

Chemical Kinetics Important Questions With Answers

NEET Chemistry 2023

1. 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

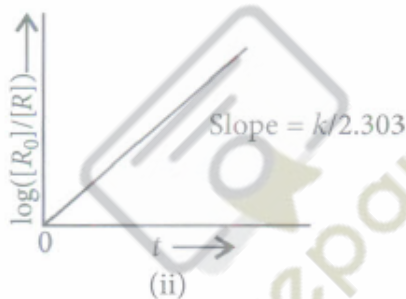
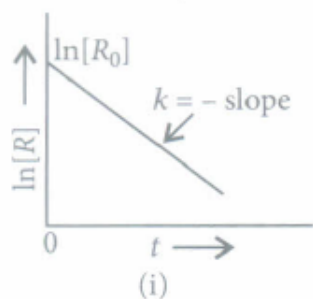
**Solution : -**

For  $t_{1/2}$  of first order reaction

$$t_{1/2} = \frac{0.693}{k}$$

i.e., independent of initial concentration of the reactant.

2. Observe the given graphs carefully.



Which of the given orders are shown by the graphs respectively?

a)

(i)	(ii)
First order	First order

b)

(i)	(ii)
Second order	Zero order

c)

(i)	(ii)
Zero order	First order

d)

(i)	(ii)
First order	Zero order

3. The activation energy for a simple chemical reaction  $A + B \rightarrow E_a$  in forward direction. The activation energy for reverse reaction

a) Is always double of  $E_a$     b) Is negative of  $E_a$     c) Is always less than  $E_a$

**d) Can be less than or more than  $E_a$**

**Solution : -**

The activation energy of reverse reaction will depend upon whether the forward reaction is exothermic or endothermic.

$$\text{As } \Delta H = E_{a(\text{forward reaction})} - E_{a(\text{backward reaction})}$$

For exothermic reaction

$$\Delta H = -ve$$

$$\therefore -\Delta H = E_{a(f)} - E_{a(b)}$$

$$\text{or } E_{a(f)} = E_{a(b)} - \Delta H$$

$$\therefore E_{a(f)} < E_{a(b)}$$

for endothermic reaction

$$\Delta H = +ve$$

$$\therefore \Delta H = E_{a(f)} + E_{a(b)} \text{ or } E_{a(f)} = \Delta H + E_{a(b)}$$

$$\therefore E_{a(f)} > E_{a(b)}$$

4. Rate of a general reaction  $A + B \rightarrow \text{products}$  can be expressed as follows on the basis of collision theory  $\text{Rate} = ZABe^{-E_a/RT}$ .

Which of the following statements is not correct for the above expression?

a)

Z is collision frequency and is equal to number of collisions per second per unit volume of the reaction mixture

b)  $e^{-E_a/RT}$  is the fraction of molecules with kinetic energy equal to or greater than  $E_a$

c)  $E_a$  is activation energy of the reaction

**d) All the molecules which collide with one other are effective collisions**

**Solution : -**

Only those collisions in which molecules collide with sufficient energy, called threshold energy and proper orientation are effective collisions. Rest of the molecules collide and bounce back.

5. For a chemical reaction,  $X \rightarrow Y$ , the rate of reaction increases by a factor of 1.837 when the concentration of X is increased by 1.5 times, the order of the reaction with respect to X is

a) 1    **b) 1.5**    c) 2    d) 2.5

**Solution : -**

$$\text{Initially rate } (r_1) = k[X]^n \quad \dots (i)$$

(let n be the order of reaction)

$$\text{then, } r_1 \times 1.837 = k(1.5 X)^n \quad \dots (ii)$$

dividing (ii) by (i)

$$1.837 = (1.5)^n$$

$$\therefore n = 1.5$$

Thus, order of reaction is 1.5.

