Department of biology

General Chemistry

Lac 1, 2, 3

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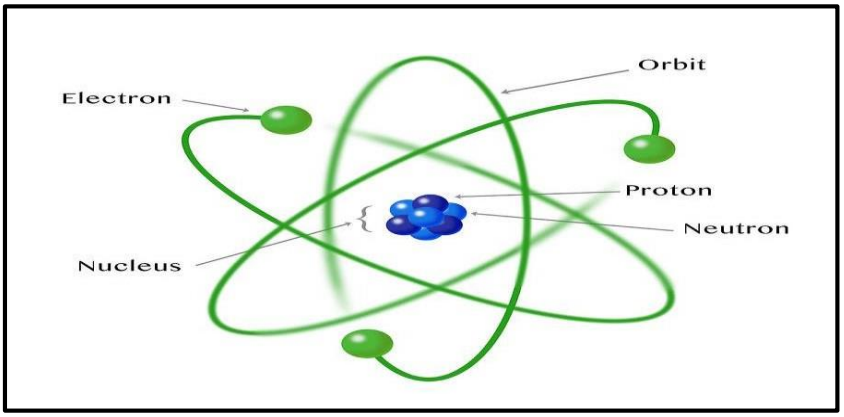
Lecture 1

Chemistry is the scientific study of the properties and behavior of matter. It is a natural science that covers the elements that make up matter to the compounds composed of atoms, molecules and ions: their composition, structure, properties, behavior and the changes they undergo during a reaction with other substances.

matter is anything that has rest mass and volume (it takes up space) and is made up of particles. The particles that make up matter have rest mass as well – not all particles have rest mass, such as the photon. Matter can be a pure chemical substance or a mixture of substances.

atom is the smallest unit of matter that forms a chemical element. Every solid, liquid, gas, and plasma is composed of neutral or ionized atoms. Atoms are extremely small.

Every atom is composed of a nucleus and one or more electrons bound to the nucleus. The nucleus is made of one or more protons and a number of neutrons. Only the most common variety of hydrogen has no neutrons. More than 99.94% of an atom's mass is in the nucleus. The protons have a positive electric charge, the electrons have a negative electric charge, and the neutrons have no electric charge.



Ion is an atom or molecule with a net electrical charge. The charge of an electron is considered to be negative by convention and this charge is equal and opposite to the charge of a proton, which is considered to be positive by convention. The net charge of an ion is not zero because its total number of electrons is unequal to its total number of protons.

Molecule is an electrically neutral group of two or more atoms held together by chemical bonds. Molecules are distinguished from ions by their lack of electrical charge. In quantum physics, organic chemistry, and biochemistry, the distinction from ions is dropped and molecule is often used when referring to polyatomic ions.

Periodic table

The periodic table is a tabular display of the chemical elements. It is widely used in chemistry, physics, and other sciences, and is generally seen as an icon of chemistry. It is a graphic formulation of the periodic law, which states that the properties of the chemical elements exhibit a periodic dependence on their atomic numbers.

The table is divided into four roughly rectangular areas called blocks. The rows of the table are called periods, and the columns are called groups. Elements from the same column group of the periodic table show similar chemical characteristics.

The first periodic table to become generally accepted was that of the Russian chemist Dmitri Mendeleev in 1869, he formulated the periodic law as a dependence of chemical properties on atomic mass. Because not all elements were then known, there were gaps in his periodic table, and Mendeleev successfully used the periodic law to predict properties of some of the

missing elements. Mendeleev not only correctly arranged the elements, but he also moved the element that appeared in the wrong place in the table to its proper location in the table based on its atomic mass.

Modern Periodic table: Moseley, a scientist, arranged the elements in a table in 1913, based his arrangement on the values of each element's atomic numbers, and thus added an update to Mendeleev's method of arranging the elements, but he kept the idea of determining each element's location in the table.

