

GCSE Chemistry (9 – 1)

Development of the model of the atom

Name:

Group:

Instructions

- Read each question carefully before you begin to answer it.
- Use black ink or black ball-point pen for your answers.
- Fill in the boxes at the top of this page with your name and group.
- Attempt to answer every question in the booklet.
- Answer the questions in the spaces provided – there may be more space than you need in some answer spaces.
- Calculators may be used for this booklet.
- For any calculations, you **must** show all your working.
- Any and all drawings or graphs should be completed in pencil.



For markers use	
Question	Mark
1	/4
2	/7
3	/11
4	/7
5	/12
Total	/41
%	
Grade	

Information

- The maximum mark for this paper is 41 marks.
- The marks for each question are shown in brackets.
- Please be aware that good English and clear presentation are required in your answers.



1. Our understanding of atomic structure has evolved significantly over time, with each new model being developed to explain new experimental evidence.

Circle the letter of the correct answer for each of the following questions.

- a) J.J. Thomson's 'plum pudding' model was the first to include a sub-atomic particle.

What was the particle that Thomson had discovered.

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|----------|----------|----------|----------|
| A | B | C | D |
| Quark | Proton | Neutron | Electron |

(1 mark)

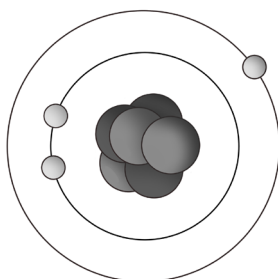
- b) When the model of the atom was developed, scientists reviewed the work of other scientists.

Why is it important for scientists to review the work of other scientists?

- A** Scientists will evaluate the data and suggest improvements.
- B** Scientists will copy the experiments to complete the research first.
- C** Scientists will argue about which scientists are correct.
- D** Other scientists can act as witnesses.

(1 mark)

- c) The figure below of an atom shows that electrons occupy different shells around the nucleus.



Who put forward this atomic model?

- | | | | |
|-----------|---------------|----------|----------|
| A | B | C | D |
| Mendeleev | J. J. Thomson | Dalton | Bohr |

(1 mark)

- d) Ernest Rutherford's alpha particle scattering experiment provided evidence for a new model of the atom. What was the main conclusion from this experiment?

- A** Electrons exist in fixed energy levels or shells.
- B** Atoms are tiny, hard spheres that cannot be divided.
- C** The existence of the neutron was confirmed.
- D** The mass of the atom is concentrated in a tiny, positively charged nucleus.

(1 mark)

(Total for Question 1 is 4 marks)

2. Our understanding of the atom has changed over time as new evidence has become available.
- a) J. J. Thomson proposed the 'plum pudding' model of the atom. This model was later disproved by the alpha particle scattering experiment.

Explain how the results of the alpha particle scattering experiment showed that the 'plum pudding' model was incorrect.

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(3 marks)

- b) Niels Bohr adapted the new nuclear model.

Describe the main improvement that Bohr made to the model of the atom.

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(2 marks)

- c) The model of the atom was later completed by the discovery of a final subatomic particle.

Name the scientist who discovered the neutron and explain why this discovery was important.

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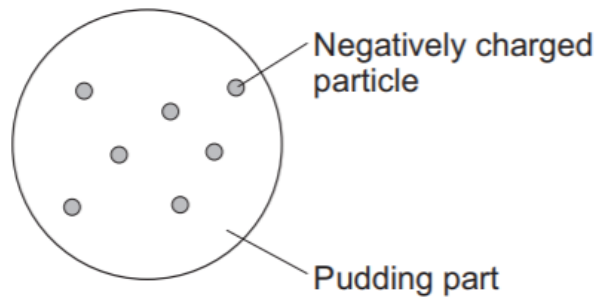
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(2 marks)

(Total for Question 2 is 7 marks)

3. Before the discovery of the nucleus, one popular scientific theory was the 'plum pudding' model of the atom. This model is illustrated in the figure below.



The plum pudding model had to account for the fact that atoms are electrically neutral despite containing negatively charged electrons.

- a) Describe the charge of the 'pudding' part of the atom in this model.

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(2 marks)

In the alpha scattering experiment, most alpha particles passed through the gold foil as expected. However, some results were unexpected and could not be explained by the plum pudding model.