6. The number of molecules of the reactants taking part in a single step of the reaction is indicative of
- a) order of a reaction    b) molecularity of a reaction    **c) fast step of the mechanism of a reaction**  
d) half-life of the reaction

7.  $3A \rightarrow 2B$ , rate of reaction  $+\frac{d[B]}{dt}$  is equal to :

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

**Solution : -**

For the reaction  $3A \rightarrow 2B$

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

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

8. The temperature dependence of the rate of a chemical reaction is given by Arrhenius equation,  $k = Ae^{-E_a/RT}$ . Which of the following graphs will be a straight line?

a)  $\ln A$  vs  $1/T$     b)  $\ln A$  vs  $E_a$     **c)  $\ln k$  vs  $1/T$**     d)  $\ln k$  vs  $-E_a/R$

9. The increase in concentration of the reactants lead to change:

a)  $\Delta H$     **b) collision frequency**    c) activation energy    d) equilibrium constant

**Solution : -**

As the concentration of reactants increases the probability of collisions increases hence collision frequency increases.

10. A first order reaction is 20% complete in 10 minutes. What is the specific rate constant for the reaction?
- a)  $0.0970 \text{ min}^{-1}$     b)  $0.009 \text{ min}^{-1}$     **c)  $0.0223 \text{ min}^{-1}$**     d)  $2.223 \text{ min}^{-1}$

**Solution : -**

$$a-x = \frac{80}{100} \times a = 0.8a, t = 10 \text{ min}$$

$$k = \frac{2.303}{t} \log \frac{a}{a-x} = \frac{2.303}{10} \log \frac{a}{0.8a}$$

$$= k = 0.2303 \log \frac{10}{8} = 0.2303(1 - 0.9030)$$

$$= 0.2303 \times 0.0970 = 0.0223 \text{ min}^{-1}$$

11. The rate constant for the reaction,  $2\text{N}_2\text{O}_5 \rightarrow 4\text{NO}_2 + \text{O}_2$  is  $2 \times 10^{-5} \text{ s}^{-1}$ . If rate of reaction is  $1.4 \times 10^{-5} \text{ mol L}^{-1} \text{ s}^{-1}$ , what will be the concentration of  $\text{N}_2\text{O}_5$  in  $\text{mol L}^{-1}$ ?

a) 0.8    **b) 0.7**    c) 1.2    d) 1

**Solution : -**

Rate =  $k[\text{N}_2\text{O}_5]$  (first order as unit of rate constant is  $\text{s}^{-1}$ ).

$$[\text{N}_2\text{O}_5] = \frac{\text{rate}}{k} = \frac{1.4 \times 10^{-5} \text{ mol L}^{-1} \text{ s}^{-1}}{2 \times 10^{-5} \text{ s}^{-1}} = 0.7 \text{ mol L}^{-1}$$

12. In a zero-order reaction for every  $10^\circ$  rise of temperature, the rate is doubled. If the temperature is increased from  $10^\circ\text{C}$  to  $100^\circ\text{C}$ , the rate of the reaction will become:

a) 256 times    **b) 512 times**    c) 64 times    d) 128 times

**Solution : -**

Rate of the reaction

$$= \frac{r_{100^\circ\text{C}}}{r_{10^\circ\text{C}}} = 2^{\left(\frac{100-10}{10}\right)} = 2^9 = 512 \text{ times}$$

13. The rate of the reaction:

$\text{CH}_3\text{COOC}_2\text{H}_5 + \text{NaOH} \rightarrow \text{CH}_3\text{COONa} + \text{C}_2\text{H}_5\text{OH}$  is given by the equation,

$$\text{rate} = k[\text{CH}_3\text{COOC}_2\text{H}_5][\text{NaOH}]$$

If concentration is expressed in  $\text{mol/L}$ , the units of  $k$  are

a)  $\text{mol}^{-2} \text{ L}^2 \text{ s}^{-1}$     b)  $\text{mol L}^{-1} \text{ s}^{-1}$     **c)  $\text{L mol}^{-1} \text{ s}^{-1}$**     d)  $\text{s}^{-1}$

