AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 5.1.1.3

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

Past-paper questions

Tier	**Foundation**
Question groups	**4**
Available paper years	**2020–2025**

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.

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

Question 01

November 2020 | 8464/C/1F | Original Q3

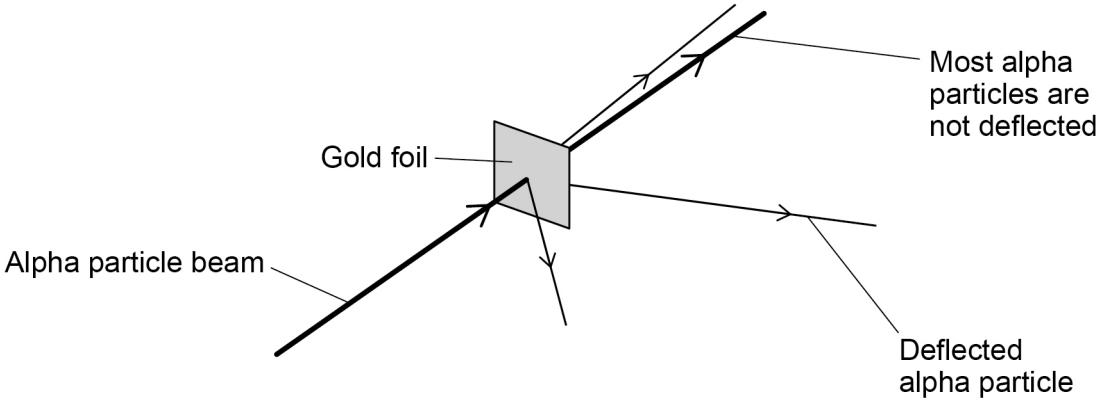
0 3 This question is about gold and compounds of gold.

In the alpha particle scattering experiment alpha particles are fired at gold foil.

Alpha particles are positively charged.

Figure 4 shows the results.

Figure 4



0 3 . 1 Some alpha particles are deflected.

Complete the sentence.

Choose the answer from the box.

[1 mark]

negatively charged	**not charged**	**positively charged**

Some alpha particles are deflected because

the nucleus of the atom is _____.

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

Question 01 · continued

0 3 . 2 Why are most alpha particles **not** deflected?

[1 mark]

Tick (✓) **one** box.

- The atom is a tiny sphere that cannot be divided. ☐
- The atom is mainly empty space. ☐
- The electrons orbit the nucleus at specific distances. ☐

0 3 . 3 What was **one** conclusion from the alpha particle scattering experiment?

[1 mark]

Tick (✓) **one** box.

- The mass is concentrated at the centre of the atom. ☐
- The mass is concentrated at the edge of the atom. ☐
- The mass is spread evenly throughout the atom. ☐

Gold reacts with the elements in Group 7 of the periodic table.

0 3 . 4 What are Group 7 elements known as?

[1 mark]

Tick (✓) **one** box.

- Alkali metals ☐
- Halogens ☐
- Noble gases ☐

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

Question 01 · continued

0 3 . 5 Fluorine, chlorine and bromine react with gold.

Which element will be the most reactive with gold?

[1 mark]

Tick (✓) **one** box.

Fluorine ☐ Chlorine ☐ Bromine ☐

0 3 . 6 3.94 g of gold reacts with chlorine to produce 6.07 g of gold chloride.

The word equation for the reaction is:

gold + chlorine → gold chloride

Calculate the mass of chlorine that reacts with 3.94 g of gold.

[1 mark]

Mass = _____ g

0 3 . 7 Calculate the relative formula mass (M_r) of gold chloride ($AuCl_3$).

Relative atomic masses (A_r): Cl = 35.5 Au = 197

[2 marks]

Relative formula mass (M_r) = _____

8

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

Question 02

November 2021 | 8464/C/1F | Original Q6

0 6 This question is about the periodic table.

0 6 . 1 **Figure 11** shows part of Mendeleev's version of the periodic table.

Figure 11

H							
Li	Be	B	C	N	O	F	
Na	Mg	Al	Si	P	S	Cl	
K Cu	Ca Zn		Ti	V As	Cr Se	Mn Br	Fe Co Ni
Rb Ag	Sr Cd	Y In	Zr Sn	Nb Sb	Mo Te	I	Ru Rh Pd

Which group of elements had **not** been discovered when Mendeleev's version of the periodic table was published?

