AQA GCSE Physics | 8463

SPECIFICATION POINT 4.4.1.3

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

Past-paper questions

Tier	**Foundation**
Question groups	**5**
Available paper years	**2011–2025**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

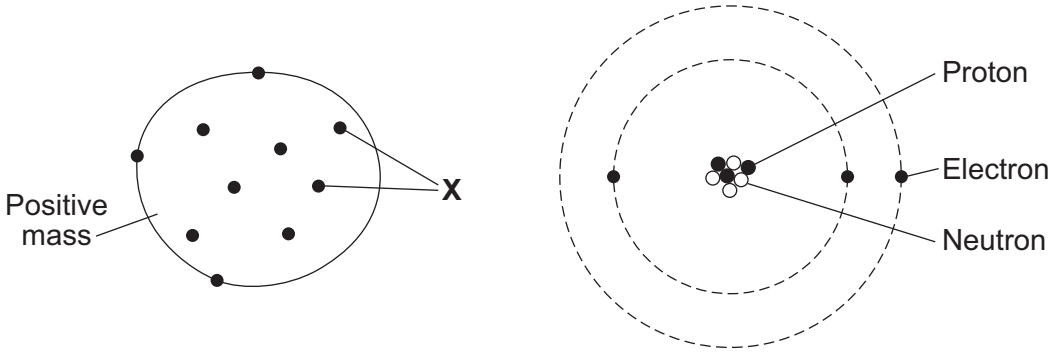
Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

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

Question 01

January 2011 | PHY2F | Original Q6 | Legacy

6 The diagrams show two different models of an atom.



'Plum pudding' model **Model used today**

6 (a) The particles labelled '**X**' in the plum pudding model are also included in the model of the atom used today.

What are the particles labelled '**X**'?

.....

(1 mark)

6 (b) Scientists decided that the 'plum pudding' model was wrong and needed replacing.

Which **one** of the following statements gives a reason for deciding that a scientific model needs replacing?

Tick (✓) **one** box.

The model is too simple. ☐

The model has been used by scientists for a long time. ☐

The model cannot explain the results from a new experiment. ☐

(1 mark)

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

Question 01 · continued

6 (c) The table gives information about the three types of particle that are in the model of the atom used today.

Particle	Relative mass	Relative charge
	1	+1
	very small	–1
	1	0

Complete the table by adding the names of the particles.

(2 marks)

4

Turn over for the next question

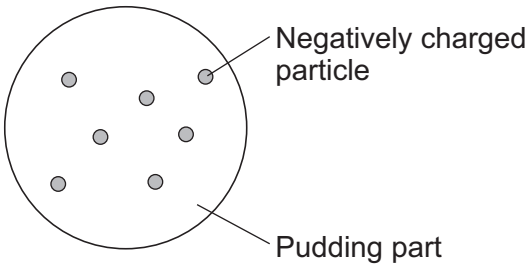
4.4.1.3 The development of the model of the atom (common content with chemistry)

Question 02

June 2015 | PH2FP | Original Q8 | Legacy

8 (a) Over 100 years ago, scientists thought the atom was like a 'plum pudding'.
Figure 11 shows the plum pudding model of the atom.

Figure 11



The scientists knew that an atom has negatively charged particles. They also knew that an atom has no overall charge.

What did the scientists conclude about the **charge** on the 'pudding part' of the atom?
[1 mark]

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.....

Question 8 continues on the next page

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

Question 02 · continued

8 (b) Two scientists named Rutherford and Marsden devised an experiment to investigate the plum pudding model of the atom. The experiment involved firing alpha particles at a thin sheet of gold. The scientists measured how many of the alpha particles were scattered.

Using the plum pudding model, the scientists predicted that only a few of the alpha particles would be scattered by more than 4°.

Over several months, more than 100 000 measurements were made.

8 (b) (i) The results from this experiment caused the plum pudding model to be replaced by a new model of the atom.

Explain why.

[2 marks]

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8 (b) (ii) Suggest **one** reason why other scientists thought this experiment provided valid evidence for a new model of the atom.

[1 mark]

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

Question 02 · continued

8 (c) **In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

Describe the model now used for the structure of an atom.

In your answer you should:
- give details of the individual particles that make up an atom
- include the relative masses and relative charges of these particles.

Do **not** include a diagram in your answer.

[6 marks]

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Extra space .....

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10

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

Question 03

0 4 The ancient Greeks thought that atoms were tiny spheres that could not be divided into anything smaller.

