AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 5.2.2.5

Polymers

Past-paper questions

Tier	**Foundation**
Question groups	**4**
Available paper years	**2022–2025**

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.

5.2.2.5 Polymers

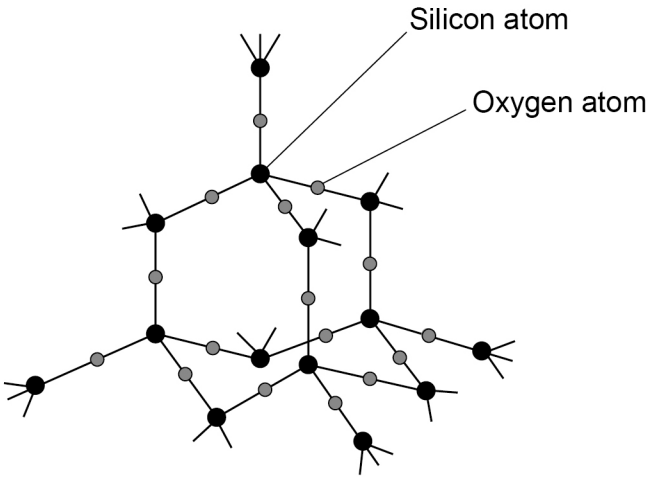
Question 01

June 2022 | 8464/C/1F | Original Q3

0 3 This question is about structure and bonding.

Figure 6 represents part of the structure of silicon dioxide.

Figure 6



0 3 . 1 What type of structure is silicon dioxide?

[1 mark]

Tick (✓) **one** box.

Giant covalent ☐

Ionic lattice ☐

Simple molecular ☐

0 3 . 2 Each oxygen atom forms two bonds.

What is the number of bonds formed by each silicon atom?

Use **Figure 6**.

[1 mark]

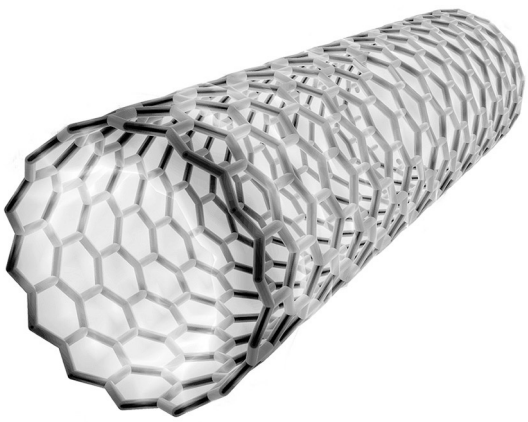
_____

5.2.2.5 Polymers

Question 01 · continued

Figure 7 represents part of a fullerene.

Figure 7



0 3 . 3 Complete the sentence.

Choose the answer from the box.

[1 mark]

hexagons	**octagons**	**squares**	**triangles**

The structure of fullerenes is based on _____ .

0 3 . 4 Complete the sentence.

Choose the answer from the box.

[1 mark]

carbon	**hydrogen**	**oxygen**

The fullerene molecule shown in **Figure 7** is made from

atoms of _____ .

5.2.2.5 Polymers

Question 01 · continued

0 3 . 5 What is the fullerene molecule shown in **Figure 7** used for?

[1 mark]

Tick (✓) **one** box.

Electronics ☐

Hand warmers ☐

Sports injury packs ☐

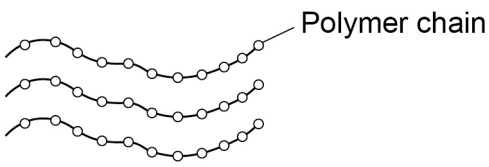
Question 3 continues on the next page

5.2.2.5 Polymers

Question 01 · continued

Figure 8 represents part of the structure of a polymer.

Figure 8



0 3 . 6 What holds the atoms together in a polymer chain?

[1 mark]

Tick (✓) **one** box.

Covalent bonds ☐

Ionic bonds ☐

Metallic bonds ☐

0 3 . 7 Complete the sentence.

Choose the answer from the box.

