P.P. Savani CFE-KOTA

Periodic test
Question bank

Std 12 : Chemistry
Chemical kinetics

Date : 13/08/23
45 minutes

Section A

- **Choose correct answer from the given options. [Each carries 1 Mark]** **[94]**

1. The rate of a chemical reaction....
(A) increases as the reaction proceeds.
(B) decreases as the reaction proceeds.
(C) may increase or decrease during the reaction.
(D) remains constant as the reaction proceeds.

2. A large increase in the rate of a reaction for a rise in temperature is due to....
(A) the decrease in the number of collisions.
(B) the increase in the number of activated molecules.
(C) the shortening of the mean free path.
(D) the lowering of the activation energy.

3. A zero order reaction is one whose rate is independent of...
(A) temperature of the reaction.
(B) the concentrations of the reactants.
(C) the concentration of the products.
(D) the material of the vessel in which the reaction is carried out.

4. The dimension of rate constant of a second order reaction involves....
(A) neither time nor concentration.
(B) only time.
(C) time and concentration.
(D) time and square of concentration.

5. The rate at which a substance reacts depends on its...
(A) atomic weight.
(B) equivalent weight.
(C) molecular weight.
(D) active mass.

6. The rate of a reaction that not involve gases is not dependent on...
(A) pressure
(B) temperature
(C) concentration
(D) catalyst

7. The rate constant of a reaction depends on...
(A) temperature
(B) mass
(C) weight
(D) time

8. A reaction involving two different reactants....
(A) can never be a second order reaction.
(B) can never be a unimolecular reaction.
(C) can never be a bimolecular reaction.
(D) can never be a first order reaction.

9. Inversion of sucrose is....
(A) zero order reaction.
(B) 1st order reaction.
(C) 2nd order reaction.
(D) 3rd order reaction.

10. A catalyst increases the rate of reaction because it...
(A) increases the activation energy.
(B) decreases the energy barrier for reaction.
(C) decreases the collision diameter.
(D) increases the temperature coefficient.

11. The reaction rate at a given temperature becomes slower, then....
(A) the free energy of activation is higher.
(B) the free energy of activation is lower.
(C) the entropy changes.
(D) the initial concentration of the reactants remains constant.

12. Half life period of second order reaction is
(A) proportional to the initial concentration of reactants.

(B) independent of the initial concentration of reactants.
(C) inversely proportional to initial concentration of reactants.
(D) inversely proportional to square of initial concentration of reactants.

13. The thermal decomposition of a compound is of first order. If a sample of the compound decomposes 50% in 120 minutes, in what time will it undergo 90% decomposition....

(A) nearly 240 minutes. (B) nearly 480 minutes.
(C) nearly 450 minutes. (D) nearly 400 minutes.

14. On increasing the temperature, the rate of the reaction increases because of...

(A) decrease in the number of collisions.
(B) decrease in the energy of activation.
(C) decrease in the number of activated molecules.
(D) increase in the number of effective collisions.

15. If initial concentration is reduced to its $1/4^{th}$ in a zero order reaction, the time taken for half of the reaction to complete....

(A) remains same. (B) becomes 4 times. (C) becomes one-fourth. (D) doubles.

16. A first order reaction which is 30% complete in 30 minutes has a half-life period of....

(A) 24.2 minutes (B) 58.2 minutes (C) 102.2 minutes (D) 120.2 minutes

17. 75% of a first order reaction was completed in 32 minutes when was 50% of the reaction completed...

(A) 16 min. (B) 24 min. (C) 8 min. (D) 4 min.

18. A first order reaction is half completed in 45 minutes. How long does it need 99.9% of the reaction to be completed....

(A) 5 Hr. (B) 7.5 Hr. (C) 10 Hr. (D) 20 Hr.

19. The rate of a chemical reaction depends upon

(A) time (B) pressure (C) concentration (D) All of these

20. The minimum energy a molecule should possess in order to enter into a fruitful collision is known as....

(A) reaction energy. (B) collision energy. (C) activation energy. (D) threshold energy.

21. Half life of a reaction is found to be inversely proportional to the cube of its initial concentration. The order of reaction is

(A) 2 (B) 5 (C) 3 (D) 4

22. Collision theory is applicable to....

(A) first order reactions. (B) zero order reactions.
(C) bimolecular reactions. (D) intra molecular reactions.

23. Which of the following statements is false in relation to enzyme....

(A) pH affects their functioning. (B) temperature affects their functioning.
(C) they always increase activation energy. (D) their reactions are specific.

24. A reaction is catalysed by 'X'. Here 'X'

(A) Decreases the rate constant of reaction.
(B) Does not affect the equilibrium constant of reaction.
(C) Decreases the enthalpy of reaction.
(D) Decreases the activation energy.

25. Which reaction characteristics are changing by the addition of a catalyst to a reaction at constant temperature.....

(i) Activation energy (ii) Equilibrium constant
(iii) Reaction entropy (iv) Reaction enthalpy
(A) (i) Only (B) (iii) only (C) (i) and (ii) only (D) All of these

26. Rate of reaction....
(A) decreases with increase in temperature.
(B) increases with increase in temperature.
(C) may increase or decrease with increase in temperature.
(D) does not depend on temperature.

27. In the first order reaction, the concentration of the reactant is reduced to 25% in one hour. The half life period of the reaction is...
(A) 2 hr. (B) 4 hr. (C) 1/2 hr. (D) 1/4 hr.

28. If a substance with half life 3 days is taken at other place in 12 days. What amount of substance is left now....
(A) 1/4 (B) 1/8 (C) 1/16 (D) 1/32

29. Which of the following statements regarding the molecularity of a reaction is wrong....
(A) it is the number of molecules of the reactants taking part in a single step chemical reaction.
(B) it is calculated from the reaction mechanism.
(C) it may be either a whole number or fractional.
(D) it depends on the rate determining step in the reaction.

30. For a first order reaction, the half-life period is independent of....
(A) initial concentration. (B) cube root of initial concentration.
(C) first power of final concentration. (D) square root of final concentration.

31. For the reaction $3A \rightarrow 2B$. What will be the reaction rate with reference to B ?
(A) $-\frac{3}{2}\frac{d[A]}{dt}$ (B) $-\frac{2}{3}\frac{d[A]}{dt}$ (C) $-\frac{1}{3}\frac{d[A]}{dt}$ (D) $\frac{2d[A]}{dt}$

32. Which statement is correct with reference to Arrhenius equation $K = Ae^{-Ea/RT}$ A ?
(A) A is adsorbent coefficient (B) E_a is a activation energy
(C) R is Rydberg constant (D) K is equilibrium constant

33. If the activation of forward reaction in a simple chemical reaction $A \rightarrow B$ is E_a, then what will be activation energy for reverse reaction ?
(A) $-E_a$ (B) Always less than E_a
(C) Always twice of E_a (D) More or less than E_a

34. The values of the rate constants of the reaction $C_2H_5I + OH^- \rightarrow C_2H_5OH + I^-$ at 30° and 60°C temperatures are 0.325 and 6.735 litre $mole^{-1}$ $second^{-1}$ than what will be the value of activation energy ?
(A) 20260 cal (B) 20260 K cal (C) 361.44 cal (D) 84773 cal

35. In a first order reaction, the concentration of the reactant, decreases from 0.8M to 0.4M in 15 minutes. The time taken for the concentration to change from 0.1M to 0.025M is....
(A) 7.5 minutes (B) 15 minutes (C) 30 minutes (D) 60 minutes

36. Which is correct about zero order reaction....
(A) rate of reaction depends on decay constant.
(B) rate of reaction is independent of concentration.
(C) unit of rate constant is $concentration^{-1}$.
(D) unit of rate constant is $concentration^{-1}$ $time^{-1}$.

37. The rate of reaction between two reactants A and B decreases by a factor of 4 if the concentration of reactant B is doubled. The order of this reaction with respect to reactant B is....

(A) –1 (B) –2 (C) 1 (D) 2

38. The rate of a reaction doubles when its temperature changes from 300 K to 310 K. Activation energy of such a reaction will be : ($R = 8.314\ JK^{-1}\ mol^{-1}$ and log 2 = 0.301)

(A) 53.6 kJ mol^{-1} (B) 48.6 kJ mol^{-1} (C) 58.5 kJ mol^{-1} (D) 60.5 kJ mol^{-1}

39. For the non - stoichiometre reaction $2A + B \rightarrow C + D$, the following kinetic data were obtained in three separate experiments, all at 298 K.

Initial Concentration (A)	Initial Concentration (B)	Initial rate of formation of C (mol $L^{-}S^{-}$)
0.1 M	0.1 M	1.2×10^{-3}
0.1 M	0.2 M	1.2×10^{-3}
0.2 M	0.1 M	2.4×10^{-3}

The rate law for the formation of C is :

(A) $\frac{dc}{dt} = k[A]\ [B]^2$ (B) $\frac{dc}{dt} = k[A]$ (C) $\frac{dc}{dt} = k[A]\ [B]$ (D) $\frac{dc}{dt} = k[A]^2\ [B]$

40. The rate constant of the reaction $A \rightarrow B$ is 0.6×10^{-3} mole per second. If the concentration of A is 5 M, then concentration of B after 20 minutes is :

(A) 0.36 M (B) 0.72 M (C) 1.08 M (D) 3.60 M

41. Decomposition of H_2O_2 follows a first order reaction. In fifty minutes the concentration of H_2O_2 decreases from 0.5 to 0.125 M in one such decomposition. When the concentration of H_2O_2 reaches 0.05 M, the rate of formation of O_2 will be :

(A) 1.34×10^{-2} mol L^{-1} min^{-1} (B) 6.93×10^{-2} mol L^{-1} min^{-1}

(C) 6.93×10^{-4} mol L^{-1} min^{-1} (D) 2.66 L min^{-1} at STP

42. The rate of a first-order reaction is 0.04 mol l^{-1} s^{-1} at 10 seconds and 0.03 mol l^{-1} s^{-1} at 20 seconds after initation of the reaction. The half life period of the reaction is....

