AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 6.4.1.3

The development of the model of the atom (common content with chemistry)

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**2**
Available paper years	**2018–2024**

Using this booklet

1. Booklet answer numbers match the question booklet.
2. Use the original question number within marking tables.
3. Examiner comments are included where available.

Name: _____ **Date:** _____

Where a precise marking extract is unavailable, the full source document is included in an appendix. Any missing mark scheme is explicitly identified.

6.4.1.3 The development of the model of the atom (common content with chemistry)

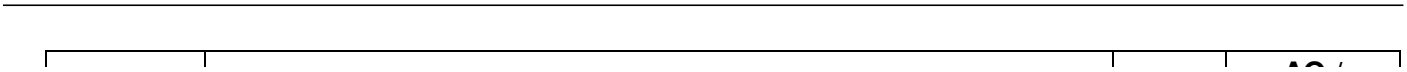
Answer 01 · Mark scheme June 2018 | 8464/P/1F | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	electron atom nucleus orbit		1 1 1 1	AO1 6.4.1.3 5.1.1.3
06.2	positive charge is provided by protons (every atom of the same element contain the) same number of protons	 do **not** accept same number of protons and neutrons ignore reference to electrons	1 1	AO1 6.4.1.2 6.4.1.3
06.3	$v = 300\ 00\ 000 \times \left(\frac{7}{100}\right)$ v = 21 000 000 (m/s)	an answer of 21 000 000 scores **2** marks allow any correct method of determining 7% of 300 000 000 allow 2.1×10^7 (m/s)	 1 1	AO2 6.4.1.3
06.4	$r = 6 \times 2.5 \times 10^{-11}$ $r = 1.5 \times 10^{-10}$ (m)	an answer in the range 1.4×10^{-10} to 1.6×10^{-10} scores **2** marks allow a ratio in the range of 5.7–6.3 or measurements that would give this range, correctly substituted allow 1.4×10^{-10} to 1.6×10^{-10} their ratio $\times 2.5 \times 10^{-11}$ correctly calculated scores **1** mark	 1 1	AO2 6.4.1.1
Total			**10**	

6.4.1.3 The development of the model of the atom (common content with chemistry)

Answer 01 · Mark scheme

June 2018 | 8464/P/1F | Original Q6



6.4.1.3 The development of the model of the atom (common content with chemistry)

Answer 02 · Mark scheme

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	2 protons and 2 neutrons	ignore helium nucleus	1	AO1 6.4.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	118		1	AO1 6.4.1.2

Question	Answers	Mark	AO / Spec. Ref.
07.3	**Level 2:** Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.	4–6	AO1 AO3 6.4.1.3
	Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.	1–3	
	No relevant content	0	
	Indicative content Plum pudding model • the atom is a ball of positive charge • electrons are embedded in the ball Reasons why the plum pudding model was replaced • the results were not correctly predicted by the plum pudding model • the plum pudding model did not predict that some particles would be deflected • the large angle deflections suggest that the atom contains a nucleus • all deflections suggest that the nucleus is charged • most alpha particles were not deflected suggesting that atoms are mostly empty space Nuclear model • mass is concentrated in the nucleus • the nucleus is charged • the atom is mostly empty space • electrons orbit the nucleus in the nuclear model		

6.4.1.3 The development of the model of the atom (common content with chemistry)

Answer 02 · Mark scheme

June 2024 | 8464/P/1F | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	James Chadwick		1	AO1 6.4.1.3

Total Question 7	**9**

6.4.1.3 The development of the model of the atom (common content with chemistry)

Answer 02 · Examiner comments

June 2024 | 8464/P/1F | Original Q7

Question 7 (standard demand)

07.1 Most students were unable to accurately recall the structure of an alpha particle, with less than one in 10 students giving a full description.

07.2 The number of neutrons was correctly determined by just under half the students.

07.3 Foundation tier students tended to struggle with this question. Most were unable to describe details of either the plum pudding model or the nuclear model of the atom, and so made very little progress with their answers. The question was not attempted by about a fifth of students, and about a third gained any credit.

Some students used diagrams of the two models as part of their answers. Clearly labelled diagrams could help students to gain credit, but many diagrams were not labelled at all. However, many answers which included unlabelled diagrams had then gone on to describe features of each model, and the diagrams may have helped these students to recall the relevant details and to structure their answers.

There were a few misconceptions, which were demonstrated by a number of students. Descriptions of the plum pudding model as a proton with embedded electrons was common. A small proportion of answers alluded to positive electrons and negative electrons being present in atoms. A similar proportion referred to atoms being neutral because they contain neutrons.

It was relatively common for students to be unable to distinguish between the predicted results and the actual results, with many answers treating both of these as results gained by experiment.

A significant minority of students stated that the nuclear model was so called because it contains neutrons. Such statements may have been caused by students looking ahead at question 07.4 and incorrectly guessing that neutrons were discovered by conducting alpha particle scattering experiments.

