Chemistry Study Materials for Class 9
(Revision Notes of Chapter -04)

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Structure of the Atom

STRUCTURE OF THE ATOM

Atoms are the basic units of matter and the defining structure of elements. Matters are made of tiny particles called atom. Atom is made of three particles; electron, proton and neutron. These particles are called fundamental particles of an atom or sub atomic particles.

Electron (e^-) - Electron is denoted by 'e' and is a negatively charged particle. The absolute charge over an electron is equal to 1.6×10^{-19} C of negative charge and is considered equal to – 1. The relative mass of electron is 1/1836. Since the mass of an electron is very small, thus it is considered equal to 0. Electrons revolve round the nucleus of atoms.

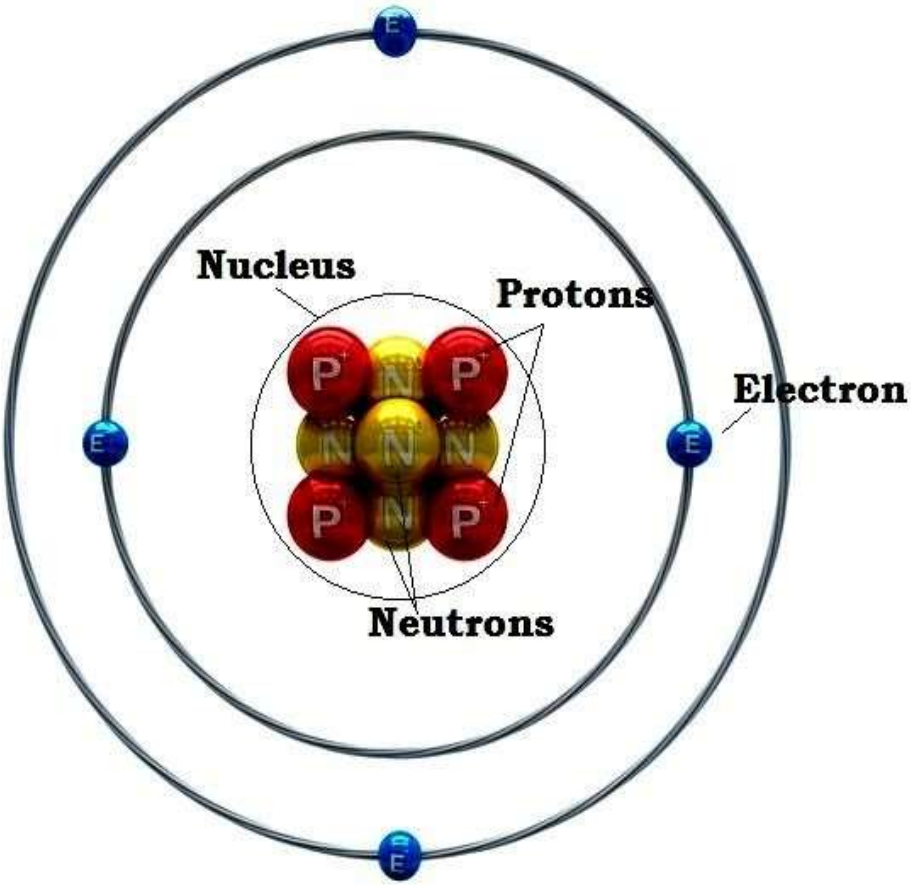
Proton (p^+) - Proton is denoted by 'p' and is positively charged particle. The absolute charge over proton is 1.6×10^{-19} coulomb of positive charge and it is considered as unit positive charge. Thus absolute charge over a proton is equal to +1.

The absolute mass of a proton is equal to 1.65×10^{-24} g and considered equal to 1 as it is equal to the mass of 1 hydrogen atom. Proton is present in the nucleus of atom.

Neutron (n) – Neutron is denoted by 'n' and is a neutral particle.

The absolute mass of neutron is 1.67×10^{-24} g. The relative mass of neutron is equal to 1. Neutron is presents in the nucleus of atom.

Nucleus – The centre of atom is called nucleus. Nucleus comprises of neutron and proton. Nucleus of an atom contains the whole mass of an atom.



INTEXT QUESTIONS PAGE NO. 47

Q1. What are canal rays?

Answer: Canal rays are positively charged radiations that can pass through perforated cathode plate. These rays consist of positively charged particles known as protons.