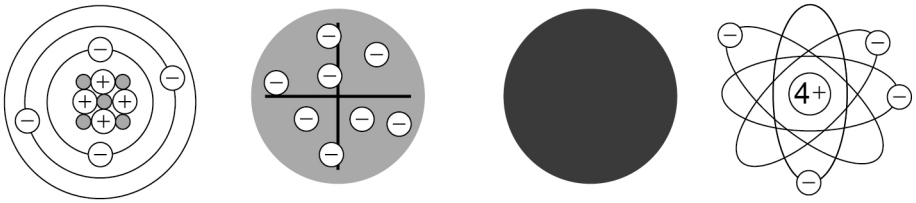
[1 mark]

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

Question 02 · continued

Figure 12 represents different models of the atom.

Figure 12



A B C D

0 6 . 2 Which model represents the plum pudding model?

[1 mark]

Tick (✓) **one** box.

A ☐ B ☐ C ☐ D ☐

0 6 . 3 Which model resulted from Chadwick's experimental work?

[1 mark]

Tick (✓) **one** box.

A ☐ B ☐ C ☐ D ☐

Question 6 continues on the next page

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

Question 02 · continued

Potassium has different isotopes.

0 6 . 4 What is meant by 'isotopes'?

You should refer to subatomic particles.

[2 marks]

0 6 . 5 **Table 2** shows the mass numbers and the percentage abundance of two isotopes of potassium.

Table 2

Mass number	Percentage abundance
39	93.1
41	6.9

Calculate the relative atomic mass (A_r) of potassium.

Give your answer to 1 decimal place.

[3 marks]

Relative atomic mass (1 decimal place) = _____

8

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

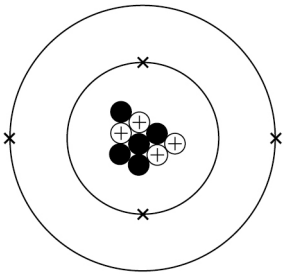
Question 03

June 2023 | 8464/C/1F | Original Q1

0 1 All substances are made from atoms.

0 1 . 1 **Figure 1** represents a beryllium atom.

Figure 1



What is the number of protons and the number of neutrons in the beryllium atom?

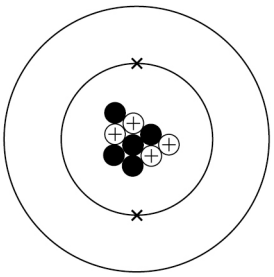
[2 marks]

Number of protons _____

Number of neutrons _____

0 1 . 2 **Figure 2** represents a beryllium **ion**.

Figure 2



What is the relative charge on a beryllium ion?

[1 mark]

Tick (✓) **one** box.

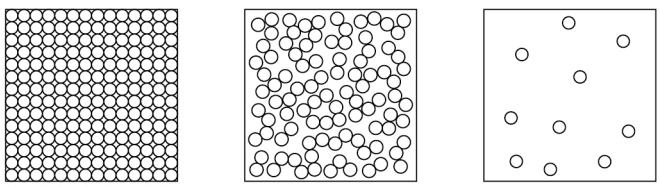
0 ☐ +1 ☐ +2 ☐

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

Question 03 · continued

Figure 3 shows the arrangement of atoms in the three states of matter.

Figure 3



A **B** **C**

0 1 . 3 What state of matter is represented by state **C** in **Figure 3**?

[1 mark]

Tick (✓) **one** box.

Gas ☐

Liquid ☐

Solid ☐

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

Question 03 · continued

0 1 . 4 What is the name of the process when state **B** changes into state **A**?

Use **Figure 3**.

[1 mark]

Tick (✓) **one** box.

Condensing ☐

Freezing ☐

Melting ☐

0 1 . 5 How can state **B** be changed into state **C**?

Use **Figure 3**.