(A) 34.1 s (B) 44.1 s (C) 54.1 s (D) 24.1 s

43. Two reactions R_1 and R_2 have identical pre-exponential factors. Activation energy of R_1 exceeds that of R_2 by 10 kJ mol^{-1}. If k_1 and k_2 are rate constants for reactions R_1 and R_2 respectively at 300 K, then $ln(k_2/k_1)$ is equal to ...... ($R = 8.314\ J\ mol^{-1}\ K^{-1}$)

(A) 8 (B) 12 (C) 6 (D) 4

44. For the reaction, $XA + YB \rightarrow ZC$, if

$\frac{-d[A]}{dt} = \frac{-d[B]}{dt} = \frac{1.5d[C]}{dt}$, then the correct statement among the following is ......

(A) the value of X = Y = Z = 3 (B) the value of X = Y = 3

(C) the value of X = 2 (D) the value of Y = 2

45. The correct difference between first and second order reactions is that...

(A) the rate of a first-order reaction does depend on reactant concentrations; the rate of a second-order reaction does not depend on reactant concentrations

(B) the rate of a first-order reaction does not depend on reactant concentrations; the rate of a second-order reaction does depend on reactant concentrations

(C) a first-order reaction can be catalyzed; a second-order reaction cannot be catalyzed

(D) the half-life of a first-order reaction does not depend on $[A]_0$ the half-life of a second-order reaction does depend on $[A]_0$.

46. Initial chemicial reaction $A_2 \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} 2A$, then $\frac{d[A]}{dt}$ = ...

(A) $k_1 [A_2] - k_{-1} [A]^2$
(B) $2k_1 [A_2] - k_{-1} [A]^2$
(C) $2k_1 [A_2] - 2k_{-1} [A]^2$
(D) $k_1 [A_2] + k_{-1} [A]^2$

47. For the chemical reaction, $N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$ what is the correct option ?

(A) $3\frac{d[H_2]}{dt} = 2\frac{d[NH_3]}{dt}$
(B) $-\frac{1}{3}\frac{d[H_2]}{dt} = -\frac{1}{2}\frac{d[NH_3]}{dt}$
(C) $-\frac{d[N_2]}{dt} = 2\frac{d[NH_3]}{dt}$
(D) $-\frac{d[N_2]}{dt} = \frac{1}{2}\frac{d[NH_3]}{dt}$

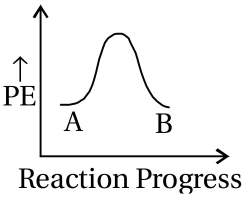
48. If the rate constant for a first order reactions K, the time (*t*) required for the completion of 99% of the reaction is given by :

(A) $t = 2.303/k$
(B) $t = 0.693/k$
(C) $t = 6.909/k$
(D) $t = 4.606/k$

49. An increase in the concentration of the reactants of a reaction leads to change in :

(A) threshold energy
(B) collision frequency
(C) activation energy
(D) heat of reaction

50. For a reaction A → B, enthalpy of reaction is –4.2 kJ mol^{-1} and enthalpy of activation is 9.6 kJ mol^{-1}. The correct potential energy profile for the reaction is shown in option.

(A)


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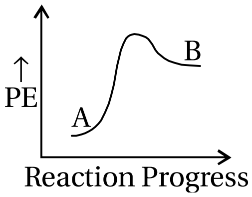

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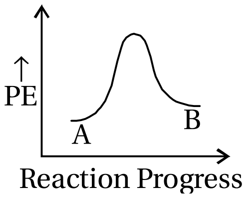
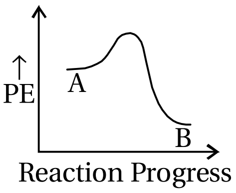


(D)


51. The slope of Arrhenius plot $\left(\ln k \text{ v/s } \frac{1}{T}\right)$ of first order reaction is -5×10^3 K. The value of Ea of the reaction is : Choose the correct option for your answer. [Given R = 8.314 J K^{-1} mol^{-1}]

(A) 166 kJ mol^{-1}
(B) –83 kJ mol^{-1}
(C) 41.5 kJ mol^{-1}
(D) 83.0 kJ mol^{-1}

52. For a first order reaction A → Products, initial concentration of A is 0.1 M, which becomes 0.001 M after 5 minutes. Rate constant for the reaction in min^{-1} is

(A) 0.4606
(B) 0.2303
(C) 1.3818
(D) 0.9212

53. Total order of reaction X + Y → XY is 3. The order of reaction with respect to X is 2. State the differential rate equation for the reaction.

(A) $-\frac{d[X]}{dt} = K[X]^3[Y]^0$
(B) $-\frac{d[X]}{dt} = K[X]^0[Y]^3$
(C) $-\frac{d[X]}{dt} = K[X]^2[Y]$
(D) $-\frac{d[X]}{dt} = K[X][Y]^2$

54. $X \xrightarrow{\text{Step-I}} Y \xrightarrow{\text{Step-II}} Z$ is a complex reaction. Total order of reaction is 2 and step-II is slow step. What is molecularity of Step-II ?

(A) 1
(B) 2
(C) 3
(D) 4

55. Reaction $3ClO^- \rightarrow ClO^-_3 + 2Cl^-$ occurs in following two steps.

(i) $ClO^- + ClO^- \xrightarrow{K_1} ClO_2^- + Cl^-$ (Slow step)

(ii) $ClO_2^- + ClO^- \xrightarrow{K_2} ClO_3^- + Cl^-$ (Fast step)

then the rate of given reaction = ...

(A) $K_1[ClO^-]^2$
(B) $K_1[ClO^-]$
(C) $K_2[ClO^-_2]$ $[ClO^-]$
(D) $K_2[ClO^-]^3$

56. How much time is required for completion of a zero order reaction ?

(A) $\frac{2[R_o]}{K}$
(B) $\frac{[R_o]}{2K}$
(C) $\frac{[R_o]}{K}$
(D) $\frac{K}{[R_o]}$

57. Time taken for consumption of half of the initial concentration is 20 seconds for a first order reaction. What will be the time taken by the same reaction to get the concentration of reactant from 0.125 M to 0.0625 M.

(A) 5 sec. (B) 20 sec. (C) 10 sec. (D) 40 sec.

58. At 298 K temperature the activation energy for the reaction $X_2 + Y_2 \rightarrow 2XY + 20$ KJ is 15 KJ. What will be the activation energy for the reaction $2XY \rightarrow X_2 + Y_2$?

(A) +35 KJ (B) –35 KJ (C) –5 KJ (D) –15 KJ

59. The rate constant value for a reaction is $1.75 \times 10^2\ L^2\ mol^{-2}\ sec^{-1}$. The half life period $t_{1/2}\ \alpha$ ....

(A) $[R_o]^{-2}$ (B) $[R_o]$ (C) $[R_o]^2$ (D) $[R_o]^{-1}$

60. The half life period for a radioactive substance is 15 minutes. How many gms of this radioactive substance is decayed from 50 gm of substance after one hour ?

(A) 25 (B) 46.875 (C) 43.75 (D) 37.5

61. The values of slope and intercept in the graph of Freundlich adsorption isotherm at 25°C temperature are 0.5 and 0.4771 respectively. What will be the propertion of adsorption at 4 bar pressure ?

(A) 6 (B) 3 (C) 24 (D) 12

62. Instantaneous rate of reaction for the reaction $3A + 2B \rightarrow 5C$ is ....

(A) $+\frac{1}{3}\frac{d[A]}{dt} = -\frac{1}{2}\frac{d[B]}{dt} = +\frac{1}{5}\frac{d[C]}{dt}$ (B) $-\frac{1}{3}\frac{d[A]}{dt} = -\frac{1}{2}\frac{d[B]}{dt} = +\frac{1}{5}\frac{d[C]}{dt}$

(C) $+\frac{1}{3}\frac{d[A]}{dt} = +\frac{1}{2}\frac{d[B]}{dt} = -\frac{1}{5}\frac{d[C]}{dt}$ (D) $+\frac{1}{3}\frac{d[A]}{dt} = -\frac{1}{2}\frac{d[B]}{dt} = -\frac{1}{5}\frac{d[C]}{dt}$

63. Time required to decompose SO_2Cl_2 to half of its initial amount is 40 minutes. If the decomposition is a first order reaction, what will be the rate constant of the reaction ?

(A) $1.73 \times 10^{-2}\ s^{-1}$ (B) $2.88 \times 10^{-2}\ s^{-1}$ (C) $2.88 \times 10^{-4}\ s^{-1}$ (D) $1.73 \times 10^{-4}\ s^{-1}$

64. For a reaction, $K = 4.5 \times 10^{-4}\ L\ mol^{-1}\ s^{-1}$. What is order of reaction ?

(A) Zero (B) First (C) Second (D) Third

65. For first order reaction, the value of slope for graph of $\log\frac{[R]_0}{[R]} \rightarrow t$ is ......

(A) $\frac{K}{2.303}$ (B) –K (C) $\frac{2.303}{K}$ (D) $-\frac{K}{2.303}$

66. For the first order reaction, what is slope of the plot $\log\frac{[R]_0}{[R]}$ vs time ?

(A) – K (B) $\frac{K}{2.303}$ (C) $-\frac{K}{2.303}$ (D) $\frac{2.303}{K}$

67. What is the correct formula for $R \rightarrow P$ reaction rate ?

(A) $\frac{-\Delta[R]}{t} = \frac{-\Delta[P]}{t}$ (B) $\frac{-\Delta[R]}{\Delta t} = \frac{\Delta[P]}{\Delta t}$ (C) $\frac{-[R]}{t} = \frac{\Delta[P]}{\Delta t}$ (D) $\frac{-\Delta[R]}{\Delta t} = \frac{\Delta t}{\Delta[P]}$

68. If graph $\log K \rightarrow \frac{1}{T}$ is plotted, a straight line is obtained then what will be value of slope ?

(A) $\frac{E_a}{2.303R}$ (B) $\frac{-E_a}{3.203R}$ (C) $\frac{-2.303R}{E_a}$ (D) $\frac{-E_a}{2.303R}$

69. The half reaction time required to decrease initial concentration from 40% to 20% is 20 minute. What time will be taken to decrease initial concentration from 10% to 5% ?

