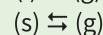
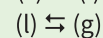
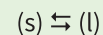


Definition /

Chemical reaction reach a state of dynamic equilibrium in which the rate of forward reaction and backward reaction are same and there is no net change in composition.

Physical Equilibrium /

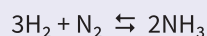
Equilibrium set up in a physical process like evaporation of water etc.



6. EQUILLIBRIUM

Chemical Equilibrium /

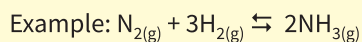
Equilibrium attained in a chemical reaction



- ✦ Possible only in a closed system.
- ✦ Both reaction occur at same rate
- ✦ All measurable property remains constant

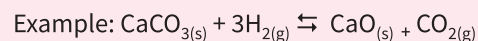
Homogeneous /

Reactant and product are in same phase.

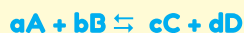


Hetrogeneous /

Reactant and product are in different phase.



Law of chemical Equilibrium /Equilibrium Law



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

Here K_c is equilibrium constant

Direction of reaction /

$$Q_c > K_c$$

Reaction goes from left to right

$$Q_c < K_c$$

Reaction goes from right to left

$$Q_c = K_c$$

No net reaction occurs

Relation between equilibrium constant K_p and K_c

$$K_p = K_c (RT)^{\Delta n_g}$$

Factor's affecting Chemical Equilibrium /

- ✦ Le Chatlier's Principle
- ✦ Effect of concentration: change in concentration \rightarrow , equilibrium shift forward/backward.
- ✦ Effect of pressure: change in equilibrium will shift in the direction having smaller number of moles.
- ✦ Effect of temperature
 - For exothermic \rightarrow low temperature favours formation of reactants.
 - For Endothermic \rightarrow High temperature favours formation of products.
- ✦ Effect of inert gas \rightarrow No change
- ✦ Effect of catalyst \rightarrow No change

Acids and Base

Acids: Liberates H_2 on reacting with metals
Turns blue litmus into red

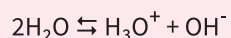
Base: Taste bitter and feel soapy
Turns red litmus into blue

Acidic $\Rightarrow [H_3O^+] > [OH^-]$

Basic $\Rightarrow [H_3O^+] < [OH^-]$

Neutral $\Rightarrow [H_3O^+] = [OH^-]$

Ionic product of water



$$K_w = [H_3O^+][OH^-] = 1 \times 10^{-14} M^2$$

$$[OH^-] = [H^+] = 10^{-7} M \text{ at } 298 K$$

$$pK_w = pK_a + pK_b = 7 + 7 = 14$$

pH Concept

$$pH = -\log[H^+]$$

$$pH = -\log[H_3O^+]$$

Ionic Equilibrium

Ostwald's Dilution Law

Applicable for weak electrolytes

$$\therefore K_c = C \alpha^2 \text{ or } \alpha = \sqrt{\frac{K_c}{C}}$$

$$\text{So, } \alpha = \frac{1}{\sqrt{C}} \text{ or } \propto \sqrt{V}$$

Where V is the volume of solution at infinite dilution

Hydrolysis of salts

Salts of strong base and strong acid does not undergo hydrolysis, eg. NaCl, KCl

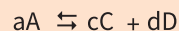
Salt of weak base and Strong Acid

$$K_h = \frac{K_w}{K_b}; p^H = \frac{1}{2} [pK_a - pK_b - \log c]$$

Salt of weak Acid and weak base

$$K_h = \frac{K_w}{K_a \times K_b}; p^H = \frac{1}{2} [pK_w - pK_a - pK_b]$$

Solubility Product (K_{sp})



$$K_{sp} = [C]^c [D]^d$$