Al-Mustaqbal University

College of Health and Medical Techniques

Department of kidney dialysis Techniques

Lec 1: General chemistry

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Introduction to Analytical Chemistry

Analytical chemistry: is the branch of chemistry that deals with the analysis of different substances, and it involves the separation, identification, and the quantification of matter. by using of classical methods along with modern scientific instruments to achieve all these purposes. Analytical chemistry is often described as the area of chemistry responsible for:

1. Characterizing the composition of matter, both qualitatively and quantitatively.

2. Improving established analytical methods.

3. Extending existing analytical methods to new types of samples.

4. Developing new analytical methods for measuring chemical phenomena.

Analytical chemistry consists of:

1. **Qualitative Analysis**: Identifies what substances are present in a sample (e.g., detecting the presence of glucose in blood).
2. **Quantitative Analysis**: Determines how much of a substance is present (e.g., - measuring the exact concentration of glucose in mg/dL).

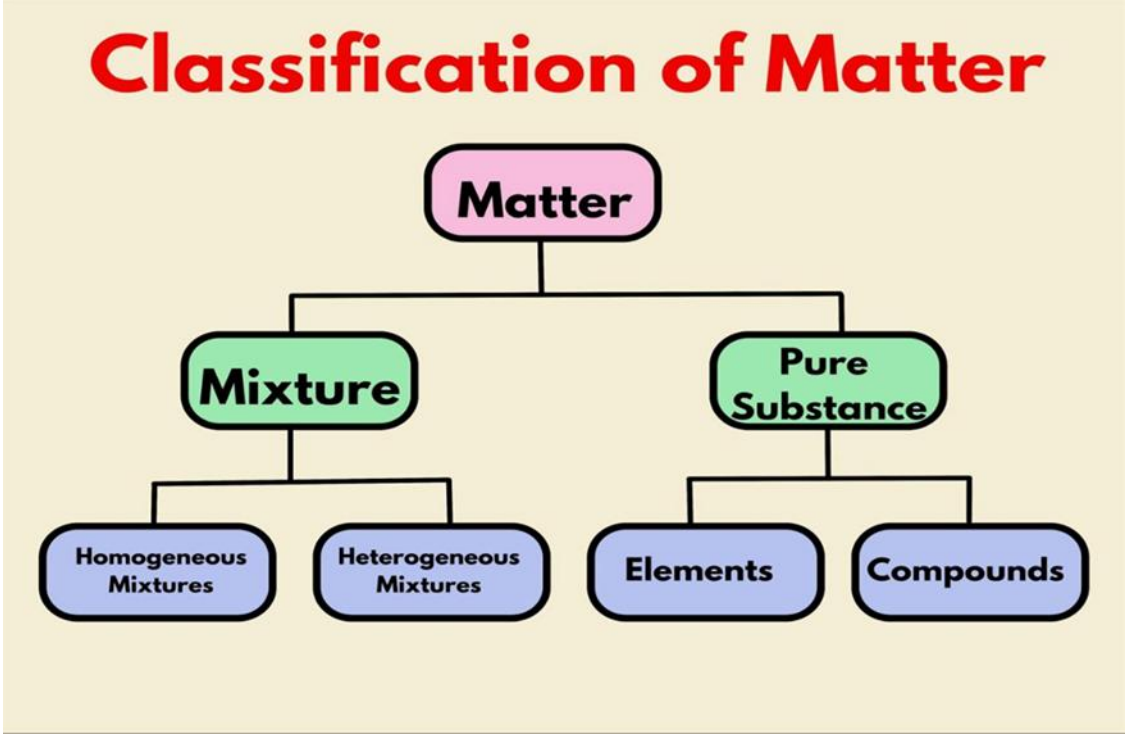
Matter and its Classification:

Matter is anything that has mass and occupies space. All matter is composed of atoms and groups of atoms bonded together, called molecules.

Substances that are made from more than one type of atom bonded together are called compounds. Compounds that are combined physically, but not chemically, are called mixtures. It is classified into:

Pure Substances: Substances that are made from one type of atom only. Elements (e.g., Gold, O2) and Compounds (e.g., H2O, NaCl).

Mixtures: Homogeneous (uniform composition, like salt-water) and Heterogeneous (non-uniform, like sand-water).



The Structure of the Atom:

The atom is the basic unit of an element. It consists of:

* **Nucleus**: Contains Protons (p^+) and Neutrons (n^0).

* **Electron Cloud**: Contains Electrons (e^-) orbiting the nucleus.

* **Atomic Number (Z)**: Number of protons.

