ARRANGEMENT OF ELECTRONS IN THE ATOMS

Electrons are negatively charged, so they form a cloud of negative charges outside the nucleus. In this cloud, the electrons are arranged according to their potential energy in different energy levels or shells. The energy levels of the electrons are denoted by the numbers 1, 2, 3, 4, 5 and 6 whereas shells are represented by the letters K, L, M, N, O and P.

1st energy level is K shell

2nd energy level is L shell

3rd energy level is M shell

4th energy level is N shell, and so on.

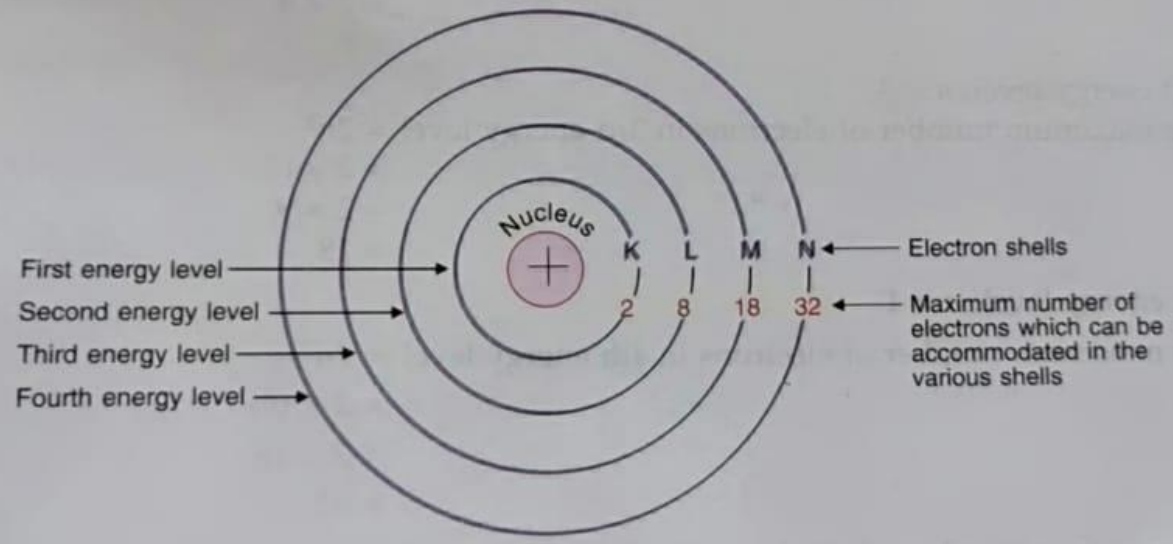

Figure Energy levels or electron shells in an atom. (This figure shows only first four shells K, L, M and N)

The energy levels or shells are represented by circles around the nucleus. The shells are counted from the centre outwards (see Figure 22). For example, K shell having the minimum energy is nearest to the nucleus ; L shell which has a little more energy is a bit farther away from the nucleus, and so on. It is obvious that **the outermost shell of an atom is at the highest energy level**.

We will now describe how the electrons fill up the various energy levels or shells in an atom. It is a well known fact that a system is most stable when it has the minimum energy. So, the electrons occupy the low

Electronic Configurations of Elements

The arrangement of electrons in the various shells (or energy levels) of an atom of the eleme known as electronic configuration of the element. In other words, electronic configuration is the distribu of electrons in various shells (or energy levels) of an atom such as K shell, L shell, M shell, etc.

In order to write down the electronic configuration of an element, we should know two things :

(*i*) We should know the number of electrons in one atom of the element.

(*ii*) We should know the maximum number of electrons that can be accommodated in different s of the atom.

The number of electrons in an atom of the element is given by the atomic number of the ele because **the number of electrons in an atom of the element is equal to the atomic number of the ele** For example, if the atomic number of an element is 12, then its atom contains 12 electrons.