Since then, different discoveries have led to the model of the atom changing.

Some of the discoveries are given in **Table 1**.

Table 1

The mass of an atom is concentrated in the nucleus.	**A**
Electrons orbit the nucleus at specific distances.	**B**
The nucleus contains neutrons.	**C**
The nucleus contains positively charged protons.	**D**

0 4 . 1 Which discovery was the earliest?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

0 4 . 2 Which discovery was the most recent?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

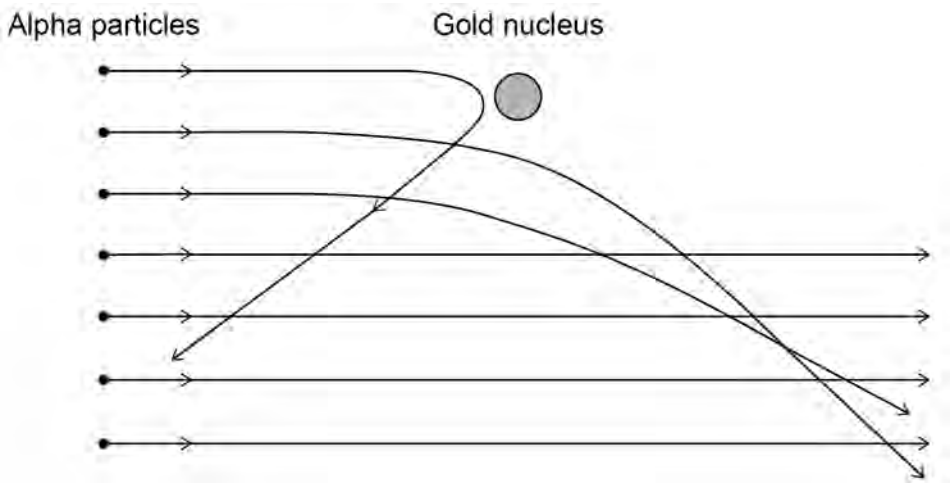
4.4.1.3 The development of the model of the atom (common content with chemistry)

Question 03 · continued

0 4 . 3 The alpha particle scattering experiment led to the nuclear model of the atom.

Figure 5 shows the paths of alpha particles travelling close to a gold nucleus.

Figure 5



Complete the sentences.

Choose answers from the box.

Each answer may be used once, more than once or not at all.

[3 marks]

attracts	**decreases**	**does not change**
increases	**reflects**	**repels**

Alpha particles and gold nuclei are both positively charged.

The gold nucleus _____ the alpha particles.

As the alpha particle approaches the gold nucleus, the electric field strength experienced by the alpha particle _____ .

As an alpha particle approaches the gold nucleus, the force experienced by the alpha particle _____ .

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

Question 03 · continued

0 4 . 4 The results of the alpha particle scattering experiment were reproducible.

What does reproducible mean?

[1 mark]

Tick (✓) **one** box.

- Another scientist repeats the experiment and gets the same results. ☐
- Another scientist repeats the experiment and gets different results. ☐
- The same scientist repeats the experiment and gets the same results. ☐
- The same scientist repeats the experiment and gets different results. ☐

6

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

Question 04

June 2023 | 8463/1F | Original Q2

0 2 Scientists developed different models of the atom as new discoveries were made.

0 2 . 1 Which particle in the atom was discovered first?

[1 mark]

Tick (✓) **one** box.

Electron ☐

Neutron ☐

Proton ☐

Question 2 continues on the next page

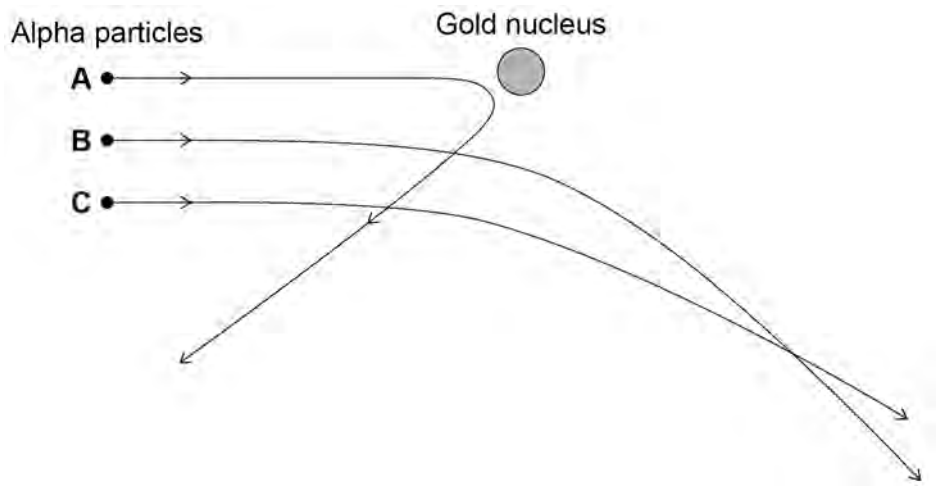
4.4.1.3 The development of the model of the atom (common content with chemistry)