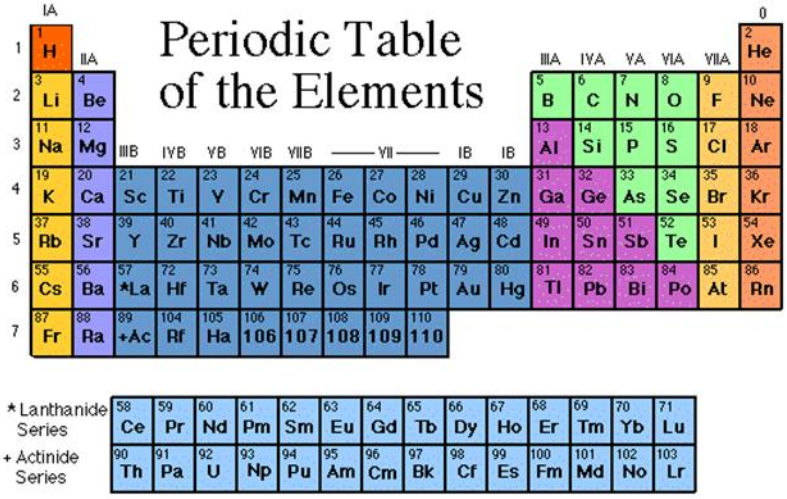
* **Mass Number (A)**: Total number of protons and neutrons.

The Periodic Table:

Elements are organized by their Atomic Number.

* **Periods (Rows)**: Indicate the number of energy shells.

* **Groups (Columns)**: Elements in a group have similar chemical behavior due to having the same number of Valence Electrons.



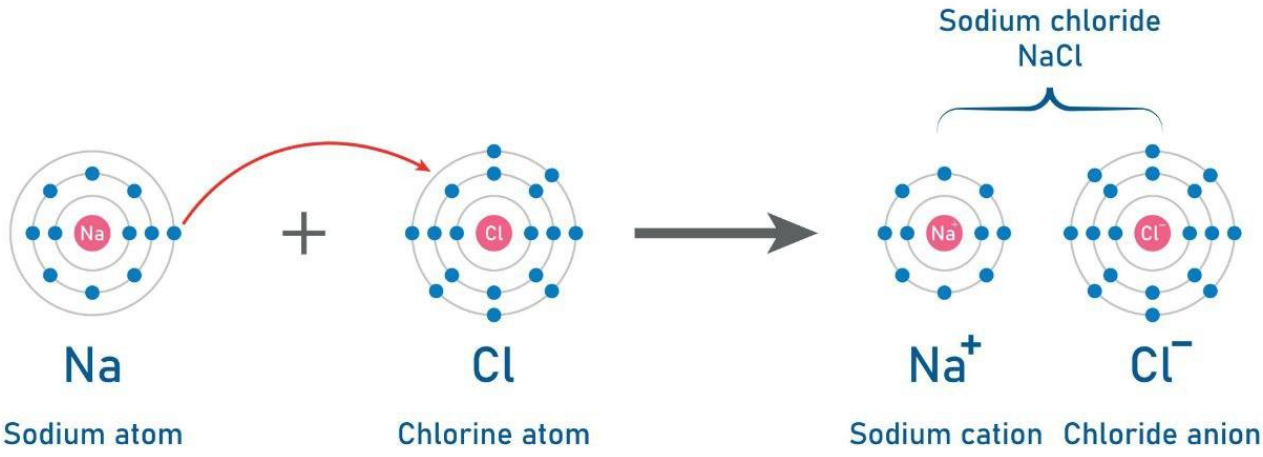
The most abundant element in the earth's crust is oxygen. The periodic table organizes the elements in a particular way. A great deal of information about an element can be gathered from its position in the period table. For example, you can predict with reasonably good accuracy the physical and chemical properties of the element. You can also predict what other elements a particular element will react with chemically.

Understanding the organization and plan of the periodic table will help you obtain basic information about each of the 118 known elements.

Chemical Bonds:

Atoms form bonds to reach a stable state (Octet Rule).

* **Ionic Bond**: Results from the transfer of electrons from a Metal to a Non-metal. One atom loses electrons (becomes a positive ion/Cation), and the other gains them (becomes a negative ion/Anion). The bond is the electrical attraction between these opposite charges.Example: Sodium Chloride (NaCl).



* **Covalent Bond**: Results from the sharing of electron pairs between Non-metals. Non-polar Covalent: Electrons are shared equally (e.g., H2 or O_2).

Polar Covalent: Electrons are shared unequally because one atom is more "hungry" for electrons (Electronegativity), like in Water (H_2O).

* **Metallic Bond**: The attraction between metal cations and a "sea" of delocalized electrons. Instead of staying with one atom, the valence electrons move freely around a lattice of positive metal ions. This is why metals conduct electricity so well.