DPP : STATES OF MATTER

DPP-01 : Gas Laws

1. At constant temperature, in a given mass of an ideal gas
(1) The ratio of pressure and volume always remains constant
(2) Volume always remains constant
(3) Pressure always remains constant
(4) The product of pressure and volume always remains constant

2. By the ideal gas law, the pressure of 0.60 mole NH_3 gas is a 3.00 L vessel at 25°C is :
(1) 48.9 atm (2) 4.89 atm (3) 0.489 atm (4) 489 atm

3. If 20 cm^3 gas at 1 atm. is expanded to 50 cm^3 at constant T, then what is the final pressure
(1) $20 \times \frac{1}{50}$ (2) $50 \times \frac{1}{20}$ (3) $1 \times \frac{1}{20} \times 50$ (4) None of these

4. If the pressure and absolute temperature of 2 litres of CO_2 are doubled, the volume of CO_2 would become
(1) 2 litres (2) 4 litres (3) 5 litres (4) 7 litres

5. In the equation of sate of an ideal gas $PV = nRT$, the value of the universal gas constant would depend only on
(1) The nature of the gas (2) The pressure of the gas
(3) The units of the measurement (4) None of these

6. In the equation PV = nRT, which one cannot be the numerical value of *R*
(1) $8.31 \times 10^7 erg\ K^{-1} mol^{-1}$ (2) $8.31 \times 10^7 dyne\ cm\ K^{-1} mol^{-1}$
(3) $8.31\ JK^{-1} mol^{-1}$ (4) $8.31\ atm.\ K^{-1} mol^{-1}$

7. A sample of gas occupies 100 ml at 27°C and 740 mm pressure. When its volume is changed to 80 ml at 740 mm pressure, the temperature of the gas will be
(1) 21.6 °C (2) 240 °C (3) – 33°C (4) 89.5 °C

8. At 0°C and one atm pressure, a gas occupies 100 cc. If the pressure is increased to one and a half-time and temperature is increased by one-third of absolute temperature, then final volume of the gas will be
(1) 80 cc (2) 88.9 cc (3) 66.7 cc (4) 100 cc

9. A pre-weighed vessel was filled with oxygen at N.T.P. and weighted. It was then evacuated, filled with SO_2 at the same temperature and pressure, and again weighted. The weight of oxygen will be
(1) The same as that of SO_2 (2) 1/2 that of SO_2
(3) Twice that of SO_2 (4) One fourth that of SO_2

10. Kinetic energy of molecules is highest in :

(1) Gases (2) Solids (3) Liquids (4) Solution

11. The maximum number of molecules is present in

(1) 0.5 g of H_2 gas (2) 10 g of O_2 gas

(3) 15 L of H_2 gas at STP (4) 5 L of N_2 gas at STP

12. The pressure and temperature of 4 dm^3 of carbon dioxide gas are doubled. Then the volume of carbon dioxide gas would be

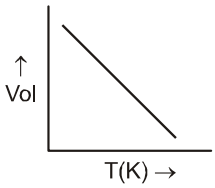
(1) $2\,dm^3$ (2) $3dm^3$ (3) $4\,dm^3$ (4) $8\,dm^3$

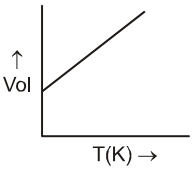
13. A gas at 298 K is shifted from a vessel of 250 cm^3 capacity to that of 1 L capacity. The pressure of the gas will:

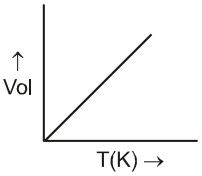
(1) become double (2) becomes four times

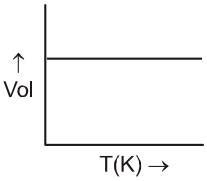
(3) decrease to half of the original value (4) decrease to one-fourth of the original value

14. The correct representation of Charles' law is given by :Z

(1) 

(2) 

(3) 

(4) 

15. There are 6.02×10^{22} molecules each of N_2,O_2 and H_2 which are mixed together at 760 *mm* and 273 *K*. The mass of the mixture in grams is

