Chemistry Study Materials for Class 9

(NCERT based Structure of the Atoms)

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Key notes

3. Bohr's Model of Atom (By Neils Bohr in 1913)

This model of atom states that:

- An atom consists of heavy positively charged nucleus. The whole mass of the atom is concentrated in the nucleus.
- The electrons in an atom revolve around the nucleus in definite circular paths called orbits or energy level.
- Each energy level is associated with definite amount of energy.
- The change in energy takes place when electron jumps from one energy level to another energy level.

Arrangement of electrons in an atom:

The arrangement of electrons in various shells (energy levels) of an atom of the element is known as Electronic configuration.

The Maximum number of electrons that could be put in a particular shell, i.e., energy levels, was given by Bohr and Bury.

According to Bohr-Bury Scheme:

- The maximum number of electrons that can be accommodated in any energy level is given by $2n^2$where n = 1, 2, 3, 4, …. (for K, L, M, N…..)

- The maximum number of electrons in the outermost orbit will be 8 electrons even if it has capacity to accommodate more electrons.
- Electrons, are not accommodated in a given shell. Unless earlier shells are filled, that is stepwise filling of shells is followed.

Orbit

The circular path around the nucleus is called orbit, energy level or shell. Energy level are represented by English alphabets: K, L, M, N, …. and so on.

Therefore,

- 1^{st} orbit is denoted by K 2^{nd} orbit is denoted by L
- 3^{rd} orbit is denoted by M, and so on.

Distribution of Electrons in a Orbit or Shell

The distribution of electrons in an orbit can be obtained by using formulae $2n^2$ where 'n' is number of that orbit.

For example:

Number of electrons in K-shell i.e. in 1^{st} orbit

Here $n = 1$ Therefore, $2n^2 = 2 \times 1^2 = 2$

Thus, maximum number of electrons in K-shell, i.e. 1^{st} shell $= 2$

Number of electrons in L-shell, i.e. in 2^{nd}orbit

Here $n = 2$, therefore, $2n^2 = 2 \times 2^2 = 8$

Thus, maximum number of electrons in L-shell $= 8$

In similar way maximum number of electrons in any shell can be calculated.

Valence Electrons

The electrons present in the outer most shell of an atom are known as valence electrons. These electrons determine the valency of an atom.

Valency

Valency is the combining capacity of an atom, i.e. their tendency to react and form molecules with atoms of the same or different elements.

For the atoms having valence electrons less than or equal to 4, valency is same as that of the number of valence electrons in that atom.

For example, valency of Magnesium $(2, 8 , 2) = 2$

If number of valence electrons exceed 4, then valency $= 8$ – Number of valence electrons.

For example, valency of Oxygen $(2, 6) = 8 – 6 = 2$.

Valency of atoms with 8 valence electrons is zero as they have fully filled valence shell and cannot gain or lose electrons to form, molecules or compounds.

Atomic number (Z)

Atomic number of an element is equal to the number of protons present in the nucleus of an atom.

Since an atom is electrically neutral, thus number of protons and number of electrons are equal, therefore:

Atomic number (z) = number of protons = number of electrons.

Mass Number (A)

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

The protons and neutrons together are called nucleon.

The number of neutrons present in the nucleus of an atom is rperesented by N.

Isotopes : Atoms of the same element having same atomic number but different mass numbers are known as Isotopes.

For example:

(i) Carbon; ${}^{12}_{6}C$ and ${}^{14}_{6}C$

(ii) Hydrogen; ${}^{1}_{1}H$ and ${}^{2}_{1}H$

(iii) Chlorine; ${}^{35}_{17}Cl$ and ${}^{36}_{17}Cl$

Applications of Isotopes

- Isotope of uranium is used as a fuel in nuclear reactor
- Isotope of cobalt is used in treatment of cancer
- Isotope of iodine is used in treatment of goiter.

Isobars: Atoms of different elements having same mass numbers are known as Isobars,

For example:

Potassium, K and Argon. Ar both have the mass numbers equal to 40.

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