Q2. If an atom contains one electron and one proton, will it carry any charge or not?

Answer: An electron is a negatively charged particle, whereas a proton is a positively charged particle. The magnitude of their charges is equal. Therefore, an atom containing one electron and one proton will not carry any charge. Thus, it will be a neutral atom.

Discovery of Electron

In 1897; J. J. Thomson, a British physicist, proposed that atom contains at least one negatively charged particle. Later this particle was named as electron. Thomson called those particles ‘corpuscles’.

Discovery of Proton:

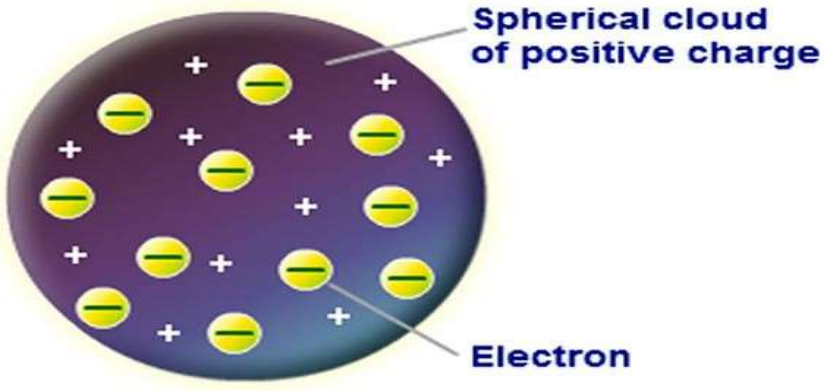
Ernest Goldstein in 1886 discovered the presence of new radiation in gas discharge tube even before the identification of electron. He called these rays as Canal Rays. His experiment led to the discovery of proton.

Discovery of Neutron:

In 1932 J. Chadwick discovered another subatomic particle called neutron. Neutron is present in the nucleus of all atoms.

THOMSON’S MODEL OF ATOM

J. J. Thomson proposed the model of atom similar to a Christmas pudding or similar to a water melon. His model of atom is generally called plum and pudding model of atom.



Thomson's Plum pudding model

He proposed that electrons are embedded the way black seeds of water melon are embedded; in the sphere of positive charge. According to Thomson

(a) An atom consists of positively charged sphere in which electrons are embedded.

(b) The quanta of negative and positive charges are equal. The equal number of negative charge and positive charge makes an atom electrically neutral.

RUTHERFORD'S MODEL OF ATOM

Ernest Rutherford in 1909 with his team bombarded very thin gold foil with α – particles. He found that

(a) Most of the α – particles passed without any hindrance.

(b) Some of the α – particles deflected from their original path at noticeable angle.

(c) Very few of the α – particles bounced back at their original path.

On the basis of his observation, he proposed the model of atom. The

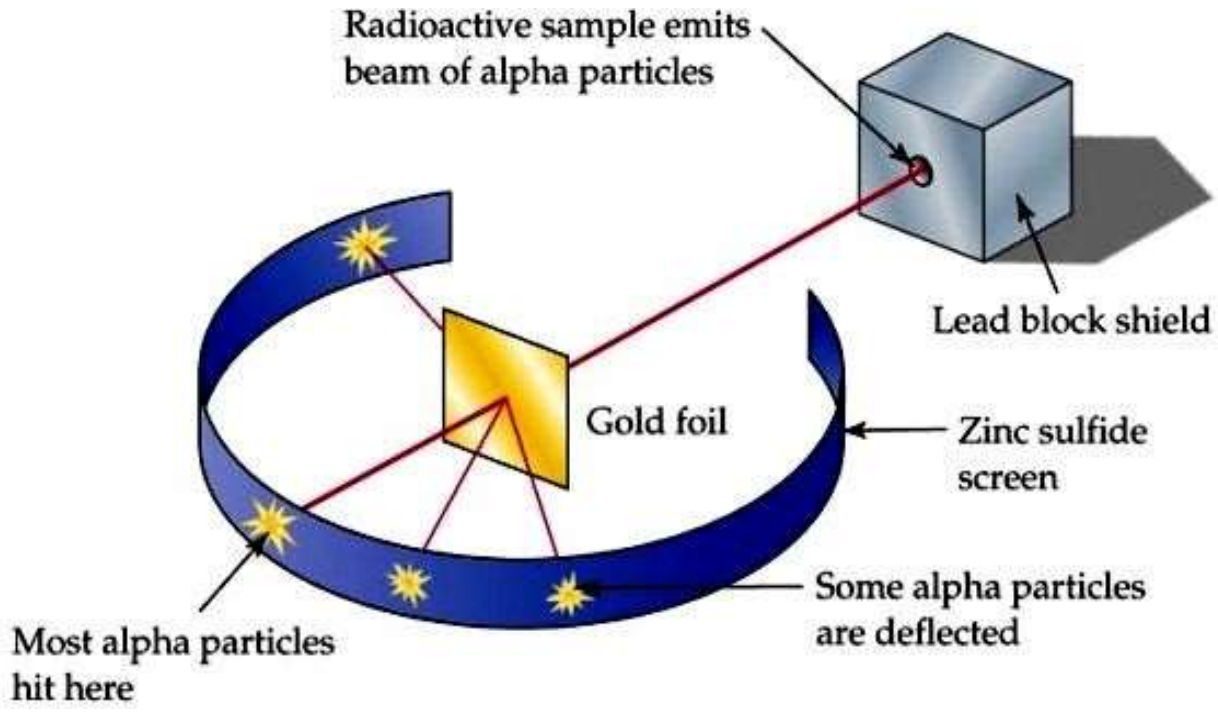
Rutherford's Model of Atom is as follows:

