat the
(a) feed water (b) (c) pulverised coal(d) combustion air furnace oil

387. An electric furnace producing heat by means of an electric arc struck between each of three electrodes and the charge is called.....furnace.

- (a) resistance
- (b) arc
- (c) low frequency induction
- (d) none of these

388. The resistance furnace produces heat by the

- (a) electric arc struck between electrodes and the charge.
- (b) flow of current through a heating element.
- (c) combination of induced current and skin effect.
- (d) none of these

389. Oxygen percentage in the flue gas coming out of a gaseous fuel fired furnace should be ideally about.....percent.

- (a) <2 (b) <5
- (c)<8 (d) < 10

390. Waste heat from the outgoing flue gases in a thermal power plant is recovered by a/an (a) economiser

- (b) steam superheater
- (c) air preheater
- (d) all (a), (b) and (c)

ANSWERS

373. (b) 374.(d) 375.(a) 376.(d) 377.(d) 378.(a) 379.(c) 380.(d) 381.(d) 382.(a)
383.(d) 384.(a)

385.(d) 386.(a) 387.(b) 388.(b) 389.(a) 390.(d)

391. Fuel economy in furnaces can be achieved by (a) using oxygen enriched combustion air. (b) preheating the combustion air.

- (c) reducing the heat loss through furnace openings & doors.
- (d) all (a), (b) and (c).

392. Air filtration in a furnace

- (a)reduces its thermal efficiency.

(b) is indicated by flame sting out.
(c) increases the flue gas temperature. (d) none of these.

393. atmosphere is maintained inside an iron blast furnace. (a)
Oxidising
(c) Inert

394. Cement Kiln is a (a) rotary Kiln
(b) tunnel Kiln
(c) natural draft furnace
(d) batch furnace

395. Acid dew point temperature (ADT) of a flue gas produced by the combustion of a fuel containing 1% sulphur may be about.....°C? (a) 80 (b) 130
(c) 180 (d) 250

396. Oxygen enrichment of combustion air does not result in increase of the
(a) flame temperature.
(b) oxygen in the flue gas.
(c) stack loss.
(d) heat transfer rate in the furnace.

397. Maximum heat transfer in high temperature furnaces is by
(a) conduction
(b) convection
(c) radiation
(d) either (a), (b) or (c); depends on the type

of furnace

398. Neutral atmosphere is maintained in a/ an.....furnace.
(a) cold rolled steel coil annealing
(b) open hearth
(c) soaking pit
(d) walking beam reheating

399. Which of the following is a batch furnace ? (a) Cupola
(b) Reheating furnace
(c) Glass tank furnace

- (b) Reducing
- (d) Decarburising

400. Large tonnage of refractory bricks are dried in

- (a) shaft furnace
- (b) rotary hearth furnace
- (c) tunnel kiln
- (d) muffle furnace

401. Flue gas outlet temperature from the chimney of any furnace should be ideally about.....°C.

- (a) 50 (b) 100
- (c) 150 (d) 250

402. furnace is not an electric furnace. (a) Arc (b) Induction (c) Pot (d) Resistance.

403. While the fuel fired furnace can be used upto a maximum temperature of about 1700°C, the electric furnace can be used upto a temperature of about.....°C.

- (a) 2000 (b) 3000
- (c) 4500 (d) 6000

404. Use of pulverised coal in boilers provides (a) higher calorific value

- (b) better combustion
- (c) smokeless burning
- (d) less erosion on furnace wall.

405. Overfire burning in a furnace is a phenomenon characterised by

- (a) supply of excess fuel.
- (b) supply of excess air.
- (c) burning carbon monoxide and other incombustible in upper zone of furnace by supplying more air.

- (d) none of these.

406. In case of pulverised coal fired steam boiler, the secondary air serves the main purpose of

- (a) transportation of coal.
- (b) drying of coal.

- (c) combustion of coal by supplying it around the burner.
- (d) preheating the primary air.

407. A system in which the boiler operates with a forced draft & induced draft fan is called..... the draft.

- (a) induced (b) natural
- (c) forced (d) balanced

408. Heat loss through openings in furnaces is directly proportional to the.....furnace temperature.

- (d) None of these

ANSWERS

391. (d) 392.(a) 393.(b) 394.(a) 395.(b) 396.(b) 397.(c) 398.(a) 399.(a) 400.(c)

401.(c) 402.(c)

403.(c) 404.(b) 405.(c) 406.(c) 407.(d) 408.(c)

- (a) fourth power of
- (b) square of absolute
- (c) fourth power of absolute
- (d) absolute

409. Thermal efficiency of a typical fluidised bed combustion (FBC) boiler will be around.....per cent.

- (a) 50 (b) 70
- (c) 80 (d) 90

410. Fluidised bed temperature exceeding 950°C in a FBC boiler may result in

- (a) ash carryover.
- (b) melting of limestone.
- (c) overheating.
- (d) ash fusion.

411. High percentage of carbon monoxide presence in the flue gas of boiler is an indicator of (a) high excess air.

- (b) low excess air.
- (c) good control of pollutants.
- (d) complete combustion.

412. Preheating of combustion air by 100 °C will save about.....per cent of

fuel.

- (a) 0.5 (b) 5
- (c) 20 (d) 35

413. Increase in feed water temperature by 30 °C for an oil fired boiler results in a saving of about.....per cent of fuel.

- (a) 0.5 (b) 5
- (c) 15 (d) 25

414. Pick out the wrong statement. The thermal efficiency of a furnace increases by

- (a) minimising unburnt losses.
- (b) preheating combustion air.
- (c) maintaining high level of excess air. (d) reducing surface heat losses.

415. Major heat losses in a furnace is accounted by

- (a) furnace openings.
- (b) hydrogen in fuel.
- (c) radiation losses.
- (d) sensible heat loss in exit flue gas.

416. The hearth pressure in the heating zone of furnace should be.....pressure.

- (a) slightly negative
- (b) high negative
- (c) slightly positive
- (d) High positive

417. For the same size and rating, efficiency of continuous furnaces will be more than batch type furnaces mainly because of

- (a) reduced flue gas losses in continuous fur-

nances.

- (b) reduced opening losses in continuous furnaces.

(c) increased flue gas losses in batch furnaces. (d) loss of energy stored in walls of batch furnaces.

ANSWERS

409.(d) 410.(d) 411.(b) 412.(b) 413.(b) 414.(c) 415.(d) 416.(b) 417.(b)

M
aterials of
c

13

Construction

1. Bog iron used for the adsorption of H_2S from 8. coke oven gas is
(a) an intimate mixture of saw dust and iron

dust (i.e. moist ferric hydroxide).

(b) iron impregnated with resin (usually bakelite). 9. (c) carbon free iron.

(d) none of these.

2. Iron alloyed with carbon upto 2% is called (a) pig iron (b) wrought iron (c) low carbon steel (d) none of these 10. Carbon content in steel is.....percent.

3. The softest material in Mohr's scale (for measuring hardness) is

(a) talc

(c) rubber

4. Karbate is

(c) 2–4 (d) 0.001–0.01 (b) gypsum 11. An ideal material of construction for the storage of 50% caustic soda solution would be

(a) karbate

Presence of cobalt in steel improves its (a) cutting ability

(b) corrosion resistance

(c) tensile strength

(d) none of these

The impure iron (pig iron) that is tapped out from blast furnace contains about..... percent carbon.

(a) 0.2 (b) 2

(c) 4 (d) 8

(a) a mixture of iron dust and saw dust. (b) high silicon cast iron

(b) carbon impregnated with resin (usually (c) monel bakelite). (d) none of these

(c) an acid resistant material. **12.** Brine (15% concentration) can be stored in a (d) both (b) and (c). vessel made of

5. Duralumin is an alloy of (a) monel (b) karbate (a) aluminium, copper and manganese. (c) cast iron (d) none of these (b) aluminium, nickel and silicon. **13.** Most suitable material of construction for the (c) aluminium and nickel. storage of concentrated nitric acid is (d) none of these. (a) cast iron

6. Corrosion resistance of steel is increased by (b) monel the addition of

(a) phosphorous and tungsten.

(b) nickel and chromium.

(c) lead and vanadium.

(d) molybdenum and tungsten.

7. White metal is an alloy of

(a) lead, tin and cadmium

(b) copper, tin and zinc

(c) copper and lead

(d) none of these

(c) karbate

(d) aluminium or chromium alloys (Cr >18%

for cold acid)

14. Babbit metal (used for making bearings) comprises of

(a) mainly tin (85%) and lead. (b) saw dust and iron dust mixture.

(c) zinc and aluminium.

(d) copper and aluminium.

1.(a) 2.(d) 3.(a) 4.(d) 5.(a) 13.(d) 14.(a)

ANSWERS

6.(b) 7.(d) 8.(a) 9.(c) 10.(a) 11.(c) 12.(a)

15. The material of construction of pressure mills used for squeezing out the juice from sugar cane is

(a) stainless steel (c) mild steel

(b) cast iron (d) monel

16. Chlorination of benzene is done to produce benzene hexachloride (a pesticide) in a photo- chemical reactor lined with

(a) karbate (b) lead or glass (c) fireclay bricks (d) PVC

17. Polymerisation reactor used for the production of styrene butadiene rubber (SBR) is made of (a) cast iron

(b) stainless steel or glass lined vessel (c) karbate

(d) wrought iron

18. Which of the following is the most suitable material of construction for evaporator & its tubes for concentrating NaOH solution to 70%?

(a) Cast iron (b) Steel

(c) Nickel (d) Karbate

19. Most common stainless steel type 316, which is highly resistant to corrosion contains (a) 16–13% Cr 10–14% Ni and 2–3% Mo. (b) 20–22% Cr, and 8–10% Ni.

(c) 2–4% Cr, 22% Ni and 2–4% Mo.

(d) none of these.

20. Caustic soda can be stored in.....drums. **25.** Bronze is an alloy of copper and

(a) lead (b) tin

(c) nickel (d) zinc

26. Rotary kilns in cement industry are lined with.....bricks.

(a) fireclay

(b) silica

(c) lead

(d) high alumina & high magnesia

27. In the kraft (sulphate) process for the paper manufacture, the digester is made of (a) cast iron

(b) (c) (d)

stainless steel karbate carbon wrought iron

(a) steel

(c) brass

21. Brass is an alloy of (a) nickel and tin (b) copper and zinc (c) tin and lead (d) copper, nickel and zinc

22. The carbonating tower used in Solvay process of soda ash manufacture is made of

(a) cast iron (b) (c) karbate (d)

23. Gun metal is an alloy of (a) nickel, tin and copper (b) copper, tin and zinc (c) copper, phosphorus and nickel (d) manganese, phosphorus and nickel

24. Balls in a ball mill are usually made of (a) steel (b) cast iron (c) stainless steel (d) bronze (b) cast iron (d) gun metal **28.** Dry chlorine can be handled in a vessel made

of

(a) iron or steel (b) PVC

(c) nickel (d) brass

29. Tank furnace used for melting of glass is made of

(a) mild steel (b) cast iron (c) refractory blocks (d) stainless steel

30. Stainless steel contains

(a) chromium and nickel (b) copper

(c) aluminium (d) vanadium

31. Caustic soda is produced in a mercury cell having anode and cathode made respectively of moving mercury and

(a) (b) (c) (d)

moving mercury and graphite.

graphite and moving mercury.

moving mercury and carbon.

moving mercury and crimped steel wire.

32. Monel metal is an alloy of (a) (b) (c)

molybdenum and nickel. nickel and copper.

molybdenum and aluminium,

stainless steel lead lined steel

(d) molybdenum and zinc. **33.** German silver is an alloy of

(a) copper, nickel and zinc.

(b) copper, aluminium and silver.

(c) silver, zinc and aluminium.

(d) silver, nickel and zinc.

34. Chromel (Nichrome) is an alloy of

(a) chromium and molybdenum.

(b) nickel and chromium.

(c) molybdenum and nickel. (d) chromium and aluminium.

ANSWERS

15. (b) 16. (b) 17. (b) 18. (c) 19. (a) 20. (a) 21. (b) 22. (a) 23. (b) 24. (a) 25. (b) 26. (d)

27. (b) 28. (a) 29. (c) 30. (a) 31. (b) 32. (b) 33. (a) 34. (b)

35. Urea autoclave is made of

(a) cast iron (b) refractory blocks (c) stainless steel (d) lead lined steel

36. Steel tower used for the storage of oleum (a) is lined with lead.

(b) need not be lined.

(c) is lined with rubber.

(d) is lined with acid-proof bricks.

37. Hydrochloric acid is stored in a.....vessel. (a) lead lined steel (c) stainless steel (b) rubber lined steel (d) cast iron

38. Photographic plates are coated with

(a) silver nitrate (b) silver halide (c) calcium silicate (d) metallic silver

39. Aqueous nitric acid is stored in

(a) steel drum

(b) stainless steel vessel

(c) cast iron vessel lined with acid-proof masonry brick

(d) cast iron vessel

40. SO_3 is absorbed using H_2SO_4 in a

(a) cast iron packed tower.

(b) stainless steel plate tower.

(c) packed steel tower lined with acid proof

bricks.

(d) none of these.

41. Hydrochloric acid absorber is made of (a) wrought iron (b) brass
(c) bronze (d) monel

46. The most resistant material to alkaline corrosion is
(a) duriron (b) nickel (c) aluminium (d) karbate

47. Presence of nickel in steel improves its (a) (a) (b)

corrosion resistance. cutting ability.
wear resistance.

(c) all (a), (b) and (c).

48. An alloy of iron containing 4% carbon is called
(a)
(c)

high carbon steel (b) wrought iron mild steel (d) none of these

49. Bell metal is an alloy of
(a) copper & zinc (b) copper & tin (c) copper & nickel (d) zinc & tin

50. Inconel is an alloy of
(a) tin, zinc and nickel
(b) (c) (d)

iron, nickel and chromium copper and nickel
copper and tin

51. Hastelloy comprises of (a) (b) (c) (d)

copper and tin
copper and nickel
molybdenum and nickel lead and tin

(b) mild steel
(d) stainless steel (a) cast iron (c) karbate

42. Sulphuric acid is mixed with ground phosphate rock (to produce phosphoric acid) in a steel digester lined with

- (a) acidic refractory
- (b) rubber
- (c) karbate
- (d) lead or acid-proof bricks

43. Hydrochloric acid is.....corrosive to common metals.

- (a) least (b) not
- (c) mildly (d) highly

44. In SO_3 absorber (Contact Process), packing material used is of

- (a) cast iron
- (b) chemical stoneware
- (c) karbate
- (d) mild steel

45. Valves in pipe size of 2" and under are normally made of

52. Ability of a material to absorb energy in deformation in the plastic range is characterised as its

- (a) ductility (b) toughness (c) creep (d) resilience

53. Slow and progressive deformation of a material with time under constant stress is called (a) creep (b) erosion (c) resilience (d) none of these

54. Wrought iron is

- (a) (b) (c)

- (d)

high carbon iron.

highly resistance to acid corrosion. malleable & ductile; and hence is used for chain links, hooks & couplings.

an alloy of iron, chromium & carbon.

55. Which of the following constituents of cast iron is mainly responsible for imparting it an anticorrosive property ?

(a) Silicon (b) Phosphorus (c) Sulphur (d) None of these

ANSWERS

35. (c) 36. (b) 37. (b) 38. (b) 39. (b) 40. (c) 41. (c) 42. (d) 43. (d) 44. (b) 45. (b) 46. (b)
47. (a) 48. (d) 49. (b) 50. (b) 51. (c) 52. (b) 53. (a) 54. (c) 55. (a)

56. Mild steel is

(a) a low carbon steel (0.05 to 0.3% carbon). (b) highly resistant to corrosion (as much as stainless steel).

(c) a high carbon steel (0.5 to 1.5% carbon). (d) very poor in strength & ductility.

57. Presence of manganese in alloy steel improves its

(a) corrosion resistance.

(b) cutting ability.

(c) abrasion resistance & toughness. (d) elasticity & creep resistance.

58. Aluminium storage vessel can be used to store (a) aqua regia

(b) ferrous sulphate

(c) hydrochloric acid (10%)

(d) none of these

59. Brass container is suitable for storing (a) aqueous ammonia

(b) beer

(c) H_2SO_4 (95%)

(d) phosphoric acid (95%)

60. Cast iron vessels are not suitable for the storage of

(a) freon

(b) H_2SO_4 (95%) at room temperature (c) H_2SO_4 (fuming)

(d) wet SO_2

61. Out of the following, copper vessels are the most suitable for the storage of

(a) bromine.

(b) dry chlorine & dry fluorine.

(c) nitric acid (95% and fuming).

(d) phosphoric acid (95%) & sulphuric acid

(95% and fuming).

62. Gunmetal and bronze are not corroded by the action of

- (a) wet chlorine.
- (b) synthetic detergent solution.
- (c) hydrochloric acid (10%).
- (d) nitric acid (< 25%).

63. Containers made of high silicon cast iron (14% Si) are not suitable for the storage of

- (a) acetic acid.
- (b) benzoic & boric acids.
- (c) phosphoric acid (95%) & sulphuric acid (95%).
- (d) hydrochloric acid (concentrated).

64. Lead lined equipments & vessels are suitable for handling

- (a) hydrochloric acid (10%).
- (b) nitric acid.
- (c) sulphuric acid upto 600C.
- (d) all (a), (b) and (c).

65. Mild steel storage vessels are suitable for the storage of

- (a) anhydrous ammonia
- (b) fatty acids
- (c) hydrochloric acid (95%)
- (d) sulphuric acid (25%)

66. Nickel made/clad equipments are suitable for handling

- (a) ammonia (both aqueous & anhydrous).
- (b) fruit juices, milk & its products and caustic

soda solution.

- (c) nitric acid & hydrochloric acid (concentrated).
- (d) sulphuric acid (concentrated).

67. Platinum and silver are corroded by

- (a) caustic soda solution
- (b) phosphoric acid
- (c) sulphuric acid (10%)
- (d) none of these

68. 18/8 stainless steel means, that it contains (a) 18% chromium and 8% nickel.
(b) 18% chromium and 8% molybdenum. (c) 18% nickel and 8% chromium.
(d) 18% molybdenum and 8% chromium.

69. Stainless steel is not corroded by
(a) hydrochloric acid (10%).
(b) nitric acid (10%).
(c) sulphuric acid (10%).
(d) saturated brine.

70. Tin vessels are corroded by
(a) anhydrous ammonia
(b) aromatic solvents
(c) synthetic detergent solution
(d) none of these

71. Rubber lined vessels are corroded by the action of
(a) aqua regia (b) chloroform (c) sulphuric acid (95%)(d) all (a), (b) and (c)

72. Silicone rubber is not resistant to the corrosive action of
(a) sulphuric acid (10%)
(b) sulphuric acid (95%)
(c) ether
(d) both (b) and (c)

ANSWERS

56. (a) 57.(c) 58.(d) 59.(b) 60.(d) 61.(b) 62.(b) 63.(d) 64.(c) 65.(a) 66.(b) 67.(d)
68.(a) 69.(b) 70.(d) 71.(d) 72.(d)

73. Perspex is nothing but
(a) acrylic sheet
(b) an elastomer
(c) an alloy of lead and tin
(d) aluminium foil clad with bakelite

74. Teflon (PTFE) is corroded by
(a) hydrochloric acid (10%)
(b) hydrochloric acid (95%)
(c) sulphuric acid
(d) none of these

75. Polythene (low or high density) containers are not corroded by
(a) sulphuric acid (10%) at room temperature. (b) nitric acid (95%) at room temperature, (c) sulphur trioxide at 60°C.
(d) any of these.

76. The most commonly used resin for making reinforced plastic is
(a) unsaturated polyester
(b) polypropylene
(c) polyurethane
(d) nylon-6

77. Carbon tetrachloride can be stored in a storage vessel made of
(a) high silicon iron (14% Si)
(b) tin
(c) stainless steel
(d) all (a), (b) and (c)

78. Concrete tank can be used to store
(a) alum (b) ferrous sulphate (c) sulphuric acid (d) saturated brine

79. Glass is corroded by
(a) fluorine (dry or wet) (b)
(c) phosphoric acid (d)
sulphuric acid none of these

80. Graphite is corroded by
(a) sulphuric acid (10%) (b) seawater (d) none of these (c) hydrochloric acid

81. Wood is corroded by (a) hydrochloric acid (c) chlorine (dry or wet) (b) SO₂
(dry or wet) (d) all (a), (b) and (c)

82. The 'bomb' in the bomb calorimeter is made of (a) molybdenum stainless steel
(b) mild steel
(c) high silicon iron (14% Si)
(d) copper

83. Most suitable material for high pressure vessel operating at 500 atm. and 500° C is (a) molybdenum stainless steel.
(b) 18/8 stainless steel.

- (c) mild steel.
- (d) high silicon iron (14% Si).

84. Centrifugal pump made of pyrex or glass can't be used to pump

- (a) milk and fruit juices.
- (b) alkaline solutions.
- (c) dilute H_2SO_4 at room temperature. (d) brine.

85. Rubber lined pumps can be used to pump (a) caustic soda

- (b) chlorinated brine
- (c) hypochlorous acid
- (d) all (a), (b) and (c)

86. Copper is dissolved from its ore by H_2SO_4 in a percolation tank made of

- (a) wood
- (b) stainless steel
- (c) reinforced concrete lined with lead (d) high silicon iron (14% Si)

87. Rotary driers are generally made of

- (a) cast iron
- (b) mild steel
- (c) high silicon iron (14% Si)
- (d) tin lined with refractory bricks

88. Kel-F is a material, which is

- (a) chemically known as polychlorotrifluoro- ethylene (PTFE).
- (b) having excellent chemical & high temperature resistance (upto 200°C).
- (c) having elastomeric properties.
- (d) all (a), (b) and (c).

89. Zircalloy used as a fuel cladding material in a nuclear reactor (thermal) is an alloy of zirco- nium

- (a) tin, nickel, iron and chromium
- (b) and graphite
- (c) and copper
- (d) none of these

90. Which of the following would not be a suitable material of construction for handling aqueous hydrofluoric acid (HF) at 1000°C ?

- (a) Monel
- (b) Stainless steel
- (c) Graphite
- (d) Kel-F and teflon

91. Specify the material of construction suitable for handling concentrated HNO_3 at 100°C .

ANSWERS

73. (a) 74. (d) 75. (a) 76. (a) 77. (d) 78. (d) 79. (a) 80. (d) 81. (d) 82. (a) 83. (a) 84. (b) 85. (d) 86. (c) 87. (b) 88. (d) 89. (a) 90. (b) 91. (a)

(a) High silicon iron, Kel-F and teflon (b) Tin and wood

(c) Silicone rubber

(d) Stainless steel

92. Concentrated HCl at 30°C can be stored in a vessel made of

(a) PTFE and porcelain.

(b) cast iron and aluminium.

(c) stainless steel and high silicon cast iron. (d) none of these.

93. Which of the following material of construction may be recommended by a chemical engineer for handling a gaseous chlorine (dry or wet) stream in a fluid flow system?

(a) High silicon iron, silicon rubber, Kel-F and

teflon.

(b) Mild steel and stainless steel.

(c) Cast iron, tin and aluminium.

(d) Copper, nickel and monel.

94. Which of the following materials may prove unsuitable for handling acetic acid (glacial & anhydrous) at 40°C ?

(a) Silicone rubber, teflon, porcelain and wood. (b) Nickel, monel, stainless steel and graphite. (c) Aluminium, copper, high silicon iron. (d) Brass, cast iron, mild steel and tin.

95. H_2SO_4 at 30°C can't be stored in a vessel made/ lined with

(a) cast iron and high silicon iron.

(b) mild steel and stainless steel.

- (c) aluminium, tin and rubber.
- (d) teflon, glass and porcelain.

96. Which of the following is an alloy of nickel and copper?

- (a) Hastelloy (b) Duriron (c) Monel (d) Inconel

97. Thermal shield used in high powered nuclear reactor to protect the walls of the reactor from radiation damage is made of

- (a) concrete (b) steel
- (c) zircalloy (d) graphite

98. Biological shield in a nuclear power reactor is made of

- (a) concrete (c) cadmium (b) steel
- (d) zircalloy

99. Muntz metal is a/an alloy of (a) magnesium & tin

- (b) ferrous material
- (c) lead & tin
- (d) copper & zinc

100. The digester of a Gobar gas plant is a (a) mild steel drum

- (b) stainless steel vessel
- (c) masonry well
- (d) cast iron vessel

101. Gas holder of a gobar (cow dung) gas plant is made of

- (a) molybdenum stainless steel
- (b) tin
- (c) mild steel
- (d) aluminium

102. Coke oven walls are lined with.....bricks. (a) silica

- (b) tar–dolomite
- (c) low thermal conductivity
- (d) fire clay

103. Coke oven regenerators are made of..... bricks.

- (a) fire clay
- (b) silica

- (c) low thermal conductivity
- (d) high electrical conductivity

104. Presence of nitrogen in steel

- (a) makes it brittle.
- (b) increases its strength.
- (c) increases its hardness.
- (d) is desirable.

105. Invar used in thermocouples is an alloy of nickel and

- (a) iron (b) copper (c) chromium (d) lead

106. Constantan used in thermocouples is an alloy of

- (a) iron & copper
- (b) copper & aluminium
- (c) lead & tin
- (d) none of these

107. For handling sulphuric acid of 95% strength, the suitable material of construction for pipes is

- (a) stainless steel (b) cast iron (c) aluminium (d) nickel

108. Hardest material so far found is

- (a) diamond (b) graphite (c) carborundum (d) pumice stone

ANSWERS

92. (a) 93. (a) 94. (d) 95. (c) 96. (c) 97. (b) 98. (a) 99. (d) 100. (c) 101. (c) 102. (a) 103. (a)

104. (a) 105. (a) 106. (d) 107. (b) 108. (a)

109. Lead alone is not used in storing equipment, because it

- (a) is very costly.
- (b) corrodes easily.
- (c) is having low creep strength.
- (d) none of these.

110. With increase in the carbon percentage in the steel, its

- (a) hardness increases.
- (b) ductility reduces.
- (c) tensile strength increases.

(d) all (a), (b) and (c).

111. Low carbon steels are those in which carbon percentage is around

(a) 0.1 to 0.35 (b) 0.4 to 0.7 (c) 0.8 to 1.5 (d) 1.5 to 2

112. Carbon percentage in medium carbon steel is around

(a) 0.1 to 0.35 (b) 0.35 to 0.5 (c) 0.8 to 1.4 (d) 1 to 1.5

113. High carbon steel contains more than percent carbon.

(a) 0.5 (b) 2.2

(c) 2.5 (d) 2.8

114. Liquid ammonia is shipped in.....containers.

(a) steel (b) aluminium (c) glass (d) lead lined

115. Water gas generator is made of

(a) carbon steel-brick lined

(b) stainless steel-lead lined

(c) cast iron

(d) high carbon steel-procelain lined

116. The chlorinator used in the manufacture of DDT is made of

(a) glass (b) glass lined steel (c) teflon (d) bakelite

117. The fermentor used for the production of ethyl alcohol from molasses is made of

(a) wood

(b) concrete

(c) copper bearing steel

(d) porcelain

118. The fermentor used in the production of penicillin (by deep fermentation process) is made of

(a) glass

(b) glass lined steel

(c) high silicon cast iron

(d) porcelain

119. Reactor used in the production of polyvinyl chloride (PVC) is made of

(a) nickel or glass lined steel

- (b) aluminium
- (c) tantalum
- (d) lead

120. Polymerisation reactor used in the production of styrene butadiene rubber (SBR) is made of

- (a) stainless steel or glass lined steel
- (b) nickel clad steel
- (c) high silicon cast iron
- (d) aluminium

121. Soap kettle used in the production of laundry soap is made of

- (a) steel with top section nickel clad or stainless steel
- (b) cast iron
- (c) nickel
- (d) concrete

122. Tubes of multiple effect evaporator used for concentration of sugar cane juice are made of

- (a) nickel
- (b) copper
- (c) stainless steel
- (d) brass

123. In the Kraft process of sulphate paper pulp manufacture, the black liquor and the white liquor storage tank is made of

- (a) concrete
- (b) wood
- (c) steel
- (d) porcelain

124. In the Contact process of sulphuric acid manufacture, 98% acid cooler is made of

- (a) stainless steel
- (b) cast iron
- (c) lead lined steel
- (d) rubber lined steel

125. Sulphur melting pit in the sulphuric acid plant is made of

- (a) lead lined stainless steel.
- (b) cast iron.
- (c) steel or cement-brick lined.
- (d) hard wood.

126. Evaporator used for concentrating tomato juice is made of

- (a) nickel

- (b) brass
- (c) stainless steel-glass lined
- (d) cast iron-rubber lined

ANSWERS

109. (c) 110. (d) 111. (a) 112. (b) 113. (a) 114. (a) 115. (a) 116. (b) 117. (c) 118. (b)
119. (a) 120. (a)

121. (a) 122. (b) 123. (c) 124. (b) 125. (c) 126. (c)

127. Which of the following has the poorest weldability ?

- (a) Low carbon steel
- (b) Mild steel
- (c) Wrought iron
- (d) High-carbon steel

128. Which of the following stainless steels is nonmagnetic ?

- (a) Ferritic (c) Austenitic (b) Martensitic (d) None of these

129. Dilute sulphuric acid is transported in..... pipes.

- (a) mild steel (b) lead
- (c) copper (d) special alloys

130. The material of construction of bearings is (a) cast iron (c) pig iron (b) babbit metal (d) steel

131. The material used in the filament of electric bulbs is

- (a) nichrome (b) tungsten (c) constantan (d) German silver

132. Constantan is an alloy of

- (a) Cu (55%) & Sn (45%).
- (b) Cu (55%) & Ni (45%).
- (c) Pt (95%) & Rh (10%).
- (d) Fe (80%) & Ni (20%).

133. For platinum thermocouples, lead wires are made of

- (a) copper & copper-nickel alloys.
- (b) copper & iron.
- (c) iron & nickel.
- (d) tin & nickel.

134. Ceramic recuperators are generally made of (a) silicon carbide.
(b) calcium carbide.
(c) fireclay bricks.
(d) high alumina bricks.

135. Beehive coke ovens are made of.....bricks. (a) silica (b) fireclay (c) silicon carbide (d) corundum

136. The main purpose of galvanising iron sheets is to
(a) harden the surface.
(b) increase its glossiness and lustre. (c) prevent the action of water.
(d) prevent the action of oxygen.

137. The purpose of nitriding the steel is to (a) harden its surface.
(b) soften its surface.
(c) improve its reliability.
(d) none of these.

138. Which of the following has the least carbon percentage ?
(a) Low carbon steel (b) Mild steel (c) Wrought iron (d) White cast iron

139. Metalloid is
(a) highly electronegative in nature. (b) an element which exhibits the properties
of both metal & non-metal.
(c) an alloy.
(d) all (a), (b) and (c).

140. Tempering of steel is done to make it (a) brittle (b) hard
(c) rollable (d) soft

141. Iron rust is
(a) ferrous oxide.
(b) hydrated ferric oxide.
(c) powdered iron.
(d) ferric sulphide.

142. Corrosion involves exchange of electrons in case of corrosion.
(a) chemical
(b) electrochemical

- (c) both (a) & (b)
(d) neither (a) nor (b)

143. Which of the following is the most prone to atmospheric corrosion?

- (a) Silver (b) Iron
(c) Tin (d) Copper

144. Atmospheric corrosion of metals result from their

- (a) slow oxidation (b) fast oxidation (c) fast hydration (d) slow dehydration

145. Galvanised iron is

- (a) harder
(b) protected from rusting
(c) alumina coated iron
(d) none of these

146. When iron is rusted, it is

- (a) converted to a fine powder
(b) reduced
(c) oxidised
(d) none of these

147. Which is the purest form of iron?

- (a) Wrought iron (b) Pig iron (c) Bessemer iron (d) Grey iron

ANSWERS

127. (d) 128. (c) 129. (b) 130. (b) 131. (b) 132. (a) 133. (a) 134. (a) 135. (a) 136. (c)
137. (a) 138. (c)

139. (b) 140. (d) 141. (b) 142. (c) 143. (b) 144. (a) 145. (b) 146. (c) 147. (a)

148. Nickel and copper are the basic constituents of

- (a) hastelloy (b) monel metal (c) German silver (d) inconel

149. Nickel and molybdenum are the basic constituents of

- (a) hastealloy (c) inconel
(b) German silver (d) solder

150. Manganese in steel affects its (a) ductility (c) hardness (b) tensile strength

- (d) none of these

151. A material is called 'ductile', if it can be (a) drawn into wires.
(b) hammered to a thin sheet.
(c) fractured without deformation.
(d) made lustrous by heating it.

152. The ability of a material to absorb energy in the elastic range is a measure of its
(a) toughness (b) resilience (c) malleability (d) brittleness

153. The damage/deterioration of metals by the.....action of fluids is called 'erosion'. (a) abrasive (b) corrosive
(c) both (a) & (b) (d) neither (a) nor (b)

154. The process of coating steel sheets by zinc to improve its corrosion resistance is called (a) calorising (b) galvanising (c) zincification (d) tempering

155. The ability of a material to offer resistance to scratching or indentation is a measure of its (b) toughness (d) resilience (a) brittleness (c) hardness

156. A material is able to retain the deformation permanently by virtue of its (b) plasticity (d) malleability (a) elasticity (c) ductility

157. Cast iron is a.....material.
(a) brittle (b) ductile (c) tough (d) malleable

158. Ball bearings are normally made of steel.
(a) high speed (b) high carbon (c) chrome (d) silicon

159. Hardened steel is softened by
(a) normalising (b) tempering (c) annealing (d) carburising

160. Babbit metal used for bearings is a..... base alloy.
(a) tin (b) lead
(c) aluminium (d) copper

161. Percentage of silver in German silver is (a) 5 (b) 10
(c) 20 (d) 0

162. Heavy duty bearings are usually made of (a) white metal
(b) phosphorous bronze

- (c) monel
- (d) zinc

163. Invar contains the highest percentage of (a) vanadium (b) iron
(c) tungsten (d) cobalt

164. The electrical conductivity of a.....decreases with rise in temperature.
(a) metal/alloy (c) dielectric (b) semi-conductor (d) none of these

165. Interchain forces are the weakest in case of (a) plastics
(b) fibres
(c) elastomers
(d) both rubber & elastomers

166. Creep is not exhibited at low temperature by (a) rubber (c) lead
(b) acrylics (d) plastics

167. Residual magnetism in steel for magnets is increased by the addition of
(a) nickel (b) cobalt
(c) tungsten (d) chromium

168. Which is an amorphous material ?
(a) Glass (b) Mica (c) Brass (d) Cast iron

169. Tempering of steel is done to make it (a) brittle (b) hard
(c) rollable (d) soft

170. Austenitic manganese steel used for making jaws of crushing machines contains about.....percent manganese.
(a) 1.5–2 (b) 3.5–4.5 (c) 7–9 (d) 12–14

171. Which of the following commercial metals is most abundantly found in India?
(a) Copper (b) Aluminium (c) Nickel (d) Zinc

ANSWERS

148. (b) 149. (a) 150. (b) 151. (a) 152. (b) 153. (a) 154. (b) 155. (c) 156. (b) 157. (a)
158. (c) 159. (b)
160. (a) 161. (d) 162. (a) 163. (b) 164. (a) 165. (d) 166. (c) 167. (b) 168. (a) 169. (d)

170.(d) 171.(b)

172. Aluminium as a material of construction suffers from the disadvantage of

(a) very high cost.

(b) rather low tensile strength.

(c) very low strength to weight ratio. (d) scarce availability.

173. Aluminium alloy is one of the most suitable materials of construction for aircrafts mainly due to its

(a) high strength to weight ratio.

(b) low temperature strength properties. (c) its ability to be cast, rolled, forged & stamped.

(d) high strength and corrosion & oxidation resistance at elevated temperature.

174. Which of the following is the lightest of engineering metals? (a)

Magnesium (c) Titanium

175. Copper has very low (a) malleability (b) ductility

(c) tensile strength (d) thermal & electrical conductivity

176. German silver used for decorative purposes contains maximum percentage of

(a) silver (b) copper

(c) zinc (d) nickel

177. Wrought iron is having very high

(a) hardness.

(b) strength.

(c) corrosion resistance.

(d) susceptibility to changes in its properties

by heat treatment.

178. Cast iron is having very high

(a) proximity between its elastic limit and ultimate breaking strength.

(b) ductility.

(c) tensile strength.

(d) all (a), (b) and (c).

179. Which of the following is not an alloy of copper and tin ?

- (a) Bell metal
- (b) Gun metal
- (c) Admiralty gun metal
- (d) Monel metal

180. As the impurities are oxidised, the melting point of iron

- (b) Aluminium (d) Tin
- (a) decreases.
- (b) remains unchanged.
- (c) increases.
- (d) may increase or decrease ; unpredictable.

181. Maximum consumption of zinc is in (a) alloying

- (b) galvanising
- (c) utensil manufacture
- (d) electrical industry

182. Zinc is highly.....at room temperature. (a) ductile

- (b) resistant to atmospheric corrosion (c) malleable
- (d) brittle

183. The largest consumption of zinc for alloys is in the making of

- (a) bearing metal (b) brasses
- (c) brazing solder (d) die casting alloys

184. Which of the following is not an alloy of tin? (a) White-bearing metal

- (b) Pewter type metal
- (c) Soft solder
- (d) German silver

185. Tin coating is not done by

- (a) vaporising
- (c) electro deposition (b) hot dipping (d) spraying

186. Tin in its pure form is used for making (a) cans for food packing.

- (b) collapsible tubes for toilet preparations. (c) foil for wrapping cheese.
- (d) all (a), (b) and (c).

187. Among the tin containing alloys, ...consumes the maximum amount of

tin. (a) solder
(c) pewter metal

188. Lead

(a) is the hardest metal in common use. (b) is the lightest metal in common use.
(c) can not be scratched by finger nails. (d) can not be work hardened.

189. Maximum consumption of lead is in the manufacture of

(a) storage batteries.
(b) solder alloys.
(c) electric cable sheathing.
(d) lead lined vessels.

190. Lead is

(a) not resistant to corrosion.
(b) white metal (d) bronzes

ANSWERS

172. (b) 173.(a) 174.(a) 175.(c) 176.(b) 177.(c) 178.(a) 179.(d) 180.(c) 181.(b)
182.(b) 183.(b)

184.(d) 185.(a) 186.(d) 187.(a) 188.(d) 189.(a) 190.(d)

(b) used as a cathodic material.

(c) not used as pigment (in its compound forms) for paints.

(d) used as a shock absorber (in mattress form) between the foundation and steel framework of skyscraper buildings.

191. Maximum consumption of copper is in (a) utensil manufacture.

(b) electrical industry.

(c) industrial equipment manufacture. (d) small scale industries.

192. Which of the following is not an alloy of copper?

(a) Muntz metal

(b) Admirability gun metal

(c) German silver

(d) Pewter metal

193. Babbit metals used for making bearings are (a) tin or lead based alloys.

(b) short of antifrictional properties. (c) having homogenous microstructure. (d) yellow metals.

194. Tin base and lead base alloys are used for bearing materials. Tin compared to lead has lower

(a) price.

(b) corrosion resistance. (c) thermal conductivity. (d) abundant availability.

195. Babbit metal is not a (a) tin base alloy (c) lead base alloy

(b) (d)

white metal pure metal

196. Which of the following is produced by condensation polymerisation ?

(a) Bakelite (b) Polythene (c) Poly vinyl chloride (d) Polystyrene

197. Which of the following is produced by addition polymerisation ?

(a) Polybutadiene

(b) Phenol formaldehyde

(c) Urea–formaldehyde

(d) Dacron

198. Thermosetting resins are those polymers, which

(a) do not increase in plasticity with rise in

temperature.

(b) allow slip to occur between molecules. (c) do not take on a permanent set.

199. Thermoplastic resins are those polymers,

which

(a) has decreased plasticity at increasing temperature.

(b) can not be moulded.

(c) easily deform under pressure at high temperature.

(d) none of these.

200. Combination of metals and ceramics are called (a) metalloy

(b) cermets

(c) pellets

(d) non–crystalline ceramics

201. Cermets are used for making

(a) cutting tools

- (b) abrasives
- (c) both (a) & (b)
- (d) neither (a) nor (b)

202. Spark plugs are made of

- (a) high alumina ceramic
- (b) metallic carbides
- (c) corundum
- (d) carborundum

203. Liners of a ball mill are never made of (a) lead

- (b) alloy steel
- (c) rubber or ceramic material
- (d) cast iron

204. Brine solution is stored/treated in.....lined vessels/pipes.

- (a) rubber (b) lead
- (c) glass (d) nickel

205. Ammonium chloride solution is stored/treated in.....vessels/pipes.

- (a) plain carbon steel
- (b) stainless steel
- (c) rubber or durmet-20 lined
- (d) lead

206. The main constituent of carborundum is.....carbide.

- (a) calcium (b) silicon
- (c) boron (d) aluminium

207. Vessels made of.....can be used to store dry chlorine.

- (a) thermoplastic materials
- (b) nickel
- (c) steel or iron
- (d) none of these

(d) none of these.

ANSWERS

191. (b) 192.(d) 193.(a) 194.(d) 195.(d) 196.(a) 197.(a) 198.(a) 199.(c) 200.(b)
201.(c) 202.(a)

203.(a) 204.(d) 205.(c) 206.(b) 207.(c)

208. Hydrochloric acid is stored in a steel vessel.

(a) lead lined (b) rubber lined (c) glass lined (d) stainless

209. Aqueous nitric acid is stored in.....vessel. (a) plain carbon steel

(b) stainless steel

(c) cast iron

(d) thermosetting plastic material

210. Anodic material used for the cathodic protection of underground buried steel pipeline is (a) nickel or copper

(b) zinc or magnesium

(c) bronze

(d) brass

211. Which of the following is the most widely used insulating material for steam carrying pipelines?

(a) Ceramic fibre blanket

(b) Glass wool and 85% magnesia

(c) Vermiculite

(d) Slag wool

212. The softest material just next to talc in the Mho's scale of hardness is

(a) quartz (b) gypsum (c) feldspar (d) fluorite

213. The hardest material just prior to diamond in Mho's scale is (a) topax

(c) corundum (b) carborundum (d) calcite

214. Glass lined vessels are not used for handling/ storing

(a) dilute H_2SO_4 (c) dilute HCl (b) dilute HNO_3

(d) hydrofluoric acid

215. Which of the following alloys does not contain nickel?

(a) Chlorinet – 2 alloy (b) Monel (c) Inconel (d) Babbit metal

216. Wrought iron is a suitable material of construction for handling.....solutions. (a) dilute acidic

(b) concentrated acidic

(c) alkalis & alkaline

(d) none of these

217. Mild steel is a/an.....steel.

(a) low carbon (b) medium carbon (c) high carbon (d) high alloy

218. Lead pipes are not safe for carrying drinking water, because water, containing dissolved oxygen attacks lead thereby forming poisonous Pb(OH)_2 .

Lead pipes are readily corroded by

(a) dilute HCl (b) acetic acid (c) concentrated H_2SO_4 (d) none of these

219. Mercury is transported in metal containers made of

(a) aluminium (b) iron

(c) lead (d) nickel

220. For spinning viscose rayon, the extrusion spinnerettes are made of

(a) platinum or gold alloys

(b) high carbon steel

(c) aluminium

(d) nickel

221. A metallic alloy in general as compared to their pure metal components is

(a) more corrosion resistant.

(b) having higher melting point.

(c) having lower hardness, reactivity and

fusibility.

(d) having lower electrical conductivity.

222. A metallic alloy in which one of the constituent metal is....., is called an amalgam.

(a) zinc (b) mercury (c) lead (d) tin

223. Maximum carbon content in any variety of steel can be upto 1.8%. Steel containing 0.4% Carbon is not used for making

(a) nuts (b) bolts

(c) chisels (d) studs

224. Condenser tubes are not made of

(a) cartridge brass

(b) muntz brass

- (c) wood metal
- (d) aluminium brass alloy

225. Evaporators used in caustic soda recovery and production plant are made of (a) monel metal (b) gun metal (c) wood metal (d) babbit metal

226. Vycor, a widely used material for making 'thermal wells' in temperature measurement, is a (a) cermet
(b) glass
(c) thermosetting plastic
(d) metallic alloy

ANSWERS

208. (b) 209. (c) 210. (b) 211. (b) 212. (b) 213. (c) 214. (d) 215. (d) 216. (c) 217. (a)
218. (b) 219. (b)

220. (a) 221. (a) 222. (b) 223. (c) 224. (c) 225. (a) 226. (b)

227. A material no longer behaves elastically beyond
(a) plastic limit (c) elastic limit (b) limiting load is a donor impurity for semi-conductors. (a) Boron (b) Antimony (c) Gallium (d) none of these (d)
breaking load **238.** does not contain copper as an alloy

228. Fatigue failure of a material results in element.
from stress.

(a) tensile

(c) fluctuating

(a) Nichrome (b) Manganin (b) compressive (c) Perminivar (d) Monel metal (d)
none of these. **239.** Steel rods are used in reinforced concrete to

229. Ball bearings are generally made of increase its strength. (a) plain carbon steel (a) shear (b) tensile (b) chrome carbon steel (c) compressive (d) none of these

(c) stainless steel **240.** Thermosetting polymers are (d) malleable cast iron (a) injection moulded (b) cast molded **230.** High speed steel should have high (c) extruded (d) none of these

(a) toughness (b) wear resistance **241.** Acetaldehyde is produced by hydration of (c)
hardenability (d) both (b) & (c) acetylene in a sulphuric acid solution of mer

231. Bush bearings are made of curic sulphate. Hydration tower is made of (a) mild steel (a) rubber lined mild steel (b) phosphorous bronze (b) lead lined mild

steel

(c) white metal alloys (c) aluminium

(d) none of these (d) cast iron

232. Steel balls for ball bearings are generally **242.** Acetaldehyde is shipped in.....drums. made of.....steel.

(a) cast

(c) free carbon

233. Cast iron has

(a) cast iron (b) steel (b) stainless (c) aluminium (d) either (b) & (c) (d) carbon chrome

243. Acetylene.....gas holder is made of (a) copper (b) cast iron (a) very high tensile strength. (c) steel (d) monel metal

(b) high ductility. **244.** is never shipped in glass carboys.(c) high malleability. (a) Ammonia (b)

Acetic acid(d) elastic limit close to ultimate breaking (c) Phenol (d) Formaldehydestrength. **245.**

Refined acetic acid storage vessel are made of

234. Dielectric strength of a material is (a) copper (b) aluminium(a) its energy storage capacity. (c) high carbon steel (d) nickel(b) a magnetic property. **246.** Which of the following is not shipped in

mild (c) its capacity to resist the flow of current. steel containers?(d) its capacity to withstand high voltage. (a) Acetone (b) Ammonia

235. All materials obey Hooke's law within elastic (c) Ethyl alcohol (d) Formic acidlimit. When elastic limit is reached, the ten

247. Neutraliser tank used for reacting nitric acid sile strain with ammonia for the production of ammo(a) increases very quickly. nium nitrate is made of(b) decreases very quickly. (a) aluminium(c) increases in proportion to stress. (b) stainless steel(d) decreases in proportion to stress. (c) high silicon (14%) iron

236. The phenomenon in which slow extension of (d) copper

material takes place with the time at con**248.** DDT is shipped instant load is called (a) stainless steel containers(a) plasticity (b) creep (b) paper bags(c) elasticity (d) ductility

ANSWERS

227. (c) 228.(c) 229.(b) 230.(d) 231.(b) 232.(d) 233.(d) 234.(d) 235.(a) 236.(b)

237.(b) 238.(a)

239.(b) 240.(b) 241.(a) 242.(d) 243.(c) 244.(a) 245.(b) 246.(d) 247.(b) 248.(d)

(c) fibre drums

(d) either (b) or (c)

249. Spray dryer for evaporating milk to produce milk powder is made of

(a) lead lined steel

(b) stainless steel

(c) aluminium

(d) cast iron

250. Mixing vessel used for the chlorination of methane to produce methyl chloride is made of

- (a) copper
- (b) cast iron
- (c) aluminium
- (d) high carbon steel

251. Fermenter used in the production of penicillin by deep fermentation process is a.....lined steel vessel.

- (a) rubber (b) monel
- (c) glass (d) nickel

252. Phenol is not shipped in

- (a) nickel lined steel tank cars.
- (b) galvanised or tin lined drums.
- (c) boxed glass carboys.
- (d) cast iron containers.

