SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

Coimbatore-641035.

23CHT101-Engineering Chemistry

Unit- I Electrochemistry

Empathy:

- How might understanding electrode potential impact our ability to design more efficient batteries or fuel cells?
- What challenges could arise when trying to measure electrode potential in real-world applications?
- What is a Conductor?
- What are the different types of Conductors?
- Is it possible to carry AC current to everywhere?

Introduction to Electrochemistry:

Electrochemistry is a branch of chemistry deals with the chemical applications of electricity. It deals with the chemical reaction produced by passing electric current through an electrolyte or the production of electric current through chemical reactions.

Important Terms Involved in Electrochemistry:

1. CURRENT:
It is the flow of electrons through a conductor.

2. CONDUCTORS:

A substance that allows electric current to pass through it called a conductor.

The ability of a material to conduct electric current is called conductors.

Eg: All metals, graphite, aqueous solution of acids, bases etc..,

3. NON CONDUCTORS:

Materials which do not conduct electric current are called non-conductors.

Eg: Plastics, wood etc..,

TYPES OF CONDUCTORS
1.Metallic conductor 2.Electrolytic conductor

Metallic conductors:

Metallic conductors are solid substance which conducts electric current due to the movement of electrons from one end to another.

Eg: All metals, graphite.

Electrolytic conductors:

Electrolytic conductors conduct electric current due to the movement of ions in solution or in fused state .The conduction increases with increase of temperature.

Eg: Acids, bases, salts, etc..,

DIFFERCENCE BETWEEN METALLIC AND ELECTROLYTIC CONDUCTION

METALLIC CONDUCTION	ELECROLYTIC CONDUCTION
It involves the flow of electrons in a conductor.	It involves the movement of ions in a solution
Conduction decreases with increase in temperature.	Conduction increases with increase in temperature.
It does not involve any transfer of matter.	It involves the transfer of electrolyte in the form of ions
No change in the chemical properties of the conductor.	Chemical reactions occurs at the two electrodes

TYPES OF ELECTROLYTIC CONDUCTORS:

The electrolytic conductors are further classified into three types

a. Strong electrolytes:

Strong electrolytes are substance which ionise completely almost at all dilutions.

Eg: HCl, NaCl, NaOH etc..,

b. Weak electrolytes:

Weak electrolytes are substances which ionize to a small extent even at high dilutions.

Eg: CH_3COOH, $CaCO_3$, NH_4OH, etc..,

c. Non electrolytes:

Non electrolytes are substances which do not ionize at any solutions.

Eg: Glucose, Sugar, Alcohol, etc..,

IMPORTANT CELL TERMINOLOGY

- Oxidation: The tendency to lose electrons.
- Reduction: The tendency to gain electrons.
- Electrode: When a metal rod is dipped in its salt solution, it develops a positive or negative potential. This assembly is called electrode.
- Anode: Anode is an electrode at which oxidation occurs.
- Cathode: Cathode is an electrode at which reduction occurs.
- Electrolytes: Electrolyte is a water soluble substance forming ions in the solution and conduct an electric current.
- Half cell: Each half cell is an electrochemical cell where oxidation occurs and the half where the reduction occurs is called half cell.

Cell: Cell is a device consisting of two half cell. The two half cells are connected through the wire

TYPES OF CELLS

Based on the type of reaction occurring in a cell, cells are classified into two types

1. Electrolytic cells

Electrolytic cells are the cells in which electrical energy is used to bring about a chemical reaction. Eg: Electroplating etc..,

2. Electrochemical cells

Electrochemical cells are the cells in which chemical energy is converted into electrical energy. Eg: Daniel cell.

REPRESENTATION OF A CELL

We will consider that a cell consists of two half cells .Each half cell is again made of a metal electrode in contact with metal ion in the solution.

1. A single vertical line (|) represents a phase boundary between metal electrode and ion solution (electrolyte).Thus the two half cell in voltaic cell are indicated as

$Zn|Zn^{2+}$ $Cu^{2+}|Cu$ (|-phase boundary)

Anode half cell Cathode half cell

The metal electrode in anode half-cell is on the left, while in cathode half -cell is on the right of the metal ion.

2.In the complete cell diagram ,the two half cells are separated by a double vertical line in between zinc -copper cell can be written as
$Zn|Zn^{2+}$ || $Cu^{2+}|Cu$ (||-Salt bridge)

The symbol for an inert electrode like the platinum electrode is often enclosed in a bracket.

$Mg|Mg^{2+}||H^{+}|H_2$(Pt)-inert electrode

Anode electrode cathode electrode

EMF OF A CELL

Electromotive force is defined as the difference of potential which cause flow of current from one electrode of higher potential to the other electrode of lower potential.

Thus the EMF of a galvanic cell can be calculated using the following relationship.

EMF = {standard reduction potential of right hand side electrode} - {standard reduction potential of left hand side electrode}

FACTORS AFFECTING EMF OF A CELL:

1. Nature of the electrolyte and electrodes.

2. Concentration and composition of the electrolytes.

3. PH and temperature of the solution.