The maximum number of electrons which can be put in a particular energy level or shell was give Bohr and Bury. According to Bohr-Bury scheme :

1. The maximum number of electrons which can be accommodated in any energy level of the at given by $2n^2$ (where n is the number of that energy level). Let us calculate the maximum numb electrons which can be put in the first four energy levels of an atom.

(*i*) For 1st energy level, $n = 1$

So, The maximum number of electrons in 1st energy level $= 2n^2$

$= 2 \times (1)^2$

$= 2 \times 1$

$= 2$

(*ii*) For 2nd energy level, $n = 2$

So, The maximum number of electrons in 2nd energy level $= 2n^2$

$= 2 \times (2)^2$

$= 2 \times 4$

$= 8$

(*iii*) For 3rd energy level, $n = 3$

So, The maximum number of electrons in 3rd energy level $= 2n^2$

$= 2 \times (3)^2$

$= 2 \times 9$

$= 18$

(*iv*) For 4th energy level, $n = 4$

So, The maximum number of electrons in 4th energy level $= 2n^2$

$= 2 \times (4)^2$

$= 2 \times 16$

$= 32$

Thus, the maximum number of electrons that can be accommodated in the first energy level econd energy level is 8, for third energy level is 18, and for the fourth energy level is 32. Now, nergy level is called K shell, the second energy level is called L shell, the third energy level is c hell and the fourth energy level is known as N shell. So, we can also say that **the maximum nu lectrons which can be accommodated in K shell is 2, for L shell is 8, for M shell is 18 and for N** 2. This can be put in the tabular form as follows :

Electron shell	*Maximum capacity*
K shell	2 electrons
L shell	8 electrons
M shell	18 electrons
N shell	32 electrons

2. The outermost shell of an atom cannot accommodate more than 8 electrons, even if it has the capacity to accommodate more electrons. (If, however, the outermost shell of an atom is the first shell or K shell, then it cannot accommodate more than 2 electrons)

This means that normally, the outermost shell of an atom can take a maximum of 8 electrons only. For example, if M shell is the outermost shell of an atom then it can hold a maximum of 8 electrons only, though its maximum rated capacity is 18 electrons. This is due to the fact that "having 8 electrons in the outermost shell" makes the atoms very stable. If, however, the outermost shell is the first shell or K shell, then it can hold a maximum of 2 electrons only. This is because having 2 electrons in the outermost shell when it is first shell or K shell (there being no other electron shells in the atom) also makes the atom very stable. This happens in the case of helium element which has only one shell (K shell) in its atom.

3. Electrons in an atom do not occupy a new shell unless all the inner shells are completely filled with electrons

This means that the electron shells in an atom are filled in a step-wise manner. First of all the electrons fill K shell, then L shell, M shell, N shell, and so on. There are, however, some exceptions to this rule (which apply to elements having atomic numbers more than 18). We will study this in higher classes.

Electronic Configurations of First Twenty Elements

Element	*Symbol*	*Atomic number*	*Electronic configuration (or Electron distribution* K L M N
1. Hydrogen	H	1	1
2. Helium	**He**	**2**	**2**
3. Lithium	Li	3	2, 1
4. Beryllium	Be	4	2, 2
5. Boron	B	5	2, 3
6. Carbon	C	6	2, 4
7. Nitrogen	N	7	2, 5
8. Oxygen	O	8	2, 6
9. Fluorine	F	9	2, 7
10. Neon	**Ne**	**10**	**2, 8**
11. Sodium	Na	11	2, 8, 1
12. Magnesium	Mg	12	2, 8, 2
13. Aluminium	Al	13	2, 8, 3
14. Silicon	Si	14	2, 8, 4
15. Phosphorus	P	15	2, 8, 5
16. Sulphur	S	16	2, 8, 6
17. Chlorine	Cl	17	2, 8, 7
18. Argon	**Ar**	**18**	**2, 8, 8**
19. Potassium	K	19	2, 8, 8, 1
20. Calcium	Ca	20	2, 8, 8, 2

I'd like to say a few words about the electronic cont