AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

GCSE
COMBINED SCIENCE: TRILOGY

F

Foundation Tier
Chemistry Paper 1F

Thursday 14 May 2020 Morning Time allowed: 1 hour 15 minutes

Materials

For this paper you must have:
- a ruler
- a scientific calculator
- the periodic table (enclosed).

Instructions
- Use black ink or black ball-point pen.
- Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.
- In all calculations, show clearly how you work out your answer.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
TOTAL	

Information
- The maximum mark for this paper is 70.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

Do not write outside the box

0 1 This question is about acids and bases.

0 1 . 1 What is the pH of sulfuric acid?

[1 mark]

Tick (✓) **one** box.

1 ☐ 7 ☐ 14 ☐

0 1 . 2 An acid reacts with zinc to produce zinc chloride and hydrogen.

Which acid reacts with zinc to produce zinc chloride?

[1 mark]

Tick (✓) **one** box.

Hydrochloric acid ☐

Nitric acid ☐

Sulfuric acid ☐

0 1 . 3 What type of substance is zinc chloride?

[1 mark]

Tick (✓) **one** box.

Alkali ☐ Base ☐ Salt ☐

Do not write outside the box

0 1 . 4 An alkali is a base in solution.

Which compound is an alkali?

[1 mark]

Tick (✓) **one** box.

Sodium hydroxide ☐

Sodium nitrate ☐

Sodium sulfate ☐

0 1 . 5 The formula of the copper ion is Cu^{2+}

The formula of the oxide ion is O^{2-}

What is the formula of copper oxide?

[1 mark]

Tick (✓) **one** box.

Cu_2O_2 ☐ CuO_2 ☐ CuO ☐

Question 1 continues on the next page

Do not write outside the box

A student reacts an acid with copper oxide.

0 1 . 6 The reaction between the acid and copper oxide is very slow at room temperature.

How could the student speed up the reaction?

[1 mark]

0 1 . 7 Complete the sentence to show how the student makes sure that **all** the acid reacts.

Choose the answer from the box.

[1 mark]

in excess	**in solution**	**molten**	**soluble**

The student adds copper oxide to the acid until the

copper oxide is _____.

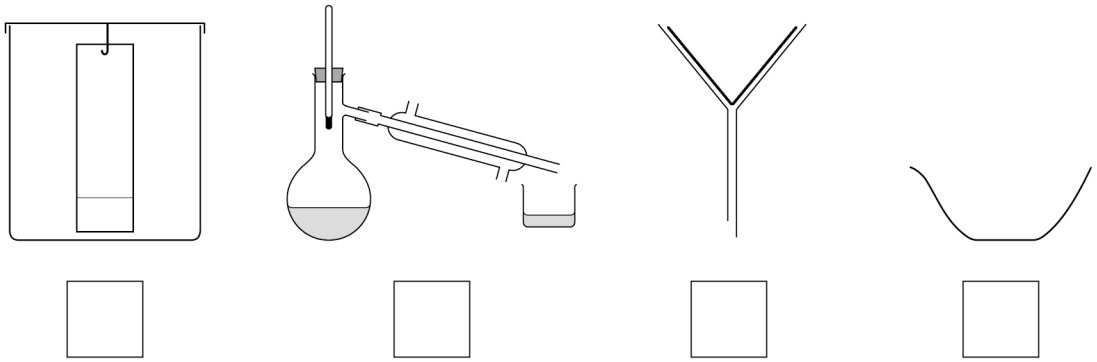
Do not write outside the box

0 1 . 8 The student filters the unreacted copper oxide from the solution.

Which apparatus does the student use?

[1 mark]

Tick (✓) **one** box.



☐ ☐ ☐ ☐

0 1 . 9 What process is used to produce crystals of a salt from a salt solution?

[1 mark]

_____

_____

9

Turn over for the next question

Do not write outside the box

0 2 A student investigated the temperature change when metal **X** was added to copper sulfate solution.

This is the method used.

1. Add 25 cm^3 of copper sulfate solution to a beaker.
2. Measure the temperature of the copper sulfate solution.
3. Add 1.0 g of metal **X** and stir.
4. Measure the highest temperature reached when metal **X** is added to copper sulfate solution.
5. Repeat steps 1 to 4 with different metals.

Figure 1 shows the apparatus used.

