Electro Chemistry

* Arhenius theory of Electrolytic dissociation :-

Let us consider a reaction -

$$AB \rightleftharpoons A^+ + B^-$$

A/c to Arhenius their exists an equillibrium between undissociated salt AB and its ion. $A^+ + B^-$. so law of mass action may be applied over this equillibrium.

$$AB \rightleftharpoons A^+ + B^-$$

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

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.

	AB	$= A^+$	$+ B^-$
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

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

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

$$\boxed{K = \frac{c\alpha^2}{1-\alpha}}$$ This is mathemetical

Formulation of ostwald dilution law.

where,

K = dissociation constant of an electrolyte AB.

for very weak electrolyte —

$\alpha << 1$, $1-\alpha = 1$

So, $K = c\alpha^2$

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

This law applicable in the case of weak electrolyte only. in which molecule complete dissociates in to ~~compleate~~ its constituents ions & thus equillibrium does not exists.

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 cation which are +vely charged move towards the -vely charged electrode know 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.

i.e., $C \propto \frac{1}{R}$

Unit –

Ohm^{-1} OR mho. (Ω^{-1}).

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

Types –

(i) Specific Conductance.

(2) Molar Conductance.

(3) Equivalent Conductance.

*. Specific Conductance –

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

i.e. $R \propto l/a$

OR $R = \rho\, l/a$ ∴ $\rho = a/l \cdot R$

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

where, l = length

a = cross sectional area.

if l = 1 cm & a = 1 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).

Thus $k = 1/\rho$ OR $k = l/a \times 1/R$

OR $k = 1/a \times$ Conductance.

Unit –

Since,

$$k = 1/a \times 1/R$$

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

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

*. 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 –

ohm^{-1} OR mho.

Λ_m increases by increasing dilution.

*. Relationship between k and Λ_m. –

Molar Conductance is related to Specific conductance by the relation –

$$\Lambda_m = k/c$$

where Λ_m = Molar Conductance.
k = Specific conductance
c = Concentration of the solution in mole per cubic metre.