Atomic Structure

Content

Developing the model of the atom

1- Dalton's model (1803)

➤ John Dalton thought that all matter was made of tiny particles called atoms, which he imagined as **tiny solid balls.** Dalton's model included these ideas:

- atoms cannot be broken down into anything simpler
- the atoms of a given element are identical to each other
- the atoms of different elements are different from one another
- during chemical reactions atoms rearrange to make different substances

2- Thomson's model (1897)- Plum pudding Model

➤ **J.J. Thomson (1856 – 1940)** was a British physicist who discovered the electron in 1897. He knew that:

- atoms are spheres of positive charge
- electrons are dotted around inside
- electrons are negatively charged
- atoms have no overall electric charge.

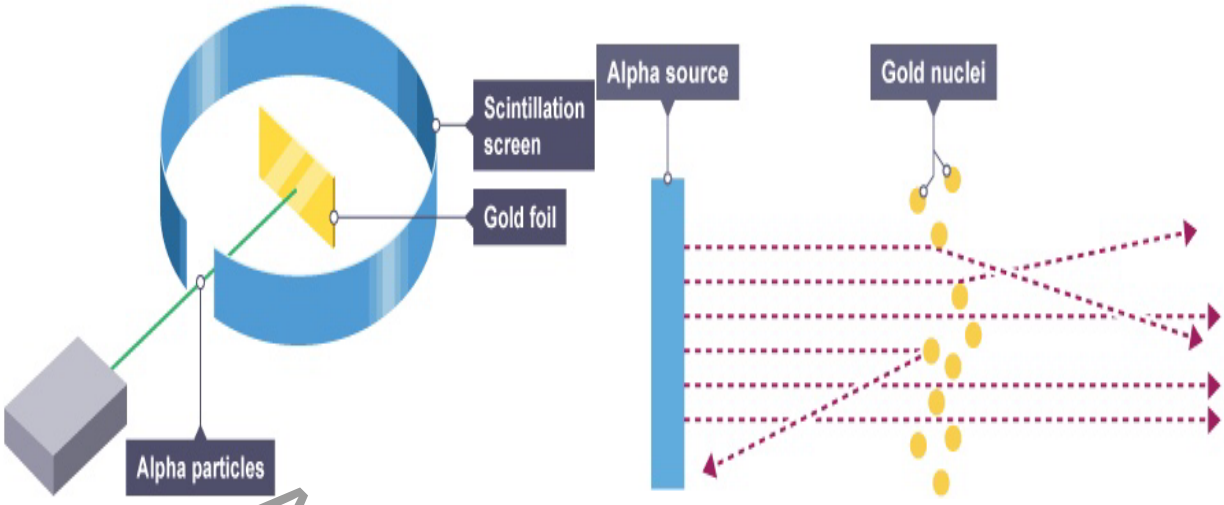
➤ Thomson devised a model of the atom in which electrons are embedded in a sphere of positive charge. This model became known as the plum pudding model because it resembled a type of dessert containing dried fruit.

3- The alpha scattering experiment

➤ **Ernest Rutherford (1871 – 1937) was a New Zealand** physicist who discovered alpha radiation. By **1907** he knew that **alpha particles** are positively charged helium ions. Rutherford wanted to find out more about their properties, so he asked his colleagues Hans Geiger and Ernest Marsden to carry out an experiment.

- Atoms are neutral overall.
- Positively charged ions form when atoms, or groups of atoms, lose electrons.
- Negatively charged ions form when atoms, or groups of atoms, gain electrons.

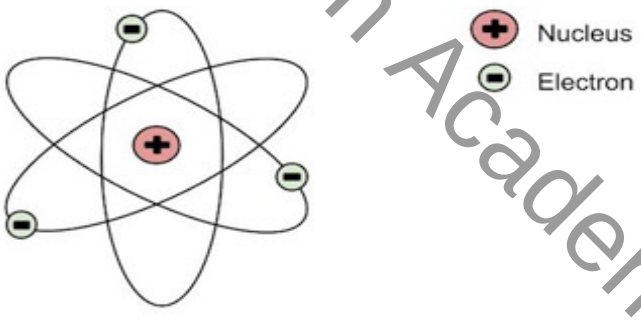
➤ The scientists aimed a beam of alpha particles at very thin gold foil. The foil was surrounded by a fluorescent screen that flashed when an alpha particle hit it. Working in the dark, Geiger and Marsden recorded the numbers and positions of these flashes.



4- Rutherford's model

➤ Rutherford developed his nuclear model in **1911**. In his study he discovered that

- a central, positively charged nucleus
- electrons arranged in a cloud around the nucleus.



