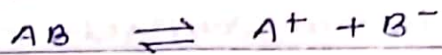


Electro Chemistry -

* Arrhenius theory of electrolytic dissociation:-

Let us consider a reaction -



A/c to Arrhenius there exists an equilibrium between undissociated salt AB and its ions.

$A^+ + B^-$. So law of mass action may be applied over this equilibrium.

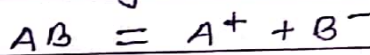


$$K = \frac{[A^+][B^-]}{[AB]}$$

where, K = Dissociation Constant of AB.

* Ostwald dilution law:-

Let us consider the dissociation of an electrolyte AB. Let C mole/litre be its initial concentration and α is its degree of dissociation.



Initial CM 0 0

$C - C\alpha$ $C\alpha$ $C\alpha$

Degree of dissociation is defined as the fraction of electrolyte which dissociates from 1 mole of an electrolyte.

then

$$K = \frac{[A^+][B^-]}{[AB]}$$

$$K = \frac{C\alpha \times C\alpha}{C - C\alpha} = \frac{C^2 \alpha^2}{C(1-\alpha)}$$

$$K = \frac{C\alpha^2}{1-\alpha}$$

This is mathematical

Formulation of Ostwald dilution law.

where,

K = dissociation constant of an electrolyte AB .

For very weak electrolyte —

$$\alpha \ll 1, \quad 1 - \alpha = 1$$

$$\text{So, } K = c\alpha^2$$

$$\alpha = \sqrt{K/c}$$

This law is applicable in the case of weak electrolyte only. ^{in which} ~~the~~ molecule completely dissociates into its constituents ions & thus equilibrium does not exist.

In the case of strong electrolyte the another theory is applied known as Debye and Huckel Theory of strong electrolyte.

* Conductance :-

The flow of electricity through solutions of electrolytes is due to the migration of ions when potential difference is applied between the two electrodes. The cations which are +vely charged move towards the -vely charged electrode known as Cathode while the anions which are -vely charged move towards the +vely charged electrode called Anode.

The ease with which electricity flows through a solution is called Conductance.

Thus, Conductance is defined as the reciprocal of the resistance.

$$\text{i.e. } G \propto \frac{1}{R}$$

Unit -

$$\text{Ohm}^{-1} \quad \text{OR} \quad \text{mho} \cdot (\Omega^{-1}).$$

In SI system, the unit of Conductance is siemen, 'S'.

Types -

- (i) Specific Conductance.
- (ii) Molar Conductance.
- (iii) Equivalent Conductance.

*. Specific Conductance -

The resistance of any conductor varies directly as its length (l) and inversely proportional to its cross sectional area (a)

$$\text{i.e. } R \propto \frac{l}{a}$$

$$\text{OR } R = \rho \frac{l}{a} \quad \text{OR} \quad \rho = \frac{R \cdot a}{l}$$

where, ρ is constant called specific resistance & R is the resistance.

where, l = length

a = cross sectional area.

if $l = 1 \text{ cm}$ & $a = 1 \text{ cm}^2$

then,

$$R = \rho.$$

ρ depends on the nature of material of the conductor.

Specific Conductance may be defined as the reciprocal of specific resistance.

It is denoted by k (Greek word Kappa).

$$\text{Thus } k = \frac{1}{\rho} \quad \text{OR} \quad k = \frac{1}{a} \times \frac{1}{R}$$

OR $k = \frac{1}{a} \times \text{Conductance.}$

Unit -

Since,

$$k = \frac{1}{a} \times \frac{1}{R}$$

$$k = \frac{\text{cm}}{\text{cm}^2} \times \text{ohm}^{-1}$$

$$k = \text{ohm}^{-1} \text{cm}^{-1}.$$

*. Molar Conductance -

The conducting power of all the ions produced by one mole of the electrolyte in a given solution is called molar conductance.

It is denoted by ' Λ_m '.

Unit -

$$\text{ohm}^{-1} \text{ OR } \text{Mho.}$$

Λ_m increases by increasing dilution.

*. Relationship between k and Λ_m . -

Molar Conductance is related to Specific Conductance by the relation -

$$\Lambda_m = \frac{k}{C}$$

where Λ_m = Molar Conductance.

k = Specific conductance

C = Concentration of the solution in mole per cubic metre.