CHEMICAL KINETICS

RATE OF REACTION

for : $aA + bB \longrightarrow xX + yY$

$$rate = \frac{-1}{a}\frac{d[A]}{dt} = \frac{-1}{b}\frac{d[B]}{dt} = \frac{1}{x}\frac{d[x]}{dt} = \frac{1}{y}\frac{d[y]}{dt}$$

INSTANTANEOUS RATE

$$rate = \frac{-d[R]}{dt} = \frac{d[P]}{dt}$$

AVERAGE RATE

$$rate = \frac{-\Delta R}{\Delta t} = \frac{-([R_2] - [R_1])}{t_2 - t_1}$$

REACTION	UNIT OF RATE CONSTANT (K)
Zero Order	$mol\ L^{-1}s^{-1}$
First Order	s^{-1}
Second Order	$mol^{-1}\ Ls^{-1}$

ORDER OF REACTION

Sum of powers of concentration of reactants in the rate law.

Order of a reaction may be whole number or a fraction.

$aA + bB \longrightarrow Product$

$rate = k[A]^x[B]^y$

$order = x + y$

MOLECULARITY

- Number of reacting species taking part in an elementary reaction
- It cannot be zero or a fraction.

Molecularity = a + b

$$aA + bB \rightleftharpoons cC + dD$$

RATE CONSTANT UNIT FOR nTH ORDER REACTION

$k = mol^{1-n}\ Litren^{-1}\ sec^{-1}$

RATE EXPRESSION

$rate \propto A]^x\ [B]^y$

RATE CONSTANT (k)

$rate = k[A]^x[B]^y$

COLLISION THEORY

A chemical reaction occurs when molecules collide with sufficient Energy.

EFFECTIVE COLLISION

Molecular collide with sufficient kinetic energy and proper orientation

COLLISION FREQUENCY

Number of collisions per unit volume of reaction mixture.

FOR BIMOLECULAR REACTION

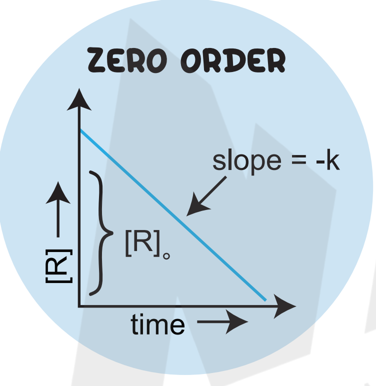
$rate = Pz_{AB}E^{-E^{a}/RT}$

P → steric factor

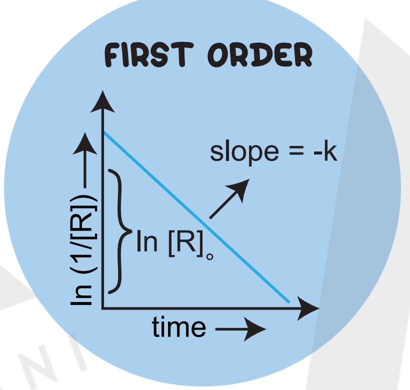
z_{AB} → collision frequency

INTEGRATED RATE EQUATION

Reaction	Differential rate law	Integrated rate law	Half life
Zero Order	$\frac{d[R]}{dt} = -k$	$kt = [R]_{\circ} - [R]$	$t_{1/2} = \frac{[R]_{\circ}}{2k}$
First Order	$\frac{d[R]}{dt} = -k[R]$	$kt = \ln\left(\frac{[R]_{\circ}}{[R]}\right)$	$t_{1/2} = \frac{0.693}{k}$



ZERO ORDER



FIRST ORDER

Half life of nth order reaction

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

Radioactive decay are first order reaction.

PSEUDO FIRST ORDER REACTION

- are not truely first order reaction but in certain conditions behaves like those.
- hydrolysis of ethyl acetate in acidic medium`

FACTORS INFLUENCING RATE

CONCENTRATION

Higher the concentration of reactants, faster is the rate of reaction.

