

3.1. ELECTRO CHEMISTRY

IMPORTANT POINTS

1. **Electrochemistry** deals with the conversion of **electrical energy into chemical energy** and Vice Versa.

- Conversion of chemical energy into electrical energy is seen in **Electro chemical cells**.
- Conversion of electrical energy to decompose chemical compounds is seen in **Electrolysis**.

2. **Galvanic (Voltaic cells)** is an electro chemical cell which converts **chemical energy into electrical energy** by redox reactions.

In Galvanic Cells two dissimilar metal plates of positive anode and negative cathode are connected through a neutral electrolyte salt solution (Salt Bridge).

Potential Difference between two electrodes is called **Cell potential**(emf of cell).

In Galvanic cells, the positive Anode releases electrons (Negative Anions) and gets oxidised; the negative Cathode receives electrons (Positive Cations) and gets reduced. Electrons migrate from Zn to Cu.

A Galvanic cell may be reversible or irreversible. **Daniel Cell** is a reversible Voltaic cell with Zn anode and Cu Cathode.

3. **Daniel Cell notation:** $\text{Zn} | \text{Zn}^{2+}_{(\text{aq})} || \text{Cu}^{2+}_{(\text{aq})} | \text{Cu}$
The two parallel lines indicates salt bridge .

4. **SHE** is a reference electrode used to measure potentials of single half cell electrodes.

5. **Nernst equation** is used to calculate the cell potential at any given temperature, pressure and reactant concentration.

$$(i) E_{\text{cell}} = E_{\text{cell}}^0 - \frac{RT}{nF} \ln \frac{[\text{Products}]}{[\text{Reactants}]}$$

(ii) For $aA + bB \rightleftharpoons cC + dD$

$$E_{\text{cell}} = E_{\text{cell}}^0 - \frac{RT}{nF} \ln \frac{[\text{C}]^c [\text{D}]^d}{[\text{A}]^a [\text{B}]^b}$$

6. **Conductance** of an electrolyte solution is a measure of its ability to conduct electricity.

Conductance of an electrolyte solution is expressed in terms of (i) Conductivity (k)

(ii) Molar Conductivity (Λ_m)

(i) Conductivity is inverse to resistivity. $k = \frac{1}{\rho}$
SI unit : Sm^{-1} = Siemen per meter.

(ii) Molar conductivity of electrolyte solution depends on its conductivity and its molar

concentration (Molarity). $\Lambda_m = \frac{k}{C}$

Also, Molar Conductivity is the conductivity of all ions produced by one mole of electrolyte in V mL of solution. $\Lambda_m = kV$

For **strong electrolytes** the conductivity **increases slowly** with dilution; for **weak electrolytes** the conductivity **increases speedily** with dilution.

7. **Infinite Dilution** is a state of dilution where there is no change in dilution when some more solvent is added.

At Infinite dilution, weak electrolyte behaves like a strong electrolyte and undergoes complete ionisation.

Limiting molar conductivity is the molar conductivity of solution at infinite dilution where its concentration approaches zero.

8. **Kohlrausch's law** is the limiting molar conductivity of an electrolyte is equal to the sum of the limiting molar conductivities of cations (λ_+^0) & anions (λ_-^0) of the electrolyte at infinite dilution. **Formula:** $\Lambda_m^0 = \lambda_+^0 + \lambda_-^0$

9. **Electrolysis:** When current is applied on ionic compounds they decompose into their constituent elements and mass is accumulated on the metal plates. This process is called electrolysis.

Our Daily LIFE

CHEM BEATS!

We used to 'Charge our Mobile Phone' for its regular usage.

While **Charging** our Phone, **Electrical Energy** is converted into **Chemical Energy!**

While using a Phone, **Chemical Energy** stored in the **battery** is converted into **Electrical Energy!!**

- చేతికున్న **Watch** లో **Battery!**
- నిత్యం వాడే **సెల్ఫోన్లో Battery!**
- ఫోటోలు తీసే **డిజిటల్ కెమెరాలో Battery!**
- చేతిలోని **T.V. Remote Control** లో **Battery!**
- నడిపే **Bike** లో **బ్యాటరీ, తిరిగే Car** లో **Battery!**
- **Battery** వాడకమే **Electro Chemistry-** యొక్క **Basic Application!**
- Ofcourse మన **Body Cells** లోని **Cell Membranes** లో నిరంతరం **Na, Cl, H ions** ల మధ్య **Electro Chemical Reactions** జరుగుతుంటాయి !!
- **రంగు రంగుల కలర్స్ లో Bike Paints, Car Paints** లలో **Electrolysis!**
- **Pure Gold** ను మరిపించే అందమైన **Rold Gold** ఆభరణాల తయారీలో **Electrolysis!!**
- **Chemical Industry** లో **Chlorine, NaOH** తయారీ, **Bauxite** నుండి **Aluminium** తయారీ, **Copper Purification Process....** వీటన్నింటిలోనూ **Electrolysis Process** జరుగుతుంది !!!