(a) Most of the part in an atom is empty.

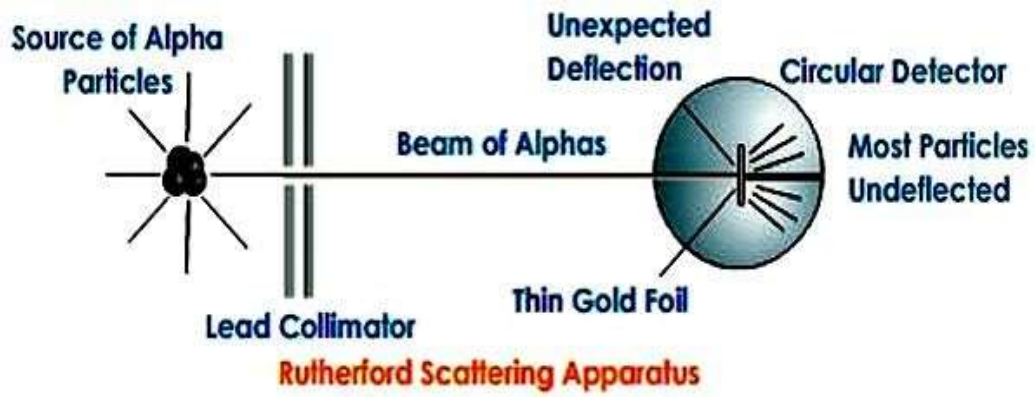
(b) There is a positively charged center in atom, which contains nearly the whole mass of atom. The centre is called nucleus.

(c) The size of nucleus is very small compared to an atom.

(d) Electrons revolve round the nucleus



The Rutherford's Experiment is also known as Geiger-Marsden Experiment.



DRAWBACKS OF RUTHERFORD MODEL

(a) According to Rutherford's Model, electron revolves round the positively charged nucleus which is not expected to be stable. But a charged particle in an accelerated motion along a circular path would lose energy because of radiation and finally would fall into nucleus. This makes an atom unstable while atoms are quite stable.

If atoms were not stable no matter would exist in nature.

(b)Rutherford model could not solve the problem of atomic mass of atom as it proposed only the existence of protons in the nucleus.

However, the problem of atomic mass could be solved after the discovery of neutron.

BOHR'S MODEL OF ATOM

Neils Bohr, a Danish physicist, in 1913 proposed model of atom which rectified the problems left by Rutherford's Model. He proposed that

(a) Electrons revolve round the nucleus in a fixed orbit.

(b)He called these orbits as 'stationary orbit'.

(c)Each stationary orbit is associated with fixed amount of energy, thus electrons do not radiate energy as long as they keep on revolving around the nucleus in fixed orbit.

