AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.1.1.3

# The development of the model of the atom (common content with physics)

## Past-paper questions

| | |
|---|---|
| Tier | **Higher** |
| Question groups | **6** |
| Available paper years | **2018–2025** |

## 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.

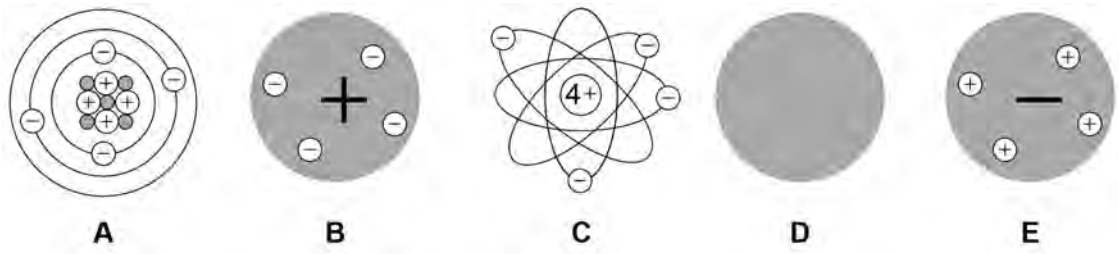
### 4.1.1.3 The development of the model of the atom (common content with physics)

**Question 01**

June 2018 | 8462/1H | Original Q4

**0 4** **Figure 3** represents different models of the atom.

**Figure 3**




**0 4 . 1** Which diagram shows the plum pudding model of the atom?

**[1 mark]**

Tick **one** box.

| A | | B | | C | | D | | E | |
|---|---|---|---|---|---|---|---|---|---|

**0 4 . 2** Which diagram shows the model of the atom developed from the alpha particle scattering experiment?

**[1 mark]**

Tick **one** box.

| A | | B | | C | | D | | E | |
|---|---|---|---|---|---|---|---|---|---|

**0 4 . 3** Which diagram shows the model of the atom resulting from Bohr's work?

**[1 mark]**

Tick **one** box.

| A | | B | | C | | D | | E | |
|---|---|---|---|---|---|---|---|---|---|

**4.1.1.3 The development of the model of the atom (common content with physics)**

**Question 01 · continued** June 2018 | 8462/1H | Original Q4

**0 4 . 4** Define the mass number of an atom.

**[1 mark]**

**0 4 . 5** Element **X** has two isotopes. Their mass numbers are 69 and 71

The percentage abundance of each isotope is:

- 60% of $^{69}$**X**
- 40% of $^{71}$**X**

Estimate the relative atomic mass of element **X**.

**[1 mark]**

Tick **one** box.

| | |
|---|---|
| < 69.5 | ☐ |
| Between 69.5 and 70.0 | ☐ |
| Between 70.0 and 70.5 | ☐ |
| > 70.5 | ☐ |

**0 4 . 6** Chadwick's experimental work on the atom led to a better understanding of isotopes.

Explain how his work led to this understanding.

**[3 marks]**

8

4.1.1.3 The development of the model of the atom (common content with physics)

Question 02

June 2019 | 8462/1H | Original Q4

**0 4** This question is about atomic structure.

**0 4 . 1** Atoms contain subatomic particles.

**Table 2** shows properties of two subatomic particles.

Complete **Table 2**.

**[2 marks]**

**Table 2**

| Name of particle | Relative mass | Relative charge |
|---|---|---|
| neutron | | |
| | | +1 |

An element **X** has two isotopes.

The isotopes have different mass numbers.

**0 4 . 2** Define mass number.

**[1 mark]**

**0 4 . 3** Why is the mass number different in the two isotopes?

**[1 mark]**

**Question 4 continues on the next page**

4.1.1.3 The development of the model of the atom (common content with physics)

Question 02 · continued



**0 4 . 4** The model of the atom changed as new evidence was discovered.

The plum pudding model suggested that the atom was a ball of positive charge with electrons embedded in it.

Evidence from the alpha particle scattering experiment led to a change in the model of the atom from the plum pudding model.

Explain how.

