

# CHEMISTRY STUDY MATERIALS FOR CLASS 9

## (NCERT based Structure of the Atoms)

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### KEY NOTES

#### Introduction:

Dalton's atomic theory in suggested that an atom was indivisible. However, the discovery of two fundamental particles named as electrons and protons, inside the atom, led to the failure of Dalton's atomic theory.

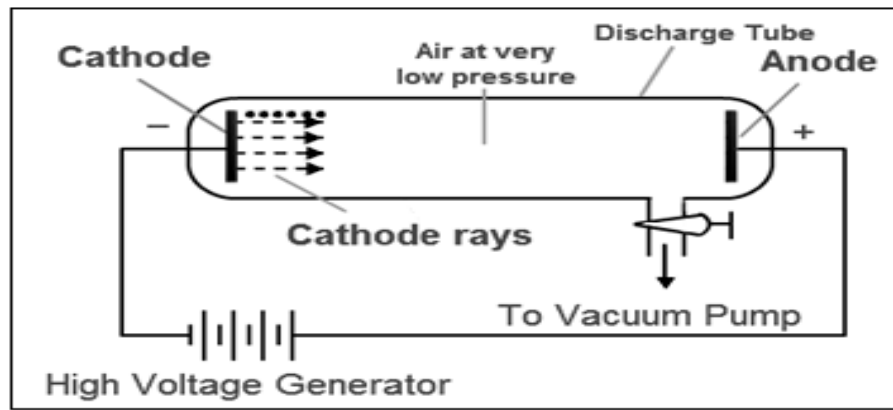
#### Fundamental particles of an atom:

Three particles; electron, proton and neutron from which an atom is consisted of, are called fundamental particles of an atom or sub atomic particles.

Particles	Relative charge	Relative mass (amu)	Absolute charge(C)	Absolute mass (kg)
Electron (e <sup>-</sup> )	-1	1/1840	-1.6 x 10 <sup>-19</sup>	9.1 x 10 <sup>-31</sup>
Proton (p <sup>+</sup> )	+1	1	+ 1.6 x 10 <sup>-19</sup>	1.65 x 10 <sup>-27</sup>
Neutron( n)	Neutral	1	0	1.67 x 10 <sup>-27</sup>

**Discovery of Electron:** By J. J. Thomson in 1897.

He carried a cathode ray experiment in which observed a stream of negatively charged particles coming out of cathode towards the anode. These particles were named as electrons.



**Thomson's Cathode Ray Tube Experiment**

**Discovery of Proton:** By Ernest Goldstein in 1886.

He observed in the same gas discharge tube, with different situations that the anode emitted positive particles which he named as Canal Rays. His experiment led to the discovery of proton.

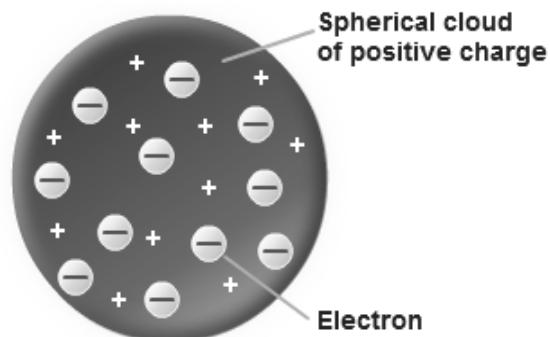
**Discovery of Neutron:** By J. Chadwick in 1932.

Neutron is present in the nucleus of all atoms.

### 1. Thomson's Model of Atom (by Joseph James Thomson in 1897)

Thomson's model of an atom proposed that:

- An atom is a uniform sphere of positive charges (due to presence of protons) as well as negative charges (due to presence of electrons).
- Atom as a whole is electrically neutral because the negative and positive charges are equal in magnitude.



Thomson's Model of an Atom

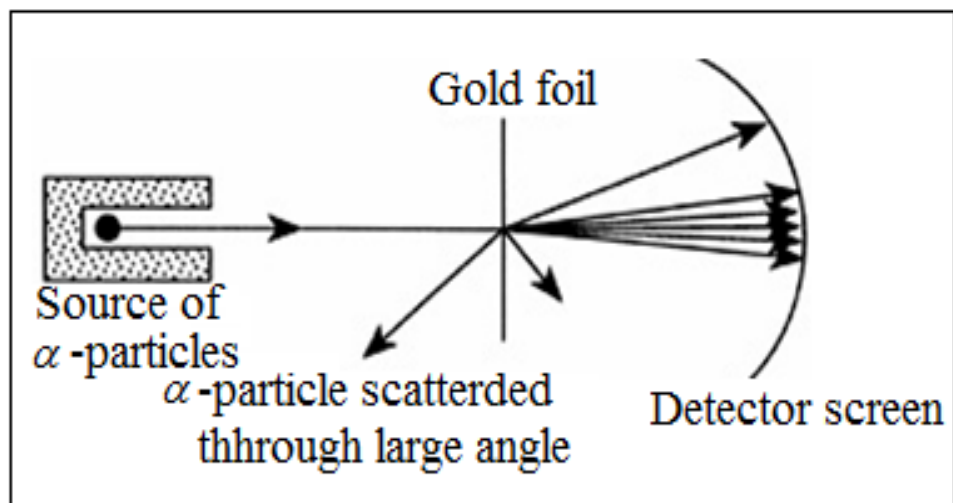
This model is also known as water melon model, plum pudding model and apple pie model.

### Limitations of Thomson's Model:

- It failed to explain how protons and electrons were arranged in atom so close to each other.

## 2. Rutherford's Model of Atom (By Ernest Rutherford in 1909)

This was based on an experiment in which  $\alpha$  - particles were bombarded on a thin gold foil.



Rutherford's  $\alpha$ -particle scattering experiment

**Observations of Rutherford's  $\alpha$ -particle scattering experiment are:**

- (a) Most of the  $\alpha$  - particles passed without any hindrance.
- (b) Some of the  $\alpha$  - particles deflected from their original path at a noticeable angle (small angle).
- (c) Very few of the  $\alpha$  - particles bounced back at their original path.

## **Postulates of Rutherford's Model of Atom:**

- (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.

## **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 continuously undergo loss of energy and finally would fall into nucleus. This makes an atom unstable while atoms are quite stable.
- (b) Rutherford model could not solve the problem of atomic mass of atom as it proposed only the existence of protons in the nucleus.

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