**Solution : -**

For a second order reaction,  $\frac{dx}{dt} = k[A]^2$

$$\frac{\text{conc}}{\text{time}} = k[\text{conc.}]^2$$

$$\frac{\text{mol L}^{-1}}{\text{s}} = k \text{ mol L}^{-1} \times \text{mol L}^{-1}$$

$$k = \text{L mol}^{-1} \text{ s}^{-1}$$

14. For the reaction,  $2\text{A} + \text{B} \rightarrow 3\text{C} + \text{D}$  which of the following does not express the reaction rate?

**a)  $-\frac{d[\text{C}]}{3 dt}$**     b)  $-\frac{d[\text{B}]}{dt}$     c)  $\frac{d[\text{D}]}{dt}$     d)  $-\frac{d[\text{A}]}{2 dt}$

**Solution : -**

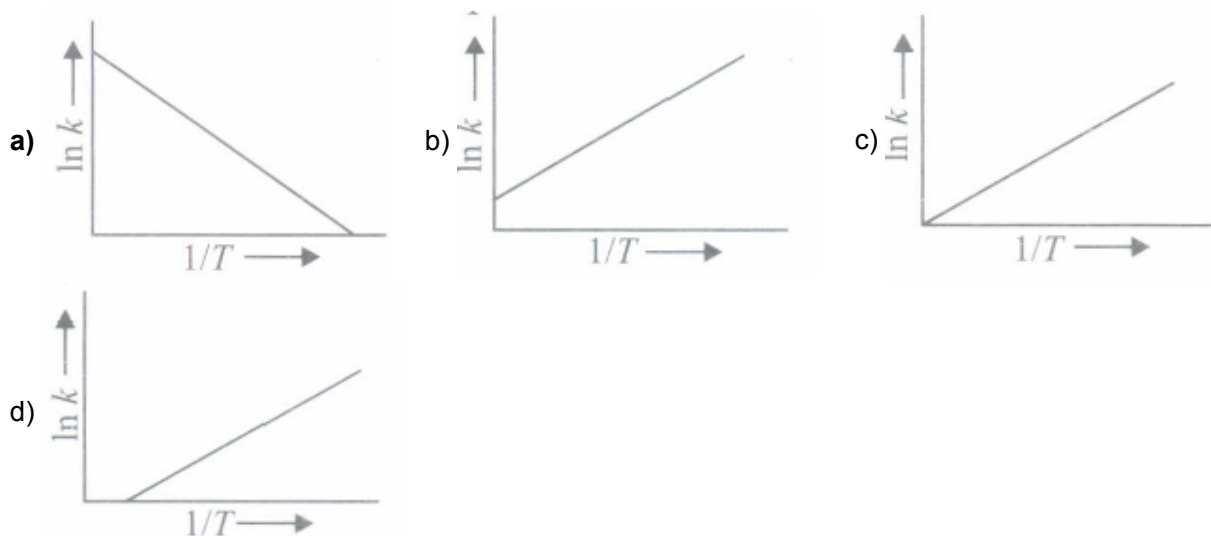
Give reaction



$$\begin{aligned} \text{Rate of reaction} &= -\frac{1}{2} \frac{d[\text{A}]}{dt} = -\frac{d[\text{B}]}{dt} \\ &= \frac{1}{3} \frac{d[\text{C}]}{dt} = \frac{d[\text{D}]}{dt} \end{aligned}$$

Hence, answer (a) is wrong.

15. According to Arrhenius equation rate constant  $k$  is equal to  $Ae^{-E_a/RT}$ . Which of the following options represents the graph of  $\ln k$  vs  $1/T$ ?