- b) Describe these unexpected results and explain the conclusion about the structure of the atom that was drawn from them.

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(2 marks)

- c) Describe **one** feature of the experimental method that helped to ensure the conclusions were scientifically valid.

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(1 mark)

d) Describe the structure of an atom according to the modern nuclear model.

Marks will be awarded for a clear, well-organised answer that uses specialist terms correctly.

In your description, you must:

- Identify the three subatomic particles and state their positions within the atom.
- State the relative mass and relative charge for each of these particles.

[illegible]

(6 marks)

(Total for Question 3 is 11 marks)

4. The modern nuclear model of the atom replaced earlier ideas, such as J.J. Thomson's 'plum pudding' model.

a) Contrast the modern nuclear model with the 'plum pudding' model by describing **two** key differences.

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(2 marks)

Before a scientist's work, like Rutherford's on the atomic model, can be published, it must be peer-reviewed.

b) Describe the process of peer review.

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(2 marks)

Niels Bohr's model of the atom described a positive nucleus surrounded by electrons in fixed shells. However, this model could not explain the total mass of most atoms.

In 1932, James Chadwick made a discovery that solved this problem.

c) Describe the particle that Chadwick discovered and explain how it completed our understanding of the nucleus.

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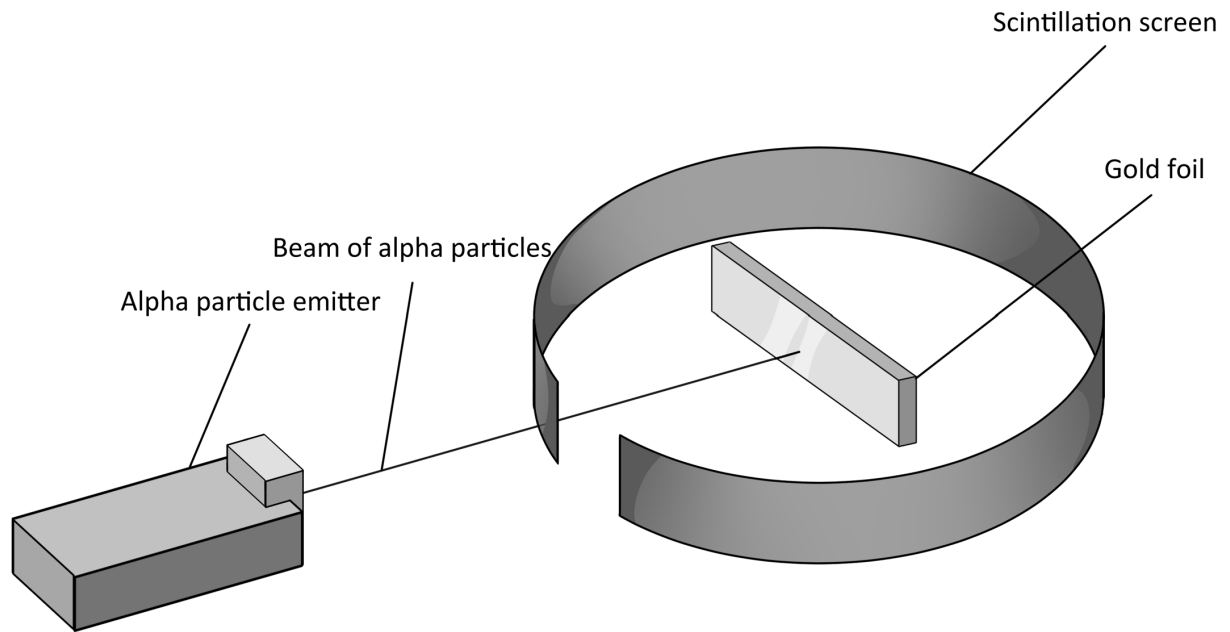
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(3 marks)

(Total for Question 4 is 7 marks)

5. The figure below shows the setup for the alpha particle scattering experiment.



a) This experiment was designed to test the 'plum pudding' model.

Based on the plum pudding model, what path were the alpha particles expected to take after hitting the gold foil? Explain your answer.

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(2 marks)

b) The actual results of the experiment were surprising.

State **two** observations that did not match the predictions of the plum pudding model.

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(2 marks)