(A) 20 minute (B) 5 minute (C) 10 minute (D) 60 minute

70. What will be the theoretical rate of elementary reaction if pressure of O_2 is increased by three times ? $2SO_{2(g)} + O_{2(g)} \rightarrow 2SO_{3(g)}$

(A) 27 times increase (B) 9 times increase (C) 18 times increase (D) 3 times increase

71. If energy of activation of a reaction is 2303 Joule, then what is the value of slope of graph log K →

$\frac{1}{T}$?

(A) –12195.12 Joule (B) –503.27 Joule (C) –120.28 Joule (D) –239.0 Joule

72. For any chemical reaction, value of slope of ln K → $\frac{1}{T}$ graph will be.....

(A) $-\frac{E_a}{2.303}$ (B) $-\frac{E_a}{R}$ (C) $-\frac{E_a}{2.303\,R}$ (D) $-E_a$

73. In elementary reaction : $2SO_{2(g)} + O_{2(g)} \rightarrow$ product. If pressure of SO_2 gas is doubled and pressure of O_2 gas is halved, then what will be the increase in rate of reaction ?

(A) Sixteen times (B) Two times (C) Four times (D) Eight times

74. Which of the following statement is not appropriate ?

(A) Activated complex is short lived molecule.

(B) Activated complex breaks due to its oscillation motion.

(C) Activated complex possesses very weak bonds.

(D) Activated complex possesses minimum potential energy.

75. For the first order reaction, the time required for completion of 50% reaction is 100 seconds. Then the rate constant will be...

(A) 6.93×10^{-3} mol^2 lit^{-2} s^{-1} (B) 6.93×10^{-3} s^{-1}

(C) 6.93×10^{-3} mol lit^{-1} s^{-1} (D) 6.93×10^{-2} s^{-1}

76. For which of the following reactions, Oswald's isolation method is useful for determination of order of the reaction ?

(A) $N_2O_{5(g)} \rightarrow 2NO_{2(g)} + \frac{1}{2}O_{2(g)}$ (B) $H_2O_{2(l)} \rightarrow H_2O_{(l)} + \frac{1}{2}O_{2(g)}$

(C) $-\frac{K}{2.303} + BrO^-_{3(aq)} + 6H^+_{(aq)} \rightarrow 3Br_{2(aq)} + 3H_2O_{(l)}$ (D) All the three given options.

77. With the help of which graph the value of Arrhenius constant can be obtained from Arrhenius equation : $K = A \cdot e^{-E_a/RT}$

(A) log K versus $\frac{1}{\log T}$ (B) K versus $\frac{1}{\log T}$ (C) log K versus $\frac{1}{T}$ (D) K versus T

78. Which is correct relation for half life period (t½) and Initial concentration of reactant $[R]_0$ for fourth order reaction.

(A) $t_{1/2} \propto \frac{1}{[R]_0^{-3}}$ (B) $t_{1/2} \propto \frac{1}{[R]_0}$ (C) $t_{1/2} \propto \frac{1}{[R]_0^3}$ (D) $t_{1/2} \propto [R]_0$

79. The order of following reaction is ....

$H_{2(g)} + Cl_{2(g)} \xrightarrow{hv} 2HCl_{(g)}$

(A) 2 (B) 1 (C) 1.5 (D) 0

80. $3ClO^- \rightarrow ClO^-_3 + 2Cl$ The rate of reaction of above reaction is given by ....

(A) $K_1[ClO^-]$ (B) $K_1[Cl^-]^2$ (C) $K_1[ClO_2{}^-]$ (D) $K_1[ClO^-]^2$

81. Which of the following relation is correct for zero order reaction ?

(A) $t_{\frac{1}{2}} \propto \frac{1}{[R]_0}$ (B) $t_{\frac{1}{2}} \propto [R]_0$

(C) $t_{\frac{1}{2}} \propto \frac{1}{[R]_0^2}$ (D) $t_{\frac{1}{2}}$ is independent of $[R]_0$

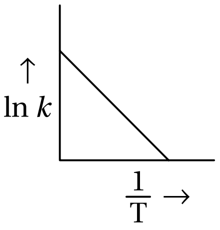
82. For the reaction 2A + B → product, $-\frac{d[A]}{dt} = K\,[A]^2[B]$. What will be the rate equation for $-\frac{d[B]}{dt}$?

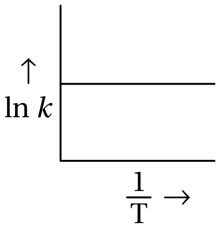
(A) $K[2A]^2[B]$ (B) $\frac{1}{2}K[A]^2[B]$ (C) $K[A][B]^2$ (D) $K[A][B]^{\frac{1}{2}}$

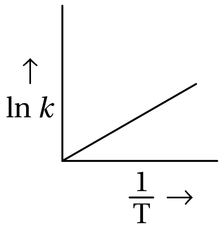
83. What is the value of slope of graph $\log_{10} K \rightarrow \frac{1}{T}$?

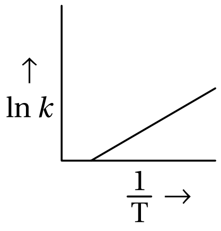
(A) $-\frac{k}{2.303}$ (B) $-\frac{E_a}{2.303R}$ (C) $-\frac{E_a}{R}$ (D) $-k$

84. Which of the following graph for $\ln k \rightarrow \frac{1}{T}$ is correct ?

(A) 

(B) 

(C) 

(D) 

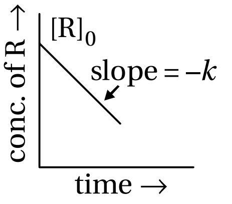
85. The decomposition of NH_3 on platinum surface is zero order reaction. What is the rate of production of N_2 if $K = 2.5 \times 10^{-4}$ mol L^{-1} S^{-1} ?

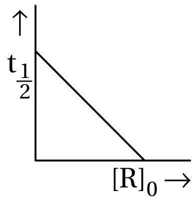
(A) 2.5×10^{-4} mol L^{-1} s^{-1} (B) 8.3×10^{-5} mol L^{-1} s^{-1}
(C) 7.5×10^{-4} mol L^{-1} s^{-1} (D) 5×10^{-4} mol L^{-1} s^{-1}

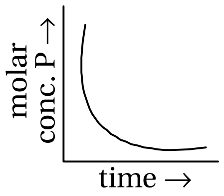
86. The role of catalyst is to change ....

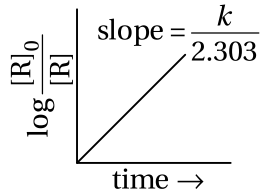
(A) Gibbs energy of reaction. (B) Enthalpy of reaction.
(C) Equilibrium constant of the reaction. (D) Activation energy of the reaction.

87. Which of the following graph is correct for a first order reaction ?

(A) 

(B) 

(C) 

(D) 

88. A first order reaction is found to have a rate constant, $K = 5.5 \times 10^{-14}$ s^{-1}. The half life of reaction is ....

(A) 1.26×10^{14} s (B) 6.93×10^{14} s (C) 1.26×10^{13} s (D) 12.6×10^{15} s

89. What is the wrong equation of rate constant for zero order reaction ?

(A) $[R] = -Kt + [R]_0$ (B) $-K = \frac{[R]-[R]_0}{t}$ (C) $K = \frac{[R]_0-[R]}{t}$ (D) $[R]_0 + [R] = -Kt$

90. What is the unit of rate constant of the second order reaction ?

(A) mol $L^{-1}s^{-1}$ (B) mol^{-1} Ls^{-1} (C) s^{-1} (D) mol^{-2} $L^{+2}s^{-1}$

91. What is the slope of graph of $\ln k \rightarrow \frac{1}{r}$?

(A) $-\frac{E_a}{R}$ (B) $\frac{-2.303\,E_a}{R}$ (C) $-\frac{R}{E_a}$ (D) $\frac{-2.303R}{E_a}$

92. Which of the following is bimolecular reaction ?

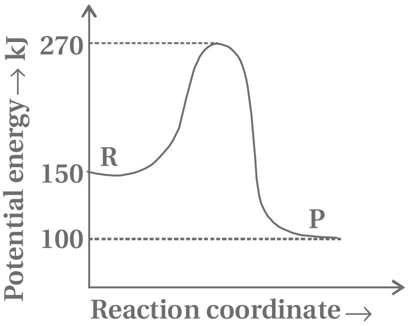
(A) $N_2 + 3H_2 \rightarrow 2NH_3$ (B) $2NH_3 \rightarrow N_2 + 3H_2$
(C) $NH_4NO_2 \rightarrow N_2 + 2H_2O$ (D) $2NO + O_2 \rightarrow 2NO_2$

93. What will be the unit of rate constant for following reaction ?

$C_2H_{4(g)} + H_{2(g)} \rightarrow C_2H_{6(g)}$

(A) $mol^{-1}\ L\,S^{-1}$ (B) S^{-1} (C) $mol\ L^{-1}\,S^{-1}$ (D) $mol^{-2}\ L^{2}\,S^{-1}$

94. For R → P reaction, following graph is given.



What will be enthalpy change for the given reaction ?

