

# MYP 5 - Mode of an atom

Content notes

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## Resources -

- Science Quest 9 - Jacaranda - second edition
- MYP 4 and 5 - Oxford
- MYP 4 and 5 - Hodder
- IGCSE Physics - Duncan
- Physics for cambridge IGCSE - workbook - David Sang and Darrell Hamilton

## **Learning outcomes :**

By the end of the topic, students will be able to describe that atoms are made up of subatomic particles and that protons and neutrons are located in the nucleus of the atom.

## **Guiding questions**

- How did Rutherford find out that the atom in solid gold are mostly solid space ?
- Where is most of the atom's mass located ?
- What is the difference between the Thomson, Rutherford and Bohr model of an atom ?
- Do we now understand the atom completely or could our models improve further ? ( discussion )

## **Timeline of the development of the model of an atom**

- About 400 BC - philosopher Democritus

All substances consists of tiny indestructible particles called atoms.

- 1808 - John Dalton

Atoms could not be divided into smaller particles

Atoms of the same element are alike

Atoms combined in simple whole number ratio.

- 1857 - scientist J. J. Thomson

Atoms were positively charged spheres with negatively charged electrons embedded in them like a plum pudding.

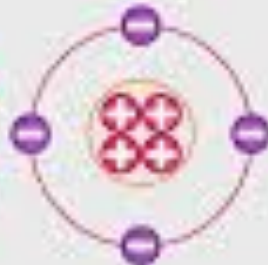
# Atomic Models



1803  
John  
Dalton



1904  
J.J.  
Thomson



1911  
Ernest  
Rutherford



1913  
Niels  
Bohr



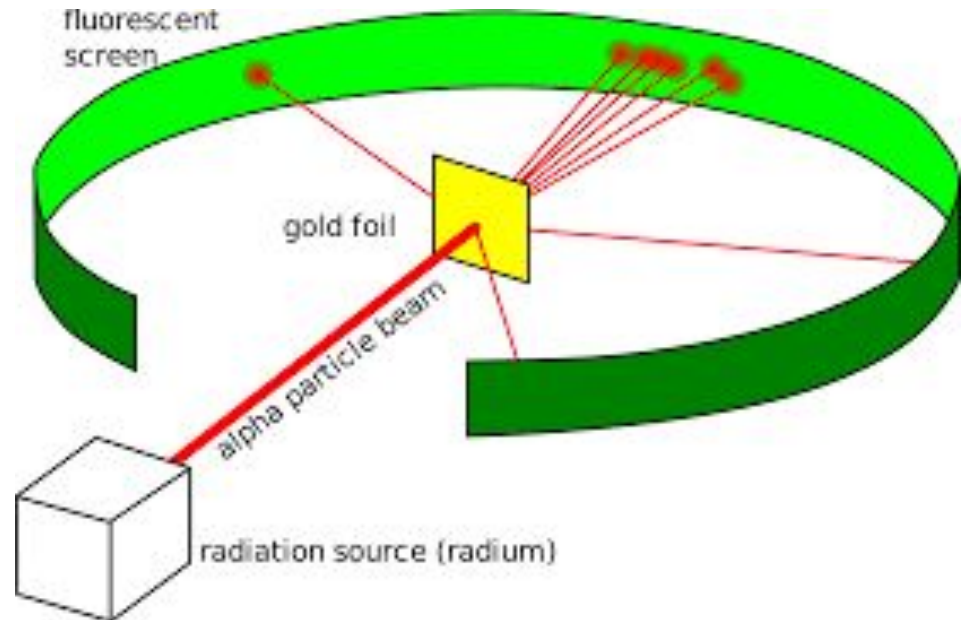
1926  
Erwin  
Schrodinger

- 1911 - Rutherford

Science as a Human Endeavour : Rutherford's model of the atom was based on a series of experiments where:

- Tiny positive alpha particles were fired at a very thin sheets of gold foil
- The particles travelled were detected using a fluorescent screen.