253. Caustic soda is transported in.....lined containers.

- (a) glass (b) nickel
- (c) neoprene (d) either (b) or (c)

254. Sulphuric acid pickling tanks are lined with (a) nickel (b) rubber (c) aluminium (d) glass

255. Molten phthalic anhydride is stored in a/ an.....vessel.

- (a) aluminium
- (b) nickel clad steel
- (c) lead lined steel
- (d) glass lined steel.

256. Plate and frame filter press is usually made of

- (a) mild steel (b) cast iron
- (c) stainless steel (d) galvanised iron

257. High resistance electrical heating elements/ wire are not made of

- (a) maraging steel
- (b) nimonic alloys
- (c) kanthal wire
- (d) nichrome

258. In order to be called steel, an alloy should have iron percentage greater than
(a) 80 (b) 70
(c) 90 (d) 50

259. Galvanising is generally done on
(a) non-ferrous metals
(b) low carbon steel
(c) stainless steel
(d) cast iron

260. Percentage elongation of a material is a measure of its
(a) ductility (b) brittleness (c) toughness (d) malleability

261. Ability of a material to.....is indicated by its damping capacity.
(a) withstand compression
(b) absorb vibration
(c) absorb shock
(d) none of these

262. A measure of toughness of a material is its (a) percentage elongation
(b) yield strength
(c) ultimate strength
(d) area under stress-strain diagram

263. Galvanising (i.e., zinc coating) of steel sheets is done to
(a) prevent its rusting by contact with corrosive atmosphere.

(b) protect the base metal by cathodic protection.
(c) both (a) & (b).
(d) neither (a) nor (b).

264. Does not contain tin as an alloying material.
(a) Brass (b) Pewter
(c) Solder (d) Babbitt metal

265. Trough of an apron conveyor is made of (a) lead lined concrete vessel
(b) wood
(c) metal
(d) either (b) or (c)

266. Metal at the top of the electromotive series is (a) least active (c) most active

(b) most stable (d) most noble

267. Addition of tungsten to steel imparts (a) magnetic properties

(b) cutting hardness

(c) corrosion resistance

(d) ductility

ANSWERS

249. (b) 250. (b) 251. (c) 252. (d) 253. (d) 254. (b) 255. (a) 256. (b) 257. (a) 258. (a)

259. (b) 260. (a)

261. (b) 262. (a) 263. (c) 264. (a) 265. (d) 266. (c) 267. (b)

268. Nickel is a constituent of

(a) bronze (b) solder (c) duralumin (d) monel metal

269. A material capable of undergoing large permanent deformation, when subjected to ten

(b) ductile

(d) none of these is termed as (a) friable

(c) brittle

270. A material capable of undergoing large permanent deformation, when subjected to compression is termed as (a) malleable

(c) brittle

(b) ductile

(d) none of these

271. 18/8 steel is a/an.....stainless steel. (a) austenitic (b) ferritic (c) martensitic (d) none of these

272. 18-4-1 high speed steel contains 18%, 4% and 1% respectively of

(a) tungsten, vanadium and chromium (b) tungsten, chromium and vanadium (c)

vanadium, chromium and tungsten (d) chromium, tungsten and vanadium

273. Age hardening is concerned with

(a) copper (b) brass

(c) duralumin (d) silver

274. Bearings subjected to light load are made of (a) white metal

(b) phosphorous bronze

- (c) monel
- (d) silicon bronze

275. Cast irons are generally specified by their (a) carbon content
(b) tensile strength
(c) hardness
(d) manufacturing process

276. Which of the following heat treatment processes is used for softening the hardened material ? (b) Tempering (d) None of these (a) Normalising (c) Annealing generally subjected to (a) (c)

spheroidising normalising (b) tempering (d) annealing

280. Addition of 2% nickel in steel makes it suitable for making
(a) electronic valves
(b) boiler plates, rivets etc.
(c) turbine blades
(d) connecting rod

281. Which of the following is universally employed as the low expansion metal in the bimetallic thermometer, which is an iron– nickel alloy containing 36% nickel and has very low co-efficient of expansion (1/20th of ordinary metals) ?
(a) Invar (b) Constantan (c) Chromel (d) Alumel

282. Thermometer bulb & capillary in case of mercury filled pressure spring expansion thermometer is normally made of.....as mercury does not amalgamate with it. (a) copper (b) copper alloys (c) stainless steel (d) monel

283. In a plate type heat exchanger, heat transfer plates are never made of
(a) (c)

stainless steel (b) cast iron titanium (d) Hastelloy C

284. German silver is an alloy of copper, nickel and
(a) zinc (b) silver
(c) tin (d) lead

285. Softness of silver can be converted into hardness by alloying it with small quantity of (a) copper & nickel (b) zinc

(c) aluminium (d) tin

286. Cast iron compared to steel is better in (a) ductility (c) strength (b) fluidity & castability (d) malleability

277. Pipes for bi-cycle frames are made of..... steel.
(a) hot rolled (b) chrome carbon (c) cold rolled (d) stainless

278. Steel pipes are normally manufactured by.....process.
(a) extrusion (b) cold working (c) forging (d) electroforming **279.** To improve the machinability of steel, it is

287. Nickel (56%) and molybdenum (17%) alloys are called (a) monel (c) inconel (b) hastelloy C (d) bronzes

288. Nickel (76%) and chromium (15%) alloys are termed as
(a) inconel (b) monel
(c) aluminium bronzes (d) brass

ANSWERS

268. (d) 269.(b) 270.(a) 271.(a) 272.(b) 273.(c) 274.(b) 275.(b) 276.(b) 277.(c)
278.(a) 279.(a)

280.(b) 281.(a) 282.(c) 283.(b) 284.(a) 285.(b) 286.(b) 287.(b) 288.(a)

289. Pick out the wrong statement.

- (a) Alloys are harder than their component elements.
- (b) Presence of silicon in steel decreases its electrical resistance.
- (c) Karbate is an acid resistant material of construction.
- (d) Nichrome, a steel alloyed with 10% Ni and 20% Cr can be used upto a temperature of 1100°C.

290. An alloy used as thermocouple material comprises of 40% nickel and 60% copper. It is called (b) kanthal
(d) German silver (a) constantan (c) chromel

291. Which of the following is not a non-ferrous

- (b) Magnalium (d) Muntz metal alloy?
- (a) Meehanite (c) Gun metal

292. Super conductors are those substances, which (a) offer no resistance to current flow. (b) conduct electricity at low temperature, (c) offer high resistance to current flow. (d) conduct electricity at high temperature.

293. The range of Mohs' scale of hardness is from (a) 1 to 15 (b) 1 to 8 (c) 1 to 10 (d) 0 to 10

294. Which one occupies the lowermost position in the electromotive series of metals?

- (a) Aluminium
- (b) Noble metals (Ag, Pt, Au)
- (c) Zinc
- (d) Alkali metals (K, Na, Li)

295. The metals occurring at the lower most position in the electromotive series

- (a) do not resist corrosion.
- (b) resist corrosion very strongly.
- (c) are very brittle.
- (d) are heat insulators.

296. Tin coating on metals is not done by (a) spraying (b) powder metallurgy (c) hot dipping (d) electro-deposition

297. Purity of electrical grade aluminium should be $\geq$ percent.

- (a) 95 (b) 99.5
- (c) 85 (d) 90

298. Hardest materials so far found is

(a) diamond (b) graphite (c) carborundum (d) pumice stone **299.** Which of the following stainless steels is nonmagnetic?

- (a) Ferritic (c) Austenitic (b) Martensitic (d) None of these

300. Material of construction of pipe generally used for conveying water in India is (a) stainless steel (b) cast iron (c) wrought iron (d) lead lined steel

301. Light weight metallic alloy used in aircraft industry is

- (a) aluminium
- (b) high silicon (14%) iron
- (c) duralumin
- (d) phosphor bronze

- 302.** Which of the following is a low melting point metal ?
 (a) Stainless steel (c) Tin
- 303.** White cast iron is not (a) malleable
 (c) brittle
 (b) Wrought iron (d) Copper
- (b) whitish in color (d) strong and hard
- 304.** Which of the following is the easiest to bend? (a) Steel
 (c) Cast iron (b) Stainless steel (d) Wrought iron
- 305.** Carbon is present in the uncombined (graphitic) form in case of
 (a) cast iron (b) steel
 (c) ferroalloy (d) none of these
- 306.** Carbon is present in the combined form (carbide) in case of
 (a) pig iron (b) steel
 (c) ferro alloys (d) all (a), (b) & (c)
- 307.** High speed cutting tool steels contain about.....percent of tungsten.
 (a) 6–8 (b) 18–20
 (c) 30–35 (d) 50–55
- 308.** Which of the following finds the least commercial use?
 (a) Pure iron
 (b) High silicon iron
 (c) Low carbon steel
 (d) High carbon steel
- 309.** Materials having.....lattice structure are usually most ductile.
 (a) f.c.c. (b) b.c.c.
 (c) h.c.p. (d) cubic

ANSWERS

289. (b) 290.(a) 291.(a) 292.(a) 293.(c) 294.(b) 295.(b) 296.(b) 297.(a) 298.(c)
 299.(c) 300.(b)
 301.(c) 302.(c) 303.(a) 304.(d) 305.(a) 306.(d) 307.(b) 308.(a) 309.(a)
310. The crystal structure of most of the common metals is

(a) orthorhombic (c) hexagonal (b) cubic
(d) none of these

311. Which of the following is the hardest? (a) Cementite (c) Austenite (b) Pearlite (d) Ferrite

312. Which of the following will have the highest melting point?
(a) Pig iron (b) Mild steel
(c) Wrought iron (d) High carbon steel

313. Constituents of stellite are
(a) zinc, copper and nickel.
(b) cobalt, chromium and tungsten. (c) zinc, aluminium and nickel.
(d) nickel, cobalt and vanadium.

314. Which of the following has the highest compressive strength?
(a) Wrought iron (b) Cast iron
(c) Mild steel (d) High carbon steel

315. Brinell Hardness Number (BHN) for talc is approximately in the range of
(a) 1–5 (b) 20–30
(c) 100–150 (d) 200–250

316. Which of the following is the softest material ? (a) Quartz (b) Calcite (c) Corundum (d) Fluorite

317. Hammers and railway rails are normally made of
(a) mild steel
(b) dead mild steel
(c) medium carbon steel
(d) high carbon steel

318. Mild steel is used for making
(a) fish plates (c) channels
(b) die block (d) drop forging

319. Dead mild steel, which contains 0.10 to 0.15 percent carbon is used for making
(a) shafts (b) flanges (c) gears (d) shear blades

320. Cold worked steel parts are normally subjected to (b) hardening (d) shot peening (a) normalising (c) annealing

321. To improve the machinability of steel by its softening, it is subjected to

322. The maximum percentage of chromium that can be added to steel is about
(a) 12 (b) 18
(c) 24 (d) 30

323. Which of the following comprises of hydrocarbons?
(a) Mica flakes (b) Glass
(c) Rubber (d) None of these

324. Maximum permissible sulphur content in steel is.....percent.
(a) 0.015 (b) 0.055
(c) 0.505 (d) 0.805

325. Which of the following is a light alloy ? (a) Monel metal (b) Dow metal (c) German silver (d) Babbitt metal

326. Carbon content in plain carbon steel is..... percent.
(a) 0.1 to 0.15 (b) 0.35 to 0.45 (c) 0.65 to 0.80 (d) 0.85 to 1.2

327. is added in low carbon steel to raise its yield point. (a) Sulphur (c) Silicon
(b) Phosphorous (d) Manganese

328. A steel alloy containing 36% nickel is called.....which has a zero coefficient of expansion.
(a) austenitic stainless steel
(b) heat resisting steel
(c) invar
(d) high speed steel

329. can replace tungsten in high speed steel. (a) Chromium (b) Vanadium
(c) Cobalt (d) Molybdenum

330. Shock resisting steels should possess high (a) hardness
(b) toughness
(c) tensile strength

(d) wear resistance

331. When the steel is subjected to normalising, its.....decreases.

(a) yield point

(b) ductility

(c) ultimate tensile strength (UTS)

(d) none of these

332. Softening of hardened steel is done by its (a) cold working (b) annealing (a) normalising (b) tempering (c) shot blasting (d) heating (c) annealing (d) carburising

ANSWERS

310. (b) 311.(c) 312.(c) 313.(b) 314.(d) 315.(b) 316.(b) 317.(d) 318.(c) 319.(b) 320.(c) 321.(b)

322.(b) 323.(c) 324.(b) 325.(b) 326.(b) 327.(d) 328.(c) 329.(d) 330.(b) 331.(b) 332.(b)

333. is not a case hardening process. (a) Carburising (c) Cyaniding (b) Nitriding (d) Annealing

334. Steel is widely used for the manufacture of motor car crankshafts. (a) Silicon

(c) Chrome

(b) Nickel

(d) Highspeed

335. Cast iron and steel pipes are produced by.....casting.

(a) die (b) investment (c) slush (d) true centrifugal

336. Dies for wire drawing are generally made of (b) stainless steel (d) high carbon steel (a) mild steel (c) carbides

337. Which of the following alloying elements is present in maximum percentage in high speed steel.

(a) Molybdenum (c) Tungsten

(b) Chromium (d) Vanadium

338. Addition of.....to the steel helps in increasing the residual magnetism in steel used for making magnets.

(b) nickel (d) cobalt

339. Which of the following is the most elastic material?

(a) Plastic (b) Glass

(c) Steel (d) Rubber

340. Which of the following has the least value of ultimate tensile strength (UTS)?

- (a) Medium carbon steel
- (b) High carbon steel
- (c) Cast iron
- (d) Wrought iron

341. Dip stick used for measuring the level of petro fuels (e.g. petrol, diesel, fuel oil etc.) in the storage tank is usually made of

- (a) brass (b) copper
- (c) high carbon steel (d) aluminium

342. In hot wire anemometer used for gas flow measurement, the wire is normally made of (a) copper

- (c) constantan

343. Ceramic materials are (a) organic in nature. (b) platinum (d) chromium

(b) stronger in compression than in tension (c) always amorphous in nature. (d) always bad heat conductors. **344.** Common house hold glass (i.e., soda-lime

glass) is a/an.....material.

- (a) fully crystalline (b) partly crystalline (c) amorphous (d) none of these

345. Cermets are.....materials.

- (a) refractory (b) reinforced
- (c) abrasive (d) fully metallic

346. The major material of construction in a soda ash plant is

- (a) (c)

Cast iron (b) PVC

Graphite (d) Stainless steel

- (a) chromium (c) tungsten

347. Which of the following classes of stainless steel does not contain nickel?

- (a) Ferritic (b) Austinitic (c) Martensitic (d) None of these

348. Monel contains copper and nickel in the ratio of

- (a) 1:1 (b) 1:2

(c) 2:1 (d) 4:1

349. Inconel typically contains

- (a) 76% Fe, 7% Cr, 15% Ni.
- (b) 15% Fe, 7% Ni, 76% Cr.
- (c) 76% Ni, 7% Fe, 15% Cr,
- (d) none of these.

350. In addition to nickel, chromium & iron; hastelloy contains

- (a) silicon (b) aluminium (c) niobium (d) molybdenum

351. Impellers of 98% sulfuric acid pump are made of

- (a) mild steel.
- (b) cast iron.
- (c) lead.
- (d) illium (a nickel - chrome alloy).

352. For transportation of 98% sulfuric acid at temperatures above 50°C.....pipes are preferred.

- (a) cast iron
- (b) mild steel
- (c) galvanized iron
- (d) (a), (b) (c) are equally useful

353. Storage vessel for hot 90% sulfuric acid is made of

- (a) lead.
- (b) cast iron.
- (c) cast iron containing 14% silicon. (d) none of these.

ANSWERS

333. (d) 334.(c) 335.(d) 336.(c) 337.(c) 338.(d) 339.(c) 340.(c) 341.(a) 342.(b)
343.(b) 344.(b)

345.(a) 346.(a) 347.(a) 348.(c) 349.(c) 350.(d) 351.(d) 352.(a) 353.(c)

354. Material of construction of vessels handling boiling nitric acid of any concentration is (a) lead.

- (c) mild steel.

355. Karbate is

- (a) an alloy of copper and nickel.

- (b) chemically impregnated carbon. (c) high – silicon iron.
(d) an alloy of copper, tin and zinc.

356. Which of the following is corrosive to titanium metal?

- (a) Dry chlorine
(b) Wet chlorine
(c) Dilute hydrochloric acid
(d) 20% sodium chloride solution

357. Most economic material of construction of storage vessels for 40% caustic soda solution in the temperature range of 20°C to 40°C is (a) cast iron (b) carbon steel (c) monel (d) zirconium

358. Molybdenum is added to stainless steel to improve its

- (a) toughness.
(b) ductility.
(c) ease of weldability.
(d) pitting and crevice corrosion resistance.

359. Evaporator tubes for concentration of caustic soda solutions are usually made of

- (a) stainless steel 316. (b) mild steel. (c) nickel. (d) aluminium.

360. Presence of ammonia can readily cause stress corrosion cracking of

- (a) nickel. (b) copper. (c) stainless steel 321. (d) zirconium.

361. Material of construction of reactor for production of chlorosulfonic acid is

- (a) carbon steel.
(b) stainless steel type 316.
(c) steel lined with polytetrafluoroethylene. (d) none of these.

362. In low-carbon steels, the carbon content is restricted to a maximum of.....percent. (a) 0.1 (b) 0.25

- (c) 1.0 (d) 4.0

363. Low carbon steel is the most commonly used engineering material, because

- (a) it is cheap.
(b) it has reasonable mechanical properties. (b) cast iron.
(d) high – silicon iron. (c) it is, in most circumstances, a very ductile material.

(d) all (a), (b), (c) are true.

364. For situations where sea water is used as a coolant, heat exchanger tubes are made of

(a) carbon steel.

(b) stainless steel Type 316.

(c) cupro – nickel alloys (70 Cu, 30 Ni). (d) aluminium.

365. Brittle materials are

(a) weak in tension but strong in compression. (b) strong in tension but weak in compression. (c) weak in tension as well as in compression. (d) strong in tension as well as in compression.

366. Stiffness is a measure of a material's resistance to

(a) wear.

(b) bending and buckling.

(c) crack propagation.

(d) (a) and (c).

367. Which of the following materials is resistant to picric acid at 100°C?

(a) Aluminium bronze.

(b) Cast iron.

(c) High silicon iron (14% silicon).

(d) Copper.

368. Which of the following materials can satisfactorily resist corrosions by cooking liquor used in the kraft pulping process?

(a) Carbon steel.

(b) 18 Cr – 8 Ni stainless steel.

(c) Glass.

(d) Cast iron.

369. Much of the world's nitric acid is produced by the oxidation of ammonia in air. The converter for ammonia oxidation is made of (a) austenitic stainless steel.

(b) aluminium.

(c) cast iron.

(d) none of these.

370. The packing particles in sulfur trioxide absorber are usually made of

(a) carbon steel.

- (b) stainless steel Type 316.
- (c) ceramic material.
- (d) alloy B-2.

371. The fatigue failure of a material can be avoided by

ANSWERS

354. (d) 355.(v) 356.(a) 357.(d) 358.(b) 359.(a) 360.(c) 361.(a) 362.(b) 363.(b)
364.(a) 365.(d)

366.(b) 367.(b) 368.(a) 369.(c) 370.(a) 371.(d)

(a) coating the surface (b) (c) nitriding (d) shot peening any of the above

372. Which of the following alloys does not contain copper?

- (a) Phosphor bronze (b) Invar
- (c) Brass (d) Muntz metal

373. A ductile fracture of material is usually not preceded by

- (a) noise (b) deformation (c) plastic flow
- (d) large amount of non-recoverable energy absorption.

374. Which of the following engineering materials is the most suitable candidate for hot chamber die casting?

- (a) Low carbon steel (b) Titanium (c) Copper (d) Tin

375. Copper is not a constituent of (a) constantan (c) nichrome (b) monel metal
(d) delta metal

376. Nickel is a.....material. (a) ferroelectric (c) dielectric (b)
ferromagnetic (d) paramagnetic

ANSWERS 372.(b) 373.(a) 374.(c) 375.(a) 376.(b)

process equipment design 14

1. Vertical vessels are not supported by 9. In the design of a paddle agitator, the ratio (a) brackets

(c) columns

(b) skirts paddle dia is normally taken as (d) saddles tank dia

2. Bracket supports are the most suitable for (a) 0.1 (b) 0.8 supporting.....vessels. (c) 0.25 (d) 0.5 (a) thick walled vertical

(b) horizontal 10. The ratio, propeller agitator dia is normally (c) thin spherical (e.g. Horton sphere) tank dia (d) none of these taken as

3. Skirt support is the most suitable for support ing.....vessels.

(a) small horizontal

(c) tall vertical

(a) 0.15–0.30 (b) 0.5–0.65

(c) 0.75–0.85 (d) 0.60–0.90 (b) large horizontal

(d) thick walled 11. Baffle width is normally taken as..... 4. Saddle supports are used for supporting..... times the tank diameter. vessels. (a) 0.1–0.12 (b) 0.4–0.5

(a) horizontal cylindrical (c) 0.45–0.6 (d) 0.2–0.45 (b) tall vertical 12. The minimum baffle height should be (c) thick walled vertical (a) (d) thick spherical (b)

5. Wind load consideration in the design of a (c) support can be neglected, when the vessel is (d) equal to the impeller diameter. twice the impeller diameter. twice the tank diameter.

3/4 of the tank height.

(a) tall (say 30 metres), but is full of liquid. 13. Baffles may be eliminated for

(b) tall but empty. (a) (c) short (< 2 m) and housed indoor. (b)

(d) none of these. (c)

6. Lug support is meant for supporting..... (d)

low viscosity liquids (< 200 poise). high viscosity liquids (> 600 poise). large diameter tanks. none of these.

vessels. **14.** Power required for agitation depends upon the (a) large horizontal cylindrical (a) height & properties of the liquid. (b) tall but empty (b) agitator type & speed of agitation. (c) small (c) size of agitator & the tank. (d) thick walled tall (d) all (a), (b) and (c).

7. The force due to wind load acting on a tall vessel **15.** The retention time of material in a rotary dryer depends upon its (a) shape. (b) outside diameter. (a) rpm (c) height. (d) all (a), (b) & (c). (b) slope & length

8. Joint efficiency (J) for a seamless pipe is (c) flights arrangement (a) 1 (b) 0.85 (d) all (a), (b) and (c)
(c) 1.2 (d) <0.5

ANSWERS

1. (d) 2. (a) 3. (c) 4. (a) 5. (c) 6. (c) 7. (d) 8. (a) 9. (b) 10. (a) 11. (a) 12. (b)
13. (b) 14. (d) 15. (d)

16. In the case of a shell and tube heat exchanger, the logarithmic mean temperature difference (a) is always less than arithmetic average value. (b) is always more than arithmetic mean value and the geometric mean value. (c) is always less than arithmetic mean value, but more than geometric mean value. (d) may be either more or less than geometric mean and arithmetic mean value depending upon whether the flow of stream is cocurrent or counter-current.

17. In a double pipe (concentric) heat exchanger, the hydraulic radius for heat transfer (for a fluid flowing through the annulus) would be (a) same as that for fluid flow.

(b) less than that for fluid flow.

(c) more than that for fluid flow.

(d) $D_2 - D_1$ (D_1 and D_2 are I.D. of inner & outer

pipes respectively).

18. Fouling factor must be included in the calculation of overall design heat transfer coefficient, when the liquid

(a) containing suspended solids flows at low

velocity.

(b) containing suspended solids flows at high velocity.

(c) is highly viscous.

(d) is of high specific gravity.

19. The value of fouling factor depends upon the (a) characteristic of process

fluid.

(b) velocity of process fluid containing sus-

pended solids.

(c) suspended solids in the fluid.

(d) all (a), (b) and (c).

20. Floating head heat exchangers are used for the

(a) heat transfer between corrosive fluids. (b) cases where temperature difference between the shell and the tubes is more ($>50^{\circ}\text{C}$).

(c) co-current heat transfer systems. (d) counter-current heat transfer systems.

21. In a shell and tube heat exchanger, the shortest centre to centre distance between the adjacent tubes is

(a) called tube pitch.

(b) called tube clearance.

(c) always less than the diameter of the tube. (d) none of these.

22. Shortest distance between two tubes is (a) called tube pitch.

(b) called tube clearance.

(c) more in case of triangular pitch as compared

to square pitch of tube layout.

(d) none of these.

23. In most of the shell and tube heat exchangers, the tube pitch is generally.....the tube diameter.

(a) less than (b) 1.25–1.50 times (c) 2.5 times (d) one-fourth of **24.** Triangular pitch tube layout as compared to

square pitch in a shell and tube heat exchanger

(a) permits the use of less tubes in a given shell diameter.

(b) facilitates comparatively easier external cleaning because of large clearance.

(c) permits the use of more tubes in a given shell diameter.

(d) both (b) and (c).

25. 25 per cent cut segmental baffle means that the baffle

- (a) height is 75% of the I.D. of the shell.
- (b) height is 25% of the I.D. of the shell.
- (c) spacing is 75% of its height.
- (d) width is 25% of its height.

26. In shell and tube heat exchangers,..... straight tie rods are used to

- (a) hold baffle in space.
- (b) fix the tubes in position.
- (c) account for thermal strain.
- (d) none of these.

27. Baffle spacing is generally.....the I.D. of the shell.

- (a) more than
- (b) not greater than
- (c) not less than one fifth of
- (d) both (b) and (c)

28. Which of the following is the most common type of baffle used in industrial shell and tube heat exchanger ?

- (a) 75% cut segmental baffle.
- (b) 25% cut segmental baffle.
- (c) Orifice baffle.
- (d) Disk and doughnut baffle.

29. In a shell and tube heat exchanger for a given heat transfer surface area, smaller diameter tubes are favoured as compared to larger di

ANSWERS

16. (a) 17.(c) 18.(a) 19.(d) 20.(b) 21.(a) 22.(b) 23.(b) 24.(c) 25.(a) 26.(a) 27.(d) 28.(b) 29.(c)

ameter ones; because the smaller diameter tubes

- (a) are easier to clean.
- (b) are less prone to fouling.
- (c) can be fitted into a smaller shell diameter hence the cost of the heat exchanger would be less.
- (d) none of these.

30. High pressure fluid in a shell and tube heat ex- changer should preferably be routed through the

(a) tubes to avoid the expansion of high pressure shell construction.
 (b) shell side for smaller total pressure drop. (c) shell side, if the flow is counter-current and tube side if the flow is co-current. (d) shell side for large overall heat transfer coefficient.

31. When one of the fluids is highly corrosive and has fouling tendency, it should

(a) preferably flow inside the tube for its easi-

er internal cleaning.

(b) perferably flow outside the tube.

(c) flow at a very slow velocity.

(d) flow outside the tube, when the flow is

counter-current and inside the tube when the flow is co-current.

32. In a shell and tube heat exchanger, the clearance of the tube is generally

(a) not less than one-fourth of the tube diameter or 3/16".

(b) more than the tube diameter.

(c) equal to the tube diameter.

(d) more in case of triangular pitch as compared to the square pitch tube layout.

33. For a given fluid, as the pipe diameter increas- es, the pumping cost

(a) decreases.

(b) increases.

(c) remains unaffected.

(d) may increase or decrease depending upon

whether the fluid is Newtonian or nonNewtonion.

34. Optimum economic pipe diameter for fluid flow is determined by the

(a) viscosity of the fluid.

(b) density of the fluid.

(c) total cost considerations (pumping cost

35.Friction factor for turbulent flow in a new pipe is given by

$$f = \frac{16}{Re} \quad (b) \quad f = \frac{0.04}{N^{0.16}} \quad (a) \quad N = Re$$

$$25 \quad (c) \quad = f N^{0.5}$$

$$Re (d) f = RRe$$

36. Optimum reflux ratio in a continuous distillation column is determined by the

(a) maximum permissible vapour velocity. (b) flooding limit of the column.
(c) total cost consideration (fixed cost of the

(d)

column plus the cooling water & steam cost).
none of these.

37. Pressure drop due to pipe fittings can be es-

D =

$$\frac{pV}{2}$$

timated by the equation, $4.f_{pgc}$

where L_e = equivalent length of straight pipeline which will incur the same frictional loss as the fitting and D = diameter of the fitting. The value of L_e (dimensionless) for 450 D

elbow and 1800 close return bends would be respectively around

(a) 5 and 10 (b) 45 and 75 (c) 180 and 300 (d) 300 and 500

L_e for 90° elbow (medium radius) and 90° **38.** D

square elbow would be respectively around (a) 25 and 60 (b) 3 and 5 (c) 100 and 250 (d) 250 and 600

L_e for a Tee (used as elbow, entering run) **39.** D

would be around

(a) 5 (b) 60

(c) 200 (d) 350

40.

L_e for a Tee (used as elbow, entering branch) D

would be check this line

(a)

(b) plus fixed cost of the pipe).

(d) none of these.

less than that for Tee (used as elbow, entering run).

more than that for Tee (used as elbow, entering run).

30.(a) 31.(a) 32.(a) 33.(a) 34.(c)

ANSWERS

35. (b) 36.(c) 37.(b) 38.(a) 39.(b) 40.(d) (c) around 90.

(d) both (b) and (c).

L_e for couplings and unions would be **41.D**

(a) 60 (b) 200

(c) 350 (d) negligible

L_e for fully open gate valves would be **42.D**

(a) much more than that for fully open globe valves.

(b) much less (say 2% than that for fully open globe valves).

(c) around 7.

(d) both (b) and (c).

L_e for fully open globe valve may be around **43.D**

(a) 10 (b) 25

(c) 75 (d) 300

44. For turbulent flow ($NRe > 2100$) of low viscosity fluid ($\mu > 20cp$) in steel pipes, the optimum inside pipe diameter is given by

(a) $D_{i,opt} = 3.9 Q^{0.45} r^{0.13}$

(b) $D_{i,opt} = 3.9 Q^{0.45} \cdot \mu^{0.95}$

(c) $D_{i,opt} = 4.7 Q^{0.36} \cdot \mu^{3.2} \cdot r^{0.13}$

(d) $D_{i,opt} = 3 Q^{0.36} \cdot \mu^{0.88}$

where, Q = fluid flow rate, ft³/sec.

r = fluid density, lb/ft³

μ = fluid viscosity, centipoise

D_i = optimum inside pipe diameter, inches

45. For laminar flow ($NRe < 2100$) in steel pipe, the optimum inside pipe diameter is given by (a) $D_{i,opt} = 3Q^{0.36}r^{0.18}$

(b) $D_{i,opt} = 3.9Q^{0.45}r^{0.23}$

(c) $D_{i,opt} = 7.6Q^{0.36}r^{0.9}$

(d) $D_{i,opt} = 3Q^{0.36}r^{1.86}m^{0.08}$

46. The necessary wall thickness for a metallic storage vessel is a function of the (a) ultimate tensile strength (or yield point) of

the material and operating temperature. (b) operating pressure and welding/joint efficiency.

(c) diameter of the vessel.

(d) all (a), (b) and (c).

47. Bubble cap plate column is

(a) a finite stage contactor.

(b) used only for distillation, not for absorption. (c) a differential stage contactor.

(d) a continuous contactor.

48. The most common standard size of bubble caps used in industrial operation is

(a) 1" dia cap with 0.5" dia riser.

(b) 6" dia cap with 4" dia riser.

(c) 8" dia cap with 1" dia riser.

(d) 4" dia cap with 8" dia riser.

49. For a given design of bubble cap, the number of bubble caps to be used per tray is set by the (a) allowable gas velocity through the slots. (b) plate spacing. (c) diameter of the column.

(d) all (a), (b) and (c).

50. Maximum and minimum linear slot velocities (in the distillation column design) as recommended by Davies are respectively.

12 and 3.4 (b) 3.4 and 12 (a) $0.5pp^{0.5}$ $0.5pp^{0.5}$

(c)

3.4 and 12 (d) $3.4_{and} 12^{0.5}mm^{0.5}$ $0.5_{and} 12^{0.5}mm^{0.5}$

where, r = gas density, lb/ft^3 , m = gas viscosity, centipoise

51. Normally, the ratio of the total riser area to the tower cross sectional area (for bubble cap towers of diameter more than 3 ft) is around

(a) 0.4–0.6 (b) 0.35–0.75 (c) 0.1–0.2 (d) 0.55–0.85

52. An adequate clearance between the tray and the shell wall of a distillation column is provided to

(a) drain the liquid from the tray when the

unit is not in operation.

(b) allow for thermal expansion and facilitate installation.

(c) avoid back-trapping.

(d) none of these.

53. The function of manholes provided in the shell of a distillation column is to

(a) keep a check on the liquid gradient over

the plate by direct visual observation. (b) give access to the individual trays for cleaning, maintenance and installation. (c) guard against foaming & entrainment by

dumping anti foaming agent through it. (d) all (a), (b) and (c).

ANSWERS

41. (d) 42. (d) 43. (d) 44. (a) 45. (a) 46. (d) 47. (a) 48. (b) 49. (a) 50. (a) 51. (c) 52. (c) 53. (b)

54. Weep holes provided in the plates of a distillation column

(a) facilitate draining out liquid from a tray when the unit is not in operation. (b) are normally located near the overflow weir so that any delivery of liquid during operation follows approximately the same path as the overflow fluid.

(c) must be large enough (usually 1/4" to 5/8" dia) to prevent plugging but should not deliver excessive amount of fluid during operation.

(d) all (a), (b) and (c).

55. Excessive liquid gradient on a tray may result in the

(a) maldistribution of gas.

(b) back trapping.

(c) gas blowing beneath cap skirt.

(d) all (a), (b) and (c).

56. The maximum liquid gradient over a tray must not exceed

(a) 0.5" – 1.25".

(b) 2" – 3.5".

(c) 5".

(d) half the tray spacing.

57. Liquid gradient over the tray results due to the

(a) resistance offered to flow of liquids by caps

& risers and the flow of gas.

(b) low gas velocity.

(c) large plate spacing.

(d) large reflux ratio.

58. Liquid gradient over a tray can be minimised by

(a) providing a higher skirt clearance or a

higher weir.

(b) decreasing the number of rows of caps

through which the liquid flows or by de-

creasing the velocity of liquid flow past the

caps or by reducing the distance along the

tray through which the liquid must flow. (c) using split flow, radial flow or cascade flow

for column diameter large than 4 ft. (d) all (a), (b) and (c).

59. Which of the following factors determine the amount of entrainment in a distillation column ?

(a) Plate spacing.

(b) Depth of liquid above the bubble cap slots.

(c) Vapour velocity in the volume between the plates.

(d) All (a), (b) and (c).

60. Larger depth of liquid on the trays of a distillation column

(a) leads to high tray efficiency.

(b) results in higher pressure drop per tray. (c) both (a) & (b).

(d) neither (a) or (b).

61. The minimum tray spacing in distillation column of diameter less than 3 ft is normally..... inches.

- (a) 6 (b) 18
- (c) 24 (d) 34

62. The minimum plate spacing in most of the petroleum refinery distillation columns (of dia > 3 ft) is normally.....inches.

- (a) 6 (b) 12
- (c) 18 (d) 34

63. The minimum plate spacing in most of the petroleum refinery distillation columns (of dia > 3ft) is normally.....inches.

- (a) 6 (b) 12
- (c) 18 (d) 34

64. Back-trapping in a distillation column results due to

- (a) low gas velocity.
- (b) high gas velocity.
- (c) excessive liquid gradient over the tray, (d) low reflux ratio.

65. “A Calming section” before the liquid flows into the downcomer is provided to

- (a) permit release of entrained vapour in the

liquid.

- (b) reduce the discharge fluctuation. (c) ensure better vapour-liquid contact. (d) cool the liquid before it flows down.

66. The length of straight rectangular weir used on cross-flow trays is generally.....the column diameter.

- (a) 0.6–0.8 times
- (b) equal to
- (c) twice
- (d) 2 ft irrespective of (for column > 3 ft diameter)

67. The distance between the top of the slots and the liquid surface when the static liquid is just ready to flow over the overflow weir is called

ANSWERS

54. (d) 55.(d) 56.(a) 57.(a) 58.(d) 59.(d) 60.(c) 61.(a) 62.(a) 63.(a) 64.(c) 65.(a) 66.(a) 67.(b)

- (a) downcomer liquid seal
- (b) static submergence
- (c) skirt clearance
- (d) none of these

68. In actual operation of distillation column, the vapour is not distributed uniformly among the bubble caps, primarily because of the

- (a) liquid gradient on the tray.
- (b) lower skirt clearance.
- (c) lower static submergence.
- (d) small downcomer liquid seal.

69. Maximum allowable vapour velocity in a bubble cap tower is determined by the

- (a) entrainment considerations.
- (b) vapour density.
- (c) diameter of the column.
- (d) none of these.

70. In actual operation of a bubble cap distillation tower, the.....at the bottom of the tower is more than that at the top of the tower. (a) molal flow rate of vapour

- (b) vapour molecular weight
- (c) pressure and temperature
- (d) all (a), (b) and (c)

71. Theoretically calculated diameter of the stripping section of the continuous rectification column is.....that of the enriching section. (a) less than

- (b) more than
- (c) same as
- (d) either more or less (depending upon relative volatility)

72. Which of the following efficiencies can be greater than 100% ?

- (a) Overall plate efficiency.
- (b) Murphree plate efficiency.
- (c) Point efficiency.
- (d) None of these.

73. Which of the following is used to set the diameter of the distillation column ?

- (a) Number of theoretical plates.
- (b) Static submergence.
- (c) Allowable vapour velocity.
- (d) Length of straight rectangular weir on

cross-flow tray.

74. Typical static submergence for bubble cap plate column operating at atmospheric pressure

- (a) 2.5"
- (b) 0.5"
- (c) 5"
- (d) 50% of the plate spacing

75. Generally, as the length of the liquid path on a tray is increased beyond 5 ft, the overall column efficiency

- (a) increases
- (b) decreases
- (c) remains same
- (d) may increase or decrease depending upon

the plate spacing

76. An increase in the liquid resistance to interphase mass transfer and a resultant reduction in plate efficiency is caused by

- (a) an increase in liquid viscosity.
- (b) an increase in relative volatility for rectification columns.
- (c) decrease in gas solubility for absorbers.
- (d) all (a), (b) and (c).

77. Overall distillation column efficiency for most of the refinery columns can be given by (for $m = 0.07 - 1.4$ cp and relative volatility < 4)

- (a) $h = 17 - 61.1 \log m$

D_p (b) $h = 24.6_m$

- (c) $h = 1.66 - 0.25 \log m$

- (d) $h = 0.25 \log m - 1.67$

where h = overall column efficiency, %

μ = molal average viscosity of feed at average column temperature and pressure,

ΔP = pressure drop per tray, psi

78. In perforated plate towers, the

(a) hole sizes may be around 1/8" or 3/16".

(b) total hole area may be around 6 to 15% of

tower cross-sectional area.

(c) pressure drop is less compared to similar bubble cap towers.

(d) all (a), (b) and (c).

79. Which of the following factors affect the pressure drop in a co-current gas-liquid absorption packed tower ?

(a) Size, shape, orientation and surface of the packing particles.

(b) Density and viscosity of fluids.

(c) Fluid flow rates.

(d) All (a), (b) and (c).

sure may be around

ANSWERS

68. (a) 69. (a) 70. (d) 71. (b) 72. (b) 73. (c) 74. (b) 75. (a) 76. (d) 77. (c) 78. (d) 79. (d)

80. Pressure drop (ΔP) and the superficial gas mass velocity (G) in case of packed absorption tower operating in the preloading range are related as

(a) $\Delta P = G$ (b) $\Delta P = G^{0.5}$

¹(c) $\Delta P = G^2$ (d) $\Delta P = G^{0.6}$

(c)

81. At the following point for a given packing and set of fluids, the pressure drop per metre of packed height, with variation in fluid rates and operating pressure

(a) increases

(b) decreases

(c) remains same

(d) may increase or decrease depending upon

the solubility of the gas in the liquid **82.** Stage efficiency for packed tower varies with the (a) type & size of packing.

(b) fluid rates and fluid properties.

(c) operating pressure and column diameter. (d) all (a), (b) and (c).

83. Pick out the wrong statement pertaining to the comparative evaluation of performance of the packed tower and the plate tower. (a) Plate tower is preferred, if interstage cooling is required to remove heats of reaction or solution.

(b) Plate tower is preferred over packed tower, if the operation involves liquids containing dispersed solids.

(c) The total weight of a dry plate tower is usually much more than that of a dry packed tower designed for the same duty.

(d) In operations involving large temperature changes, (e.g. distillation), plate towers are preferred over packed towers as the packing may be crushed due to large temperature changes.

84. Pick out the correct statement.

(a) When highly corrosive fluids are to be handled, the plate towers prove to be cheaper and easier to construct than packed tower.

(b) Packed towers are generally preferred over plate towers, if the liquids have a foaming tendency.

(c) The pressure drop through the packed towers is generally more than the pressure drop through plate towers designed

85. Bubble cap tray is the most commonly used tray in large distillation column, because (a) of its flexibility and nearly constant efficiency

(b)

(d)

under varying conditions of operation. it incurs less pressure drop as compared to any other tray designed for the same duty. it eliminates the foaming and entrainment tendency during operation.
none of these.

86. In a double pipe concentric heat exchanger, the equivalent diameter of annulus for heat transfer would be

(a)

$$\frac{D_2^2 - D_1^2}{D_2 - D_1}$$

(b) $D_2 - D_1$

$$\frac{D_2^2 - D_1^2}{D_2 + D_1}$$

$$\frac{D_2^2 - D_1^2}{D_2 - D_1}$$

(c) None of these

where, D_1 and D_2 are I.D. of inner and outer pipes

87. In the above question, the equivalent diameter of annulus for pressure drop would be (a) $D_2 - D_1$.

$$\frac{D_2^2 - D_1^2}{D_2 - D_1}$$

$$\frac{D_2^2 - D_1^2}{D_2 + D_1}$$

$$\frac{D_2^2 - D_1^2}{D_2 - D_1}$$

$$\frac{D_2^2 - D_1^2}{D_2 + D_1}$$

(c)

$$\frac{D_2^2 - D_1^2}{D_2 - D_1}$$

$$\frac{D_2^2 - D_1^2}{D_2 + D_1}$$

(d) same as that for heat transfer.

88. Lug support is

(a)

(b)

(c)

the most suitable for thick vertical vessel. same as bracket support.

provided usually for vessels of much smaller height than skirt supported vessels.

(d) all (a), (b) and (c).

89. A cylindrical storage tank can have a self supported conical roof,

(a) if its diameter is less than 15-20 metres.

(b) if its diameter is more than 50 meters.

(c) if the thickness of the roof is more than

(d)

that of the cylindrical shell. irrespective of its diameter.

90. Column support for the roof of cylindrical storage tank must be provided for

(a) (b) (c) (d) all tanks irrespective of their heights and small diameter tanks.

large diameter tanks. small diameter tall tanks.

for same duty. (d) none of these.

80.(c) 81.(c) 82.(d) 83.(c) 84.(b) diameters.

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85. (a) 86.(c) 87.(a) 88.(d) 89.(a) 90.(b) **91.** Normally, the plate thickness of the bottoms and roofs of vertically cylindrical storage vessels as compared to that of the cylindrical shell is (a) more

(b) less

(c) same

(d) more or less depending upon the pressure

& temperature inside the vessel and the nature of the fluid contained therein.

92. For a cylindrical shell, (subject to the thickness of uppermost course being more than the minimum for dia of the tank in question), the thickness of the courses of shell

(a) decreases upwards.

(b) increases upwards.

(c) remains same throughout.

(d) may decrease or increase upwards depending upon whether vacuum or positive pressure would be maintained inside the shell.

93. In hydrostatic testing of welded pipe (for leakage, strength etc.) the ratio of minimum hydrostatic test pressure to internal design pressure is around

(a) 0.5 (b) 1.5

(c) 2.5 (d) 3.5

94. Of the pressure vessels, with same thickness but different diameters, which one withstands higher pressure ?

(a) Larger dia vessel.

(b) Smaller dia vessel.

(c) Larger dia long vessel.

(d) Strength of the vessel is same irrespective of the diameter.

95. In condenser, the cooling water is passed in the tube side in a pass arrangement, because (a) it reduces heat transfer area.

(b) more thinner tubes can be used.

(c) pressure drop is reduced.

(d) it makes condenser compact.

96. In the agitators, the power required will be changed with the increase of diameter of agitator (D) as

(a) D^2 (b) D^5

(c) D (d) D^9

97. The wall thickness for a large high pressure pipeline is determined by the consideration of the (a) axial tensile stress in the pipe.

(b) forces exerted by static and dynamic action at bends.

(c) circumferential pipewall tension.

(d) temperature stresses.