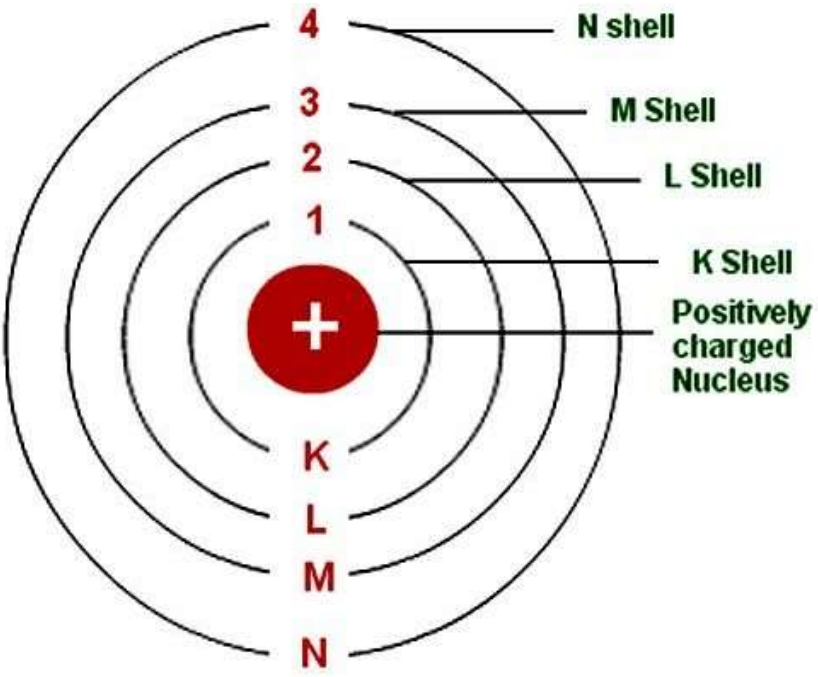
The circular path around the nucleus is called orbit, energy level or shell.

Energy level are represented by letter – K, L, M, N,. …..and so on.

Therefore,

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

The orbits are denoted by 1, 2, 3, …. and so on.



INTEXT QUESTIONS PAGE NO. 49

Q1. On the basis of Thomson's model of an atom, explain how the atom is neutral as a whole.

Answer:

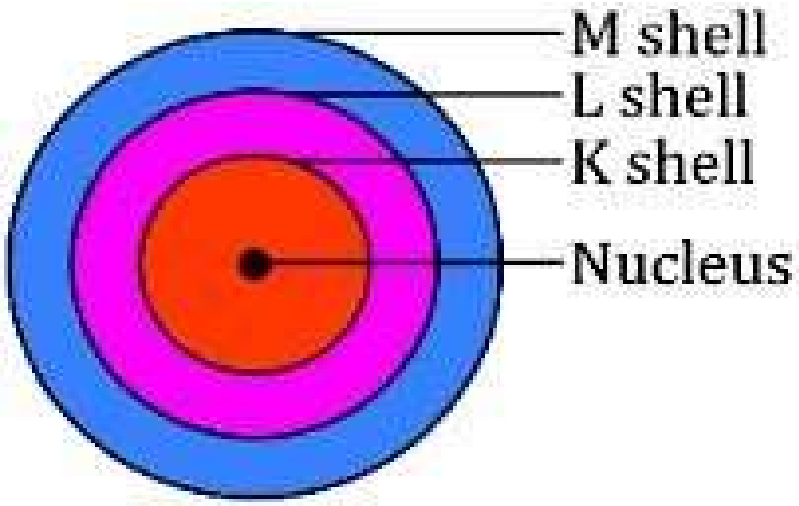
As per Thomson's model of the atom, an atom consists both negative and positive charges which are equal in number and magnitude. So, they balance each other as a result of which atom as a whole is electrically neutral.

Q2. On the basis of Rutherford's model of an atom, which subatomic particle is present in the nucleus of an atom?

Answer: On the basis of Rutherford's model of an atom, protons are present in the nucleus of an atom.

Q3. Draw a sketch of Bohr's model of an atom with three shells.

Answer:



Q4. What do you think would be the observation if the α-particle scattering experiment is carried out using a foil of a metal other than gold?

Answer: If α-particle scattering experiment is carried out using a foil of any metal as thin as gold foil used by Rutherford, there would be no change in observations. But since other metals are not so malleable so, such a thin foil is difficult to obtain. If we use a thick foil, then more α- particles would bounce back and no idea about the location of positive mass in the atom would be available with such a certainty.

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