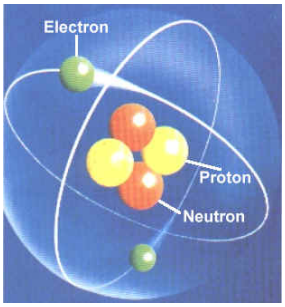
What Is an Atom?

Created: Monday, 27 June 2011 05:30 | Published: Monday, 27 June 2011 05:30 | Written by Super User | Print

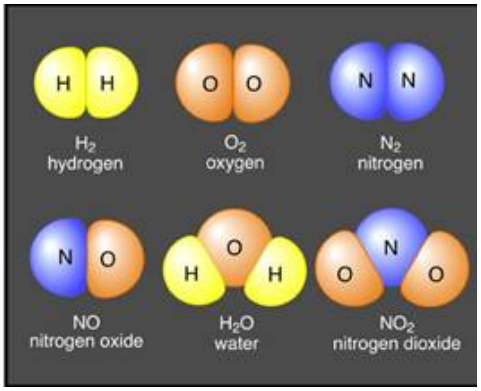
Dalton’s Atomic Theory



The concept of the atom is given by John Dalton. He proposed a theory of atom known as Dalton’s atomic theory.

According to him atoms are the smallest and indivisible part of matter. They are considered as building block of matter. Everything around us in the universe is made up of atom. Any substance composed of only single type of atom constitutes an element. There are total 109 elements in the periodic table, of which 92 elements are found naturally whereas another 17 elements are artificially prepared by the scientists.

Atoms are the smallest basic unit of elements. All the atoms in one element are identical in mass and chemical properties. The atoms of different element have different mass and different chemical properties.



The image shows that the atoms of hydrogen element are identical to each other. Similarly the atoms of oxygen and atoms of nitrogen are identical to each other, while the atoms of hydrogen, oxygen and nitrogen are not same, they are totally different from each other.

When a chemical reaction takes place between two elements, it takes place at atomic level to form acompound. As in the image the NO, H_2O and NO_2 compound is formed from different atoms.

Modern Atomic Theory

According to Dalton theory, atoms are considered as indivisible part of matter. Later on, some postulates of this theory are contradicted by modern atomic theory. According to this theory:

- Atoms are divisible and destructible.
- They are divisible into sub atomic particles such as electrons, protons and neutrons.
- Atoms of the same element may not be identical in all respect.

Structure of an Atom

Rutherford's Atomic Model

In 20th century, Rutherford studied the atomic structure and discovered the presence of atomic nucleus in the centre of atom. He suggested that nucleus contains all the positive charge that is protons in the centre and to oppose positive charge, sufficient numbers of electrons are revolving round the nucleus. The attractive force of protons present in the nucleus is balanced by centrifugal force arising due to rotation of electrons around it. But Rutherford's atomic model couldn't explain the stability of atom.

Bohr's Atomic Model

Neil Bohr, a Danish scientist proposed Bohr's atomic model to explain the structure of atom. According to him, electrons revolve around the nucleus in fixed orbits and they are associated with certain amount ofenergy levels. The levels are designated by integer n or by K, L, M, N ...shell. When an electron absorbs energy it moves to higher energy level or shell while same electron moves to the lower energy level when it loses same amount of energy. This atomic model gives specific location and type of rotation of electrons around the nucleus.

James Chadwick in 1932 proved the presence of neutrons along with protons in the nucleus

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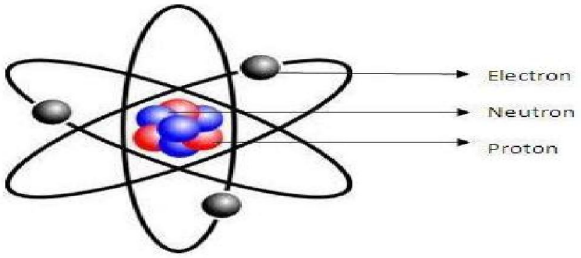

Constituents of an Atom

All the above theories prove that an atom consists of central

nucleus and electrons.

The central nucleus consists of protons and neutrons and electrons are revolving around the nucleus along imaginary path known as shells ororbits or orbital's as shown in the figure.

Nucleus

The nucleus consists of heavy subatomic particles called protons and neutrons. Protons and neutrons together called asnucleons . Protons are positively charged particles while neutrons are neutral having no charge on it. Therefore nucleus of an element is positively charged. Protons and neutrons are approximately of same size and same mass. As we know, like charges repel each other and unlike charges attract each other. Force of repulsion acts between the protons present in the nucleus as they are of same positive charge. But strong atomic binding energy combat and overcomes this force of repulsion and helps to hold the nucleons together in a nucleus.

Electron

Electrons are negatively charged particles revolving around the nucleus in a particular orbit or shell. The negative charge of electron is balanced by the positive charge of proton present in the nucleus. Magnitude of proton and electron in an atom are equal but of opposite sign which makes the atom stable. As they are oppositely charged they are attracted toward each other.

The mass of a proton is 1840 times larger than the mass of an electron. Therefore, the mass of atom is concentrated in its nucleus and electron occupies thevolume of an atom.

Atomic Number and Atomic Mass

An atom of each element has its own characteristic number that distinguishes it from atom of other element. In other words, the number of protons in thenucleus of respective atom determines atomic number of an element. The atomic number of an element remains constant that means the number of protons of every atom in an element is always remain the same. For example all the helium atoms contain 2 protons and have an atomic number 2.

Neutral atoms of the element have same number of electrons and protons therefore atomic number is also equal to number of electron in a neutral atom. When the number of electrons is more than the number of protons present in the nucleus, then atom is called asanion. If the number of electrons is less than the number of protons present in the nucleus, then atom is termed ascation.

The total number of protons and neutrons present in a nucleus of an atom in an element determines it Mass number. Atoms of same element (same atomic number) having different atomic mass is termed as isotopes. Example- U235, U238 and U232 are the isotopes of uranium having same atomic number with different atomic mass.

Give some more examples of isotopes.

Try to answer. Still need help? Want to know more about Atom?Click here to schedule live help from a certified tutor!

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