98. The LMTD correction factor (FT) is applied in.....heat exchangers.

(a) 1–1 cocurrent

(b) double pipe

(c) all multipass

(d) all (involving liquid/liquid heat transfer)

99. At equal mass velocities, the values of film coefficients for gases as compared to that for liquids are generally.

(a) higher (b) lower

(c) same (d) unpredictable

100. The LMTD correction factor (FT) is defined as the

(a) ratio of true temperature difference to

the LMTD.

(b) ratio of LMTD to the true temperature difference.

(c) difference of true temperature difference and the LMTD.

(d) geometric mean of the true temperature difference and the LMTD.

101. With increase in the number of shell passes, the value of FT

- (a) increases
- (b) decreases
- (c) remains same
- (d) remains same, only if the number of tube

passes does not change.

102. Cooling water fouling factors vary in the range of 0.001 to 0.003

- (a) $(\text{BTU/hr.ft}^2 \cdot ^\circ\text{F})^{-1}$
- (b) $(\text{kcal/hr.m}^2 \cdot ^\circ\text{C})^{-1}$
- (c) $(\text{W/m}^2 \cdot ^\circ\text{K})^{-1}$
- (d) $(\text{kcal/hr. m. } ^\circ\text{C})^{-1}$

The shell side pressure drop in a shell and **103.**
tube heat exchanger is maximum for..... baffle.

- (a) disk and ring
- (b) segmental
- (c) orifice
- (d) independent of the type of

104. It is not desirable to design a heat exchanger for LMTD correction factor, FT, of less than (a) 0.99 (b) 0.95
(c) 0.80 (d) 0.55

ANSWERS

91. (b) 92.(a) 93.(b) 94.(b) 95.(a) 96.(b) 97.(c) 98.(c) 99.(b) 100.(a) 101.(a) 102.
(a)
103.(c) 104.(b)

105. For given number of passes, pitch & tube diameter, the maximum number of tubes that can be accommodated in a shell of tripled inside diameter will be.....times.

- (a) about 9
- (b) considerably more than 9
- (c) considerably less than 9
- (d) about 3

106. Which of the following is the best tube material from thermal conductivity point of view alone ?

(a) Aluminium (b) Stainless steel (c) Copper (d) Carbon steel

107. Which tube arrangement in a heat exchanger would facilitate highest heat transfer rate ? (a) Triangular pitch.

(b) Square pitch.

(c) Diagonal square pitch.

(d) Heat transfer rate is independent of tube

arrangement.

108. With increase in temperature drop (in a shell and tube heat exchanger), the LMTD correction factor, F_T

(a) decreases very rapidly

(b) increases very rapidly

(c) remains constant

(d) increases linearly

109. The dust collection efficiency of a cyclone separator

(a) decreases with increase in gas flow rate. (b) is inversely proportional to the mass of

the dust particle.

(c) is directly proportional to the radius of the dust particle path.

(d) none of these.

110. In the design of a bag filter, the gas temperature is an important consideration, as it affects the

(a) gas density (b) gas viscosity (c) fibre selection (d) all (a), (b) & (c)

111. The operating pressure drop range in a bag filter is about.....mm water gauge.

(a) 50–150 (b) 5–10

(c) 500–1500 (d) 1500–2500

112. The ratio of volumes of the mixed reactor to the plug flow reactor (for identical feed composition, flow rate, conversion, and for all positive reaction orders) is always

- (b) <1
 (c) >1
 (d) equal to the order of reaction

113. The optimum size ratio for two mixed reactors in series depends on the kinetics of the reaction and the conversion level. For reaction orders more than one, the

- (a) equal sized reactors are the best. (b) smaller reactor should come first. (c) larger reactor should come first. (d) none of these.

114. tray arrangement is recommended for distillation column having diameter upto 4 ft. (a) Radial flow (c) Split flow (b) Cross flow (d) Cascade

115. Vapor velocity in a distillation column for non-foaming mixture is in the range of..... times the flooding velocity.

- (a) 0.1 to 0.3 (b) 0.6 to 0.7 (c) 0.85 to 0.95 (d) 1.5 to 2

116. Pressure drop per tray in the atmospheric distillation column is about.....psi. (a) 0.01–0.5 (b) 0.07–0.12 (c) 0.5–1.0 (d) 1–3

117. In a distillation column, the minimum residence time for liquid in the downspout is about.....seconds.

- (a) 1 (b) 8
 (c) 80 (d) 180

118. Hold up of material in a operating rotary drier is in the range of
 (a) 0.05 to 0.15 (b) 0.25 to 0.50 (c) 0.5 to 0.8 (d) 0.8 to 0.9

119. Length to diameter ratio of most rotary driers is in the range of
 (a) 1 to 2 (b) 4 to 10 (c) 10 to 20 (d) 20 to 30

120. In a rotary drier, the average retention time of solid is

- (a) $ZH.r$ (b) L
 (c) $L ZH.r$
 (d) $r (d)^{ZH} (c)^{H..}$
 (e) $L.r$

where Z = length of the drier, metres r = apparent solid density, kg/m^3 L = flow

rate of dry solids, kg/sec. m^2 drier cross-section H = hold up of solid.

(a) 1

ANSWERS

105. (c) 106. (a) 107. (a) 108. (d) 109. (d) 110. (a) 111. (c) 112. (b) 113. (b) 114. (b)
115. (b) 116. (b)
117. (a) 118. (b) 119. (a) 120. (b)

121. Rotary driers are most economically designed **129.** Equivalent diameter for heat transfer calculation for a duct of square cross-section having side as 'd' will be (a) 0.01 to 1 (b) 1.5 to 2.5 (c) d (d) 5 to 10 (e) 10 to 20

122. McCabe Thiele method used for finding (c) 2 (d) 2d theoretical stages in a distillation column as **130.** In a shell and tube heat exchanger having square pitch, the shell side equivalent diameter (a) sensible heat differences are small, better is given by

cause the temperature changes from tray to tray is small. (a) $Pd - rd$ (b) Pd (c) $Pd/4$ (d) $Pd/2$ (e) $Pd/4$ Trouton's rule is applicable.

(c) liquid/vapor loading across the column $4P^2_{pdP2}$ remains constant. (c) d (d) (d) all (a), (b) and (c).

123. The slope of operating line in the rectifying section of a distillation column is unity, if the (a) 0 (b) ∞ (c) 1 (d) 2 (e) 3 (f) 4 (g) 5 (h) 6 (i) 7 (j) 8 (k) 9 (l) 10 (m) 11 (n) 12 (o) 13 (p) 14 (q) 15 (r) 16 (s) 17 (t) 18 (u) 19 (v) 20 (w) 21 (x) 22 (y) 23 (z) 24 (aa) 25 (ab) 26 (ac) 27 (ad) 28 (ae) 29 (af) 30 (ag) 31 (ah) 32 (ai) 33 (aj) 34 (ak) 35 (al) 36 (am) 37 (an) 38 (ao) 39 (ap) 40 (aq) 41 (ar) 42 (as) 43 (at) 44 (au) 45 (av) 46 (aw) 47 (ax) 48 (ay) 49 (az) 50 (ba) 51 (bb) 52 (bc) 53 (bd) 54 (be) 55 (bf) 56 (bg) 57 (bh) 58 (bi) 59 (bj) 60 (bk) 61 (bl) 62 (bm) 63 (bn) 64 (bo) 65 (bp) 66 (bq) 67 (br) 68 (bs) 69 (bt) 70 (bu) 71 (bv) 72 (bw) 73 (bx) 74 (by) 75 (bz) 76 (ca) 77 (cb) 78 (cc) 79 (cd) 80 (ce) 81 (cf) 82 (cg) 83 (ch) 84 (ci) 85 (cj) 86 (ck) 87 (cl) 88 (cm) 89 (cn) 90 (co) 91 (cp) 92 (cq) 93 (cr) 94 (cs) 95 (ct) 96 (cu) 97 (cv) 98 (cw) 99 (cx) 100 (cy) 101 (cz) 102 (da) 103 (db) 104 (dc) 105 (dd) 106 (de) 107 (df) 108 (dg) 109 (dh) 110 (di) 111 (dj) 112 (dk) 113 (dl) 114 (dm) 115 (dn) 116 (do) 117 (dp) 118 (dq) 119 (dr) 120 (ds) 121 (dt) 122 (du) 123 (dv) 124 (dw) 125 (dx) 126 (dy) 127 (dz) 128 (ea) 129 (eb) 130 (ec) 131 (ed) 132 (ee) 133 (ef) 134 (eg) 135 (eh) 136 (ei) 137 (ej) 138 (ek) 139 (el) 140 (em) 141 (en) 142 (eo) 143 (ep) 144 (eq) 145 (er) 146 (es) 147 (et) 148 (eu) 149 (ev) 150 (ew) 151 (ex) 152 (ey) 153 (ez) 154 (fa) 155 (fb) 156 (fc) 157 (fd) 158 (fe) 159 (ff) 160 (fg) 161 (fh) 162 (fi) 163 (fj) 164 (fk) 165 (fl) 166 (fm) 167 (fn) 168 (fo) 169 (fp) 170 (fq) 171 (fr) 172 (fs) 173 (ft) 174 (fu) 175 (fv) 176 (fw) 177 (fx) 178 (fy) 179 (fz) 180 (ga) 181 (gb) 182 (gc) 183 (gd) 184 (ge) 185 (gf) 186 (gg) 187 (gh) 188 (gi) 189 (gj) 190 (gk) 191 (gl) 192 (gm) 193 (gn) 194 (go) 195 (gp) 196 (gq) 197 (gr) 198 (gs) 199 (gt) 200 (gu) 201 (gv) 202 (gw) 203 (gx) 204 (gy) 205 (gz) 206 (ha) 207 (hb) 208 (hc) 209 (hd) 210 (he) 211 (hf) 212 (hg) 213 (hh) 214 (hi) 215 (hj) 216 (hk) 217 (hl) 218 (hm) 219 (hn) 220 (ho) 221 (hp) 222 (hq) 223 (hr) 224 (hs) 225 (ht) 226 (hu) 227 (hv) 228 (hw) 229 (hx) 230 (hy) 231 (hz) 232 (ia) 233 (ib) 234 (ic) 235 (id) 236 (ie) 237 (if) 238 (ig) 239 (ih) 240 (ii) 241 (ij) 242 (ik) 243 (il) 244 (im) 245 (in) 246 (io) 247 (ip) 248 (iq) 249 (ir) 250 (is) 251 (it) 252 (iu) 253 (iv) 254 (iw) 255 (ix) 256 (iy) 257 (iz) 258 (ja) 259 (jb) 260 (jc) 261 (jd) 262 (je) 263 (jf) 264 (jg) 265 (jh) 266 (ji) 267 (jj) 268 (jk) 269 (jl) 270 (jm) 271 (jn) 272 (jo) 273 (jp) 274 (jq) 275 (jr) 276 (js) 277 (jt) 278 (ju) 279 (jv) 280 (jw) 281 (jx) 282 (jy) 283 (jz) 284 (ka) 285 (kb) 286 (kc) 287 (kd) 288 (ke) 289 (kf) 290 (kg) 291 (kh) 292 (ki) 293 (kj) 294 (kk) 295 (kl) 296 (km) 297 (kn) 298 (ko) 299 (kp) 300 (kq) 301 (kr) 302 (ks) 303 (kt) 304 (ku) 305 (kv) 306 (kw) 307 (kx) 308 (ky) 309 (kz) 310 (la) 311 (lb) 312 (lc) 313 (ld) 314 (le) 315 (lf) 316 (lg) 317 (lh) 318 (li) 319 (lj) 320 (lk) 321 (ll) 322 (lm) 323 (ln) 324 (lo) 325 (lp) 326 (lq) 327 (lr) 328 (ls) 329 (lt) 330 (lu) 331 (lv) 332 (lw) 333 (lx) 334 (ly) 335 (lz) 336 (ma) 337 (mb) 338 (mc) 339 (md) 340 (me) 341 (mf) 342 (mg) 343 (mh) 344 (mi) 345 (mj) 346 (mk) 347 (ml) 348 (mm) 349 (mn) 350 (mo) 351 (mp) 352 (mq) 353 (mr) 354 (ms) 355 (mt) 356 (mu) 357 (mv) 358 (mw) 359 (mx) 360 (my) 361 (mz) 362 (na) 363 (nb) 364 (nc) 365 (nd) 366 (ne) 367 (nf) 368 (ng) 369 (nh) 370 (ni) 371 (nj) 372 (nk) 373 (nl) 374 (nm) 375 (nn) 376 (no) 377 (np) 378 (nq) 379 (nr) 380 (ns) 381 (nt) 382 (nu) 383 (nv) 384 (nw) 385 (nx) 386 (ny) 387 (nz) 388 (oa) 389 (ob) 390 (oc) 391 (od) 392 (oe) 393 (of) 394 (og) 395 (oh) 396 (oi) 397 (oj) 398 (ok) 399 (ol) 400 (om) 401 (on) 402 (oo) 403 (op) 404 (oq) 405 (or) 406 (os) 407 (ot) 408 (ou) 409 (ov) 410 (ow) 411 (ox) 412 (oy) 413 (oz) 414 (pa) 415 (pb) 416 (pc) 417 (pd) 418 (pe) 419 (pf) 420 (pg) 421 (ph) 422 (pi) 423 (pj) 424 (pk) 425 (pl) 426 (pm) 427 (pn) 428 (po) 429 (pp) 430 (pq) 431 (pr) 432 (ps) 433 (pt) 434 (pu) 435 (pv) 436 (pw) 437 (px) 438 (py) 439 (pz) 440 (qa) 441 (qb) 442 (qc) 443 (qd) 444 (qe) 445 (qf) 446 (qg) 447 (qh) 448 (qi) 449 (qj) 450 (qk) 451 (ql) 452 (qm) 453 (qn) 454 (qo) 455 (qp) 456 (qq) 457 (qr) 458 (qs) 459 (qt) 460 (qu) 461 (qv) 462 (qw) 463 (qx) 464 (qy) 465 (qz) 466 (ra) 467 (rb) 468 (rc) 469 (rd) 470 (re) 471 (rf) 472 (rg) 473 (rh) 474 (ri) 475 (rj) 476 (rk) 477 (rl) 478 (rm) 479 (rn) 480 (ro) 481 (rp) 482 (rq) 483 (rr) 484 (rs) 485 (rt) 486 (ru) 487 (rv) 488 (rw) 489 (rx) 490 (ry) 491 (rz) 492 (sa) 493 (sb) 494 (sc) 495 (sd) 496 (se) 497 (sf) 498 (sg) 499 (sh) 500 (si) 501 (sj) 502 (sk) 503 (sl) 504 (sm) 505 (sn) 506 (so) 507 (sp) 508 (sq) 509 (sr) 510 (ss) 511 (st) 512 (su) 513 (sv) 514 (sw) 515 (sx) 516 (sy) 517 (sz) 518 (ta) 519 (tb) 520 (tc) 521 (td) 522 (te) 523 (tf) 524 (tg) 525 (th) 526 (ti) 527 (tj) 528 (tk) 529 (tl) 530 (tm) 531 (tn) 532 (to) 533 (tp) 534 (tq) 535 (tr) 536 (ts) 537 (tt) 538 (tu) 539 (tv) 540 (tw) 541 (tx) 542 (ty) 543 (tz) 544 (ua) 545 (ub) 546 (uc) 547 (ud) 548 (ue) 549 (uf) 550 (ug) 551 (uh) 552 (ui) 553 (uj) 554 (uk) 555 (ul) 556 (um) 557 (un) 558 (uo) 559 (up) 560 (uq) 561 (ur) 562 (us) 563 (ut) 564 (uu) 565 (uv) 566 (uw) 567 (ux) 568 (uy) 569 (uz) 570 (va) 571 (vb) 572 (vc) 573 (vd) 574 (ve) 575 (vf) 576 (vg) 577 (vh) 578 (vi) 579 (vj) 580 (vk) 581 (vl) 582 (vm) 583 (vn) 584 (vo) 585 (vp) 586 (vq) 587 (vr) 588 (vs) 589 (vt) 590 (vu) 591 (vv) 592 (vw) 593 (vx) 594 (vy) 595 (vz) 596 (wa) 597 (wb) 598 (wc) 599 (wd) 600 (we) 601 (wf) 602 (wg) 603 (wh) 604 (wi) 605 (wj) 606 (wk) 607 (wl) 608 (wm) 609 (wn) 610 (wo) 611 (wp) 612 (wq) 613 (wr) 614 (ws) 615 (wt) 616 (wu) 617 (wv) 618 (ww) 619 (wx) 620 (wy) 621 (wz) 622 (xa) 623 (xb) 624 (xc) 625 (xd) 626 (xe) 627 (xf) 628 (xg) 629 (xh) 630 (xi) 631 (xj) 632 (xk) 633 (xl) 634 (xm) 635 (xn) 636 (xo) 637 (xp) 638 (xq) 639 (xr) 640 (xs) 641 (xt) 642 (xu) 643 (xv) 644 (xw) 645 (xx) 646 (xy) 647 (xz) 648 (ya) 649 (yb) 650 (yc) 651 (yd) 652 (ye) 653 (yf) 654 (yg) 655 (yh) 656 (yi) 657 (yj) 658 (yk) 659 (yl) 660 (ym) 661 (yn) 662 (yo) 663 (yp) 664 (yq) 665 (yr) 666 (ys) 667 (yt) 668 (yu) 669 (yv) 670 (yw) 671 (yx) 672 (yy) 673 (yz) 674 (za) 675 (zb) 676 (zc) 677 (zd) 678 (ze) 679 (zf) 680 (zg) 681 (zh) 682 (zi) 683 (zj) 684 (zk) 685 (zl) 686 (zm) 687 (zn) 688 (zo) 689 (zp) 690 (zq) 691 (zr) 692 (zs) 693 (zt) 694 (zu) 695 (zv) 696 (zw) 697 (zx) 698 (zy) 699 (zz) 700 (aa) 701 (ab) 702 (ac) 703 (ad) 704 (ae) 705 (af) 706 (ag) 707 (ah) 708 (ai) 709 (aj) 710 (ak) 711 (al) 712 (am) 713 (an) 714 (ao) 715 (ap) 716 (aq) 717 (ar) 718 (as) 719 (at) 720 (au) 721 (av) 722 (aw) 723 (ax) 724 (ay) 725 (az) 726 (ba) 727 (bb) 728 (bc) 729 (bd) 730 (be) 731 (bf) 732 (bg) 733 (bh) 734 (bi) 735 (bj) 736 (bk) 737 (bl) 738 (bm) 739 (bn) 740 (bo) 741 (bp) 742 (bq) 743 (br) 744 (bs) 745 (bt) 746 (bu) 747 (bv) 748 (bw) 749 (bx) 750 (by) 751 (bz) 752 (ca) 753 (cb) 754 (cc) 755 (cd) 756 (ce) 757 (cf) 758 (cg) 759 (ch) 760 (ci) 761 (cj) 762 (ck) 763 (cl) 764 (cm) 765 (cn) 766 (co) 767 (cp) 768 (cq) 769 (cr) 770 (cs) 771 (ct) 772 (cu) 773 (cv) 774 (cw) 775 (cx) 776 (cy) 777 (cz) 778 (da) 779 (db) 780 (dc) 781 (dd) 782 (de) 783 (df) 784 (dg) 785 (dh) 786 (di) 787 (dj) 788 (dk) 789 (dl) 790 (dm) 791 (dn) 792 (do) 793 (dp) 794 (dq) 795 (dr) 796 (ds) 797 (dt) 798 (du) 799 (dv) 800 (dw) 801 (dx) 802 (dy) 803 (dz) 804 (ea) 805 (eb) 806 (ec) 807 (ed) 808 (ee) 809 (ef) 810 (eg) 811 (eh) 812 (ei) 813 (ej) 814 (ek) 815 (el) 816 (em) 817 (en) 818 (eo) 819 (ep) 820 (eq) 821 (er) 822 (es) 823 (et) 824 (eu) 825 (ev) 826 (ew) 827 (ex) 828 (ey) 829 (ez) 830 (fa) 831 (fb) 832 (fc) 833 (fd) 834 (fe) 835 (ff) 836 (fg) 837 (fh) 838 (fi) 839 (fj) 840 (fk) 841 (fl) 842 (fm) 843 (fn) 844 (fo) 845 (fp) 846 (fq) 847 (fr) 848 (fs) 849 (ft) 850 (fu) 851 (fv) 852 (fw) 853 (fx) 854 (fy) 855 (fz) 856 (ga) 857 (gb) 858 (gc) 859 (gd) 860 (ge) 861 (gf) 862 (gg) 863 (gh) 864 (gi) 865 (gj) 866 (gk) 867 (gl) 868 (gm) 869 (gn) 870 (go) 871 (gp) 872 (gq) 873 (gr) 874 (gs) 875 (gt) 876 (gu) 877 (gv) 878 (gw) 879 (gx) 880 (gy) 881 (gz) 882 (ha) 883 (hb) 884 (hc) 885 (hd) 886 (he) 887 (hf) 888 (hg) 889 (hi) 890 (hj) 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1002 (lr) 1003 (ls) 1004 (lt) 1005 (lu) 1006 (lv) 1007 (lw) 1008 (lx) 1009 (ly) 1010 (lz) 1011 (ma) 1012 (mb) 1013 (mc) 1014 (md) 1015 (me) 1016 (mf) 1017 (mg) 1018 (mh) 1019 (mi) 1020 (mj) 1021 (mk) 1022 (ml) 1023 (mm) 1024 (mn) 1025 (mo) 1026 (mp) 1027 (mq) 1028 (mr) 1029 (ms) 1030 (mt) 1031 (mu) 1032 (mv) 1033 (mw) 1034 (mx) 1035 (my) 1036 (mz) 1037 (na) 1038 (nb) 1039 (nc) 1040 (nd) 1041 (ne) 1042 (nf) 1043 (ng) 1044 (nh) 1045 (ni) 1046 (nj) 1047 (nk) 1048 (nl) 1049 (nm) 1050 (nn) 1051 (no) 1052 (np) 1053 (nq) 1054 (nr) 1055 (ns) 1056 (nt) 1057 (nu) 1058 (nv) 1059 (nw) 1060 (nx) 1061 (ny) 1062 (nz) 1063 (oa) 1064 (ob) 1065 (oc) 1066 (od) 1067 (oe) 1068 (of) 1069 (og) 1070 (oh) 1071 (oi) 1072 (oj) 1073 (ok) 1074 (ol) 1075 (om) 1076 (on) 1077 (oo) 1078 (op) 1079 (oq) 1080 (or) 1081 (os) 1082 (ot) 1083 (ou) 1084 (ov) 1085 (ow) 1086 (ox) 1087 (oy) 1088 (oz) 1089 (pa) 1090 (pb) 1091 (pc) 1092 (pd) 1093 (pe) 1094 (pf) 1095 (pg) 1096 (ph) 1097 (pi) 1098 (pj) 1099 (pk) 1100 (pl) 1101 (pm) 1102 (pn) 1103 (po) 1104 (pp) 1105 (pq) 1106 (pr) 1107 (ps) 1108 (pt) 1109 (pu) 1110 (pv) 1111 (pw) 1112 (px) 1113 (py) 1114 (pz) 1115 (qa) 1116 (qb) 1117 (qc) 1118 (qd) 1119 (qe) 1120 (qf) 1121 (qg) 1122 (qh) 1123 (qi) 1124 (qj) 1125 (qk) 1126 (ql) 1127 (qm) 1128 (qn) 1129 (qo) 1130 (qp) 1131 (qq) 1132 (qr) 1133 (qs) 1134 (qt) 1135 (qu) 1136 (qv) 1137 (qw) 1138 (qx) 1139 (qy) 1140 (qz) 1141 (ra) 1142 (rb) 1143 (rc) 1144 (rd) 1145 (re) 1146 (rf) 1147 (rg) 1148 (rh) 1149 (ri) 1150 (rj) 1151 (rk) 1152 (rl) 1153 (rm) 1154 (rn) 1155 (ro) 1156 (rp) 1157 (rq) 1158 (rr) 1159 (rs) 1160 (rt) 1161 (ru) 1162 (rv) 1163 (rw) 1164 (rx) 1165 (ry) 1166 (rz) 1167 (sa) 1168 (sb) 1169 (sc) 1170 (sd) 1171 (se) 1172 (sf) 1173 (sg) 1174 (sh) 1175 (si) 1176 (sj) 1177 (sk) 1178 (sl) 1179 (sm) 1180 (sn) 1181 (so) 1182 (sp) 1183 (sq) 1184 (sr) 1185 (ss) 1186 (st) 1187 (su) 1188 (sv) 1189 (sw) 1190 (sx) 1191 (sy) 1192 (sz) 1193 (ta) 1194 (tb) 1195 (tc) 1196 (td) 1197 (te) 1198 (tf) 1199 (tg) 1200 (th) 1201 (ti) 1202 (tj) 1203 (tk) 1204 (tl) 1205 (tm) 1206 (tn) 1207 (to) 1208 (tp) 1209 (tq) 1210 (tr) 1211 (ts) 1212 (tt) 1213 (tu) 1214 (tv) 1215 (tw) 1216 (tx) 1217 (ty) 1218 (tz) 1219 (ua) 1220 (ub) 1221 (uc) 1222 (ud) 1223 (ue) 1224 (uf) 1225 (ug) 1226 (uh) 1227 (ui) 1228 (uj) 1229 (uk) 1230 (ul) 1231 (um) 1232 (un) 1233 (uo) 1234 (up) 1235 (uq) 1236 (ur) 1237 (us) 1238 (ut) 1239 (uu) 1240 (uv) 1241 (uw) 1242 (ux) 1243 (uy) 1244 (uz) 1245 (va) 1246 (vb) 1247 (vc) 1248 (vd) 1249 (ve) 1250 (vf) 1251 (vg) 1252 (vh) 1253 (vi) 1254 (vj) 1255 (vk) 1256 (vl) 1257 (vm) 1258 (vn) 1259 (vo) 1260 (vp) 1261 (vq) 1262 (vr) 1263 (vs) 1264 (vt) 1265 (vu) 1266 (vv) 1267 (vw) 1268 (vx) 1269 (vy) 1270 (vz) 1271 (wa) 1272 (wb) 1273 (wc) 1274 (wd) 1275 (we) 1276 (wf) 1277 (wg) 1278 (wh) 1279 (wi) 1280 (wj) 1281 (wk) 1282 (wl) 1283 (wm) 1284 (wn) 1285 (wo) 1286 (wp) 1287 (wq) 1288 (wr) 1289 (ws) 1290 (wt) 1291 (wu) 1292 (wv) 1293 (ww) 1294 (wx) 1295 (wy) 1296 (wz) 1297 (xa) 1298 (xb) 1299 (xc) 1300 (xd) 1301 (xe) 1302 (xf) 1303 (xg) 1304 (xh) 1305 (xi) 1306 (xj) 1307 (xk) 1308 (xl) 1309 (xm) 1310 (xn) 1311 (xo) 1312 (xp) 1313 (xq) 1314 (xr) 1315 (xs) 1316 (xt) 1317 (xu) 1318 (xv) 1319 (xw) 1320 (xx) 1321 (xy) 1322 (xz) 1323 (ya) 1324 (yb) 1325 (yc) 1326 (yd) 1327 (ye) 1328 (yf) 1329 (yg) 1330 (yh) 1331 (yi) 1332 (yj) 1333 (yk) 1334 (yl) 1335 (ym) 1336 (yn) 1337 (yo) 1338 (yp) 1339 (yq) 1340 (yr) 1341 (ys) 1342 (yt) 1343 (yu) 1344 (yv) 1345 (yw) 1346 (yx) 1347 (yy) 1348 (yz) 1349 (za) 1350 (zb) 1351 (zc) 1352 (zd) 1353 (ze) 1354 (zf) 1355 (zg) 1356 (zh) 1357 (zi) 1358 (zj) 1359 (zk) 1360 (zl) 1361 (zm) 1362 (zn) 1363 (zo) 1364 (zp) 1365 (zq) 1366 (zr) 1367 (zs) 1368 (zt) 1369 (zu) 1370 (zv) 1371 (zw) 1372 (zx) 1373 (zy) 1374 (zz) 1375 (aa) 1376 (ab) 1377 (ac) 1378 (ad) 1379 (ae) 1380 (af) 1381 (ag) 1382 (ah) 1383 (ai) 1384 (aj) 1385 (ak) 1386 (al) 1387 (am) 1388 (an) 1389 (ao) 1390 (ap) 1391 (aq) 1392 (ar) 1393 (as) 1394 (at) 1395 (au) 1396 (av) 1397 (aw) 1398 (ax) 1399 (ay) 1400 (az) 1401 (ba) 1402 (bb) 1403 (bc) 1404 (bd) 1405 (be) 1406 (bf) 1407 (bg) 1408 (bh) 1409 (bi) 1410 (bj) 1411 (bk) 1412 (bl) 1413 (bm) 1414 (bn) 1415 (bo) 1416 (bp) 1417 (bq) 1418 (br) 1419 (bs) 1420 (bt) 1421 (bu) 1422 (bv) 1423 (bw) 1424 (bx) 1425 (by) 1426 (bz) 1427 (ca) 1428 (cb) 1429 (cc) 1430 (cd) 1431 (ce) 1432 (cf) 1433 (cg) 1434 (ch) 1435 (ci) 1436 (cj) 1437 (ck) 1438 (cl) 1439 (cm) 1440 (cn) 1441 (co) 1442 (cp) 1443 (cq) 1444 (cr) 1445 (cs) 1446 (ct) 1447 (cu) 1448 (cv) 1449 (cw) 1450 (cx) 1451 (cy) 1452 (cz) 1453 (da) 1454 (db) 1455 (dc) 1456 (dd) 1457 (de) 1458 (df) 1459 (dg) 1460 (dh) 1461 (di) 1462 (dj) 1463 (dk) 1464 (dl) 1465 (dm) 1466 (dn) 1467 (do) 1468 (dp) 1469 (dq) 1470 (dr) 1471 (ds) 1472 (dt) 1473 (du) 1474 (dv) 1475 (dw) 1476 (dx) 1477 (dy) 1478 (dz) 1479 (ea) 1480 (eb) 1481 (ec) 1482 (ed) 1483 (ee) 1484 (ef) 1485 (eg) 1486 (eh) 1487 (ei) 1488 (ej) 1489 (ek) 1490 (el) 1491 (em) 1492 (en) 1493 (eo) 1494 (ep) 1495 (eq) 1496 (er) 1497 (es) 1498 (et) 1499 (eu) 1500 (ev) 1501 (ew) 1502 (ex) 1503 (ey) 1504 (ez) 1505 (fa) 1506 (fb) 1507 (fc) 1508 (fd) 1509 (fe) 1510 (ff) 1511 (fg) 1512 (fh) 1513 (fi) 1514 (fj) 1515 (fk) 1516 (fl) 1517 (fm) 1518 (fn) 1519 (fo) 1520 (fp) 1521 (fq) 1522 (fr) 1523 (fs) 1524 (ft) 1525 (fu) 1526 (fv) 1527 (fw) 1528 (fx) 1529 (fy) 1530 (fz) 1531 (ga) 1532 (gb) 1533 (gc) 1534 (gd) 1535 (ge) 1536 (gf) 1537 (gg) 1538 (gh) 1539 (gi) 1540 (gj) 1541 (gk) 1542 (gl) 1543 (gm) 1544 (gn) 1545 (go) 1546 (gp) 1547 (gq) 1548 (gr) 1549 (gs) 1550 (gt) 1551 (gu) 1552 (gv) 1553 (gw) 1554 (gx) 1555 (gy) 1556 (gz) 1557 (ha) 1558 (hb) 1559 (hc) 1560 (hd) 1561 (he) 1562 (hf) 1563 (hg) 1564 (hi) 1565 (hj) 1566 (hk) 1567 (hl) 1568 (hm) 1569 (hn) 1570 (ho) 1571 (hp) 1

(b)^{Pd}

^pRaoult's Law.

(a) positive (b) negative (c) no (d) none of these (c)^{Pd}

^p125. The normal range of velocity of water in pipes ^d

²² / 4) is.....m/sec. (d) (4_{Pd}

(a) 0.1–0.5 (b) 1–2 (c) 10–50 (d) 80–100^d

126. The normal range of velocity of steam in ¹³². Tube side heat transfer co-efficient for

turbulent flow of liquid through tubes is proportional to (a) 0.1–0.5 (b)

1–5

(c)

10–20

(d)

80–100

(a) $G^{0.2}$ (b) $G^{0.5}$ (c) $G^{0.8}$ (d) $G^{1.5}$ 127. In a heat exchanger, shell side fluid

velocity 133. The average velocity in the tubes of a 1-4 heat exchanger is.....times that in 1-1 heat exchanger having the same size & number of (b) pitch tubes and operated at same liquid flow rate. (c) both (a) & (b) (a) 2 (b) 1/2 (d) neither (a) nor (b) (c) 4 (d) 1/4

128. Width and depth of grooves in the tube sheet 134. Tube side pressure drop in a 1-2 heat exchanger normally are.....inch respectively. (for turbulent flow of fluids through the tubes) is about.....times, than that in a (a)

11 (b) 11 1-1 heat exchanger having the same size &

8 and 64 64 and 8 number of tubes and operated at the same liquid flow rate.

(c)¹ and 8 (d)¹ and 5 (a) 2 (b) 1/2 (c) 4 (d) 8

ANSWERS

121. (d) 122. (d) 123. (b) 124. (b) 125. (b) 126. (d) 127. (c) 128. (a) 129. (a) 130. (a)

131. (a) 132. (c)

133. (c) 134. (d)

135. Steam side heat transfer co-efficient for design consideration under ordinary condition can be assumed to be about kcal/hr.m². °C. (a) 1250 (b) 2500 (c) 7500 (d) 15000

136. Thin spherical shells subjected to internal pressure, develop.....stresses.

(a) radial

(b) circumferential

- (c) both (a) & (b)
- (d) neither (a) nor (b)

137. Where does the maximum tensile strength occur in a thick cylindrical vessel subjected to internal pressure ?

- (a) At the inner surface.
- (b) At the mid thickness of the cylindrical wall. (c) At the outer surface.
- (d) None of these.

138. Circumferential (hoop) stress in a thin cylindrical vessel under internal pressure is..... the longitudinal stress.

- (a) half (b) equal to (c) twice (d) eight times

139. For pipe flows, head is proportional to..... at constant capacity.

- (a) $1/D$ (b) $1/D^2$
- (c) $1/D^3$ (d) D^2

where $\rightarrow D$ = pipe diameter

140. Nominal size of a pipe is an indication of its.....diameter. (a) inner

(c) approximate (b) outer

(d) none of these **141.** If a single tube pass heat exchanger is converted to two passes; for the same flow rate, the pressure drop per unit length in tube side will.....times.

- (a) increase by 1.8
- (b) decrease by 22
- (c) increase by 21.6
- (d) none of these

142. A single pass air heater is connected to a two pass unit. For the air flow rate and other conditions remaining the same, the film heat transfer co-efficient for air will vary in the ratio of

- (a) 2 (b) 22.8 (c) 20.2 (d) none of these

143. What is the slope of the operating line in the rectifying section of a distillation column ? (a) 0 (b) ∞

- (c) >1 (d) <1

144. What is the slope of the operating line in the stripping section of a

distillation column ? (a) 0 (b) ∞
(c) >1 (d) <1

145. What is the slope of the feed line, if the feed to a distillation column is a saturated liquid ? (a) 0 (b) ∞
(c) >1 (d) <1

146. Reflux ratio variation in a distillation column is between
(a) zero and infinity
(b) zero and one
(c) minimum and infinity
(d) none of these

147. Overall tray efficiency of a distillation column is the ratio of the number of

(a) overall gas transfer units to the number

of ideal trays required.

(b) ideal trays required to the number of real trays required.

(c) real trays required to the number of ideal trays required.

(d) none of these.

148. The absorption factor is defined as

(a) S_1/S_2 (b) $S_1.S_2$

(c) S_2/S_1 (d) $1/S_1.S_2$

where, S_1 = slope of the equilibrium curve,

S_2 = slope of the operating line

149. What is the value of 'q' for saturated Vapor feed to a distillation column ?

(a) 0 (b) 1

(c) < 0 (d) > 1

where q = fraction of the feed stream that is liquid. **150.** The slope of the feed line in distillation operation is given by

(a) $-q$ (b) $-q/(1-q)$

(c) $-q/(q-1)$ (d) none of these where, q = fraction of the feed stream that is

liquid.

151. What is the value of 'q' for saturated liquid feed to a distillation column ?

(a) 0 (b) < 1

(c) 1 (d) > 1

ANSWERS

135. (c) 136. (a) 137. (a) 138. (c) 139. (c) 140. (c) 141. (c) 142. (b) 143. (d) 144. (c)

145. (b) 146. (c)

147. (b) 148. (a) 149. (a) 150. (b) 151. (c)

152. In a shell and tube heat exchanger, the 'tube pitch' is defined as the distance between the centres of two adjacent tubes. In a rivetted joint, the rivets in the pitch are opposite to each other. (a) O.D. of the tube for square pitch. (a) zig-zag (b) chain (b) shortest distance between two adjacent (c) diamond (d) none of these

tube holes. **161.** The wall thickness of thin cylindrical shell (c) shortest centre to centre distance between hemispherical ends is that of two adjacent tubes. the spherical ends. (d) none of these. (a) equal to

153. If 'D' is the inside diameter of the shell of a (b) more than shell and tube heat exchanger, then the baffle (c) less than spacing is usually in the range of (d) either (b) or (c); depends on maximum (a) $D/2$ or minimum 2" to $5D$. permissible internal pressure

(b) $D/5$ or minimum 2" to $5D$. **162.** Diameter of rivet hole (d , mm) and the plate (c) $D/5$ or minimum 2" to D . thickness (t , mm) are related by Unwin's formula as (d) none of these.

154. In a multiple effect evaporator system having

(a) $d = 1.1 t$ (b) $d = t$ (c) $d = 1.5 t$ (d) $d = 3 t$

per unit surface area is approximately equal (c) $d = 1.5 t$ (d) $d = 3 t$ to times that in a single effect.

163. The approximate liquid depth in an agitation (a) ' n ' th (b) $(1/n)$ th tank is equal to (c) $0.5 n$ th (d) $1.5 n$ th (a) $0.5 d$ (b) $0.75 d$

155. The equivalent diameter for fluid flow (c) d (d) $2d$ through a channel of constant non-circular cross-section where, d = tank diameter

cross section of area A' is given by **164.** For turbine agitator, the impeller diameter is (a)

4

A/P

(b)

A/P

about

(a) 0.3 to 0.5 d (b) 0.1 to 0.2 d (c) $4P/A$ (d) A
 (c) 0.65 to 0.85 d (d) 0.95 where, P = perimeter of the channel in contact **165.**
 Frame thickness in the plate and frame filled with the fluid under pressure is normally in the range of.....

156. The longitudinal stress induced in a thin walled cylindrical vessel under internal pressure is (a) 0.25 to 100 (b) 0.25 to 8 (c) 1 to 5 (d) 1 to 12

(a) $pd/2t$ (b) $pd/4t$ **166.** Pressure differential maintained across a continuous rotary vacuum filter is in the (c) pd/t (d) $pd/8t$

157. The circumferential (hoop) stress in a thin walled cylindrical vessel under internal pressure is (a) 50 to 100 (b) 100 to 150 (c) 250 to 500 (d) 600 to 700

(a) $pd/2t$ (b) $pd/4t$ **167.** head is the most economical for cylindrical vessels designed for operating at high (c) pd/t (d) $pd/8t$

158. The equivalent diameter for pressure drop is.....that for heat transfer. (a) Hemispherical (b) Dished (c) equal to (d) greater than (c) Ellipsoidal (d) Conical

(d) not related with **168.** liquor is best handled in a long tube **159.** The distance between the centre of a rivet hole to the nearest edge of the plate is called (a) Foamy (a) pitch (b) margin (c) Viscous back pitch (d) none of these **169.** is the determining factor for the number

of bubble caps to be used per tray.

ANSWERS

152. (c) 153. (b) 154. (b) 155. (a) 156. (b) 157. (a) 158. (d) 159. (b) 160. (b) 161. (b) 162. (b) 163. (c)

164. (a) 165. (b) 166. (c) 167. (c) 168. (a) 169. (a)
 (b) Scaling (d) Salting (a) Permissible slot velocity
 (b) Tray diameter
 (c) Liquid load
 (d) Vapor load

170. In case of a shell and tube heat exchanger, the effect of L/D on inside film heat transfer coefficient vanishes after a Reynold number of

- (a) 1000 (b) 3000
(c) 5000 (d) 10000

171. What is the minimum recommended ligament for square pitch arrangement in case of heat exchangers ?

- (a) 6.5 cms
(b) 6.5 mm
(c) Equal to tube I.D
(d) Equal to tube O.D

172. of water makes it a widely used coolant in heat exchangers.

- (a) Low corrosiveness
(b) Low dirt factor
(c) High specific heat
(d) Low viscosity

173. The ratio of down take area to cross-sectional area of the tube, for calendria type evaporator ranges from

- (a) 0.5 to 1 (b) 1 to 1.5 (c) 1.5 to 2 (d) 2 to 2.5

174. For a 25 mm hole drilled in plates to be rivetted, the shank diameter of the rivet should be.....mm.

- (a) 25 (b) 23
(c) 26 (d) 11

175. A rivetted joint does not fail by.....of rivets. (a) tearing

- (b) shearing
(c) tearing of the plate across a row (d) none of these

176. To avoid the tearing off the plate of an edge, the margin (*i.e.*, the minimum distance from the centre of the rivet hole to the nearest edge of the plate) should be equal to (a) $0.5 d$ (b) d

- (c) $1.5 d$ (d) $2.5 d$

177. The ratio of lateral strain to linear strain is termed as the

- (a) Poisson's ratio (b) bulk modulus (c) modulus of elasticity (d) shear modulus

178. The ratio of shear stress to shear strain is called (a) bulk modulus

- (b) shear modulus
(c) modulus of rigidity

(d) modulus of elasticity

179. The ratio of linear stress to linear strain is termed as the

(a) modulus of elasticity

(b) modulus of rigidity

(c) bulk modulus

(d) none of these

180. The units of Young's modulus of elasticity and.....are the same.

(a) strain (b) stress

(c) modular ratio (d) none of these

181. The ratio for the rate of washing to the final rate of filtration in a washing type of plate and frame filter is

(a) 0.25 (b) 0.50

(c) 0.75 (d) 1.25

182. Speed of the drum of the rotary vacuum filter normally ranges from.....rpm.

(a) 0.1 to 2 (b) 5 to 7

(c) 3 to 8 (d) 8 to 15

183. Tube height in a calendria type evaporator is normally less than.....metres.

(a) 1 (b) 2

(c) 3.5 (d) 5.5

184. In case of bubble cap distillation column of diameter greater than 1.2 metres, the cap diameter is roughly about.....cms.

(a) 10 (b) 20

(c) 30 (d) 35

185. A minimum clearance of about.....mm is maintained between the distillation column wall and the bubble cap.

(a) 19 (b) 38

(c) 76 (d) 95

186. Hole diameter of the seive trays in the distillation column ranges from.....mm.

(a) 1 to 3 (b) 4 to 8

(c) 3 to 12.5 (d) 12.5 to 18.5

187. Pick out the wrong statement.

(a) Lug supports are less expensive than other type of supports.

(b) A pipe is differentiated from a tube by the fact that a pipe has a greater wall thickness compared to the tube.

ANSWERS

170. (d) 171. (b) 172. (c) 173. (a) 174. (b) 175. (d) 176. (c) 177. (a) 178. (b) 179. (a)

180. (b) 181. (a)

182. (a) 183. (b) 184. (a) 185. (b) 186. (c) 187. (c)

(c) A reducer is used to change the direction of a pipe in a straight run.

(d) The method of fixing tubes to a tube sheet by expanding is called 'tube rolling'.

188. In a distillation column, bubble caps are located on trays with a pitch of.....times the outside diameter of the caps.

(a) 1.3 to 2 (b) 1.6 to 2 (c) 2.5 (d) 1.5 to 3

189. In a distillation column, minimum clearance to be maintained between the overflow weir and the last row of the bubble caps is..... cms.

(a) 2.5 (b) 7.5

(c) 15 (d) 20

190. In the downcomer of a distillation column, the minimum recommended residence time is about.....seconds.

(a) 2.5 (b) 5

(c) 12.5 (d) 17.5

191. In a thin cylindrical shell, the hoop stress is.....stress.

(a) radial

(b) circumferential tensile

(c) compressive

(d) longitudinal

192. A pressure vessel is said to be made of 'thick' shell, if the ratio of its diameter to wall thickness is

(a) 10 (b) 10

(c) 20 (d) 20

193. Rivets are generally specified by the (a) head diameter (b) shank diameter (c) overall length (d) none of these

194. Correct use of 'factor of safety' is very important in equipment design. It is defined as the ratio of the (a) ultimate stress to breaking stress. (b) ultimate stress to working stress. (c) working stress to ultimate stress. (d) none of these.

195. The stress developed in a material without any permanent set is called the (a) ultimate stress (b) yield stress (c) elastic limit (d) breaking stress

196. Pick out the correct statement (a) Centre to centre distance between two consecutive rivets in a row is called the pitch.

(b) A rivetted joint made in overlapping plates is called butt joint.
(c) Hole size drilled in rivetted plates is less than the actual size of the rivet.
(d) none of these.

197. In case of a 'thin' pressure vessel, the ratio of its diameter to wall thickness is (a) <10 (b) >10 (c) >20 (d) 30

198. Speed of industrial paddle agitator ranges from.....rpm. (a) 1 to 5 (b) 20 to 100 (c) 500 to 750 (d) 1000 to 2000

199. closure is the weakest enclosure for cylindrical vessels. (a) Hemispherical (b) Torispherical (c) Conical or flat plate (d) Elliptical

200. In common bubble cap distillation column design practice, riser area is

approximately equal to

(a) $A_a = S_a$ (b) $1.2 A_a = 1.2 S_a$ (c) $S_a = 1.5 A_a$ (d) $A_a = 1.5 S_a$

where, A_a = Annular passage area, and, S_a = Slot area

201. LMTD correction factor is used in heat exchanger design for

(a) double pipe heat exchanger.

(b) 'multipass shell and tube heat exchanger. (c) fouling fluids.

(d) counter flow of hot and cold fluids.

202. The difficulty of liquid distribution in packed towers is accentuated, when the ratio of tower diameter to packing diameter is

(a) <30 (b) <7

(c) $> 7 < 15$ (d) $> 20 < 50$

203. In a multipass shell and tube heat exchanger, the baffles on shell side is primarily provided for

(a) reducing scale deposition.

(b) increasing pressure drop.

(c) fixing the tubes.

(d) creating turbulence.