Rutherford Model of the Atom

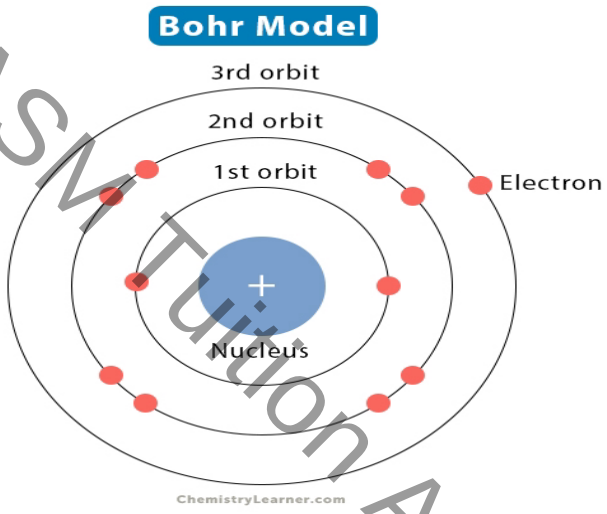
5- Bohr's model

➤ Rutherford's model had a problem. Orbiting electrons would lose energy and spiral down into the nucleus. **Niels Bohr (1885 – 1962)** was a Danish physicist whose model overcame this problem. His 1913 model was based on theoretical calculations, but the results of experiments confirmed them later. In the Bohr model:

- electrons having negative charge orbit the nucleus at different distances
- each orbit has a particular energy
- electrons can only move from one orbit to another by gaining or losing the difference in energy between the orbits.
- Nucleus made up of group of particles(protons) which has positive charge

➤ The orbits are called **shells or energy levels.**

➤ After approving the idea of nucleus, in **1932 James Chadwick** proved the existence of neutron.



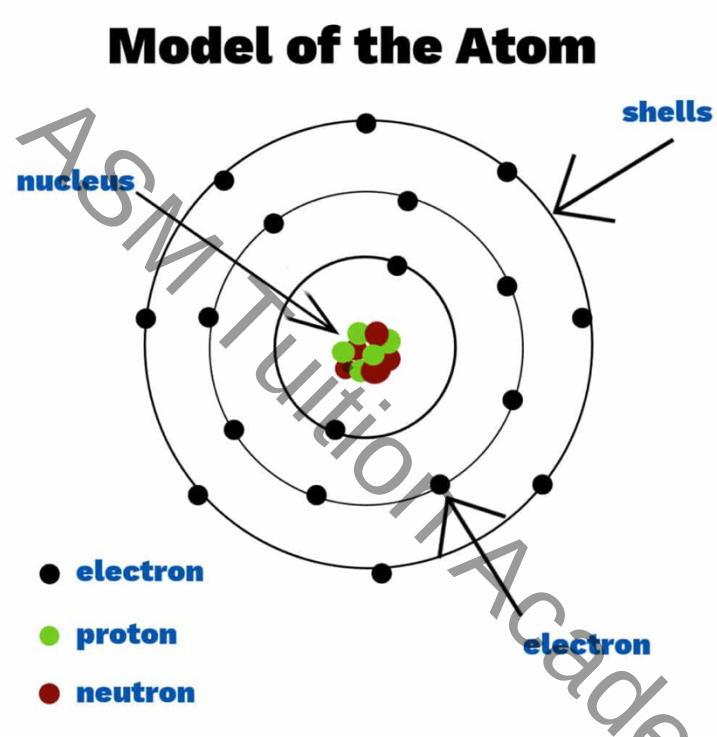
6- Current Model of the Atom

- There is a central nucleus containing protons(having +ve charge) and neutrons(which is neutral and having 0 charge)
- Electrons(having -ve charge) surround the nucleus in shells or energy levels
- The nucleus contains most of the mass of an atom
- The nucleus is very small compared to an atom.

➤ Atoms are neutral overall because the number of protons is equal to the number of electrons. The number of neutrons affects the mass of an atom but not its charge. Here is the table of sub atomic particle with their charges

Subatomic particle	Relative mass	Relative charge
Proton	1	+1
Neutron	1	0
Electron	Very small	–1

- In an atom no of **Protons = no of Electrons** , as proton and electrons have an equal but opposite charges
- Electron move within the atom or sometime leave the atom by absorbing EM radiations
- If electron move to **orbit which is closer to nucleus** , they **release energy (EM radiation)**. If electrons **move outer shells or sometime move to another atom** it's **gain energy(EM radiation)**



7- Evolution in Atomic Model