[1 mark]

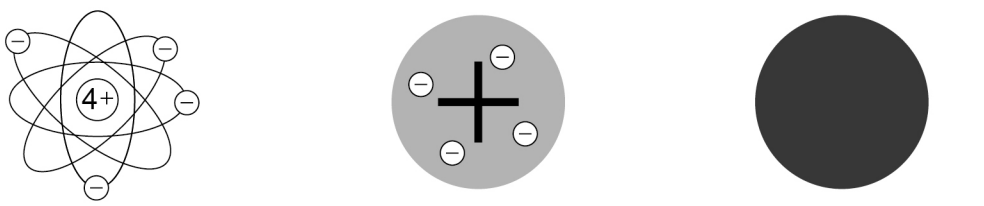
Question 1 continues on the next page

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

Experimental evidence led to the scientific model of the atom changing over time.

0 1 . 6 **Figure 4** shows three models for the atom.

Figure 4

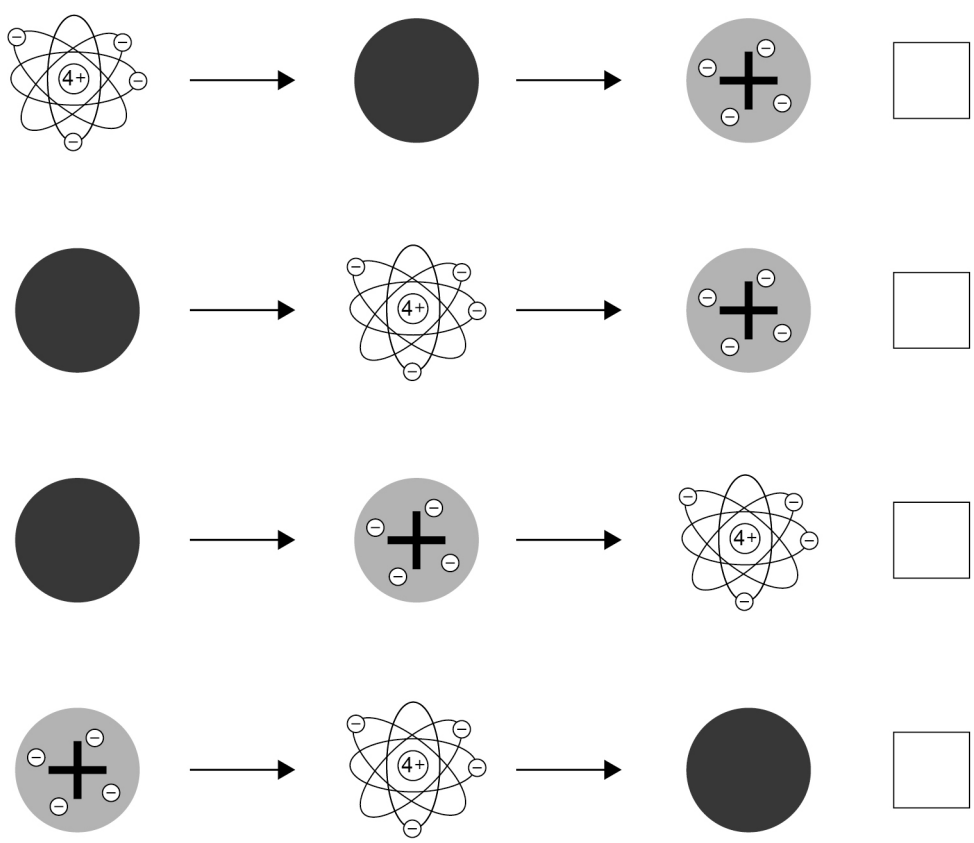


Nuclear model **Plum pudding model** **Tiny spheres model**

What is the order for the development of the model of the atom?

[1 mark]

Tick (✓) **one** box.



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

Question 03 · continued

0 1 . 7 Complete the sentence.

Choose the answer from the box.

[1 mark]

Bohr	**Chadwick**	**Mendeleev**

The existence of neutrons was discovered by _____.

8

Turn over for the next question

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

Question 04

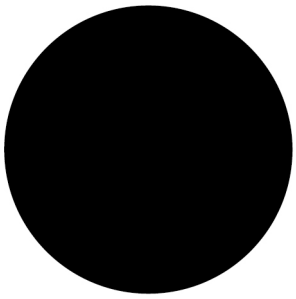
0 1 This question is about atoms and ions.