Figure 1

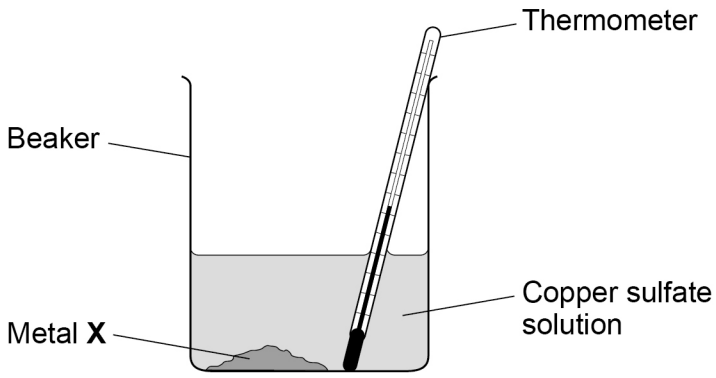
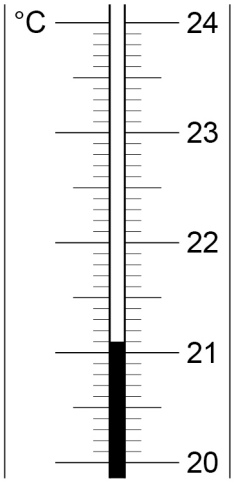


Figure 2 shows the thermometer reading of the copper sulfate solution at the start of the investigation.

Figure 2



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0 2 . 1 The highest temperature reached when metal **X** was added to copper sulfate solution was 35.5 °C

Determine the temperature change when metal **X** is added to copper sulfate solution.

Use **Figure 2**.

[2 marks]

Highest temperature = 35.5 °C

Temperature at start = _____ °C

Temperature change = _____ °C

0 2 . 2 Give **two** variables the student should keep the same in this investigation.

[2 marks]

1 _____

_____

2 _____

_____

0 2 . 3 The student repeated the experiment with metal **Y**.

Table 1 shows four results for metal **Y**.

Table 1

	Test 1	**Test 2**	**Test 3**	**Test 4**
Temperature change in °C	9.2	7.3	9.5	9.2

Calculate the mean temperature change for metal **Y**.

Do **not** include the anomalous result in your calculation.

[2 marks]

_____

_____

_____

_____

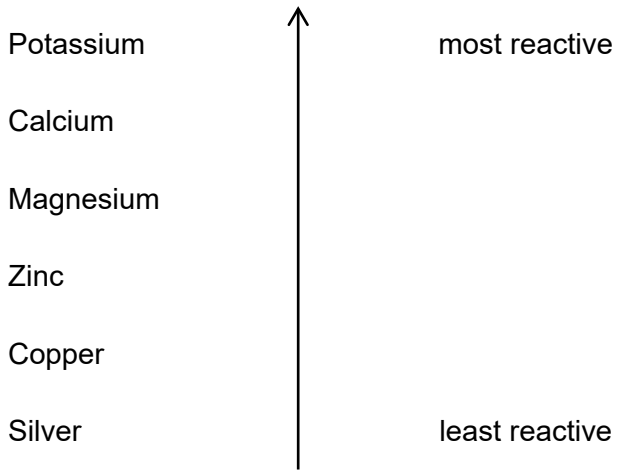
Mean temperature change = _____ °C

Turn over ►

The more reactive the metal added to copper sulfate solution, the greater the temperature change.

Figure 3 shows a reactivity series.

Figure 3



0 2 . 4 The student repeated the experiment.

The student added:

- magnesium to copper sulfate solution
- an unknown metal **A** to copper sulfate solution.

Table 2 shows the results.

Table 2

Metal	**Temperature change in °C**
Magnesium	12
Metal **A**	8

The student concludes metal **A** is zinc.

Give **one** reason why the student is correct.

Use **Figure 3** and **Table 2**.

[1 mark]

Do not write outside the box

0 2 . 5 The student did the experiment with silver and copper sulfate solution.

What happens to the temperature of the mixture?

Use **Figure 3**.

[1 mark]

Tick (✓) **one** box.

Decreases ☐

Increases ☐

Stays the same ☐

0 2 . 6 Suggest **one** reason why the student should **not** add potassium metal to copper sulfate solution.

[1 mark]

0 2 . 7 100 cm^3 of the copper sulfate solution contains 1.8 g of copper sulfate.