ANSWERS

188. (a) 189.(b) 190.(b) 191.(b) 192.(a) 193.(b) 194.(b) 195.(c) 196.(a) 197.(b) 198.(b) 199.(c)

200.(a) 201.(b) 202.(b) 203.(d)

204. The ratio of tube length to shell diameter in case of liquid shell and tube heat exchanger ranges from

(a) 2 to 3 (b) 3 to 5

(c) 4 to 8 (d) 6 to 12

205. In a continuous distillation column, the optimum reflux ratio ranges from.....times the minimum reflux ratio.

(a) 1.1 to 1.5 (b) 1.6 to 2 (c) 2.2 to 2.6 (d) 2.7 to 3

206. shaped roof is most commonly used for cylindrical tanks. (a) Cone

(c) Umbrella

(b) Dome (d) Flat

207. Most of the storage vessels/tanks are made cylindrical, because of the fact that a cylinder (a) has greater structural strength. (b) is easy to fabricate.
(c) both (a) and (b).
(d) neither (a) nor (b).

208. In case of plain carbon steel, butt welded joints are used for shell plate thickness cms.
(a) 1.2 (b) 0.5
(c) 3.8 (d) 6.8

209. Apex angle of conical heads used in the bottom heads of chemical process equipments is usually
(a) 30° (b) 45°
(c) 60° (d) 75°

210. Steam is preferred to be used as a heating medium in heat exchangers, because of its (a) low cost.
(b) high latent heat.
(c) non-corrosive condensate.
(d) high film co-efficient.

211. The main purpose of providing stepping on the trays is to
(a) increase the residence time.
(b) decrease the pressure drop.
(c) facilitate handling of large flow rate of liquid.
(d) improve the flow condition.

212. Minimum recommended baffle spacing in a shell and tube heat exchanger is about (a) $0.2 D$ (b) 0.5
(c) $0.66 D$ (d) $0.80 D$

where, D = shell diameter

213. Diameter of bubble caps used in high pressure columns is.....as compared to that used in identical vacuum columns.
(a) less
(b) more
(c) same
(d) either (a) or (b); no generalisation can be

made

214. Maximum plate efficiency is achieved in case of.....flow.

- (a) split (b) cross
- (c) cascade (d) reverse

215. Maximum acceptable total liquid gradient over a tray is about.....mm.

- (a) 5.5 (b) 12.5
- (c) 30.5 (d) 45.5

216. Which of the following packing materials provides for maximum mass transfer ?

- (a) Lessig rings.
- (b) Raschig rings.
- (c) Cross-partition rings.
- (d) All give the same value.

217. tower is the most suitable gas-liquid contacting device involving highly corrosive fluids.

- (a) Sieve plate (b) Packed (c) Bubble cap plate (d) None of these

218. Normal screwed fittings are used for pipes upto a diameter of.....inches.

- (a) 1.5 (b) 3
- (c) 5 (d) 7

219. Cylindrical storage tanks used for the storage of volatile liquids (e.g., naphtha) have..... roofs.

- (a) conical (b) flat
- (c) floating (d) fixed

220. In case of 1.5" heat exchanger tubes, the in- side flow area.....with decrease in BWG. (a) increases (b) decreases (c) remains same (d) none of these

221. A 'rupture disc' is provided in chemical equipments as an accessory meant for

- (a) relieving excess pressure.
- (b) creating turbulence.
- (c) enhancing mixing rate.
- (d) avoiding vortex formation.

222. Safety valves are provided in chemical equipments to guard against

excessive

ANSWERS

204. (c) 205.(a) 206.(a) 207.(c) 208.(c) 209.(c) 210.(b) 211.(c) 212.(a) 213.(b)
214.(b) 215.(b)

216.(c) 217.(b) 218.(b) 219.(c) 220.(b) 221.(a) 222.(b)

(a) temperature

(b) pressure/pressure fluctuation

(c) turbulence

(d) noise

223. Cylindrical pressure vessels in horizontal condition is generally supported on a..... support.

(a) lug (b) skirt

(c) saddle (d) guy wire

224. dished head is the strongest of all. (a) Hemispherical (c)

Torispherical (b) Elliptical

(d) none of these

225. Flanges are connected to pipes by (a) screwing (c) brazing (b) welding

(d) all (a), (b) and (c)

226. Factor of safety (i.e., over design factor) in heat transfer equipments is about.....percent more than the actual/theoretical design factor. (a) 5—10 (b) 15—20 (c) 30—35 (d) 35—40

227. Wall thickness of schedule 40 pipe as compared to that of schedule 80 pipe is

(a) more

(b) less

(c) same

(d) either (a) or (b); depends upon the I.D. of

the pipe

228. Minimum tube pitch recommended for shell and tube heat exchangers is about..... times the outside diameter of the tube.

(a) 1.25 (b) 1.75

(c) 2.5 (d) 3.5

229. Minimum baffle spacing recommended in a shell and tube heat exchanger is equal to (a) 5 cms

(b) 40% of the I.D. of the shell

(c) 25 cms

(d) I.D. of the shell

230. Thickness of the frame of a plate and frame filter as compared to that of plates is

(a) less (b) same

(c) more (d) either (a) or (b)

231. Shell side heat transfer co-efficient in case of square pitch as compared to the triangular pitch under similar condition of fluid flow and tube size is

232. A/an.....is used for changing the direction of a pipeline.

(a) elbow (b) union

(c) flange (d) disc compensator

233. Heat transfer co-efficient for a horizontal condenser as compared to a vertical condenser operating under similar conditions is (a) same (b) less

(c) about 3 times (d) about 0.33 times

234. Removable connection of tubes to tube sheet is called

(a) ferrule (b) socket

(c) nipple (d) saddle

235. In a multipass shell and tube heat exchanger, the problem of differential expansion between the shell and tube passes is taken care of by using a

(a) U-bend

(b) floating head tube sheet

(c) either (a) or (b)

(d) neither (a) nor (b)

236. In a multipass shell and tube heat exchanger, the shell side cross flow area does not depend upon

(a) baffle spacing (b) clearance (c) pitch (d) none of these

237. Holes of a sieve tray are arranged in triangular pitch of.....times the hole diameter. (a) 1.5 to 2 (b) 2.5 to 5 (c) 5 to 10 (d) 10 to 15

238. In distillation columns, bubble caps are held in place over trays by

(a) rivets (b) a hold down bar (c) bolts (d) both (b) and (c)

239. Generally, no corrosion allowance in wall thickness of a part is required, if the thickness is more than.....mm.

(a) 10 (b) 20

(c) 30 (d) 5

240. Pick out the wrong statement.

(a) In a flanged and standard dished head, the crown radius is shell outside diameter. (b) In a flanged and shallow dished head,

the crown radius is $>$ shell outside diameter.

(c) Flat head covers are most suitable for (a) more (b) same larger vessels operating at very high (c) less (d) twice^{pressure}.

ANSWERS

223. (c) 224. (a) 225. (d) 226. (b) 227. (b) 228. (a) 229. (a) 230. (c) 231. (c) 232. (a)

233. (c) 234. (a)

235. (c) 236. (d) 237. (b) 238. (d) 239. (c) 240. (c)

(d) Flanged only head is a type of flat head in which gradual change in the shape at the centre results in reduced local stresses.

241. A head comprises of straight flange section, corner torus section and central dished section. Crown radius and knuckle radius in a head is related respectively to the

(a) central dished section and corner torus section.

(b) corner torus section and central dished section.

(c) central dished section and straight flange section.

(d) straight flange section and corner torus section.

242. Practical dividing line between a ductile and brittle materials is suggested, when the ultimate elongation is about 5%. Generally, larger the knuckle radius, stronger is the corner torus section of a head. The knuckle radius provided should be less than.....of the head.

(a) 6% of I.D.

(b) 3 times the thickness

(c) either (a) or (b), whichever is larger (d) either (a) or (b), whichever is smaller

243. Generally, elliptical dished heads

(a) are manufactured on 2:1 ratio of major to minor axis and is recommended to be used for pressure vessels operating above a pressure of 1.5 MN/m^2 .

(b) resist half the pressure rating compared to hemi spherical head provided on the cylindrical shell of the same thickness and diameter.

(c) are approximately as strong as seamless cylindrical shell having the corresponding I.D and O.D.

(d) all (a), (b) and (c).

244. A pipe is generally made of circular cross section, because a circular cross-section has the

(a) higher structural strength.

(b) lowest surface area requirement for a

given volume.

(c) both (a) & (b).

(d) none of these.

245. Lap joints are preferred for plates having thickness.....mm.

(a) > 12.5 (b) < 3

246. For annular flow of a fluid, the ratio of the equivalent diameter for pressure drop calculation to the equivalent diameter for heat transfer calculation is

(a) $\frac{d_1}{d_2}$

(b) $\frac{d_2}{d_1}$

(c) $\frac{d_1 + d_2}{2}$

(d) $\frac{d_1 - d_2}{2}$

(e) $\frac{d_1^2 + d_2^2}{d_1 + d_2}$

(f) $\frac{d_1^2 - d_2^2}{d_1 - d_2}$

(g) $\frac{d_1^3 - d_2^3}{d_1 - d_2}$

(h) $\frac{d_1^4 - d_2^4}{d_1 - d_2}$

247. In a shell and tube heat exchanger, the overall heat transfer co-efficient is proportional to the tube side (volumetric flow rate)^{0.8}. This is valid, only when

the ratio of the tube side film resistance to the total resistance is almost equal to

(a) ∞ (b) 1

(c) 20.8 (d) 2

248. Ratio of tube length to shell diameter for a shell and tube heat exchanger is
(a) 8 : 1 to 12 : 1 for both liquid-liquid and

gas-gas heat exchangers.

(b) 4 : 1 to 8 : 1 for liquid-liquid exchanger. (c) <4:1 for gas-gas exchangers.

(d) both (b) & (c).

249. In case of a shell and tube heat exchanger, the minimum shell thickness for carbon steel (inclusive of corrosion allowance) depends on shell diameter and is in the range of..... mm.

(a) 3–5 (b) 5–11

(c) 8–15 (d) 12–18

250. Baffles are provided in a shell and tube heat exchanger to increase the turbulence and velocity of the shell side fluid. Which of the following shaped baffles does not fall in the category of transverse baffle ?

(a) Segmental baffle

(b) Flat plate extending across the wall (c) Disk type baffle

(d) Helical type baffle

251. Pick out the wrong statement pertaining to shell and tube heat exchanger.

(a) Clearance between shell & baffles

and between tube & baffles should be minimum to avoid by-passing of the fluid, but it should be enough to permit the removal of tube bundle.

(b) Baffles are supported independently of (c) > 5 (d) 5-10

ANSWERS

241. (a) 242. (c) 243. (d) 244. (c) 245. (b) 246. (a) 247. (b) 248. (d) 249. (b) 250. (b)
251. (d) the tubes by tie rods and positioned by spacers.

(c) Tie rods are fixed at one end in the tube sheet by making blind holes and the minimum number of tie rods is 4 with at least 10 mm diameter.

(d) Bracket supports are used for horizontal shell, while saddle support is used for vertical shell.

252. In case of design of a shell and tube heat exchanger,

(a) minimum cleaning lane of 6.5 mm is provided, when tubes are on a square

pitch.

(b) minimum tube sheet thickness (in which tubes are fixed) is equal to the O.D. of the tube upto 15 mm tube diameter; and for > 15 mm tube diameter, tube sheet thickness is smaller than tube diameter.

(c) O.D. of the tube is 6 to 40 mm while the tube lengths used are 0.5, 2.5, 3.0, 4.0, 5.0, 6 metres.

(d) all (a), (b) & (c).

253. In inclined long tube vertical evaporators, the tubes are inclined at an angle of

(a) 15° (b) 90°

(c) 45° (d) 60°

254. Pick out the wrong statement pertaining to the design of a long tube vertical evaporator. (a) Tube dia is 3-6 cms, while tube length in

3-6 metres.

(b) Steam is fed to the shell, whereas the liquor is filled inside the tube.

(c) Liquor level is maintained at 1/3rd to 1/2 of the height of the tube.

(d) none of these.

255. In which of the following evaporators, steam is fed inside the tube while the liquor is outside the tube ?

(a) Long tube vertical evaporator

(b) Short tube vertical evaporator

(c) Horizontal tube evaporator

(d) None of these

256. In a vertical short tube evaporator (Calendria type), the

(a) (a)

200 cms and cylindrical drum dia of 1-6 metres are normally used.

(b) area of central downtake is equal to 40 to 100% of total cross-sectional area of the

(c) liquor is inside the tube while the steam is outside the tube.

(c) (d) all (a), (b) & (c).

257. Pick out the wrong statement pertaining to the design of a horizontal tube evaporator. (a) It is unsuitable for concentrating those

liquids, which form a scale or deposit salt.

(b) It is suitable for process, in which the final product is a liquor instead of solid.

(c) Its usual dimensions are: tube dia = 2-3 cms; evaporator body dia = 1-4 metres and evaporator height = 2.5-4 metres.

(d) Liquor flows inside the tube, while the steam is outside submerging the tube.

258. Pick out the wrong statement.

(a) In practical operation, distillation towers having diameter 3-6 metres equipped with bubble cap (round) size of 15 cms are used.

(b) Height of packing in a packed tower is about 3 times the column diameter for raschig rings and about 5 to 10 times the column diameter for saddle packing. In a sieve tray, the minimum hole diameter is equal to the tray thickness.

(d) In a stainless steel sieve tray, the minimum hole diameter is equal to 10 times the plate thickness.

259. Corrosion allowance in the design of pressure vessel/chemical equipment is not necessary, if

(a) plain carbon steel and cast iron parts are

used.

(b) wall thickness is > 30 mm.

(c) material of construction is high alloy

steel.

(d) both (b) & (c).

260. Which of the following material is seldom used for pressure vessel construction ? (a) (c)

Rimmed still (b) Mild steel Killed steel (d) Semi-killed steel

261. Low pressure steam (with saturation temperature between 105 to 120°C) is usually used in the vacuum evaporators, which normally employ a vacuum of about.....mm Hg (referred to a 760 mm mercury barometer). (a) 250 (b) 450 (c) 650 (d) 750

surrounding tube.

ANSWERS

252. (d) 253.(c) 254.(d) 255.(c) 256. (d) 257.(d) 258.(d) 259.(d) 260.(a) 261.(c)

262. Steam economy is defined as the amount of evaporation per unit amount of steam used, while the capacity is the total evaporation obtained per hour. Use of multiple effect in evaporation

(a) increases capacity.

(b) increases economy.

(c) does not affect the capacity.

(d) both 'b' & 'c'

263. heat exchanger is also known as 'hair pin type' exchanger. (a) Double pipe (c) Plate type

(b) Finned

(d) Regenerative

264. The clearance between two tubes in a shell and tube heat exchanger is known as 'ligament', whose minimum value is.....the outside diameter of the tube, but in no case it should be less than 4.5 mm.

(a) equal to (b) half

(c) one fourth (d) three fourth

265. Tube wall thickness depends on the corrosiveness of the fluids and their operating pressure & temperature and is specified by Birmingham wire gauge (B.W.G)-a number which varies from 8 to 18 with the numbers 14 and 16 being more commonly used. Outside diameter of tubes varies from about 15 to 50 mm; however a tube of less than..... mm outside diameter is generally not recommended for fouling fluids.

(a) 16 (b) 19

(c) 28 (d) 38

266. In a shell and tube heat exchanger, triangular pitch arrangement as compared to square pitch arrangement

(a) results in higher shell side pressure

drop.

(b) can accommodate less number of tubes for a given shell diameter.

(c) facilitates easier shell side cleaning; hence is more suitable for handling high dirt factor shell side fluid.

(d) creates relatively lower turbulence on the shell side resulting in lower shell side heat transfer co-efficient.

267. In a shell and tube heat exchanger, tube side.....of the mass velocity.

(a) heat transfer co-efficient is proportional (b) pressure drop is proportional to the

square

(c) both 'a' & 'b'

(d) neither 'a' nor 'b'

268. Tubes are fixed to the tube sheet (a thick circular metallic plate) by the method of tube rolling and brazing (non-removable) or ferrule connection (removable). Thickness of the tube, sheet is normally.....the outside diameter of the tube but in no case it should be less than 22 mm (7/8").

(a) half (b) three fourth (c) equal to (d) 1.5 times

269. The centre to centre distance between two consecutive baffles in a shell and tube heat exchanger is called the baffle pitch or baffle spacing, which is more than 1/5th the I.D. of the shell. Which of the following is not a function of the baffles ?

(a) To increase the residence time of shell

(b)

side fluid.

To provide support to the tube bundle.

(c)

(c) To reduce the induced vibration in the tubes.

(d) To increase the tube side heat transfer co-efficient by inducing turbulence.

270. Pick out the wrong statement pertaining to a

shell and tube heat exchanger.

(a) The minimum value of baffle spacing is 50 mm.

(b) The maximum value of baffle spacing is equal to the I.D. of the shell.

The maximum unsupported tube span is generally about 75 times tube diameter, but is reduced to about 60 times for aluminium, copper & alloys of these.

(d) Disk and doughnut baffle is the most commonly used baffle.

271. The thickness of segmental baffles (25-35% cut truncated plates usually) is generally..... the tube wall thickness.

(a) equal to (b) twice

(c) four times (d) half

272. Pick out the wrong statement about routing of fluids in a shell and tube heat exchanger. (a) The corrosive and fouling fluid should be

preferably routed through the tubes. (b) The viscous fluid should be routed to 0.8th power through the shell side.

ANSWERS

262.(d) 263.(a) 264.(c) 265.(a) 266.(a) 267.(c) 268.(c) 269.(d) 270.(d) 271.(b)

272.(d)

(c) Lower flow rate fluid should be routed through the shell side.

(d) Higher pressure fluid stream should be routed through the shell side.

273. For identical situation, condensing film co- efficient in case of a horizontal condenser is almost.....the value expected in case of vertical condenser.

(a) half (b) twice

(c) thrice (d) five times

274. The operating velocity in the absorption tower is usually 40-50% of the flooding velocity. Packed absorption towers are normally designed for a pressure drop of about.....mm of water column per metre height of packing. (a) 1–5 (b) 20–40

(c) 100–150 (d) 1000–1500

275. In packed absorption tower, onset of flood- ing usually occurs at a pressure drop of about.....mm of water column per metre height of packing.

(a) 25–50 (b) 50–75

(c) 200–250 (d) 750–1000

276. Which of the following is not a graphical method (but is an analytical method) for the calculation of theoretical number of stages in case of continuous binary distillation ? (a) Sorel-Lewis method.
(b) McCabe-Thiele's method.
(c) Ponchon-Savarit method.
(d) none of these.

277. Normally, the length to diameter ratio of rotary dryers varies from 4 to 10 and for its economic operation, the number of transfer units (NTU) for such dryers varies from (a) 1.5–2.5 (b) 3.5–5.5 (c) 7.5–10.0 (d) 10–15

278. With increase in the reflux ratio for a fixed production from a continuous binary distillation column, the.....decreases.

- (a) fixed charges initially
- (b) running cost of cooling water for condenser
- (c) vapour & liquid load both
- (d) running cost of steam for reboiler

279. Height equivalent to a theoretical plate (HETP) is the height of packing that will give the same separation as one theoretical plate in gas-liquid mass transfer operations like distillation, absorption/stripping and humidification/dehumidification. HETP which is experimentally determined, depends upon the (a) flow rates of each fluid.

- (b) type and size of packing.
- (c) concentration of each fluid.
- (d) all a, b & c.

280. Which of the following is not a valid assumption in continuous binary distillation for calculating the number of equilibrium stages by McCabe-Thiele's method ?

- (a) Sensible heat changes for vapour & liquid are negligibly small.
- (b) Reflux is not a saturated liquid. (c) Molar latent heat of the two components are equal.
- (d) Heat of mixing of normal liquid is assumed to be zero.

281. Ponchon Savarit method is based on the use of enthalpy concentration

diagram, which contains the bubble point curve (saturated liquid curve), dew point curve (saturated vapour curve) and equilibrium tie lines. As compared to McCabe-Thiele's method, this method

(a) is more accurate in finding the number of

equilibrium stages.

(b) accounts for the enthalpy changes in the process.

(c) facilitates direct calculation of heat load on reboiler & condenser from the diagram used in this method.

(d) all 'a', 'b' & 'c'.

282. Heat transfer co-efficient, $hG(\text{Kcal/hr.m}^2.^\circ\text{C})$ and mass velocity of air, $G(\text{kg/hr.m}^2)$ for air flow parallel to the surface in case of constant drying rate in batch drying is related as $hG = 0.0176G^{0.8}$. But when the flow of air perpendicular to the surface is encountered, this equation changes to

(a) $hG = 1.004G^{0.37}$

(b) $hG = 1.004G^{0.8}$

(c) $hG = 0.0176G^{0.37}$

(d) $hG = 0.0176G^{1.37}$

283. Smaller sized packings are generally dumped to the packed columns, and the large ones of size greater than.....mm are stacked individually, which provides better control over bed porosity and offers lower gas pressure drop.

ANSWERS

273. (c) 274.(b) 275.(b) 276.(a) 277.(a) 278.(a) 279.(d) 280.(b) 281.(d) 282.(a)

283.(c) (a) 25 (b) 50

(c) 75 (d) 150

284. Maximum size of the raschig rings used in a packed tower is about.....of the column diameter.

(a) 1/10th (b) 1/20th

(c) 1/30th (d) 1/50th

285. Liquid redistribution should be done in a packed tower packed with raschig rings every 6 metres or.....times the column diameter, whichever is lower.

(a) 2.5–3.0 (b) 5–7.5

(c) 10–12.5 (d) 15–20

286. Lessing ring is formed by the addition of a partition across the centre of a Raschig ring, which results in an area increase of about.....percent.

(a) 5 (b) 20

(c) 35 (d) 55

287. In case of saddle packing (e.g., Berl and Intalox saddles), the maximum size of the packing should not exceed.....of the column diameter.

(a) 1/5th (b) 1/15th

(c) 1/30th (d) 1/50th

288. In packed towers provided with saddle packing, liquid redistributors are positioned at every.....times column diameter or 6 metres whichever is less.

(a) 2–3 (b) 5–8

(c) 10–15 (d) 20–25

289. In packed towers provided with pall rings liquid redistributors are positioned at heights of every 6 metres or 5-10 times the column diameter, whichever is less. Maximum size of the pall rings should not exceed.....of the column diameter.

(a) 1/10–1/15th (b) 1/5–1/10th (c) 1/20–1/30th (d) 1/2 to 1/4th

290. The practical representative values of HETP for a number of commercial operations lies within a range of.....metre.

(a) 0.1–0.2 (b) 0.2–0.5 (c) 0.4–0.9 (d) 1.2–1.5

291. Commercial packed scrubbers are normally designed for a pressure drop range of.....mm water column per metre of packed height. (a) 4–8 (b) 17–34

(c) 52–68 (d) 88–105

292. For identical operating conditions, the pressure drop over.....tray is the highest out of the following.

(a) sieve (b) valve

(c) counterflow (d) bubble cap

293. Souders equation given by, $u_k^l = \frac{r v}{v}$

v

, is used for the calculation of the.....in a continuous distillation column. (a) diameter of the bubble cap column (b) diameter of the sieve plate column (c) tray pressure drop (d) residence time in the downcomer for the

disengagement of entrained vapour **294.** Diameter of the sieve tray column is determined by the

- (a) lower limit of vapour velocity.
- (b) upper limit of the vapour velocity.
- (c) hole diameter of the sieve tray.
- (d) height of the plate spacing.

295. A high vapour velocity is required for high plate efficiency in a sieve plate column. The satisfactory value of operating vapor velocity for design purpose in sieve plate column is about.....percent of the flooding velocity. (a) 45 (b) 60 (c) 80 (d) 95

296. In sieve plate column, holes are drilled or punched in sizes ranging from 2.5 to 12 mm (5 mm being widely used). The hole pitch is normally.....times the hole diameter to give the required hole area. (a) 0.5 to 1.5 (b) 2.5 to 4.0 (c) 5 to 10 (d) 10 to 15

297. Bubble cap diameter used for the distillation column having diameter ranging from 1.5 to 4.5 metres is about.....mm. (a) 10 (b) 50 (c) 100 (d) 150

298. Pick out the wrong statement about the design of sieve plate column and the bubble cap column. (a) The downcomer design and the residence

time in the downcomer is almost same for sieve plate and bubble cap columns.
ANSWERS

284. (c) 285.(a) 286.(b) 287.(b) 288.(b) 289.(a) 290.(c) 291.(b) 292.(d) 293.(a) 294.(b) 295.(c) 296.(b) 297.(c) 298.(c)

(b) Weir length for a bubble cap plate is the same as that for the sieve plate. (c) Weir height for a bubble cap plate column is the same as that for a sieve plate column.

(d) Weir height in case of a bubble cap plate ranges from 50 to 150 mm and is higher than the sieve plate.

299. In the allocated cap area, bubble caps are generally arranged on equilateral triangular pitch. Number of caps fixed on a plate is with a (a) clearance of 25–75 mm.

(b) cap pitch of 1.3–2 times the cap diameter. (c) either 'a' or 'b'

(d) neither 'a' nor 'b'.

300. In the design of a shell and tube heat exchanger, the corrosion allowance (a) need not be provided for non-pressure

parts like tie rods, spacers, baffles, supports etc.

(b) for carbon steel and cast iron pressure parts is 1.5 mm (except for tubes) and for severe conditions it is 3 mm.

(c) for internal cover and tube sheet is provided on both the sides.

(d) all (a), (b) & (c).

301. Welded joint efficiency in the design of chemical process equipment is taken as

(a) 0.55 (b) 0.75

(c) 0.85 (d) 0.95

302. Spherical shaped pressure vessel is considered to be the most ideal, because it can

(a) withstand higher pressure for a given

metallic shell thickness.

(b) be fabricated very easily.

(c) be designed without wind load considerations.

(d) be supported very easily.

303. Needle valves are generally not used for

(a) very large diameter pipes.

(b) high pressure throttling service.

(c) very accurate flow control.

(d) smaller sizes of pipe.

304. Any shell opening greater than 5 cms for a storage tank must be reinforced for reason of

(a) preventing the local overstressing of the shell around the opening.

(b) reduction of discontinuity in shape at the junction.

(c) making the joint leak proof.

(d) none of these.

305. Hoop (circumferential) stress induced in a thin walled 'Horton Sphere' used for the storage of liquid ammonia under pressure is

(a)

$$pD_{(b)} pD$$

$$2t \ 4t$$

$$pD_{(d)} pD_{(c)} \ 3t \ 6t$$

306. Large process vessels operating under extreme temperature and pressure conditions are normally clad/ lined with materials like stainless steel, aluminium, nickel & its alloys, copper & its alloys and titanium. The cladding thickness is generally about..... percent of the total thickness.

(a) 1 to 5 (b) 10 to 20 (c) 30 to 40 (d) 40 to 50

307. Longitudinal stress induced in a thin walled cylindrical storage vessel is

(a)

$$pD_{(b)} pD$$

$$2t \ 4t$$

$$pD_{(d)} pD_{(c)} \ 3t \ 6t$$

308. Log mean temperature difference in case of multi-pass shell and tube heat exchanger is always

(a) less than arithmetic mean value. (b) more than arithmetic mean value. (c) more than geometric mean value. (d) both (b) & (c).

309. shaped roof is the most commonly used roof for cylindrical storage tanks. (a) Conical (b) Flat

(c) Dome (d) Umbrella

310. In chemical process equipments, the conical bottom heads used, usually has an apex angle of

- (a) 20° (b) 40°
(c) 60° (d) 80°

311. The testing pressure of storage tanks and pressure vessels designed as per Indian standard codes should be about.....times the design pressure.

- (a) 1.5 to 2 (b) 3 to 4
(c) 4 to 5 (d) > 5

ANSWERS

299. (c) 300.(d) 301.(c) 302.(a) 303.(a) 304.(a) 305.(a) 306.(b) 307.(b) 308.(a)
309.(a) 310.(c)

311.(a)

312. Vertical storage vessels are never supported by.....support. (a) bracket

- (c) skirt
(b) saddle (d) lug

313. Multiple blade paddle agitator is used for mixing high viscosity liquids/paste in which the paddle diameter is commonly 0.8 times the tank diameter. However, the width of the blade is in the range of.....times the paddle diameter.

- (a) 0.1 to 0.25 (b) 0.3 to 0.5 (c) 0.5 to 0.6 (d) 0.65 to 0.80

314. The diameter of a propeller agitator used in agitation tank ranges from....percent of the tank diameter and its peripheral speed is normally 300 to 500 metres/minute.

- (a) 5 to 10 (b) 15 to 30 (c) 40 to 50 (d) 55 to 75

315. The ideal size of round bubble caps to be used in industrial distillation column having a diameter of 3-6 metres is.....cms.

- (a) 5 (b) 15
(c) 7.5 (d) 50

316. Cylindrical shell thickness of rotary drier is generally.....mm.

- (a) 2–3 (b) 18–22
(c) 6–8 (d) 12–15

317. A cylindrical pressure vessel of volume check it has to be designed to withstand a maximum internal pressure of 10 atm. The allowable design stress of the material is 125N/mm and corrosion allowance is 2 mm. The thickness of the vessel for a length/diameter ratio of 3 will be close to

- (a) 5 mm (b) 6 mm
- (c) 8 mm (d) 10 mm

318. support is the best pipe support for supporting steam pipelines with thermal stresses induced in them.

- (a) Hanger (b) Spring hanger (c) Roller (d) None of these

319. For flanges, the number of bolts is decided by **320.** In a calendria type evaporator, the downtake area is 50–100% of.....area.

- (a) tube surface
- (b) vapor disengagement
- (c) tube sheet
- (d) tube cross-section

321. The tube sheet diameter in a shell and tube heat exchanger depends on the number of tubes, tube diameter, pitch length and type of pitch arrangement.

Generally, the tube sheet diameter is.....per cent more than the tube bundle diameter.

- (a) 20 (b) 40
- (c) 60 (d) 75

322. Generally, the plate efficiency increases with increasing ratio of liquid rate to gas rate. Maximum efficiency is achieved in.....tray arrangement.

- (a) cross flow (b) split flow (c) reverse flow (d) cascade flow

323. As per IS:2825, the design pressure for the vessel under internal pressure is obtained by adding a.....per cent to the maximum working gauge pressure.

- (a) (c)

minimum of 5 maximum of 2 (b) maximum of 5 (d) maximum of 3

the diameter of each bolt and the (a) bolt circle diameter.

- (b) bolt spacing.
- (c) total bolt area.
- (d) none of these.

324. Distance between the centre of a rivet hole to

the nearest edge of the plate is called (a) margin (b) pitch
(c) back pitch (d) clearance

325. Number of rivets increases from outermost row to the innermost row in a.....riveted joint.

(a) zig-zag (b) chain
(c) diamond (d) none of these,

326. Number of bubble caps to be used per tray in a distillation column is determined by the (a) vapor load

(b) liquid load
(c) permissible slot velocity
(d) tray diameter

327. In distillation, for the case of total reflux, the.....is same as the equilibrium line. (a) operating line (b) $x = y$ line (c) $x = 2y$ line (d) $x = 0.5 y$ line

312.(b) 313.(a) 314.(b) 315.(b) 316.(c) 324.(a) 325.(c) 326.(c) 327.(a)

ANSWERS

317.(d) 318.(c) 319.(c) 320.(d) 321.(a) 322.(a) 323.(a)

Chemical engineering economics

1. Which of the following is the cheapest material of construction for the storage of sodium hydroxide upto a concentration of 75%?

(a) Stainless steel (b) Plain carbon steel
(c) Nickel (d) Copper

2. Optimum number of effects in a multiple effect evaporator is decided by the

(a) cost benefit analysis.
(b) floor area availability.
(c) terminal parameters.
(d) evaporation capacity required.

3. Cost of instrumentation in a modern chemical plant ranges from.....percent of the total

plant cost.

- (a) 5 to 10 (b) 20 to 30
(c) 40 to 50 (d) 60 to 70

4. Equipment installation cost in a chemical process plant ranges from.....percent of the purchased equipment cost.

- (a) 10 to 20 (b) 35 to 45
(c) 55 to 65 (d) 70 to 80

5. 'Lang factor' is defined as the ratio of the capital investment to the delivered cost of major equipments. The value of 'Lang factor' for fixed capital investment, for a solid-fluid processing chemical plant ranges from

- (a) 1.2 to 1.4 (b) 2.5 to 2.7
(c) 4.2 to 4.4 (d) 6.2 to 6.4

6. 'Utilities' in a chemical process plant includes compressed air, steam, water, electrical power, oxygen, acetylene, fuel gases etc. Utility costs for ordinary chemical process plants ranges roughly from.....percent of the total product cost.

- (a) 1 to 5 (b) 10 to 20
(c) 25 to 35 (d) 35 to 45

7. Which of the following ceramic packing materials is the costliest of all ?

- (a) Berl saddles (b) Raschig rings
(c) Pall rings (d) Intalox saddles

15

8. Cost of piping in a fluid processing unit (*e.g.*, distillation) of a chemical process plant is about.....percent of the fixed capital investment.

(a) 4 (b) 13 (c) 22 (d) 34

9. Expenditure on research and development (R & D) is categorised as the....., while making an estimate of the total product cost for a chemical plant.

(a) overhead cost
(b) fixed expenses
(c) general expenses
(d) direct production cost

10. The 'total capital investment' for a chemical process plant comprises of the fixed capital investment and the

(a) overhead cost
(b) working capital
(c) indirect production cost (d) direct production cost

11. In a chemical process plant, the total product cost comprises of manufacturing cost and the (a) general expenses (c) R & D cost
(b) overhead cost (d) none of these

12. Purchased cost of equipments for a chemical process plant ranges from.....percent of the fixed capital investment.

(a) 10 to 20 (b) 20 to 40 (c) 45 to 60 (d) 65 to 75

13. The inventory of raw materials included in the working capital is usually about..... months supply of raw materials valued at delivery prices.

(a) one (b) three
(c) six (d) twelve

14. According to six-tenths-factor rule, if the cost of a given unit at one capacity

is known, then the cost of similar unit with 'n' times the capacity of the first unit is approximately equal to.....times the cost of the initial unit.

ANSWERS

1.(b) 2.(a) 3.(b) 4.(b) 5.(c) 6.(b) 7.(a) 8.(b) 9.(c) 10.(b) 11.(a) 12.(b) 13.(a) 14.(b)
(a) n (b) $n^{0.6}$
(c) $n^{0.4}$ (d) n

15. Gross earning is equal to the total income minus (a) total product cost (c) income tax
(b) fixed cost
(d) none of these

16. Profit is equal to revenue minus
(a) book value (b) total cost (c) operating cost (d) none of these

17. The amount of simple interest during 'n' interest period is
(a) $p.i.n$. (b) $p(1 + i.n)$ (c) $p(1 + i)n$ (d) $p(1 - i.n)$ where, i = interest rate based on the length of one interest period, p = principal

18. Annual depreciation costs are constant, when the.....method of depreciation calculation is used.
(a) declining balance
(b) straight line
(c) sum of the years digit
(d) none of these

19. With increase in the discounted cash flow rate of return, the ratio of the total present value to the initial investment of a given project

(a) decreases (b) increases (c) increases linearly (d) remains constant

20. The amount of compounded interest during 'n' interest periods is
(a) $p[(1 + i)^n - 1]$ (b) $p(1 + i)^n$ (c) ppi^n (d) $p(1 + i^n)$

21. The ratio of working capital to total capital investment for most chemical plants (except for non-seasonal based products) is in the range of.....percent.

(a) 0.1 to 1 (b) 1 to 2

(c) 10 to 20 (d) 50 to 60

22. Effective and nominal interest rates are equal, when the interest is compounded

(a) annually (c) monthly (b) fortnightly (d) half-yearly

23. if 'S' is the amount available after 'n' interest periods for an initial principal 'P' with the discrete compound interest rate 'i' the present worth is given by

(a) $(1 + i)^n/S$ (b) $S/(1+i)^n$ (c) $S/(1 + in)$ (d) $S/(1 + n)^i$

24. Payback period (a) and economic life of a project are the same. (b) is the length of time over which the earnings on a project equals the investment.

(c) is affected by the variation in earnings after the recovery of the investment.
(d) all (a), (b) and (c).

25. Depreciation

(a) costs (on annual basis) are constant when the straight line method is used for its determination.

(b) is the unavoidable loss in the value of the plant, equipment and materials with lapse in time.

(c) does figure in the calculation of income tax liability on cash flows from an investment.

(d) all (a), (b) and (c).

26. Accumulated sum at the end of 5 years, if Rs.

10000 is invested now at 10% interest per annum on a compound basis is Rs.

(a) 15000 (b) 16105

(c) 18105 (d) 12500

27. A balance sheet for an industrial concern shows

(a) the financial condition at any given time.

(b) only current assets.

(c) only fixed assets.

(d) only current and fixed assets.

28. Generally, income taxes are based on the (a) total income

(b) gross earning

(c) total product cost

(d) fixed cost

29. Factory manufacturing cost is the sum of the direct production cost

(a) fixed charges and plant overhead cost. (b) and plant overhead cost.

(c) plant overhead cost and administrative expenses.

(d) none of these.

30. “Break-even point” is the point of intersection of

(a) fixed cost and total cost.

(b) total cost and sales revenue.

(c) fixed cost and sales revenue.

(d) none of these.

31. A shareholder has say in the affairs of company management compared to a debenture holder.

(a) more (b) less

(c) same (d) no

ANSWERS

15. (a) 16. (b) 17. (a) 18. (b) 19. (a) 20. (a) 21. (c) 22. (a) 23. (b) 24. (b) 25. (d) 26. (b)

27. (a) 28. (b) 29. (a) 30. (b) 31. (a)

32. Depreciation is.....in profit with time. (a) decrease (c) no change (b) increase

(d) none of these

33. Which of the following is a component of working capital investment ?

(a) Utilities plants.

(b) Maintenance and repair inventory. (c) Process equipments.

(d) Depreciation.

34. The value of a property decreases.....with time in straight line method of determining depreciation.

(a) linearly

(c) exponentially (b) non-linearly (d) logarithmically

35. A machine has an initial value of Rs. 5000, service life of 5 years and final

salvage value of Rs. 1000. The annual depreciation cost by straight line method is Rs.

- (a) 300 (b) 600
(c) 800 (d) 1000

36. Which of the following methods of depreciation calculations results in book values greater than those obtained with straight line method ? (a) Multiple straight line method

- (b) Sinking fund method
(c) Declining balance method
(d) Sum of the years digit method

37. In declining balance method of depreciation calculation, the

- (a) value of the asset decreases linearly with

time.

- (b) annual cost of depreciation is same every year.

(c) annual depreciation is the fixed per centage of the property value at the beginning of the particular year.

- (d) none of these.

38. After tax, cash receipt is calculated by the formula

(a) $(1 - T_r)(r - E - D) + D$

(b) $(1 - TR)(R - D) + TR.E$

(c) $(1 - TR)(R - e - D) + D$

(d) $(1 - TR)(R - E) + TR.D$

where, T_r = Tax rebate, R = Revenues

e = Expenses other than depreciation E = Expenses including depreciation

D = Depreciation

39. If the interest rate of 10% per period is compounded half yearly, the actual annual return on the principal will be.....percent.

- (a) 10 (b) 20
(c) >20 (d) <20

40. For a given fluid, as the pipe diameter increases, the pumping cost
(a) decreases.
(b) increases.
(c) remains the same.
(d) may increase or decrease, depending upon

whether the fluid is Newtonian or nonNewtonian.

41. Optimum economic pipe diameter for fluid is determined by the
(a) viscosity of the fluid.
(b) density of the fluid.
(c) total cost considerations (pumping cost

plus fixed cost of the pipe).

(d) none of these.

42. Out of the following, the depreciation calculated by the.....method is the maximum. (a) diminishing balance
(b) straight line
(c) sum of the years digit
(d) sinking fund

43. The economic life of a large chemical process plant as compared to a small chemical plant is (a) only slightly more (b) much more (c) slightly less (d) almost equal

44. In financial accounting of a chemical plant, which of the following relationship is in valid? (a) Assets = equities
(b) Assets = liabilities + net worth
(c) Total income = costs + profits
(d) Assets = capital.

45. A balance sheet for a chemical plant shows its financial condition at any given date. It does not contain the.....of the plant.

(a) current asset (b) current liability (c) long term debt (d) profit

46. The.....of a chemical company can be obtained directly from the balance sheet as the difference between current assets and current liabilities.

(a) cash ratio

- (b) net working capital
- (c) current ratio
- (d) liquids assets

ANSWERS

32. (a) 33.(b) 34.(a) 35.(c) 36.(b) 37.(c) 38.(c) 39.(c) 40.(a) 41.(c) 42.(a) 43.(b)
44.(d) 45.(d) 46.(b)

47. Which of the following is not a current asset of a chemical company ?

- (a) Inventories
- (b) Marketable securities
- (c) Chemical equipments
- (d) None of these.

48. Manufacturing cost in a chemical company does not include the

- (a) fixed charges.
- (b) plant overheads.
- (c) direct products cost.
- (d) administrative expenses.

49. Which of the following is not a component of working capital ?

- (a) Raw materials in stock.
- (b) Finished products in stock.
- (c) Transportation facilities.
- (d) Semi-finished products in the process.

50. 'Six-tenth factor' rule is used for estimating the (a) equipment installation cost.

- (b) equipment cost by scaling.
- (c) cost of piping.
- (d) utilities cost.

51. In an ordinary chemical plant, electrical installation cost may be about

- (a) 10–15% of purchased equipment cost. (b) 3–10% of fixed capital investment.
- (c) either (a) or (b).
- (d) neither (a) nor (b).

52. Fixed capital investment of a chemical plant is the total amount of money needed to supply the necessary plant and manufacturing facilities plus the working capital for operation of the facilities. Which of the following

components of fixed capital investment requires minimum percentage of it ?

- (a) Electrical installation cost.
- (b) Equipment installation cost.
- (c) Cost for piping.
- (d) Equipment insulation cost.

53. Construction expenses are roughly.....percent of the total direct cost of the plant. (a) 2 (b) 10
(c) 30 (d) 50

54. The ratio of gross annual sales to the fixed capital investment is termed as the.....ratio. (a) cash reserve (c) turnover
(b) capital
(d) investment

55. Which of the following relationship is not correct is case of a chemical process plant ? (a) Manufacturing cost = direct product cost +

- fixed charges + plant overhead costs (b) General expenses = administrative expenses + distribution & marketing expenses
- (c) Total product cost = manufacturing cost + general expenses
- (d) Total product cost = direct production cost + plant overhead cost.

56. taxes are based on gross earnings. (a) Property (b) Excise
(c) Income (d) Capital gain

57. Which of the following is not a component of depreciation cost ?
(a) Repairs and maintenance cost.
(b) Loss due to obsolescence of the equipment. (c) Loss due to decrease in the demand of

product.

- (d) Loss due to accident/breakdown in the machinery.

58. Annual depreciation cost are not constant when, the.....method of depreciation calculation is used.

(a) straight line (b) sinking fund (c) present worth (d) declining balance.

59. of depreciation calculation accounts for the interest on investment.

(a) Straight line method

(b) Declining balance

(c) both (a) and (b)

(d) neither (a) nor (b).

60. Chemical engineering plant cost index is used for finding the present cost of a particular chemical plant, if the cost of similar plant at some time in the past is known. The present cost of the plant = original cost

index value at present $\times$ index value at time original cost was obtained

The most major component of this cost index is (a) fabricated equipment and machinery. (b) process instruments and control. (c) pumps and compressors. (d) electrical equipments and material.

61. Utilities cost in the operation of chemical process plant comes under the
ANSWERS

47. (c) 48.(d) 49.(c) 50.(b) 51.(c) 52.(b) 53.(b) 54.(c) 55.(d) 56.(c) 57.(a) 58.(d)

59.(d) 60.(a) 61.(c)

(a) plant overhead cost

(b) fixed charges

(c) direct production cost

(d) general expenses

62. Nominal and effective interest rates are equal, when the interest is compounded

(a) quarterly

(b) semi-annually

(c) annually

(d) in no case, they are equal

63. Maximum production start up cost for making a chemical plant operational is about..... percent of the fixed capital cost.

(a) 1 (b) 5

(c) 10 (d) 30

64. Effluent treatment cost in a chemical plant is categorised as the.....cost.

(a) fixed (b) overhead (c) utilities (d) capital

65. Which of the following does not come under the sales expenses for a product of a chemical plant?

(a) Advertising (c) Legal fees (b) Warehousing (d) Customer service.

66. Which of the following is the costliest material of construction used in pressure vessel construction ?

(a) Low alloy steel (c) Titanium

(b) Lead

(d) High alloy steel

67. Pick out the wrong statement.

(a) Gross margin = net income – net expenditure (b) Net sales realisation (NSR) = Gross sales –

selling expenses

(c) At break even point, NSR is more than the total production cost

(d) Net profit = Gross margin – depreciation – interest

68. Pick out the wrong statement.

(a) Debt-equity ratio of a chemical company describes the lenders contribution for each rupee of owner's contribution *i.e.*, debt-equity ratio = total debt/net worth.

(b) Return on investment (ROI) is the ratio of profit before interest & tax and capital employed (*i.e.* net worth + total debt).

(c) Working capital = current assets + current liability.

(d) Turn over = opening stock + production closing stock.

69. Operating profit of a chemical plant is equal to (a) profit before interest and tax *i.e.*, net profit + interest + tax

- (b) profit after tax plus depreciation
- (c) net profit + tax
- (d) profit after tax

70. Which of the following is not a component of the fixed capital for a chemical plant facility? (a) Raw materials inventory.

- (b) Utilities plants.
- (c) Process equipment.
- (d) Emergency facilities.

71. Which of the following is not a component of the working capital for a chemical process plant ?

- (a) Product inventory.
- (b) In-process inventory.
- (c) Minimum cash reserve.
- (d) Storage facilities.

72. Total product cost of a chemical plant does not include the.....cost.

- (a) market survey
- (b) operating labour, supervision and supplies
- (c) overhead and utilities
- (d) depreciation, property tax and insurance

73. Fixed charges for a chemical plant does not include the

- (a) interest on borrowed money.
- (b) rent of land and buildings.
- (c) property tax, insurance and depreciation.
- (d) repair and maintenance charges.

74. Cost incurred towards.....in a chemical plant is a component of the utilities cost. (a) water supply

- (b) running a control laboratory
- (c) property protection
- (d) medical services

75. A present sum of Rs. 100 at the end of one year, with half yearly rate of interest at 10%, will be Rs.

- (a) 121 (b) 110
- (c) 97 (d) 91

76. The depreciation during the year 'n', in diminishing balance method of

depreciation calculation, is calculated by multiplying a fixed percentage 'N' to the

(a) initial cost.

