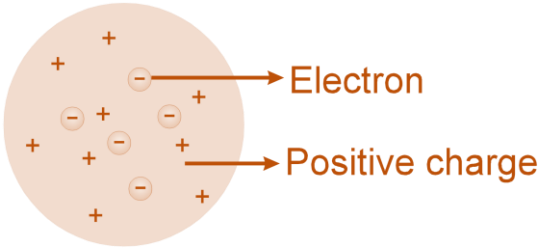
Atomic Models

Thomson's Model of Atom

According to Thomson, atom consists of a uniform sphere of positive charge in which electrons are distributed uniformly, which is why atom is electrically neutral. This model of an atom is known as the *'plum-pudding model' or 'watermelon model'.*

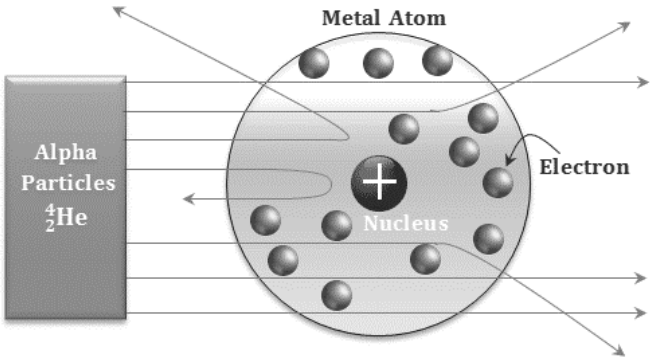


Rutherford's Model of Atom

A beam of alpha particles obtained from spontaneously radioactive isotopes of polonium directed to very thin platinum or gold foil. The direction of motion of α-particles after emerging from the metal sheets traced on a fluorescent screen.

Rutherford gold foil experiment observations

a. Most of the α- particles (nearly 99%) passed through the gold foil undeflected.
b. Some of the α - particles were deflected by small angles.
c. A very few α - particles (1 in 20000) were either deflected by very large angles or were actually reflected back along their path.



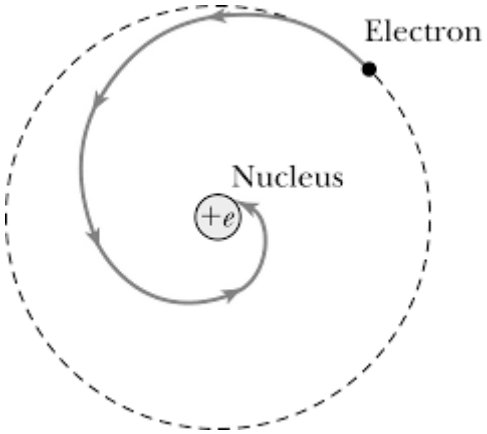
Conclusions:

a. Most of the mass and all the positive charge of an atom is concentrated in a very small region called nucleus. Size of the nucleus is extremely small as compared with the size of the atom.
b. The dimension of the nucleus is negligible compared to the atom. The Radius of the atomic nucleus ~ 10^{-13} being the same as that of an electron but the radius of an atom ~ 10^{-8}. Thus, an atom must have a very empty structure.
c. The large deflection of an alpha particle from its original path was due to Coulombic repulsion between the alpha particle and the positive nucleus of an atom. Hence entire positive charge also resides in the nucleus.

d. The nucleus is surrounded by electrons which are revolving around it at very high speeds. The electrostatic force of attraction between electrons and the nucleus is balanced by the centrifugal force acting on the revolving electrons.
e. Total negative charge on the electrons is equal to the total positive charge on the nucleus so that atom overall is electrically neutral.

Limitations:

a. Rutherford's model failed to explain stability of atoms. A moving charged particle always emits energy. Thus the loss of kinetic energy and eventually hit the nucleus of an atom.



b. Rutherford's model also failed to explain the existence of certain definite lines in the hydrogen spectrum.