

ELECTROCHEMISTRY – 01

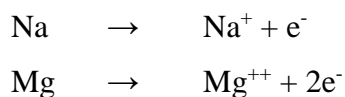
Computer Science (Section – B)

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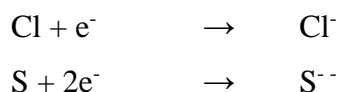
ATOM: Atom is the smallest particle of an element that participates in a chemical reaction i.e. in chemical bond formation. In other words, atom is the defining structure of an element, which cannot be broken by any chemical means. A typical atom consists of a nucleus of protons and neutrons with electrons orbiting around the nucleus.

ION: Electrically charged atom or group of atoms formed either by the loss or gain of one or more electrons is called an ion. In ions the number of electrons and the number of protons are unequal. If the number of electrons is less than the number of protons, then the species (ion) is a positive ion called cation and if the number of electrons is more than the number of protons, then the species a negative ion called anion.

Cations: Cations are the positively charged atoms or group of atoms. In cations the number of electrons are less than the number of protons. These are formed by the loss of one or more electrons. In general metal atoms have the tendency to lose electron(s) thus acquiring positive charge.



Anions: Anions are the negatively charged atoms or group of atoms. In anions the number of electrons are more than the number of protons. These are formed by the gain of one or more electrons. In general non-metal atoms have the tendency to gain electron(s) thus acquiring negative charge.



DIFFERENCE BETWEEN ATOMS AND IONS

	ATOMS	IONS
1	Atom is the smallest and an indivisible unit of matter.	Ions are atoms or group of atoms with an electrical charge.
2	Atoms are electrically neutral.	Ions carry either positive or negative charge.
3	In atoms the number of electrons and protons are equal.	In ions the number of electrons and protons are unequal.
4	Atoms cannot exist independently except for the atoms of noble gases.	Ions can exist independently.

5	Atoms are generally unstable.	Ions are generally stable.
6	Atoms do not have stable electronic configuration in the outermost orbit.	Ions generally have stable electronic configuration in the outermost orbit.

ELECTROLYTE: Substances that dissociate into their constituent ions either in their aqueous solutions or in their molten states and hence conduct electricity are called electrolytes. For example: HCl, H₂SO₄, CH₃COOH, NaOH, NH₄OH, NaCl, KNO₃, NH₄Cl etc. It is of the following two types.

Strong Electrolytes: Substances that dissociate almost completely into their constituent ions either in their aqueous solutions or in their molten states are called strong electrolytes. For example: strong acids such as, HCl, HNO₃, H₂SO₄ etc., strong bases such as NaOH, KOH etc., salts of strong acids and strong bases such as NaCl, KNO₃, K₂SO₄ etc.

Weak Electrolytes: Substances that do not dissociate completely but only partially into their constituent ions either in their aqueous solutions or in their molten states are called weak electrolytes. For example: weak acids such as, CH₃COOH (acetic acid), C₆H₅COOH (benzoic acid), weak bases such as, CH₃NH₂ (methanamine), NH₄OH (ammonium hydroxide), salts of weak acids and weak bases CH₃COONa (sodium acetate), CH₃COONH₄ (ammonium acetate) etc.

Non-electrolytes: Substances that do not dissociate at all into their constituent ions either in their aqueous solutions or in their molten states and do not conduct electricity are called non-electrolytes. For example: solutions of cane sugar, glycerine, acetone etc.

IONIZATION: Any process (heat, electrical discharge, particle collisions, radiation, electrolytic dissociation etc.) by which neutral atoms or molecules gain or lose electrons, thus acquiring a net electrical charge is called ionization.

ELECTROLYTIC DISSOCIATION: The process of dissociation of an electrolyte into its constituent ions when dissolved in water or any other solvent is called electrolytic dissociation. Simply the dissociation of an ionic compound into its constituent ions by dissolving in a polar solvent like water is called electrolytic dissociation or ionic dissociation.

ARRHENIUS THEORY OF ELECTROLYTIC DISSOCIATION: In order to explain the properties of electrolytic solutions, Arrhenius forwarded a theory in 1884, called as theory of electrolytic dissociation or ionic theory. Following are the important postulates of the theory.

1. The theory assumes that the solid electrolytes are composed of ions which are held together by strong electrostatic forces of attraction.
2. When an electrolyte is dissolved in water it dissociates into their constituent ions i.e. cations and anions. For example:



3. The process of splitting of electrolyte molecule into their constituent ions is called ionisation.
4. It is observed that all electrolytes do not ionize to the same extent. Some are almost completely ionised while some are only feebly ionised.
5. Ions present in solution constantly reunite to form neutral electrolyte molecules and thus there exist a state of dynamic equilibrium between ions and the neutral molecules.



6. The solution of electrolytic always remains electrically neutral as the total charges on cations are always equal to the total charges on anions.
7. When an electric current is passed through the electrolytic solution, the cations move towards cathode and anion moves towards anode i.e. electrolysis occurs.
8. The properties of electrolytes in the solution are the properties of ions present in it.
9. The ions act like molecule towards colligative properties.
10. The conductivity of the electrolytic solution depends upon the number and nature of ions present in the solution.