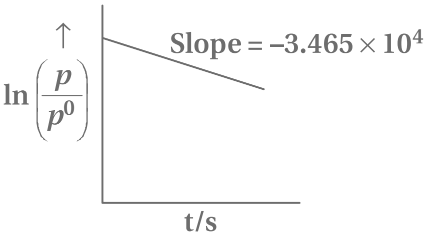
(A) –50 kJ (B) 50 kJ (C) 120 kJ (D) 170 kJ

//X

●

[1]

1. For the decomposition of azomethane. $CH_3N_2CH_{3(g)} \rightarrow CH_3CH_{3(g)} + N_{2(g)}$ a first order reaction, the variation in partial pressur K is given as



The half life of the reaction is .... × 10^{-5} s. [Nearest integer]

Periodic test
Question bank

P.P. Savani CFE-KOTA
Std 12 : Chemistry
Chemical kinetics

Date : 13/08/23
45 minutes

Section A

- **Choose correct answer from the given options. [Each carries 1 Mark]** **[94]**

1. The rate of a chemical reaction....
(A) increases as the reaction proceeds.
(B) decreases as the reaction proceeds.
(C) may increase or decrease during the reaction.
(D) remains constant as the reaction proceeds.

Ans. (B) decreases as the reaction proceeds.

2. A large increase in the rate of a reaction for a rise in temperature is due to....
(A) the decrease in the number of collisions.
(B) the increase in the number of activated molecules.
(C) the shortening of the mean free path.
(D) the lowering of the activation energy.

Ans. (B) the increase in the number of activated molecules.

3. A zero order reaction is one whose rate is independent of...
(A) temperature of the reaction.
(B) the concentrations of the reactants.
(C) the concentration of the products.
(D) the material of the vessel in which the reaction is carried out.

Ans. (B) the concentrations of the reactants.

4. The dimension of rate constant of a second order reaction involves....
(A) neither time nor concentration.
(B) only time.
(C) time and concentration.
(D) time and square of concentration.

Ans. (C) time and concentration.

5. The rate at which a substance reacts depends on its...
(A) atomic weight.
(B) equivalent weight.
(C) molecular weight.
(D) active mass.

Ans. (D) active mass.

6. The rate of a reaction that not involve gases is not dependent on...
(A) pressure
(B) temperature
(C) concentration
(D) catalyst

Ans. (A) pressure

7. The rate constant of a reaction depends on...
(A) temperature
(B) mass
(C) weight
(D) time

Ans. (A) temperature

8. A reaction involving two different reactants....
(A) can never be a second order reaction.
(B) can never be a unimolecular reaction.
(C) can never be a bimolecular reaction.
(D) can never be a first order reaction.

Ans. (B) can never be a unimolecular reaction.

9. Inversion of sucrose is....
(A) zero order reaction.
(B) 1st order reaction.
(C) 2nd order reaction.
(D) 3rd order reaction.

Ans. (B) 1st order reaction.

10. A catalyst increases the rate of reaction because it...

(A) increases the activation energy.
(B) decreases the energy barrier for reaction.
(C) decreases the collision diameter.
(D) increases the temperature coefficient.

Ans. (B) decreases the energy barrier for reaction.

11. The reaction rate at a given temperature becomes slower, then....

(A) the free energy of activation is higher.
(B) the free energy of activation is lower.
(C) the entropy changes.
(D) the initial concentration of the reactants remains constant.

Ans. (A) the free energy of activation is higher.

12. Half life period of second order reaction is

(A) proportional to the initial concentration of reactants.
(B) independent of the initial concentration of reactants.
(C) inversely proportional to initial concentration of reactants.
(D) inversely proportional to square of initial concentration of reactants.

Ans. (C) inversely proportional to initial concentration of reactants.

13. The thermal decomposition of a compound is of first order. If a sample of the compound decomposes 50% in 120 minutes, in what time will it undergo 90% decomposition....

(A) nearly 240 minutes.
(B) nearly 480 minutes.
(C) nearly 450 minutes.
(D) nearly 400 minutes.

Ans. (D) nearly 400 minutes.

14. On increasing the temperature, the rate of the reaction increases because of...

(A) decrease in the number of collisions.
(B) decrease in the energy of activation.
(C) decrease in the number of activated molecules.
(D) increase in the number of effective collisions.

Ans. (D) increase in the number of effective collisions.

15. If initial concentration is reduced to its $1/4^{th}$ in a zero order reaction, the time taken for half of the reaction to complete....

(A) remains same.
(B) becomes 4 times.
(C) becomes one-fourth.
(D) doubles.

Ans. (C) becomes one-fourth.

16. A first order reaction which is 30% complete in 30 minutes has a half-life period of....

(A) 24.2 minutes
(B) 58.2 minutes
(C) 102.2 minutes
(D) 120.2 minutes

Ans. (B) 58.2 minutes

17. 75% of a first order reaction was completed in 32 minutes when was 50% of the reaction completed...

(A) 16 min.
(B) 24 min.
(C) 8 min.
(D) 4 min.

Ans. (A) 16 min.

18. A first order reaction is half completed in 45 minutes. How long does it need 99.9% of the reaction to be completed....

(A) 5 Hr.
(B) 7.5 Hr.
(C) 10 Hr.
(D) 20 Hr.

Ans. (B) 7.5 Hr.

19. The rate of a chemical reaction depends upon

(A) time
(B) pressure
(C) concentration
(D) All of these

Ans. (D) All of these

20. The minimum energy a molecule should possess in order to enter into a fruitful collision is known as....

(A) reaction energy. (B) collision energy. (C) activation energy. (D) threshold energy.

Ans. (D) threshold energy.

21. Half life of a reaction is found to be inversely proportional to the cube of its initial concentration. The order of reaction is

(A) 2 (B) 5 (C) 3 (D) 4

Ans. (D) 4

22. Collision theory is applicable to....

(A) first order reactions. (B) zero order reactions.

(C) bimolecular reactions. (D) intra molecular reactions.

Ans. (C) bimolecular reactions.

23. Which of the following statements is false in relation to enzyme....

(A) pH affects their functioning. (B) temperature affects their functioning.

(C) they always increase activation energy. (D) their reactions are specific.

Ans. (C) they always increase activation energy.

24. A reaction is catalysed by 'X'. Here 'X'

(A) Decreases the rate constant of reaction.

(B) Does not affect the equilibrium constant of reaction.

(C) Decreases the enthalpy of reaction.

(D) Decreases the activation energy.

Ans. (D) Decreases the activation energy.

25. Which reaction characteristics are changing by the addition of a catalyst to a reaction at constant temperature.....

(i) Activation energy (ii) Equilibrium constant

(iii) Reaction entropy (iv) Reaction enthalpy

(A) (i) Only (B) (iii) only (C) (i) and (ii) only (D) All of these

Ans. (A) (i) Only

26. Rate of reaction....

(A) decreases with increase in temperature.

(B) increases with increase in temperature.

(C) may increase or decrease with increase in temperature.

(D) does not depend on temperature.

Ans. (C) may increase or decrease with increase in temperature.

27. In the first order reaction, the concentration of the reactant is reduced to 25% in one hour. The half life period of the reaction is...

(A) 2 hr. (B) 4 hr. (C) 1/2 hr. (D) 1/4 hr.

Ans. (C) 1/2 hr.

28. If a substance with half life 3 days is taken at other place in 12 days. What amount of substance is left now....

(A) 1/4 (B) 1/8 (C) 1/16 (D) 1/32

Ans. (C) 1/16

29. Which of the following statements regarding the molecularity of a reaction is wrong....

(A) it is the number of molecules of the reactants taking part in a single step chemical reaction.

(B) it is calculated from the reaction mechanism.

(C) it may be either a whole number or fractional.

(D) it depends on the rate determining step in the reaction.

Ans. (C) it may be either a whole number or fractional.

30. For a first order reaction, the half-life period is independent of....

(A) initial concentration.

(B) cube root of initial concentration.

(C) first power of final concentration.

(D) square root of final concentration.

Ans. (A) initial concentration.

31. For the reaction 3A → 2B. What will be the reaction rate with reference to B ?

(A) $-\frac{3}{2}\frac{d[A]}{dt}$

(B) $-\frac{2}{3}\frac{d[A]}{dt}$

(C) $-\frac{1}{3}\frac{d[A]}{dt}$

(D) $\frac{2d[A]}{dt}$

Ans. (B) $-\frac{2}{3}\frac{d[A]}{dt}$

➠ $3A \rightarrow 2B$

Reaction rate = $\frac{-1}{3}\frac{d[A]}{dt} = \frac{1}{2}\frac{d[B]}{dt}$

$\therefore \frac{d[B]}{dt} = -\frac{2}{3}\frac{d[A]}{dt}$

32. Which statement is correct with reference to Arrhenius equation $K = Ae^{-Ea/RT}$ A ?

(A) A is adsorbent coefficient

(B) E_a is a activation energy

(C) R is Rydberg constant

(D) K is equilibrium constant

Ans. (B) E_a is a activation energy

33. If the activation of forward reaction in a simple chemical reaction A → B is E_a, then what will be activation energy for reverse reaction ?

(A) $-E_a$

(B) Always less than E_a

(C) Always twice of E_a

(D) More or less than E_a

Ans. (D) More or less than E_a

34. The values of the rate constants of the reaction $C_2H_5I + OH^- \rightarrow C_2H_5OH + I^-$ at 30° and 60°C temperatures are 0.325 and 6.735 litre $mole^{-1}$ $second^{-1}$ than what will be the value of activation energy ?

(A) 20260 cal

(B) 20260 K cal

(C) 361.44 cal

(D) 84773 cal

Ans. (A) 20260 cal

➠ $\frac{\log K_2}{K_1} = \frac{E_a}{2.303R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)$

$\therefore \frac{\log 6.735}{0.325} = \frac{E_a}{2.303} \times 1.987 \left(\frac{1}{303} - \frac{1}{333}\right)$

$\therefore E_a = 20260$ cal

35. In a first order reaction, the concentration of the reactant, decreases from 0.8M to 0.4M in 15 minutes. The time taken for the concentration to change from 0.1M to 0.025M is....