[1 mark]

atomic	**intermolecular**	**macromolecular**

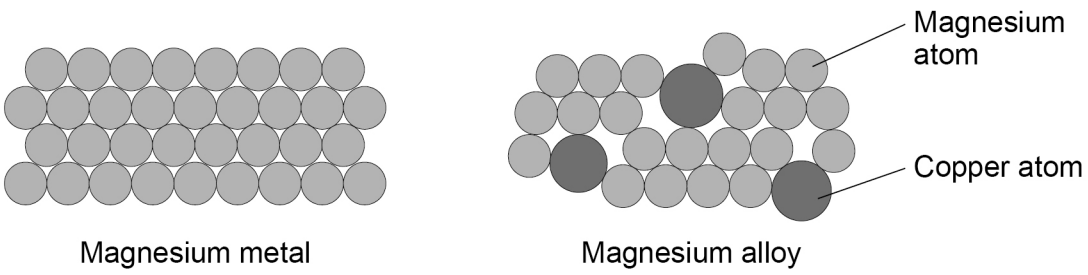
In **Figure 8** the polymer chains are held together by

_____ forces.

Figure 9 represents part of the structures of:

- magnesium metal
- a magnesium alloy.

Figure 9



Magnesium metal

Magnesium alloy

0 3 . 8 Calculate the percentage of copper atoms in the alloy.

[3 marks]

Number of magnesium atoms in the alloy = _____

Number of copper atoms in the alloy = _____

Total number of atoms in the alloy = _____

_____

Percentage of copper atoms in the alloy = _____ %

0 3 . 9 Explain why the magnesium alloy is harder than magnesium metal.

Use **Figure 9**.

[3 marks]

_____

_____

_____

_____

_____

_____

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5.2.2.5 Polymers

Question 02

June 2023 | 8464/C/1F | Original Q3

0 3 Structure and bonding is used to explain properties of compounds.

Metal atoms react with non-metal atoms to form ions.

0 3 . 1 Which group of elements does **not** form ions?

[1 mark]

Tick (✓) **one** box.

Alkali metals ☐

Halogens ☐

Noble gases ☐

Question 3 continues on the next page

5.2.2.5 Polymers

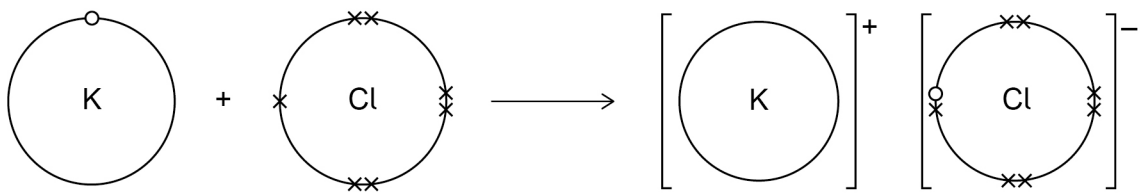
Question 02 · continued

0 3 . 2 Potassium reacts with chlorine to produce potassium chloride (KCl).

Figure 6 shows what happens to the electrons in the outer shells when a potassium atom reacts with a chlorine atom.

The dots (o) and crosses (×) represent electrons.

Figure 6



Describe what happens when a potassium atom reacts with a chlorine atom to produce potassium chloride.

Answer in terms of electrons.

[4 marks]

5.2.2.5 Polymers

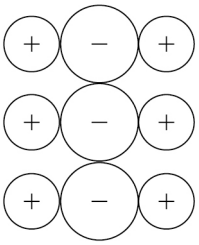
Question 02 · continued

0 3 . 3 In solid ionic compounds, oppositely charged ions attract to form a giant structure.

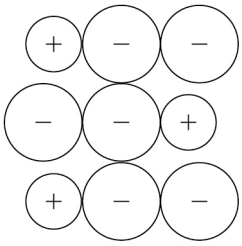
Which structure represents the arrangement of ions in solid potassium chloride?

[1 mark]

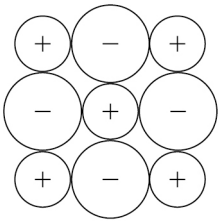
Tick (✓) **one** box.



☐



☐



☐

Question 3 continues on the next page

Non-metal atoms share electrons to form covalent bonds.

0 3 . 4 Water (H_2O) is a covalent molecule.

Table 2 shows the number of electrons in the outer shells of hydrogen atoms and of oxygen atoms.

