

## **CHAPTER – 4 STRUCTURE OF ATOM**

Dalton assumed that atom is indivisible, i.e., it has no constituent particles. But, a series of experimental evidences revealed that an atom is not the smallest particle.

Some other particles smaller than the atom are also present which are called sub-atomic particles, i.e., electrons, protons and neutrons. The atoms of different elements differ in the number of electrons, protons and neutrons.

### **Charged Particles in Matter**

The particles that carry an electric charge are called charged particles. Generally, on rubbing two objects together, they become electrically charged. It means that some charged particles are present within the atom or atom is made up of some charged particles. Two such particles are electrons and protons.

### **Discovery of Electrons–Cathode Rays (By J. J. Thomson)**

Thomson explained presence of electrons by cathode ray's experiment.

#### **Facts about Electrons**

- Charge and mass of electron are  $-1.6 \times 10^{-19}$  C (C = Coulomb) and  $9.1 \times 10^{-31}$  kg respectively.

### **Discovery of Protons–Anode Rays/Canal Rays (By E. Goldstein)**

E. Goldstein by his famous anode rays/canal rays' experiment was able to detect presence of positively charged particles called protons in the atom.

#### **Facts about Protons**

- Charge on proton =  $+1.6 \times 10^{-19}$  C
- Mass of proton =  $1.673 \times 10^{-24}$  gm.

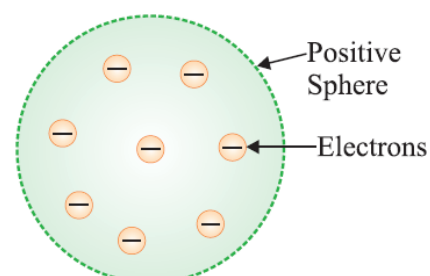
i.e., Mass of proton  $\cong 1840 \times$  Mass of electron

### **Discovery of Neutrons (By J. Chadwick)**

- J. Chadwick bombarded lighter elements (like lithium, boron etc.) with  $\alpha$ -particles and observed emission of new particles having zero charge but having mass equal to that of proton.
- These particles were called 'Neutron' i.e., neutral particle of the atom.

### **Thomson's Model of an Atom**

JJ Thomson was the first scientist to propose a model for the structure of an atom.



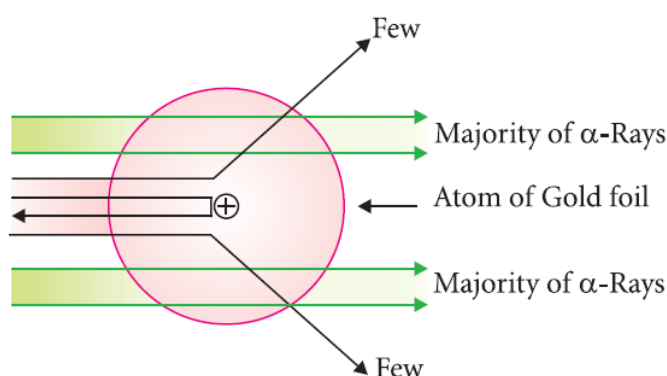
#### **Structure of the Atom**

The postulates of his model are

- The mass of an atom is assumed to be uniformly distributed throughout the atom.
- An atom is considered to be a sphere of uniformly distributed positive charge in which electrons are embedded.
- The negative and positive charge balance each other therefore, atom as a whole is neutral.

### Rutherford's Model of an atom

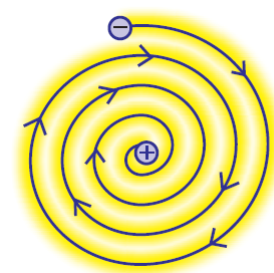
- In his famous 'α-ray Scattering Experiment', Rutherford bombarded α-ray (Helium nucleus  ${}_2\text{He}^4$ ) upon thin gold foil.
- Rutherford made following observations from this experiment:
  - Most of α-particles passed through gold foil undeflected.
  - Some of the α-particles deflected by foil by small angles.
  - One out of every 12000 particles appeared to rebound.



- On the basis of his experiment, Rutherford proposed model of atom having following features:
  - There is positively placed nucleus in an atom. Nearly all the mass resides in nucleus (Proton + Neutron).
  - Electrons revolves round the nucleus in circular paths.
  - Size of nucleus is very small compared to the size of atom.

### Drawbacks of Rutherford's Model

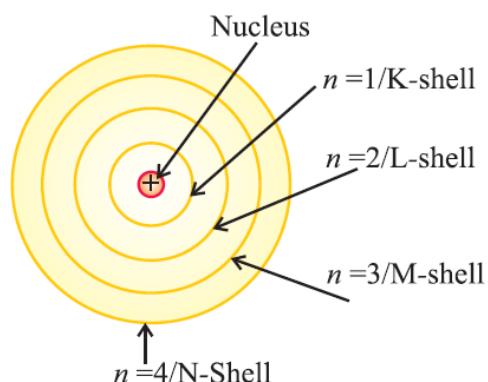
According to Rutherford, electrons revolve round the nucleus in circular paths, but electrons being charged particles will lose their energy and finally will fall into the nucleus. This will make atom highly unstable.



### Bohr's Model of an atom

Neil Bohr proposed modified model of structure of atom. He made following assumptions:

- 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 or shells are represented by the letters K, L, M, N, or the numbers,  $n=1,2,3,4, \dots$



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