

Topic :- Chemical Kinetics

1 (b)

For parallel path reaction

$$K_{\text{average}} = K_1 + K_2 = 1.26 \times 10^{-4} + 3.8 \times 10^{-5} \\ = 1.64 \times 10^{-4} \text{sec}^{-1}$$

$$\text{Also fractional yield of } B = \frac{K_B}{K_{\text{av}}} = \frac{1.26 \times 10^{-4}}{1.64 \times 10^{-4}} = 0.7683$$

$$\text{Fractional yield of } A = \frac{K_A}{K_{\text{av}}} = \frac{3.8 \times 10^{-5}}{1.64 \times 10^{-4}} = 0.2317$$

3 (d)

$$\text{For first order : } k = \frac{0.693}{t_{1/2}} = \frac{0.693}{1386} = 5 \times 10^{-4} \text{s}^{-1}$$

4 (a)

Ionic reactions are instantaneous one.

5 (b)

For zero order reaction, rate of reaction is independent of concentration i.e., rate of reaction does not depend upon the concentration of reactant.

$$\frac{dx}{dt} = k[A]^0$$

6 (c)

$$t_{1/2} = 100 \text{s}$$

$$k = \frac{0.693}{t_{1/2}} = \frac{0.693}{100}$$

$$k = 6.93 \times 10^{-3} \text{s}^{-1}$$

7 (b)

The rate law for the reaction is as

$$r = \frac{dx}{dt} = k(A)(B)^2(C)^0 = k(A)(B)^2$$

on increasing the concentration of A, B and C two times.

$$r' = \frac{dx}{dt} = k(2A)(2B)^2(2C)^0 \\ = 8k(A)(B)^2$$

Thus, the rate increases eight times.

8 (a)

Activation energy is the needed by reactant molecules to gain threshold energy level.

9 (a)

The rate of zero order reaction is independent of the concentration of the reactants or the

concentration of the reactant do not change with time. Thus, the rate of reaction remains constant.

$$\frac{dx}{dt} = k(a - x)^0 \Rightarrow \frac{dx}{dt} = k$$

Or Rate = k

10

(b)

For first order reaction,

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

Where, a = initial concentration

X = change in concentration during time 't'.

If 75% of the reaction was completed in 32 min, then

$$k = \frac{2.303}{32} \log_{10} \frac{100}{100 - 75} = \frac{2.033}{32} \log_{10} 4$$

$$k = 0.0433 \text{ min}^{-1}$$

Hence, time required for the completion of 50% reaction.

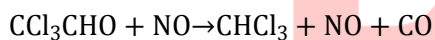
$$t = \frac{2.303}{0.0433} \log_{10} \frac{100}{100 - 75}$$

$$= \frac{2.033}{32} \log_{10} 2 = 16 \text{ min}$$

11

(a)

For the reaction :



$$\text{Rate} = \frac{dx}{dt} = k[\text{CCl}_3\text{CHO}][\text{NO}]$$

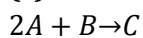
$$k = \frac{dx}{dt \times [\text{CCl}_3\text{CHO}][\text{NO}]}$$

$$= \frac{\text{mol/L}}{\text{s} \times \text{mol/L} \times \text{mol/L}}$$

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

12

(c)



Rate of reaction,

$$= -\frac{1}{2} \frac{d[A]}{dt} = -\frac{d[B]}{dt} = \frac{d[C]}{dt}$$

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

$$= 2 \times 2.2 \times 10^{-3}$$

$$= 4.4 \times 10^{-3} \text{ mol L}^{-1} \text{ min}^{-1}$$

13

(d)

For third order reaction,

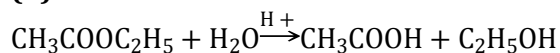
$$\text{rate} = k[A]^3$$

$$\frac{\text{mol L}^{-1}}{\text{s}} = k(\text{mol} - \text{L}^{-1})^3$$

$$k = \frac{1}{\text{mol}^2 \text{L}^{-2} \text{s}}$$

$$= \text{mol}^{-2} \text{L}^2 \text{s}^{-1}$$

14 **(d)**



Since, in this reaction, water is excess, it is an example of pseudo first order reaction (as rate depends only on the concentration of $\text{CH}_3\text{COOC}_2\text{H}_5$).

16 **(d)**

The efficiency of an enzyme in catalyzing a reaction is due to its capacity to lower the activation energy of the reaction

17 **(c)**

The rate of reaction is:

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

18 **(a)**

For exothermic reaction, activation energy of reverse reaction is greater than activation energy of forward reaction, i.e., $E_f < E_r$

19 **(a)**

$$2.303 \log \frac{K_2}{K_1} = \frac{E_a}{R} \frac{[T_2 - T_1]}{T_1 T_2}$$

$$\therefore 2.303 \log 3 = \frac{E_a [313 - 273]}{2 \cdot 313 \times 273}$$

$$\therefore E_a = 4693 \text{ cal}$$

20 **(d)**

$\ln K = \ln A - \frac{E_a}{RT}$ is Arrhenius equation. Thus plots of $\ln K$ vs $1/T$ will give slope = E_a/R .

ANSWER-KEY										
Q.	1	2	3	4	5	6	7	8	9	10
A.	B	B	D	A	B	C	B	A	A	B
Q.	11	12	13	14	15	16	17	18	19	20
A.	A	C	D	D	C	D	C	A	A	D

PE