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For Deg II Chem Hons Paper-IV &
Deg II sub courses

Electrolytic conduction

Such Conductor in which electricity flows as a result of chemical change is known as electrolytic Conductor or electrolyte.

Such conductor in which electricity flows without producing any chemical is known as Metallic Conductor.

Like Metallic conductor electrolyte also obey ohm's Law of electricity.

Ohm's Law statement :-

The current flowing through a conductor is directly Proportional to the potential difference (E) applied across the Conductor and inversely Proportional to the resistance (R) of the Conductor.

$$C = \frac{E}{R}$$

C = Strength of the current
R = Resistance.

Conductance :- It is the easiness with which the current flows through a conductor. It is the reciprocal of Resistance.

$$\text{Conductance } (C) = \frac{1}{R}$$

$$\text{Unit of Conductance} = \frac{1}{\text{ohm}} = \text{ohm}^{-1}$$

specific Conductance :-
The resistance of a conductor is directly Proportional to its length (l) and inversely Proportional to its area of cross-section.

$$R \propto \frac{l}{a}$$

$R = \frac{\rho \cdot l}{a}$ where ρ is a constant known as specific resistance

If $l = 1$ cm, $a = 1$ sq. cm Then $R = \rho$

Thus specific resistance is defined as the resistance of a specimen of material of 1 cm Length and 1 sq-cm is cross-sectional area

Now the reciprocal of specific resistance is the specific conductance.

Thus the specific conductance is the conductance of 1 cm cube of material. It is denoted by K

$$K = \frac{1}{\rho} = \frac{l}{a} \times \frac{1}{R}$$

∴ specific conductance = Cell constant × Conductance

Cell constant = $\frac{l}{a}$

conductance = $\frac{1}{R}$

Unit of K :—

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

Equivalent Conductance :—

It is defined as the conducting Power of all the ions produced by one gram equivalent of an electrolyte in a given solution. It is denoted by Λ (Lambda)

Equivalent conductance = Conductance × Volume of solution in ml containing 1 gram-equivalent of electrolyte.

$$\boxed{\Lambda = K \times \phi}$$

Effect of dilution:

When a given solution containing 1 gram-equivalent of electrolyte is diluted, the equivalent conductance increases but the sp. conductance decreases on dilution.

On dilution the volume of the solution increases but the number of ions per unit volume decreases hence sp. conductance decreases. Whereas on dilution the degree of dissociation of electrolyte increases as a result of which the same amount of electrolyte furnishes more ions. As the equivalent conductance is the conducting power of all the ions produced by 1 gram-equivalent of electrolyte hence it increases with dilution.

Molar conductance (μ):-

It is defined as the conducting power of all the ions produced by one gram-mole of an electrolyte in a given solution. It is denoted by

$$\Lambda = K \times \phi'$$

Where K = specific conductance

ϕ' = It is the volume of electrolytic solution in ml containing 1 gram-mole of the electrolyte

Unit of Λ :— $Ohm^{-1}\,cm^2$

or $mho\,cm^2$

Effect of dilution :—

Like equivalent conductance it also increases upon dilution. Because on dilution the degree of dissociation of electrolyte increases hence 1 gram-mole of electrolyte is capable of furnishing more ions in solution with dilution and thus the conducting power of solution increases hence the molar conductance increases.

The End