16. If 60% of a first order reaction was completed in 60 min, 50% of the same reaction would be completed in approximately: ( $\log 4 = 0.60$ ,  $\log 5 = 0.69$ )

- a) 50 min    **b) 45 min**    c) 60 min    d) 40 min

**Solution : -**

For the first order reaction

$$k = \frac{2.303}{t} \log \frac{a}{a-x}$$

$$k_1 = \frac{2.303}{t_1} \log \frac{a_1}{a_1-x_1}$$

$$k_2 = \frac{2.303}{t_2} \log \frac{a_2}{a_2-x_2}$$

$$x_1 = \frac{60}{100} a_1, t_1 = 60$$

$$x_2 = \frac{50}{100} a_2, t_2 = ?$$

From equation (1) and (2)

$$\frac{2.303}{t_1} \log \frac{a_1}{a_1-x_1} = \frac{2.303}{t_2} \log \frac{a_2}{a_2-x_2}$$

$$\frac{2.303}{60} \log \frac{a_1}{\left(a_1 - \frac{60}{100} a_1\right)} = \frac{2.303}{t_2} \log \frac{a_2}{\left(a_2 - \frac{50}{100} a_2\right)}$$

$$\frac{1}{60} \log \frac{100}{40} = \frac{1}{t_2} \log \frac{100}{50}$$

$$\Rightarrow t_2 = 46.5 \approx 45 \text{ min}$$

17. In pseudo unimolecular reactions,

- a) both the reactants are present in low concentration  
 b) both the reactants are present in same concentration    c) one of the reactant is present in excess  
**d) one of the reactant is non-reactive**

18. If hydrogen and oxygen are mixed and kept in the same vessel at room temperature, the reaction does not take place to form water because

- a) activation energy for the reaction is very high at room temperature**  
 b) molecules have no proper orientation to react to form water  
 c) the frequency of collisions is not high enough for the reaction to take place  
 d) no catalyst is present in the reaction mixture

19. What will be the half-life of the first order reaction for which the value of rate constant is  $200 \text{ s}^{-1}$ ?

- a)  $3.46 \times 10^{-2} \text{ s}$     **b)  $3.46 \times 10^{-3} \text{ s}$**     c)  $4.26 \times 10^{-2} \text{ s}$     d)  $4.26 \times 10^{-3} \text{ s}$

**Solution : -**

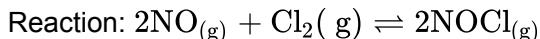
$$t_{1/2} = \frac{0.693}{k} = \frac{0.693}{200} = 3.46 \times 10^{-3} \text{ s}$$

20. The rate of the reaction  $2\text{NO} + \text{Cl}_2 \rightarrow 2\text{NOCl}$  is given by the rate equation  $\text{rate} = k[\text{NO}]_2 [\text{Cl}_2]$

The value of the rate constant can be increased by:

- a) increasing the concentration of NO    **b) increasing the temperature**  
 c) increasing the concentration of the  $\text{Cl}_2$     d) doing all of these

**Solution : -**



Rate =  $k[\text{NO}]_2 [\text{Cl}_2]$

Hence the value of rate constant can be increased by increasing the temperature and is independent of the initial concentration of the reactants.

21. The role of a catalyst is to change \_\_\_\_\_

- a) Gibbs energy of reaction    b) enthalpy of reaction    **c) activation energy of reaction**  
 d) equilibrium constant

22. The rate constant of a first order reaction is  $15 \times 10^{-3} \text{ s}^{-1}$ . How long will 5.0 g of this reactant take to reduce to 3.0 g?

- a) 10.10 s    b) 15 s    **c) 34.07 s**    d) 7.57 s

**Solution : -**

$$t = \frac{2.303}{k} \log \frac{a}{(a-x)}$$

$$\text{or } t = \frac{2.303}{15 \times 10^{-3}} \log \frac{5}{3} = 34.07 \text{ s}$$

23. For the reaction  $\text{A} + \text{B} \rightarrow \text{products}$ , what will be the order of reaction with respect to A and B?