(A) 7.5 minutes

(B) 15 minutes

(C) 30 minutes

(D) 60 minutes

Ans. (C) 30 minutes

36. Which is correct about zero order reaction....

(A) rate of reaction depends on decay constant.

(B) rate of reaction is independent of concentration.

(C) unit of rate constant is concentration^{-1}.

(D) unit of rate constant is concentration^{-1} time^{-1}.

Ans. (B) rate of reaction is independent of concentration.

37. The rate of reaction between two reactants A and B decreases by a factor of 4 if the concentration of reactant B is doubled. The order of this reaction with respect to reactant B is....

(A) –1 (B) –2 (C) 1 (D) 2

Ans. (B) –2

38. The rate of a reaction doubles when its temperature changes from 300 K to 310 K. Activation energy of such a reaction will be : (R = 8.314 JK^{-1} mol^{-1} and log 2 = 0.301)

(A) 53.6 kJ mol^{-1} (B) 48.6 kJ mol^{-1} (C) 58.5 kJ mol^{-1} (D) 60.5 kJ mol^{-1}

Ans. (A) 53.6 kJ mol^{-1}

39. For the non - stoichiometre reaction 2A + B → C + D, the following kinetic data were obtained in three separate experiments, all at 298 K.

Initial Concentration (A)	Initial Concentration (B)	Initial rate of formation of C (mol $L^{-}S^{-}$)
0.1 M	0.1 M	1.2×10^{-3}
0.1 M	0.2 M	1.2×10^{-3}
0.2 M	0.1 M	2.4×10^{-3}

The rate law for the formation of C is :

(A) $\frac{dc}{dt} = k[A]\,[B]^2$ (B) $\frac{dc}{dt} = k[A]$ (C) $\frac{dc}{dt} = k[A]\,[B]$ (D) $\frac{dc}{dt} = k[A]^2\,[B]$

Ans. (B) $\frac{dc}{dt} = k[A]$

➠ 2A + B → C + D

$$\text{Rate of Reaction} = \frac{-1}{2}\frac{d[A]}{dt} = -\frac{d[B]}{dt}$$

$$= \frac{d[C]}{dt} = \frac{d[D]}{dt}$$

➠ Let rate of Reaction = $k[A]^x[B]^y$

or $\frac{d[C]}{dt} = k[A]^x[B]^y$

➠ Now from table,

$1.2 \times 10^{-3} = k\ [0.1]^x[0.1]^y$ ......(i)

$1.2 \times 10^{-3} = k\ [0.1]^x[0.2]^y$ ......(ii)

$2.4 \times 10^{-3} = k\ [0.2]^x[0.1]^y$ ......(iii)

➠ Dividing equation (i) by (ii),

$$\frac{1.2 \times 10^{-3}}{1.2 \times 10^{-3}} = \frac{k[0.1]^x[0.1]^y}{k[0.1]^x[0.2]^y}$$

$\therefore \quad 1 = \left[\frac{1}{2}\right]^y \qquad \therefore y = 0$

➠ Now, Dividing equation (i) by (iii)

$$\frac{1.2 \times 10^{-3}}{2.4 \times 10^{-3}} = \frac{k[0.1]^x[0.1]^y}{k[0.2]^x[0.1]^y}$$

$\therefore \quad \left[\frac{1}{2}\right]^1 = \left[\frac{1}{2}\right]^x \quad \therefore x = 1$

➠ Hence $\frac{d[C]}{dt} = k[A]^1[B]^0$.

40. The rate constant of the reaction A → B is 0.6×10^{-3} mole per second. If the concentration of A is 5 M, then concentration of B after 20 minutes is :

(A) 0.36 M (B) 0.72 M (C) 1.08 M (D) 3.60 M

Ans. (B) 0.72 M

➠ For zero order reaction :

$x = K \cdot t = 0.6 \times 10^{-3} \times 20 \times 60 = 0.72$ M

41. Decomposition of H_2O_2 follows a first order reaction. In fifty minutes the concentration of H_2O_2 decreases from 0.5 to 0.125 M in one such decomposition. When the concentration of H_2O_2 reaches 0.05 M, the rate of formation of O_2 will be :

(A) 1.34×10^{-2} mol L^{-1} min^{-1} (B) 6.93×10^{-2} mol L^{-1} min^{-1}

(C) 6.93×10^{-4} mol L^{-1} min^{-1} (D) 2.66 L min^{-1} at STP

Ans. (C) 6.93×10^{-4} mol L^{-1} min^{-1}

➠ Here solution is given assuming unit of rate is the option to be $mol^{-1}L^{-1}$ min^{-1}.

➠ For first order reaction $K = \frac{1}{50} \ln \frac{0.5}{0.125}$

$$K = \frac{\ln 4}{50} \ min^{-1}$$

➠ Now $R = K[H_2O_2]^1$

$$= \left(\frac{\ln 4}{50}\right) \times 0.05 \ M \ min^{-1}$$

$$= 2 \times 0.693 \times 10^{-3} \ mol \ L^{-1} \ min^{-1}$$

and $H_2O_2 \rightarrow H_2O + \frac{1}{2} O_2$

➠ So rate of reaction,

$$R = \frac{R_{O_2} (\text{Rate of formation of } O_2)}{\left(\frac{1}{2}\right)}$$

or $R_{O_2} = \frac{1}{2}R = \frac{2 \times 0.693 \times 10^{-3}}{2}$ mol L^{-1} min^{-1}

$R_{O_2} = 6.93 \times 10^{-4}$ mol L^{-1} min^{-1}

42. The rate of a first-order reaction is 0.04 mol l^{-1} s^{-1} at 10 seconds and 0.03 mol l^{-1} s^{-1} at 20 seconds after initation of the reaction. The half life period of the reaction is....

(A) 34.1 s (B) 44.1 s (C) 54.1 s (D) 24.1 s

Ans. (D) 24.1 s

➠ $K = \frac{2.303}{10} \log \frac{0.04}{0.03} = \frac{2.303 \times 0.124}{10}$

$t_{\frac{1}{2}} = \frac{2.303 \times 0.3010 \times 10}{2.303 \times 0.124} = 24.27 \text{ second}$

43. Two reactions R_1 and R_2 have identical pre-exponential factors. Activation energy of R_1 exceeds that of R_2 by 10 kJ mol^{-1}. If k_1 and k_2 are rate constants for reactions R_1 and R_2 respectively at 300 K, then $ln(k_2/k_1)$ is equal to ...... ($R = 8.314$ J mol^{-1} K^{-1})

(A) 8 (B) 12 (C) 6 (D) 4

Ans. (D) 4

➠ $k_1 = Ae^{-\frac{Ea_1}{RT}}$; $k_2 = Ae^{\frac{-(Ea_1 - 10)}{RT}}$

$\ln\left[\frac{k_2}{k_1}\right] = \frac{10}{RT} = \frac{10}{8.314 \times 10^{-3} \times 300} = 4$

44. For the reaction, XA + YB → ZC, if

$\frac{-d[A]}{dt} = \frac{-d[B]}{dt} = \frac{1.5d[C]}{dt}$, then the correct statement among the following is ......

(A) the value of X = Y = Z = 3 (B) the value of X = Y = 3

(C) the value of X = 2 (D) the value of Y = 2

Ans. (B) the value of X = Y = 3

45. The correct difference between first and second order reactions is that...

(A) the rate of a first-order reaction does depend on reactant concentrations; the rate of a second-order reaction does not depend on reactant concentrations

(B) the rate of a first-order reaction does not depend on reactant concentrations; the rate of a second-order reaction does depend on reactant concentrations

(C) a first-order reaction can be catalyzed; a second-order reaction cannot be catalyzed

(D) the half-life of a first-order reaction does not depend on $[A]_0$ the half-life of a second-order reaction does depend on $[A]_0$.

Ans. (D) the half-life of a first-order reaction does not depend on $[A]_0$ the half-life of a second-order reaction does depend on $[A]_0$.

➠ Half life time of a first order reaction $(t_{1/2}) = \frac{0.693}{K}$

➠ Half life time of a second order reaction $(t_{1/2})$; $t_{1/2} \propto \frac{1}{[A_0]}$

46. Initial chemicial reaction $A_2 \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} 2A$, then $\frac{d[A]}{dt}$ = ...