Question 04 · continued June 2023 | 8463/1F | Original Q2

In an experiment that led to the nuclear model of the atom, alpha particles were directed at a sheet of gold foil.

Figure 3 shows the path of three alpha particles passing close to a gold nucleus.

Figure 3



0 2 . 2 An alpha particle has a radius of 1.7 femtometres.

The radius of a gold nucleus is 4.2 times larger than the radius of an alpha particle.

Calculate the radius of a gold nucleus in femtometres.

[2 marks]

Radius of a gold nucleus = _____ femtometres

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

Question 04 · continued

0 2 . 3 Alpha particles are deflected by the gold nucleus.

What are the charges on an alpha particle and a gold nucleus?

[1 mark]

Tick (✓) **one** box.

- An alpha particle and a gold nucleus are both neutral. ☐
- An alpha particle and a gold nucleus are both positively charged. ☐
- An alpha particle is positively charged and a gold nucleus is neutral. ☐

0 2 . 4 Which statement describes the force between the alpha particle and the gold nucleus?

[1 mark]

Tick (✓) **one** box.

- A contact force ☐
- A force of attraction ☐
- A force of repulsion ☐
- There is no force ☐

0 2 . 5 Which alpha particle in **Figure 3** experiences the largest force from the gold nucleus?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐

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

Question 04 · continued

Table 1 lists different models of the atom in alphabetical order.

Table 1

Model
Bohr
Nuclear
Plum pudding
Tiny spheres that cannot be divided

0 2 . 6 Which model in **Table 1** was developed first?

[1 mark]

0 2 . 7 Which model in **Table 1** was developed last?

[1 mark]

8

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

Question 05

0 3 Different radioactive isotopes emit different types of radiation.

0 3 . 1 One isotope of uranium (U) decays into thorium (Th) by emitting an alpha particle (He).

Which nuclear equation shows the decay of this isotope of uranium?

[1 mark]

Tick (✓) **one** box.