(b) book value at the end of $(n - 1)$ th year,

ANSWERS

62. (c) 63.(c) 64.(c) 65.(c) 66.(c) 67.(c) 68.(c) 69.(c) 70.(a) 71.(a) 72.(d) 73.(a)
74.(a) 75.(a) 76.(b)

(c) depreciation during the $(n - 1)$ th year. (d) difference between initial cost and salvage value.

77. Pick out the wrong statement.

(a) The discount factor is the ratio of present worth to future worth.

(b) Turnover ratio is gross sales/fixed capital. (c) Per cent rate of return is annual profits/ total initial capital investment.

(d) The product cost is equal to manufacturing cost + profits.

78. Depreciation must be based on the period and amount of use of the equipment. Which method of depreciation calculation takes the time value of money into account?

(a) Straight line method

(b) Sum of years-digits method

(c) Sinking fund method

(d) Declining balanced method

79. Match the methods of accountancy (List 1) with their application (List II).

List I

A. Lang factor method.

B. Net present worth method.

List II

(i) Calculation of depreciation.

(ii) Estimation of capital cost.

(iii) Analysis of profitability.

(a) A - ii, B - iii (b) A - ii, B - i (c) A - i, B - ii (d) A - i, B - iii

80. What is gross sales (in lakhs) of chemical plant having a turn over ratio of unity and working capital of Rs. 8 lakh, if the total capital investment is 50 lakhs?

- (a) 32 (b) 42
(c) 21 (d) 48

81. Return on investment (ROI) means

- (a) initial investment / annual return. (b) annual net cash flow / capital cost. (c) annual cost / cost of capital.
(d) cost of capital / annual cost.

82. The net present value (NPV) is equal to the sum of the

- (a) present value of all cash flows.
(b) returns.
(c) all cash flows.
(d) none of these.

83. The internal rate of return (IRR) of an investment is calculated by

- (a) selecting a discount rate, so that $NPV = 0$. (b) making sure that benefit/cost ratio equals

unity.

- (c) equating total discounted costs with discounted benefits.
(d) all 'a', 'b', & 'c'.

84. The return on investment (ROI) is expressed as

- (a) (annual net cash flow/capital cost) $\times 100$. (b) annual cost/capital cost.
(c) (first cost/first year benefits) $\times 100$. (d) net present value/internal rate of return.

85. The present value of an equipment is Rs. 10000 and interest on discount rate is 10%. The future value of cash flow at the end of 2 years is

- (a) 1998 (b) 2000
(c) 2002 (d) 2004

86. The present value of Rs. 1000 in 10 years time at an interest rate of 10 % is

- (a) 2500 (b) 386
(c) 352 (d) 10000

87. The cost of a heat exchanger is Rs 1 lakh. The simple payback period (SPP) in years considering annual savings of Rs. 6000 and annual operating cost of Rs. 10000 is

- (a) 0.5 (b) 1.5

(c) 2 (d) 4

88. Which of the following is not a financial indicator?

- (a) Return on investment (ROI).
- (b) Critical path method (CPM).
- (c) Internal rate of return (IRR).
- (d) Net present value (NPV).

89. An investment of Rs. 5,00,000 is made for an energy efficient pump. The power reduction achieved is 10.4 kW. If the energy cost is Rs. 4/kWh, the pay back period at 8000 hours of operation per year will be.....months.

- (a) 6 (b) 12
- (c) 18 (d) 24

90. Future value of cash flow is equal to

- (a) $NPV(1+i)^n$ (b) $NPV(1-i)^n$ (c) $NPV+(1-i)^n$ (d) $NPV/(1+i)^n$

91. What is the expected return on investment (ROI) from the project with Rs. 10 lakh invest

ANSWERS

77. (d) 78. (c) 79. (a) 80. (b) 81. (b) 82. (a) 83. (d) 84. (a) 85. (c) 86. (b) 87. (c) 88. (b) 89. (c) 90. (a) 91. (b)

ment and annual saving of Rs. 3 lakhs and the annual operating cost of Rs. 1 lakh?

- (a) 10% (b) 20%
- (c) 30% (d) 38%

92. What is the monthly saving in Rs. if an investment of Rs. 2,40,000 has a simple payback period of 2 years?

- (a) 8600 (b) 9600
- (c) 10000 (d) 12000

93. What is the ROI from a project which requires a capital cost of Rs. 200 lakhs and having an annual net cash flow of Rs. 40 lakhs?

- (a) 20% (b) 50%
- (c) 150% (d) 225%

94. What is the future value of a cash flow in Rs. at the end of the 6th year, if the present value is Rs. 2 lakhs and the interest rate is 9%?

(a) 335420 (b) 286500 (c) 308000 (d) 2,54,000

95. What is the expected return on investment (ROI) from the project with Rs. 5 lakh investment and annual saving of Rs. 1.75 lakhs with annual operating cost of Rs. 0.25 lakhs?

(a) 25 (b) 30
(c) 35 (d) 40

96. The broad indicator of the annual return expected from initial capital investment is (a) IRR (b) NPV
(c) ROI (d) none of these.

97. Costs associated with the design, planning, installation and commissioning of a project are (a) project costs
(c) variable costs
(b) capital costs (d) salvage value.

98. The ratio of annual net cash flow to capital cost is called
(a) internal rate of return (IRR)
(b) return on investment (ROI)
(c) net present value (NPV)
(d) discount factor.

ANSWERS 92.(c) 93.(a) 94.(a) 95.(b) 96.(c) 97.(b) 98.(b)

environMental engineering

1. The earth's atmosphere is an envelope of gases (c) Carbon monoxide present upto a height of about.....kms.

(a) 10 (b) 200 ¹⁶(d)Hydrogen sulphide

Sulphur dioxide present in the industrial (c) 1000 (d) 2000 **8.**

2. The density of the gases (present in air) decreases with increasing altitude to such an extent, that about 70% of the mass of atmospheric air is found in the lower 5 km. of the atmosphere. This lower region of atmosphere chimney exhaust gases causes

- (a) respiratory & lung disease.
- (b) reduction in plant's productivity owing to

acid rain.

(c) corrosion of building materials.

(d) all (a), (b) and (c).

Exposure to SO₂ containing chimney gases results in the

(a) reduction in strength of leather & cloth. (b) acceleration of corrosion rates of metals. (c) increased drying & hardening time of

paints.

(d) all (a), (b) and (c).

(b) troposphere **9.** (d) none of these

3. Which of the following is not a natural source of air pollution ?

(a) Volcanic eruptions and lightening discharges.

(b) Biological decay of vegetable matter. (c) Photochemical oxidation of organic matter. **10.** Carbon monoxide is a pollutant, which causes (d) None of these. (a) respiratory disease (e.g. asthma).

4. Which of the following is a manmade source of (b) asphyxiation (suffocation) leading to air pollution ?
death.

(c) retardation in crop growth. (a) Automobile exhaust. (d) damage to building materials like

marble.^(b) Forest fire.

(c) Bacterial action in soil and swamp areas **11.** On prolonged exposure to high concentration (d) All (a), (b) and (c). of carbon monoxide (> 5000 ppm), man dies

5. Which of the following sources is responsible ^{because} for maximum air pollution ?^(a)

(a) Industrial chimney exhaust.^(b)

(b) Forest fire.^(c)

(c) Automobiles exhaust.

(d) Photochemical oxidation of organic matter.

of clotting of blood.

of jamming of respiratory tract. it forms carboxyhaemoglobin by combining with haemoglobin of blood, thereby making it incapable of absorbing oxygen.

(d) it forms CO₂ by combining with oxygen **6.** For existence of aquatic life in water, the dispresent in the blood.

solved oxygen content in it, should not be less **12.** Four major constituents of atmospheric air are^{than.....ppm.} A. nitrogen B. argon^(a) 10000 ^(b) 5 C. oxygen D. carbon dioxide^(c) 500 ^(d) 1000 Arrange them in decreasing order of their per

7. Which of the following is the most major concentage in air.

stituents of air pollutants ? (a) A, C, B,D (b) A, D, B, C (a) Oxides of sulphur (c)

C, D, A, B (d) A, C, D, B^(b) Oxides of nitrogen

is called the

(a) ionosphere (c) stratosphere

ANSWERS

1. (b) 2.(b) 3.(d) 4.(a) 5.(c) 6.(b) 7.(a) 8.(d) 9.(d) 10.(b) 11.(c) 12.(a)

13. Global warming may result in

(a) flood

(b) cyclone

(c) decrease in food productivity

(d) all (a), (b) and (c)

14. Ozone is

(a) a primary pollutant.

(b) a secondary pollutant.

- (c) impervious to ultra-violet rays.
- (d) both (b) and (c)

15. Smog is

- (a) nothing but black smoke.
- (b) a combination of smoke and fog.
- (c) a liquid particle resulting from vapor condensation.
- (d) a solid particle *e.g.* flyash.

16. Particulates ($< 1\mu\text{m}$ size) remaining suspended in air indefinitely and transported by wind currents are called

- (a) fumes (b) mists
- (c) smoke (d) aerosols

17. Which of the following is not a secondary air pollutant ?

- (a) Ozone
- (b) Photochemical smog
- (c) Sulphur dioxide
- (d) All (a), (b) & (c)

18. 'Particulate' air pollutants are finely divided solids and liquids. Which of the following is not a 'particulate' ?

- (a) Dust & mists
- (b) Smoke & fumes
- (c) Photochemical smog & soot
- (d) None of these

19. 'Safe limit' called Threshold Limit Value (TLV) of carbon monoxide in atmospheric air is < 50 ppm. The main source of carbon monoxide pollutant in air is the

- (a) industrial chimney exhaust.
- (b) automobiles exhaust.
- (c) photochemical reaction in polluted atmosphere.
- (d) burning of domestic fuel.

20. High concentration of carcinogenic hydrocarbon pollutants in atmospheric air causes (a) cancer

(b) silicosis

(c) respiratory disease (*e.g.*, asthma) (d) reduced crop yield

21. Persons working in cement plants and limestone quarries are more prone to disease like (a) cancer

(b) asthma

(c) silicosis

(d) flourosis (bone disease)

22. Higher concentration of nitrogen dioxide in atmospheric air causes (a) cancer

(c) asphyxiation (b) bronchitis (d) corrosion

23. Fluorosis (a bone disease) is caused by the presence of high concentration of.....in atmospheric air.

(a) hydrocarbons

(b) hydrogen flouride

(c) hydrogen sulphides

(d) nitrogen dioxide

24. Presence of high concentration of ozone and smog in atmospheric air causes the

(a) embrittlement & decrease of folding resistance of paper.

(b) cracking of rubber products.

(c) fading of dye on textiles.

(d) damage of electrical insulator on high tension power line.

25. Moist atmospheric air at high temperature (*e.g.*, in summer) having high concentration of sulphur dioxide causes

(a) fading of dyes on textiles.

(b) corrosion, tarnishing & soiling of metals. (c) reduced strength of textiles.

(d) all (a), (b) and (c).

26. Lead exhausted in the atmosphere by automobiles using leaded petrol (*i.e.* tetraethyl lead for improving octane number) is a lethal air pollutant which causes

(a) paralysis of muscles & loss of appetite. (b) nervous depression.

(c) gastroentisitis & diarrhea.

(d) all (a), (b) and (c).

27. Which of the following causes death by asphyxiation, if its presence in

atmospheric air exceeds maximum allowable concentration (*i.e.* > 50 ppm) ?

- (a) Benzopyrene
- (b) Peroxyacyl nitrate
- (c) Carbon monoxide
- (d) Sulphur dioxide

ANSWERS

13. (d) 14. (d) 15. (b) 16. (d) 17. (c) 18. (d) 19. (b) 20. (a) 21. (c) 22. (b) 23. (b) 24. (b)
25. (d) 26. (d) 27. (c)

28. Most efficient and suitable dust removal equipment for removal of flyash from flue gas in a thermal power plant is the

- (a) gravity settling chamber
- (b) cyclone separator
- (c) electrostatic precipitator
- (d) bag filter

29. Which of the following is an adsorbant for removal of nitrogen oxides from gas/air ? (a) Active carbon

- (b) Silica gel
- (c) Bog iron (iron oxide)
- (d) Pulverised limestone

30. Particles having diameter greater than 75 μm (micrometer = 10^{-6} mm) are called

- (a) grit (b) dust

- (c) powder (d) smoke

31. Carbonaceous particles having size less than 1 μm are called (a) grit

- (c) aerosols (b) aggregates (d) smoke

32. 5–200 μm size particles are called

- (a) colloids or aerosols (b) powder (c) dust (d) smoke

33. 80% less than 200 mesh size particles are called

- (a) smoke (b) powder (c) grit (d) aggregates

34. Which of the following pollutants is not emitted during volcanic eruptions ?

- (a) SO_2 (b) H_2S

(c) CO (d) hydrocarbons

35. Main pollutant present in automobile exhaust is

(a) SO₂ (b) CO₂

(c) NO (d) hydrocarbons

36. plant emits large amount of SO₂ as

(b) Sulphuric acid

(d) Iron & steel an air pollutant. (a) Nitric acid (c) Chloralkali

37. Which of the following plants does not emit appreciable amount of SO₂ in atmosphere ? (a) Thermal power plant

(b) Petroleum refinery

(c) Nitric acid plant

(d) Sulphuric acid plant

38. Which of the following is a green house gas other than CO₂ ?

(a) Methane

(b) Nitrous oxide

(c) Chlorofluro carbons (CFC)

(d) All (a), (b) and (c)

39. Which of the following dust collection equipments is the least efficient (for sub-micronic particles) ?

(a) Dust catcher (gravity type)

(b) Cyclone separator

(c) Bag filter

(d) Hollow wet scrubber

40. Photochemical smog is formed from automobile exhaust

(a) by reaction of hydrocarbon & nitric oxide

in presence of sunlight.

(b) appears only on sunny days.

(c) is harmful for crops and trees also besides

causing eye irritation & asthma.

(d) all (a), (b) & (c)

41. Threshold Limit Value (TLV) is the maximum allowable concentration (*i.e.* safe limit) of pollutants in air. Safe limit for SO₂ in air is.....ppm.

- (a) 5 (b) 500
(c) 1000 (d) 2000

Maximum allowable concentration of CO₂ in **42.**
air for safe working is.....ppm (parts per million).

- (a) 50 (b) 1000
(c) 2000 (d) 5000

43. Threshold limit value (TLV) of CO in air is.....ppm.

- (a) 5 (b) 50
(c) 2000 (d) 5000

44. TLV of ammonia, nitrogen dioxide and phenol vapor in air
is.....ppm.

- (a) 5 (b) 100
(c) 1000 (d) 2000

45. Acute danger to human life (*i.e.* death) exists, if the concentration of CO₂ in
atmospheric air exceeds.....percent (by volume).

- (a) 1 (b) 3
(c) 7 (d) 20

46. Death may occur, when SO₂ concentration in atmospheric air
exceeds.....ppm. (a) 20 (b) 100

- (c) 400 (d) 200

ANSWERS

28. (c) 29.(b) 30.(a) 31.(d) 32.(a) 33.(b) 34.(d) 35.(a) 36.(b) 37.(c) 38.(d) 39.(a)
40.(d) 41.(a) 42.(d) 43.(b) 44.(a) 45.(d) 46.(c)

47. If carbon monoxide content in atmospheric air exceeds.....ppm, death is
bound to occur, (a) 50 (b) 500

- (c) 1000 (d) 3000 (*i.e.* 0.3%)

48. Beyond what concentration(ppm) of H_2S in air, acute danger to human life exists ?

- (a) 50 (b) 100
- (c) 300 (d) 700

49. TLV of ozone (O_3) and phosgene (COCl_2) in air is.....ppm.

- (a) 0.1 (b) 25
- (c) 100 (d) 1000

50. Smoke is produced due to

- (a) insufficient supply of combustion air and insufficient time for combustion.
- (b) poor quality of fuel and improper mixing of fuel & combustion air.
- (c) poor design & overloading of furnace.
- (d) all (a), (b) and (c).

51. Reinglemann chart is used for the measurement of the

- (a) combustibles present in automobile exhaust.
- (b) smoke density from a chimney.
- (c) exhaust gas density.
- (d) flue gas temperature.

52. When the concentration of SO_2 in air is greater than.....ppm, it gives a pungent smell. (a) 0.01 (b) 0.1

- (c) 1 (d) 4

53. Peroxyacyl nitrate (PAN), a pollutant is found in the

- (a) automobile exhaust.
- (b) flue gas of coal based power plant. (c) exhaust of nitric acid plant.
- (d) exhaust of sulphuric acid plant.

54. Pick out the wrong statement.

- (a) Biological oxygen demand (BOD) is a characteristic and not a constituent of water.
- (b) BOD is a measure of the amount of oxygen which will be demanded & used in 5 days by the biological decomposition of the organic matter present in water stream present as food for the living organism.
- (c) BOD is expressed in mg/litre (typically, $\text{BOD} = 2.5 \text{ mg/litre}$ for potable water).

(d) none of these

55. Pick out the correct statement.

(a) Chemical oxygen demand (COD) is a measure of chemically oxidisable organic matter present in water.

(b) COD is determined by oxidising the organic matter present in water with potassium dichromate in concentrated sulphuric acid solution at boiling temperature for specified time.

(c) COD is related to BOD of a given waste in water but the relationship varies for different wastes. Typically COD of potable water may be 1–2 mg/litre.

(d) all (a), (b) and (c).

56. Which of the following is the most lethal water pollutant ?

(a) Phenol and cyanide

(b) Chlorine

(c) Alkalies

(d) Suspended solids

57. Presence of soluble organics in polluted water causes

(a) undesirable plants growth.

(b) depletion of oxygen.

(c) fire hazards.

(d) explosion hazards.

58. Presence of non-biodegradable substances like alkyl benzene sulphonate (ABS) from the detergents in polluted water stream causes (a) fire hazards.

(b) explosion hazards.

(c) persistent foam.

(d) depletion of dissolved oxygen.

59. BOD of raw municipal sewage may be in the range of about.....mg/litre.

(a) 1–2 (b) 5–10

(c) 150–300 (d) 2000–3000

60. COD of raw municipal sewage may be in the range of about.....mg/litre.

(a) 1–2 (b) 5–10

(c) 150–300 (d) 1500–2500

61. Disinfection of water is done to destroy pathogenic bacteria and thus prevent water borne diseases. Disinfection of water may be done by the use of

(a) ozone and iodine.

(b) chlorine or its compounds

(c) ultraviolet light for irradiation of water. (d) all (a), (b) & (c).

ANSWERS

47. (d) 48.(d) 49.(a) 50.(d) 51.(b) 52.(d) 53.(a) 54.(d) 55.(d) 56.(a) 57.(b) 58.(c)
59.(c) 60.(c) 61.(d)

62. Presence of.....in water stream are deleterious to aquatic life.

(a) soluble and toxic organics

(b) suspended solids

(c) heavy metals and cynides

(d) all (a), (b) & (c)

63. Presence of nitrogen and phosphorous in waste water discharged into lakes and ponds causes (a) foaming

(b) odour nuisances

(c) undesirable plant growth

(d) turbidity

64. Presence of volatile compounds like gasoline, oil, alcohol, ether etc. in municipal sewers may cause

(a) explosion

(b) non biodegradable foam

(c) undesirable plant growth

(d) corrosion

65. Oil and grease present in an emulsified state in waste water discharged from industries can be removed by

(a) biological oxidation.

(b) skimming off.

(c) settling out using chemical reagents. (d) chlorination.

66. Which is the most practical and economical method for removal of suspended solid matter (b) aerobic oxidation.

(c) both (a) & (b).

(d) neither (a) nor (b).

70. Polluted water having low BOD are most economically treated in

(a) (b) (c)

sedimentation tanks oxidation ponds
sludge digester

(d)

(d) clarifier

71. Lagoons used for purification of polluted water (a) are large shallow artificial lakes also known as clarification lakes, maturation ponds or oxidation ponds.

(b) use micro-organisms/bacteria in presence of dissolved oxygen.

(c) gives an excellent final effluent (with 3 to 4 lagoons arranged in series) having suspended solid < 1 mg/litre and BOD = 3.8 mg/litre.

all (a), (b) & (c).

72. Aerobic biological oxidation ponds used for the purification of polluted water

(a)

(b)

(c)

(d)

destroys/removes pathogen from the sewage. is not very effective for non-biodegradable substances (e.g. ABS) containing effluents. destroys/removes pathogen much more effectively if the sewage is chlorinated. all (a), (b) & (c).

from polluted water ? (a) Sedimentation (b) (c) Chlorination (d) Skimming off
Biological oxidation

67 . Which of the following is the most efficient for removal of very finely divided suspended solids and colloidal matter from the polluted water stream ?

(a) Sedimentation tank

(b) Circular clarifier

(c) Mechanical flocculation

(d) Chemical coagulation

68. Pick out the one which is not a chemical coagulant.

- (a) Aluminium sulphate
- (b) Ferrous sulphate
- (c) Hydrated lime
- (d) Chloramine

69. Biological oxidation ponds remove organic matters present in the polluted water by (a) using the activities of bacteria and other

micro organisms.

73. Which is the best and the most effective method for the removal of organic contaminant present in the polluted water in very small quantity (say < 200 mg/litre)?

- (a) Lagooning
- (b) (c) (d)

Activated carbon adsorption Biological oxidation pond Chemical coagulation

74. Iron & manganese present in the water is removed by

- (a) simple filtration.
- (b) (c) (d)

oxidation followed by settling. chemical coagulation.
chlorination only.

75. The commonest form of iron & manganese found in ground water as pollutant is in the form of their

- (a) carbonates (c) chlorides (b) bicarbonates (d) sulphides

76. Iron & manganese present as pollutant in water can not be removed by

ANSWERS

62. (d) 63.(c) 64.(a) 65.(c) 66.(a) 67.(d) 68.(b) 69.(c) 70.(b) 71.(d) 72.(d) 73.(b)
74.(b) 75.(d) 76.(d)

(a) ion exchange process.

(b) oxidation followed by settling & filtration. (c) lime soda process or manganese zeolite process.

(d) chlorination.

77. Salt content in sea water is about.....percent. (a) 0.5 (b) 1
(c) 3.5 (d) 10

78. Dose of chlorine for disinfection of water is about.....mg/litre of water.
(a) 0.01 (b) 0.1
(c) 0.3 (d) 1

79. Presence of bacteria in potable (drinking) water causes
(a) turbidity (c) bad odour (b) disease

(d) bad taste & colour

80. Which of the following pollutants is absent in the emissions from a fertiliser plant ? (a) SO_2 & SO_3 (b) NO_2
(c) NH_3 (d) CO

81. Noise pollution level in a chemical plant is ex
(b) decibel

(d) none of these pressed in (a) roentgen

(c) hertz

86. High noise level in a chemical plant can be controlled by the
(a) suppression of noise at the source itself. (b) path control of noise.
(c) protection of operating personnel. (d) all (a), (b) & (c).

87. Pick out the correct statement.

(a) Noise from ball mills can be dealt with by fibre glass lined enclosures.

(b) Noise from vibrating chutes can be reduced by lining the metallic chute with rubber.

(c) Noise of conveyor belt system is reduced by using urethane coated cloth conveyor belts and rubber/plastic covered metallic rollers.

(d) all (a), (b) & (c).

88. In sewage treatment, its sedimentation is speeded up by commonly adding
(a) hydrochloric acid.(b) lime.
(c) copper sulphate. (d) sodium sulphate.

89. The lowest layer of atmosphere is known as the

(a) stratosphere (c) ionosphere (b) troposphere (d) none of these

82. A man exposed to excessive noise level in the working environment may suffer from (a) hearing loss
(b) rupture of ear drum
(c) nervousness & fatigue
(d) all (a), (b) & (c)

83. Maximum allowable noise exposure limits for a man working for 8 hours a day in a noisy chemical plant is about.....decibels.

(a) 20 (b) 60
(c) 85 (d) 120

84. Thermal pollution of air due to excessive heat & temperature in the working place causes

(a) reduction in working efficiency of man- power.
(b) fatigue.
(c) high breathing rate.
(d) all (a), (b) & (c).

85. Radioactive solid nuclear wastes are disposed off by

(a) high temperature incineration.
(b) pathological incineration.
(c) pyrolysis
(d) underground burial in concrete containers.

90. Septic tanks are used for the.....of the deposited solids.

(a) separation
(b) anaerobic decomposition
(c) aerobic decomposition
(d) none of these

91. The principal gas evolved from sludge digestion tank is

(a) CO (b) CO₂
(c) CH₄ (d) N₂

92. Which of the following processes is involved in the biochemical treatment of sewage efflu- ents?

(a) Oxidation (b) Reduction (c) Dehydration (d) Fermentation

93. Solid content in most of the domestic sewage is about.....percent.

(a) 0.001 (b) 0.1

(c) 5 (d) 10

94. Siderosis is a disease caused by the inhalation of.....dust.

(a) coal (b) silica (c) iron (d) none of these

ANSWERS

77. (c) 78. (d) 79. (b) 80. (d) 81. (b) 82. (d) 83. (c) 84. (d) 85. (d) 86. (d) 87. (d) 88. (b)

89. (b) 90. (b) 91. (c) 92. (a) 93. (b) 94. (c)

95. Threshold limit value (TLV) means maximum (a) Chlorine permissible/acceptable concentration. TLV of (b) Alkalis phosgene in air is about.....ppm (parts per (c) Benzene hexachloride million). (d) Alkyl benzene sulphonate (ABS)

(a) 0.002 (b) 0.2 **106.** 'Pneumoconiosis' is a disease caused by the (c) 1.2 (d) 4.8 inhalation of.....dust.

96. Inhalation of silica dust causes a disease called (a) coal (b) uranium ore (a) bronchitis (b) silicosis (c) iron ore (d) lime

(c) pneumoconiosis (d) none of these **107.** The Killer gas which caused Bhopal gas trag

97. From pollution control point of view, the maxiedy in 1984 was mum permissible concentration of sulphur di(a) phosgene oxide in atmospheric air is about.....ppm. (b) methyl iso-cynate (MIC)

(a) 1 (b) 5 (c) carbon monoxide

(c) 50 (d) 500 (d) sulphur dioxide

98. Tolerable limit of nitrogen oxides in air **108.** Out of the following, TLV of.....is maxiis.....ppm. mum (about 5000. ppm).

(a) 0.1 (b) 1 (a) carbon dioxide

(c) 5 (d) 25 (b) toluene

99. Which of the following industries discharge (c) carbon disulphide mercury as a pollutant ?(d) acetaldehyde

(a) Chloro-alkali industry **109.** Reingleman chart is used for the evaluation (b) Tanneries of.....pollution.

(c) Beverage plant (a) air (b) water (d) Phosphoric acid plant (c) noise (d) radioactive

100. TLV of mercury in potable (drinking) water **110.** Which of the following gases is having the is about.....ppm. widest explosion limit (about 2 to 81% gas in (a) 0.001 (b) 0.1 gas-air mixture), rendering it the property of (c) 1 (d) 5 the most explosive gas ?

101. There are thirteen metals which are treated (a) Hydrogen as pollutants. Which of the following metals (c) Carbon monoxide (b) Acetylene (d) Ammonia

is not a pollutant ? (a) Mercury

(c) Aluminium **111.** Exposure to chemicals having carcinogenic

(b) Arsenic properties cause

(d) Lead (a) dermatitis (skin disorder)

102. Maximum permissible limit of mercury in (b) cancer human blood is.....micrograms/100 c.c. (c) asphyxiation

(a) 1 (b) 7 (d) asthma

(c) 19 (d) 82 **112.** Inhalation of silica dust by human being dur**103.** TLV of lead for public sewer/waste water is ing hand drilling in mica mining, lead & zinc about....ppm.

mining, silica refractory manufacture and in (a) 1 (b) 25 foundaries causes

(c)

150

(d)

650

(a) asphyxiation (suffocation).

(b) shortness of breath.**104.** Fluorosis is caused due to the presence of ex(c) tuberculosis.cessive amount of.....in drinking water. (d) all (a), (b) and (c).

(a) mercury (b) lead **113.** Inhalation of lead compounds present in the (c) fluoride (d) arsenic automobile exhausts (using leaded petrol) **105.** The destruction

of water borne pathogens is causes termed as disinfection of water. Which of the (a) blood poisoning.following is a water disinfectant ?

ANSWERS

95. (b) 96.(b) 97.(b) 98.(c) 99.(a) 100.(a) 101.(c) 102.(b) 103.(a) 104.(c) 105.(a) 106.(a)

107.(b) 108.(a) 109.(a) 110.(b) 111.(b) 112.(d) 113.(d)

(b) anaemia.

(c) nervous system disorder.

(d) all (a), (b) and (c).

114. Which is a secondary air pollutant ?

(a) Photochemical smog

(b) Sulphur dioxide

(c) Nitrogen dioxide **124.**

(d) Dust particles

115. A gas is termed as non-toxic, if its maximum permissible concentration (TLV) ranges is responsible for the red brownish color of water.

(a) carbonates

(b) bi-carbonates

(c) iron & manganese

(d) arsenic.

Infective bacteria in water is killed by the..... process.

(a)sterilisation (b) aeration (c) disinfection (d) none of these.

125. The pH value of potable water should be between.....ppm. (a) 1000 to 2000 (b) 3000 to 6000 (a) 1 to 1.5 (b) 6.5 to 8 (c) 6000 to 9000 (d) 10000 to 100000 (c) 13 to 14 (d) 4 to 5

116. Presence of nitrates in water in excess of 50

126. In a sedimentation tank, the detention period causes risk for water ranges from.....hours. (a) 2 to 4 (b) 8 to 12 (b) gastroenteritis (c) 16 to 20 (d) 24 to 32 (c) asphyxiation

(d) tooth decay **127.** In water treatment, alum [$Al_2(SO_4)_3$] is used **117.** Presence of a certain minimum quantity for the process of

of fluorine is desirable in potable water to (a) filtration (b) coagulation prevent (c)

sedimentation (d) disinfection. (a) dental cavities (b) scale formation **128.** The

resistance of water to the passage of (c) water-borne disease (d) corrosion light through it is a measure of the **118.** is the process of killing organism in

(a) turbidity (b) color water. (c) hardness (d) dissolved gases. (a) Coagulation (b)

Sterilisation **129.** Algae growth in water is controlled by (c) Disinfection (d)

Sedimentation (a) deoxidation

119. Growth of is promoted by the presence (c) bleaching (b) chlorination (d) aeration.

of manganese in water, **130.** Foul Maximum permissible residual chlorine (a) free (b) algae in treated water should be.....mg/litre. (c) micro-organisms (d) mosquito (a) 0.001 to 0.01 (b) 0.2 to 0.3

120. Presence of bacteria in water causes (c) 2 to 3 (d) 5 to 10 disease like typhoid.

(a) aerobic

(c) anaerobic

131. Maximum permissible residual chlorine in

(b) pathogenic treated water should be.....mg/litre. (d) non-pathogenic (a) 0.001 to 0.01 (b) 0.02 to 0.3

121. Maximum permissible turbidity in potable (c) 2 to 3 (d) 5 to 10 water is.....ppm. **132.** Fresh domestic sewage is.....in color. (a) 1 (b) 10 (a) grey (b) dark brown (c) 250 (d) 1000 (c) red (d) black.

122. Turbidity of water is an indication of the **133.** Fresh sewage is.....in nature. presence of (a)acidic (b) neutral (a) suspended inorganic matter (c) alkaline (d) highly acidic. (b) dissolved solids **134.** substances present in sewage are (c) floating solids removed in grit chamber during sewage (d) dissolved gases treatment.

123. Presence of dissolved impurities of..... (a) Organic (b) Fatty (c) Inorganic (d) Dissolved

ANSWERS

114. (a) 115.(d) 116.(a) 117.(a) 118.(c) 119.(c) 120.(b) 121.(b) 122.(a) 123.(c) 124.(a) 125.(b)

126.(a) 127.(b) 128.(a) 129.(b) 130.(c) 131.(b) 132.(a) 133.(c) 134.(c)

135. The type of bacteria which is active in trickling filter during biological treatment of sewage is the.....bacteria. (a) anaerobic

(c) anaerobic

(b) saprophytic (d) parasitic.

136. During sewage treatment, the sewage is subjected to.....treatment in Imhoff tank. (a) filtration (b) digestion (c) sedimentation (d) both (b) and (c).

137. A shallow pond in which the sewage is retained and biologically treated is called (a) oxidation (b) Imhoff tank (c) lagoon (d) skimming tank

138. In sewage treatment, the detention period allowed for oxidation ponds ranges from.....weeks.

(a) 1 to 2 (b) 4 to 5

(c) 9 to 10 (d) 15 to 20.

139. The function of skimming tank in sewage treatment is to remove.....substances. (a) dissolved solid (c) oil & fatty
(b) suspended solid (d) gritty & inorganic

140. Fine grit present in sewage is removed in the.....during sewage treatment. (a) grit chamber (b) detritus tank (c) trickling filter (d) skimming tank.

141. The main type of sludge gas evolved during sewage treatment in Imhoff tank is
(a) CO (b) CH₄ (c) CO (d) H₂

142. The most commonly used chemical coagulant in water treatment is (a) ferrous sulphate (c) lime
(b) alum
(d) hydrazine

143. Sound produced by an automobile horn heard at a distance of 1.5 metres corresponds to about.....decibels.
(a) 90 (b) 120
(c) 150 (d) 180

144. Noise level in a quiet private business office is about.....decibels.
(a) 25 (b) 50
(c) 70 (d) 85

145. Reingleman chart No. 2 corresponds to..... percent black smoke.
(a) 10 (b) 20
(c) 40 (d) 80

146. Maximum permissible concentration (i.e. TLV) of DDT in public water supply system is.....micro gram (m g)/litre.
(a) 2 (b) 42
(c) 332 (d) 1050

147. Which of the following is the common pollutant emitted from metallurgical smelters, thermal power plant and cement plants ? (a) NO_x (b) Hg
(c) SO₂ (d) F

- 148.** Arsenic pollutant is not generated in industries.
 (a) tanneries (b) glass & ceramic (c) beverages (d) any of these.
- 149.** TLV of aldrin in public water supply system is about.....µg/litre.
 (a) 0.5 (b) 17
 (c) 357 (d) 1097
- 150.** The common pollutant generated in chloralkali industry and battery manufacture is (a) mercury (b) brine
 (c) phosphate (d) none of these.
- 151.** Permissible safe limit (TLV) of.....toxic gas is 100–1000 parts per million (ppm). (a) highly (b) moderately (c) extremely (d) very extremely.
- 152.** There are five concentric layers within the atmosphere which is differentiated on the basis of temperature. The atmospheric layer which lies close to the earth's surface in which human being along with other organisms live is called troposphere. The rate at which air temperature in the troposphere gradually decreases with height is about.....°C/km. (a) 0.05 (b) 1
 (c) 6.5 (d) 15
- 153.** Most of the atmospheric air pollutants are present in large quantity in (a) stratosphere (c) troposphere (b) thermosphere (d) mesosphere
- 154.** In large thermal power stations very fine particulates present in flue gas are removed by
 (a) wet scrubber
 (b) bag filter
 (c) electrostatic precipitators
 (d) dust catcher

ANSWERS

135. (c) 136. (d) 137. (a) 138. (b) 139. (c) 140. (b) 141. (b) 142. (b) 143. (b) 144. (b)
 145. (c) 146. (b)
 147. (c) 148. (c) 149. (b) 150. (a) 151. (b) 152. (c) 153. (c) 154. (c)
155. Direct reaction of unsaturated hydrocarbons with either NO or NO₂ produces an eye irritating pollutant compound known as (a) photochemical smog.
 (b) peroxy acetyl nitrate (PAN) or methyl nitrile.

(c) benzopyrene.

(d) poly acrylonitrile.

156. The average thickness of ozone layer in stratosphere is about.....dobson unit (DU). (a) 20 (b) 250

(c) 750 (d) 1500

157. Inorganic impurities causing water pollution is (a) fats (b) carbohydrates (c) salts of metals (d) protein.

158. The detrimental effect on organism and water quality with temperature rise of aquatic system is the reduction of.....of water. (a) dissolved oxygen content (b) biological oxygen demand

(c) vapor pressure

(d) all (a), (b) and (c)

159. Workers working in industry are most prone to white lung cancer.

(a) coal mining (c) textile

(b) limestone mining (d) asbestos

160. Automobile exhaust is passed through two compartments catalytic converter employing platinum as catalyst for

(a) conversion of CO into CO₂ in the second

compartment.

(b) conversion of NO_x into N₂ and NH₃ in the first compartment.

(c) oxidation of unburnt hydrocarbon fuel in the second compartment.

(d) all (a), (b) and (c).

161. Oceans act as sinks for atmospheric gases including carbon dioxide whose concentration in the atmosphere is increased by the (a) forestation (b) rain (c) green house effect (d) vegetation

162. A considerable part of the harmful ultraviolet radiation of the sun does not reach the earth surface, because of the fact that, there is a layer of.....high above earth's atmosphere, which absorbs it.

(a) hydrogen (b) (c) ozone (d) carbon dioxide none of these

163. Pick out the wrong statement.

(a) The concentric layer in atmosphere which contains about 70% of the total

mass of atmosphere and characterised by a steady decrease in temperature is called stratosphere.

- (b) Stratosphere is rich in ozone and is located just above the troposphere.
- (c) Troposphere is a turbulent dusty zone containing much of water vapor and clouds.
- (d) The earth's atmosphere is an envelope of gases extending upto a height of about 200 kms.

164. Which of the following pollutants, if present in atmosphere is detectable by its odour ?

- (a) CO (b) SO₂ (c) NO₂ (d) CO₂

165. The concentration of water vapour in troposphere, which depends upon the altitude & temperature varies in the range of zero to.....percent.

- (a) 1 (b) 4
- (c) 8 (d) 12

166. Oilish impurities present in the effluent discharged from the electroplating industry is normally not removed by

- (a) chemical coagulation
- (b) floatation & skimming
- (c) centrifugation
- (d) ultrafiltration

167. can not control the noise pollution. (a) Use of silencers

- (b) Green house gases
- (c) Vibration damping
- (d) Tree plantation

168. Which of the following is the most active zone of atmosphere in which weathering events like rain, storm & lightning occur ?

- (a) Thermosphere (c) Stratosphere (b) Troposphere (d) none of these

169. TLV of NO₂ & NO exposure for the human being is 5 & 25 ppm respectively. Prolonged exposure of human being to NO₂ causes (a) skin disorder (b) bronchitis (c) bone disease (d) cancer

170. The maximum CO₂ is emitted into the atmosphere by

- (a) combustion (b) urea

(c) biomass burning (d) trees

ANSWERS

155. (b) 156.(b) 157.(c) 158.(a) 159.(c) 160.(d) 161.(c) 162.(a) 163.(b) 164.(b)
165.(b) 166.(a)
167.(b) 168.(b) 169.(b) 170.(a)

171. Which of the following is not a source of ozone emission in the atmosphere ?

- (a) Refrigerators.
- (b) Xerox machines.
- (c) Dermatological photo-therapy equipments.
- (d) High voltage electrical equipments.

172. Lung cancer & DNA breakage are the major ill effects of excessive ozone exposure to human beings. Ozone layer depletion in the atmosphere is mainly caused by the presence of (a) CO₂

- (b) SO₂
- (c) hydrocarbons
- (d) CFC (chloro fluoro carbon)

173. Ambient noise level can be reduced by..... decibels by planting trees (like coconut, neem etc.) near public utility buildings (like hospitals & schools).

- (a) 1–2 (b) 5–10
- (c) 15–20 (d) 25–30

174. Which of the following is not a practical method of low level radioactive waste disposal ?

- (a) Dilution with inert material.
- (b) Discharging to atmosphere through tall

stacks after dilution.

- (c) Disposing off in rivers & oceans. (d) Filling in steel crates and shooting it off

out of earth's gravity.

175. Which of the following is not a weightless pollutant ?

- (a) SPM
- (b) Thermal pollution
- (c) Radioactive rays

(d) Noise pollution

176. Presence of nitrogen in high concentration in contaminated air reduces partial pressure of oxygen in lungs, thereby causing asphyxia (suffocation) leading to death from oxygen deficiency. Concentration of N_2 in contaminated air at which it acts as a natural asphyxant is $\geq$ percent.

- (a) 84 (b) 8
(c) 80 (d) 92

177. Dissolved oxygen content in river water is around.....ppm.

178. The term Biological Oxygen Demand (BOD) is used in relation to

- (a) (c)

potable water (b) cooling water distilled water (d) industrial effluents

179. A masonry structure built below ground level, where biochemical reaction takes place due to anaerobic bacteria is called

- (a) cesspool (b) lagoon
(c) skimming mill (d) septic tank

180. LD50 stands for

- (a) legal dose of a specified toxic chemical in which 50 test animals die.
(b) lethal dose of a toxic chemical in which

(c)

50% of test animals survive and remaining die.

lethal dose of toxic chemical in which 50 test animals out of 500 die.

- (d) lethal dose of a toxic chemical in which 50 test animals out of 500 survive.

181. PAN which stands for.....is a secondary pollutant.

- (a) peroxyacetyl nitrate
(b) peroxyacetate nitrate
(c) peroacetate nitrile
(d) peroacetate nitrate

182. What is BOD (ppm) of a water sample having initial oxygen concentration

of 10 ppm and final oxygen concentration of 4 ppm after keeping it in a closed bottle for 6 days at 25°C ? (a) 2.5 (b) 6
(c) 14 (d) 1.5

183. The ozone layer depletion is caused by NO and CFC (chloroflouro carbon). Depletion of ozone layer causes.....cancer.
(a) lung (b) blood
(c) skin (d) breast

184. In which region of atmosphere, the temperature does not decrease with the attitude? (a) Troposphere (c) Mesosphere (b) Thermosphere (d) None of these.

185. Which of the following is the coldest region of atmosphere? (a) (c)

Thermosphere Stratosphere (b) Troposphere (d) Mesosphere

186. Ozone layer is present in (a) 5 (b) 100 (a) exosphere (b) troposphere (c) 250 (d) 500 (c) stratosphere (d) mesosphere

ANSWERS

171. (a) 172. (d) 173. (b) 174. (d) 175. (a) 176. (a) 177. (a) 178. (d) 179. (d) 180. (b)
181. (a) 182. (b)

183. (c) 184. (b) 185. (d) 186. (c)

187. Pick out the wrong statement about carbon dioxide (CO₂).

(a) CO₂ can absorb infrared radiation but does not allow them to pass through.
(b) CO₂ is involved in the formation of photochemical fog.
(c) CO₂ is responsible for green house effect. (d) CO₂ is not considered as an atmospheric pollutant.

188. White lung cancer is caused by inhalation of (a) paper dust (b) silica dust
(c) asbestos dust (d) textiles dust.

189. Which is not a green house gas?

(a) O₂ (b) CFC
(c) CH₄ (d) CO₂.

190. Pick out the wrong statement about photochemical smog (also called Los Angeles smog). Photochemical smog

- (a) causes irritation in eyes.
- (b) is formed in summer during day time. (c) is reducing in nature.
- (d) formation involves NO, O₃ & hydrocarbons.

191. Pick out the wrong statement about London smog (also called sulphurous smog or classical smog). London smog

- (a) is formed during winter in morning time. (b) causes bronchitis.
- (c) contains H₂SO₄ droplets.
- (d) is oxidising in nature.

192. Which of the following is present in maximum amount in acid rain?

- (a) H₂CO₃ (b) H₂SO₄
- (c) HCl (d) HNO₃

193. Which of the following has the greatest affinity for hemoglobin ?

- (a) CO (b) CO₂
- (c) O₂ (d) NO.

194. Pick out the wrong statement.

- (a) NO is more harmful than NO₂.
- (b) Mesosphere and thermosphere are collectively called ionosphere.

(c) Gases involved in the formation of photo chemical smog are NO & hydrocarbons.

(d) Slowing down of formation of chlorophyll in presence of SO₂ is called chlorosis which causes loss of green color in leaves. **195.** Which region of the atmosphere is closest to the earth's surface?

(a) Thermosphere (c) Stratosphere (b) Troposphere (d) Mesosphere **196.** Which of the following is the most toxic particulate ?

- (a) Soot
- (b) Fly ash
- (c) Smog
- (d) Inorganic compounds

197. Global warming is mostly caused by the emission of

- (a) SO₂ (b) CO.
- (c) CO (d) C₂H₆

198. Pick out the wrong statement about the effect of green house gases.
(a) Major gas responsible for green house effect is carbon dioxide.

(b) Methane and ozone also contribute to the
(c)

green house effect.

Green house effect results in lowering of sea levels over a period of time.

(d) Green house effect results in global warming.

199. Which of the following does not cause pollution?

(a) Nuclear power plant.

(b) Hydroelectric power plant.

(c) CNG powered automobiles.

(d) Underground coal mining.

200. Which of the following is the most harmful for life on the globe?

(a) (c)

Soil erosion. (b) Deforestation. Increasing desert. (d) Nuclear fall out.

201. Organic wastes which can be readily decomposed by micro-organisms are called biodegradable. Pick out the biodegradable pollutant out of the following:

(a) Pesticides

(b) Mercuric salts

(c) Domestic wastes

(d) Lead compounds

202. does not fall into the category of chemical pollutant.

(a) Solid wastes (b) Liquid wastes (c) Pesticides (d) Noise

203. Which of the following is not a component of biosphere?

(a) Thermosphere (b) Atmosphere (c) Lithosphere (d) Hydrosphere

ANSWERS

187. (b) 188.(d) 189.(a) 190.(c) 191.(d) 192.(b) 193.(d) 194.(a) 195.(b) 196.(a)

197.(b) 198.(c)

199.(b) 200.(d) 201.(c) 202.(d) 203.(a)

204. Water pollution is not caused by

- (a) oxygen demanding wastes.
- (b) automobile exhaust.
- (c) plant nutrients.
- (d) disease causing agents.

205. Air pollution is not caused by

- (a) ozone (b) nitric oxide
- (c) hydrogen (d) hydrogen sulphide

206. Reaction with ultraviolet light is responsible for the production of

- (a) smog (b) ozone
- (c) nitrogen dioxide (d) sulphur trioxide

207. Photochemical oxidant, PAN (peroxy acyl nitrates) is formed by the action of on hydrocarbons in the presence of sunlight. (a) oxides of nitrogen (b) (c) hydrogen sulphide (d) carbon dioxide sulphur dioxide

208. Which of the following air pollutants is absent in vehicular emissions?

- (a) Hydrocarbons (b) Sulphur dioxide (c) Carbon monoxide (d) Flyash

209. If BOD (biological oxygen demand) of river water is high, then it implies that the river IS (a) polluted with pesticides.