TEMPERATURE

Rate of reaction increases with increase in temperature.

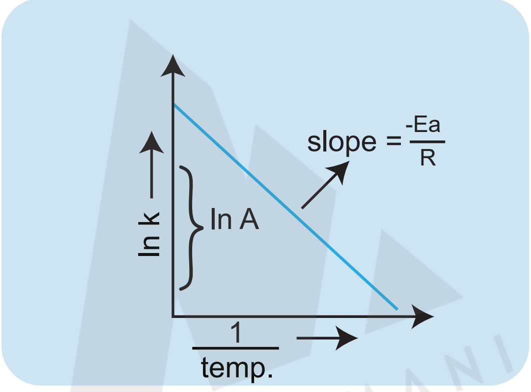
SURFACE AREA

Greater is the surface area, faster is the reaction rate.

PRESENCE OF CATALYST

Rate of reaction increases in presence of a catalyst.

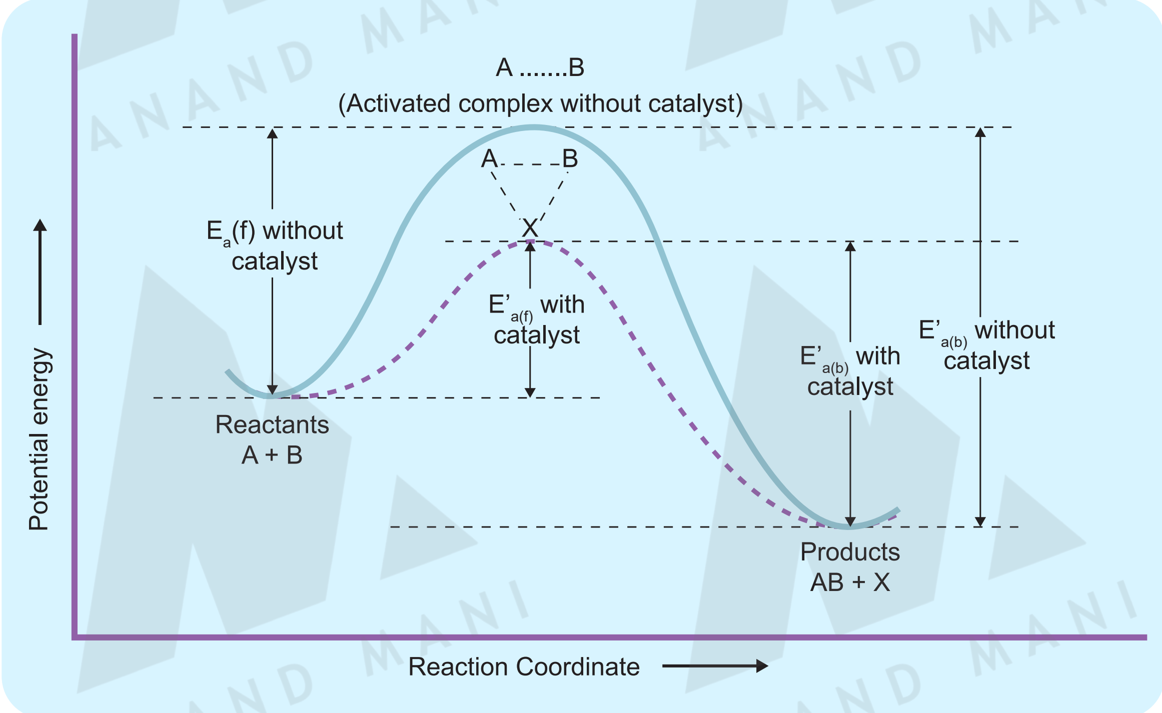
ARRHENIUS EQUATION



$$\log\left(\frac{k_1}{k_2}\right) = \frac{E_a}{2.303}\left[\frac{T_1 - T_2}{T_1T_2}\right]$$

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

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



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