Table 2

Element	Number of electrons in the outer shell of an atom
Hydrogen	1
Oxygen	6

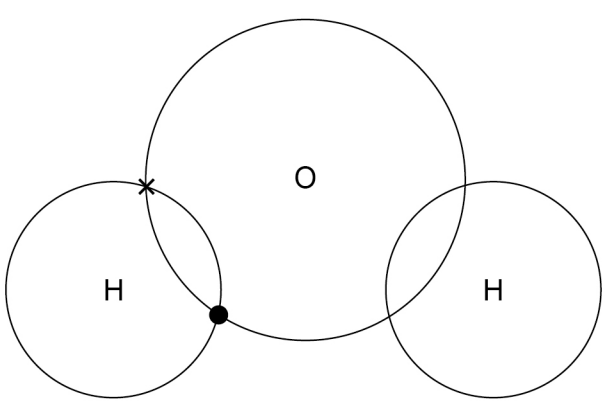
Figure 7 shows part of a dot and cross diagram for a molecule of water.

Complete the dot and cross diagram.

You should only show electrons in the outer shells.

[2 marks]

Figure 7



0 3 . 5 Silica has a giant covalent structure.

Figure 8 represents the structure of silica.

Figure 8



Determine the ratio of silicon (Si) atoms to oxygen (O) atoms in silica.

Use **Figure 8**.

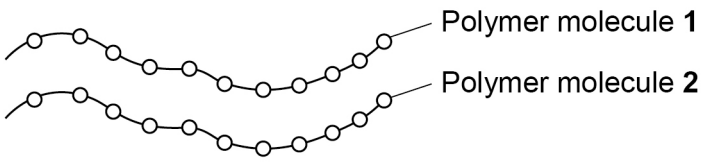
[1 mark]

_____ Si : _____ O

0 3 . 6 Polymers have very large molecules.

Figure 9 represents part of the structure of a polymer.

Figure 9



What holds polymer molecule **1** and polymer molecule **2** together in a polymer?

[1 mark]

Tick (✓) **one** box.

Covalent bonds ☐

Electrostatic attraction between ions ☐

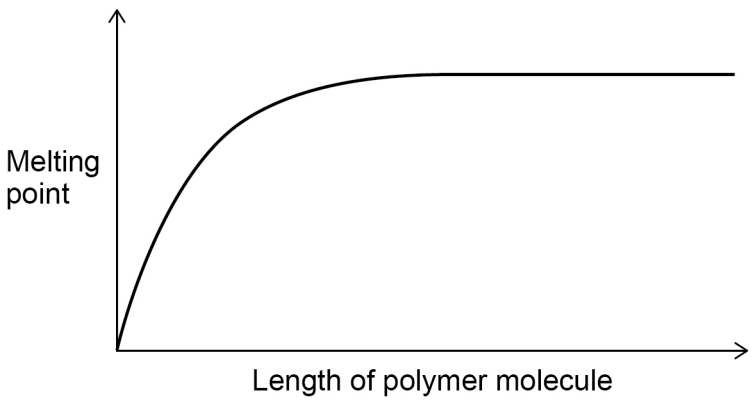
Weak intermolecular forces ☐

5.2.2.5 Polymers

Question 02 · continued

0 3 . 7 **Figure 10** shows the melting point of a polymer as the length of the polymer molecule increases.

Figure 10



Describe the trend shown in **Figure 10**.

[3 marks]

13

5.2.2.5 Polymers

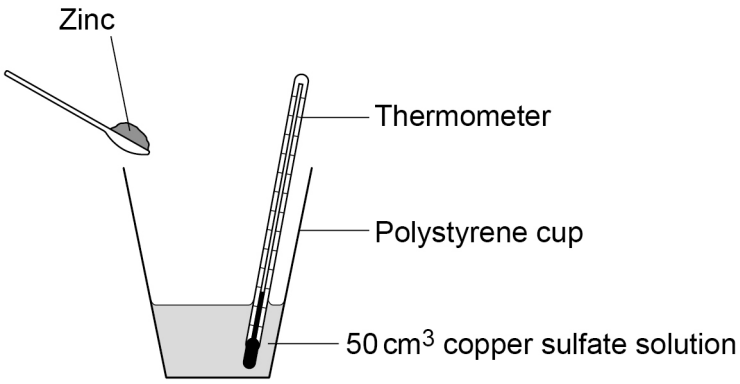
Question 03

June 2024 | 8464/C/1F | Original Q3

0 3 A student investigated the temperature change when different masses of zinc were added to copper sulfate solution.

Figure 5 shows the apparatus.

Figure 5



This is the method used.