**[4 marks]**

8

4.1.1.3 The development of the model of the atom (common content with physics)

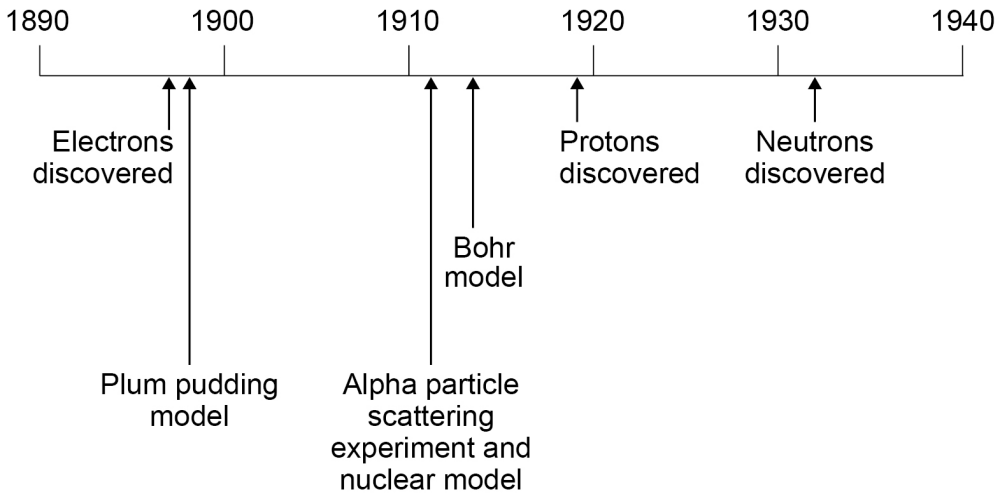
Question 03

November 2020 | 8462/1H | Original Q5

**0 5** This question is about the development of scientific theories.

**Figure 2** shows a timeline of some important steps in the development of the model of the atom.

**Figure 2**




**0 5 . 1** The plum pudding model did not have a nucleus.

Describe **three** other differences between the nuclear model of the atom and the plum pudding model.

**[3 marks]**

1 _____

_____

_____

2 _____

_____

_____

3 _____

_____

_____

4.1.1.3 The development of the model of the atom (common content with physics)

Question 03 · continued



**0 5 . 2** Niels Bohr adapted the nuclear model.

Describe the change that Bohr made to the nuclear model.

**[2 marks]**

**0 5 . 3** Mendeleev published his periodic table in 1869.

Mendeleev arranged the elements in order of atomic weight.

Mendeleev then reversed the order of some pairs of elements.

A student suggested Mendeleev's reason for reversing the order was to arrange the elements in order of atomic number.

Explain why the student's suggestion **cannot** be correct.

Use **Figure 2**.

**[2 marks]**

**0 5 . 4** Give the correct reason why Mendeleev reversed the order of some pairs of elements.

**[1 mark]**

8

**4.1.1.3 The development of the model of the atom (common content with physics)**

**Question 04**



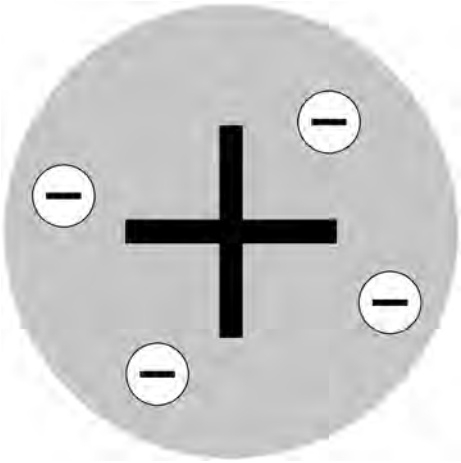
**0 1** Discoveries in chemistry led to a better understanding of atomic structure.

**0 1 . 1** Atoms were originally thought to be tiny spheres that could not be divided.

The plum pudding model of the atom was then developed.

**Figure 1** represents the plum pudding model of the atom.

**Figure 1**



Describe the plum pudding model of the atom.

**[2 marks]**

**0 1 . 2** Atoms contain electrons, neutrons and protons.

Write these three particles in order of their discovery.

**[1 mark]**

Earliest _____

_____

Latest _____

**4.1.1.3 The development of the model of the atom (common content with physics)**

**Question 04 · continued**



Very few atoms of the element tennessine (Ts) have ever been identified.

The atomic number of tennessine is 117

**0 1 . 3** Predict the number of outer shell electrons in an atom of tennessine.

Give **one** reason for your answer.

Use the periodic table.

**[2 marks]**

Number of outer shell electrons _____

Reason _____

_____

**0 1 . 4** Tennessine was first identified by a small group of scientists in 2010.

Suggest **one** reason why tennessine was **not** accepted as a new element by other scientists until 2015.