Scientists have adopted the periodic table's arrangement of the elements, which is a table that includes the known chemical elements arranged according to their behavior and chemical properties, on the following basis:

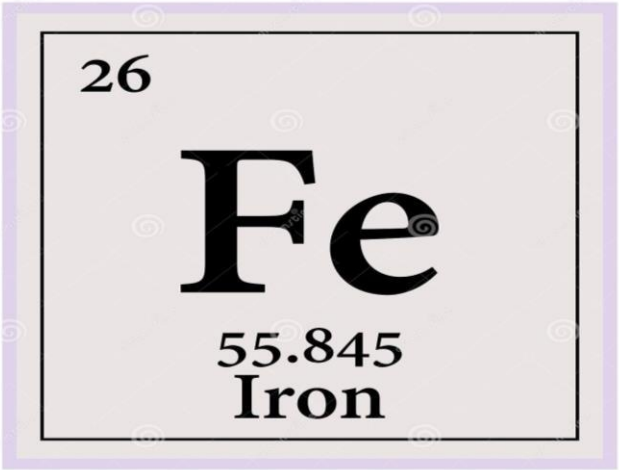
1- the elements are arranged according to the increasing atomic number.

2- The elements are arranged in horizontal columns called (the period) according to the increase in the electronic orbits

3- The elements are arranged in vertical columns called (group) according to the number of electrons present in the outermost orbital of the atoms of the elements, as the periodic table contains eight main groups

Most of the elements of a group share similar chemical properties, so they are sometimes called a family. The family name of each group is based on the name of the first element in the column of that group. There are 118 elements in the modern

periodic table, each with its own square. The element name is written in each square, for example: Iron and the element symbol Fe, as well as the atomic number of the element, which is 26 and written above the element symbol, and the average atomic mass of isotopes of the element, which is 55.847 and written below the element name.



The periodic table can be divided into four regions:

Block (S): It is located to the left of the periodic table and includes the first groups A (alkali metals) and the second A (alkaline earth metals), where all of its elements end in the secondary shell S.

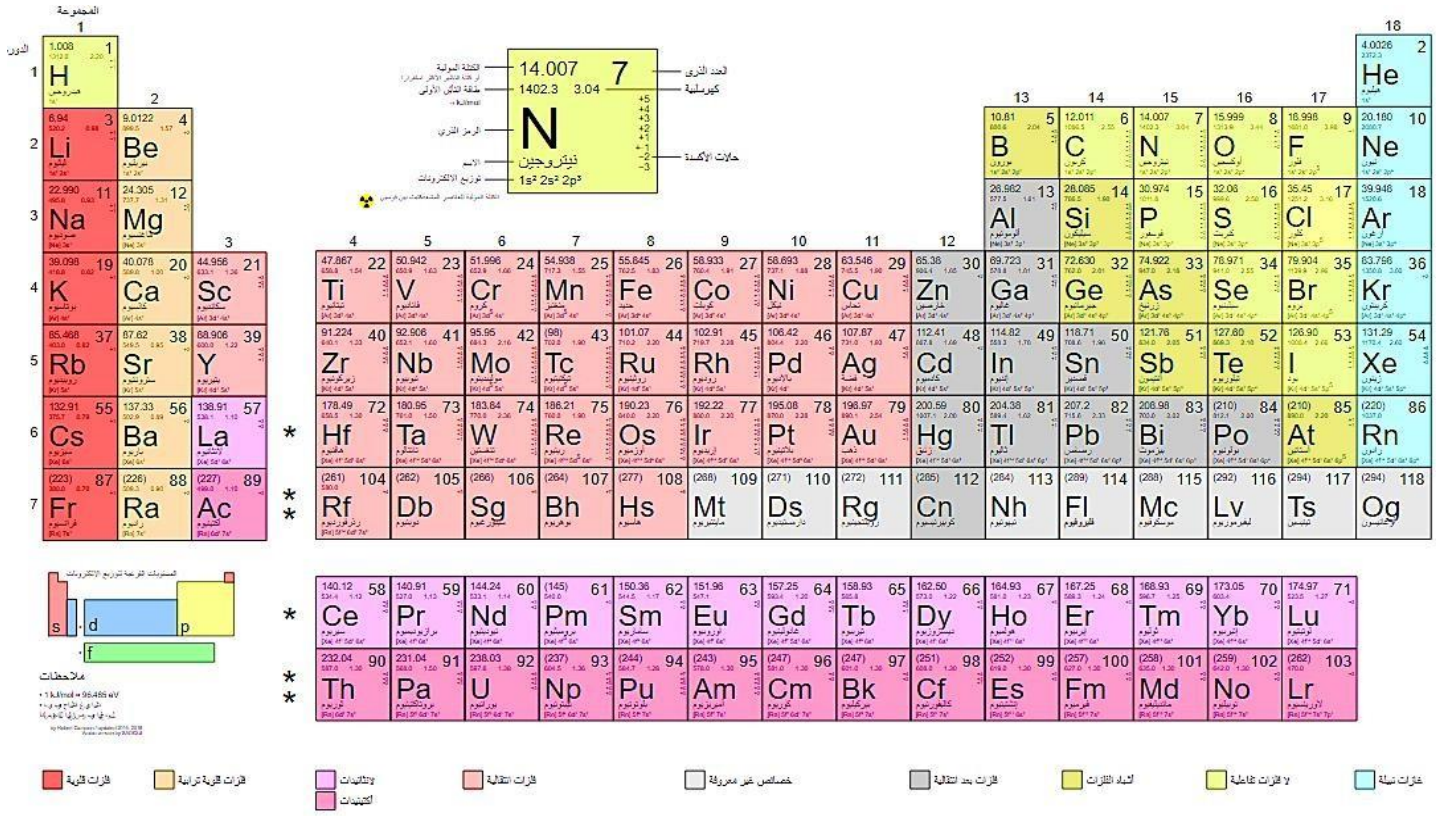
Block (P): It is located to the right of the periodic table and includes the groups from the third A to the eighth A, where all of its elements end in the secondary shell P.