1. Pour 50 cm^3 of copper sulfate solution into a polystyrene cup.
2. Measure the starting temperature of the copper sulfate solution.
3. Add 1.0 g of zinc.
4. Stir the mixture.
5. Measure the highest temperature reached.
6. Repeat steps 1 to 5 two more times.
7. Repeat steps 1 to 6 with different masses of zinc.

5.2.2.5 Polymers

Question 03 · continued

0 3 . 1 The student varied the mass of zinc.

What type of variable is the mass of zinc?

[1 mark]

Tick (✓) **one** box.

Control ☐

Dependent ☐

Independent ☐

Question 3 continues on the next page

5.2.2.5 Polymers

Question 03 · continued

Zinc reacts with copper sulfate solution to produce salt **A** and copper.

The word equation for the reaction is:

zinc + copper sulfate → salt **A** + copper

0 3 . 2 What is the name of salt **A**?

[1 mark]

0 3 . 3 The temperature of the solution increases when zinc reacts with copper sulfate solution.

Give **two** other observations that can be made when zinc reacts with copper sulfate solution.

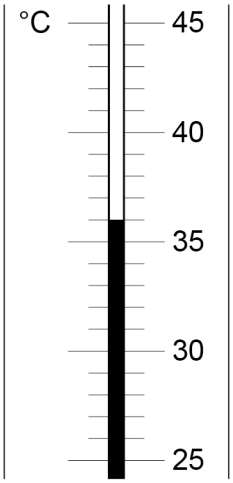
[2 marks]

1 _____

2 _____

0 3 . 4 **Figure 6** shows the highest temperature reached in one experiment.

Figure 6



Complete **Table 3**.

Use **Figure 6**.

[2 marks]

Table 3

Starting temperature in °C	21
Highest temperature reached in °C	
Temperature increase in °C	

Question 3 continues on the next page

A teacher repeated the investigation using a digital thermometer.

Table 4 shows the results.

Table 4

Mass of zinc in grams	Temperature increase in °C			
	Experiment 1	Experiment 2	Experiment 3	**Mean**
1.0	7.8	7.3	7.7	**B**
2.0	13.1	13.8	13.3	13.4
3.0	20.4	12.9	20.2	20.3

0 3 . 5 Calculate value **B** in **Table 4**.

[2 marks]

B = _____ °C

0 3 . 6 The range of the results is the minimum value of temperature increase to the maximum value of temperature increase.

What is the range of temperature increase for the experiment with **2.0 g** of zinc?

[1 mark]

Range = _____ °C to _____ °C

5.2.2.5 Polymers

Question 03 · continued

0 3 . 7 One of the results for **3.0 g** of zinc is anomalous.

Which result is anomalous?

Suggest **one** reason why this result is anomalous.

[2 marks]

Anomalous result _____

Reason _____

_____

_____

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Turn over for the next question

5.2.2.5 Polymers

Question 04

June 2025 | 8464/C/1F | Original Q4

0 4 This question is about metals.

0 4 . 1 Complete the sentence.

Choose the answer from the box.

[1 mark]

compounds	**elements**	**polymers**

Most metals are found in the Earth as _____.

0 4 . 2 Iron is extracted from iron oxide by reduction with carbon.

Why is iron extracted by reduction with carbon?

[1 mark]

Tick (✓) **one** box.