(A) $k_1 [A_2] - k_{-1} [A]^2$ (B) $2k_1 [A_2] - k_{-1} [A]^2$ (C) $2k_1 [A_2] - 2k_{-1} [A]^2$ (D) $k_1 [A_2] + k_{-1} [A]^2$

Ans. (C) $2k_1 [A_2] - 2k_{-1} [A]^2$

➠ Rate $= \frac{-d[A_2]}{dt} = \frac{1}{2}\frac{d[A]}{dt}$

Rate $= k_1 [A_2] - k_{-1} [A]^2$

$\therefore \frac{1}{2}\frac{d[A]}{dt} = k_1 [A_2] - k_{-1} [A]^2$

$\therefore \frac{d[A]}{dt} = 2k_1 [A_2] - 2k_{-1} [A]^2$

47. For the chemical reaction, $N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$ what is the correct option ?

(A) $3\frac{d[H_2]}{dt} = 2\frac{d[NH_3]}{dt}$ (B) $-\frac{1}{3}\frac{d[H_2]}{dt} = -\frac{1}{2}\frac{d[NH_3]}{dt}$

(C) $-\frac{d[N_2]}{dt} = 2\frac{d[NH_3]}{dt}$ (D) $-\frac{d[N_2]}{dt} = \frac{1}{2}\frac{d[NH_3]}{dt}$

Ans. (D) $-\frac{d[N_2]}{dt} = \frac{1}{2}\frac{d[NH_3]}{dt}$

➠ $N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$ for reaction,

Rate constant = $\frac{-d[N_2]}{dt} = -\frac{1}{3}\frac{d[H_2]}{dt} = +\frac{1}{2}\frac{d[NH_3]}{dt}$

48. If the rate constant for a first order reactions K, the time (t) required for the completion of 99% of the reaction is given by :

(A) $t = 2.303/k$ (B) $t = 0.693/k$ (C) $t = 6.909/k$ (D) $t = 4.606/k$

Ans. (D) $t = 4.606/k$

➠ When 99% reaction is completed,

$$[R]_t = \left(\frac{100-99}{100}\right)[R]_o$$

$$t = \frac{2.303}{K}\log\frac{[R]_o}{[R]_t}$$

$$\therefore\ t = \frac{2 \times 303}{K}\log\frac{[R]_o}{\left(\frac{100-99}{100}\right)[R]_o}$$

$$t = \frac{2.303}{K}\log 100 = \frac{2.303}{K}\log 10^2$$

$$t = \frac{2.303}{K} \cdot 2\log 10$$

$$t = \frac{2.303 \times 2}{K}\quad [\because \log 10 = 1]$$

$$t = \frac{4.606}{K}$$

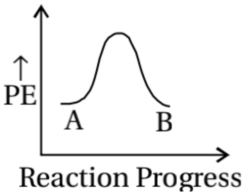
49. An increase in the concentration of the reactants of a reaction leads to change in :

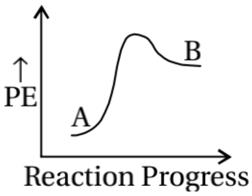
(A) threshold energy (B) collision frequency (C) activation energy (D) heat of reaction

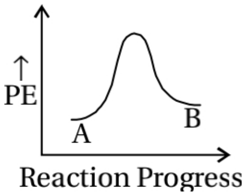
Ans. (B) collision frequency

➠ The rate of chemical reaction depends on the number of collision happening between molecules per unit volume in per unit time.

50. For a reaction A → B, enthalpy of reaction is –4.2 kJ mol^{-1} and enthalpy of activation is 9.6 kJ mol^{-1}. The correct potential energy profile for the reaction is shown in option.

(A)


(B)


(C)


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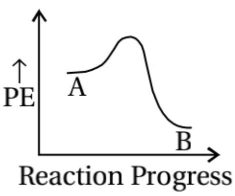
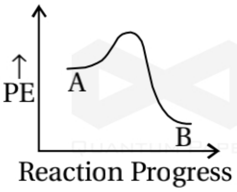
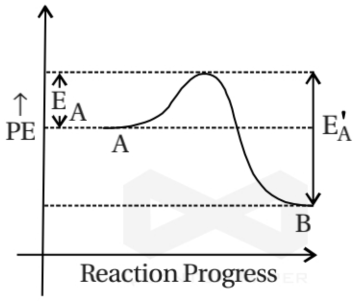


Ans. (D)



➠



➠ $\Delta H = E_A - E'_A$

$E_A < E'_A \Rightarrow \Delta H = -$**Ve** $E_A < E'_A$

Option (D) has $E_A < E'_A$

51. The slope of Arrhenius plot $\left(\ln k \text{ v/s } \frac{1}{T}\right)$ of first order reaction is -5×10^3 K. The value of Ea of the reaction is : Choose the correct option for your answer. [Given R = 8.314 J K^{-1} mol^{-1}]

(A) 166 kJ mol^{-1} (B) –83 kJ mol^{-1} (C) 41.5 kJ mol^{-1} (D) 83.0 kJ mol^{-1}

Ans. (C) 41.5 kJ mol^{-1}

➠ For first order kinetics, lnk v/s $\frac{1}{T}$ The plot has a negative slope, $\frac{-E_A}{R}$.

Therefore, $\frac{-E_A}{R} = -5 \times 10^3$

$E_A = R \times 5 \times 10^3$

$= 8.314 \times 5 \times 10^3$

$= 41.5 \times 10^3$ J mol^{-1} = 41.5 kJ mol^{-1}

52. For a first order reaction A → Products, initial concentration of A is 0.1 M, which becomes 0.001 M after 5 minutes. Rate constant for the reaction in min^{-1} is

(A) 0.4606 (B) 0.2303 (C) 1.3818 (D) 0.9212

Ans. (D) 0.9212

➠ $[R]_0 = 0.1M$, $t = 5$ min, $[R]_t = 0.001M$

$$K = \frac{2.303}{t} \log \frac{[R]_0}{[R]_t} = \frac{2.303}{5} \log \frac{0.1}{0.001}$$

$$= 0.4606 \log \frac{10^{-1}}{10^{-3}}$$

$$= 0.4606 \log 10^2$$

$$= 0.4606 \times 2 \log 10$$

$K = 0.9212$ min^{-1}

53. Total order of reaction X + Y → XY is 3. The order of reaction with respect to X is 2. State the differential rate equation for the reaction.

(A) $-\frac{d[X]}{dt} = K[X]^3[Y]^0$ (B) $-\frac{d[X]}{dt} = K[X]^0[Y]^3$ (C) $-\frac{d[X]}{dt} = K[X]^2[Y]$ (D) $-\frac{d[X]}{dt} = K[X][Y]^2$

Ans. (C) $-\frac{d[X]}{dt} = K[X]^2[Y]$

54. $X \xrightarrow{\text{Step-I}} Y \xrightarrow{\text{Step-II}} Z$ is a complex reaction. Total order of reaction is 2 and step-II is slow step. What is molecularity of Step-II ?

(A) 1 (B) 2 (C) 3 (D) 4

Ans. (B) 2

55. Reaction $3ClO^- \rightarrow ClO^-_3 + 2Cl^-$ occurs in following two steps.

(i) $ClO^- + ClO^- \xrightarrow{K_1} ClO_2^- + Cl^-$ (Slow step)

(ii) $ClO_2^- + ClO^- \xrightarrow{K_2} ClO_3^- + Cl^-$ (Fast step)

then the rate of given reaction = ...

(A) $K_1[ClO^-]^2$ (B) $K_1[ClO^-]$ (C) $K_2[ClO^-_2]\ [ClO^-]$ (D) $K_2[ClO^-]^3$

Ans. (A) $K_1[ClO^-]^2$

56. How much time is required for completion of a zero order reaction ?

(A) $\frac{2[R_o]}{K}$ (B) $\frac{[R_o]}{2K}$ (C) $\frac{[R_o]}{K}$ (D) $\frac{K}{[R_o]}$

Ans. (C) $\frac{[R_o]}{K}$

57. Time taken for consumption of half of the initial concentration is 20 seconds for a first order reaction. What will be the time taken by the same reaction to get the concentration of reactant from 0.125 M to 0.0625 M.

(A) 5 sec. (B) 20 sec. (C) 10 sec. (D) 40 sec.

Ans. (B) 20 sec.

58. At 298 K temperature the activation energy for the reaction $X_2 + Y_2 \rightarrow 2XY + 20$ KJ is 15 KJ. What will be the activation energy for the reaction $2XY \rightarrow X_2 + Y_2$?

(A) +35 KJ (B) –35 KJ (C) –5 KJ (D) –15 KJ

Ans. (A) +35 KJ

➠ $\Delta_R H = \begin{pmatrix}\text{Activation}\\ \text{energy of}\\ \text{forward reaction}\end{pmatrix} - \begin{pmatrix}\text{Activation}\\ \text{energy of}\\ \text{reverse reaction}\end{pmatrix}$

$\therefore\ -20 = 15 - x$

$\therefore\ x = 35$ KJ

59. The rate constant value for a reaction is $1.75 \times 10^2\ L^2\ mol^{-2}\ sec^{-1}$. The half life period $t_{1/2}\ \alpha$ ....

(A) $[R_o]^{-2}$ (B) $[R_o]$ (C) $[R_o]^2$ (D) $[R_o]^{-1}$

Ans. (A) $[R_o]^{-2}$

➠ $K = 1.75 \times 10^2\ L^2\ mol^{-2}\ sec.^{-1}$

➠ According to the unit of K, it indicates 3rd order reaction, so half life time.

$t_{1/2} \propto [R_o]^{1-n}$

$\therefore\ [R_o]^{-2}$

60. The half life period for a radioactive substance is 15 minutes. How many gms of this radioactive substance is decayed from 50 gm of substance after one hour ?

(A) 25 (B) 46.875 (C) 43.75 (D) 37.5

Ans. (B) 46.875

➠ Method-I : $\text{Ao} \xrightarrow{15} \frac{\text{Ao}}{2} \xrightarrow{30} \frac{\text{Ao}}{4} \xrightarrow{45} \frac{\text{Ao}}{8} \xrightarrow{60} \frac{\text{Ao}}{16}$

After 60 min, $\frac{50}{16} = 3.125$ gram substance remains.

$\therefore$ 50 – 3.125 = 46.875 gram substance decay.

➠ Method-II : Radioactive reactions are always first order reaction.

$$\therefore\ t_{\frac{1}{2}} = \frac{0.693}{K}$$

$$\therefore\ K = \frac{0.693}{t_{\frac{1}{2}}} = \frac{0.693}{15} = 0.0462 \text{ minute}^{-1}$$

$$\text{Now } K = \frac{2.303}{t} \log \frac{[R]_O}{[R]_t}$$

$$0.0462 = \frac{2.303}{60} \log \frac{50}{[R]_t}$$

$$\therefore\ \log 50 - \log [R]_t = \frac{0.0462 \times 60}{2.303}$$

$$1.6989 - \log [R]_t = 1.2036$$

$$\therefore\ \log [R]_t = 1.6989 - 1.2036$$

$$\log [R]_t = 0.495$$

$$[R]_t = \text{antilog } 0.495 \approx 3.12$$

$\therefore$ 50 – 3.12 ≈ 46.875 gram substance decay.