Exp.	[A] (mol L <sup>-1</sup> )	[B] (mol L <sup>-1</sup> )	initial rate (mol L <sup>-1</sup> s <sup>-1</sup> )
1.	$2.5 \times 10^{-4}$	$3 \times 10^{-5}$	$5 \times 10^{-4}$
2.	$5 \times 10^{-4}$	$6 \times 10^{-5}$	$4 \times 10^{-3}$
3.	$1 \times 10^{-3}$	$6 \times 10^{-5}$	$1.6 \times 10^{-2}$

- a) 1 with respect to A and 2 with respect to B    **b) 2 with respect to A and 1 with respect to B**  
 c) 1 with respect to A and 1 with respect to B    d) 2 with respect to A and 2 with respect to B

**Solution : -**

Rate =  $k[\text{A}]^x [\text{B}]^y$

From expo (1),  $5 \times 10^{-4} = k (2.5 \times 10^{-4})^x (3 \times 10^{-5})^y$  .....(i)

From expo (2),  $4 \times 10^{-3} = k (5 \times 10^{-4})^x (6 \times 10^{-5})^y$  .....(ii)

Dividing (ii) by (i),  $\frac{4 \times 10^{-3}}{5 \times 10^{-4}} = 2^x \cdot 2^y = 8$

From expo (3),  $1.6 \times 10^{-2} = k (1 \times 10^{-3})^x (6 \times 10^{-5})^y$  ... (iii)

Dividing (iii) by (ii),  $\frac{1.6 \times 10^{-2}}{4 \times 10^{-3}} = 2^x = 4$

or  $x = 2, y = 1$

Hence, order with respect to A is 2 and with respect to B is 1.

24. A reaction is 50% completed in 2 hours and 75% completed in 4 hours. The order of reaction is

- a) 0    **b) 1**    c) 2    d) 3

**Solution : -**

The reaction goes to 50% completion in first 2 hours. If the initial concentration is A, it becomes A/2 in 2 hours. Then, in the next 2 hours, it comes A/4 from A/2. This means it again reduced by half in 2 hours. This means the half-life of the reaction is 2 hours which is constant. Half-life is constant in the first order reaction. Hence, the order of the reaction is 1.

25. Assertion: Complex reaction takes place in different steps and the slowest step determines the rate of reaction.

Reason: Order and molecularity of a reaction are always equal.

- a) If both assertion and reason are true and reason is the correct explanation of assertion  
 b) If both assertion and reason are true but reason is not the correct explanation of assertion

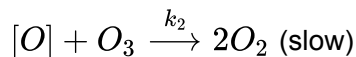
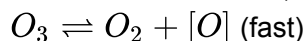


$$\frac{dx}{dt} = k[X] \text{ (For a first order reaction)}$$

$$0.00352 = k \times 0.01 \Rightarrow k = 0.352$$

$$t_{1/2} = \frac{0.693}{k} = \frac{0.693}{0.352} = 1.969 \text{ min.}$$

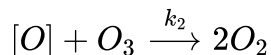
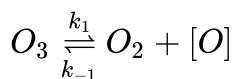
31. The chemical reaction,  $2O_3 \rightarrow 3O_2$  proceeds as



The rate law expression will be

a) Rate =  $k[O][O_3]$     **b) Rate =  $k[O_3]^2 [O_2]^{-1}$**     c) Rate =  $k[O_3]^2$     d) Rate =  $k[O_2][O]$

**Solution : -**



Rate of reaction is determined by slow step hence,

$$\text{Rate} = k_2[O][O_3]$$

[O] is unstable intermediate so substitute the value of

[O] in above equation

$$\text{Rate of forward reaction} = k_1 [O_3]$$

$$\text{Rate of backward reaction} = k_{-1}[O_2][O]$$

At equilibrium,

Rate of forward reaction = Rate of backward reaction

$$k_1[O_3] = k_{-1}[O_2][O]$$

$$[O] = \frac{k_1[O_3]}{k_{-1}[O_2]}$$

$$\text{Rate} = k_2 \left( \frac{k_1[O_3]}{k_{-1}[O_2]} \right) [O_3] = \frac{k[O_3]^2}{[O_2]}$$