Calculate the mass of copper sulfate in 25 cm^3 of this copper sulfate solution.

[2 marks]

Mass = _____ g

11

Turn over for the next question

Do not write outside the box

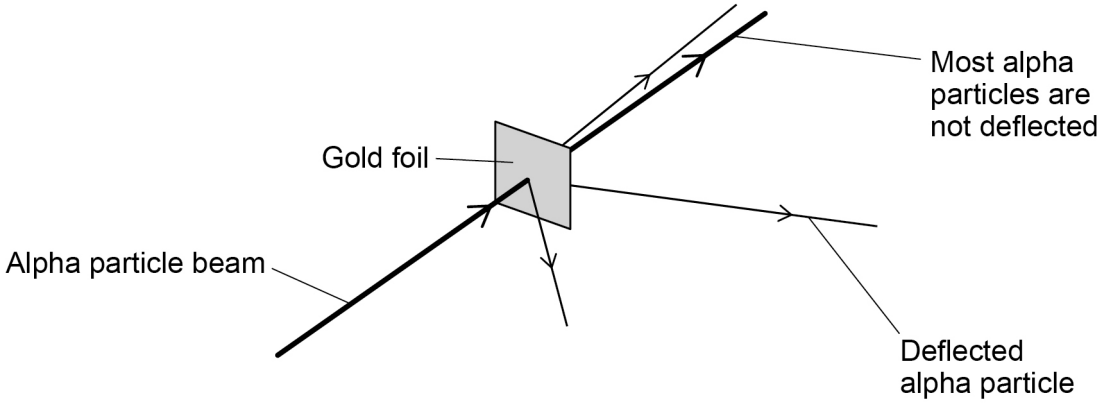
0 3 This question is about gold and compounds of gold.

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 _____.

Do not write outside the box

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 ☐

Do not write outside the box

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) = _____

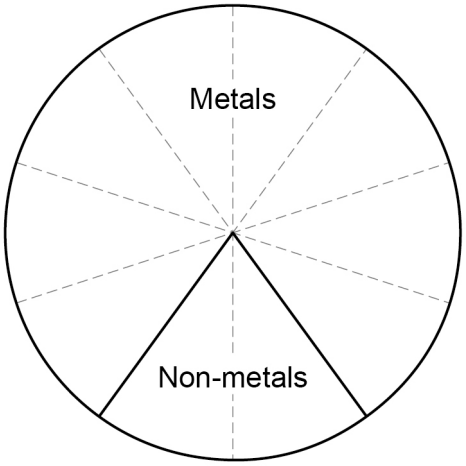
8

Do not write outside the box

0 4 This question is about elements and compounds.

0 4 . 1 **Figure 5** shows the proportion of elements in the periodic table that are metals and non-metals.

Figure 5



Determine the percentage of the elements in **Figure 5** that are metals.

[2 marks]

Percentage = _____ %

0 4 . 2 Give **two** physical properties of metals.

[2 marks]

1 _____

2 _____

0 4 . 3 Sodium reacts with chlorine to produce sodium chloride.

Balance the equation for the reaction.

[1 mark]

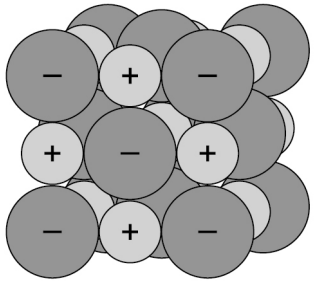
_____ $Na + Cl_2 \rightarrow$ _____ $NaCl$

Turn over ►

Do not write outside the box

Figure 6 shows part of the structure of sodium chloride (NaCl).

Figure 6



Sodium chloride

0 4 . 4 What holds the particles together in sodium chloride?

Use **Figure 6**.

[1 mark]

Tick (✓) **one** box.

Electrostatic attractions ☐

Intermolecular forces ☐

Metallic bonds ☐

0 4 . 5 Solid sodium chloride does not conduct electricity.

Give **two** ways in which sodium chloride can be made to conduct electricity.

[2 marks]

1 _____

_____

2 _____

_____

8

Do not write outside the box

0 5 This question is about elements in the periodic table.

0 5 . 1 What property was used to arrange elements in early periodic tables?

[1 mark]

Tick (✓) **one** box.

