Rutherford's alpha particles scattering experiment :- Rutherford bombarded a thin sheet of gold (of 0·00004 cm thickness) with alpha particles* in an evacuated chamber.

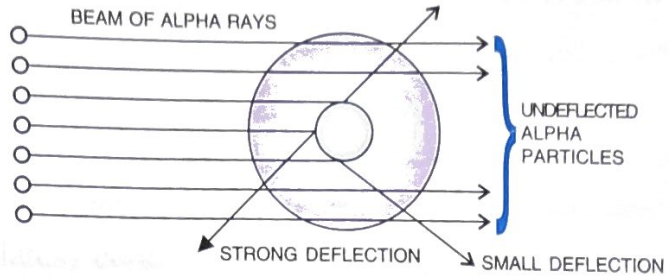


Fig. 4.5 Diagram to show scattering of alpha particles by a single atom

Following were his observations :

- Most of the alpha particles passed straight through the foil without any deflection from their path.
- A small fraction of them were deflected from their original path by small angles.
- Only a few particles bounced back.

On the basis of the above observations, Rutherford made the following conclusions :

- *Most of the space in an atom was empty* because alpha particles went straight.
- *There was a heavy positively charged mass in the atom* which caused deflection of a small fraction of alpha particles.
- The positively charged mass is very small and is centrally located because only few particles bounced back. It was named as the nucleus of an atom.

* *Alpha particles are positively charged particles with two units of positive charge and four units of mass. They are formed by the removal of two electrons from a helium atom.*

Based on his experiment, Rutherford suggested a model for the structure of the atom which is known as *Rutherford's Atomic Model.*

RUTHERFORD'S ATOMIC MODEL

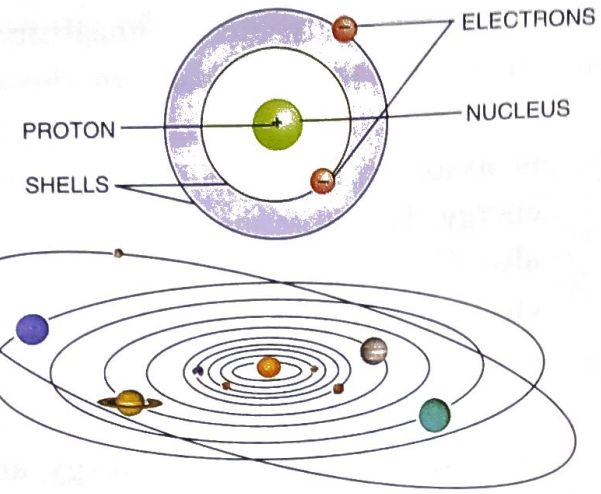
According to this model, an atom consists of mainly two parts :

1. *The centrally located nucleus*
   - The nucleus is a centrally located positively charged mass. The entire mass of the atom is concentrated in it. It is the densest part of the atom.
   - The size of the nucleus is very small compared to the size of the atom as a whole.

   > If we consider a circular stadium as an atom, then its nucleus is no more than a cricket ball placed at the centre of the stadium.

2. *The outer circular orbits*
   - Electrons revolve in circular orbits called shells in the space available around the nucleus.
   - An atom is electrically neutral *i.e.* the number of protons and the number of electrons present in an atom are equal.

Thus, a model similar to that of the solar system was proposed by Rutherford (Fig. 4.6). Just as in the solar system, the sun is at the centre and the planets revolve around it, in an atom the electrons revolve around the centrally located nucleus containing protons.



ig. 4.6 Rutherford's model of the atom was somewhat like the solar system

OVERY OF NEUTRONS ($_0n^1$)

he mass of an atom was in fact considered entirely concentrated within the nucleus form of protons, since electrons were thought to have negligible mass. But it was discovered that the nucleus had a r mass than could be accounted for by s alone, it was realized that there must hird type of sub-atomic particle, which resent in the nucleus and had neither e nor negative charge.

1932 **James Chadwick** discovered batomic particle and called it *neutron*, it had no charge. Its mass was found almost equal to that of a proton, *i.e.* $\times 10^{-24}$ g.

rties of neutrons

he mass of a neutron is slightly more than at of a proton, *i.e.*, $1{\cdot}676 \times 10^{-24}$ g ompared to $1{\cdot}672 \times 10^{-24}$ g.

ectrically a neutron is neutral, *i.e.*, it has charge.

toms of same element may differ in the mber of neutrons leading to the rmation of isotopes.

Table 3.1 : Properties of sub-atomic particles

Particle	*Symbol*	*Charge* ($1{\cdot}602 \times 10^{-19}$C)	*Atomic mass grams*
Electron	$_{-1}e^0$ or e^-	−1	$9{\cdot}1 \times 10^{-28}$ g
Proton	$_{+1}p^1$ or p^+	+1	$1{\cdot}6 \times 10^{-24}$ g
Neutron	$_0n^1$ or n	0	$1{\cdot}6 \times 10^{-24}$ g

An atom of hydrogen contains only one proton and one electron but no neutron. All other atoms have all the three particles.

STRUCTURAL STABILITY OF AN ATOM

We know that there exists a force of attraction between particles with opposite electrical charges. Thus, there is a force of attraction between the electrons and the protons present within an atom. It is expected that electrons being lighter, charged and in constant motion, would gradually lose energy and come closer to the nucleus and eventually fall into it, thus resulting in the structural collapse of the atom. But this does not happen.

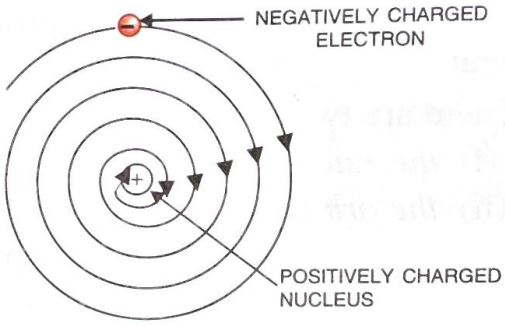


Fig. 4.7 Showing an electron losing energy and eventually falling into the nucleus, but this does not happen.

Rutherford could not explain the stability of atom. It was Neil Bohr who could explain the atomic stability.

According to Bohr's theory, the electrons revolve in fixed orbits or shells around the nucleus at a very high speed*, with each orbit

* *Velocity of light is 3×10^8 m/sec. The speed of an electron is about 1/10th the speed of light.*

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2020 SEPTEMBER

DAY 273 - 093 WEEK 40

TUESDAY

Wk	M	T	W	T	F	S	S
36		1	2	3	4	5	6
37	7	8	9	10	11	12	13
38	14	15	16	17	18	19	20
39	21	22	23	24	25	26	27
40	28	29	30				

September 2020

APPOINTMENT / MEETING

Class - VIII

Subject - Chemistry

Chapter 4 Atomic Structure Part-2

Date - 23.6.20

(1) What are the observations of Rutherford alpha particles scattering experiment?

(2) What are the conclusions of Rutherford alpha particles scattering experiment?

(3) What are the ~~postulates of~~ parts of Rutherford atomic model?

(4) What is neutron?

(5) What are the properties of neutron?

(6) Name the subatomic particles, their symbol, charge and mass.

P. Sn

23.6.20

NOTES