$^{230}_{92}U \rightarrow {}^{226}_{90}Th + {}^{4}_{2}He$ ☐

$^{226}_{90}Th \rightarrow {}^{230}_{92}U + {}^{4}_{2}He$ ☐

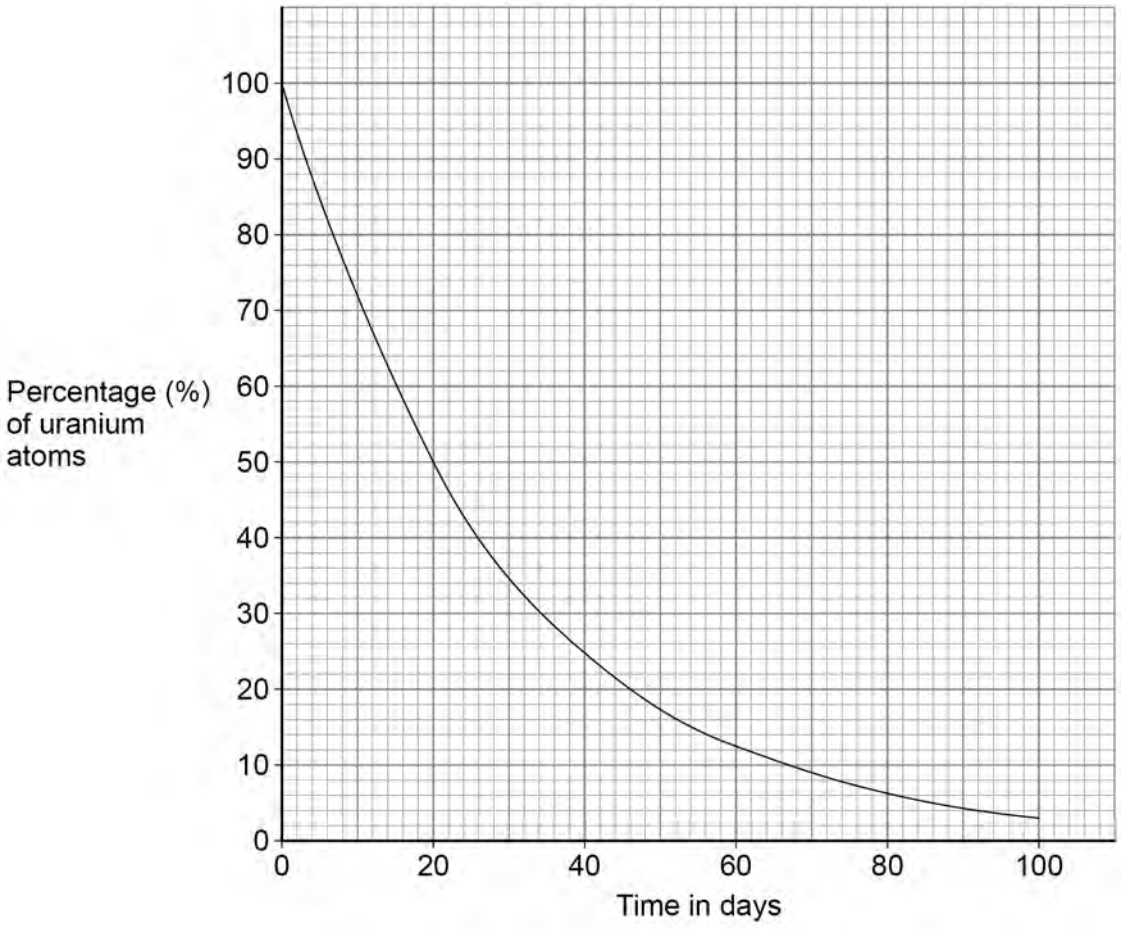
$^{230}_{92}U + {}^{226}_{90}Th \rightarrow {}^{4}_{2}He$ ☐

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

Question 05 · continued

Figure 4 shows how the percentage of uranium atoms in a sample of one uranium isotope varies with time.

Figure 4



0 3 . 2 What is the time taken for 50% of the atoms of this uranium isotope to decay?

Use **Figure 4**.

[1 mark]

Time taken = _____ days

0 3 . 3 What is the half-life of this uranium isotope?

[1 mark]

