# Electrochemistry

# References

1- Fundamental physical chemistry , by
Maron and Lando .
2- physical chemistry , 5th Edition by
Iran . Levin .
3-Physical Chemistry ,6th Edition , By
Atkins .
4- Modern Electrochemistry ,By
John Bockris & Amulya Reddy .
5- physical chemistry , By
Gorden M. & Barrow .
6- Physical chemistry , By
Robert A. Alberty

# Syllabus of Electrochemistry

1.Introduction about electrochemistry science.
2.Faraday's Laws.
3.Applications of Faraday's Laws.
4.Electrical conductance , Resistance, specific resistance, specific conductance, molar and equivalent conductance, cell constant, and solvent correction.
5.Conductivity Measurement.
6.Applications of conductance (Debye-Huckel-Onsagar equation, Kohlrausch Law, Ostwald dilution Law, Determine the hydrolysis constant for salt, and Conductometric titration.
7.Debye- Huckel theory.
8.Migration of ions towards the electrodes.
9.Hittorf's method, and transport number of ions.
10.Electrochemical cell and electrolytic cell.
11.Electromotive force (EMF).
12.Type of electrodes.
13- Thermodynamics and EMF .
14-Electrochemical cells .
15-Electrolysis and polarization .
16- Type of
17- Corrosion .

# International system

| Physical Quantity | Name of Unit | Unit Symbol | Unit Expressed In terms of Base Units |
|---|---|---|---|
| Force | Newton | N | $m.Kg.s^{-2}$ |
| Energy | Joule | J | $N.m$ or $m^2.Kg.s^{-2}$ |
| Power | Watt | W | $J.s^{-1}$ |
| Quantity of electricity | Coulomb | C | $A.s$ |
| Electromotive force | Volt | v | $J.A^{-1}.s^{-1}$ |
| Electro resistance | Ohm | Ω | $V.A^{-1}$ or $m^2.Kg.s^{-3}.A^{-2}$ |
| Electric conductance | Siemens | S | $\Omega^{-1}$ |
| Electrical capacitor | Farad | F | $A.v^{-1}.s$ or $m^{-2}.Kg^{-1}.s^4.A^2$ |
| Current density | Current | i | $A.cm^{-2}$ |
| Current | Amper | I | A |

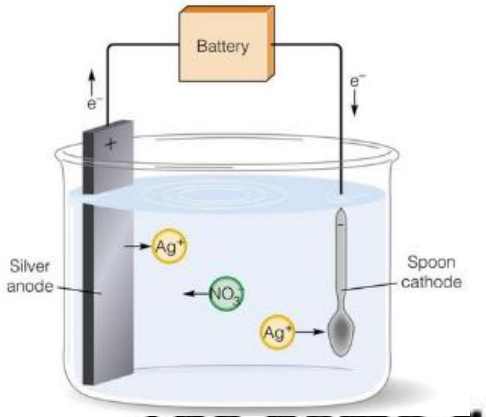
# Why Study Electrochemistry?

- Batteries


- Corrosion

- Industrial production of chemicals such as $Cl_2$, NaOH, $F_2$ and l

- Biological redox reactions




The heme group

# electrochemistry

Electrochemistry : is the branch of physical chemistry that concerns itself with the interrelation of chemical phenomena and electricity . It  deals not only with the study of electrical properties of solutions of electrolytes, but also with the elucidation of the relation between chemical action and electricity in such systems .

**Conductors** are the substances which allow the passage of electric current.

**Non-conductors** or **insulators** are the substances which don't allow the passage of electrical current through them. Examples are rubber, wax, wood.

