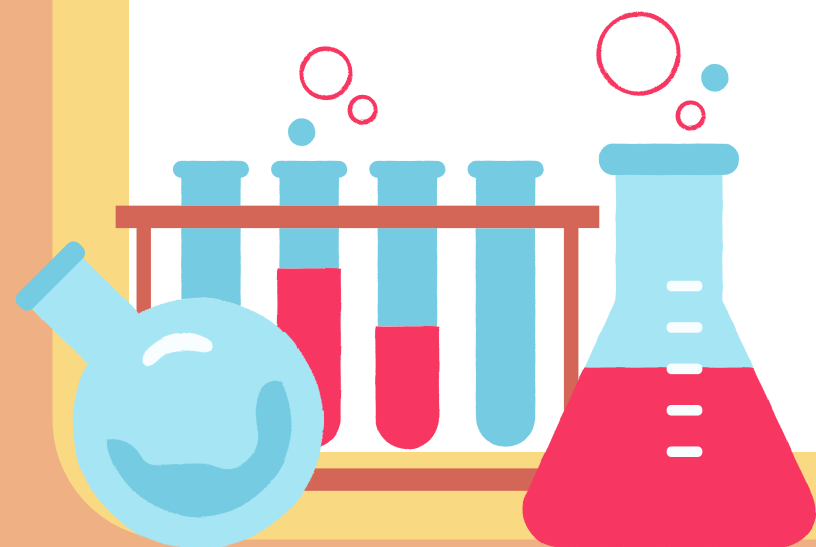


4TH SEM

ORGANIC CHEMISTRY



**ZERO ORDER
REACTION**



DEPTH OF BIOLOGY

- A reaction is a process in which the reactants get converted into product
- WHAT IS ZERO ORDER REACTION ?
- A chemical reaction in which the rate is independent of the concentration of the reactants, i.e. the rate does not change when the concentration of the reactants increases or decreases.

Examples- $\text{H}_2 + \text{Cl}_2 \rightarrow 2\text{HCl}$

$\text{N}_2\text{O} \rightarrow \text{N}_2 + \frac{1}{2} \text{O}_2$

$\text{CH}_3\text{COCH}_3 + \text{I}_2 \rightarrow \text{ICH}_2\text{COCH}_3 + \text{HI}$

DEPTH OF BIOLOGY

- suppose a reaction in which reactant A gets converted into product B

At time = 0,
{when reaction
hasn't started}
concentration =

Reactant

A

C_0

Product

B

0

At time = t,
concentration =

C_t

b_t

DEPTH OF BIOLOGY

DEPTH OF BIOLOGY

- differentiation rate law [D.R.L.]-
- $r = -dc/dt$
- here negative sign is used because there is decrease in concentration of the reactant
- Rate law = $r = K [C]^0$ \longrightarrow K is used as a constant & 0 signifies that it is zero order reaction
- $[C]^0 = 0$. So then, $r = K$ & also $r = -dc/dt$
- Hence by using above 2 equations
- $K = -dc/dt$
- Now , we will multiply this equation with dt as reaction is occurring w.r.t. time & then integrate it

DEPTH OF BIOLOGY

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$$\int_0^t K \times dt = \int_{C_0}^{C_t} \frac{-dc \times dt}{dt}$$

K is a constant so
it's integration
cannot be done

$$K \int_0^t dt = - \int_{C_0}^{C_t} dc$$

Here integration & differentiation
will cancel out each other

- In integration: upper limit - lower limit. So,

$$K [t-0] = - [C_t - C_o]$$

$$- Kt = [C_t - C_o]$$

$$C_t = -kt + C_o$$

DEPTH OF BIOLOGY

- **WHAT is HALF LIFE OF A REACTION?**
- **The half-life of a chemical reaction can be defined as the time taken for the concentration of a given reactant to reach 50% of its initial concentration (i.e. the time taken for the reactant concentration to reach half of its initial value).**
- **It is denoted by the symbol ' $t_{1/2}$ ' and is usually expressed in seconds.**

DEPTH OF BIOLOGY

- **HALF LIFE OF Zero order reaction -**
- **For a zero-order reaction, the units of the rate constant are $\text{mol.L}^{-1}\text{s}^{-1}$.**
- In half life the concentration of reactant will be $C_0/2$ and that of the product will be $bt/2$ and time will be $t_{1/2}$ because half of the reactant will get converted into product

DEPTH OF BIOLOGY

DEPTH OF BIOLOGY

$$C_t = -kt + C_o$$

substituting $C_t = C_o/2$ & $t = t^{1/2}$ in the above equation, we get

$$C_o/2 = -k t^{1/2} + C_o$$

$$C_o/2 - C_o = -k t^{1/2}$$

$$C_o/2 = -k t^{1/2}$$

$$C_o/2k = t^{1/2}$$

Or

$$t^{1/2} = C_o/2k$$

This is the life half of zero order reaction