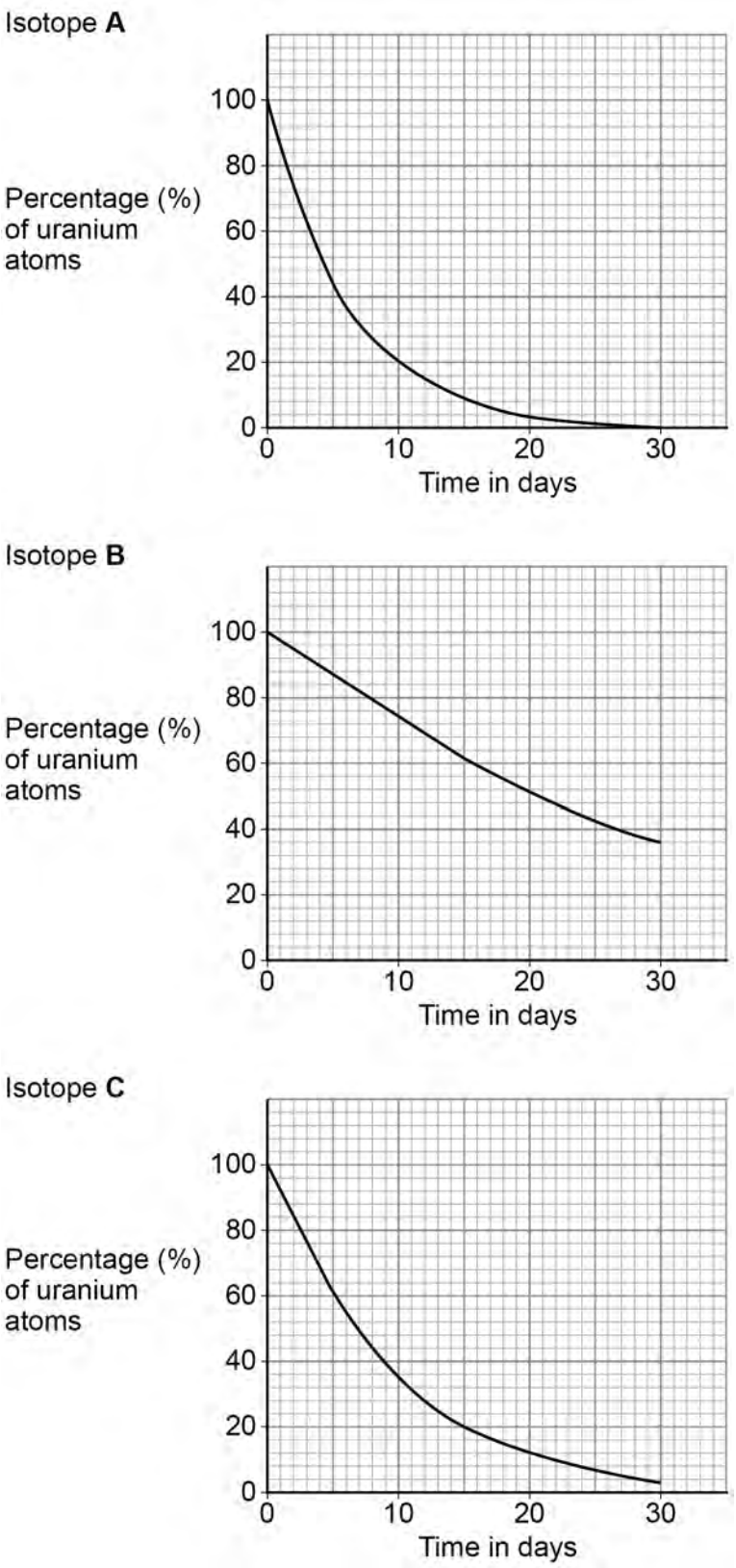
Half-life = _____ days

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

Question 05 · continued

0 3 . 4 **Figure 5** shows how the percentage of uranium atoms varies with time for three different isotopes of uranium, **A**, **B** and **C**.

Figure 5



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

Question 05 · continued

Which isotope is the most unstable?

Give a reason for your answer.

[2 marks]

Tick (✓) **one** box.

Isotope **A** ☐

Isotope **B** ☐

Isotope **C** ☐

Reason _____

_____

_____

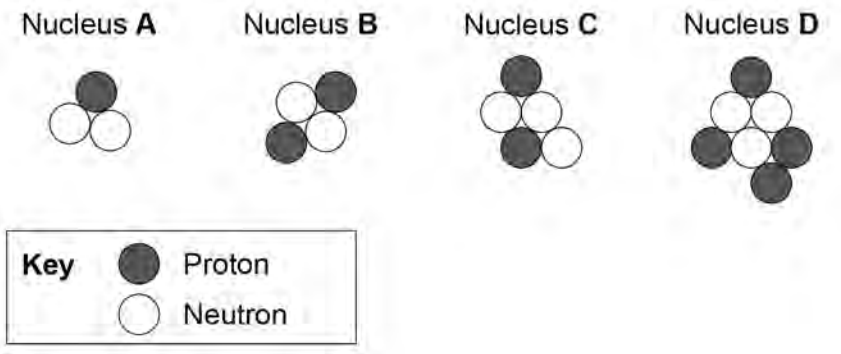
Question 3 continues on the next page

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

Question 05 · continued

Figure 6 shows the nuclei of four different atoms.

Figure 6



0 3 . 5 Which nucleus in **Figure 6** has the smallest **mass** number?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

0 3 . 6 Which nucleus in **Figure 6** has an **atomic** number of 4?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

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

Question 05 · continued

0 3 . 7 Which **two** nuclei in **Figure 6** are isotopes of the same element?

Give a reason for your answer.

[2 marks]

Nucleus ☐ and nucleus ☐

Reason _____

_____

Scientists have replaced old models of the atom with newer models.

The nuclear model of the atom has a nucleus at the centre.

0 3 . 8 Which model of the atom was replaced by the nuclear model?

[1 mark]

Tick (✓) **one** box.

Bohr model ☐

Plum pudding model ☐

Tiny spheres that cannot be divided ☐

0 3 . 9 What does the nuclear model state about the mass of an atom?

[1 mark]

Tick (✓) **one** box.

The mass of the atom is concentrated in the electrons. ☐

The mass of the atom is concentrated in the nucleus. ☐

The mass of the atom is spread throughout the atom. ☐

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