- (b) not at all polluted.
- (c) highly polluted with Inorganic chemicals. (d) highly polluted with biodegradable organic chemicals.

210. Earth is protected from harmful effects of ultraviolet radiations by

- (a) carbon dioxide layer (b) ozone layer (c) troposphere (d) oxygen layer

211. pH value of acid rain lies below

- (a) 6.8 (b) 5.6
- (c) 4.0 (d) 2.8

212. Which of the following is a secondary air pollutant?

- (a) Pollen grains (b) Flyash (c) Sulphur dioxide (d) Ozone

213. Which of the following is primary air pollutant?

- (a) Particulates
- (b) Photochemical smog
- (c) Peroxy acetyl nitrate (PAN)
- (d) Formaldehyde

214. Which of the following air pollutants is not responsible for the formation of Photochemical smog?

- (a) NO_x (b) HC
- (c) O₃ (d) SO₂

215. Concentration of ozone in stratospheric ozone layer is about.....ppm as compared to about 0.05 ppm in the troposphere.

- (a) 1 (b) 5
- (c) 10 (d) 50

216. Ozone layer is found in stratosphere between.....km above the ground level. (a) 10–50 (b) 20–50

- (c) 50–100 (d) 250

217. Projected temperature increase by the year 2100 due to climate change is.....°C. (a) 2 (b) 4

- (c) 6 (d) 8

218. The predicted rise in mean sea level (MSL) due to global warming by the year 2100 is cms.

- (a) 5–6 (b) 9–88
- (c) 100 (d) 200

219. Which of the following compounds can easily break the ozone molecules in stratosphere? (a) Bromine (c) both a & b (b) Chlorine

- (d) neither 'a' nor b

220. The main source of CFC (chlorofluorocarbons) in household sector is

- (a) refrigerators. (b) televisions. (c) washing machines. (d) none of these.

221. The average daily consumption rate of respiratory air by an adult human being is about.....kg/day.

- (a) 6 (b) 12
- (c) 24 (d) 36

222. Most major source of air pollution in modern days is

- (a) volcanic eruptions.
- (b) forest fires.
- (c) dust storms.

(d) automobiles & industries.

223. The air pollutant which does not cause any major adverse affect on farm animals is (a) carbon dioxide (b) lead (c) fluorine (d) arsenic

224. The air pollutant which causes severe damage to plants even at much lower concentrations than what may be harmful to human health is (a) ozone. (b) flourine. (c) carbon monoxide. (d) PAN.

ANSWERS

204. (b) 205.(c) 206.(b) 207.(a) 208.(d) 209.(d) 210.(b) 211.(b) 212.(d) 213.(a) 214.(d) 215.(c)

216.(b) 217.(a) 218.(b) 219.(c) 220.(a) 221.(b) 222.(d) 223.(a) 224.(b)

225. Pick out the wrong statement.

(a) Two third of acid rains are caused by SO₂ gas which is mainly produced by the burning of coal & oil.

(b) A rainfall is generally classified as acidic, if its pH value is less than 5.6.

(c) One third of acid rain is caused by nitrogen oxides (NO_x) which are mainly produced by automobiles & industrial emissions, nitrogenous fertiliser (e.g., urea) production and forests & grasslands on fire.

(d) To neutralise the acidic nature of lake waters (caused by acid rain) liquid ammonia is sprayed on lake water.

226. Respiratory suspended particulate matter (RSPM) includes all particles in air mass of size upto 10 microns. RSPM is also designated as

(a) PM_{2.5} (b) PM₅

(c) PM₁₀ (d) PM₂₅

227. During temperature inversions in atmosphere, air pollutants tends to

(a) disperse laterally.

(b) accumulate below inversions layer. (c) disperse vertically.

(d) accumulate above inversions layer.

228. Heavy loading of pollen grains in respiratory air causes

(a) typhoid (c) anaemia (b) influenza (d) hayfever

229. Which of the following devices can be used to control both gaseous as well as particulate pollutants in the industrial emissions? (a) Cyclone separator

- (b) Bag filter
- (c) Spray scrubber
- (d) Electrostatic precipitator (dry type)

230. The most significant primary gaseous pollutant found in vehicular emissions, is (a) SO₂ (b) NO_x
(c) CO (d) O₃

231. Presence of excessive amount of carbon monoxide in atmospheric air is hazardous to human health, because it causes
(a) reduction in oxygen carrying capacity of

blood.

(b) high blood pressure. (c) loss of sense of smell. (d) conjunctivities.

232. High lead exposures in human beings either

through air inhalation or food ingestion does not cause

(a) high blood pressure.

(b) disorder of central nervous system. (c) cancer.

(d) mental retardation.

233. Longer exposures of human beings to nitrogen dioxide (NO₂) to even in small concentration may cause.....disease.

(a) heart (b) lung

(c) kidney (d) liver

234 . Higher exposure of nitrogen oxides (NO_x) does not cause

(a) allergies & viral attacks

(b) pneumonia

(c) bronchitis

(d) conjunctivities

235. The permissible RSPM (annual average) ambient air quality standard for industrial areas in India is 120 µg/m³. The same limit for TSPM is.....µg/m³.

(a) 140 (b) 240

(c) 360 (d) 420

TSPM – Total suspended particulate matter µg/m³-microgram per cubic meter

236. The most significant environmental issue threatening human health is
(a) acid rain.
(b) global warming.
(c) ozone layer depletion.
(d) noise pollution.

237. Depletion of ozone layer in stratosphere is caused due to the reaction of ozone with (a) SO_2 (b) Cl_2
(c) N_2O (d) CO_2

238. Reduction in thickness of ozone layer to less than 150 DU (1.5 mm) is termed as ozone hole, which is likely to increase the incidence of.....in human beings.
(a) skin cancer
(b) respiratory disease (asthma)
(c) kidney failure
(d) lung disease

239. Which of the following is not an effect of excessive noise on human beings?
(a) General annoyance & sleeplessness (b) High blood pressure & gastric secretion: (c) Gradual hearing loss
(d) Asthmatic attacks.

225.(d) 226.(c) 227.(b) 228.(d) 229.(c) 237.(b) 238.(a) 239.(d)

ANSWERS

230. (c) 231.(a) 232.(c) 233.(b) 234.(d) 235.(c) 236.(c) **240.** Maximum sound level beyond which it is regarded as an ambient pollutant is..... decibels.
(a) 50 (b) 80
(c) 95 (d) 105

241. The taste threshold & odour threshold of SO_2 are.....ppm respectively.
(a) 0.1 & 0.5 (b) 0.3 & 0.5 (c) 0.5 & 0.1 (d) 1 & 3

242. The average NO_2 concentration in tobacco smoke is about.....ppm.
(a) 1 (b) 5
(c) 25 (d) 50.

243. The temperature gradient of ambient air is, change of ambient temperature with height is termed as the

- (a) environmental lapse rate (ELR). (b) adiabatic lapse rate (ALR).
(c) dry adiabatic lapse rate (DALR). (d) super adiabatic lapse rate (SALR).

244. Match the causes of various environmental pollutant's effects.

Causes

A. CO B. CO₂

C. CH₄ D. SO₂

Effects

I. acid rain

II. explosion

III. asphyxiation

IV. green house effect

Codes : A B (a) II III I IV (c) I III IV II C D

(b) III IV II I (d) IV II I III **245.** Which of the following solid waste disposal methods is ecologically most acceptable? (a) Pyrolysis (b) Incineration (c)

Composting (d) Sanitary landfill. **246.** Non disposal of solid waste may cause the spread of

(a) dysentery.

(b) malaria.

(c) typhoid.

(d) rodents related plague.

247. Match the pollution control equipments with the pollutants removed:

Equipments

A. Electrostatic precipitators

B. Cyclone separator

C. Wet scrubbers

D. Absorbers Pollutant removed

I. coarse particles

II. fine dust

III. gas

IV. sulfur dioxide

Codes: A B C D

(a) I II III IV

- (b) II I III IV
 (c) II I IV III
 (d) I II IV III.

248. Aerosol is

- (a) finely divided ash particles.
 (b) diffused liquid particles.
 (c) dispersion of small solid/liquid particles in gaseous media.
 (d) carbon particles of microscopic size.

249. Which of the following methods can be employed for plastic and rubber waste disposal? (a) Incineration (b) Composting (c) Sanitary landfill (d) Pyrolysis

250. Match the environmental effects of various air pollutants.

Air pollutants

- A. Carbon monoxide
 B. Particulate matter
 C. Nitrogen oxides
 D. Sulfur dioxide.

Environmental effects

- I. respiratory problems for living beings. II. chemical reaction with hemoglobin in the blood.
 III. reduction in visibility & aero allergens. IV. photochemical smog in atmosphere.

Codes : A B C D (a) II III I IV (c) II III IV I (b) III II IV I (d) III II I IV

251. Match the features of various solid waste disposal methods.

- Solid waste disposal methods* A. Incineration B. Sanitary landfill C. Composting D. Salvage by sorting

Features

Requires presorting, grinding and turning.

- II. Limited to special wastes and selected materials.
- III. High operational and maintenance cost

ANSWERS

240. (b) 241.(b) 242.(b) 243.(a) 244.(b) 245.(c) 246.(d) 247.(b) 248.(c) 249.(a)
250.(c) 251.(c) IV. Tractor
V. Rat and fly breeding

Codes :

A B C D

(a) II V IV III

(b) I IV II III

(c) III IV I II

(d) III V IV II

252. For rural areas, most suitable solid waste disposal method is

- (a) land filling (c) pyrolysis
- (b) composting (d) incineration

253. The most popular method of solid waste disposal in India is

- (a) pyrolysis
- (b) incineration
- (c) landfill
- (d) fluidised bed combustion

254. Major air pollutants from a coal fired thermal power station are fly ash and

- (a) ozone.
- (b) hydrogen fluoride.
- (c) hydrogen sulfide.
- (d) sulfur dioxide.

255. Biomedical waste (comprising of both solid & liquid wastes) generated in Indian hospitals is about 1.45 kg / day / patient. Which of the following methods is generally not adopted for safe disposal of biomedical wastes? (a)

- Incineration.
- (b) Landfilling.
- (c) Hydroclaving.
- (d) Shredding after disinfection.

256. 80% the total CO₂ annually emitted into atmosphere comes from

(a) combustion of fossil fuels (coal oil & gas). (b) landfills.

(c) methane release from termites & cattle

sheep.

(d) rotting vegetation.

257. Which of the following gas is generally not present in sewers?

(a) H₂S (b) CH₄

(c) CO₂ (d) CO

258. When a sheet of paper moistened with lead acetate, held for 5 minutes in a manhole, turns black; then the sewer certainly contains

(a) H₂S (b) CO₂

(c) CH₄ (d) CO

259. Which of the following gases is generally not evolved during decomposition of sewage? (a) H₂S (b) CO₂

(c) CH₄ (d) NH₃

260. Minimum dissolved oxygen (D.O) content prescribed for a river stream to avoid fish kill is.....ppm.

(a) 0.1 (b) 1

(c) 2 (d) 4

261. As compared to fresh river water, sea water contains.....oxygen.

(a) 5% more (b) 5% less (c) 20% more (d) 20% less

262. Dissolved oxygen content in river/water streams is

(a) minimum at noon.

(b) maximum at noon.

(c) maximum at midnight.

(d) same throughout the day.

263. Sewage disposal causes formation of sludge banks in sea waters. The most common method of waste water disposal is its

(a) utilisation for irrigational purposes. (b) rapid infiltration.

(c) dilution in surface water.

(d) natural evaporation.

264. Primary treatment of sewage is meant for the removal of
(a) fine suspended organic matter
(b) larger suspended matter
(c) pathogenic (disease causing) bacteria (d) dissolved organic matter

265. Match the equipments/techniques used for the removal of unwanted materials during preliminary treatment of sewage.

I. Skimming tanks A. Oil & grease

II. Grit chambers

III. Screening

B. Floating materials C. Dissolved organic

matter IV. Reverse osmosis D. Sand (a) I-A, II-D, III-B, IV-C

(b) I-A, II-B, III-C, IV-D

(c) I-D, II-C, III-B, IV-A

(d) I-D, II-A, III-B, IV-C

tains

ANSWERS

252. (b) 253. (c) 254. (d) 255. (b) 256. (a) 257. (d) 258. (a) 259. (b) 260. (d) 261. (d)

262. (b) 263. (c)

264. (b) 265. (a)

266. Maximum efficiency of BOD removal is achieved in

(a) aerated lagoon (c) oxidation pond (b) oxidation ditch (d) trickling filter

267. The secondary treatment of sewage is caused by

(a) chlorine (b) bacteria (c) algae (d) coagulants

268. The phenomenon by virtue of which soil is clogged with sewage matter is called, sewage (a) sulking (b) bulking (c) sickness (d) farming

269. Algae dies out, though fish life may survive, in a river zone, known as the zone of

(a) degradation.

(b) aeration.

(c) active decomposition.

(d) recovery.

270. Which of the following air pollutants is not a colorless gas?

- (a) SO₂ (b) NO
- (c) O₃ (d) None of these

271. Which of the following is generally not used as an adsorbant for removal of air pollutants? (a) Zeolites

- (b) Activated carbon
- (c) Carbon fibre
- (d) Polymeric materials

272. What percentage of sulfur present in a fossil fuel (e.g., coal, oil) is converted into sulfur dioxide in a utility or industrial boiler? (a) 25 (b) 50
(c) 75 (d) 95

273. Which factor does not influence the formation of the NO_x in a boiler?

- (a) Nitrogen content of the fuel being fired. (b) Volume of flue gas.
- (c) Temperature of combustion zone. (d) Oxygen concentration.

274. Which category of source has the highest NO_x emission?

- (a) Fuel handling & utilisation.
- (b) Fuel combustion (electric utilities). (c) Solvent utilisation.
- (d) Transportation (automobiles, planes).

275. The emission of which air pollutant is likely to increase when the combustion zone temperature- (a) Volatile organic compounds (VOC's). (b) Carbon monoxide (CO).

- (c) Dioxins and furan compounds.
- (d) Nitrogen oxides, NO_x.

276. Which category of sources is most responsible for sulfur dioxide emissions?

- (a) Industrial processes.
- (b) Utility and industrial boilers.
- (c) Transportation (automobiles, planes). (d) Solvent utilisation.

277. The environmental or prevailing lapse rate can be determined from the actual temperature profile of the atmosphere. The dry adiabatic lapse rate (DALR) is minus.....°C/km. (a) 6.5 (b) 9.8

- (c) 14.5 (d) 1.5

278. Unstable atmospheric conditions most commonly develop on (a) (c)

cloudy days clear night (b) cloudy nights (d) sunny days

279. On cloudy days with no strong surface heating, atmospheric conditions are likely to be (a) stable. (b) (c) extremely stable. (d) unstable. neutral.

280. Vertical mixing of air pollutants due to buoyancy is increased when atmospheric conditions are

(a) unstable (b) neutral

(c) stable (d) extremely stable

281. Which categories of sources is most responsible for volatile organic compounds (VOC's) emissions?

(a) Fuel handling and distribution. (b) Fuel combustion.

(c) Transportation (automobiles, planes). (d) Solvent utilisation.

282. The plume in the following diagram is

perature of a boiler increases?

ANSWERS

266. (b) 267. (b) 268. (c) 269. (a) 270. (d) 271. (d) 272. (d) 273. (b) 274. (d) 275. (d)

276. (b) 277. (b)

278. (d) 279. (d) 280. (a) 281. (d) 282. (d)

(a) coning (b) looping (d) Pesticides used in the buildings only (c) lofting (d) fumigation hurt the pests as they are designed to

283. What is the name of the plume shown below ^{kill them.}

in the diagram? **290.** pollutants are emitted directly from

(a) Looping (c) Fanning identifiable sources. (a) Toxic

(c) Primary

(b) Hazardous (d) Secondary

291. Respirable particle of size $PM_{2.5}$ (microns) will affect the.....system on inhalation. (a) nervous (b) cardiovascular (c) respiratory (d) urinary

292. Plume rise from a stack is due to (a) momentum and buoyancy

(b) the composition of the stack gas

(b) Coning (c) heat and type of pollutant

(d) Trapping (d) none of these.

284. The total dissolved solids in drinking water **293.** Ground level pollutants concentration is should not exceed.....mg / litre.

(a) 1 (b) 100

(c) 500 (d) 1000

285. Methamoglobinemia (blue baby disease) **294.** is due to presence of excess of.....in the drinking water.

(a) chlorides

(c) dissolved oxygen (b) nitrates minimum, if plume shape is

(a) looping (b) coning

(c) fanning (d) fumigating

On cloudy day with no strong surface heating atmospheric conditions are likely to be (a) stable (b) unstable

(c) neutral (d) extremely stable

(d) PH **295.** Diesel engine exhaust is the main source **286.** What rubbish material do we throw away the of three highly toxic pollutants that have a most? widespread impact on the urban air quality (a) Plastic (b) Aluminium and human health. Main pollutants in the (c) Paper (d) Glass diesel exhaust are

287. Mercury is a hazardous chemical. Which item (a) NO_x, SO₂, SPM does not contain mercury? (b) SPM, C₆H₆

(a) Clinical thermometers (c) SO₂, C₆H₆, NH₃

(b) Fluorescent light bulbs (d) Pb, NO_x, CO₂

(c) Computer discs **296.** Which of the following devices is fitted to mo- (d) Blinking light in sneakers tor vehicles to chemically reduce some gases

288. Which of the following items are recyclable? produced by internal combustion engines

(a) Plastic milk jugs (Petrol & diesel engines) like NO_x, CO & HC (b) Cereal boxes into less harmful products? (c) Aluminium soda cans (a) Tailpipe

(d)

all

‘a, ‘b’

and

‘c’

(b) Carburettor

(c) Catalytic converter

289. Pick out the wrong statement about indoor (d) Supercharger air pollution. **297.** The increase in

concentration of CO₂ in our (a) Smoking is only dangerous to the person environment in last fifty years since 1960 is who is smoking and not others around. about.....per cent. Current level of CO₂(b) Formaldehyde is a gas that can come is 390 ppm in the year 2015 from building materials & furnishings. (a) 2.5 (b) 7.5 (c) Printers and fax machines are the source (c) 15 (d) 25 of ozone in an official building.

ANSWERS

283. (a) 284. (a) 285. (b) 286. (c) 287. (c) 288. (d) 289. (d) 290. (b) 291. (c) 292. (a) 293. (c) 294. (c)

295. (a) 296. (c) 297. (c)

298. The presence of high coliform counts in water **306.** Which of the following materials is fairly reindicates sistant to sulfur dioxide attack? (a) decreased biological oxygen demand (a) Nylon (b) Leather (B.O.D) (c) Aluminium (d) Paper

(b) contamination by human waste **307.** Air pollution by Beryllium is caused from fol (c) hydrocarbon contamination lowing industry? (d) phosphorous contamination. (a) Coal mining industry

299. Vermicomposting of solid waste is done by (b) Fertiliser industry (a) bacteria (b) fungus (c) Rocket fuel (c) animals (d) worms (d) Pesticide industry.

300. Which of the following in non-biodegradable? **308.** Leprous stone (e.g., yellowing of marble of (a) Fruit (b) Vegetables Taj Mahal) is formed due to air pollution by (c) Earthworm (d) Aluminium foil (a) CO₂ (b) NO₂

301. If waste materials contaminate the source (c) SO₂ (d) CO of drinking water, which of the following dis **309.** H₂S as an air pollutant is not produced by ease will spread?

(a) Typhoid

(c) Anemia

(a) petroleum industry

(b) Scurvy (b) sewage treatment plant (d) Malaria (c) pesticide industry

302. Which of the following solid waste materials (d) automobile exhaust. can not be decomposed by bacteria to form **310.** Plant/Vegetation suffer from a disease compost? called.....due to exposure to polluted (a) Dead plants air.

(b) Plastic bags (a) necrosis (b) silicosis (c) Kitchen wastes (c) tobacosis (d) byssinosis (d) Bodies of insects living in the soil. **311.** Which of the following air pollutants is emitted from the following industry?

caused by noise pollution?

- (a) Irritation
- (c) Diarrhoea
- (a) Methyl isocyanate (MIC)

- (b) Hypertension (b) HF
- (d) Deafness. (c) NO

304. The rise in present temperature of earth ^(d) SO₂ compared to 100 years ago is about.....°C. **312.** Arsenic pollution does not take place from (a) 0.3 to 0.6 (b) 2 to 4 (c) 0.3 to 0.04 (d) 5 to 6

305. Match the occupational diseases caused by various causative agents **313.**

Causative agents/pollutants

(i) Coal dust particles
the.....industry.

- (a) coal mining (b) paper (c) petroleum (d) iron ore mining

Nickel as an air pollutant is not emitted from (a) coal mining (b) diesel oil (c) tobacco smoke (d) viscose rayon plant

(ii) Cotton dust particles **314.** SO₂ present in pollutant air will not cause (iii) Iron dust particles (a) rapid corrosion of aluminium (iv) Copper dust particles (b) acute & chronic vegetable leaf injury **Occupational disease** (c) irritation of upper respiratory tract I. Byssinosis (d) destruction of paint pigment. II. Siderosis

III. Chalcosis **315.** If chimney of an industrial plant is emitting particulate matter @ Q ton/hr, the stack (a) (i)-IV, (ii)-I, (iii)-II, (iv)-IV height in meter is given by (subject to not less than 30 metres) (b) (i)-IV, (ii)-III, (iii)-II, (iv)-I

- (c) (i)-II, (ii)-III, (iii)-I, (iv)-IV (a) $74.Q^{0.27}$ (b) $14 Q^{0.3}$ (d) (i)-I, (ii)-III, (iii)-II, (iv)-IV (c) $14Q^{0.27}$ (d) $74Q^2$

ANSWERS

298. (d) 299.(d) 300.(d) 301.(b) 302.(b) 303.(c) 304.(a) 305.(a) 306.(c) 307.(c) 308.(c) 309.(b)

310.(a) 311.(a) 312.(b) 313.(d) 314.(a) 315.(a)

316. Industrial chimney located near tall building
326. Presence of which of the following organisms should be at least.....times the height of the building is an indicator of sewage pollution? (a) Volvox

(a) 0.5 (b) 2.5 (b) Escherichia Coli

(c) 4 (d) 5.5 (c) Aerobacter aerogene

317. Air borne disease caused due to animals hide (d) Spirogyra

handling is **327.** Water borne amoebic dysentery is caused by (a) anthrax (b)

lung cancer (a) virus (b) protozoa (c) hypertension (d) asthma (c) bacteria (d) all 'a', 'b', & 'c'

318. Workers working in.....industry are likely to suffer from silicosis disease. (d) Spirogyra
having pH greater than

(a) stone crushing (b) textile (a) 5.5 (b) 6.5 (b) sugar (d) storage battery (c) 7.5 (d) 9.5.

319. Beryllium fumes are emitted from (d) Spirogyra
drinking (a) auto exhaust water may cause

(b) fluorescent lamp industry (a) cholera (b) dysentery (c) thermal power plant (c) typhoid (d) all 'a', 'b', & 'c'

(d) fertiliser industry **330.** Biochemical Oxygen Demand (BOD) of safe **320.**

Cadmium is not emitted to atmosphere from drinking water must be.....mg/litre.

(a) tobacco smoke (a) 0 (b) 3–5

(b) coal mining (c) 7–9 (d) < 10

(c) zinc mining **331.** To ensure proper growth of teeth of children, (d) viscose rayon plant
the quantity of fluoride used in water supply

321. Of the total air pollution of a city, generally.....mg/litre.

Automobile exhaust alone contributes (a) 0.1 (b) 1 about.....per cent of the total. (c) 5 (d) 10

(a) 10–20 (b) 25–35 **332.** The digested sludge from septic tanks is re (c) 50–60 (d) 85–90 moved after a maximum period of.....

322. Stack height in metre of an industrial plant years. emitting SO_2 @ Q kg/hr is given by (subject to (a) 1 (b) 3 a minimum height of 30 metres) (c) 5 (d) 7

(a) $14Q^{0.3}$ (b) $Q^{2.5}$ **B.O.D** removal in a oxidation pond may be (c) $Q^{0.3}$ (d) $Q^{2.7}$ **333.** upto.....per cent.

323. Fly ash emitted from chimney of thermal (a) 70 (b) 80 power plant can be used (c) 90 (d) 99 (a) in land as fertiliser **334.** The daily cover of municipal solid waste (b) for disinfection of water landfills consists of (c) for brick manufacturing (a) bentonite (b) compacted soil (d) all 'a', 'b', & 'c' (c) lime (d) sand

324. Windrow is a method of solid waste disposal by **335.** Eutrophication of lakes is primarily due to (a) sanitary landfill

(b) composting
(c) incineration
(d) none of these

325. Which of the following disease is not caused **336.** by virus?

(a) Polio (b) Influenza
(c) Dengu (d) Typhoid
(a) multiplication of bacteria (b) excessive inflow of nutrients (c) increase in benthic organisms (d) thermal and density currents.

Presence of nitrogen in a waste water sample is due to the decomposition of (a) fats (b) vitamins (c) protein (d) carbohydrates.

ANSWERS

316. (b) 317. (a) 318. (a) 319. (b) 320. (d) 321. (c) 322. (a) 323. (c) 324. (b) 325. (d)
326. (b) 327. (b)
328. (d) 329. (d) 330. (a) 331. (b) 332. (b) 333. (c) 334. (b) 335. (b) 336. (c)
337. Secondary treatment of sewage removes (a) suspended organic matter
(b) dissolved and colloidal organic matter (c) fats and grease
(d) pathogenic (disease causing) bacteria

338. Pick out the wrong statement:

- (a) Biochemical oxygen demand of safe drinking water is zero.
- (b) The amount of oxygen consumed by sewage from potassium dichromate is termed as C.O.D.
- (c) The color of fresh domestic sewage is slightly more than 1.
- (d) The specific gravity of sewage is slightly more than 1.

339. Most commonly used chemical for controlling the algae is

- (a) alum
- (b) copper sulfate
- (c) bleaching powder
- (d) lime.

340. pH value range to be maintained for proper functioning of a sludge digestion tank may be (a) 3.5-4.5 (b) 6.5-8.5
(c) 8.5-10.5 (d) <5

341. Thermal Pollution of aquatic ecosystem

- (a) reduces the ability of water to hold dissolved oxygen.
- (b) reduces the ability of water to hold dissolved CO₂.
- (c) increases the ability of water to hold dissolved CO₂.
- (d) does not have any impact on dissolved CO₂ or O₂.

342. Which of the following indoor air pollutants has the significant impact on human health? (a) Cigarette smoke

- (b) Formaldehyde
- (c) Radon
- (d) Nitrogen oxides.

343. Chronic condition caused by exposure to polluted air is exemplified by

- (a) skin cancer
- (b) decrease in O₂ level
- (c) lung cancer
- (d) emphysema

344. Most significant source of methane currently is

- (a) coal mining
- (b) landfills

- (c) waste water treatment
- (d) cultivation of rice.

345. What would have been the average temperature (°F) on earth, if the green house effect did not exist?

- (a) 0 (b) 50
- (c) 150 (d) 200.

346. Most of the available fresh water worldwide is used for which of the following purposes? (a) Power plant cooling

- (b) Agriculture
- (c) Public drinking
- (d) Industrial processes.

347. waste does not come under the category of hazardous waste.

- (a) Reactive (b) Non-toxic (c) Inflammable (d) Corrosive

ANSWERS

337.(b) 338.(c) 339.(d) 340.(b) 341.(a) 342.(a) 343.(d) 344.(b) 345.(a) 346.(b)
347.(a)

polyMer technology

1. Molecular weight of polymers are in the range of

- (a) 10 to 10^3 (b) $10^2 - 10^7$
- (a) not used for surface coating.
- (b) a good abrasive.

(c) $10^7 - 10^9$ (d) $10^9 - 10^{11}$

17

(c) an elastomer.

(d) a polyester.

10. Thermosplastic materials

(a) do not soften on application of heat. (b) are heavily branched molecules. (c) are solvent insoluble.

(d) none of these.

11. Vulcanisation of rubber

(a) decreases its tensile strength. (b) increases its ozone & oxygen reactivity, (c) increases its oil & solvent resistance. (d) converts its plasticity into elasticity.

12. Thermosetting materials

(a) are cross-linked molecules. (b) soften on application of heat. (c) are solvent soluble.

(d) none of these.

13. Most commonly used rubber vulcanisation 2. Poly Vinyl chloride (PVC) is a.....material. (a) thermoplastic

(b) thermosetting

(c) fibrous

(d) chemically active

3. Dacron is a/an

(a) polyester

(b) unsaturated polyester

(c) polyamide

(d) inorganic polymer

4. Phenol formaldehyde

(a) employs addition polymerisation. (b) employs condensation polymerisation.

(e) is a monomer.

(d) is an abrasive material.

5. Nylon-6 is manufactured from

(a) caprolactum.

(b) adipic acid and hexamethylene diamine. (c) maleic anhydride and hexamethylene diamine.

(d) sebasic acid and hexamethylene diamine.

6. Poly tetra fluoro ethylene (PTFE) is known as (a) dacron (b) teflon (c) bakelite (d) celluloid

7. Styrene butadiene rubber (SBR) is

(a) a natural rubber.

(b) another name of silicone rubber.

(c) a synthetic polymer.

(d) a synthetic monomer.

8. Nylon-66 is manufactured from

(a) adipic acid and hexamethylene diamine. (b) caprolactum.

(c) maleic anhydride and hexamethylene diamine.

(d) dimethyl terephthalate (DMT) and ethylene glycol.
agent is

(a) sulphur (c) platinum

14. Zeigler process (a) produces high density polythene. (b) uses no catalyst. (c) produces low density polythene. (d) employs very high pressure.

15. Celluloid is

(a) cellulose acetate

(b) regenerated cellulose

(c) cellulose nitrate

(d) cellulose acetate butyrate

16. Viscose rayon is

(a) cellulose nitrate

(b) regenerated cellulose nitrate (c) regenerated cellulose acetate (d) none of these

17. Thermosetting plastic materials (b) bromine (d) alumina

9. Epoxy resin is

ANSWERS

1. (b) 2.(a) 3.(a) 4.(b) 5.(a) 6.(b) 7.(c) 8.(a) 9.(b) 10.(d) 11.(d) 12.(a)

13.(a) 14.(a) 15.(c) 16.(d) 17.(c)

(a) can be repeatedly melted. (b) is useful for melt casting. (c) can not be melted after forming. (d) is useful for spinning.

18. Phthalic anhydride is used

(a) in making PVC

(b) as plasticisers

(c) in insecticides manufacture (d) for making nylon-6

19. Bakelite is a/an

(a) addition polymer (c) thermoplastic (b) elastomer (d) none of these

20. The repeating units of PTFE are (a) $\text{C}_1\text{H}_2\text{CH} - \text{CH}_3$ (b) $\text{F}_2\text{C} = \text{CF}_2$ (c) $\text{F}_3\text{C} - \text{CF}_3$ (d) $\text{FClC} = \text{CF}_2$

..... is a homopolymer.**21.**

(a) Neoprene (b) Bakelite (c) Nylon-66 (d) Terylene

22. Synthetic polymer produced by using terephthalic acid and ethylene glycol is

(a) terylene (b) nylon-66 (c) PVC (d) polyesterene

23. Nylon-66 is a polyamide of

(a) hexamethylene diamine and adipic acid. (b) adipic acid and methyl amine.

(c) vinyl chloride and formaldehyde.

(d) none of these.

24. is a natural fibre.

(a) Cellulose (b) Dacron (c) Nylon-6 (d) none of these

25. is a copolymer.

(a) styrene butadiene rubber (SBR)

(b) Neoprene

(c) PVC

(d) None of these

26. Which of the following types of polymers has the strongest inter particle forces ?

- (a) Elastomers
- (b) Fibres
- (c) Thermoplastics
- (d) Thermosetting polymers

27. is not a condensation polymer. (a) Teflon (b) Nylon-66 (c) Dacron (d) Polystyrene

28. is a copolymer.

- (a) Nylon-66
- (b) Polypropylene
- (c) PVC
- (d) Poly tetra fluoro ethylene

29. Which of the following is not a natural fibre? (a) Silk (b) Viscose rayon (c) Wool (d) Cotton

30. Polycaprolactum is

- (a) nylon-6 (b) nylon-66 (c) dacron (d) rayon

31. Acrylonitrile is mainly used in the.....industry.

- (a) polymer (b) printing (c) dyeing (d) photographic

32. Silicone is a/an

- (a) monomer
- (b) inorganic polymer
- (c) thermoplastic material
- (d) a natural polymer

33. Polyvinyl chloride (PVC) is

- (a) a thermosetting material.
- (b) a condensation polymerisation product. (c) made by employing emulsion polymerisation. (d) none of these.

34. Flexible foam (for mattresses) are usually made of

- (a) PVC
- (c) polyurethanes (b) silicone rubber (d) polyamides

35. Which of the following is not an elastomer ? (a) Polyisoprene (b) Neoprene

(c) Nitrile-butadiene (d) None of these

36. Nylon-6 is a (a) polyamide (c) polyester (b) thermosetting resin (d) none of these

37. Styrene butadiene rubber (SBR) as compared to natural rubber has

(a) poor tensile strength.

(b) poorer resistance.

(c) greater amount of heat build up on heavy

loading,

(d) all (a), (b) and (c).

38. Nylon-6 as compared to nylon-66 is

(a) harder.

(b) more abrasion resistant.

(c) having higher melting point.

(d) none of these.

39. Plasticisers are added to synthetic plastics to (a) impart flexibility.

(b) improve workability during fabrication.

ANSWERS

18. (b) 19. (d) 20. (b) 21. (a) 22. (a) 23. (a) 24. (a) 25. (a) 26. (d) 27. (a) 28. (a) 29. (b)
30. (a) 31. (a) 32. (b) 33. (c) 34. (c) 35. (d) 36. (a) 37. (d) 38. (d) 39. (d) (c) develop
new unproved properties not present in the original resin.
(d) all (a), (b) and (c),

40. Polythene a/an

(a) addition polymerisation product.

(b) condensation polymerisation product. (c) thermosetting material

(d) none of these.

41. Dacron is a

(a) condensation polymerisation product of hexamethylene diamine and adipic acid.

(b) condensation polymerisation product of dimethyl terephthalate (DMT) and ethylene glycol.

(c) thermosetting material.

(d) none of these.

42. Bakelite is

(a) same as polytetra fluoro ethylene (PTFE).

(b) an inorganic polymer.

(c) same as thermoset phenol formaldehyde.

(d) not a polymer.

43. The process involved in converting rubber into a thin sheet or coating it on fabric is called (a) extrusion (b) mastication (c) calendering (d) vulcanisation

44. Nitrile rubber is produced by the polymerisation of (a) acrylonitrile & butadiene.

(b) acrylonitrile & styrene.

(c) isobutylene & isoprene.

(d) none of these.

45. Main constituent of natural rubber is (a) polystyrene (b) polyisoprene (c) polybutadiene (d) poly chloroprene

46. Polymethyl methacrylate (PMMA) is known as (b) teflon

(d) nylon-6 (a) bakelite (c) perspex

47. is a thermosetting plastic.

(a) PVC (b) Polythene (c) Bakelite (d) Polystyrene

48. Phenol formaldehyde is produced by condensation polymerisation. It is also known as (a) teflon (b) bakelite (c) polyester (d) nylon-66

49. Which of the following is not a thermoplastic material ?

(a) Epoxy polymer (b) PVC

(c) Polystyrene (d) Polythene

50. Neoprene is chemically known as (a) polybutandiene

(b) styrene butadiene rubber (SBR) (c) polyurethane

(d) polychloroprene

51. Teflon is

(a) (b)

phenol formaldehyde an inorganic polymer (c) polytetra fluorouethylene (PTFE)
(d) a monomer

52. Reaction of dimethyl terephthalate (DMT) and ethylene glycol produces

(a) nylon-6

(c) polyester 53. Neoprene is a

(a) monomer

(c) polyester (b) dacron (d) PVC

(b) synthetic rubber (d) none of these

54. In a cross linked polymer, the monomeric units are linked together to constitute a three dimensional network. Which of the following is a cross-linked polymer ?

(a) (b) (c) (d)

Bakelite (phenol formaldehyde) Polyester

Polythene

Nylon-6

55. In a linear polymer, the monomeric units are linked together to form long straight chains The cross linked or branched chain polymers compared to linear polymers have higher (a) densities

(b) melting point

(c) tensile strength

(d) hardness, rigidity & brittleness

56. Dacron is a/an

(a) addition polymer

(b) condensation polymer

(c) polyester

(d) both (b) and (c)

57. Low density polythene as compared to high density polythene is

(a) harder (b) tougher (c) chemically inert (d) more flexible

58. Condensation polymerisation of caprolactum is carried out in the reactor maintained at a temperature of.....°C for producing nylon-6.

(a) -20 to 25 (b) 50 to 75 (c) 100 to 150 (d) 250 – 280

ANSWERS

40. (a) 41.(d) 42.(c) 43.(c) 44.(a) 45.(b) 46.(c) 47.(c) 48.(b) 49.(a) 50.(d) 51.(c)
52.(b) 53.(b) 54.(a) 55.(d) 56.(d) 57.(d) 58.(d)

59. Low pressure Zeigler process for the manufacture of polythene uses a catalyst which is (a) Ni

(b) V_2O_5

(c) Fe

(d) aluminium triethyl combined with titanium tetrachloride

60. Temperature and gage pressure maintained during the manufacture of hot SBR (styrene butadiene rubber) are

(a) 50°C and $3\text{--}4\text{ kg/cm}^2$

(b) 50°C and 1 kgf/cm^2

(c) 250°C and 10 kgf/cm^2

(d) 250°C and 1 kgf/cm^2

61. Temperature and gage pressure maintained during the manufacture of cold SBR (styrene butadiene rubber) are

(a) 50°C and 1 kgf/cm^2 .

(b) -20°C and 1 kgf/cm^2 .

(c) 0°C and 1 kgf/cm^2 .

(d) 0°C and 3 kgf/cm^2 .

62. Polypropylene compared to polythene is (a) harder

(b) stronger

(c) lighter

(d) all (a), (b) and (c)

63. Polystyrene is a light, transparent, thermoplastic material used for making

(a) toys and combs

(b) packaging bags

(c) non-sticking utensils

(d) electrical insulation

64. Rain coats are made of

(a) neoprene (b) PVC

(c) polyurathane (d) SBR

65. Neoprene which is used for making shoe heels & belts is superior to natural rubber in its stability to aerial oxidation and resistance to oils & other solvents. The monomer used for making neoprene is

- (a) chloroethane (c) isoprene
- (b) chlorophrene (d) none of these

66. Which of the following is a polymer of hexamethylene diamine and adipic acid ? (a) Nylon-6 (b) Nylon-66 (c) Nylon-6,10 (d) Epoxy resin

67. The starting material used for the manufacture of caprolactum is,
(a) ethyl benzene (b) cyclohexane (c) ethylene glycol (d) DMT

68. The synthetic fibres produced from.....are known as rayon.
(a) lignin (b) cellulose (c) polyamides (d) ethylene glycol

69. Cellulose content in bomboo fibre is about..... percent.
(a) 10 (b) 20
(c) 50 (d) 85

70. 90% of the caprolactum is converted to nylon-6 on its condensation polymerisation in the reactor maintained at a temperature of.....°C.

- (a) -5 (b) 10-30
- (c) 250-280 (d) 500-600

71. In nylon-66, the first and second numbers (*i.e.*,6) respectively designate the number of carbon atoms present in the

(a) hexamethylene diamine and the ring. (b) hexamethylene diamine and the adipic

acid.

- (c) adipic acid and the ring.
- (d) none of these.

72. Linear polymers are normally

- (a) thermosetting.
- (b) thermoplastic.
- (c) elastometric.
- (d) having extremely high softening point.

- 73.** Polyesters are manufactured by the polycondensation reaction of
 (a) dibasic acid with dihydric alcohol. (b) a single monomer.
 (c) carboxylic acid with ethylene.
 (d) inorganic acid with ethylene glycol.
- 74.** Nylon-66 compared to nylon-6 has
 (a) lower melting point.
 (b) more abrasion resistant properties. (c) higher hardness.
 (d) all (a), (b) and (c).
- 75.** In nylon-6, the number 6 represents the total number of
 (a) carbon atoms in the ring.
 (b) carbon atoms in the linear polymer chain. (c) nitrogen atoms in the ring.
 (d) hydrogen atoms in the ring.
- 76.** Polycaprolactum is also known as
 (a) nylon-66 (b) nylon-6 (c) teflon (d) SBR

ANSWERS

59. (d) 60. (a) 61. (a) 62. (d) 63. (a) 64. (b) 65. (b) 66. (b) 67. (b) 68. (b) 69. (c) 70. (b)
 71. (b) 72. (b) 73. (a) 74. (c) 75. (a) 76. (b)
- 77.** Polyhexamethylene adipimide is also known as (a) bakelite (b) nylon-66 (c) epoxy resin (d) silicone rubber
- 78.** The major component of acrylic fibres is (a) polyamides
 (c) polyacrylonitrile
- 79.** Elastomers are (a) thermosetting material.
 (b) exemplified by protein derivatives. (c) having high flexural strength.
 (d) having very high tensile strength and heat resistance.
- 80.** Maximum consumption of polymers is in (a) electrical insulation
 (b) toys making
 (c) coating and films
 (d) packaging
- 81.** Low pressure Zeigler process of polythene manufacture
 (a) employs a pressure of 30 kgf/cm^2 . (b) achieves a yield of 95–98% based on ethylene.
 (c) produces very low density polythene. (d) does not use any catalyst for polymerisation.

82. Polyvinyl chloride (PVC)

(a) is produced by polycondensation reaction. (b) uses either emulsion or suspension polymerisation methods.

(c) can be made thermosetting by adding a plasticiser.

(d) softening temperature is 200°C.

83. Typical solvent polymerisation reaction conditions for the production of high density polythene by Zeigler process is

(a) 7 kgf/cm² and 70°C.

(b) 1000 kgf/cm² and 100°C.

(c) 7 kgf/cm² and 700°C.

(d) 1 kgf/cm² (gage) and 70°C.

84. Temperature maintained in the emulsion polymerisation reactor for PVC manufacture is about.....°C.

(a) -20 (b) 50

(c) 250 (d) 500

85. Epoxy resins (i.e., epoxide polymers)

(a) are made by addition polymerisation reaction only. (b) poly olefins (d) polyesters

tion only.

(b) contain an epoxy group
ends of the polymer.

77. (b) 78. (c) 79. (c) 80. (c) 81. (b)

89. (c) 90. (b) 91. (b) 92. (b) 93. (c) 94. (c) 95. (b) 96. (a) at the

(c) (d)

are cross-linked polymers only. use emulsion polymerisation methods.

86. Which of the following is generally not used as cord for synthetic rubber tyre casing ?

(a) Dacron (b) Nylon

(c) Cellulose (d) None of these

87. Which of the following is an inorganic polymer ?

(a) Teflon (b) perspex (c) Silicones (d) Bakelite

88. The monomer of natural rubber is

(a) DMT (b) isoprene (c) 2 methyl-1-propene (d) both (b) and (c)

89. is an addition polymer.

(a) Nylon (b) Bakelite (c) Polythene (d) none of these

90. Which of the following polymers is used for making a non stick coating on frying pans ? (a) Bakelite (b) Teflon

(c) Perspex (d) PVC

91. Cross linked polymers are

(a) thermoplastic (b) thermosetting (c) either (a) or (b) (d) fibres only

92. Due to its excellent permeability to air/gas and oxidation resistance, the tubes of automobile tyres is made of

(a) cold SBR (b) butyl rubber (c) Buna N (d) Buna S

93. is not a polyester fibre.

(a) Terylene (b) Dacron

(c) Nylon (d) Polyacrylonitrile

94. The major constituent of laminate of safety glass, which holds the broken glass, pieces in their places during accident (and thus minimises the danger from flying glass fragments) is

(a) (c) polyvinyl alcohol (b) polyvinyl acetate polyvinyl butyral (d) PVC

95. Polyvinyl alcohol is used as a (a) (b)

cation/anion exchanger. water soluble adhesive. (c) textile fibre.

(d) non-sticky coating on frying pans. **96.** Perspex can be used as a substitute of glass.

Its monomer is

(a) methyl methacrylate

(b) DMT

ANSWERS

82. (b) 83.(a) 84.(b) 85.(b) 86.(c) 87.(c) 88.(d) (c) butadiene

(d) tetrafluoroethylene

97. Which of the following is a copolymer ? (a) PVC (b) Bakelite (c) Polythene (d) Teflon

98. Which of the following is not a condensation polymer ?

(a) Bakelite

(b) Melamine polymer

(c) Polymethylmethacrylate (PMMA) (d) None of these

99. polymer is used for making unbreakable crockery.

(a) Thermoplastic (c) Addition

(b) Melamine (d) none of these

100. Which of the following polymers belong to the class of formaldehyde resin ?

(a) Melamine resins (b) Teflon

(c) Dacron (d) None of these

101. Ion exchange resins are made of

(a) lucite

(b) sulphonated bakelite

(c) polystyrene

(d) teflon

102. Diphenylamine is added to rubber to (a) vulcanise it.

(b) protect it from deterioration on exposure

to air.

(c) make it non-inflammable.

(d) make it thermosetting.

103. Branched chain polymers as compared to linear polymers have

(a) higher melting point.

(b) higher tensile strength.

(c) lower density.

(d) none of these.

104. In condensation polymerisation as compared to addition polymerisation

(a) the monomers are unsaturated compounds. (b) no co-product is lost.

(c) the monomers contain two functional

groups.

(d) generally only one monomer is involved

105. Chain growth polymerisation is a process, in which the monomers are added in a chain fashion, and it requires an initiator to produce the free radical. An example of chain growth polymerisation products is

(a) nylon-66 (b) teflon

(c) polyester (d) bakelite

106. In step growth polymerisation, condensation occurs in a stepwise manner with or without the elimination of smaller molecules. An example of step growth polymerisation product is (a) terylene (c) PVC

(b) Polybutadiene (d) polypropylene

107. Rayon is superior to cotton in making gauge for wound treatment, because rayon (a) is a synthetic polymer.

(b) does not stick to the wound unlike cotton. (c) can absorb over 90% of its own weight of

water.

(d) both (b) and (c).

108. Vulcanisation of rubber does not increase its (a) elasticity (b) plasticity (c) ductility (d) none of these

109. Thermosetting polymers as compared to thermoplastic polymers

(a) are formed by addition polymerisation. (b) have three dimensional structure.

(c) have linear structure.

(d) none of these.

110. Polypropylene is preferred to polythene because the former is

(a) non-inflammable (b) harder

(c) stronger (d) both (b) & (c)

111. Branched chain polymers compared to linear polymers have higher (a) density.

(b) tensile strength.