32. The rate of disappearance of  $SO_2$  in the reaction,  $2SO_2 + O_2 \rightarrow 2SO_3$  is  $1.28 \times 10^{-5} \text{ M s}^{-1}$ . The rate of appearance of  $SO_3$  is

a)  $0.64 \times 10^{-5} \text{ M s}^{-1}$     b)  $0.32 \times 10^{-5} \text{ M s}^{-1}$     c)  $2.56 \times 10^{-5} \text{ M s}^{-1}$     **d)  $1.28 \times 10^{-5} \text{ M s}^{-1}$**

**Solution : -**

The rate of disappearance of  $SO_2$  and the rate of formation of  $SO_3$  are same.

33. What will be the rate equation for the reaction  $2X + Y \rightarrow$

Z, if the order of the reaction is zero?

a) Rate =  $k[X][Y]$     **b) Rate = k**    c) Rate =  $k[X]^0[Y]$     d) Rate =  $k[X][Y]^0$

**Solution : -**

$$\text{Rate} = k[X]^0 [Y]^0 \text{ or rate}$$

34. Which of the following statements about the catalyst is true?

a) A catalyst makes the reaction feasible by making  $\Delta G$  more negative

b) A catalyst makes equilibrium constant more favourable for forward reaction

**c) A catalyst accelerate rate of reaction by bringing down the activation energy**

d) A catalyst always increases the rate of reaction

35. The order of reaction is decided by

a) temperature    **b) mechanism of reaction as well as relative concentration of reactants**    c) molecularity

d) pressure

36. A first order reaction has a specific reaction rate of  $10^{-2} \text{ sec}^{-1}$ . How much time will it take for 20 g of the reactant to reduce to 5g?

**a) 138.6 sec**    b) 346.5 sec    c) 693.0 sec    d) 238.6 sec

**Solution : -**

Half-life for a first order reaction,

$$t_{1/2} = \frac{0.693}{K} \text{ where } K = 10^{-2} \text{ sec}^{-1}$$

$$\text{So, } t_{1/2} = \frac{0.693}{10^{-2}} \text{ sec.}$$

Also, for the reduction of 20 g reactant to 5 g, two half-lives will be required.

For 20 g of the reactant to reduce to 5 g, time taken,

$$t = 2 \times \frac{0.693}{10^{-2}} \text{ sec} = 138.6 \text{ sec}$$

37. The half-life for radioactive decay of C-14 is 5730 years. An archaeological artifact containing wood had only 80% of the C-14 found in a living tree. The age of the sample is  
a) 1485 years    **b) 1845 years**    c) 530 years    d) 4767 years

**Solution : -**

Radioactive decay follows first order kinetics.

Therefore,

$$\text{Decay constant } (\lambda) = \frac{0.693}{t_{1/2}} = \frac{0.693}{5730}$$

$$\text{Given, } [R_0] = 100 \therefore [R] = 80$$

$$\text{and } t = \frac{2.303}{\lambda} \log \frac{[R]_0}{[R]} = \frac{2.303}{\left(\frac{0.693}{5730}\right)} \log \frac{100}{80}$$

$$= \frac{2.303 \times 5730}{0.693} \times 0.0969 = 1845 \text{ years}$$

38. When initial concentration of a reaction is doubled in a reaction, its half-life period is not affected. The order of the reaction is :  
a) zero    b) second    **c) first**    d) more than zero but less than first