© 2024 AQA and its licensors. All rights reserved.

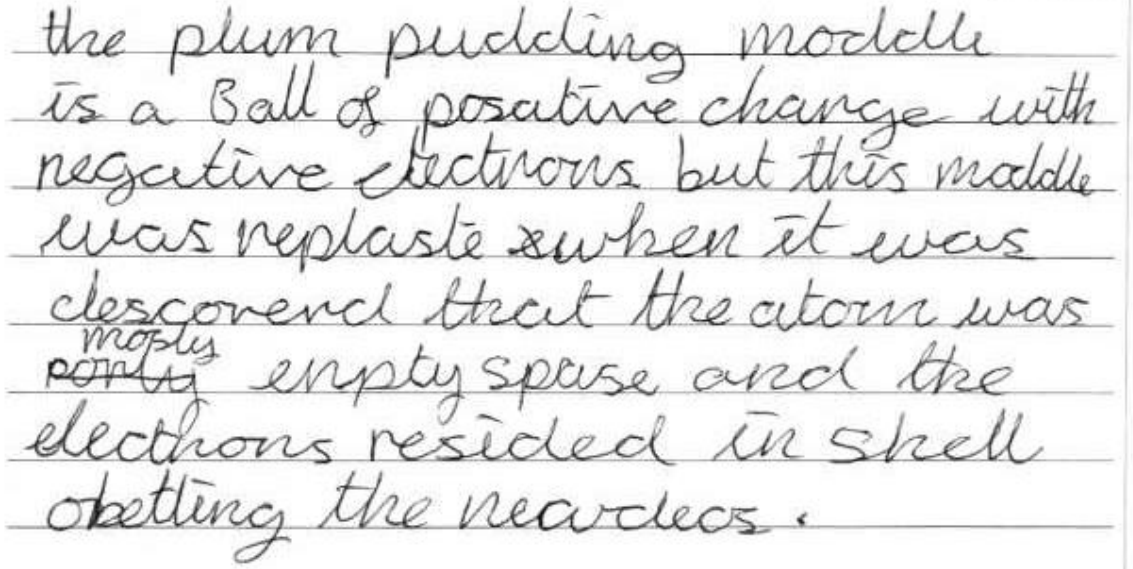
6.4.1.3 The development of the model of the atom (common content with chemistry)

Answer 02 · Examiner comments June 2024 | 8464/P/1F | Original Q7

Describe how the actual results led to the plum pudding model of the atom being replaced by the nuclear model.

You should include details of the plum pudding model and the nuclear model of the atom.

[6 marks]



This response is at the top of Level 1, gaining 3 marks. There is a description of the plum pudding model, but the description of the nuclear model lacks any detail about the massive and charged nature of the nucleus. Had the answer also included some detail about the nucleus or referred to how the actual results led to the rejection of the plum pudding model, the answer would have been in Level 2.

© 2024 AQA and its licensors. All rights reserved.

6.4.1.3 The development of the model of the atom (common content with chemistry)

Answer 02 · Examiner comments June 2024 | 8464/P/1F | Original Q7

Describe how the actual results led to the plum pudding model of the atom being replaced by the nuclear model.

You should include details of the plum pudding model and the nuclear model of the atom.

[6 marks]

- The ~~pudd~~ plum pudding model was a solid sphere of positive charge, with negatively charged electrons throughout.
- Some alpha particles passed straight through, showing it is mainly empty space, not a solid ball.
- Some were slightly deflected showing there are the electrons circling the positive charge in the middle.
- Some completely ~~deff~~ deflected back as they were repelled by the positive charge at the centre of the atom.
- The nuclear model was made to show these findings. It had a positive nucleus in the centre, a cloud of electrons orbitting it and the rest is mainly empty space.

In order to achieve the top mark on 'extended response' type questions, answers do not have to be completely correct, and neither do they need to address every single point in the indicative content on the mark scheme.

This response (from a Higher tier paper) gives a complete description of the plum pudding model. It describes how the evidence led to an understanding both that the atom is mostly empty space and that the nucleus is positively charged. However the statement that some alpha particles were deflected by electrons is incorrect, and there is no mention of the nucleus being massive.

However, taken as a whole, there is a reasonably detailed description of the plum pudding model, relevant points made about how the evidence led to the nuclear model, and a reasonably detailed description of the nuclear model, which was enough to allow this student to gain the maximum mark of 6 on this question.

07.4 About 40% of students correctly identified the scientist who provided evidence for the existence of neutrons.

© 2024 AQA and its licensors. All rights reserved.

6.4.1.3 The development of the model of the atom (common content with chemistry)

Answer 02 · Examiner comments June 2024 | 8464/P/1F | Original Q7

Contact us

Our friendly team will be happy to support you between 8am and 5pm, Monday to Friday.

Tel: 01483 477756
Email: gcsescience@aqa.org.uk

aqa.org.uk

© 2024 AQA and its licensors. All rights reserved.