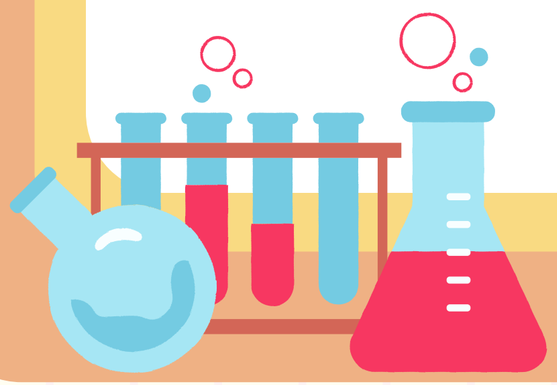
4TH SEM

ORGANIC CHEMISTRY

FIRST ORDER REACTION



DEPTH OF BIOLOGY

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- A reaction is a process in which the reactants gets converted into product

- WHAT IS FIRST ORDER REACTION ?

A first-order reaction can be defined as a chemical reaction in which the reaction rate is linearly dependent on the concentration of only one reactant. In other words, a first-order reaction is a chemical reaction in which the rate varies based on the changes in the concentration of only one of the reactants

- Examples- $SO_2Cl_2 \rightarrow Cl_2 + SO_2$
- $2N_2O_5 \rightarrow O_2 + 4NO_2$

DEPTH OF BIOLOGY

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

	Reactant A	Product B
At time =0, {when reaction hasn't started} concentration=	C_o	0
At time =t, concentration=	C_t	b_t

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 = $r = K [C]^1$ → 1 is used because it is first order reaction

- Hence by using above 2 equations
- $K [C] = -dc/dt$

- $-kdt = dc /[C]$

integrating both sides

$$-\int_0^t K\,dt = \int_{C_0}^{C_t} \frac{-dc}{[C]}$$

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

Here integration & differentiation will cancel out each other

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

$$K\,[t-0] = -\,[\ln Ct - \ln Co]$$

$$-\,Kt = [\ln Ct - \ln Co]$$

$$\ln Ct = -kt + \ln Co$$

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 ‘t1/2’ and is usually expressed in seconds.

$\ln Ct = -kt + \ln Co$

$kt = \ln Co/Ct$

substituting $Ct = Co/2$ & $t = t\,½$ in the above equation, we get

$$kt½ = \ln Co/Co/2$$

$$kt\,½ = \ln 2$$

$$\ln 2/k = t\,½$$ Or $$t\,½ = 2Co/k$$

This is the life half of first order reaction