Your notes

GCSE Chemistry: revision notes

The history of the atomic model

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Early ideas

- Before electrons were discovered, atoms were thought to be tiny spheres that could not be divided (**John Dalton**'s model, early 1800s).
- **J.J. Thomson** discovered the electron in 1897. This led to the **plum pudding model**: a ball of positive charge with negative electrons embedded in it.

The nuclear model

- In the **alpha particle** scattering experiment (Geiger and Marsden, working with Rutherford, 1909), positively charged **alpha particles** were fired at thin gold foil.
- Most went straight through, so most of the atom is empty space. A few were deflected, and a very few bounced back, so the mass is concentrated in a tiny, positively charged centre: the nucleus.
- This **nuclear model** replaced the **plum pudding model**.

Bohr, protons and neutrons

- **Niels Bohr** adapted the **nuclear model**: electrons orbit the nucleus at specific distances (**energy levels** or shells). His calculations agreed with experimental observations.
- Later experiments showed that the positive charge of a nucleus is made of smaller particles, each with the same positive charge: protons.
- **James Chadwick** provided evidence for neutrons in 1932, about 20 years after the nucleus became an accepted idea.

How science works

- New experimental evidence can lead to a scientific model being changed or replaced.

- Models are accepted when they explain the observations and make predictions that are confirmed by experiments.

Key terms

Plum pudding model	Thomson's model of the atom: a ball of positive charge with electrons embedded in it.
Alpha particle	A positively charged particle made of two protons and two neutrons.
Alpha scattering experiment	Firing alpha particles at gold foil, which showed atoms have a small, dense, positive nucleus.
Nuclear model	The model of the atom with a tiny positive nucleus surrounded by electrons.
Energy level	A fixed distance from the nucleus where electrons orbit; also called a shell.
John Dalton	Proposed that atoms were tiny spheres that could not be divided.
J.J. Thomson	Discovered the electron and proposed the plum pudding model.
Ernest Rutherford	Led the alpha scattering work that showed atoms have a nucleus.
Niels Bohr	Suggested that electrons orbit the nucleus in fixed energy levels.
James Chadwick	Found evidence for the neutron.

Quick questions

Cover the answers and test yourself: remembering is what makes it stick.

1. What did the plum pudding model say an atom was?
2. Who discovered the electron?
3. In the alpha scattering experiment, why did most alpha particles pass straight through the gold foil?
4. Why were a few alpha particles deflected back?
5. What did Niels Bohr suggest?
6. Who provided evidence for the neutron?
7. Which model replaced the plum pudding model?
8. What charge do alpha particles have?

Answers

1. A ball of positive charge with electrons embedded in it
2. J.J. Thomson
3. Most of the atom is empty space
4. They hit a small, dense, positive nucleus

Your notes

5. Electrons orbit the nucleus at specific distances
6. James Chadwick
7. The nuclear model
8. Positive

What to do next

Practise 10 questions on this topic

Try 7 exam questions, with mark schemes

Read the lesson, one step at a time

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