**Solution : -**

For a first order reaction

$$k = \frac{2.303}{t} \log \frac{[R]_0}{[R]}$$

$$\text{At } t_{1/2} = [R] = \frac{[R]_0}{2}$$

$$\therefore k = \frac{2.303}{t_{1/2}} \log \frac{[R]}{[R]_0/2} = \frac{2.303}{t_{1/2}} \times 0.3010$$

$$\Rightarrow t_{1/2} = \frac{0.693}{k}$$

39. The rate of the reaction,  $A+B+C \rightarrow P$  is given by:  $r = -\frac{d[A]}{dt} = k[A]^{1/2}[B]^{1/2}[C]^{1/4}$ . The order of the reaction is  
a) 1    b) 2    c) 1/2    **d) 5/4**

40. For a reaction  $R \rightarrow P$ , the concentration of a reactant changes from 0.05 M to 0.04 M in 30 minutes. What will be the average rate of reaction in minutes?  
a)  $4 \times 10^{-4} \text{ M min}^{-1}$     b)  $8 \times 10^{-4} \text{ M min}^{-1}$     c)  $3.3 \times 10^{-4} \text{ M min}^{-1}$     **d)  $2.2 \times 10^{-4} \text{ M min}^{-1}$**

**Solution : -**

$$\text{Average rate} = -\frac{\Delta[R]}{\Delta t} = \frac{([R]_2 - [R]_1)}{t_2 - t_1}$$

$$= -\frac{(0.04 - 0.05)}{30} = \frac{0.01}{30}$$

$$= 3.3 \times 10^{-4} \text{ M min}^{-1}$$

41. Activation energy of a chemical reaction can be determined by\_\_\_\_\_.

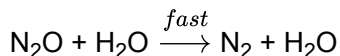
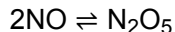
- a) determining the rate constant at standard temperature  
b) determining the rate constants at two temperatures    c) determining probability of collision  
**d) using catalyst**

**Solution : -**



$$\log \frac{k_2}{k_1} = \frac{E_a}{2.303R} \left[ \frac{T_2 - T_1}{T_1 T_2} \right]$$

42. For a reaction,  $2\text{NO} + 2\text{H}_2 \rightarrow \text{N}_2 + 2\text{H}_2\text{O}$ , the possible mechanism is



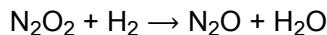
What is the rate law and order of the reaction?

a) Rate =  $[\text{N}_2\text{O}_2]$ , order = 1    **b) Rate =  $[\text{N}_2\text{O}_2][\text{H}_2]$ , order = 2**    c) Rate =  $[\text{N}_2\text{O}_2]^2$ , order = 2

d) Rate =  $[\text{N}_2\text{O}_2]^2 [\text{H}_2]$ , order = 3

**Solution : -**

The slowest step of the reaction is rate determining step.



Rate of reaction =  $[\text{N}_2\text{O}_2] [\text{H}_2]$

Hence, order of reaction = 2.

43. Assertion:  $E_a$  of the forward reaction is higher than that of backward reaction in a reversible endothermic reaction.

Reason: Increasing the temperature of the substance increases the fraction of molecules which collide with energies greater than  $E_a$ .

a) If both assertion and reason are true and reason is the correct explanation of assertion

**b) If both assertion and reason are true but reason is not the correct explanation of assertion**

c) If assertion is true but reason is false    d) If both assertion and reason are false

**Solution : -**

Threshold energy of reactants is less than that of products in reversible endothermic reactions hence.  $E_a$  for forward reaction is more than  $E_a$  for backward reaction.

