Determination of Solubility and Solubility Products of an Sparingly Soluble Salt: –

We Know Silver Chloride is a sparingly Soluble Salt.
A minute quantity of salt will pass in to Solution when it is suspended in conductivity water at 25°C

The Conductance of solution along with Conductance of Water used in preparation of Solution is also determined by Conductometric Measurement at 25°C.

The difference is multiplied by cell constant which gives the Specific Conductance of the solution due to dissolved Salt.

Let the value find is $Z\ Sm^{-1}$

Let us suppose the solubility of Silver Chloride (AgCl) is x mole per Cubic metre

so, Concentration of AgCl in the Aqueous Solution, $C = x\ mol\ m^{-3}$.

Hence the Molar Conductance of the solution will be given by

$$\mu,\ \text{or}\ \Lambda_m = \frac{K}{c}$$

$$\mu\ \text{or}\ \Lambda_m = \frac{K}{c} = Z\ Sm^{-1}/x$$

At infinite dilution,

$$\Lambda_\infty\ \text{or}\ \Lambda_m = \lambda_{Ag^+} + \lambda_{Cl^-}$$

$$= (61.92 + 76.34)\,10^{-4}$$

$$= 138.26 \times 10^{-4}\ Sm^2 mol^{-1} \quad \text{———} (1)$$

and,

$$\Lambda_m = \frac{Z\ Sm^{-1}}{x} \quad \text{———} (2)$$

From eqn (1) and (2)

$$\frac{Z\ Sm^{-1}}{x} = 138.26 \times 10^{-4}\ Sm^2 mol^{-1}$$

$$\text{or}\ x = \frac{Z\ Sm^{-1}}{138.26 \times 10^{-4}\ Sm^2 mol^{-1}} = \frac{Z}{138.26 \times 10^{-4}}\ mol\ m^{-3}$$

Thus, the Solubility of AgCl at 25°C is

$$= \frac{Z}{138.26 \times 10^{-4}}\ mol\ m^{-3}\ \text{or}\ \frac{Z}{138.26 \times 10^{-7}}\ mol\ dm^{-3}$$

$$\text{or}\quad x = \frac{Z}{138.26 \times 10^{-7}}\ mol\ dm^{-3} \times 143.5\ g\cdot mol^{-1}$$

$$= \frac{Z \times 143.5}{138.26 \times 10^{-7}}\ g\ dm^{-3}$$

Determination of degree of dissociation of Weak electrolyte or Degree of Ionisation.

The degree of dissociation of weak electrolyte at any dilution can be calculated by the given relationship -

We know,

$$\underset{(\text{Alpha})}{\alpha} = \frac{\lambda_v}{\lambda_\alpha} = \frac{\text{Equivalent Conductivity at given dilution}}{\text{Equivalent Conductivity at infinite dilution}}$$

and $\lambda_v = K_v \times V$

i.e Equivalent Conductivity at given dilution = Specific Conductivity x Volume

(i) By knowing (K_v) specific conductivity and volume λ_v Equivalent conductivity at the given dilution can be calculated.

(ii) λ_α is calculated by Kohlarush's law.

$$\lambda_\alpha = \lambda_a + \lambda_c$$

where λ_a and λ_c are ionic conductance of Anion and Cation.

By knowing the value of λ_v (Equivalent Conductivity at given dilution) and λ_α (Equivalent Conductivity at infinite dilution, the degree of dissociation 'α' (Alpha) can be calculated.

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