Structure of Atom

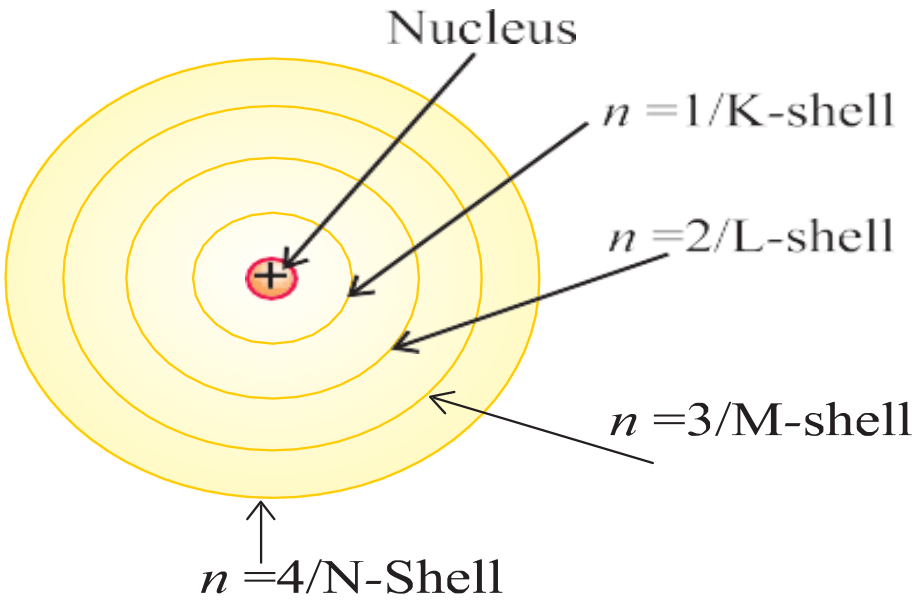
Bohr's Atomic Model

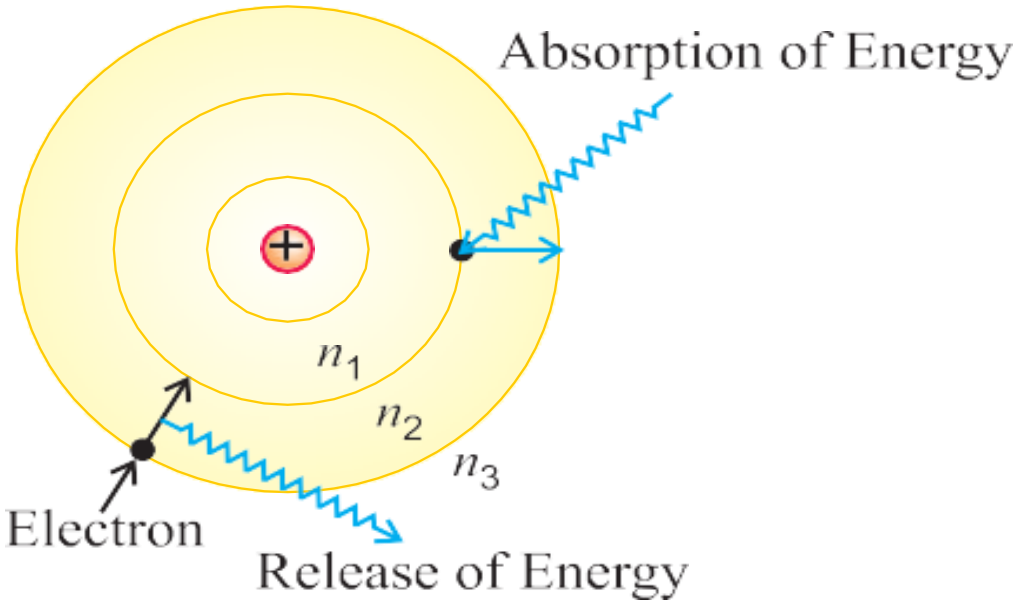
To overcome drawbacks of Rutherford's Model, Neil Bohr in 1912 proposed modified model of structure of atom. He made following assumptions:

(i) Only certain special orbits known as discrete orbits of electrons are allowed inside the atom.

