ELECTROCHEMISTRY – 02
Computer Science (Section – B)
10 – 04 – 2021 (4th Period)

DEGREE OF IONIZATION OR DEGREE OF DISSOCIATION

The no. of moles of electrolyte dissociated per mole of the electrolyte in to their constituent ions is called degree of dissociation or degree of ionization. In other words, the ratio of the no of moles of electrolyte dissociated into ions to the total number of moles of electrolyte taken is called degree of ionization or degree of dissociation. It is denoted by α.

i.e., $$\alpha = \frac{Number\ of\ moles\ of\ electrolyte\ dissociated\ into\ ions}{Total\ number\ of\ moles\ electrolyte\ taken}$$

Thus, For strong electrolytes: $\alpha = 1$

For weak electrolytes: $\alpha < 1$

For non-electrolytes: $\alpha = 0$

FACTORS GOVERNING DEGREE OF IONIZATION: Degree of ionization depends upon the following factors.

1. **Nature of electrolyte**: Ionic substances ionize in aqueous solution hence, they are electrolyte. Strong electrolyte such as HCl, H_2SO_4, KOH, NaOH, NaCI etc. ionize almost completely in their solution. Weak electrolytes such as HCOOH, CH_3COOH, NH_4OH, CH_3COONH_4 etc. do not ionize completely but only partially in their solution. Covalent substances do not ionize in their solution hence they non-electrolyte.
2. **Nature of Solvent**: Polar solvents such as water overcome the force of attraction binding the oppositely charged ions easily. As a result electrolytes ionize to a greater extent in polar solvents. Non-polar solvents are unable to overcome the force of attraction between oppositely charged ions. As a result electrolyte do not ionize in non-polar solvents.
3. **Concentration of the solution**: The degree of ionization of an electrolyte decrease with concentration i.e. higher the concentration of electrolyte smaller will be the degree of ionization.
4. **Temperature**: The degree of ionization increases with increase in temperature and vice-versa.
5. **Dilution**: The degree of ionization increases with increase in dilution and becomes maximum at infinite dilution.
6. **Dielectric constant**: The solvent having higher value of dielectric constant has higher capacity to separate the ions of the electrolyte. As a result electrolytes ionize to a greater

extent in the solvents of higher dielectric constant like water than those having lower value of dielectric constant. Therefore, higher the value of dielectric constant of a solvent more will be its ionizing power.

7. **Presence of common ion**: The presence of common in the solution suppresses the ionization of weak electrolytes. As a result the extent of ionization decreases and consequently the degree of ionization also decreases.

COMMON ION EFECT

The suppression in the degree of dissociation of a weak electrolyte (such as a weak acid or weak base) by the addition of an electrolyte from outside having a common ion is called common ion effect.

For example the degree of dissociation of a weak acid acetic acid (CH_3COOH) is further suppressed by adding sodium acetate (CH_3COONa) from outside having a common acetate (CH_3COO^-) ion.

When a weak electrolyte such as acetic acid is treated with water, it dissociates and an equilibrium exists as follows,

$$CH_3COOH_{(aq)} \rightleftharpoons CH_3COO^-_{(aq)} + H^+_{(aq)}$$

By applying law of mass action we can have,

$$K_a = \frac{[CH_3COO^-][H^+]}{[CH_3COOH]}$$

Where 'K_a' is dissociation constant of acid.

If small amount of a strong electrolyte like sodium acetate (CH_3COONa) is added to the aqueous solution of CH_3COOH, it gets dissociated and equilibrium exists, as

$$CH_3COONa_{(aq)} \rightleftharpoons CH_3COO^-_{(aq)} + Na^+_{(aq)}$$

Here, CH_3COO^- ions are common hence their concentration increases. According to Le-Chatelier's principle, equilibrium shifts towards left. To keep the value of K_a constant, the concentration of CH_3COOH molecules is increased. In this way ionisation of CH_3COOH is suppressed by adding CH_3COONa.

CONDUCTORS: Substances that give passage i.e. allow the electric current to pass hrough them are called electrical conductors or simply conductors. For example, metals, graphite, fused salts, aqueous solutions of acids, bases and salts. Conductors are of two types.

1. Electronic conductors
2. Electronic or Ionic conductors

Electronic Conductors: Substances that give passage to the flow of electric current because of the presence of free electrons are called electronic conductors. These conductors transfer electric current by transfer of electrons, without the transference of any matter. For example, Metals such as aluminium, copper, silver etc., graphite (an allotropic form of carbon) and various alloys. Silver is the best known electronic conductor. Graphite is the only non-metal which is electronic conductor. All metals conduct electric current because of the presence of free electrons, hence electronic conductors are sometimes also referred to as metallic conductors.

Electrolytic Conductors (Ionic Conductors): Substance that give passage to the flow of electric current because of the presence of free ions are called electrolytic conductors. These conductors transfer electric current by transfer of ions i.e. by transference of matter. For example, aqueous solutions of acids, bases and salts.

INSULATORS: Substances that do not allow electric current to pass through them are called electrical insulators or simply insulators. For example: wood, glass, rubber, plastics etc.