Class ⇒ B.Sc. (Part-1) Subsidiary
Subject ⇒ Chemistry
Chapter ⇒ Ionic Equilibrium
Topic ⇒ Equivalent Conductance and Molar Conductance.

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Equivalent Conductance

The conductance of all the ions produced from one gm equivalent of the electrolyte dissolved in V cm^3 of the solution when the distance between the electrodes is one cm and the area of the electrodes is so large that whole of the solution is contained between them is called equivalent conductance.

Equivalent conductance is represented by λ_{eq}.

Equivalent conductance is equal to the product of the specific conductance k and the volume v in cc containing one gm. equivalent of the electrolyte at the dilution v.

Equivalent conductivity = specific conductivity × V

$$\lambda_{eq} = K \times V$$

Where v is the volume in cm^3 containing one gm equivalent of the electrolyte.

If the solution has a concentration of c gm equivalent per litre i.e. c gm equivalents are present in 1000 cm^3 of the solution, then the volume of the solution containing one gm equivalent will be 1000/c. Thus the above

expression becomes

$$\lambda_{eq.} = K \times \frac{1000}{C_{eq}}$$

or $$\lambda_{eq} = K \times \frac{1000}{\text{Normality}}$$

$$\therefore \lambda_{eq.} = K \times \frac{1000}{N}$$

Units of Equivalent Conductance

$$\lambda_{eq} = K \times V$$
$$= ohm^{-1} cm^{-1} \times \frac{cm^3}{gm\ Eq.}$$
$$= ohm^{-1} cm^2 (gm\ Eq.)^{-1} \text{ or } S\,cm^2 eq^{-1} \text{ or } \Omega^{-1} cm^2 eq^{-1}$$

S.I. Unit

The unit of Equivalent Conductance are $S\,m^2 eq^{-1}$.

$$1\,S\,m^2 eq^{-1} = 10^4 \times S\,cm^2 eq^{-1}.$$

Molar Conductance

The molar conductance of a solution at a dilution V is the conductance of all the ions produced from one mole of the electrolyte dissolved in V cm^3 of the solution when the electrodes are one cm apart and the area of the electrodes is so large that the whole of the solution is contained between them.

Molar Conductance is usually represented by λ_m.

Molar conductance is related to the specific conductance as follows-

Molar Conductance = Specific Conductance × Volume in cm^3

containing one mole of the electrolyte.

$$\lambda_m = K \times V$$
$$= K \times \frac{1000}{c}$$
$$= K \times \frac{1000}{\text{Molarity}}$$

$$\therefore \lambda_m = K \times \frac{1000}{M}$$

Where K is the specific conductivity and V is the volume of the solution containing one mole of the electrolyte and c is the molar concentration.

Units of Equivalent conductance

$ohm^{-1} cm^2 mol^{-1}$ or $S cm^2 mol^{-1}$ or $\Omega^{-1} cm^2 mol^{-1}$

S.I. Unit

$S m^2 mol^{-1}$

$1 S m^2 mol^{-1} = 10^4 \times S cm^2 mol^{-1}$

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