(1) 6.2 (2) 4.12 (3) 3.09 (4) 7

16. A bottle of cold drink contains 200 *ml* liquid in which CO_2 is 0.1 molar. Suppose CO_2 behaves like an ideal gas, the volume of the dissolved CO_2 at STP is

(1) 0.224 litre (2) 0.448 litre (3) 22.4 litre (4) 2.24 litre

17. Five grams each of the following gases at 87^oC and 750 *mm* pressure are taken. Which of them will have the least volume

(1) HF (2) HCl (3) HBr (4) HI

18. A certain sample of gas has a volume of 0.2 *litre* measured at 1 *atm*. pressure and 0^oC. At the same pressure but at 273^oC, its volume will be

(1) 0.4 *litres* (2) 0.8 *litres* (3) 27.8 *litres* (4) 55.6 *litres*

19. The constant *R* is

(1) Work done per molecule (2) Work done per degree absolute

(3) Work done per kalvin per mole (4) Work done per mole

20. If two moles of an ideal gas at 546 *K* occupy a volume of 44.8 *litres*, the pressure must be

(1) 2 *atm* (2) 3 *atm* (3) 4 *atm* (4) 1 *atm*

21. How many moles of *He* gas occupy 22.4 *litres* at 30^oC and one atmospheric pressure

(1) 0.90 (2) 1.11 (3) 0.11 (4) 1.0

22. Pure hydrogen sulphide is stored in a tank of 100 *litre* capacity at 20ºC and 2 *atm* pressure. The mass of the gas will be

(1) 34 *g* (2) 340 *g* (3) 282.4 *g* (4) 28.24 *g*

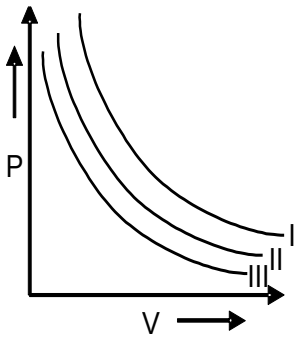
23. One *litre* of a gas weighs 2 *g* at 300 *K* and 1 *atm* pressure. If the pressure is made 0.75 *atm*, at which of the following temperatures will one *litre* of the same gas weigh one *gram*

(1) 450 *K* (2) 600 *K* (3) 800 *K* (4) 900 *K*

24. The density of a gas at 27ºC and 1 *atm* is *d*. Pressure remaining constant at which of the following temperatures will its density become 0.75 d

(1) 20ºC (2) 30ºC (3) 400 *K* (4) 300 *K*

25. I, II, III are three isotherms respectively at T_1, T_2, T_3. Temperature will be in order



(1) $T_1 = T_2 = T_3$ (2) $T_1 < T_2 < T_3$ (3) $T_1 > T_2 > T_3$ (4) $T_1 > T_2 = T_3$

26. The density of neon will be highest at

(1) STP (2) 0ºC and 2 atm (3) 273ºC and 1 atm (4) 273ºC and 2 atm

27. The volume of a gas measured at 27°C and 1 atm pressure is 10 L. To reduce the volume to 2 L at 1 atm pressure, the temperature required is :

(1) 60 K (2) 75 K (3) 150 K (4) 225 K

28. The density of a gas is 1.964 g dm^{-3} at 273 K and 76 cm Hg. The gas is :

(1) CH_4 (2) C_2H_6 (3) CO_2 (4) Xe

DPP-02 : Daltons law of partial pressure

1. The total pressure exerted by a number of non-reacting gases is equal to the sum of the partial pressures of the gases under the same conditions is known as

(1) Boyle's law (2) Charle's law (3) Avogadro's law (4) Dalton's law

2. A cylinder is filled with a gaseous mixture containing equal masses of CO and N_2. The partial pressure ratio is :

(1) $P_{N_2} = P_{CO}$ (2) $P_{CO} = 0.875\ P_{N_2}$ (3) $P_{CO} = 2\ P_{N_2}$ (4) $P_{CO} = ½\ P_{N_2}$

3. Equal volumes of two gases which do not react together are enclosed in separate vessel. Their pressure at 100 mm and 400 mm respectively. If the two vessel are joined together, then what will be the pressure of the resulting mixture (temperature remaining constant) ?