Rutherford Scattering  
simulation link



He and his team observed that most of the particles went straight through the gold foil and very few were deflected back. This led them to several important conclusions.

- He explained that the few particles that were deflected back were repelled by a very small positively charged nucleus in the atoms of the gold.
- Most of the alpha particles continued through the foil because each gold atom consists mainly of empty space.
- He said later that his observations were about as credible as if you had fired a 16 inch shell at a piece of tissue paper and it had come back and hit you !

One major flaws : It proposed that orbiting electrons would eventually lose energy and spiral in towards the nucleus.

- 1913 - scientist Niels Bohr

Electrons orbit the nucleus at different energy levels.

Electrons from one energy level can jump to another energy level by gaining or by releasing packets of energy.

Although Bohr's model explained why electrons did not spiral in towards the nucleus, it did not explain all of the known properties of the atom.

- 1926 - Schrödinger model

The atom consists of a nucleus surrounded by a hazy cloud of electrons. Regions of the atom where the mathematics predicts that electrons are more likely to be found are represented by denser shading (

- 1932 - Sir James Chadwick

Discovered that the nucleus contained particles called neutrons that had mass about the same as a proton and no charge.

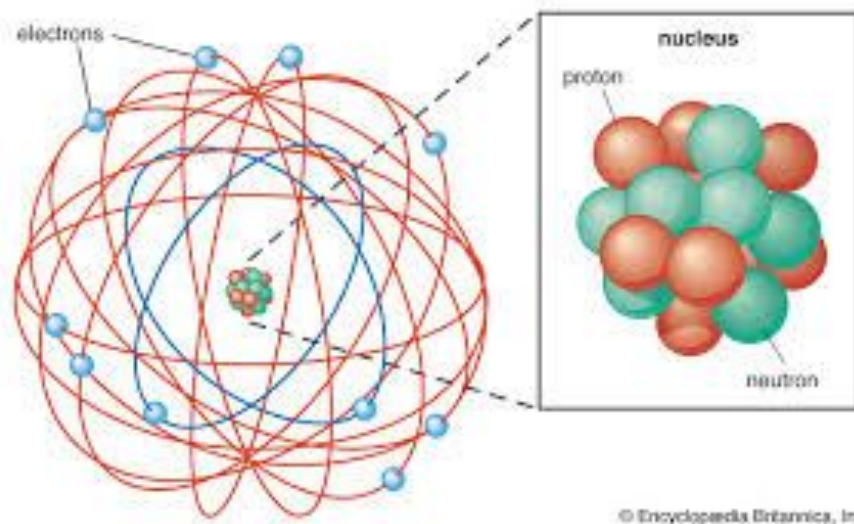
- **Current model of the atom**

Nucleus - located at the middle of the atom. It is very small and dense. Composed of positively charged protons and neutral neutrons held by strong nuclear force. It makes up almost all the mass of the atom.

Protons - They are positively charged and has the mass almost same as that of the neutrons

Neutrons - No charge and mass approximately same as that of the protons. In the neutral atom, number of protons is same as the number of neutrons.

Electrons - Orbit the nucleus, following paths commonly known as electron clouds. Negatively charged particles. Tiny mass about  $1/1800$  of the mass of proton.



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## Key terms

Alpha particles - positively charged nucleus of helium atom, consisting of two protons and two neutrons.

Electrons - extremely tiny ( mass approximately  $1/1800$  times of proton ) , negatively charged particles orbiting the nucleus.

Neutrons - neutrally charged particles within the nucleus of an atom.

Nucleus - Central part of an atom, made of protons and neutrons, positively charged.

Protons - positively charged particles found in the nucleus of an atom with mass approximately same as that of the neutrons.

Refer to practice sheet under Criteria A and B tab of our website [www.shreejiedu.in](http://www.shreejiedu.in) to check and reflect upon your learning.