D. B. College [Jaynagar] Lect:- 10
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Application of Law of Mass Action & D.O.D.:-

$$\alpha \propto V^{\frac{\Delta n_g}{n_p}}$$

$n_p \rightarrow$ no. of gaseous moles of product.

$$PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$$

$$\alpha \propto V^{\frac{1}{2}} \propto \frac{1}{P^{\frac{1}{2}}}$$

V↑ 4 times α 2 times ↑

P ↑ 16 times α 4 times ↓

① $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$

$\alpha \propto V^{0/2}$

$\alpha \propto V^0 \propto p^0$ α is independent of V & P

② $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$

$\alpha \propto V^{-2/2}$

$\alpha \propto V^{-1} \propto \frac{1}{p^{-1}}$

P ↑ 4 times α ↑ 4 times

V ↑ 4 times α ↓ 4 times

$\alpha \propto \frac{1}{V} \propto P$

③ $C(s) + \frac{1}{2} O_2(g) \rightleftharpoons CO(g)$

$\alpha \propto V^{\frac{1/2}{1}}$

$\alpha \propto \sqrt{V} \propto \frac{1}{\sqrt{P}}$

V ↑ 4 times α ↑ 2 times

P ↑ 8 times α ↓ $2\sqrt{2}$ times

Ques $2A(g) + 3B(g) \rightleftharpoons 2C(g)$

If V of reacn mix is ↑ upto 4 times then D.O.D.

① increased upto 8

② ↓ sed upto 8

③ remains same

④ Can't be said

$\alpha \propto V^{-3/2}$

$\alpha \propto \frac{1}{V^{3/2}} \propto \frac{1}{(4)^{3/2}}$

$\propto \frac{1}{(4)^1 (4)^{1/2}} \propto \frac{1}{8}$

Ques $A(s) + 2B(g) \rightleftharpoons 4C(g) + D(s)$

if P is increased by 64 times then D.O.D.

① ↑ upto 4 times

② ↓ upto 4 times

③ ↑ upto 8 times

④ ↓ upto 8 times

$\alpha \propto \frac{1}{P^{2/4}} \cdot \frac{1}{P^{1/2}}$

$\alpha \propto \frac{1}{(64)^{1/2}} \propto \frac{1}{(8)^{2 \times 1/2}}$

Application of K:-

$$K = \frac{[Product]}{[Reactant]}$$

1. Stability of Reactant or Product :-

$$R \rightleftharpoons P$$

$$K = \frac{[P]}{[R]}$$

K↑ [P]↑ hence Prod. is more stable

K↓ [R]↑ hence Reactant is more Stable

Ques $X_2 + O_2 \rightleftharpoons 2XO \quad K_1 = 10$

$X_2 + 2O_2 \rightleftharpoons 2XO_2 \quad K_2 = 100$

which oxide is more stable

$$XO_2 > XO$$

$$K_2 > K_1$$

Ques which oxide of nitrogen is more Stable?

① $N_2(g) + 2O_2(g) \rightleftharpoons 2NO_2(g) \quad K_1 = 10^{-3}$

② $2N_2(g) + O_2(g) \rightleftharpoons 2N_2O \quad K_2 = 10^{-1}$

③ $2NO(g) \rightleftharpoons N_2(g) + O_2(g) \quad K_3 = 0.5$

④ $2N_2O_3(g) \rightleftharpoons 2N_2(g) + 3O_2(g) \quad K_4 = 0.025$

$N_2(g) + O_2(g) \rightleftharpoons 2NO(g) \quad K_3' = \frac{1}{0.5} = 2$

$2N_2(g) + 3O_2(g) \rightleftharpoons 2N_2O_3(g)$ $K_4' = \frac{1}{0.025}$

$= 40$

$N_2O_3 > NO > N_2O > NO_2$

Ex $2NO(g) \rightleftharpoons N_2(g) + O_2(g)$ $K_1 = 16$

$2NO_2(g) \rightleftharpoons N_2(g) + 2O_2(g)$ $K_2 = 25$

$NO > NO_2$

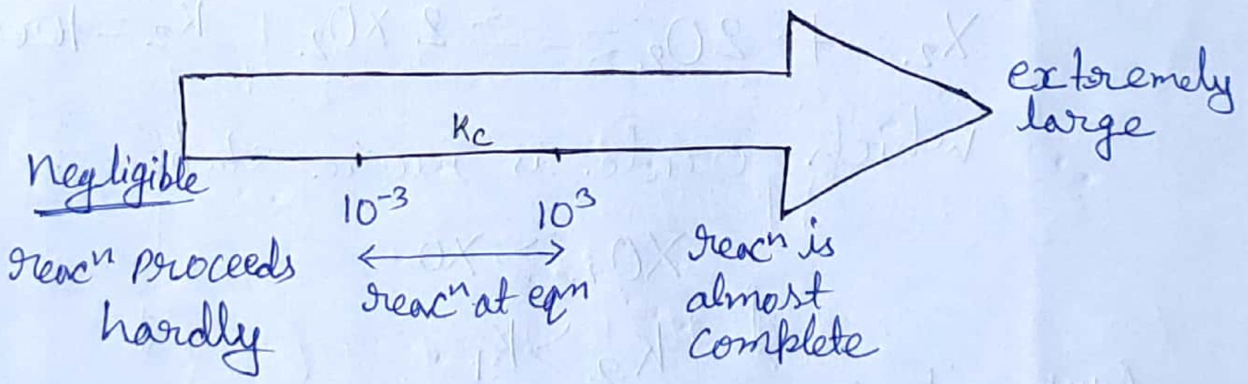
2. Extent of Reaction :—

$K = \frac{[Product]}{[Reactant]}$ $K \rightarrow$ extent of reacn

$K \rightarrow$ rate ✗

Higher the Value of K, Product is formed more

Lower the Value of K, Reactant is left more



$H_2(g) + Br_2(g) \rightleftharpoons 2HBr(g)$ $K = 5 \times 10^{48}$

reacn is almost Complete

$N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$ $K = 2 \times 10^{-18}$

reacn hardly Proceed

$H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$ $K = 57$

reacn is at eqm