44. In a first order reaction, the concentration of reactant is reduced to 1/8 of the initial concentration in 75 minutes at 298 K. What is the half-life period of the reaction in minutes?

a) 50 min.    b) 15 min.    c) 30 min.    **d) 25 min.**

**Solution : -**

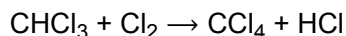
Let  $a = 1$ ,  $a - x = 1/8$ ,  $t = 75$  min.

$$k = \frac{2.303}{t} \log \frac{a}{a-x} = \frac{2.303 \times 0.903}{75} \text{min.}^{-1}$$

For first order reaction.

$$t_{1/2} = \frac{0.693}{k} = \frac{0.693 \times 75}{2.303 \times 0.903} = 25 \text{min.}$$

45. Assertion: For the reaction



Rate =  $k[\text{CHCl}_3][\text{Cl}_2]^{1/2}$

Reason: Rate of reaction is always equal to the sum of the stoichiometric coefficients of the reacting species in a balanced chemical equation.

a) If both assertion and reason are true and reason is the correct explanation of assertion

b) If both assertion and reason are true but reason is not the correct explanation of assertion

**c) If assertion is true but reason is false**    d) If both assertion and reason are false

**Solution : -**

Rate of reaction depends upon the experimental conditions such as concentration of reactants, temperature and catalyst. It may not be equal to the stoichiometric coefficients of the reacting species in a balanced chemical equation.

46. Which of the following statements is not correct for the catalyst?

- a) It catalyses the forward and backward reaction to the same extent    **b) It alters  $\Delta G$  of the reaction**  
 c) It is a substance that does not change the equilibrium constant of a reaction  
 d) It provides an alternate mechanism by reducing activation energy between reactants and products

**Solution : -**

A catalyst does not alter Gibbs energy,  $\Delta G$  of a reaction.

47. In the presence of a catalyst, the heat evolved or absorbed during the reaction \_\_\_\_\_  
 a) increases    b) decreases    **c) remains unchanged**    d) may increase or decrease

**Solution : -**

Catalyst alters the activation energy of both forward and backward reactions equally hence heat of reaction remains unchanged.

48. Rate constant of two reactions are given below Identifying their order of reaction.

(i)  $k = 5.3 \times 10^{-2} \text{ L mol}^{-1} \text{ s}^{-1}$

(ii)  $k = 3.8 \times 10^{-4} \text{ s}^{-1}$

- a) (i) second order, (ii) first order**    b) (i) first order, (ii) second order    c) (i) zero order, (ii) first order  
 d) (i) second order, (ii) zero order

**Solution : -**

For second order, rate constant

$$= \frac{\text{molL}^{-1}}{\text{s}} \times \frac{1}{(\text{molL}^{-1})^2} = \text{mol}^{-1} \text{ L s}^{-1}$$

For first order, rate constant =  $\frac{\text{molL}^{-1}}{\text{s}} \times \frac{1}{\text{molL}^{-1}} = \text{s}^{-1}$ .

49. For a reaction  $\text{P} + \text{Q} \rightarrow 2\text{R} + \text{S}$ . Which of the following statements is incorrect?

- a) Rate of disappearance of P = Rate of appearance of S  
 b) Rate of disappearance of Q = 2 x Rate of appearance of R  
 c) Rate of disappearance of P = Rate of disappearance of Q  
**d) Rate of disappearance of Q =  $\frac{1}{2}$  x Rate of appearance of R**

50. The decomposition of a hydrocarbon follows the equation  $k = (4.5 \times 10^{11} \text{ s}^{-1})e^{-28000\text{K}/T}$ . What will be the value of activation energy?

- a) 669 kJ mol<sup>-1</sup>    **b) 669 kJ mol<sup>-1</sup>**    c) 4.5 x 10<sup>11</sup> kJ mol<sup>-1</sup>    d) 28000 kJ mol<sup>-1</sup>

**Solution : -**

Arrhenius equation,  $k = Ae^{-E_a/RT}$

Given equation is  $k = (4.5 \times 10^{11} \text{ s}^{-1})e^{-28000\text{K}/T}$

Comparing both the equations, we get

$$-\frac{E_a}{RT} = \frac{28000\text{K}}{T}$$

$$E_a = 28000 \text{ K} \times R = 28000 \text{ K} \times 8.314 \text{ J K}^{-1}\text{mol}^{-1}$$

$$= 232.79 \text{ kJ mol}^{-1}$$