(1) 125 mm (2) 500 mm (3) 1000 mm (4) 250 mm

4. A gaseous mixture contains 56 g of N_2, 44 g CO_2 and 16 g of CH_4. The total pressure of the mixture is 720 mm Hg. The partial pressure of CH_4 is

(1) 180 mm (2) 360 mm (3) 540 mm (4) 720 mm

5. Equal weights of ethane and hydrogen are mixed in an empty container at 25°C. The fraction of the total pressure exerted by hydrogen is :

(1) 1 : 2 (2) 1 : 1 (3) 1 : 16 (4) 15 : 16

6. a sample of O_2 gas is collected over water at 23°C at a barometric pressure of 751 mm Hg (vapour pressure of water at 23°C is 21 mm Hg). The partial pressure of O_2 gas in the sample collected is

(1) 21 mm Hg (2) 751 mm Hg (3) 0.96 atm (4) 1.02 atm

DPP-03 : Grahams Law of diffusion

1. If 4 g of oxygen diffuse through a very narrow hole, how much hydrogen would have diffused under identical conditions ?

(1) 16 g (2) 1 g (3) 1/4 g (4) 64 g

2. Two gram of hydrogen diffuse from a container in 10 minutes. How many grams of oxygen would diffuse through the same container in the same time under similar conditions ?

(1) 0.5 g (2) 4 g (3) 6 g (4) 8 g

3. The ratio of the rate of diffusion of a given element to that of helium is 1 : 4. The molecular weight of the element is

(1) 32 (2) 64 (3) 16 (4) None of these

4. The molecular weight of a gas which diffuse through a porous plug at 1/6th of the speed of hydrogen under identical conditions is

(1) 27 (2) 72 (3) 36 (4) 48

5. The time taken for a certain volume of a gas 'X' to diffuse through a small hole is 2 minutes. It takes 5.65 minutes for oxygen to diffuse under the similar conditions. The molecular weight of 'X' is

(1) 8 (2) 4 (3) 16 (4) 32

6. The ratio of rates of diffusion of SO_2, O_2 and CH_4 is :

(1) $1 : \sqrt{2} : 2$ (2) 1 : 2 : 4 (3) $1 : \sqrt{2} : 1$ (4) $1 : 2 : \sqrt{2}$

7. If the four tubes of a car are filled to the same pressure with N_2, O_2, H_2 and *Ne* separately, then which one will be filled first

(1) N_2 (2) O_2 (3) H_2 (4) *Ne*

8. The densities of hydrogen and oxygen are 0.09 and 1.44 g L^{-1}. If the rate of diffusion of hydrogen is 1 then that of oxygen in the same units will be :

(1) 4 (2) 1/4 (3) 16 (4) 1/16

9. The densities of two gases are in the ratio of 1 : 16. The ratio of their rates of diffusion is

(1) 16 : 1 (2) 4 : 1 (3) 1 : 4 (4) 1 : 16

10. Rate of diffusion of a gas is

(1) Directly proportional to its density

(2) Directly proportional to its molecular mass

(3) Directly proportional to the square root of its molecular mass

(4) Inversely proportional to the square root of its molecular mass

11. At constant temperature and pressure which gas will diffuse first H_2 or O_2?

(1) Hydrogen (2) Oxygen

(3) Both will diffuse in same time (4) None of the above

12. X ml of H_2 gas effuses through a hole in a container in 5 sec. The time taken for the effusion of the same volume of the gas specified below under identical conditions is :

(1) 10 sec. He (2) 20 sec. O_2 (3) 25 sec. CO_2 (4) 55 sec. CO_2

DPP-04 : Kinetic theory of gases

1. The ratio of root mean square velocity to average velocity of gas molecules at a particular temperature is

(1) 1.086 : 1 (2) 1 : 1.086 (3) 2 : 1.086 (4) 1.086 : 2

2. Which of the following is valid at absolute zero temperature ?

(1) Kinetic energy of the gas becomes zero but the molecuar motion does not become zero

(2) Kinetic energy of the gas becomes zero and the molecular motion also becomes zero

