STRUCTURE OF ATOM

Charged particles in Matter :

- Electron
  e^-
  Negatively charged particle
- Proton
  p^+
  Positively charged particle
- Neutron
  n
  Neutral particle

Models for structure of an atom :

THOMSON'S ATOMIC MODEL

- An atom consists of a positively charged sphere and the electrons are embedded in it.
- The negative and positive charges are equal in magnitude. So, the atom as a whole is electrically neutral.

RUTHERFORD'S ATOMIC MODEL

- There is a positively charged centre in an atom called the nucleus. Nearly all the mass of an atom resides in the nucleus.
- The electrons revolve around the nucleus in circular paths.

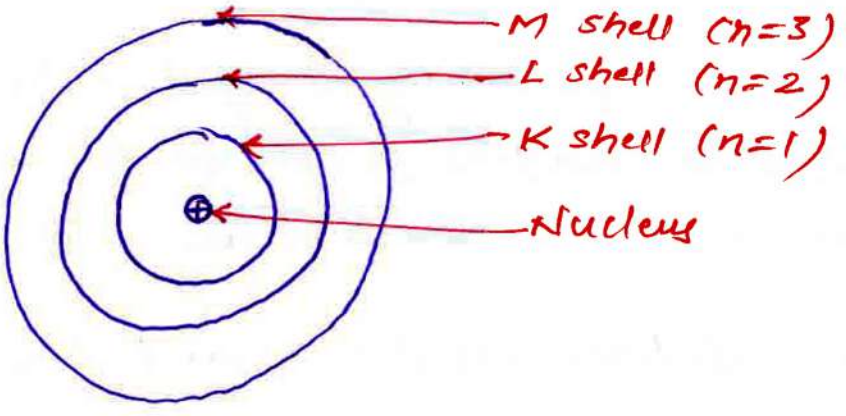
- The size of the nucleus is very small as compared to the size of the atom.

Drawback's of Rutherford's model of atom

The revolution of the electron in a circular orbit is not expected to be stable. During acceleration, the revolving electron would lose energy and finally fall into the nucleus.

BOHR'S ATOMIC MODEL :

- Only certain special orbits known as discrete orbits of electrons, are allowed inside the atom.
- While revolving in discrete orbits the electrons do not radiate energy.



A few energy levels in an atom

Electronic distribution OR Arrangement in shells :

- The maximum number of electrons present in a shell is given by the formula $2n^2$, where 'n' is the orbit number or energy level index, 1, 2, 3 - - - .

  K - shell will be $= 2 \times 1^2 = 2$

  L - shell will be $= 2 \times 2^2 = 8$

  M - shell will be $= 2 \times 3^2 = 18$

- The maximum number of electrons that can be accomodated in the outermost shell is 8.

- Electrons are not accomodated in a given shell, unless the inner shells are filled.

Valency

The combining capacity of an element is called its valency. The number of electrons gained, lost or shared so as to make the octet of electrons in the outermost shell, gives us directly the combining capacity of the element i.e valency.

Examples:

Na , V = 1

Ca , V = 2

F , V = 1

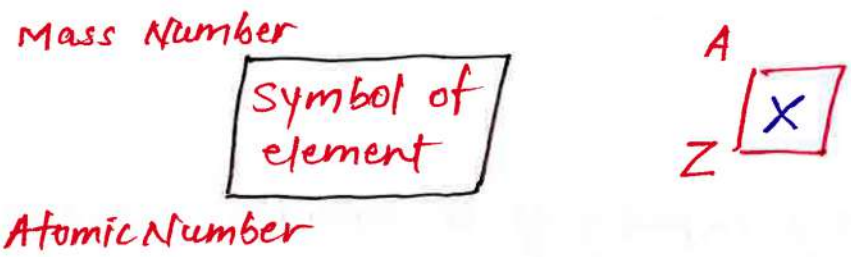
Atomic Number :

The atomic number is defined as the total number of protons present in the nucleus of an atom. It is denoted by 'Z'.

Mass Number :

The mass number is defined as the sum of the total number of protons and neutrons present in the nucleus of an atom. It is denoted by 'A'.

Symbolic representation of an element :



for example, nitrogen is written as $^{14}_{7}N$.

Isotopes :

Isotopes are the atoms of same element which have same atomic number but different mass numbers. Hydrogen has three isotopes i.e. Protium ($^{1}_{1}H$), Deuterium ($^{2}_{1}H$ or D) and Tritium ($^{3}_{1}H$ or T).

- The chemical properties of isotopes are similar but their physical properties are different.

Average atomic mass :

Average atomic mass $= F_1M_1 + F_2M_2 + F_3M_3 + ---$

Where, F_1, F_2, F_3 --- are relative abundance of isotopes.

M_1, M_2, M_3 --- are atomic masses of isotopes.

Applications of Isotopes :

- Uranium - 235 is used as fuel in nuclear reactors.
- Cobalt - 60 is used in the treatment of cancer.
- Iodine - 131 is used in the treatment of goiter.

Isobars :

Isobars are the atoms of different elements with different atomic numbers but same mass number.

$^{40}_{18}Ar$ and $^{40}_{20}Ca$ are isobars.