EQUIVALENT CONDUCTANCE & MOLAR CONDUCTANCE

Equivalent conductivity (Λ): The conductance of that volume of solution containing one equivalent of an electrolyte is known as equivalent conductivity. It is denoted by Λ.

Let us consider the V cm^3 of solution containing one equivalent of an electrolyte. Its conductance is equal to equivalent conductance, Λ.

Also we know that the conductance shown by 1 cm^3 solution containing this electrolyte is called specific conductance, κ.

i.e.,

the conductance of V cm^3 --------- Λ

the conductance of 1 cm^3 --------- κ

Therefore:

Λ = κ.V ---------- equation (3)

We know that the normality (N) of a solution is given by the equation:

$$N = \frac{n_e}{V(\text{in cc})} \times 1000$$

For above electrolytic solution, no. of equivalents, $n_e = 1$.

Hence

$$V(\text{in cc}) = \frac{1000}{N}$$

By substituting the above value in the equation (3), we can now write:

$$\Lambda = \kappa . \frac{1000}{N}$$

Units of Λ:

$$= \frac{Ohm^{-1} . cm^{-1}}{equivalents . cm^{-3}}$$

$= cm^2 . ohm^{-1}. equiv^{-1} = cm^2 . mho. equiv^{-1}$

or

m^2 . Siemens. $equiv^{-1}$

Molar conductivity (Λ_m or μ): The conductance of that volume of solution containing one mole of an electrolyte is known as molar conductivity. It is denoted by Λ_m or μ.

It is related to specific conductance, κ as:

$$\mu = \kappa . V$$

or

$$\mu = \kappa . \frac{1000}{M}$$

Where

M = molarity of the electrolytic solution.

Units of μ:

= $cm^2 . ohm^{-1} . mol^{-1} = cm^2 . mho. mol^{-1}$

or

m^2 . Siemens. mol^{-1}

The relation between equivalent conductance, Λ and molar conductance, μ can be given by:

μ = Λ x equivalent factor of the electrolyte

The equivalent factor of the electrolyte is usually the total charge on either anions or cations present in one formula unit of it. It may be equal to basicity in case of acids or equal to acidity in case of bases.