***Types of conductors***

1. **Metallic conductors.**

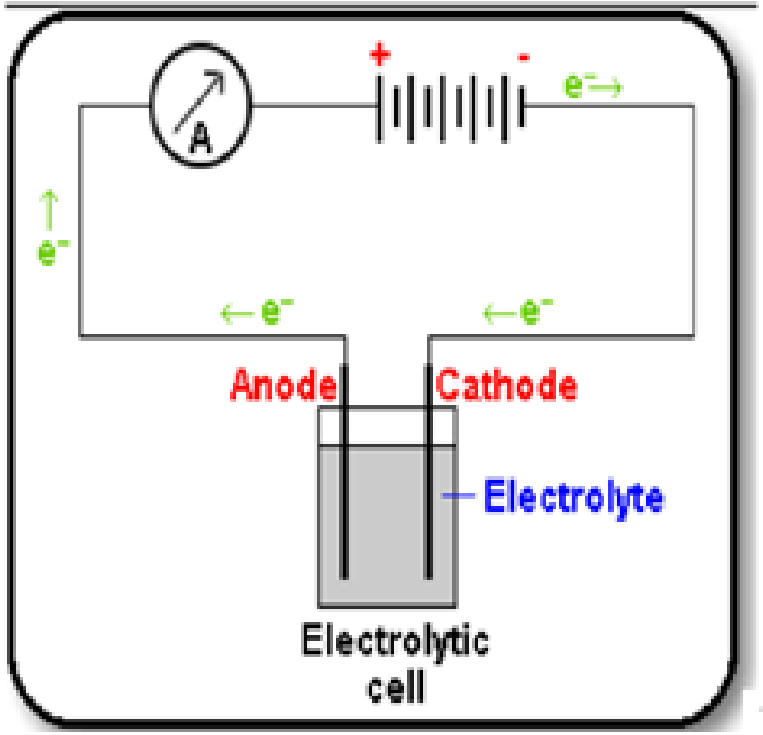
   There are metallic substances which allow the electricity to pass trough them without undergoing any chemical /physical change.

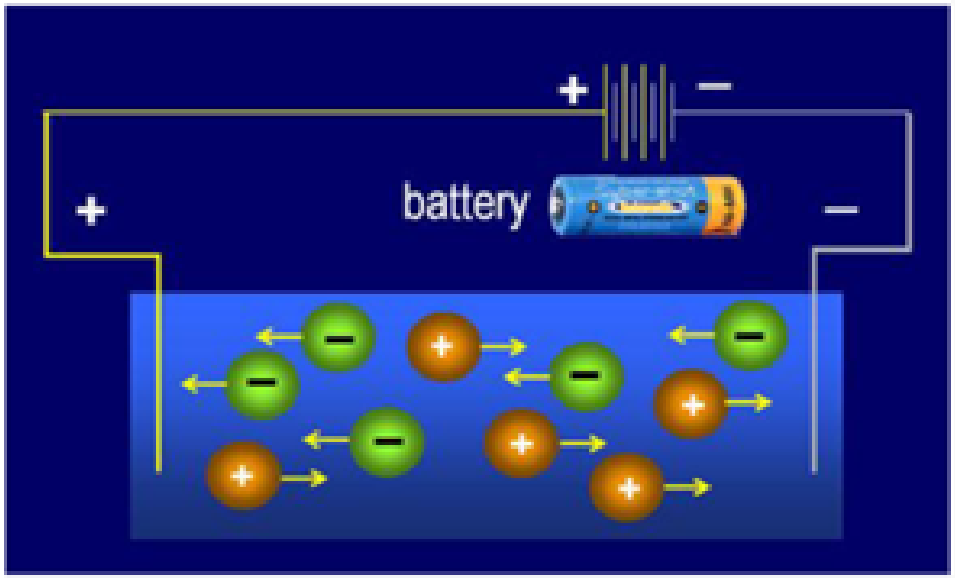
   Eg: all metals, graphite, etc.

2. **Electrolytes.**

   There are substances which allow the electricity to pass through them in their molten states or in the form of their aqueous solutions and undergo chemical decomposition.

- Electrolyte solutions and molten salts conduct electricity through the migration of ions.
- When the current is passed through an electrolyte solution decomposition and changes occur in the composition of electrolytes



| Metallic conduction | Electrolytic conduction |
| --- | --- |
| Metallic conduction is carried by the movement of electrons | Electrolytic conduction is carried by the movement of ions |
| No change in the chemical properties of the conductor | It involves the decomposition of the electrolyte as a result of the chemical reaction |
| It does not involve the transfer of any matter | It involves the transfer of matter as ions |
| Metallic conduction decreases with increase in temperature | Electrolytic conduction increases with increase in temperature |

## According to the Degree of dissociation (α) electrolytes can be classified into the following:

- ***strong electrolytes*** ***are*** compounds that dissociate to a large extent ( α> 30%) into ions when dissolved in water. For example, HCl, $H_2SO_4$, $HNO_3$, HI, NaOH, KOH, KCl.
- ***medium strong electrolytes*** α = 2 - 30%. $H_3PO_4$, $H_3PO_3$.
- ***weak electrolytes*** ***are*** compounds that dissociate to only a small extent α<2%. For example, $NH_4OH$, $H_2S$, HCN, $H_2CO_3$.
- ***nonelectrolytes*** α = 0 are compounds that don't dissociate when dissolved in water.