**[1 mark]**

_____

_____

**Question 1 continues on the next page**

4.1.1.3 The development of the model of the atom (common content with physics)

Question 04 · continued



**0 1 . 5** The discovery of isotopes explained why some relative atomic masses are not whole numbers.

Element **R** has two isotopes.

**Table 1** shows the mass numbers and percentage abundances of the isotopes of element **R**.

**Table 1**

| Mass number | Percentage abundance (%) |
|---|---|
| 6 | 7.6 |
| 7 | 92.4 |

Calculate the relative atomic mass ($A_r$) of element **R**.

Give your answer to 1 decimal place.

**[3 marks]**

Relative atomic mass (1 decimal place) = _____

9

**4.1.1.3 The development of the model of the atom (common content with physics)**

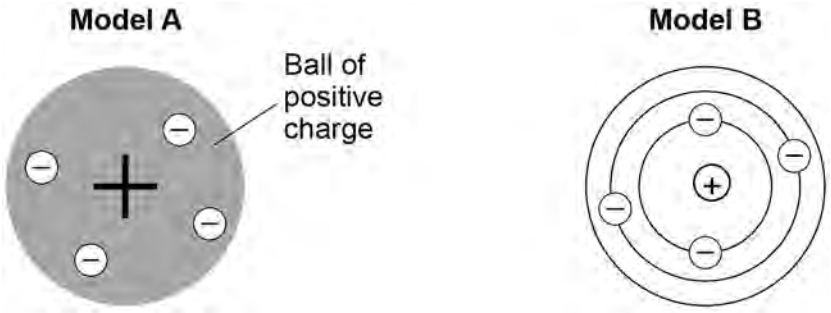
**Question 05**



**0 3** This question is about models of the atom.

**Figure 2** shows two early models of the atom.

**Figure 2**




**0 3 . 1** Name the models of the atom shown in **Figure 2**.

**[2 marks]**

Model **A** _____

Model **B** _____

**0 3 . 2** Compare model **A** with the model of the atom used today.

Use **Figure 2**.

**[4 marks]**

_____

_____

_____

_____

_____

_____

_____

_____

4.1.1.3 The development of the model of the atom (common content with physics)

Question 05 · continued



**0 3 . 3** Chadwick's experiments showed the existence of neutrons in an atom.

This led to an understanding of isotopes.

Define the term 'isotopes'.

Refer to subatomic particles in your answer.

**[2 marks]**

8

**Turn over for the next question**

**4.1.1.3 The development of the model of the atom (common content with physics)**

**Question 06**



**0 5** This question is about small particles.

Before the discovery of the electron, atoms were thought to be tiny spheres that could not be divided.

**0 5 . 1** The discovery of the electron led to the plum pudding model of the atom.

Describe the plum pudding model of the atom.

**[2 marks]**

**0 5 . 2** The model of the atom changed again after the alpha particle scattering experiment.

Give **two** conclusions that were made from the alpha particle scattering experiment.

**[2 marks]**

1

2

**0 5 . 3** Niels Bohr made another change to the model of the atom.

What was this change?

**[1 mark]**

4.1.1.3 The development of the model of the atom (common content with physics)

Question 06 · continued



**0 5 . 4** A helium atom has a radius of $1.4 \times 10^{-10}$ m.

The nucleus of this atom has a radius of $1.7 \times 10^{-15}$ m.

How many times larger is the radius of the atom than the radius of the nucleus?

**[1 mark]**

Tick (✓) **one** box.

~1000 times larger ☐

~10 000 times larger ☐

~100 000 times larger ☐

~1 000 000 times larger ☐

4.1.1.3 The development of the model of the atom (common content with physics)

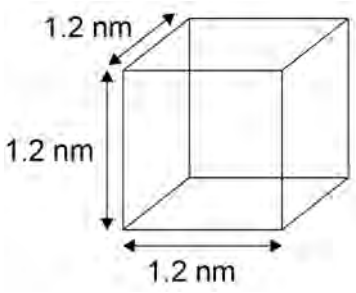
Question 06 · continued



Nanoparticles contain a few hundred atoms.

**0 5 . 5** **Figure 5** represents a cubic nanoparticle.

**Figure 5**




Calculate the simplest surface area : volume ratio of the cubic nanoparticle.

**[4 marks]**

Simplest surface area to volume ratio = _____ : _____

**0 5 . 6** Lenses in reading glasses often have a scratch-resistant coating that contains a hard substance.

Nanoparticles of the hard substance are used instead of fine particles of the hard substance.

Explain why nanoparticles are used instead of fine particles.

**[2 marks]**

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