ELECTRO CHEMISTRY

Types of Conductivity

1. Specific Conductance (κ) => (kappa)
2. Equivalent Conductance (Λ) => (Lambda
3. Molar Conductance (Λ_m or μ)

1. Specific Conductance:

$$\kappa = L \times \frac{l}{A}$$

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

L= Conductance of Solution
l = Distance between electrodes
A = Are of surface of Electrode

Unit of κ , CGI: mho.cm^{-1} or Ω^{-1}cm^{-1} . SI: Sm^{-1}

2. Equivalent Conductance:

$$\Lambda = \kappa \times \frac{1000\,cm^3}{C} = \kappa \times V$$

C = Gram Equivalent Mass/Liter

Here, $C = \frac{equivalent\ mass}{Volume\ \mathrm{in}\ Liter}$

And, $equivalent\ mass = \frac{Atomic\ mass\ \mathrm{in}\ gram}{Charge\ \mathrm{of}\ cation}$

Example: Equivalent Mass of Na_2CO_3 is (106/2), because cation Na^+ has a positive charge of 2.

Unit of Equivalent conductance(Λ) Ω^{-1} cm^{-1}. (g. eqv)$^{-1}$ or in SI: S.m^2.(g. Eqv)$^{-1}$

3. Molar Conductance:

$$\Lambda_m = \kappa \times V = \kappa \times \frac{1000\,cm^2}{M}$$

M =Moles of Electrolyte

Cell Constant = $\frac{l}{A}$

Faraday's First law of Electrolysis:

$$W = ZQ$$
$$Q = I \times t$$
$$W = ZIt$$
$$Z = \frac{W}{Q} = \frac{atomic\ mass\ \mathrm{in}\ gram}{valency \times 96473}$$

Z = Electrochemical equivalent
Z = W/Q

*** Nernest Equation of Electric Cell Potential**

$$E_{cell} = E^{o}_{cell} - \frac{RT}{nF} lnQ$$

$$E_{cell} = E^{o}_{cell} - \frac{0.0592\,V}{n} \times logQ$$

Here, E_{cell} = Potential of Battery or Cell in a nonstandard Temperature

E^{o}_{cell} = Potential of Battery or Cell in a Standard Temperature

R = Ideal Gas Constant

T = Temperature in Kelvin Scale

F = Faraday's Constant Charge

Q = Ratio of Product Ion(s) and Reactant ion(s) = $\frac{[Product\,ion]^{x}}{[Reactant\,ion]^{y}}$

Example of Q:

Suppose the full Redox reaction is following:

$$Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$$

then , $Q = \frac{[Z^{2+}]}{[Cu^{2+}]}$

n = Change of Charges;

for example :

if half oxidizing reaction is

$Zn(s) \longrightarrow Zn^{2+}(aq) + 2e^{-}$

and reducing half reaction is:

$Cu^{2+} (aq) + 2e^{-} \longrightarrow Cu(s)$

then , n = 2