Class 9th

CHEMISTRY
CHAPTER - 04
STRUCTURE OF ATOM

1. Atom

An atom is the smallest particle of matter. The existence of different kinds of matter is due to different atoms constituting them. Many scientists contributed in revealing the presence of charged particles in an atom.

2. Structure of atom

Dalton's atomic theory suggested that the atom was indivisible and indestructible. But the discovery of two fundamental particles (electrons and protons) inside the atom, led to the failure of this aspect of Dalton's atomic theory.

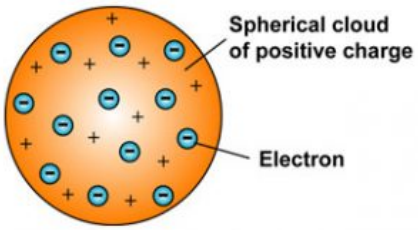
3. Sub-Atomic Particles

- **Electron:** Electron was discovered by J.J. Thomson in cathode ray experiment, Electron contains negative charge, it is represented by symbol e^-.
- **Proton:** Proton was discovered in anode ray experiment. Anode rays are also called positive rays or canal rays. Proton was discovered by E. Goldstein. It is represented by symbol p.
- **Neutron:** Neutron was discovered by James Chadwick. It is a neutral particle. It is represented by symbol n.

4. Models of atom

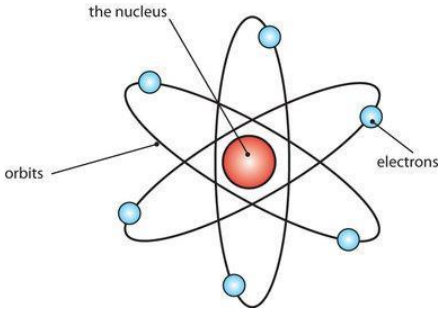
4.1 Thomson's model of atom:

According to Thomoson's model, electrons are embedded in the positively charged mass distributed uniformly throughout the atomic sphere. The negative and positive charges are equal in magnitude. So atom as a whole is electrically neutral.



4.2 Rutherford's Model of atom:

- According to this model all the positively charged particles are present in a small space in the center of the atom. This small space is called nucleus. Nearly all the mass of an atom is concentrated in the nucleus.
- The electrons revolve around the nucleus just as the planets revolve around the sun.
- Electrons (negatively charged) revolve around the nucleus in orbits with a very high speed to overcome the electrostatic force of attraction due to positively charged particles (protons) present in the nucleus.



Drawbacks of Rutherford's model:

· It is possible to have infinite number of orbits. It could not be explained by this model.

● This model could not explain the stability of the atoms. The moving electron must continuously lose energy and fall into the nucleus. Actually, it is not the case.

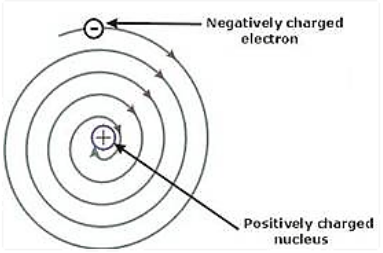
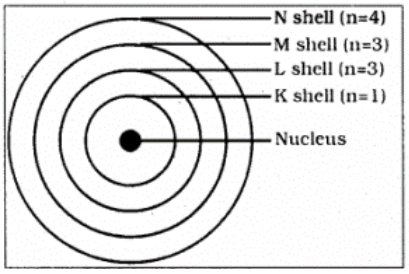


Diagram showing the atom losing energy

4.3 Bohr's model of atom:

- 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. These orbits are called energy levels. Orbits or shells are represented by K, L, M, N or the numbers, n = 1, 2, 3, 4…. .



Bohr's Model

5. Neutrons

In 1932, J. Chadwick discovered another subatomic particle which had no charge and a mass nearly equal to that of a proton. It was eventually named as neutron. Neutrons are present in the nucleus of all atoms, except hydrogen.

6. Distribution of electrons in different orbits:

- Maximum number of electrons present in a orbit or shell is given by $2n^2$ (n = shell number)
- The maximum number of electrons that can be accommodated in the outermost orbit is 8.
- Electrons are not accommodated in a given shell unless the inner shells are completely filled.

7. **Valency:** The combining power (or capacity) of an element is known as its valency. The outermost shell or orbit of our atom is known as the valence shell. The electrons present in outermost shell of an atom are knows as valence electrons.

8. **Atomic number (Z):**
It is the number of protons present in an atom, which determines its atomic number. It is denoted by 'Z'

9. **Mass number (A):**
It is equal to the sum of protons and neutrons.

10. **Isotopes**
Atoms of the same element with same atomic number but a different mass number, are called isotopes. Isotopes have same chemical properties but different physical properties. For example: ${}_{1}^{1}H$, ${}_{1}^{2}H$, ${}_{1}^{3}H$

10. **Applications of isotopes:**

- An isotope of Uranium used as fuel.
- An isotope of Cobalt is used in the treatment of cancer
- An isotope of Iodine is used in the treatment of goiter.

11. **Isobars**
Atoms of different elements with same mass number but different atomic numbers are called isobars. For example: ${}_{18}^{40}Ar$, ${}_{20}^{40}Ca$.