(3) Kinetic energy of the gas decreases but does not become zero

(4) None of the above

3. If a gas is expanded at constant tempertaure

(1) the pressure increase

(2) the kinetic energy of the molecules remains the same

(3) the kinetic energy of the molecules decrease

(4) the number of molecules of the gas increases

4. At the same temperature and pressure, which of the following gases will have the highest kinetic energy per mole ?

(1) Hydrogen (2) Oxygen (3) Methane (4) All the same

5. The ratio amongs most probable velocity, mean velocity and root mean square velocity is given by
(1) 1 : 2 : 3 (2) 1 : $\sqrt{2}$: $\sqrt{3}$ (3) $\sqrt{2}$: $\sqrt{3}$: $\sqrt{8/\pi}$ (4) $\sqrt{2}$: $\sqrt{8/\pi}$: $\sqrt{3}$

6. The root mean square speeds at STP for the gases H_2, N_2, O_2 and HBr are in the order :
(1) $H_2 < N_2 < O_2 < HBr$ (2) $HBr < O_2 < N_2 < H_2$ (3) $H_2 < N_2 = O_2 < HBr$ (4) $HBr < O_2 < H_2 < N_2$

7. Which is not true in case of an ideal gas
(1) It cannot be converted into a liquid
(2) There is no interaction between the molecules
(3) All molecules of the gas move with same speed
(4) At a given temperature, *PV* is proportional to the amount of the gas

8. The r.m.s. velocity of a certain gas is υ at 300 K. The temperature, at which the r.m.s. velocity becomes double
(1) 1200 K (2) 900 K (3) 600 K (4) 150 K

9. The kinetic energy of N molecules of O_2 is x joule at – 123ºC. Another sample of O_2 at 27ºC has a kinetic energy of 2 x. The latter sample contains _____ molecules of O_2
(1) N (2) N/2 (3) 2 N (4) 3 N

10. The kinetic energy for 14 grams of nitrogen gas at 127°C is nearly (mol. mass of nitrogen = 28 and gas constant = 8.31 JK^{-1} mol^{-1})
(1) 1.0 J (2) 4.15 J (3) 2494 J (4) 3.3 J

11. The density of a gas *A* is three times at equal temperature, pressure that of a gas *B*. if the molecular mass of *A* is *M*, the molecular mass of *B* is
(1) 3 *M* (2) $\sqrt{3}$ *M* (3) $M/3$ (4) $M/\sqrt{3}$

12. Kinetic energy and pressure of a gas per unit volume are related as
(1) $P = \frac{2}{3}K.E$ (2) $P = \frac{3}{2}K.E$ (3) $P = \frac{1}{2}K.E$ (4) P = 2 K.E

13. Helium atom is two times heavier than a hydrogen molecule at 298 *K*, the average kinetic energy of helium is
(1) Two times that of a hydrogen molecule (2) Same as that of a hydrogen molecule
(3) Four times that of a hydrogen molecule (4) Half that of a hydrogen molecule

14. At 27ºC, the ratio of *rms* velocities of ozone to oxygen is
(1) $\sqrt{3/5}$ (2) $\sqrt{4/3}$ (3) $\sqrt{2/3}$ (4) 0.25

DPP-05 : Real gases

1. The values of Vander Waals constant "a" for the gases O_2, N_2, NH_3 & CH_4 are 1.36, 1.39, 4.17, 2.253 L^2 atm $mole^{-2}$ respectively. The gas which can most easily be liquified is:
(1) O_2 (2) N_2 (3) NH_3 (4) CH_4

2. The pressure of real gases is less than that of ideal gas because of

(1) increase in the number of collisions (2) finite size of particles

(3) intermolecular attraction (4) increase in kinetic energy of the molecules

3. At lower temperature, mostely gases show

(1) negative deviation (2) positive deviation

(3) positive and negative deviation (4) None

4. The Vander Waal's equation explains the behaviour of

(1) Ideal gases (2) Real gases (3) Vapour (4) Non-real gases

5. Any gas shows maximum deviation from ideal gas at

(1) 0ºC and 1 atmospheric pressure (2) 100ºC and 2 atmospheric pressure

(3) –100ºC and 5 atmospheric pressure (4) 500ºC and 1 atmospheric pressure

6. A gas is said to behave like an ideal gas when the relation $PV/T = \text{constant}$. When do you expect a real gas to behave like an ideal gas