Iron is less reactive than carbon. ☐

Iron has the same reactivity as carbon. ☐

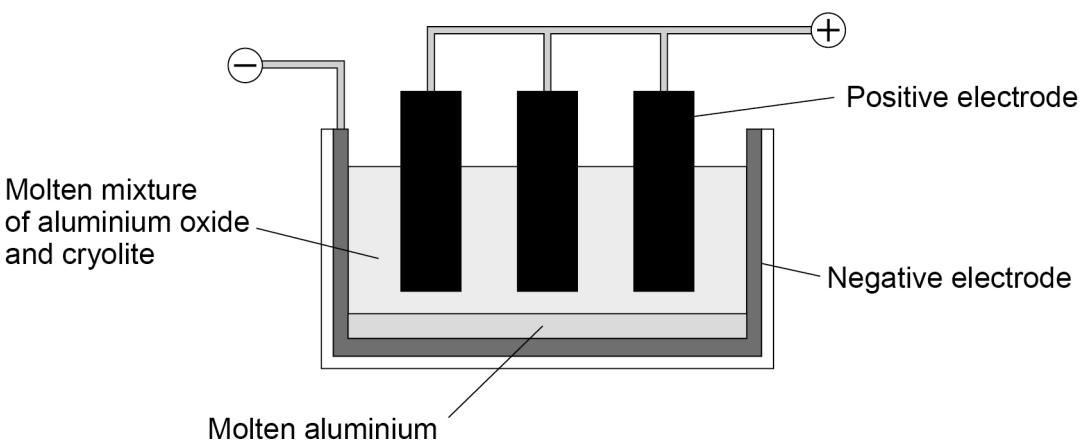
Iron is more reactive than carbon. ☐

Question 4 continues on the next page

Aluminium is extracted by the electrolysis of aluminium oxide.

Figure 8 shows the apparatus used to extract aluminium.

Figure 8



0 4 . 3 The mixture of aluminium oxide and cryolite has a lower melting point than aluminium oxide alone.

Why is the melting point lowered?

[1 mark]

Tick (✓) **one** box.

To reduce the amount of energy used ☐

To reduce the purity of the aluminium formed ☐

To reduce the rate of reaction ☐

5.2.2.5 Polymers

Question 04 · continued

0 4 . 4 After some time, the positive electrodes need to be replaced.

Why must the positive electrodes be replaced?

[1 mark]

Tick (✓) **one** box.

- The electrodes dissolve in the molten mixture. ☐
- The electrodes melt in the molten mixture. ☐
- The electrodes react with aluminium. ☐
- The electrodes react with oxygen gas. ☐

Question 4 continues on the next page

5.2.2.5 Polymers

Question 04 · continued

Aluminium can be mixed with other metals to form alloys.

0 4 . 5 How does the hardness of an alloy of aluminium compare with the hardness of pure aluminium?

[1 mark]

Tick (✓) **one** box.

The alloy is harder than the pure metal. ☐

The alloy and the pure metal have the same hardness. ☐

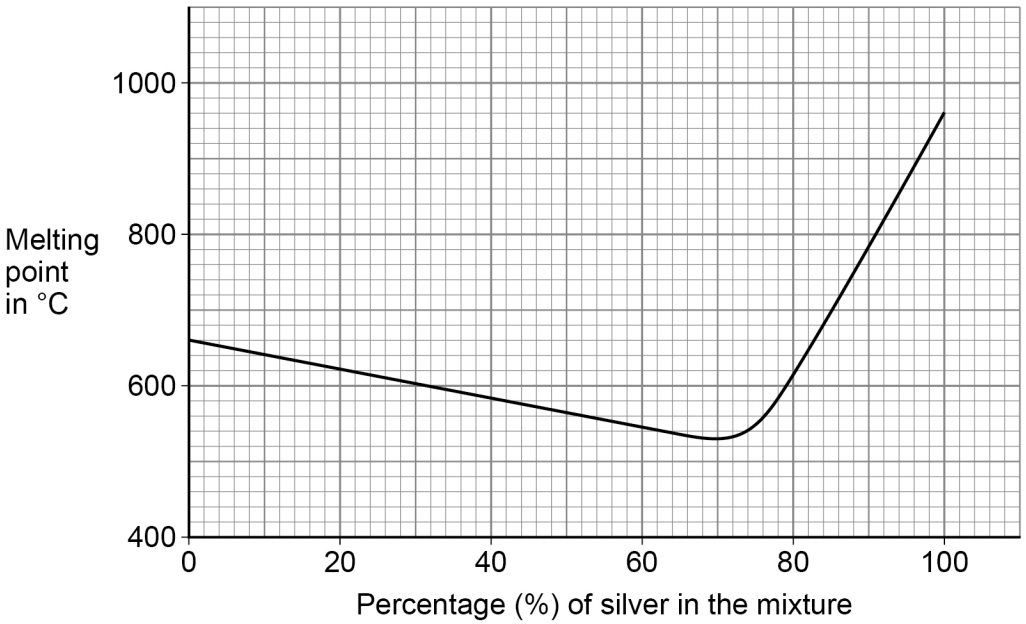
The alloy is less hard than the pure metal. ☐

5.2.2.5 Polymers

0 4 . 6 Aluminium can form an alloy with silver.

Figure 9 shows how the melting point of the alloy changes with the percentage (%) of silver in the mixture.

Figure 9



Describe how the melting point of the alloy changes as the percentage of silver in the mixture increases.

Use data from **Figure 9**.

[3 marks]

8