

Models of the Atom

Questions for GCSE Physics



1. What subatomic particle was discovered by J. J. Thomson?

The Electron

2. What name was given to J. J. Thomson's model of the atom?

The Plum Pudding Model

3. Describe J. J. Thomson's model of the atom.

*The atom was a sphere/region of **positive charge (positive matter)**.*

Negatively charged electrons were embedded/scattered throughout the positive matter.

4. Explain why an atom in Thomson's model had no overall electrical charge.

*The atom contained both **positive and negative charge**.*

*The total positive charge was **equal to / balanced / cancelled by** the total negative charge.*

5. Rutherford, Geiger and Marsden used alpha particles to investigate atomic structure. What electrical charge does an alpha particle have?

Positive / positively charged.



6. The scientists fired alpha particles at a very thin sheet of metal. What metal did they use?

Gold

7. Most of the alpha particles did pass straight through the metal foil. What does this suggest about the structure of an atom?

Most of the atom is empty space.

8. Some alpha particles were deflected through large angles. What conclusion could Rutherford draw from this observation?

The positive charge is concentrated in a small region / nucleus.

*The nucleus is **positively charged**.*

9. A very small number of alpha particles were deflected back towards their source. What did this suggest about the nucleus?

*The nucleus is **very small**.*

*The nucleus is **very dense** / **contains most of the mass of the atom**.*

10. What did Niels Bohr add to the nuclear model of the atom?

*Electrons exist/orbit the nucleus in **fixed shells** / **fixed energy levels**.*



11. A student says:

“Rutherford’s experiment proved that atoms are solid objects because some alpha particles bounced back.”

Explain why the student’s conclusion is incorrect. Use evidence from the scattering experiment in your answer.

[4 marks]

Award 1 mark for each valid point, to a maximum of 4 marks:

- **Most alpha particles passed straight through the foil.**
- **This showed that most of the atom is empty space.**
- **Only a very small number of alpha particles were deflected backwards.**
- **This showed that the nucleus occupies only a very small part of the atom.**
- **Large-angle/backwards deflections show that the positive charge is concentrated in the nucleus.**
- **The nucleus is dense / contains most of the atom’s mass.**
- **Therefore, the backwards scattering does not show that the whole atom is solid.**

12. Describe how the model of the atom changed as a result of new experimental evidence.

Your answer should include the contributions of **Dalton, Thomson, Rutherford and Bohr**.

[6 marks]

Level 3 — 5–6 marks

The student gives a clear and logically ordered account of the development of the atomic model. The contributions of Dalton, Thomson, Rutherford and Bohr are described accurately. There is a clear connection between new experimental evidence and changes to the model.

Level 2 — 3–4 marks

The student gives a generally correct account containing several stages in the development of the atomic model. There is some explanation of how evidence led to changes, but the account may contain omissions or lack detail.

Level 1 — 1–2 marks



The student gives a limited description containing one or more relevant facts about atomic models or the scientists involved. Links between experimental evidence and changes to the model are limited or absent.

0 marks

No relevant content.

Indicative content

Answers may include:

- *Dalton described atoms as tiny, indivisible solid spheres.*
- *Different elements were thought to contain atoms with different masses.*
- *J. J. Thomson discovered the electron, showing that atoms were not indivisible.*
- *Thomson proposed the plum pudding model.*
- *In this model, negatively charged electrons were embedded in positive matter.*
- *Rutherford, Geiger and Marsden fired alpha particles at thin gold foil.*
- *Most alpha particles passed straight through, suggesting that most of an atom is empty space.*
- *Some were deflected through large angles and a very small number came backwards.*
- *This evidence was inconsistent with the plum pudding model.*
- *Rutherford proposed the nuclear model, with a very small, dense, positively charged nucleus containing most of the atom's mass.*
- *Electrons were outside/orbiting the nucleus.*
- *Bohr proposed that electrons could only occupy fixed shells / energy levels.*
- *Electrons could move between energy levels by absorbing or emitting energy.*

