CHEMICAL EQUILIBRIUM

EQUILIBRIUM CONSTANT 'K'

For a General Reaction $aA + bB \rightleftharpoons pP + qQ$

The equilibrium constant expression is $K_c = \frac{[P]^p [Q]^q}{[A]^a [B]^b}$ where K_c is the **Equilibrium Constant** (or K_p if they are all gases)

RELATION BETWEEN K_p AND K_c

For the Reaction $aA + bB \rightleftharpoons cC + dD$

$$K_p = \frac{[p_C]^c \times [p_D]^c}{[p_A]^a \times [p_B]^b} = \frac{[C]^c [D]^d}{[A]^a [B]^b} \frac{(RT)^{c+d}}{(RT)^{a+b}}$$

$$K_p = K_C (RT)^{\Delta ng}$$

if $\Delta n_g = 0 \Rightarrow K_p = K_c$

Where, $\Delta n_g = (c+d) - (a+b)$

= no. of moles of gaseous products – no. of moles of gaseous Reactants

WHAT DOES THE VALUE OF 'K' MEAN ?

(a) K >> 1 Reactants ⇌ **Products**

If K>> 1, the reaction is product-favoured; product predominates at Equilibrium.

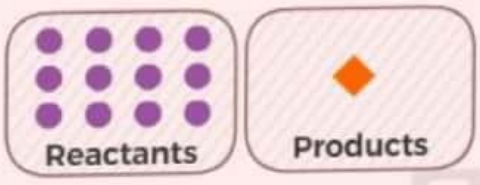
(a) K << 1 **Reactants** ⇌ **Products**

If K<< 1, the reaction is reactant-favoured; reactant predominates at Equilibrium.

(a) K = 1 The reaction lies in the middle (mix of reactants and products)

MAGNITUDE OF 'K'

Small ($K < 10^{-3}$)



Mostly Reactants

Intermediate ($10^{-3} \leq K \leq 10^{3}$)

Significant amounts of reactants and products

Large ($K > 10^{3}$)

Mostly Products