

Relation between K_p & K_c

If partial pressure is taken as active mass for a gas, the equilibrium constant is called K_p and if concentration is taken as active mass then equilibrium constant is called K_c .

$$\text{Therefore } K_c = \frac{[C]^x [D]^y}{[A]^m [B]^n} \quad \text{--- (i)}$$

If A, B, C & D all are gases then

$$K_p = \frac{P_C^x \times P_D^y}{P_A^m \times P_B^n} \quad \text{--- (ii)}$$

For a gas —

$$PV = nRT$$

$$\text{or } P = \frac{n}{V} RT \quad \text{Where } \frac{n}{V} = C = \text{concentration}$$

$\therefore P \propto C$ at constant temperature

$$\text{or } P = CRT$$

$$\therefore P_A = C_A RT$$

$$P_B = C_B RT$$

$$P_c = C_c R T$$

$$P_D = C_D R T$$

Hence, putting the value of P_A, P_B, P_c & P_D in eqn (1) —

~~$$K_p = \frac{P_c P_D}{P_A P_B}$$~~

$$K_p = \frac{[C]^x [D]^y (RT)^{x+y}}{[A]^m [B]^n (RT)^{m+n}}$$

$$\text{or } K_p = K_c [RT]^{(x+y) - (m+n)}$$

$$\therefore K_p = K_c [RT]^{\Delta n} \quad \text{--- (ii)}$$

$$\text{If } \Delta n = 0$$

then

$$K_p = K_c \quad \text{(iv)}$$

$$\Delta n = \text{no. of mole of products} - \text{no. of mole of reactants}$$

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