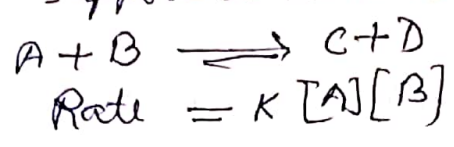


What is chemical equilibrium?

Equilibrium means equal on both sides. In case of chemical equilibrium the reaction must be a reversible one. When both forward and backward reaction is stopped it assumes eqm.

Law of mass action — The rate of a reaction is directly proportional to the multiple of active masses of the reactant. It is known as law of mass action. Suppose a reaction



where k - constant
bracket sign indicates active masses.

K_c and K_p and their relationship

Suppose a reaction is of the type

$$aA + bB \xrightleftharpoons[k_2]{k_1} cC + dD$$

where
a moles of A
b moles of B
c moles of C
d moles of D

For forward reaction

$$\text{Rate}_1 = k_1 [A]^a [B]^b \quad \text{--- (1)}$$

For backward reaction

$$\text{Rate}_2 = k_2 [C]^c [D]^d \quad \text{--- (2)}$$

At eqm

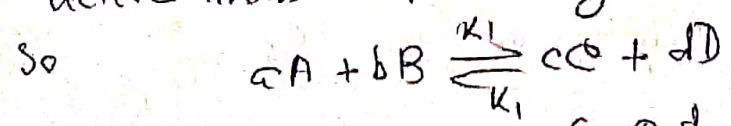
$$\text{Rate}_1 = \text{Rate}_2$$

$$k_1 [A]^a [B]^b = k_2 [C]^c [D]^d$$

$$\frac{k_1}{k_2} = \frac{[C]^c [D]^d}{[A]^a [B]^b}$$

$$K_c = \frac{[C]^c [D]^d}{[A]^a [B]^b} \quad \text{--- (3)}$$

In case of gaseous state the concentration or active mass replaced by partial pressure



$$K_p = \frac{P_C^c \times P_D^d}{P_A^a \times P_B^b}$$

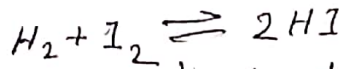
where

P_A	→ partial pressure of	A
P_B	"	B
P_C	"	C
P_D	"	D

(4)

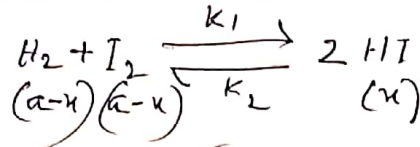
K_p, K_c values and type of equilibrium.

Suppose a reaction



here 1 mole of hydrogen reacts with 1 mole of iodine and produces 2 mole of hydroiodic acid

If initial concentration of reactant = a and ~~int~~ concentration of product = x then



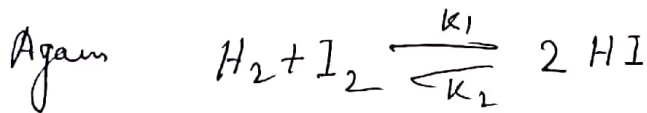
$$K_p = \frac{[HI]^2}{[H_2][I_2]} = \frac{(x_p)^2}{(a-x)_p (a-x)_p}$$

$$= \frac{x_p^2}{(a-x)(a-x)p^2}$$

where $p \rightarrow$ partial pressure.

$$K_p = \frac{x^2}{(a-x)^2}$$

i.e. the reaction does not depend on pressure.



$$K_p = K_c (RT)^{n_2 - n_1}$$

here $n_2 = 2$ (product)

$n_1 = 1+1$ (reactant)

$$K_p = K_c (RT)^{2-2}$$

$$K_p = K_c (RT)^0$$

$$\therefore \boxed{K_p = K_c}$$

That means in $H_2 + I_2 \rightleftharpoons 2HI$ reaction

$K_p = K_c$, it says where the reaction is completed in gaseous form or in liquid form, no influence of pressure is found and in all aspect the K_p and K_c bears ~~at~~ same value.