CHEMISTRY DEPARTMENT

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- Subject: *Chemistry (physical)*
- Course: B.Sc(Hon's)
- Year : Second year
- Semester : IV (CC-410)
- College :Patna Women's College,Patna University,Patna
- Topic: *Conductance*

Conductance

- *Electrolysis*: The process of decomposition of an electrolyte by the passage of electric current through it is known as electrolysis.
- Example: NaCl
- *Faraday'S law of electrolysis*:
- *1st law of electrolysis*: For the same electolyte, the mass of a substance produced or consumed at an electrode is directly proportional to the quantity of charge passed through electrolytic cell, w is the electrochemical equivalent of the substance.

- m αQ
- m αIt (Q=It)
- m=wIt $\longrightarrow$ (1)
- m= mass of a substance

  w=electrochemical equivalent of the substance

  I=Current

  t= time

  I=1 ampere, t=1 sec, equation (1) becomes

  m=w $\longrightarrow$ (2)

- From equation electrochemical equivalent of a substance may be defined as the mass of the substance produced or consumed when a current of 1 ampere for 1 second is passed through electrolyte.
- Example: Electrochemical equivalent of silver is 0.001118.

- *2nd law of electrolysis*: When same quantity of electricity is passed through different electrolytes , the amount of product obtained are proportional to their chemical equivalent or equivalent weight.

- $m\alpha E$ → (3)

  ↓ → equivalent wt of the substance

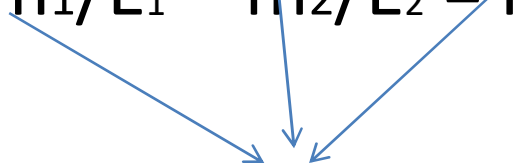
- is the weight of the substance decomposed or deposited by the passage of a certain quantity of electricity
- equation (3)can be put as

- m= constant X E

or, m/E =Constant (4)

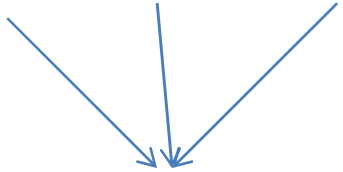
- when same quantity of electricity is passed through different electrolytes, equation (4) can be put as

- $m_1/E_1 = m_2/E_2 = m_3/E_3$ =Constant (5)



- represents the amount of various ions liberated or consumed at their electrodes

- $E_1 = E_2 = E_3$



Equivalent weight

- *Resistance or Conductance*: Metallic conductor as well as electrolytes obey Ohm's law , states that:

- “The strength of current I flowing through a conductor is directly proportional to the potential difference E applied across the conductor and inversely proportional to the resistance R of the conductor.
- Ohm’s law becomes as
- $I=E/R$
- $C=1/R$ C=conductance

- Unit: mhos
- *Resistance*: The resistance R of a conductor is
- (i) directly proportional toits length9lcm) and
- (ii) inversely proportional to its area of a cross section.
- $R \alpha l/a$ or $R=\rho l/a$ (1)
-
- constant depending on the nature of material of the conductor and is called "specific resistance" or "resistivity."

- If l=1cm, a =l sq cm, ρ=R ohms
- *Specific Resistance:* defined as the resistance of a uniform column of the material of the conductor having a length of 1 cm and a cross section of 1sq cm."
- $\rho = R\,\frac{a}{l} = \frac{\text{ohm}(\text{cm})^2}{\text{cm}} = \text{ohm.cm}$

- *Specificconductance*: The specific conductance of a conductor is the reciprocal of specific resistance and is denoted by k. equation (2) can be written as
- R=1/k. l/a ohms
- K=1/RXl/a ohm-1cm-1

- *Equivalent Conductance*: "The conductance of a solution containing 1 gm equivalent of an electrolyte when placed between two sufficiently large electrodes which are 1 cm apart."
- Represented by λ_v , V is the volume in c.c. contains 1 gm equivalent of electrolyte dissolved in it and is measured in reciprocal ohm, or mho.

- *Molecular Conductance*: "The conductance of a solution containing 1 gm mole of the electrolyte when placed between two sufficiently large electrodes placed one cm apart."
- Represented by μ measured in mhos.