61. The values of slope and intercept in the graph of Freundlich adsorption isotherm at 25°C temperature are 0.5 and 0.4771 respectively. What will be the propertion of adsorption at 4 bar pressure ?

(A) 6 (B) 3 (C) 24 (D) 12

Ans. (A) 6

➠ $\log \frac{x}{m} = \log k + \frac{1}{n} \log p$ Here, $\log k = 0.4771$

$$\therefore\ \frac{x}{m} = (3)\ (4)^{0.5} = 3 \times (4)^{\frac{1}{2}} \qquad \therefore\ k = 3$$

$$= 3 \times \sqrt{4} = 3 \times 2 = 6 \qquad \frac{1}{n} = 0.5$$

62. Instantaneous rate of reaction for the reaction 3A + 2B → 5C is ....

(A) $+\frac{1}{3}\frac{d[A]}{dt} = -\frac{1}{2}\frac{d[B]}{dt} = +\frac{1}{5}\frac{d[C]}{dt}$

(B) $-\frac{1}{3}\frac{d[A]}{dt} = -\frac{1}{2}\frac{d[B]}{dt} = +\frac{1}{5}\frac{d[C]}{dt}$

(C) $+\frac{1}{3}\frac{d[A]}{dt} = +\frac{1}{2}\frac{d[B]}{dt} = -\frac{1}{5}\frac{d[C]}{dt}$

(D) $+\frac{1}{3}\frac{d[A]}{dt} = -\frac{1}{2}\frac{d[B]}{dt} = -\frac{1}{5}\frac{d[C]}{dt}$

Ans. (B) $-\frac{1}{3}\frac{d[A]}{dt} = -\frac{1}{2}\frac{d[B]}{dt} = +\frac{1}{5}\frac{d[C]}{dt}$

➠ $3A + 2B \longrightarrow 5C$

Reaction rate $= -\frac{1}{3}\frac{d[A]}{dt} = -\frac{1}{2}\frac{d[B]}{dt} = +\frac{1}{5}\frac{d[C]}{dt}$

63. Time required to decompose SO_2Cl_2 to half of its initial amount is 40 minutes. If the decomposition is a first order reaction, what will be the rate constant of the reaction ?

(A) $1.73 \times 10^{-2}\ s^{-1}$ (B) $2.88 \times 10^{-2}\ s^{-1}$ (C) $2.88 \times 10^{-4}\ s^{-1}$ (D) $1.73 \times 10^{-4}\ s^{-1}$

Ans. (C) $2.88 \times 10^{-4}\ s^{-1}$

➠ $t_{\frac{1}{2}} = 40$ minute $= 40 \times 60$ s $= 2400$ seconds

➠ For the first order reaction,

$$K = \frac{0.693}{t_{\frac{1}{2}}} = \frac{0.693}{2400} = 0.000288$$

$\therefore\ K = 2.88 \times 10^{-4}\ s^{-1}$

64. For a reaction, $K = 4.5 \times 10^{-4}\ L\ mol^{-1}\ s^{-1}$. What is order of reaction ?

(A) Zero (B) First (C) Second (D) Third

Ans. (C) Second

➠ $K = 4.5 \times 10^{-4}\ L\ mol^{-1}\ s^{-1}$

Unit of K is $L\ mol^{-1}\ s^{-1}$, which shows that given reaction is of second order

65. For first order reaction, the value of slope for graph of $\log \frac{[R]_0}{[R]} \rightarrow t$ is ......

(A) $\frac{K}{2.303}$ (B) $-K$ (C) $\frac{2.303}{K}$ (D) $-\frac{K}{2.303}$

Ans. (A) $\frac{K}{2.303}$

➠ For the first order reactions,

$\log \frac{[R]_0}{[R]} = \frac{K}{2.303}$ is comparing with $y = mx + C$

$m = \frac{K}{2.303}$ will be obtain.

66. For the first order reaction, what is slope of the plot $\log \frac{[R]_0}{[R]}$ vs time ?

(A) $-K$ (B) $\frac{K}{2.303}$ (C) $-\frac{K}{2.303}$ (D) $\frac{2.303}{K}$

Ans. (B) $\frac{K}{2.303}$

67. What is the correct formula for R → P reaction rate ?

(A) $\frac{-\Delta[R]}{t} = \frac{-\Delta[P]}{t}$ (B) $\frac{-\Delta[R]}{\Delta t} = \frac{\Delta[P]}{\Delta t}$ (C) $\frac{-[R]}{t} = \frac{\Delta[P]}{\Delta t}$ (D) $\frac{-\Delta[R]}{\Delta t} = \frac{\Delta t}{\Delta[P]}$

Ans. (B) $\frac{-\Delta[R]}{\Delta t} = \frac{\Delta[P]}{\Delta t}$

68. If graph $\log K \rightarrow \frac{1}{T}$ is plotted, a straight line is obtained then what will be value of slope ?

(A) $\frac{E_a}{2.303R}$ (B) $\frac{-E_a}{3.203R}$ (C) $\frac{-2.303R}{E_a}$ (D) $\frac{-E_a}{2.303R}$

Ans. (D) $\frac{-E_a}{2.303R}$

69. The half reaction time required to decrease initial concentration from 40% to 20% is 20 minute. What time will be taken to decrease initial concentration from 10% to 5% ?

(A) 20 minute (B) 5 minute (C) 10 minute (D) 60 minute

Ans. (A) 20 minute

70. What will be the theoretical rate of elementary reaction if pressure of O_2 is increased by three times ? $2SO_{2(g)} + O_{2(g)} \rightarrow 2SO_{3(g)}$

(A) 27 times increase (B) 9 times increase (C) 18 times increase (D) 3 times increase

Ans. (D) 3 times increase

71. If energy of activation of a reaction is 2303 Joule, then what is the value of slope of graph $\log K \rightarrow \frac{1}{T}$?

(A) –12195.12 Joule (B) –503.27 Joule (C) –120.28 Joule (D) –239.0 Joule

Ans. (C) –120.28 Joule

72. For any chemical reaction, value of slope of $\ln K \rightarrow \frac{1}{T}$ graph will be.....

(A) $-\frac{E_a}{2.303}$ (B) $-\frac{E_a}{R}$ (C) $-\frac{E_a}{2.303\,R}$ (D) $-E_a$

Ans. (B) $-\frac{E_a}{R}$

73. In elementary reaction : $2SO_{2(g)} + O_{2(g)} \rightarrow$ product. If pressure of SO_2 gas is doubled and pressure of O_2 gas is halved, then what will be the increase in rate of reaction ?

(A) Sixteen times (B) Two times (C) Four times (D) Eight times

Ans. (B) Two times

74. Which of the following statement is not appropriate ?

(A) Activated complex is short lived molecule.

(B) Activated complex breaks due to its oscillation motion.

(C) Activated complex possesses very weak bonds.

(D) Activated complex possesses minimum potential energy.

Ans. (D) Activated complex possesses minimum potential energy.

75. For the first order reaction, the time required for completion of 50% reaction is 100 seconds. Then the rate constant will be...

(A) 6.93×10^{-3} mol^2 lit^{-2} s^{-1} (B) 6.93×10^{-3} s^{-1}

(C) 6.93×10^{-3} mol lit^{-1} s^{-1} (D) 6.93×10^{-2} s^{-1}

Ans. (B) 6.93×10^{-3} s^{-1}

76. For which of the following reactions, Oswald's isolation method is useful for determination of order of the reaction ?

(A) $N_2O_{5(g)} \rightarrow 2NO_{2(g)} + \frac{1}{2}O_{2(g)}$ (B) $H_2O_{2(l)} \rightarrow H_2O_{(l)} + \frac{1}{2}O_{2(g)}$

(C) $-\frac{K}{2.303} + BrO^-_{3(aq)} + 6H^+_{(aq)} \rightarrow 3Br_{2(aq)} + 3H_2O_{(l)}$ (D) All the three given options.

Ans. (C) $-\frac{K}{2.303} + BrO^-_{3(aq)} + 6H^+_{(aq)} \rightarrow 3Br_{2(aq)} + 3H_2O_{(l)}$

77. With the help of which graph the value of Arrhenius constant can be obtained from Arrhenius equation : $K = A \cdot e^{-E_a/RT}$

(A) $\log K$ versus $\frac{1}{\log T}$ (B) K versus $\frac{1}{\log T}$ (C) $\log K$ versus $\frac{1}{T}$ (D) K versus T

Ans. (C) $\log K$ versus $\frac{1}{T}$

78. Which is correct relation for half life period ($t½$) and Initial concentration of reactant $[R]_0$ for fourth order reaction.

(A) $t_{1/2} \propto \frac{1}{[R]_0^{-3}}$ (B) $t_{1/2} \propto \frac{1}{[R]_0}$ (C) $t_{1/2} \propto \frac{1}{[R]_0^3}$ (D) $t_{1/2} \propto [R]_0$

Ans. (C) $t_{1/2} \propto \frac{1}{[R]_0^3}$

79. The order of following reaction is ....

$$H_{2(g)} + Cl_{2(g)} \xrightarrow{hv} 2HCl_{(g)}$$

(A) 2 (B) 1 (C) 1.5 (D) 0

Ans. (D) 0

80. $3ClO^- \rightarrow ClO^-_3 + 2Cl$ The rate of reaction of above reaction is given by ....

