Introduction

Electrochemistry is the branch of science which deals with the relationship between chemical reaction and electricity.

Conductors

A Substance or material that allows electric current to pass through it is called *conductor*

e.g All metals, graphite , fused salts, aqueous solution of acids, bases, etc.,

Non Conductor

- Materials which do not conduct electric current are called *non-conductor* or *insulator*

e.g Plastics , wood most of the non metals, etc

Type of conductor: i) Metallic conductor (or) Electronic conductor ii) Electrolytic conductor

Metallic conductor (or) Electronic conductor

- These conductor are solid substance which conduct electric current by moment of free electron from one end to another end
- The conduction decreases with increase of temperature. e.g. metals

Electrolytic conductor

- Electrolytic conductors conduct electric current by free ions or moment of ions in solution.
- The conduction increases with increase of Temperature. e.g Acids, Bases & Ions

Types of Electrolytes

Strong Electrolytes: Complete ionisible in dilute solution (e.g KCl, NaCl, NaOH, KOH)

Weak Electrolytes: Partially ionisible in dilute solution (e.g CH_3COOH, NH_4OH)

Non Electrolytes: These electrolytes do not ionisible in any solution (e.g glucose, sucrose)

Difference between Metallic Conductor & Electrolytic Conductor

S.No	Metallic Conductor	Electrolytic Conductor
1	It involves only free electron in a conductor	It involves only free ions in a solution
2	It does not involve any transfer of matter	It involves transfer of electrolyte in the form of ions.
3	Conduction decreases with increase of Temperature	Conduction increases with increase of Temperature
4	No change in chemical properties of the conductor	Chemical reaction occur at the two electrodes

Fundamental components of electrochemical cell

Current: Current is the flow of electrons through a wire or any conductor.

Electrode: Electrode is a material which conducts electrons.

Anode: oxidation half-reaction takes place; e.g.. $Zn \rightarrow Zn^{2+} + 2e^{-}$

The electron at the surface of the metal electrode.

Cathode: reduction half-reaction occurs; e.g.. $Cu^{2+} + 2e^{-} \rightarrow Cu$

- Movement of metal ions from the solution to the electrode to gain electrons in reduction.
- Oxidation of metal releases metal ions into the solution of oxidation half-cell.

Electrolyte : Internal conducting environment that allows ions to migrate between both half cells so as to preserve electro neutrality

External circuit: Two half-cells are joined together by wire through which electrons flow.

Salt bridge / porous membrane: Serves as a bridge to complete the electric circuit and maintain electro neutrality in the electrolyte.

Electrode potential

A metal (M) consists of metal ions (M^{n+}) with valence electrons. When the metal (M) is placed in a solution of its own salt, any one of the following reactions will occur.

(i) Positive metal ions may pass into the solution.

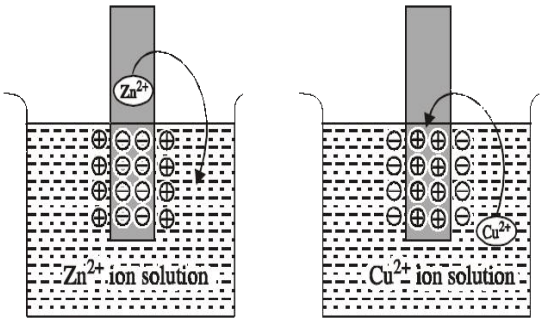
$M \longrightarrow M^{n+} + ne^{-}$ (oxidation)

(ii) Positive metal ions from the solution may deposit over the metal.

$M^{n+} + ne^{-} \longrightarrow M$ (reduction)

Examples – 1 :Zn electrode dipped in $ZnSO_4$ solution

When Zn electrode is dipped in $ZnSO_4$ solution, Zn goes into the solution as Zn^{2+} ions. Now, the Zn electrode attains a negative charge, due to the accumulation of valence electrons on the metal. The negative charges developed on the electrode attract the positive ions from solution. Due to this attraction the positive ions remain close to the metal.



Example -2 Cu electrodes dipped in $CuSO_4$ solution

When Cu electrode is dipped in $CuSO_4$ solution, Cu^{2+} ions from the solution deposit over the metal. Now, the Cu electrode attains a positive charge, due to the accumulation of Cu^{2+} ions on the metal. The positive charges developed on the electrode attract the negative ions from solution. Due to this attraction, the negative ions remain close to the metal.

Factors affecting electrode potential

The rate of the above reactions depend on (i) The nature of the metal (ii) The temperature (iii) The concentration of metal ions in solution