(c) melting point.

(d) degree of irregularity in atomic packing.

112. Hot drink (e.g, tea) cups are usually made of (a) polystyrene (b) polythene (c) polypropylene (d) PVC

113. Liners of bags are usually made of (a) polythene (b) PVC (c) polypropylene (d) polyesters

114. Glyptal used in the manufacture of paints & lacquers is a.....polymer. (a) polyamide (b) polystyrene (c) polyester (d) polyacrylonitrile

115. Which of the following is not a polyolefin ? (a) Polystyrene (c) Neoprene (b) Polypropylene (d) None of these

ANSWERS

97.(b) 98.(c) 99.(b) 100.(a) 101.(b) 102.(b) 103.(c) 104.(c) 105.(b) 109.(b) 110.(d) 111.(d) 112.(a) 113.(c) 114.(c) 115.(c)

106. (a) 107.(b) 108.(b) **116.** Which of the following polymers does not belong to the class of polyacrylates polymer ? (a) PMMA (b) Polyacrylonitrile (c) Polyethyl acrylate (d) None of these

117. Which of the following is not the commercial name of polymethylmethacrylate (PMMA)? (a) Perspex (b) Lucite (c) Plexiglass (d) Teflon

118. Acrilan fibres used for making cloth, carpet & blankets, which is a hard, horny & high melting polymeric material is nothing but (a) polyacrylonitrile (b) polyamide (c) saturated polyester (d) alkyd resin

119. Vinyl flooring is done using.....sheets. (a) polypropylene (b) PVC (c) polythene (d) polyvinyl acetate

120. Bristles of tooth brushes are made of (a) nylon-6 (b) nylon-66 (c)

polystyrene (d) PVC

121. Contact lenses for eyes are made of perspex, which is nothing but

- (a) polymethylmethacrylate
- (b) polystyrene
- (c) unsaturated polyester
- (d) polypropylene

122. Fillers such as zinc oxide and carbon black are added to the crude natural rubber before vulcanisation in order to improve its (a) elasticity

- (b) strength
- (c) plasticity
- (d) weathering characteristics

123. The monomer for the production of neoprene

- (b) chloroprene (d) none of these rubber is
- (a) acetylene (c) isoprene

124. Size range of polymer molecules varies from.....metre.

- (a) 10^{-2} to 10^{-5} (b) 10^{-4} to 10^{-7} (c) 10^{-1} to 10^{-2} (d) 10^{-8} to 10^{-10}

125. Polymerisation process in which two or more monomers of chemically different nature (b) addition polymerisation

- (c) chain polymerisation
- (d) none of these

126. Condensation polymerisation of..... produces bakelite.

- (a) propylene
- (b) phenol & formaldehyde
- (c) phenol & acetaldehyde
- (d) urea & formaldehyde

127. Vulcanisation of raw rubber makes it (a) soft (b) less elastic (c) plastic (d) tacky

128 . Ebonite is a/an

- (a) highly vulcanised rubber.
- (b) natural rubber.
- (c) unvulcanised raw rubber.

(d) adhesive.

129. Thermocol is a spongy, porous, rigid or flexible foamed plastic, obtained by blowing gas/ air through molten

(a) (c)

saturated polyester (b) polyurethane polystyrene (d) either (b) or (c)
take part is called (a) copolymerisation

130. A copolymer is formed by the combination of two or more monomer molecules

(a) in a chain without the elimination of water. (b) with the elimination of small amount of

water.

(c) of the same monomer by elimination of small molecules of water.

(d) none of these.

131. Thermocol (expanded polystyrene) is not used for

(a) low temperature thermal insulation as in refrigerator and air conditioners. (b) acoustic control and ceiling for building. (c) high temperature thermal insulation in furnaces.

(d) packing of delicate electronic gadgets.

132. Rexin (also called artificial leather), which is used for making table cover, automobile seat cover, shoes etc. is made by coating thick cloth with molten

(a) teflon (b) bakelite (c) SBR (d) PVC

133. is produced by polymerisation of chloroprene.

(a) Thiokol (a polysulphide rubber)

(b) Butyl rubber

116.(d) 117.(d) 118.(a) 119.(b) 120.(b)

ANSWERS

121. (a) 122.(d) 123.(b) 124.(a) 125.(a) 126.(b) 127.(b) (c) Neoprene **143.**

Softening point of high density polythene is (d) Polyurethane rubber about.....°C.

134. Thermosetting resins/polymers as compared (a) 85 (b) 135 to thermoplastic ones are (c) 165 (d) 205

(a) soluble in all organic solvents. **144.** Plexiglass (also called lucite) because of its (b) more brittle. high optical transparency is used for making (c) formed by addition polymerisation only. lenses. It is chemically (d) easily reshaped & reused. (a) polymethyl methacrylate (PMMA).

135. Phosphates (e.g., tricresyl, tributyl, tetrabutyl, (b) Polytetrafluoroethylene (PTFE). triphenyl etc.) are added to polymers to act as (c) polycarbonates. (a) hardeners (d) phenolic resins.

(b) anti-shrinkage agents **145.** Viscosity of a polymer solution or melt (c) plasticisers (a) decreases with increase in molecular (d) transparency improves weight.

136. moulding is used for shaping of thermosetting plastics exclusively. (b) decreases with increase in temperature. (c) increases with increase in temperature. (a)

Compression

(c) Transfer

(b)

Injection

(d) does not vary with temperature rise. **146.** Flexible plastic pipes are made of (d) Extrusion (a) high density polyethylene (HDPE).

137. Automobile steering wheels are normally (b) low density polyethylene (LDPE). made of (c) polypropylene. (a) cellulose acetate (d) unsaturated polyester. (b) cellulose nitrate **147.** Vulcanisation of rubber decreases its (c) PVC (a) tensile strength. (d) high density polythene (b) resistance to organic solvents.

138. Density of low density polythene is (c) tackiness. about.....gm/c.c. (d) working temperature range. (a) 0.38 (b) 0.56 **148.** Tubeless tyres are made of.....rubber, (c) 0.81 (d) 0.91

139. Density of high density polythene is about.....gm/c.c. (a) 1.18 (b) 1.05

(c) 0.95 (d) 0.99 **149.** **140.** Which of the following is generally not drawn into fibre ?

which is a co-polymer of isoprene & isobutylene.

(a) nitrile (b) silicone (c) neoprene (d) butyl Which of the following rubbers has the widest service temperature range (–75 to 275°C) ?

- (a) Polyamide
- (b) Unsaturated polyesters
- (a)
- (c)

Butyl rubber (b) Silicon rubber Nitrile rubber (d) Silicone rubber **150.** Tyres are made by (c) Saturated polyesters
(d) Polyacrylonitrile

141. Zeigler – Natta catalyst is used in the polymerisation of

- (a) vinyl acetate (c) propylene (b) vinyl chloride **151.** (d) styrene

142. Which of the following polymers are produced by employing all bulk polymerisation, solution polymerisation & suspension polymerisation technique of addition (chain) polymerisation ? (a) PVC (b) Bakelite (c) PTFE (d) Epoxy resin (a) injection moulding
(b) extrusion
(c) rotational moulding
(d) compression moulding

Antioxidants are added to rubber to protect it from the attack of light, heat & atmospheric ozone. Which of the following is an antioxidant used in rubber ?

- (a) Carbon
- (b) Alkylated diphenyl amine
- (c) Thiokol
- (d) Magnesium

ANSWERS

134. (b) 135. (c) 136. (c) 137. (a) 138. (d) 139. (c) 140. (b) 141. (c) 142. (a) 143. (b)
144. (a) 145. (c)
146. (b) 147. (c) 148. (d) 149. (d) 150. (c) 151. (b)

152. Cellulose acetate has very high film permeability among all the polymers of the order of 5000 gm/100 m². Which of the following polymers has the maximum film elongation (of the order of 100%) ?

- (a) Water impermeable cellophane
- (b) Polythene
- (c) Cellulose acetate
- (d) Teflon

153. Plastic tubes & pipes are generally made by.....moulding.
(a) injection (b) transfer (c) extrusion (d) compression

154. Which of the following is stretched into fibres ? (a) Saturated polyester
(b) Unsaturated polyester
(c) Isoprene
(d) Bakelite

155. Mastication of rubber means
(a) its softening.
(b) a treatment to retard its deterioration

due to oxidation.
(c) improving its curing rate.
(d) depression of its freezing point.

156. Polyvinyl acetate is never used for making (a) moulded articles
(c) adhesives

157. Synthetic rubber

(a) deforms, if stretched to double of its original dimension.
(b) is brittle at low temperature.
(c) is softer at higher temperature.
(d) is highly permeable to air & water and is readily attacked by chemicals & atmospheric gases.

158. Styrene butadiene rubber (SBR) is never used for making
(a) coated fabrics
(b) front wheel tyres of aeroplanes (i.e., heavy

duty tyres)
(c) gaskets
(d) soles of shoes

159. Which of the following is the lowest cost plastic commercially available ?
(b) fibres
(d) all (a), (b) & (c)

(a) Polythene (c) Bakelite (b) Teflon (d) PVC

160. Paper like thin plastic articles can be produced by

- (a) blow moulding
- (b) vacuum thermo forming
- (c) injection moulding
- (d) none of these

161. Polyurathane can not be used to make (a) automobile cushion

- (b) thermal insulation in refrigerator
- (c) coating and adhesive
- (d) fibre reinforced plastic (FRP)

162. Most of the plastics are safe to be used upto a maximum temperature of.....°C. (a) 100 (b) 150

- (c) 350 (d) 450

163. Epoxy resin is a polymer containing two or more groups called epoxide group or

ethoxyline group. It is a

- (a) polyamide & an elastomer.
- (b) good adhesive.
- (c) surface coating agent.
- (d) both (b) and (c).

164. Polycaprolactum is nothing but

- (a) orlon (b) nylon 6,6 (c) Nylon 6 (d) saran

165. Out of all the elastomers, natural rubber has the longest elongation range & flexibility of the order of.....percent.

- (a) 1–1000 (b) 1000–1500 (c) 1500–2000 (d) 2000–2500

166. Addition polymerisation is not involved in the manufacture of

- (a) low density polythene.
- (b) poly vinyl chloride.
- (c) polystyrene.
- (d) polyhexamethylene adipamide.

167. polythene is most prone to stress cracking .

- (a) High density (b) Low density (c) Cross-linked (d) Linear low density

168. Commercial production of polypropylene employs.....polymerisation.

(a) emulsion (b) suspension (c) solution (d) bulk

169. Addition of stabiliser during PVC manufacture is done to

(a) improve its impact strength.

(b) improve its elasticity.

ANSWERS

152.(b) 153.(c) 154.(a) 155.(a) 156.(a) 157.(d) 158.(b) 159.(a) 160.(b) 161.(d)

162.(b) 163.(d)

(c) reduce the melt viscosity & glass transition temperature.

(d) prevent its thermal degradation. **170.** polymer is produced by the copolymerisation of vinyl chloride vinyl acetate.

(a) Fibrous

(c) Rubbery (b) Leathery (d) Hard

171. is normally used for the manufacture of refrigerator components and transistor parts. (a) Polypropylene (c) Polyester

(b) Polystyrene (d) Polyurethane **172.** Nylon 6 as compared to nylon 6,6 has lower (a) abrasion resistance.

(b) thermal stability.

(c) adhesion to rubber.

(d) hardness.

173. Nylon 6, 10 which is used for bristles making is superior to nylon 6, 6 due to its lower -water absorption capacity, is a/an

(a) polyester (b) polyamide (c) polyisoprene (d) polystyrene

174. Melamine formaldehyde resin which has a very high anti tacking properties, is not used for the

(a) electrical insulation purpose.

(b) tanning of leather.

(c) strengthening of plaster of paris. (d) decorative laminates.

175. Cation exchange resins (0.3 to 1 mm size) used in water treatment is prepared from..... resins.

(a) epoxy

(b) phenol formaldehyde

(c) urea formaldehyde

(d) melamine formaldehyde

176. Alkyd resin *e.g.*, glyptal resin formed by phthalic anhydride and glycerene is not used (a) for surface coating of automobiles & aircrafts.

(b) for fibre making.

(c) as plasticiser for PVC & nitrocellulose. (d) for film forming materials.

177. Molecular weight of a polymer is equal to the molecular weight of the repeat unit multiplied by the degree of polymerisation. What is the molecular weight of poly vinyl chloride (PVC), if its degree of polymerisation is 800 ? (a) 50000 (b) 51600

178. All thermoplastic, thermosetting & elastic materials can be processed in a extrusion machine, however it can not be used for the production of plastic

(a) filaments (b) pipes

(c) buckets (d) tubings

179. scrap can be recycled & reutilised. (a) Bakelite (b) Epoxy resin (c) Polythene (d) None of these

180. Lavatory cisterns are normally made of (a) expanded polystyrene

(b) saturated polyester

(c) perspex

(d) PVC

181. resins are produced by the condensation polymerisation of formaldehyde with urea or melamine.

(a) Epoxy (b) Amino

(c) Alkyd (d) Phenolic

182. Thiokol is nothing but

(a) polysulphide rubber

(b) polyamide fibre

(c) engineering plastic

(d) expanded polystyrene

183. Polymethyl methacrylate (PMMA) which is also known as perspex and is produced by bulk polymerisation of methyl methacrylate is not a.....polymer.

(a) thermoplastic

(b) thermosetting

(c) linear

(d) glass like transparent

184. Acrylonitrile-butadiene-styrene(ABS) copolymer, which is produced by blending styreneacrylonitrile copolymer with butadiene based elastomer, is a/an

- (a) rigid foam
- (b) engineering plastic
- (c) thermosetting polymer
- (d) spongy rubber

185. Natural rubber is obtained from latex which is a colloidal dispersion of rubber in water. Which of the following is used as a coagulant in latex ?

- (a) Ammonium alum
- (b) Potassium alum
- (c) both a & b
- (d) neither a nor b

(c) 49000 (d) 50800

ANSWERS

170. (b) 171.(b) 172.(a) 173.(b) 174.(c) 175.(c) 176.(b) 177.(a) 178.(c) 179.(c)
180.(a) 181.(b)
182.(a) 183.(b) 184.(b) 185.(c)

186. Bakelite (phenol–formaldehyde) resin can not be used as

- (a) decorative paint.
- (b) decorative laminates.
- (c) electrical insulation.
- (d) glass reinforced plastics.

187. Catalyst used in the production of high density polythene by low pressure Ziegler process is

- (a) aluminium triethyl activated with TiCl_4
- (b) platinum
- (c) molybdenum
- (d) Nickel

188. Alkyd resin is a/an

- (a) polyamide
- (b) polyester
- (c) polyolefin
- (d) addition polymer

189. Rayon is a.....fibre.

(b) polyamide (d) natural (a) cellulosic (c) polyester

190. Which of the following is not a polymer of two monomes?

(a) Teflon (b) Bakelite (c) SBR (d) None of these

191. Transistor Parts and refrigerator components are normally made of

(a) polystyrene

(b) polyester

(c) high density polythene

(d) polyurathane

192. Polyurathane can not be used for making (a) mattresses & foam

(b) coating material

(c) adhesives

(d) bottles

193. Alkyd resin can not be used for making (a) plasticiser

(b) paint & varnish

(c) fibres

(d) film forming materials

194. fibres are made of polyamides. (a) Dacron (b) Nylon

(c) Rayon (d) Orlon

195. The generic chemical name for the class of polymers which are commercially known as nylons is

(a) polyolefins (c) polyacrylate (b) polyamide (d) polyurathane

196. Plastic articles are normally produced by.....moulding. (a) green sand

(c) shell

(b) injection (d) dry sand

197. Collapsible tubes for tooth paste are produced by.....extrusion.

(a) direct (b) indirect (c) impact (d) none of these

198. Unbreakable crockeries are made from..... polymers.

(a) polystyrene (b) melamine (c) polyester (d) polyurathane

199. Which of the following variety of rubber has a very low permeability for gases and finds application in tyre inner tubes?

- (a) Neoprene.
- (b) Styrene butadiene rubber.
- (c) Nitrile rubber (copolymer of butadiene

and acrylonitrile).

- (d) Butyl rubber.

200. Methyl tertiary butyl ether (MTBE) produced by an acid catalyzed reaction of methanol with isobutene is a/an

- (a) octane improver of gasoline
- (b) plasticizer
- (c) defoaming reagent
- (d) liquid detergent

201. Nylon 6 is produced by polymerizing caprolactam in presence of catalytic amount of (a) ammonia (b) hydrocyanic acid (c) water (d) hydrofluoric acid

202. Which of the following is a thermosetting polymer?

- (a) Polyethylene (b) Polystyrene (c) Polyvinyl chloride (d) Phenolic resin

203. Chemical name of nylon 6, 6 is

- (a) polyhexamethylene diamine,
- (b) polyhexadamine.
- (c) polyhexamethylene adipimide.
- (d) none of these

204. Orion is a polymer of (a) acrylonitrile (c) vinyl acetate (b) difluoroethane (d) chloroprene

205. Which of the following is a thermosetting polymer?

- (a) PMMA (b) PVA
- (c) FVC (d) Bakelite

ANSWERS

186. (a) 187. (a) 188. (b) 189. (a) 190. (a) 191. (a) 192. (d) 193. (c) 194. (b) 195. (b) 196. (b) 197. (c)

198. (b) 199. (d) 200. (a) 201. (d) 202. (d) 203. (c) 204. (a) 205. (d)

206. Polypropylene is not used in making (a) clothes.

- (b) ropes.

- (c) parachute ropes.
- (d) heat resistant plastic.

207. Acetate rayon is prepared from

- (a) starch (b) adipic acid (c) phthalic acid (d) cellulose

208. Which of the following fibres are made of polyamides?

- (a) Orlon (b) Nylon
- (c) Dacron (d) Rayon

209. Which of the following sets contains only addition polymer?

- (a) Polythene, polypropylene, terylene. (b) Acrilon, PVC, polythene.
- (c) Nylon, polybutadiene, buna-S.
- (d) Bakelite, PVC, polythene.

210. Which of the following is used to make nonstick cookware?

- (a) Polyethylene terephthalate.
- (b) Polystyrene.
- (c) PVC.
- (d) PTFE.

211. High density polythene is a.....polymer. (a) branch-chain (c) cross-linked (b) linear
(d) none of these

212. Zeigler-Natta catalyst is

- (a) R_3Al
- (b) $TiCl_4$
- (c) $(C_2H_5)_3Al$ & $TiCl_4$
- (d) $(C_2H_5)_3B$ & $TiCl_2$

Natural rubber is a polymer of isoprene, **213.**
which is

- (a) 1, 3 – butadiene.
- (b) 1,2– butadiene.
- (c) 2 – methyl –1, 3 – butadiene.
- (d) 1, 3 – pentadiene.

214. Polymer used in bullet proof glass is (a) nomex (b) kevlar

(c) plexiglass (d) lexan

215. Which of the following is a biodegradable

(b) Neoprene (d) Teflon
polymer?

(a) Nylon 2,6 (c) Perspex

216. Carbon black used in rubber manufacture acts as a/an

(a) vulcanising agent.

(b) accelerator.

(c) extender.

(d) reinforcing agent.

217. Which of the following is not a reinforcing fibre for plastic?

(a) Nichrome fibres

(b) Polymeric fibres

(c) Carbon fibres

(d) Glass fibres

218. Novolaks and Resols are.....plastics. (a) phenolic (b) amino

(c) epoxy (d) epoxide

219. Which of the following ethylene polymers will you recommend for making buckets and washing-up bowls?

(a) LDPE.

(b) HDPE.

(c) Linear LDPE.

(d) None of the foregoing; I will recommend

polystyrene for the said purpose. **220.** The major uses of ethylene glycol are as

(a) antifreeze agents in automobiles and as a raw material in the manufacture of poly (ethyleneterephthalate).

(b) a plasticizer

(c) an antioxidant

(d) all a,b & c

221. Raw materials for the production of styrene are

- (a) benzene and ethylene
- (b) toluene and propylene
- (c) toluene and ethanol
- (d) m-xylene and ethylene

222. Acrylonitrile is produced by “oxidation” of (a) ethylene (c) isobutylene (b) propylene (d) styrene

223. Manufacture of styrene-butadiene rubber (SBR) is one case where butadiene is consumed to a large extent. SBR is used mainly in making

- (a) carry-bags
- (b) toys
- (c) tyres
- (d) eraser (for removing pencil marks)

224. Nitrile rubber is a copolymer of butadiene and

- (a) acetonitrile (c) acrylonitrile

ANSWERS

(b) adiponitrile (d) styrene
 206.(d) 207.(d) 208.(b) 209.(b) 210.(d) 211.(b) 212.(c) 213.(c) 214.(d) 215.(a)
 216.(d) 217.(a) 218.(a) 219.(b) 220.(a) 221.(a) 222.(b) 223.(c) 224.(c)

Miscellaneous questions

1. Nitrogen compounds are not used in the manufacture of (a) rigid

18

(c) ductile (d) plastic (a) fertilisers (b) gun powder **10.** Milligram of KOH required to saponify 1 gm of (c) tip of match sticks (d) explosive oil is called its.....number.

2. Electrode potential is not concerned with the (a) saponification (b) acid measurement of

(a) pH value

(c) viscosity

(c) precipitation (d) emulsion

(b) temperature **11.** The process of removal of scale formed during (d) density hot rolling of steel is termed as

3. Material lacking in toughness is usually (a) descaling (c) pickling (b) shot blasting

(d) skimming termed as (a) plastic (c) brittle (b) malleable **12.** Out of the following, the joint produced (d) ductile by.....has the lowest strength.

4. cycle is the most efficient thermody- (a) soldering (b) welding namic cycle.

(a) Diesel

(c) Rankine

(c) brazing (d) rivetting

(b) Otto **13.** With increase in carbon percentage in steel, its (d) Carnot (a) yield stress decreases.

5. The hydraulic radius of a circular pipe of di (b) elongation percent increases. ameter 'd' flowing full is (c) tensile strength increases. (a) $d/4$ (b) $d/2$ (d) impact strength increases.

(c) $2d/3$ (d) $d/3$ **14.** The tensile strength of plastics ranges **6.** Gantt charts are used for streamlining the from.....kg/mm².

(a) inventory control (a) 10 to 50 (b) 50 to 100

(b) production schedule (c) 0.01 to 0.1 (d) 0.1 to 10

(c) sales forecasting 15. Which of the following is a synthetic abrasive? (d) quality control
(a) Corundum (b) Emery

7. While the bin cards are used in the effective (c) Pumice (d) Silicon caride stores management, the queing theory is as 16. Thermoplastics are never moulded usingsociated with the.....time. (a)(a) waiting (b)(b) idle (c)(c) inspection (d) injection moulding
blow moulding
extrusion
compression moulding

(d) tool replacement 17. Which of the following is not a ferromagnetic 8. Cobalt-60 is used as a source of.....in medi-material?cal therapy & industrial radiography. (a) Nickel (b) Cobalt(a) X-rays (b) g-rays (c) Aluminium (d) Iron(c) a-rays (d) b-rays 18. Common salt is produced from sea water in In9. The materials which fracture even at small dia generally by the.....method.strains are termed as brittle, while those (a) freeze drying materials which exhibit an appreciable (b) solar evaporationdeformation before failure are termed as

ANSWERS

1. (c) 2.(b) 3.(c) 4.(d) 5.(a) 6.(b) 7.(a) 8.(b) 9.(c) 10.(a) 11.(c) 12.(a) 13.(c) 14.(d) 15.(d) 16.(d) 17.(c) 18.(b)

(c) electrolytic
(d) none of these

19. Young's modulus of a material is the measure of its
(a) stiffness
(b) malleability
(c) creep resistance
(d) tensile strength

20. test is the the appropriate test to determine whether the material is ductile
(b) Cupping (d) Tensile

21. Oxygen content below.....percent in air contaminated with nitrogen does not support combustion and is unsafe for human exposure.

(a) 18 (b) 16
(c) 14 (d) 12

22. Pick out the wrong conversion of absolute & kinematic viscosities.

- (a) 1 stoke = 1 cm²/sec.
- (b) 1 N.sec/m² = 10 poise
- (c) 1 stoke = 1 m²/sec
- (d) 1 m²/sec = 10⁴ stokes

23. The minimum carbon content in steel should be.....percent for it to respond to a hardening treatment.

- (a) 0.2 (b) 0.4
- (c) 0.6 (d) 0.8

24. is not used as a material of construction
(b) Rhodium

- (d) Duralumin in thermocouples. (a) Alumel
- (c) Constantan

25. Which of the following does not lower the surface tension of liquids ? (a) Fat
(c) Detergent
(b) Soap
(d) Surfactant

29. At the point of boundary layer separation in fluid flow, the
(a) shear stress is maximum.
(b) velocity gradient is flat.
(c) density variation is maximum.
(d) shear stress is zero.

30. All modes of heat transfer i.e., conduction, convection & radiation occur in case of the (a)
(b)

condensation of steam in a partial condenser. boiler furnace.

- (c) insulated pipe carrying high pressure steam.
- (d) none of these.

31. is used as a material of construction for the blade of power saw.

- (a)
- (c)

Wrought iron Mild steel

(b) Stainless steel (d) High speed steel

32. Name the safety device used to protect the boiler, when the water level falls below a minimum level.

(a) (c)

Blow down valve Fusible plug

(b) Blow off cock (d) Safety valve

33. One ton of refrigeration is not equivalent to the heat removal rate of

(a) (c)

200 BTU/minute (b) 50 kcal/minute 50 kJ/sec. (d) 3.5 KW

34. Which of the following welding processes employs the highest welding temperature ? (a) Arc welding (b) Gas welding (c) Thermit welding (d)

Resistance welding

35. Refrigerative cooling employed during long distance transportation of food stuffs is normally done by

(a) ice

26. Photographic plates are coated with

(a) silver nitrate (b) silver halide (c) calcium silicates (d) metallic silver

27. The thermal efficiency of a heat engine giving an output of 4 KW with an input of 10000 Joules/sec is.....percent.

(a) 40 (b) 80

(c) 10 (d) 25

28. Which of the following is an unconventional source of energy ?

(a) Thermal power

(b) (c) (d)

Hydroelectric power Nuclear-fusion power Solar power

or brittle.

(a) Impact (c) Hardness

(b) (c) (d)

liquid nitrogen

liquid oxygen

vacuum evaporation

36. 'Cryogenics' is concerned with the generation & use of low temperature in the range of (a) 0°K to 123°K

(b) 0°C to -123°C

(c) 0°C to -273°C

(d) 0°K to 273°K

37. Brazing is the joining of metals

(a) without melting the base metal.

ANSWERS

19. (a) 20. (a) 21. (b) 22. (b) 23. (a) 24. (d) 25. (a) 26. (b) 27. (a) 28. (d) 29. (a) 30. (b)

31. (d) 32. (c) 33. (c) 34. (d) 35. (b) 36. (a) 37. (c)

(b) with a non-ferrous filler.

(c) both (a) & (b).

(d) neither (a) nor (b).

38. Which of the following forces does not act on a fluid at rest ?

(a) Viscous force

(b) Gravity force

(c) Hydrostatic force

(d) Surface tension force

39. Fahrenheit and Centigrade scales have the same readings at

(a) -55° (b) -40°

(c) -33° (d) -58°

40. Thermal efficiency of an internal combustion engine is around.....percent.

(a) 8 (b) 35

(c) 65 (d) 80

41. Specific gravity of a metal, which weighs 5 kg in air and 4 kg when

submerged in water, will be

- (a) 5 (b) 1.25
- (c) 2.5 (d) 3.75

42. Rockwell number represents the

- (a) hardness of a substance.
- (b) colour of a pigment.
- (c) density of a polymer.
- (d) active ingredients in a fertiliser.

43. Which of the following metals reacts violently with water ? (a) Mercury (c) Calcium

44. Dowtherm is a (b) Sodium

(d) Magnesium

(a) high temperature heating medium (a petroleum product).

(b) product of coal tar distillation.

(c) very heat sensitive material.

(d) none of these.

45. Lubrication is done to control

(a) friction (b) wear

(c) temperature (d) all (a), (b) & (c)

46. In inventory control theory, the economic order quantity (EOQ) is the

(a) lot size corresponding to break even analysis. (b) average level of inventory.

(c) optimum lot size.

(d) none of these.

47. A material expanding freely due to heating will develop.....stress.

(a) no

(c) tensile (b) compressive (d) thermal

48. 'GASOHOL' widely used in Brazil as a motor fuel is a mixture of alcohol and

(a) petrol.

(b) LPG.

(c) light hydrocarbon gases (e.g. butane or

propane).
(d) none of these.

49. stress can not be sustained by a fluid in equilibrium.
(a) Shear (b) Tensile (c) Compressive (d) None of these

50. Ignition of fuel in a diesel engine is by (a) spark
(b) hot compressed air
(c) fuel injection
(d) none of these

51. Air-petrol ratio in an automotive petrol engine is around
(a) 14:1 (b) 22 :1
(c) 25:1 (d) 4:1

52. Commonly used flux for brazing is
(a) zinc chloride (b) borax
(c) ammonium chloride (d) rosin

53. Out of the following, the rays having the lowest wavelength is the
(a) radio waves
(b) ultrasonic waves
(c) infra red rays
(d) X-rays

54. With increase in pressure, the latent heat of steam
(a) increases.
(b) decreases.
(c) remains unchanged.
(d) data insufficient; can't be predicted.

55. Water tube boiler is the one, in which
(a) water passes through tubes and flue gases around it.
(b) tube carrying hot flue gases are immersed in a pool of water.
(c) tubes are placed in vertical position.
(d) none of these.

56. The highest stress that a material can withstand for a specified length of time without excessive deformation is called the strength.

ANSWERS

38. (a) 39.(b) 40.(b) 41.(a) 42.(a) 43.(b) 44.(a) 45.(d) 46.(c) 47.(a) 48.(a) 49.(a)
50.(b) 51.(a) 52.(b) 53.(a) 54. (b) 55.(a) 56.(a)

(a) creep (b) endurance (c) fatigue (d) none of these

57. Out of the following, the.....pipe has the least corrosion resistance.

(b) copper

(d) wrought iron (a) mild steel (c) cast iron

58. 'End cooler' or 'after cooler' is employed in air compressor mainly to

(a) remove oil vapour or moisture from air. (b) cool the dry air before use.

(c) reduce the volumetric capacity of receiver. (d) none of these.

59. 'Ice point' is designated on Farenhite temperature scale by

(a) 0° (b) 32°

(c) 62° (d) 212°

60 . Multistage compression of air as compared to single stage compression offers the advantage of (a) power saving per unit weight of air delivered. (b) moisture elimination in the inter-stage

cooler.

(c) increased volumetric efficiency.

(d) all (a), (b) & (c).

61. The leg of a barometric leg pump is longer than the Toricellian leg, which is about..... metres.

(a) 1 (b) 5

(c) 34 (d) 10

62. Fibrous fracture is normally encountered in the.....materials. (a) hard

(c) ductile

(b) elastic (d) brittle

63. Dryness fraction of dry steam is

(a) 0 (b) ∞

(c) 1 (d) 0.5

64. The suction and delivery pressure for a two stage compressor are 1 and 25 atm respectively. The intermediate stage pressure would be around.....atm.

- (a) 5 (b) 10
(c) 15 (d) 20

65. Energy required to compress a hot gas as compared to cold gas will be

- (a) more.
(b) less.
(c) same.
(d) more or less depending upon the nature of

the gas.

66. Corrosion of metals can not be prevented by its (a) tempering (c) aluminising
(b) chromising (d) alloying

67. With increase in temperature, the electrical conductivity of semiconductors

- (a) increases.
(b) decreases.
(c) (d)

remain constant.

either (a) or (b), depends on the type of semi-conductor.

68. Silicon percentage in the silicon steel used for electrical appliances/equipments is

- (a) 0.3–0.4 (b) 12–14
(c) 3–4 (d) 20–25

69. Dry saturated steam can be converted into superheated steam by

- (a) increasing its cross-sectional area of flow. (b) passing it through a pressure
reducing

valve.

- (c) forcing it downwards through a vertical
tube.

(d) none of these

70. Energy of the sun arises mainly from.....reactions.

- (a) fusion (b) fission
(c) combustion (d) phosphorous

71. Cold chisel & hammers are made of (a) (b) (c) (d)

high speed steel high carbon steel forged steel
mild steel

72. 1% concentration of water vapor in air is equivalent to.....ppm (parts per million). (a) 10000 (b) 1000
(c) 100 (d) 10

73. Heat treatment of steel is done mainly to change its
(a) (b) (c)

mechanical properties. physical properties. chemical composition.

(d) all 'a', 'b' & 'c'.

74. Closeness of packing is maximum in case
of.....crystal lattice.

(a) (c)

face centred body centred (b) simple cubic (d) none of these

75. Saturated steam at a pressure of 25 kg/cm^2 is throttled to attain 5 kg/cm^2 .
Then the outcoming steam will be

ANSWERS

57. (d) 58.(a) 59.(b) 60.(d) 61.(d) 62.(c) 63.(c) 64.(a) 65.(a) 66.(a) 67.(a) 68.(c)
69.(b) 70.(a) 71.(b) 72.(a) 73.(a) 74.(a) 75.(c)

(a) wet (b) saturated (c) superheated (d) none of these

76. is the most important element which controls the physical properties of
steel. (a) Manganese (b) Silicon

(c) Carbon (d) Vanadium

77. addition increases the depth of hard

(b) Nickel

(d) Vanadium ness of steel. (a) Chromium (c) Tungsten

78. Fatigue resistance of a material is measured by the

(a) elastic limit.

(b) ultimate tensile strength.

- (c) Young's modulus.
- (d) endurance limit.

79. Minimum temperature upto which water can be theoretically cooled down in the cooling tower by evaporative cooling is equal to the.....temperature of air.

- (a) wet bulb (b) dry bulb (c) saturation (d) dew point

80. Thermal diffusivity of a substance is proportional to

- (a) $1/k$ (b) k
- (c) k^2 (d) $1/k^2$

where, k = Thermal conductivity

81. With increase in impurities in metals, their corrosion resistances

- (a) increase
- (b) decrease
- (c) remain same
- (d) may increase or decrease ; depending on

the type of metal

82. Dezincification is a form of corrosion, which specifically applies to

- (a) steel
- (b) brass
- (c) stainless steel
- (d) babbit metal

83. All radiations falling on a black body are (a) refracted (b) reflected (c) transmitted (d) absorbed

84. of air does not increase with increase in temperature.

- (a) Density
- (b) Thermal diffusivity
- (c) Viscosity
- (d) Thermal conductivity

85. Which of the following is the most suitable for removing fine particles (< 1 micron diameter) from air below its dew point ?

- (a) (b) (c)

Venturi scrubber
Electrostatic precipitator Cyclone separator

(d) Fabric filter

86. Steel is welded using the flame. (a) carburising (b) neutral (c) oxidising (d) all (a), (b) & (c)

87. In the formation of cermets, the ratio of ceramic material to metallic material is usually 80:20. Which of the following is a cermet ?

(a) Zirconia (b) Alumina
(c) Bakelite (d) Tungsten carbide

88. remains constant during the adiabatic cooling of moist air.
(a) (b) (c)

Wet bulb temperature Dry bulb temperature Relative humidity

(d) Specific humidity

89. Pipelines carrying various utilities in chemical industries are identified by their colour codes.

The color of pipeline carrying steam is

(a) black (b) silver grey
(c) green (d) yellow

90. Duralumin is an alloy of aluminium and copper.
Percentage of copper in duralumin is

(a) 38 (b) 26
(c) 16 (d) 4

91. Material of construction of foundry crucible is

(a) lead
(c) graphite (b) stainless steel (d) cast iron

92. Dezincification is a form of corrosion especially applicable to

(a) brass (b) nichrome (c) stainless steel (d) monel

93. Which of the following phenomenon will exhibit the minimum heat transfer?

(a) Boiling.

(b) (c) (d)

Forced convection in air. free convection in air. Conduction in air.

94. A steam carrying pipeline is insulated with two layers of insulating materials with the

ANSWERS

76. (c) 77.(a) 78.(d) 79.(a) 80.(b) 81.(b) 82.(b) 83.(d) 84.(a) 85.(b) 86.(b) 87.(d)
88.(b) 89.(a) 90.(b) 91.(d) 92.(a) 93.(d) 94.(c)

inferior insulation material forming the inner part. If the two insulating layers are interchanged, the heat conducted will

(a) increase.

(b) decrease.

(c) remain unaffected.

(d) may increase or decrease; depends on the thickness of each layer.

95. has a negative co-efficient of linear ex- pansion.

(a) Iron (b) Copper (c) Rubber (d) Nickel

96. Use of water as a manometric liquid suffers from the disadvantage of its

(a) low vapour pressure.

(b) corrosive nature.

(c) high vapour pressure.

(d) high boiling point.

97. Temperature of hot gases flowing in a pipe is measured by a thermocouple inserted in the thermal well. The thermal well made of..... will facilitate the most accurate measurement of the temperature.

(a) copper

(c) aluminium

(b) steel (d) brass

98. Ammonia gas can be dried by

(a) PCl_5

(b) quick lime

(c) CaCl_2

(d) concentrated H_2SO_4

99. Chlorine acts as a bleaching agent only in the presence of

(a) dry air (b) (c) moisture (d) pure oxygen sun light

100. Fluorine is not a constituent of

(a) freon (b) chloroform (c) teflon (d) fluorocarbons

101. No cutting fluid is normally used, while machining

(a) cast iron (b) aluminium (c) mild steel (d) stainless steel

102. Sudden fall of atmospheric pressure by a large amount is an indication of the

(a) rain (b) cold wave (c) storm (d) fair weather

103. Increase in temperature, in general results in the

(a) decrease in the viscosities of both liquids & gases.

(b) increase in the viscosities of both liquids & gases.

(c) increase in the viscosity of liquids and decrease in that of gases.

(d) decrease in the viscosity of liquids and increase in that of gases.

104. Paint spray gun works on the principle of

(a) Bernoulli's theorem.

(b) Boyle's law.

(c) Newton's law of viscosity.

(d) none of these.

105. Which of the following commonly used condenser tube materials has the lowest thermal conductivity?

(a) Admirability brass.

(b) Stainless steel.

(c) Aluminium brass.

(d) Titanium.

106. A solid aluminium ball, when quenched in a water bath maintained at 40°C, cools down from 550°C to 450°C in 20 seconds. The expected temperature of the ball after next 20 seconds may be about.....°C.

(a) 370 (b) 340

(c) 320 (d) 300

107. The dimensional formula of bulk modulus of elasticity is same as that of the

(a) pressure (b) density (c) force (d) none of these

108. When a copper ball is heated, the largest percentage increase will be in its
(a) radius (b) area
(c) mass (d) volume

109. Factor of safety is the ratio of the..... stress to the working stress.
(a) tensile (c) yield (b) compressive (d) bearing

110. The wet bulb temperature is lower in dry air than in wet air at the same temperature. A dry bulb thermometer registers a higher temperature than a wet bulb thermometer except at.....percent relative humidity. (a) 0 (b) 100
(c) 50 (d) none of these

111. Galvanic corrosion
(a) occurs in a bimetal couple.

ANSWERS

95. (b) 96.(c) 97.(a) 98.(b) 99.(c) 100.(b) 101.(a) 102.(c) 103.(d) 104.(a) 105.(b)
106.(a)

107.(a) 108.(d) 109.(c) 110.(b) 111.(a)

(b) occurs in highly stressed metallic parts only.

(c) is exemplified by caustic embrittlement of boiler tubes.

(d) is also called dezincification.

112. is the process of coating the surface of steel with aluminium oxide, thereby imparting it increased resistance to corrosion & oxidation upto a temperature of 700°C .

(a) Vaneering (b) Galvanising (c) Electroplating (d) Calorising

113. If the head is doubled in a centrifugal pump, the power required will increase in the ratio of

(a) 2^3 (b) $2^{3/2}$

(c) $2^{5/2}$ (d) $2^{1/3}$

114. The cooling rate required to freeze 1 ton of water at 0°C into ice at 0°C in 24 hours is..... BTU/hr.

(a) 100 (b) 200

(c) 1000 (d) 2000

115. A solar cell converts the sunlight directly into.....power. (a) thermal

(c) mechanical (b) electrical (d) chemical

116. Minimum safe distance between two liquid fuel storage tanks is equal to

(a) H (b) $H/2$

(c) $H/4$ (d) $H/6$

where, H = height of the tank

117. 'Dikes' are low height walls made around the storage vessels meant for storing hazardous & inflammable material (*e.g.*, petroleum products). Volume of dikes is equal to (a) V (b) $V/2$

(c) $2V$ (d) $3V$

Where, V = Volume of the storage vessel

118. The instrument based on the following principle is used for the measurement of oxygen only in the flue gases.

(a) Chemical absorption.

(b) Thermal conductivity.

(c) Infrared absorption.

(d) Paramagnetism.

119. Normal dosage of chlorine in public water supply scheme ranges from.....ppm. (a) 0.5 to 1 (b) 10 to 15 (c) 300 to 500 (d) 1000 to 1500

120. pipe is the most suitable for carrying sanitary drainage.

(a) Stainless steel

(b) Reinforced cement concrete

(c) Cast iron

(d) Asbestos cement

121. joint is usually used for joining cast iron pipes mostly used for temporary pipelines, where it may be necessary to dismantle & reassemble the pipeline very frequently. (a) Collar (b) Flanged (c) Bell and Spigot (d) Expansion

122. Large diameter reinforced cement concrete (RCC) pipes are generally joined by.....joint. (a) flanged iron (b) collar

(c) flexible (d) expansion

123. Which is the most suitable joint for the pipes, which are laid submerged under water, where the bottom of the river bed is uneven ? (a) Collar joint (b) Flexible joint (c) Flanged joint (d) Expansion joint

124. The type of pump used for lifting large quantity of sewage is a.....pump.
(a) gear
(c) reciprocating (b) centrifugal (d) plunger

125. New water wells are disinfected with chlorine in the form of
(a) sodium chloride
(b) sodium hypochlorate
(c) bleaching powder
(d) aluminium chloride

126. The underground well of a biogas plant is called the
(a) septic tank (b) oxidation well (c) digester (d) lagoon

127. Density in the solid state is slightly less than that in its liquid state, in case of
(a) carbon dioxide (b) water
(c) mercury (d) none of these.

128. A metalloid possesses the characteristics of both the metals and non-metals. Which of the following is not a metalloid?
(a) Arsenic (b) Antimony (c) Lead (d) none of these

129. An example of a buffer solution is
(a) mercury
(b) lime water
(c) human blood
(d) concentrated nitric acid

ANSWERS

112.(d) 113.(b) 114.(b) 115.(b) 116.(d) 117.(a) 118.(d) 119.(a) 120.(c) 121.(b)
122.(c) 123.(b) 124 .(b) 125.(c) 126.(c) 127.(b) 128.(c) 129. (c)

130. For a fixed cross sectional area, the most economical channel section has maximum (a) wetted perimeter.
(b) fluid discharge rate.

- (c) fluid velocity.
(d) depth of flowing fluid.

131. Which of the following has rotten egg smell ? (a) Hydrogen sulphide (b) Styrene
(c) Phenol (d) Dimethyl amine

132. Frother is added in the froth floatation cell used in ore beneficiation to stabilise the air bubbles (*i.e.*, froth), which will hold the ore particles, but it does not affect the floatability of minerals. Which of the following is not used as a frother? (a) Cresylic acid (c) Pine oil
(b) Xanthates (d) all 'a', 'b' & 'c'

133. Liquor poisoning generally occurs due to the presence of.....in it. (a) ethyl alcohol
(c) methyl alcohol (b) impurities (d) carbonic acid

134. Volumetric composition of flue gas analysed with the Orsat apparatus is :
 $\text{CO}_2 = 12\%$, $\text{O}_2 = 8\%$, $\text{CO} = \text{nil}$, $\text{N}_2 = 80\%$.

This flue gas composition indicates that (a) pure oxygen has been used for combustion. (b) nitrogen percentage in the fuel is very high. (c) excess air has been used for combustion. (d) hydrogen is not present in the fuel.

135. A psychrometer does not measure the..... temperature of moist air.
(a) isomorphism (c) amorphism

144. Glass reacts with (a) H_2SO_3
(c) HNO_3

(a) foam (b) steam
(c) water (d) carbon dioxide **139.** The ultimate strength in tension for steel is.....times the ultimate strength in shear. (a) 0.5 (b) 0.9
(c) 15 (d) 2.5

140. Out of the following,.....waves have the largest wavelength.

(a) radio (b) light
(c) X-ray (d) Gamma-ray **141.** Fog is an example of colloidal system of (a) solid dispersed in gas.
(b) solid dispersed in liquid.
(c) liquid dispersed in gas.
(d) gas dispersed in liquid.

142. Which of the following equipments is used for liquid dispersion ?

- (a) Packed column
- (b) Venturi scrubber
- (c) Bubble cap plate column
- (d) Wetted wall column

143. The ability of a substance to assume two or more crystalline structure is called

- (b) polymorphism (d) isomerism

(b) HF

(d) $K_2Cr_2O_7$ **145.** First empirical temperature scale conceived is the.....temperature scale.

(a) dew point (c) wet bulb (b) dry bulb

(d) none of these (a) Absolute (c) Farenhite (b) Reaumer (d) Celcius

136. 'Sterilised zone' around a hazardous chemical industry is an area with.....km radius around it, in which the total population/inhabitants should be less than 20000 preferably in the upwind direction.

- (a) 0.5 (b) 5
- (c) 25 (d) 50

137. 'Flare tower' used in industry is meant for

(a) venting off (after burning) the excess inflammable/toxic gases at high pressure.

(b) absorbing the pollutant gases from the furnace exhaust.

(c) cooling of furnace exhaust gases.

(d) none of these.

138. Fire on fuel oil lines can be extinguished by **146.** Lead is most readily dissolved in (a) acetic acid (c) nitric acid (b) hydrochloric acid (d) sulphuric acid.

147. Which of the following is a weak acid ? (a) HF (b) HCl

(c) HI (d) HBr

148. Protection of ship hulls against sea water corrosion is done by coating with zinc because of the fact that zinc compared to iron is (a) reduced preferentially. (b) cheaper.

- (c) oxidised preferentially.
- (d) lighter.