(ii) While revolving in discrete orbits, the electrons do not radiate energy.

(iii) Energy is emitted or absorbed by an atom only when an electron moves from one orbit to another.





Atomic Number

The total number of proton lying in the nucleus of any atom is called the atomic number.

- An atomic number is the identity of an atom, changing atomic number means changing the atom.
- Atomic number is denoted by 'Z'. ($Z = n_P$)
- For a neutral atom, no. of protons and electrons are equal.

Atomic number, Z = Number of unit positive charge on the nucleus
= Total number of unit positive charges carried by all protons present in the nucleus.
= Number of protons in the nucleus (p)
= Number of electrons revolving in the orbits (e)

Eg :- Hydrogen – Atomic number = 1 (1 proton)

Helium - Atomic number = 2 (2 protons)

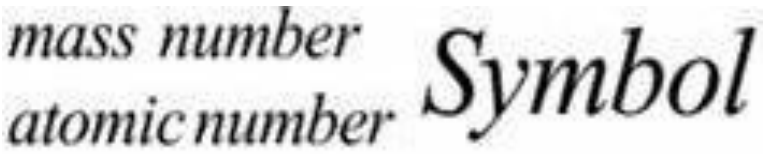
Mass Number

It is the sum of total number of protons and no. of neutrons lying in the nucleus of an atom. Ie. Mass Number =No. of proton +No. of neutrons

- It is denoted by 'A'. ($A = n_P + n_n$)

Representation of Atom: ${}^{A}E$ (E = Symbol of element)

E.g., ${}^{26}Al_{13}$ [$Z_{Al} = 13\ (n_p)$, ${}^{26}Al = 13\ (n_p) + 13\ (nn)$]



Example. *Calculate number of protons, electrons and neutrons for :*

(a) ${}^{35}_{17}Cl$ *(b)* ${}^{23}_{11}Na$

Solution : (a) ${}^{35}_{17}Cl$ $Z_{Cl} = 17\ (n_P)$

Here, since Cl is neutral, so $n_e = n_P = 17$. Now,

$A_{Cl} = 35$

Or $35 = n_P + n_n$

Or $35 = 17 + n_n$

Or $n_n = 35 - 17 = 18$

Distribution Of Electrons In Various Shells/Electronic configuration :- The distribution of electrons in various shells in the order of increasing energy is called electronic configuration.

The distribution of electrons in various shells is done in accordance to 'Bohr- Bury Scheme'.

Bohr-Bury Scheme

This scheme can be summarized as follows :

The filling of electrons in an atom is done in accordance to '$2n^2$', where 'n' is the number of shell and '$2n^2$' represents the total number of electrons that can be accommodated in that particular shell.

If $n = 1$, *i.e.,* K = shell, $2n^2 = 2 \times 1^2 = 2$ electrons

If $n = 2$, *i.e.,* L = shell, $2n^2 = 2 \times 2^2 = 8$ electrons

If $n = 3$, *i.e.,* M = shell, $2n^2 = 2 \times 3^2 = 18$ electrons

If $n = 4$, *i.e.,* N = shell, $2n^2 = 2 \times 4^2 = 32$ electrons

Maximum no. of electrons that can be filled in particular shell

The outermost shell can't hold more than 8 electrons, while second last shell can't have more than 18 electrons, even though they may have capacity to hold more electrons.

For example, in 'Ca_{20}', the electron distribution will be :

	K	L	M	N
$Ca_{20} =$	2	8	8	2

But $Ca_{20} = 2, 8, 10$ is wrong although 'M' shell can contain upto 18 electrons.

The outermost shell can't hold more than 2 electrons and the penultimate shell can't hold more than 8 electrons unless the preceding inner shell (antepenultimate shell) is filled completely obeying '$2n^2$' rule.

Some examples :

(a) $K_{19} = 2, 8, 8, 1$ (b) $Al_{13} = 2, 8, 3$ (c) $F_9 = 2, 7$

(d) $Ne_{10} = 2, 8$ (e) $Na_{11} = 2, 8, 1$

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