The model of the atom has changed over time.

0 1 . 1 In an early model, scientists thought the atom was a tiny sphere that could **not** be divided.

Figure 1 represents this early model of the atom.

Figure 1



The discovery of a subatomic particle led to a change in the model in **Figure 1**.

Which was the first subatomic particle to be discovered?

[1 mark]

Tick (✓) **one** box.

Electron ☐

Neutron ☐

Proton ☐

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

Question 04 · continued

0 1 . 2 In a later model of the atom, most of the mass was concentrated in the centre of the atom.

What is the name of the centre of an atom?

[1 mark]

0 1 . 3 Atoms contain three types of subatomic particle.

Draw **one** line from each subatomic particle to the relative charge of the particle.

[2 marks]

Subatomic particle	Relative charge of the particle
Electron	+1
Neutron	0
Proton	–1

0 1 . 4 What is meant by the 'atomic number of an atom'?

[1 mark]

Tick (✓) **one** box.

- The number of neutrons only ☐
- The number of protons only ☐
- The number of neutrons + the number of protons ☐

Question 1 continues on the next page

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

Question 04 · continued

0 1 . 5 **Table 1** shows information about two isotopes of an element.

Table 1

	Mass number	Percentage (%) abundance
Isotope **A**	10	19.7
Isotope **B**	11	80.3

Calculate the relative atomic mass (A_r) of the element.

Use the equation:

$$A_r = \frac{\text{(mass number} \times \text{percentage) of isotope } \mathbf{A} + \text{(mass number} \times \text{percentage) of isotope } \mathbf{B}}{100}$$

Give your answer to 1 decimal place.

[3 marks]

A_r (1 decimal place) = _____

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

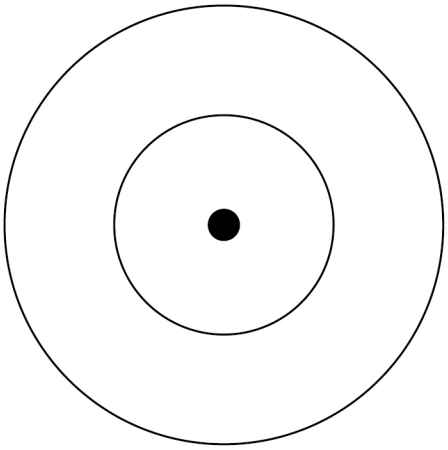
Question 04 · continued

0 1 . 6 An oxygen atom has eight electrons.

Complete **Figure 2** to show the electronic structure of an oxygen atom.

[1 mark]

Figure 2



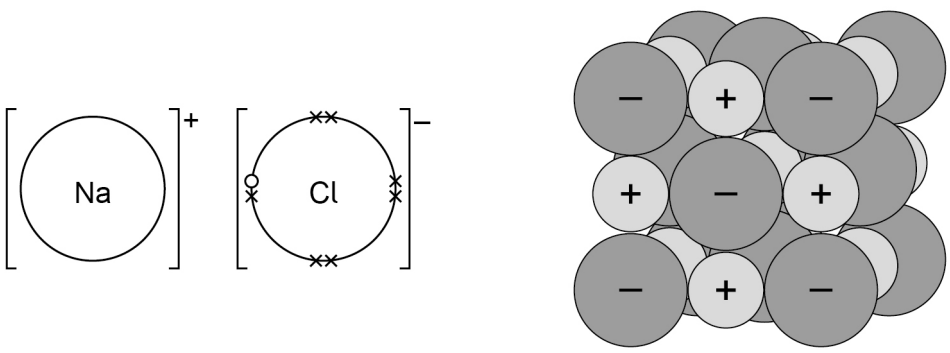
Question 1 continues on the next page

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

Question 04 · continued

0 1 . 7 **Figure 3** represents two models of sodium chloride.

Figure 3



Model **A** Model **B**

What are **two** advantages of model **B** compared with model **A**?

[2 marks]

Tick (✓) **two** boxes.

Model **B** shows the 3D arrangement of the ions. ☐

Model **B** shows the charges on the ions. ☐

Model **B** shows the electronic structures of the ions. ☐

Model **B** shows the relative sizes of the ions. ☐

Model **B** shows which elements are present. ☐

11