149. Which of the following is the most suitable material of construction for the condenser

ANSWERS

130. (b) 131.(a) 132.(b) 133.(c) 134.(c) 135.(a) 136.(b) 137.(a) 138.(a) 139.(c)
140.(a) 141.(c)
142.(b) 143.(b) 144.(b) 145.(c) 146.(a) 147.(a) 148.(c) 149.(c)
tubes, where the cooling medium is brine (salty water)? (a) Aluminium (c)
Titanium (b) Copper
(d) Stainless steel

150. In spite of large heat transfer co-efficients in boiling liquids, fins are used advantageously, where the entire surface is exposed to..... boiling.
(a) film (b) nucleate (c) transition (d) all modes of

151. Work hardenable alloy steel used to make the bucket wheel excavators, blades of bulldozers and other earth moving equipments contain iron, carbon and
(a) manganese (c) nickel
(b) silicon
(d) chromium

152. Pick out the wrong statement. If the net positive suction head (NPSH) requirement of a pump is not satisfied, then
(a) it will deliver low discharge of liquid. (b) its efficiency will not be affected.
(c) it will not develop sufficient head to raise

water.

(d) it will be cavitated.

153. is the trade name assigned to a nonferrous cast alloy composed of cobalt, chromium & tungsten.
(a) Stellite (b) High speed steel (c) Cermet (d) Alnico

154. Which of the following is the most wear resistant grade of carbide used for the cutting tools?
(a) Aluminium carbide
(b) Tungsten carbide

- (c) Nickel carbide
- (d) Iron carbide

155. Maximum amount of thermal radiation is emitted at all wavelengths at any specified temperature by a/an.....body.

- (a) grey (b) black
- (c) opaque (d) white

156 . Drills are usually made of

- (a) cermets (b) high speed steel (c) alloy steel (d) tungsten carbide

157. Carbon percentage in high speed steel tool material is 0.6 to 1.0. The hardness of carbon tool steels is increased, when it is alloyed with

- (a) vanadium & chromium
- (b) silicon
- (c) tungsten
- (d) manganese

158. Ceramic tips for the cutting tool are prepared from.....powder.

- (a) carbon
- (c) aluminium oxide (b) silicon carbide (d) tungsten

159. Electrochemical corrosion can occur, only if.....is present in contact with metal. (a) air (b) oxygen

- (c) liquid medium (d) gaseous medium

160. is a non volatile film forming constituent of a paint.

- (a) Thinner (b) Dryer
- (c) Drying oil (d) none of these

161. Which of the following is a common constituent of both paint and oil varnish ? (a) Extender (b) Pigment (c) Thinner (d) Drying oil

162. When dry bulb temperature & wet bulb temperature of moist air is the same, it means that the

- (a) partial pressure of water vapour is less

than the total pressure.

- (b) humidity is $< 100\%$ & dew point temperature of air has not reached.

(c) dew point temperature of air has not reached & air is not saturated fully. (d) air is fully saturated.

163. Which of the following has the least oiliness? (a) Mineral oils (c) Greases (b) Vegetable oils (d) Animal oils

164. The best lubricants for a machine working at high temperature & load is (a) grease (c) animal oils (b) solid lubricant (d) mineral oils

165. Moist air is cooled along the line of constant....., when it is passed over a cold & dry cooling coil, such that no condensation occurs?

- (a) enthalpy
- (b) relative humidity
- (c) wet bulb temperature
- (d) dew point temperature

166. Catalyst used in the 'catalytic converter' employed in automobile exhaust line for combustion

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150. (d) 151. (a) 152. (b) 153. (a) 154. (b) 155. (a) 156. (b) 157. (a) 158. (c) 159. (c) 160. (c) 161. (d)

162. (d) 163. (a) 164. (b) 165. (d) 166. (b)

Complete combustion/oxidation of carbon monoxide, nitrogen oxides and hydrocarbons is (a) alumina

- (b) platinum
- (c) vanadium pentoxide
- (d) iron oxide

167. Which of the following low melting alloy containing bismuth and lead is used for electric fuse?

- (a) Wood's metal (c) Monel metal (b) Babbitt metal (d) Duralumin

168. The same volume of all gases is representative of their

- (a) specific gravities.
- (b) densities.
- (c) gas characteristic constants.
- (d) molecular weights.

169. Superheating of steam is done at constant (b) entropy (d) volume (a) enthalpy (c) pressure

170. Presence of sulphur in the fuel fired in a furnace (a) contributes to its heating value.

(b) helps in electrostatic precipitation of ash

from flue gases.

(c) corrodes ducts & air preheater, if the flue gas temperature is low.

(d) all 'a', 'b' & 'c'.

171. The dew point of moist air becomes..... with decrease in its relative humidity. (a) less than the wet bulb temperature (b) more than the wet bulb temperature (c) more than the dry bulb temperature (d) equal to wet bulb temperature

172. A solution which resists change in its pH value on addition of acid/alkali is called the.....solution. (a) neutral

(c) buffer

(b) ideal

(d) zero pH

173. Specific.....is a dimensionless quantity. (a) heat (b) humidity (c) weight (d) none of these

174. Pressure gauges are never connected directly to the live steam line; rather a loop or syphon is interposed as close as possible to the pressure gauge. This is done to

(a) avoid the overheating of the tubes & bellows which operate them to minimise error and damage.

(b) form a seal of water by steam condensate

to fill the tube or bellows at the pressure being measured,

(c) both 'a' & 'b'.

(d) avoid the static head error introduced by steam entry.

175. Holes in a plate for rivetted joints is preferably made by

(a) drilling (b) tapping (c) reaming (d) punching

176. For a small scale toy factory, the fixed cost per month is Rs. 5000/-. The variable cost per toy is Rs. 20 and sales price is Rs. 30 per toy. The break even production per month will be.....toys.

- (a) 250 (b) 500
(c) 1000 (d) 3000

177. Which of the following pair is correctly matched?

- (a) Heat transfer: Thermal diffusivity. (b) Mass transfer: Diffusion co-efficient.
(c) Momentum transfer: Kinematic viscosity. (d) all 'a', 'b' & 'c' are correctly matched.

178. The expected efficiency of a single rivetted lap joint is of the order of 50%. If the thickness of the plate is increased four times, then the rivet diameter will have to be increased.....times.

- (a) two (b) four
(c) six (d) eight

179. Which of the following material handling equipments is not suitable for moving materials in varying paths ?

- (a) Hand trolley (b) Belt conveyor (c) Crane (d) Truck

180. The routing function in a production system design is concerned with the (a) material flow optimisation through the

plant.

- (b) machine utilisation.
(c) quality control of the product.
(d) manpower utilisation.

181. Metals in general have a low value of thermal

- (a) conductivity (b) diffusivity (c) inertia (d) all (a),(b)&(c)

182. Gas carrying pipelines are best joined by

ANSWERS

167. (a) 168.(d) 169.(c) 170.(d) 171.(a) 172.(a) 173.(d) 174.(c) 175.(a) 176.(b)
177.(d) 178.(a)

179.(b) 180.(b) 181.(c) 182.(c)

- (a) nuts & bolts (c) welding
(b) rivetting

(d) none of these

183. The temperature at which the magnetic property of iron disappears (*i.e.*, it becomes non-magnetic) and its electrical conductivity & specific heat also changes, is called the 'Curie point', which is.....°C.

(a) 768 (b) 908

(c) 1400 (d) 1539

184. Desert air coolers being rendered ineffective in rainy season is due to

(a) low humidity (b) low temperature (c) high humidity (d) sunny weather

185. Out of the following materials, the one which generally exhibits a yield point is

(a) hard bronze

(b) soft brass

(c) cold rolled mild steel

(d) hot rolled mild steel

186. Cast iron compared to steel is better in (a) ductility (b) strength

(c) malleability (d) fluidity & castability

187. joint is mostly used for joining pipes carrying water at low pressure.

(a) Nipple (b) Socket

(c) Union (d) Bell and spigot

188. Break even point represents the condition, when the company runs under no profit no loss condition. In break even analysis, total cost comprises of fixed cost (a) only.

(b) plus variable cost.

(c) plus overhead cost.

(d) plus selling expenses.

189. Depreciation of machines falls under the indirect expenses head. As per income tax regulations, it is calculated by the.....method. (a) diminishing balance

(b) sinking fund

(c) multiple straight line

(d) sum of the years digit

190. Diameter of the rivet to be provided on a 20 mm. thick boiler plate will be.....mm. (a) 10 (b) 20

(c)30 (d) 40

191. Viscoelastic behaviour is observed in..... materials.

- (a) non-crystalline organic polymeric
- (b) ceramic
- (c) all crystalline
- (d) all amorphous

192. Which of the following is the largest quantum of pressure?

- (a) 1kg/cm^2
- (b) 1 bar
- (c) 1 atmosphere
- (d) 1 kilo Pascal

193. High relative humidity decreases the evaporative process and as the temperature is increased, the relative humidity decreases. The comfort range for human body is the ambient temperature of 22 to 27°C with relative humidity ranging from.....percent.

- (a) 5 to 10
- (b) 15 to 25
- (c) 45 to 50
- (d) 75 to 80

194. Which of the following materials has the poorest electrical conductivity ?

- (a) Carbon
- (b) Aluminium
- (c) Silver
- (d) Stainless steel

195. The best guide to judge the general quality of water is the measurement of its

- (a) pH value.
- (b) electrical conductivity.
- (c) turbidity.
- (d) dissolved oxygen content.

196. The maximum percentage of chromium that can be added to steel is about

- (a) 12
- (b) 18
- (c) 24
- (d) 30

197. With increase in temperature, the electrical conductivity of a.....decreases.

- (a) (c)

semi-conductor dielectric

- (b) metal or alloy
- (d) none of these

198. Maximum permissible sulphur content in steel is.....percent.

- (a) 0.015
- (b) 0.055

(c) 0.505 (d) 0.805

199. The malleability of a material is the property by virtue of which it can be rolled or hammered into thin sheets. Which of the following materials has the maximum malleability ? (a) Lead (b) Copper (c) Aluminium (d) Wrought iron

200. The escape velocity of a body on earth which is independent of its mass is about.....km/ second.

(a) 3 (b) 7

(c) 11 (d) 15

ANSWERS

183. (a) 184. (c) 185. (d) 186. (d) 187. (b) 188. (b) 189. (a) 190. (d) 191. (a) 192. (c) 193. (c) 194. (a)

195. (b) 196. (b) 197. (a) 198. (a) 199. (a) 200. (c)

201. In a drilling process, the metal is removed by both shearing & extrusion.

General purpose drills are made of

(a) stainless steel

(b) mild steel

(c) high speed steel

(d) high carbon steel

202. A jig is used while.....a hole.

(a) boring (b) counter boring (c) drilling (d) enlarging

203. can replace tungsten in high speed steel. (a) Chromium (b) Vanadium (c) Cobalt (d) Molybdenum

204. Shock resisting steels should possess high (a) hardness (b) toughness (c) tensile strength (d) wear resistance

205. Which of the following alloying elements reduces the formation of iron sulphide in steel? (a) Cobalt (b) Nickel

(c) Manganese (d) Vanadium

206. Turning/machining of.....usually does not require any cutting fluid.

(a) cast iron (b) stainless steel (c) mild steel (d) copper

207. Which of the following fastening devices has a head at one end and a nut fitted to the other ? (a) Bolt (b) Stud

(c) Top bolt (d) None of these

208. The most important function of a washer is to provide bearing area and washers are normally specified by their hole diameters. The diameter of washer as compared to the nut is (a) more

(b) less

(c) same

(d) more but less than the diameter of bolt

209. Which of the following fastening devices has its both ends threaded ?

(a) Bolt (b) Stud

(a) Set screw (d) Split nut

210. A spring material should have low

(a) elastic limit

(b) deflection value

(c) fatigue resistance

(d) none of these

211. Coarse grained steels have

(a) low toughness achieved in continuous process, because (b) no tendency to distort of long residence time.

ANSWERS

201. (c) 202. (c) 203. (c) 204. (c) 205. (b) 206. (a) 207. (b) 208. (a) 209. (b) 210. (d)

211. (b) 212. (c)

213. (d) 214. (c) 215. (b) 216. (b) 217. (a) 218. (b) 219. (d) 220. (d) 221. (b)

(c) high density

(d) very high toughness

212. Fine grained steels have

(a) high brittleness

(b) higher tendency to distort

(c) high ductility

(d) none of these

213. Number of electrons in the outermost shell of a semi-conductor material is

(a) 2 (b) 4

(c) 6 (d) 8

214. Absolute zero pressure can be attained at a temperature of

(a) 0°C (b) 0°K

(c) 0°R (d) none of these **215.** Holes for rivetting purposes should be preferably made by

(a) cutting torch (b) drilling (c) punching (d) none of these **216.** Screws are specified by their.....diam- eters.

(a) minor (b) major

(c) pitch (d) none of these **217.** The bolt is subjected to.....when the nut is tightened by putting the washer beneath it.

(a) tension

(b) shear

(c) compression

(d) bending & tension

218. The basic constituent of vegetable oils is (a) triglyceride (c) fatty alcohol

(b) (d)

fatty acids mono esters

219. Springs are not made of (a) phosphor bronze. (b) nickel steel.

(c) monel.

(d) carbon steel ($c \leq 0.5\%$).

220. Regeneration of molecular sieve requires it to be heated to a temperature of about.....°C.

(a) 80 – 120 (b) 200 – 300 (c) 600 – 800 (d) 1000 – 1100

221. Batch process is preferred over continuous process, when the

(a) product yields and quality can not be (b) sales demand of product is not steady. (c) same equipment can not be used for several processes of the same nature.

(d) all (a),(b)&(c)

222. Welded joint is superior to rivetted joint in respect of ease of fabrication, weight and strength. Which of the following joints is the most suitable for pipes carrying fluids under high pressure and temperature ?

(a) Flanged joint (b) Expansion joint

(c) Bell and spigot joint (d) None of these **223.** Aromatics are desired constituents of (b) diesel (d) petrol (a) lubricating oil

(c) kerosene

224. Boiler draught of 10 mm water column is equivalent to

(a) 1 kgf/m² (b) 10 kgf/m²

(c) 10 kgf/mm² (d) 1 kgf/mm² **225.** Moh's scale of hardness, which consists of 10

standard minerals is used for the measurement of.....hardness.

(b) indentation (d) rebound

(a) scratch

(c) dynamic **226.** A polymer is termed as an elastomer, if its

percentage elongation is more than 100%. An

elastomer is termed as 'rubber' if its percentage elongation is more than.....percent.

(a) 150 (b) 200

(c) 300 (d) 400

227. Which of the following contains the least percentage of carbon ?

(a) Pig iron

(c) Cast iron

(b) Wrought iron (d) Malleable iron **228.** Copper is not present as an alloying constituent in

(a) silicon bronze (c) nichrome

(b) constantan (d) delta metal **229.** Tin is not present as an alloying element in

(a) phosphor bronze (b) gun metal

(c) fusible metal (d) white metal **230.** Function of blow down valve in a boiler is to

(a) maintain the drum level.

(b) keep the drum pressure constant.

(c) drain out the sludge from the drum.

(d) empty the boiler during shutdown. **231.** The most detrimental impurity in high pressure boiler feed water is

(a) suspended salt (b) dissolved salt

(c) silica (d) turbidity **232.** Draught produced by a tall chimney due to density difference between hot flue gas inside

the chimney and atmospheric air outside the

chimney is more appropriately known as

the.....draught.

(a) natural

(c) forced

(b) induced (d) chimney **233.** Fibre reinforced plastic (FRP) are

(a) made of glass fibre and thermoplastic resins.

(b) anisotropic.

(c) made of thermosetting resin and glass fibre.

(d) both 'b' & 'c'

234. Which of the following are made out of the carbon steel having carbon content of 0.9 to 1% ?

(a) Small punches, broaches, reamers and springs.

(b) Cutlery, screws, rivets and files.

(c) Mandrels, twist drills, small lathe tools and razors.

(d) Forgings like cam shaft, structural steel plate, threading dies and drawing dies. **235.** Alloys having more than 80% copper are generally more

(a) abrasion resistant.

(b) corrosion resistant.

(c) prone to season cracking.

(d) machinable.

236. Presence of sulphur in steel reduces the

(a) hardness.

(b) grain size.

(c) tensile strength.

(d) toughness & transverse ductility. **237.** What is the percentage of chromium in 18-4-

1 high speed steel?

(a) 1 (b) 4

(c) 18 (d) 23

238. Primary designation of steel is based on its

(a) hardness & tensile strength.

(b) carbon content.

(c) iron content.

(d) alloying elements content.

239. Carnot cycle is also termed as the constant.....cycle in thermodynamics.

(a) entropy (b) pressure

(c) volume (d) heat

ANSWERS

222. (b) 223.(c) 224.(b) 225.(a) 226.(b) 227.(b) 228.(c) 229.(d) 230.(c) 231.(c)
232.(a) 233.(d)

234.(a) 235.(b) 236.(d) 237.(c) 238.(d) 239.(d)

240. The value of $\gamma = c_p/c_v$ at $< 500^\circ\text{C}$ for air & most common gases can be safely assumed to be (a) 0.8 (b) 1
(c) 1.4 (d) 1.8

Friction factor for fluid flow in pipe does not **241.**
depend upon the

- (a) pipe length.
- (b) pipe roughness.
- (c) fluid density & viscosity.
- (d) mass flow rate of fluid.

242. Good design of the casing of a centrifugal pump aims at minimising the

- (a) cavitation
- (b) frictional losses
- (c) kinetic energy loss
- (d) static head

243. The normal stress is the same in all directions at a point in a fluid, only when the fluid (a) is at rest & has zero viscosity.

- (b) is frictionless.
- (c) layer has no motion relative to an adjacent layer of fluid.
- (d) is incompressible & frictionless.

244. Which of the following is the correct nature of shear stress distribution along the cross section in a horizontal circular pipe under steady state fluid flow condition?

- (a) (b) (c) (d)

245. Temperature profile along the length of a gas-gas counter flow heat exchanger is correctly represented by

- (a) horizontal (b) vertical (c) inclined (d) any

247. The kinematic viscosity (in stoke) and the absolute/dynamic viscosity (in poise) are the same for.....at room temperature. (a) air (b) water

- (c) mercury (d) alcohol

248. Even though heat transfer co-efficients in boiling liquids is large, use of fins is advantageous, when the entire surface is exposed to.....boiling.

(a) film (b) nucleate (c) transition (d) all modes of

249. Window panes of aeroplanes are normally made of

- (a) perspex (PMMA)
- (b) teflon (PTFE)
- (c) bakelite (phenol formaldehyde)
- (d) polystyrene

250. Styrofoam is the commercial name of (a) polyurathene (b) polystyrene (c) polyacrylonitrile (d) polybutadiene

251. Which of the following polymers is obtained by copolymerisation of three monomers ? (a) SAN (b) ABS

(c) SBR (d) PTFE

252. Which of the following is not used bearing material ?

(a) Copper-lead alloys (b) Babbitts (c) Bronzes (d) Cermets

253. Plastics as a material of construction suffer from the drawback of low

- (a) machinability
- (b) density
- (c) strength
- (d) plastic deformation

254. Resistance of an electrical conductor is proportional to its

- (a) A (b) l
- (c) A^2 (d) both 'b' & 'c'

where, l = length and A = cross-sectional area of the conductor

255. Pick out the correct combination about the role of various additives used in polymers. (a) Plasticiser : increases the polymer

strength.

(b) Heat stabiliser : increases the maximum

246. Venturimeter is used to measure the flow rate of fluids in pipes, when the pipe is in position.

service temperature.

ANSWERS

240. (c) 241.(a) 242.(c) 243.(d) 244.(c) 245.(c) 246.(d) 247.(c) 248.(a) 249.(a)
250.(b) 251.(b)

252.(d) 253.(c) 254.(d) 255.(c)

(c) Fillers : Does not affect the property of polymer but increases its weight. (d)
Lubricants : increases the flexibility of polymers.

256. In the Bayer's process, bauxite is digested under pressure using

(a) H_2SO_4 (b) NaOH

(c) NH_3 (d) HCl

257. Lap joints are preferred over butt joints in soldering/brazing, because these joints are (a) weaker in tension but stronger in shear. (b) weaker in shear but stronger in tension. (c) stronger in both shear and tension. (d) The lap joints are easily made.

258. Young's modulus of a material gives idea about its

(a) toughness. (c) hardness. (b) stiffness. (d) strength. **261.** Match the following.

List I

(a) Ergun equation

(b) Hagen Poiseuille equation

(c) Bernoulli equation

(d) Fourier equation

List II

I. Tube flow

II. Overall energy balance

III. Packed bed

IV. Heat flow

262. Match the following processes with their physical principles.

List I

(a) Flotation

(b) Jigging

(c) Heavy media separation

(d) Tabling

259. If Reynolds number is greater than 1, then the

- (a) viscous force is larger than the inertia force.
- (b) inertia force is larger than the viscous force.
- (c) inertia force is larger than the surface tension force.
- (d) inertia force is larger than the gravitational force.

260. A furnace wall is made of three materials (I, II, and III) of equal thickness and having thermal conductivities k_1 , k_2 and k_3 respectively. The steady state temperature profile inside each material is shown in the figure below.

Thermal conductivity of the materials would vary as

- (a) $k_1 > k_2 > k_3$ (b) $k_2 > k_1 > k_3$ (c) $k_3 > k_1 > k_2$ (d) $k_3 > k_2 > k_1$

List II

I. Difference in specific gravity II. Difference in hydrophobicity III. Differential lateral movements IV. Differential initial acceleration

263. Match the following.

List I

- (a) Nickel-silvers
- (b) Nitroalloys

- (c) Babbits
- (d) Permalloy

I.

List II

Alloy of tin, antimony and copper used as a bearing mater.

II. Steels used for nitriding containing Al, Cr and Mo.

III. Soft magnetic material used as electromagnet.

IV. Ternary alloys of copper, nickel and zinc with good formability.

264. Semi-conductors normally employ..... bonding.

- (a) co-ordinate (b) ionic
- (c) covalent (d) metallic

265. Out of the following, the alloy which has equal percentage of constituents,

is

(a) white metal (b) gun metal (c) duralumin (d) constantan

ANSWERS

256. (b) 257. (d) 258. (b) 259. (b) 260. (c) 261. (a) 262. (a) 263. (a) 264. (c) 265. (d)

266. Transition from laminar to turbulent zone in free convection heat transfer is governed by the critical value of

(a) Grashoff number.

(b) Grashoff number & Reynolds number, (c) Reynolds number.

(d) Grashoff number & Prandtl number.

267. The pressure drop per unit length for laminar flow of fluid through a long pipe is proportional to

(a) A (b) D

(c) $1/A$ (d) $1/A^2$

where, A = cross-sectional area of the pipe & D = Diameter of the pipe

268. Reynolds number of a fluid flowing in a circular pipe is 10000. What will be the Reynolds number when the fluid velocity is decreased by 30% & the pipe diameter is increased by 30% ?

(a) 9100 (b) 13000

(c) 7000 (d) 2550

269. Existence of velocity potential implies that the fluid is

(a) irrotational (c) compressible (b) ideal

(d) in continuum

270. Transition from laminar flow to turbulent flow in fluid flow through a pipe does not depend upon the

(a) length of the pipe.

(b) diameter of the pipe.

(c) density of the fluid.

(d) velocity of the fluid.

271. Gage pressure within a spherical droplet of a fluid is ' p '. What will be gage pressure within a bubble of the same size & of the same fluid ? (a) p (b) $2p$

(c) $0.5p$ (d) $0.25p$

272. In radiative heat transfer, a grey surface is the one, which has

- (a) emissivity independent of wavelength. (b) grey appearance to the eye.
(c) zero reflectivity.
(d) equal brightness in all directions.

273. Specific heat of an ideal gas depends upon its (a) molecular weight (b) pressure (c) temperature (d) volume

274. Co-efficient of performance of a Carnot cycle refrigerator operating between -23°C and $+$ (a) 3 (b) 5
(c) 0.5 (d) 1.5

275. When an isolated thermodynamic system executes a process,
(a) work is done.
(b) heat transfer takes place.
(c) mass flow occurs across the boundary of the system.
(d) no chemical reaction takes place within the system.

276. Knocking tendency in a petrol engine decreases with increasing
(a) supercharging
(b) compression ratio
(c) wall temperature
(d) engine speed

277. fluid force is not considered in the Navier-Stokes equation.
(a) Turbulent (b) Viscous (c) Gravity (d) Pressure

278. forces do not act in case of fluids. (a) Vibratory (c) Elastic (b) Centrifugal (d) Tensile

279. Propane & butane are the main constituents of (a) LNG (b) LPG
(c) CNG (d) naphtha

280. Glycerol is purified by.....distillation. (a) fractional (b) steam
(c) vacuum (d) simple

281. Raney's nickel used as a catalyst is nickel (a) in a fine state of division
(b) and chromium alloy

(c) and aluminium alloy
(d) and iron alloy

282. Moth ball contains

(a) naphthalene (b) camphor (c) phenol (d) benzoic acid

283. Match the uses (List II) of various chemicals (List I)

List I A. Glycerol

B. Formic acid

C. Ethyl chloride

D. Chloroform

List II I. Refrigerant

II. Flavouring agent

27°C is

ANSWERS

266. (d) 267. (c) 268. (a) 269. (a) 270. (a) 271. (b) 272. (a) 273. (c) 274. (b) 275. (d)
276. (d) 277. (a)

278. (d) 279. (b) 280. (c) 281. (a) 282. (a) 283. (a)

III. Transparent soap

IV. Coagulating agent for rubber latex (a) A – III, B – IV, C – I, D – II

(b) A – I, B – IV, C – II, D – I

(c) A – IV, B – III, C – II, D – I

(d) A – III, B – I, C – IV, D – II

284. Water flow in pipes can be measured by (a) pitot tube (b) doppler effect (c) electric field (d) x-rays

285. In project management, the critical path in the network is that path which is

(a) having no slack in any activity

(b) quickest

(c) extends from start to finish

(d) shortest

286. The major difference between CPM and PERT is

(a) PERT is an expansion of CPM.

(b) CPM is an expansion of PERT.

(c) CPM uses fixed time estimates, while

PERT uses several time estimates. (d) CPM provides graphic, while PERT does not provide graphic.

287. The presence of silica in boiler feed water causes

(a) corrosion (b) steam carryover (c) scale formation (d) condensation

288. If the speed of a pump is doubled, then the pump

(a) shaft power goes up by 8 times

(b) head goes up by 4 times

(c) both 'a' & 'b'

(d) neither 'a' nor 'b'

289. Cooling tower effectiveness is

(a) $A/(R+A)$ (b) $R/(A + R)$ (c) A/R (d) R/A

where, A = approach, and, R = range

290. In project management, what does 80/20 rule say? (a) 80% is vital work and 20% is trivial. (b) 20% of work consumes 80% of your time

and resources.

(c) First 20% of work consumes 80% of your time and resources.

(d) None of these.

291. A shell and tube heat exchanger is most suitable, if a

(a) liquid is heating another liquid

(b) gas is heating a liquid

(c) liquid is heating a gas

(d) gas is heating another gas

292. The most economic insulation is the thickness, where the

(a) depreciation cost of insulation & energy

cost due to losses are the same.

(b) energy losses are minimized.

(c) energy cost due to losses are minimized. (d) sum of energy cost due to losses & insulation depreciation cost is minimum.

- 293.** Drain points are provided in steam pipelines for effective removal of
 (a) dirt (b) steam
 (c) condensate (d) air
- 294.** Steam trap is a device which discharges (a) condensate
 (b) air
 (c) non-condensate gases
 (d) all 'a', 'b' & 'c'
- 295.** Low pressure dry saturated steam is preferred over high pressure superheated steam for indirect process heating due to its higher (a) specific volume (b) latent heat (c) temperature (d) dryness fraction
- 296.** The flow of water in wash hand basin, when it is being emptied through a central opening, is an example of vortex.
 (a) free (b) forced
 (c) rotational (d) none of these
- 297.** Ageing of pipe means that with increasing time, the
 (a) relative roughness of pipe decreases. (b) pipe becomes smoother.
 (c) absolute roughness of pipe increases. (d) absolute roughness of pipe decreases.
- 298.** NB of a pipe stands for
 (a) normal bore
 (b) normal bit
 (c) nominal bore
 (d) nominal outer diameter
- 299.** The inlet and outlet for tube side fluids in case of 1–3 shell and tube heat exchanger will be on.....sides of the heat exchanger. (a) same
 (b) opposite
 (c) perpendicular
 (d) either same or perpendicular

ANSWERS

284. (b) 285.(a) 286.(c) 287.(c) 288.(c) 289.(b) 290.(b) 291.(a) 292.(d) 293.(c)
 294.(d) 295.(b)
 296.(a) 297.(a) 298.(c) 299.(b)

300. Demineralisation in water treatment means the removal of.....salts.
(a) total (b) only hardness (c) alkali (d) non-hardness

301. Which of the following is recommended for pumping light fuel oil?
(a) Gear pump
(b) Diaphragm pump
(c) Centrifugal pump
(d) 'a', 'b' & 'c'

302. 1 kg of LPG is equal to.....kcal. (a) 4000 (b) 6000
(c) 12000 (d) 26000

303. Energy supplied by combustion of a fuel is equal to the mass of fuel consumed multiplied by its
(a) temperature difference
(b) density
(c) calorific value
(d) specific heat

304. What is the oil equivalent of 1000 kg of coal, if the C.V. of oil & coal are 10000 & 4200 kcal/ kg respectively?
(a) 128 (b) 420
(c) 84 (d) 4200

305. The working media in a thermo-compressor is
(a) steam (b) water
(c) compressed air (d) dewater

306. Fyrite apparatus is used for the determination of.....in the flue gases.
(a) unburnt analysis
(b) volumetric analysis
(c) smoke density
(d) density of unburnt

307. The insulation thickness for which the total cost is minimum is called
(a) economic thickness of insulation (b) minimum insulation thickness
(c) maximum insulation thickness (d) cheapest insulation thickness

308. A 100 mm diameter water pipe is carrying water at a velocity of 1.5 m/sec. Water flow rate in the pipe is.....m³/hr.

- (a) 24.2 (b) 42.4
(c) 66.6 (d) 88.8

309. Emissivity is a measure of material's ability to.....heat.

- (a) radiate (b) absorb (c) absorb & radiate (d) none of these

310. Out of the following, which will be an ideal heating medium for heat transfer in a heat exchanger?

- (a) Dry saturated steam.
(b) Superheated steam.
(c) Hot water.
(d) Wet steam.

311. The operating point in a pumping system is identified by the point of intersection of (a) NPSH curve and pump curve.

- (b) pump curve and system curve.
(c) system curve and efficiency curve. (d) pump curve and theoretical power curve.

312. Heat removed by a 1.5 tons air conditioner installed in a room and working continuously for 2 hours will be about.....kCal. (a) 3000 (b) 6000

- (c) 9000 (d) 12000

313. Centrifugal air compressors are the most efficient, when they are operating at

- (a) 50% load (b) 75% load
(c) full load (d) all load conditions

314. When pure H₂ is burned with stoichiometric quantity of air, the volume percentage of N₂ in flue gas on dry basis will be

- (a) 21 (b) 77
(c) 79 (d) 100

315. Rotary air compressors develop a maximum air pressure of about.....kg/cm².

- (a) 5 (b) 10
(c) 25 (d) 50

316. Velocity of flame propagation in S.I. engine is maximum for a fuel air mixture which is.....stoichiometric.

- (a) 10% richer than
- (b) equal to
- (c) more than 10% richer than
- (d) 10% leaner than

317. In order to burn 1kg of CH_4 completely, the minimum number of kg of oxygen needed is (taking atomic weights of H, C and O as 1, 12, and 16 respectively).

(a) 3 (b) 4

(c) 5 (d) 6.

318. When the temperature of a solid metal increases,

ANSWERS

300. (a) 301. (c) 302. (c) 303. (c) 304. (b) 305. (a) 306. (b) 307. (a) 308. (b) 309. (c) 310. (a) 311. (b)

312. (c) 313. (c) 314. (d) 315. (b) 316. (d) 317. (b) 318. (a)

(a) strength of the metal decreases but ductility increases.

(b) both strength and ductility of the metal decrease.

(c) both strength and ductility of the metal increase.

(d) strength of the metal increases but the ductility decreases.

319. Heat is generated in a nuclear reactor (thermal) by

(a) combustion of a nuclear fuel e.g. uranium. (b) fusion of atoms of uranium.

(c) absorption of neutrons in uranium atoms. (d) fission of U-235 by neutrons.

320. A fertile material is the one, which can be (a) converted into fissile material on absorption of neutron.

(b) fissioned by slow (thermal) neutrons. (c) fissioned by fast neutrons.

(d) fissioned by either slow or fast neutrons.

321. Which of the following is not a naturally occurring nuclear fuel ? (a)

Uranium-238 (c) Plutonium-239 (b) Thorium-233 (d) None of these

322. Thermal shield is used in high powered nuclear reactors to

(a) protect the walls of the reactor from radiation damage.

(b) absorb the fast neutrons.

(c) slow down the secondary neutrons. (d) protect the fuel element from coming in contact with the coolant.

323. 'Light water' used as a coolant in nuclear reactor is nothing but

(a) ordinary water.

(b) mildly acidic (pH = 6) water.

(c) mildly alkaline (pH = 8) water.

(d) none of these.

324. Enriched uranium means that, it contains (a) more than 0.71% of U-235.

(b) only fertile material.

(c) only fissile material.

(d) no impurities.

325. A homogeneous reactor is the one, in which the (a) fissile atoms are evenly distributed throughout the mass of nuclear reactor.

(b) same substance (e.g. heavy water) is used as moderator & coolant.

(c) the fuel and the moderator is mixed to form a homogeneous material.

(d) all (a), (b) and (c).

326. A heterogeneous reactor is the one, in which the moderator and the

(a) coolant are different materials.

(b) coolant are present in different phases

(e.g. , heavy water and graphite). (c) fuel are present in different phases (e.g. uranium and heavy water).

(d) none of these.

327. In a pressurised water reactor (PWR), the (a) fuel is natural uranium and heavy water

acts both as moderator & coolant. (b) coolant water boils in the core of the reactor.

(c) coolant water is pressurised to prevent

bulk boiling of water in the core. (d) use of moderator is not required.

328. A boiling water reactor is the one, in which the

(a) coolant water is allowed to boil in the

core of the reactor.

(b) coolant water, after being heated in the

reactor core, generates steam in a boiler. (c) pressurised water is pumped into the core.

(d) fuel and the coolant are thoroughly mixed to form a homogeneous solution.

329. Liquid metal (*e.g.*, molten sodium) is preferred as a coolant in case of a/an.....reactor.

- (a) homogeneous
- (b) graphite moderated
- (c) fast breeder
- (d) enriched uranium (3% U-235) fuelled

330. U-235 content in enriched uranium, that is normally used in power reactors (*e.g.*, at Tarapur atomic power plant), is about..... percent.

- (a) 85 (b) 50
- (c) 3 (d) 97

331. Which of the following may not need a moderator ?

- (a) Candu reactor
- (b) Fast breeder reactor
- (c) Homogeneous reactor
- (d) Pressurised water reactor

332. A fast breeder reactor

(a) utilises fast neutrons for causing fission.

ANSWERS

319. (d) 320. (a) 321. (c) 322. (a) 323. (a) 324. (a) 325. (c) 326. (c) 327. (c) 328. (a)

329. (c) 330. (c)

331. (b) 332. (d)

(b) converts fertile material (*e.g.*, U-238) into fissile material (Pu-239). He, N₂ etc.), because it

(c) normally employs molten sodium as coolant. (a) is a better neutron moderator as well. (d) all (a), (b) and (c). (b) requires comparatively smaller pumps

333. Which of the following is not a fertile material ?

- (a) Th-232 (b) U-238
- (c) U-233 (d) none of these

334. A nuclear reactor can't be used for

and heat exchanger for a given heat transfer rate.

has a better heat transfer characteristics, and it can be pressurised to attain a high temperature.

(d) all (a), (b) and (c). (a) the production of radio isotopes. **341.** Heavy water is preferred over ordinary water (b) supplying intense fields or beams of neutrons as a coolant, because it is used for scientific experiments. (a) acts both as an efficient coolant as well (c) marine ship propulsion. as a moderator. (d) none of these. (b)

can be heated to a higher temperature **335.** Moderating material used in a thermal reactor without pressurizing.

the moderator should be a (c) is less prone to radiation damage.

(a) good absorber of neutrons. (d) all (a), (b) and (c).

(b) solid substance. **342.** Spent fuel from the nuclear thermal reactor (c) poor absorber of neutrons. contains (d) none of these. (a) fission products (b) plutonium

336. Ordinary water is not used as a moderator (c) unused fuel (d) all (a), (b) & (c) because, it **343.** Uranium ore is currently mined & concentrated (a) has a low absorption cross-

section. concentrated at (b) has a low scattering cross-section. (a) Jadugoda (b) Ghatsila (c) absorbs neutrons. (c) Khethri (d) Alwaye (d) does not absorb neutrons. **344.** Commercial power generation from fusion reaction **337.** Uranium is recovered from its ore (pitchblende) by (a) it is difficult to control fusion reaction. (a) froth floatation technique. (b) leaching with sulphuric acid.

(c) smelting in a furnace.

the fuel required (e.g. deuterium and tritium) is scarce.

(c) it is difficult to initiate fusion reaction. (d) dissolving in water. (d) quantity of fuel required for initiating fusion

338. The main purpose of control rod in a nuclear fission reaction is prohibitively high. reactor is to control the **345.** Biological shield is provided in a nuclear (a) chain

reaction and hence the power output of reactor to protect the..... from rapid by regulating the number of secondary neutrons causing fission. (a) fuel elements (b) emission of hazardous radiation. (b) operating personnel (c) conversion of fissile material into fertile (c) walls of the reactor material. (d) none of these (d) velocity of the secondary neutrons. **346.** The main ore of uranium is **339.** An ideal coolant for a nuclear reactor should (a) pitchblende (a) be a good absorber of neutrons. (c) cassiterite

(b) monazite sand (d) chalcopyrite (b) be capable of attaining high temperature **347.**

The main ore of thorium is pitchblende, only when it is pressurised. (a) pitchblende (b) monazite sand (c) have high density, but low heat transfer (c) limonite (d) galena - efficient.

(d) be free from radiation damage and non **348.** Heavy water (D_2O) in a nuclear reactor serves as a

ANSWERS

333. (c) 334. (d) 335. (c) 336. (c) 337. (b) 338. (a) 339. (d) 340. (d) 341. (d) 342. (d)

343. (a) 344. (a)

345. (b) 346. (a) 347. (b) 348. (c)

(a) coolant (b) moderator

(c) both (a) & (b) (d) neutron absorber

349. Which of the following is a moderating material used in nuclear reactor ?

- (a) Graphite.
- (b) Cadmium.
- (c) Zircalloy (an alloy of zirconium and aluminium).
- (d) Stainless steel.

350. The function of moderators in nuclear reactor is to

- (a) slow down the secondary neutrons. (b) absorb the secondary neutrons. (c) control the chain reaction.
- (d) none of these.

351. Which of the following nuclear materials is fissile ?

- (a) Uranium-238 (c) Plutonium-239 (b) Thorium-232 (d) None of these

352. Quantity of fissionable material (i.e. U-235) in natural uranium is.....percent. (a) 0.71 (b) 6.31

- (c) 99.29 (d) 12.73

353. "Critical mass" is the minimum mass of nuclear fissile material required for the (a) sustainment of chain reaction.

- (b) power generation on commercial scale. (c) economic power generation.
- (d) none of these.

354. 'Heavy water' is termed as 'heavy' because it is (a) denser than water.

- (b) an oxide of deuterium.
- (c) a heavy liquid.
- (d) an oxide of heavier isotope of oxygen.

355. Radioactive decay of a material involves a.....order reaction.

- (a) third (b) second
- (c) first (d) zero

356. Which is used as a coolant in nuclear reactor due to its high capture cross-section? (a) H_2 (b) N_2

- (c) He (d) CO_2

357. Main source of.....is monazite sand. (a) uranium (c) hafnium (b) polonium (d) thorium

358. The molecular weight of heavy water is (a) 10 (b) 18

359. Which is a fertile nuclear fuel ?

- (a) U-233 (b) U-235

(c) Pu-239 (d) Th-232

360. Indian monazite sand contains.....thorium.

(a) 10 (b) 25

(c) 60 (d) 90

361. The type of pump used for the recirculation of molten sodium coolant in liquid metal cooled reactor is a/an.....pump.

(a) electromagnetic (b) reciprocating (c) centrifugal (d) volute

362. H₂ is a better coolant than CO₂. due to its relatively

(a) lower density.

(b) higher specific heat.

(c) non-reactivity to uranium.

(d) lower neutron capture cross-section.

363. Percentage of heavy water in ordinary water is around

(a) 0.015 (b) 7.54

(c) 0.71 (d) 32.97

364. The most commonly used nuclear fuel in boiling water reactor is

(a) enriched uranium

(b) natural uranium

(c) plutonium

(d) monazite sand

365. Molten sodium is used as a coolant in a fast breeder reactor, because of its.

(a) excellent moderating properties. (b) neutron breeding capability.

(c) faster heat removal capability from the

core.

(d) capability to increase the reaction rate in the core.

366. In a homogeneous nuclear reactor, the..... are mixed together.

(a) fuel & coolant

(b) fuel & moderator

(c) coolant & moderator

(d) none of these

367. Gas cooling as compared to water cooling of nuclear reactors
(a) can not attain a high temperature. (b) is more efficient as gas has a higher specific heat.
(c) 20 (d) 36

ANSWERS

349. (a) 350. (a) 351. (c) 352. (a) 353. (a) 354. (b) 355. (c) 356. (a) 357. (d) 358. (c) 359. (d) 360. (a)

361. (a) 362. (b) 363. (a) 364. (a) 365. (c) 366. (b) 367. (d)

(c) can produce only saturated steam for feeding to power turbine.

(d) none of these.

368. The electric power generation cost in nuclear power plant is less than that in a coal based thermal power plant, mainly because the (a) fuel cost per unit power generated is less.

(b) thermal efficiency of the former is higher. (c) maintenance cost of the former is less. (d) none of these.

369. Coolant used in a boiling water reactor is (a) hydrogen gas

(b) water

(c) steam

(d) a mixture of water & steam

370. Function of control rod in a nuclear reactor is to control

(a) temperature

(b) pressure

(c) fuel consumption

(d) absorption of neutrons

371. A moderator.....the neutrons.

(a) slows down (b) absorbs (c) accelerates (d) reflects

372. Enrichment of uranium is done to increase the concentration of.....in the natural uranium.

(a) U-238 (b) U-233

(c) U-235 (d) Pu-239

373. Fuel for a nuclear reactor (thermal) is (a) uranium (b) plutonium (c) radium

(d) none of these

374. Fuel for a fast breeder reactor is

(a) plutonium (b) uranium (c) radium (d) neptunium

375. Which of the following factors is the most important in the site selection for a nuclear power plant?

(a) Absence of earthquake prone zone in

nearby areas.

(b) Abundant availability of water. (c) Remotely located from residential areas.

(d) Proximity to fuel source.

376. Coolant used in a fast breeder reactor is (a) molten sodium (b) heavy water (c) ordinary water (d) helium

377. Safety rods provided in nuclear reactors to guard against accidents, in case of earthquake are made of

(a) high carbon steel.

(b) molybdenum.

(c) zircalloy.

(d) boron or cadmium.

378. High porosity refractory bricks have

(a) poor resistance to the penetration of molten slag, metal & flue gases.

(b) poor heat conductivity & low strength.

(c) better thermal spalling resistance.

(d) all (a), (b) and (c).

379. Pyrometric cone equivalent (PCE) of a refractory is the measure of its

(a) spalling resistance.

(b) fusion point.

(c) resistance to slag penetration

(d) resistance to carbon monoxide attack.

380. To resist spalling tendency, a refractory should have

(a) greater diffusivity.

(b) low specific heat.

(c) low thermal co-efficient of expansion. (d) all (a), (b) and (c).

381. Which is an acidic refractory ?

(a) Magnesite (b) Dolomite

(c) Fireclay (d) Chrome magnesite

382. Which is a basic refractory ?

(a) Fireclay (b) Silica
(c) Chrome magnesite (d) None of these

383. Which is a neutral refractory ?

(a) Graphite (c) Silica
(b) Magnesite chrome (d) Magnesia

384. Insulating refractories should have

(a) high porosity
(b) low thermal conductivity
(c) both (a) and (b)
(d) neither (a) nor (b)

385. Cermets are

(a) composite material containing ceramic

& metallic constituents.

(b) having high strength & resistance to
high temperature.

(c) used in space vehicles, missiles & nuclear energy plants.
(d) all (a), (b) and (c).

ANSWERS

368. (a) 369.(d) 370.(d) 371.(a) 372.(c) 373.(a) 374.(a) 375.(a) 376.(a) 377.(d)
378.(d) 379.(b)

380.(d) 381.(c) 382.(c) 383.(a) 384.(b) 385.(d)

386. Refractories are dried in the

(a) rotary kilns (b) tunnel kilns (c) sun (d) none of these

387. With increase in the porosity, thermal spalling resistance of fireclay brick

(a) increases
(b) decreases
(c) remains same
(d) may increase or decrease

388. Fireclay bricks are not used in the

(a) blast furnace (b) hot blast stove (c) cupola (d) wall of coke oven

389. Fireclay bricks are used in the

- (a) furnaces allowed to cool frequently (b) flues
- (c) chimney linings
- (d) all (a), (b) and (c)

390. bricks are used in the burning zone of a cement rotary kiln.

- (a) High alumina (b) Fireclay
- (c) Thoria (d) Silicon carbide

391. With decrease in porosity, the.....of the refractories decreases.

- (a) strength
- (b) thermal conductivity
- (c) spalling resistance
- (d) none of these

392. is the measure of the strength of refractory under the combined effect of temperature & load.

- (a) Porosity
- (b) RUL
- (c) Specific gravity
- (d) Thermal conductivity

393. Spalling tendency of refractories is reduced by increasing its

- (a) porosity
- (b) specific gravity
- (c) thermal conductivity
- (d) strength

394. Refractories used in/for.....should have low thermal conductivity.

- (a) coke ovens (b) insulation (c) regenerators (d) muffle furnaces

395. Basic bricks are not made of

- (a) fireclay (c) foresterite
- (b) magnesite (d) chromite

396. bricks should not be used in oxidising atmosphere.

- (a) Tar dolomite (b) Carbon (c) Silica (d) Fireclay

397. Most Cermets, which normally have high thermal conductivity and high thermal shock resistance, comprises of ceramic & metallic components of.....percent respectively. (a) 80 and 20 (b) 20 and 80 (c) 50 and 50 (d) 60 and

- 398.** An ideal refractory should have high (a) spalling rate
(b) fusion point
(c) shrinkage ability
(d) none of these

ANSWERS

386.(b) 387.(a) 388.(d) 389.(d) 390.(a) 391.(c) 392.(b) 393.(a) 394.(b) 395.(a)
396.(b) 397.(a) 398.(b)

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