Block (d): It is located in the middle of the periodic table and includes the groups from and includes the groups from the first B to the eighth B, where they represent the transitional elements or metals, and they all end with the secondary shell d.

Block (f): It is located at the bottom of the periodic table and includes the internal transition elements, which all end in the secondary shell f, and are divided into two groups

1- Lanthanides: They are 14 elements that start with Ce and end with Lu.

2- Actinides: They are 14 elements that start with Th and end with Lr.



Chemical bonds

A chemical bond is a lasting attraction between atoms, ions or molecules that enables the formation of chemical compounds. The bond may result from the electrostatic force of attraction between oppositely charged ions as in ionic bonds or through the sharing of electrons as in covalent bonds. The strength of chemical bonds varies considerably; there are "strong bonds" or

"primary bonds" such as covalent, ionic and metallic bonds, and "weak bonds" or "secondary bonds" such as dipole–dipole interactions, the London dispersion force and hydrogen bonding.

Types of chemical bonds:

1- Ionic bonding is a type of chemical bonding that involves the electrostatic attraction between two atoms with sharply different electronegativities. an ionic bond results from the transfer of electrons from a metal to a non-metal in order to obtain a full valence shell for both atoms.

2- Covalent bond is a chemical bond that involves the sharing of electron pairs between atoms. These electron pairs are known as shared pairs or bonding pairs. In organic chemistry, covalent bonds are much more common than ionic bonds.

3- Metallic bond is a type of chemical bonding that arises from the electrostatic attractive force between conduction electrons and positively charged metal ions.

4- Hydrogen bonding (or H-bond) is a primarily electrostatic force of attraction between a hydrogen (H) atom which is covalently bound to a more electronegative atom or group.

5- Dipole interactions electrostatic interactions between molecules which have permanent dipoles. Often molecules contain dipolar groups of atoms, This occurs if there is symmetry within the molecule that causes the dipoles to cancel each other out.

6- London forces or van der Waals forces It is generated when two molecules without a dipole moment contact, and the immediate polarity of one of the two molecules acts to generate an induced polarity in the other, worsening the bonding between the two molecules.