Calculation of order of reaction

a) Initial rate method

$r \propto [B]^2$ $r \propto [A]^1$

$r = [A]^1[B]^2$

[A]	[B]	Rate
0.2 (2)	0.2	x (4)
0.2	0.4	4x
2 (0.4)	0.4	8x (2)

b) Half life method

$$\frac{(t_{1/2})_1}{(t_{1/2})_2} = \left(\frac{C_2}{C_1}\right)^{n-1}$$

$$t_{1/2} \propto \frac{1}{(C_0)^{n-1}}$$

- if $n=0$ then $t_{1/2} \propto C_0$
- if $n=1$ then $t_{1/2}$ = constant
- if $n=2$ then $t_{1/2} \propto \frac{1}{C_0}$

Collision Theory

For the formation of product reactant must collide and cross 2 barriers

- → Orientation Barrier
- → Energy Barrier → Activation Energy (E_a) minimum extra energy given to cross energy barrier

$$\text{Rate} = PZ_{AB}(e)^{-E_a/RT}$$

P = Steric / Probablity Factor

Z_{AB} = collision frequency

* $e^{-E_a/RT}$ = fraction of molecule having energy $\geq E_a$

Approx Dependency K,T

- With Inc in Temperature rate of rxn increases

For every 10°C rise in temperature rate becomes 2 times of the original

$$\mu^{\frac{T_f - T_i}{10}} = \frac{R_{T_f}}{R_{T_i}} = \frac{K_{T_f}}{K_{T_i}}$$

if	R
20°C	·5
30	10
40	20
50	40
60 →	80

Accurate Dependency K,T

$$K = A(e)^{-E_a/RT}$$

K = rate constant

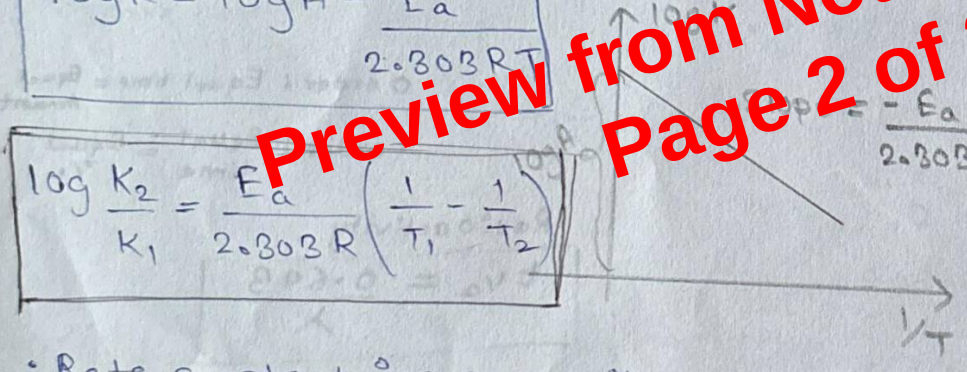
A = Arrhenius / Pre Expo / Frequency Factor

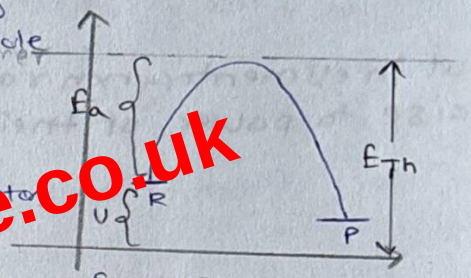
E_a = Activation Energy

T = Temp ; R = Boltzmann

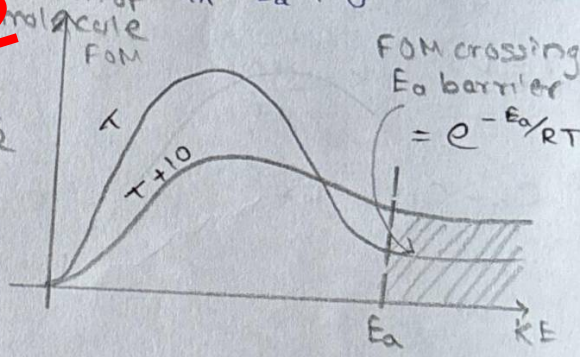
$$\log K = \log A - \frac{E_a}{2.303RT}$$

$$\log\frac{K_2}{K_1} = \frac{E_a}{2.303R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)$$





$E_{Th} = E_a + U$



- Rate constant increase with increase in Temperature
- Independent of Nature of reaction

*Monitoring the progress of reaction

a) Pressure measurement method (Mujhe aata hai)

b) Titration method $K = \frac{2.303}{t}\log\frac{V_\infty - V_0}{V_\infty - V_t}$

c) Optical Rotation method $K = \frac{2.303}{t}\log\left(\frac{\theta_\infty - \theta_0}{\theta_\infty - \theta_t}\right)$

$$K_{eq} = \frac{K_f}{K_b} = \frac{A_f e^{-E_{af}/RT}}{A_b e^{-E_{ab}/RT}}$$

$$K_{eq} = A' e^{-\Delta H/RT}$$

$$\Delta H = \Sigma H_p - \Sigma H_R = (E_a)_f - (E_a)_b$$

Pseudo first reaction

→ When reactant in excess (Solvent)

- → Acid Catalysed Hydrolysis of Ethyl acetate (H_2O excess)
- → Inversion of Cane sugar
- → Benzdiazochl with water (excess)

Catalyst do not change

• ΔH • ΔG • K_{eq} • eqm state

they only ↓ E_a