(1) When the temperature is low

(2) When both the temperature and pressure are low

(3) When both the temperature and pressure are high

(4) When the temperature is high and pressure is low

7. The units of the van der Waal's constant 'b' are

(1) atmosphere (2) joules (3) L mol^{-1} (4) mol L^{-1}

8. For the non-zero values of force of attraction between gas molecules, gas equation will be :

(1) $PV = nRT - \frac{n^2a}{V}$ (2) PV = nRT + nbP (3) PV = nRT (4) $P = \frac{nRT}{V-b}$

9. At low pressures, the van der Waal's equation is written as :

$$\left[p + \frac{a}{V^2}\right] V = RT$$

The compressibility factor is then equal to:

(1) $\left(1 - \frac{a}{RTV}\right)$ (2) $\left(1 - \frac{RTV}{a}\right)$ (3) $\left(1 + \frac{a}{RTV}\right)$ (4) $\left(1 + \frac{RTV}{a}\right)$

10. Gases deviate from the ideal gas behaviour because their molecules

(1) possess negligible volume (2) have forces of attraction between them

(3) are polyatomic (4) are not attracted to one another

11. A real gas most closely approaches the behaviour of an ideal gas at

(1) 15 atm and 200 K (2) 1 atm and 273 K (3) 0.5 atm and 500 K (4) 15 atm and 500 K

12. A gas can be liquiefied :

(1) above its critical temperature (2) at its critical temperature

(3) below its critical temperature (4) at any temperature

13. Vander Waal's constants '*a*' and '*b*' are related with..... respectively

(1) Attractive force and bond energy of molecules (2) Volume and repulsive force of molecules

(3) Shape and repulsive forces of molecules (4) Attractive force and volume of the molecules

14. At high temperature and low pressure, the Vander Waal's equation is reduced to

(1) $\left(p+\frac{a}{V_m^2}\right)(V_m)=RT$ (2) $pV_m=RT$ (3) $p(V_m-b)=RT$ (4) $\left(p+\frac{a}{V_m^2}\right)(V_m-b)=RT$

15. If for the gases, the critical temperature mentioned below i.e.,

Gas	Critical temp.
A	T_{C_1}
B	T_{C_2}
C	T_{C_3}
D	T_{C_4}

$T_{C_1} > T_{C_2} > T_{C_3} > T_{C_4}$

Which of the following can be predicted ?

(1) Ease of liquefaction is minimum in gas D

(2) Gas A has maximum value of van der Waal's constant 'a'

(3) Ease of liquefaction is directly proportional to van der Waal's constant 'a'

(4) All of these

ANSWER KEY

DPP-01

1.	(4)	**2.**	(2)	**3.**	(1)	**4.**	(1)	**5.**	(3)	**6.**	(4)	**7.**	(3)
8.	(2)	**9.**	(2)	**10.**	(1)	**11.**	(3)	**12.**	(3)	**13.**	(4)	**14.**	(3)
15.	(1)	**16.**	(2)	**17.**	(4)	**18.**	(1)	**19.**	(3)	**20.**	(1)	**21.**	(1)
22.	(3)	**23.**	(1)	**24.**	(3)	**25.**	(3)	**26.**	(2)	**27.**	(1)	**28.**	(3)

DPP-02

1.	(4)	**2.**	(1)	**3.**	(4)	**4.**	(1)	**5.**	(4)	**6.**	(3)		

DPP-03

1.	(2)	**2.**	(4)	**3.**	(2)	**4.**	(2)	**5.**	(2)	**6.**	(1)	**7.**	(3)
8.	(2)	**9.**	(2)	**10.**	(4)	**11.**	(1)	**12.**	(2)				

DPP-04

1.	(1)	**2.**	(2)	**3.**	(2)	**4.**	(4)	**5.**	(4)	**6.**	(2)	**7.**	(3)
8.	(1)	**9.**	(1)	**10.**	(3)	**11.**	(3)	**12.**	(1)	**13.**	(2)	**14.**	(3)

DPP-05

1.	(3)	**2.**	(3)	**3.**	(1)	**4.**	(2)	**5.**	(3)	**6.**	(4)	**7.**	(3)
8.	(1)	**9.**	(1)	**10.**	(2)	**11.**	(3)	**12.**	(3)	**13.**	(4)	**14.**	(2)
15.	(4)												