(A) $K_1[ClO^-]$ (B) $K_1[Cl^-]^2$ (C) $K_1[ClO_2^-]$ (D) $K_1[ClO^-]^2$

Ans. (D) $K_1[ClO^-]^2$

81. Which of the following relation is correct for zero order reaction ?

(A) $t_{\frac{1}{2}} \propto \frac{1}{[R]_0}$ (B) $t_{\frac{1}{2}} \propto [R]_0$

(C) $t_{\frac{1}{2}} \propto \frac{1}{[R]_0^2}$ (D) $t_{\frac{1}{2}}$ is independent of $[R]_0$

Ans. (B) $t_{\frac{1}{2}} \propto [R]_0$

82. For the reaction 2A + B → product, $-\frac{d[A]}{dt} = K\,[A]^2[B]$. What will be the rate equation for $-\frac{d[B]}{dt}$?

(A) $K[2A]^2[B]$ (B) $\frac{1}{2}K[A]^2[B]$ (C) $K[A][B]^2$ (D) $K[A][B]^{\frac{1}{2}}$

Ans. (B) $\frac{1}{2}K[A]^2[B]$

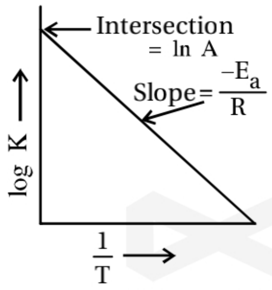
83. What is the value of slope of graph $\log_{10} K \rightarrow \frac{1}{T}$?

(A) $-\frac{k}{2.303}$ (B) $-\frac{E_a}{2.303R}$ (C) $-\frac{E_a}{R}$ (D) $-k$

Ans. (B)

➠ According to Arrhenius,

$k = e^{-Ea/RT}$



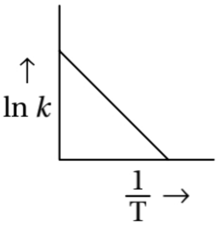
$$\therefore \ln k = -\frac{E_a}{R} + \ln A$$

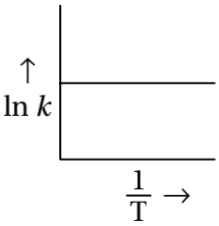
$$\therefore \underbrace{\log k}_{y} = \underbrace{\frac{E_a}{2.303R}}_{m} \underbrace{\left(\frac{1}{T}\right)}_{x} + \underbrace{A}_{c}$$

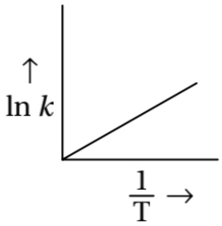
$\therefore$ If the graph of $\log k \rightarrow \frac{1}{T}$ is to be drawn then,

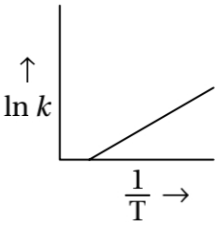
Slope = $-\frac{E_a}{2.303R}$ and intersection = A.

84. Which of the following graph for $\ln k \rightarrow \frac{1}{T}$ is correct ?

(A) 

(B) 

(C) 

(D) 

Ans. (A)

➠ $k = A\, e^{-E_a/RT}$

$\therefore \ln k = \ln (A\, e^{-E_a/RT})$

$\therefore \ln k = \ln A - \frac{E_a}{RT}$

$$\therefore \underbrace{\ln k}_{y} = \underbrace{\ln A}_{c} + \underbrace{\frac{1}{T}}_{x}\underbrace{\left(-\frac{E_a}{R}\right)}_{m}$$

➠ this equation A is of linear equation, $y = mx + c$ in which slope = $-\frac{E_a}{R}$ and intercept = $\ln k$

85. The decomposition of NH_3 on platinum surface is zero order reaction. What is the rate of production of N_2 if $K = 2.5 \times 10^{-4}$ mol L^{-1} S^{-1} ?

(A) 2.5×10^{-4} mol L^{-1} s^{-1}
(B) 8.3×10^{-5} mol L^{-1} s^{-1}
(C) 7.5×10^{-4} mol L^{-1} s^{-1}
(D) 5×10^{-4} mol L^{-1} s^{-1}

Ans. (A) 2.5×10^{-4} mol L^{-1} s^{-1}

➠ For zero order reaction,

Rate = K $[\text{reactant}]^0$

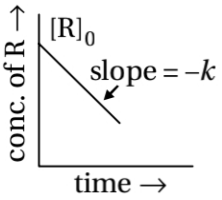
$= K \times 1 = K = 2.5 \times 10^{-4}$ mol L^{-1} s^{-1}

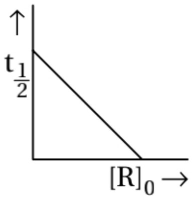
86. The role of catalyst is to change ....

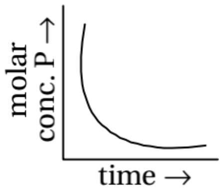
(A) Gibbs energy of reaction.
(B) Enthalpy of reaction.
(C) Equilibrium constant of the reaction.
(D) Activation energy of the reaction.

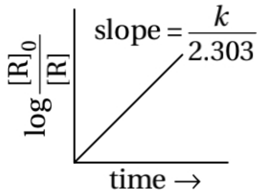
Ans. (D) Activation energy of the reaction.

87. Which of the following graph is correct for a first order reaction ?

(A) 

(B) 

(C) 

(D) 

Ans. (D)

➠ The equation for the first order reaction is given by : $\log \frac{[R]_0}{[R]} = \frac{kt}{2.303}$

➠ Comparing the equation with $y = mx + c$, the slope of the plot is given by :

$m = \frac{k}{2.303}$ and intercept $c = 0$

88. A first order reaction is found to have a rate constant, $K = 5.5 \times 10^{-14}\ s^{-1}$. The half life of reaction is ………… .

(A) 1.26×10^{14} s (B) 6.93×10^{14} s (C) 1.26×10^{13} s (D) 12.6×10^{15} s

Ans. (C) 1.26×10^{13} s

➠ $K = 5.5 \times 10^{-14}\ s^{-1}$

For the first order reaction $t_{½} = \frac{0.693}{K}$

$= \frac{0.693}{5.5 \times 10^{-14}}$

$= 0.126 \times 10^{14}$

$t_{½} = 1.26 \times 10^{13}$ s

89. What is the wrong equation of rate constant for zero order reaction ?

(A) $[R] = -Kt + [R]_0$ (B) $-K = \frac{[R]-[R]_0}{t}$ (C) $K = \frac{[R]_0 - [R]}{t}$ (D) $[R]_0 + [R] = -Kt$

Ans. (D) $[R]_0 + [R] = -Kt$

➠ For the zero order reaction $K = \frac{[R]_0 - [R]}{t}$ holds true.

$\therefore$ $[R]_0 + [R] = -Kt$ equation is incorrect.

90. What is the unit of rate constant of the second order reaction ?

(A) $mol\ L^{-1}s^{-1}$ (B) $mol^{-1}\ Ls^{-1}$ (C) s^{-1} (D) $mol^{-2}\ L^{+2}s^{-1}$

Ans. (B) $mol^{-1}\ Ls^{-1}$

91. What is the slope of graph of $\ln k \rightarrow \frac{1}{r}$?

(A) $-\frac{E_a}{R}$ (B) $\frac{-2.303\ E_a}{R}$ (C) $-\frac{R}{E_a}$ (D) $\frac{-2.303R}{E_a}$

Ans. (A) $-\frac{E_a}{R}$

92. Which of the following is bimolecular reaction ?

(A) $N_2 + 3H_2 \rightarrow 2NH_3$ (B) $2NH_3 \rightarrow N_2 + 3H_2$

(C) $NH_4NO_2 \rightarrow N_2 + 2H_2O$ (D) $2NO + O_2 \rightarrow 2NO_2$

Ans. (B) $2NH_3 \rightarrow N_2 + 3H_2$

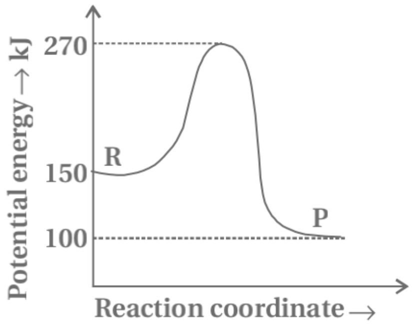
93. What will be the unit of rate constant for following reaction ?

$C_2H_{4(g)} + H_{2(g)} \rightarrow C_2H_{6(g)}$

(A) $mol^{-1}\ L\ S^{-1}$ (B) S^{-1} (C) $mol\ L^{-1}\ S^{-1}$ (D) $mol^{-2}\ L^2\ S^{-1}$

Ans. (B) S^{-1}

94. For R → P reaction, following graph is given.



What will be enthalpy change for the given reaction ?

(A) –50 kJ (B) 50 kJ (C) 120 kJ (D) 170 kJ

Ans. (A) –50 kJ

➠ $\Delta H = E_a - E'_a$

$= (270 - 150) - (270 - 100)$

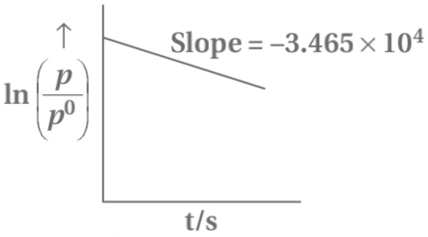
$= 120 - 170$

$= -50$ kg

//X

● **[1]**

1. For the decomposition of azomethane. $CH_3N_2CH_{3(g)} \rightarrow CH_3CH_{3(g)} + N_{2(g)}$ a first order reaction, the variation in partial pressure with time at 600 K is given as



The half life of the reaction is .... $\times 10^{-5}$ s. [Nearest integer]

➠ 2

➠ For a first order reaction $k = \frac{1}{t} \ln\left[\frac{P_0}{P}\right]$

$$\ln\left[\frac{P_0}{P}\right] = kt$$

$$t_2 = \frac{\ln 2}{k} = \frac{0.693}{3.465 \times 10^4} = 2 \times 10^{-5} \text{ s}$$