Atomic number ☐

Atomic weight ☐

Mass number ☐

0 5 . 2 In early periodic tables, iodine (I) was placed before tellurium (Te).

Mendeleev placed iodine after tellurium.

Figure 7 shows part of Mendeleev's periodic table.

Figure 7

16 **O**	19 **F**
32 **S**	35.5 **Cl**
79 **Se**	80 **Br**
128 **Te**	127 **I**

Suggest **one** reason why Mendeleev placed iodine in the column shown in **Figure 7**.

[1 mark]

Do not write outside the box

Table 3 shows the melting points of three Group 1 metals.

Table 3

Metal	Melting point in °C
Lithium	180
Sodium	98
Potassium	63

0 5 . 3 What state is lithium at 100 °C?

Use **Table 3**.

[1 mark]

Tick (✓) **one** box.

Gas ☐ Liquid ☐ Solid ☐

0 5 . 4 Complete the graph in **Figure 8**.

Use **Table 3**.

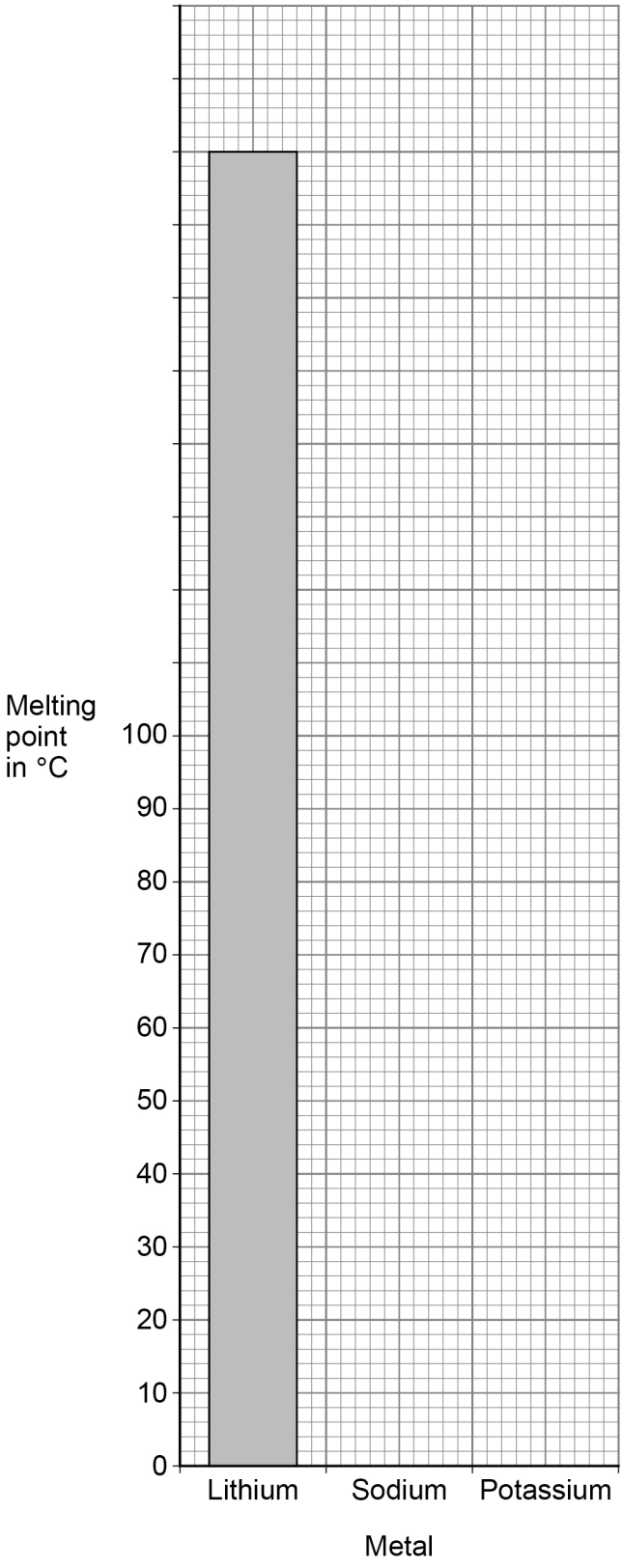
You should:

- complete the scale on the y-axis
- draw bars to show the melting points of sodium and potassium.

[3 marks]

Do not write outside the box

Figure 8



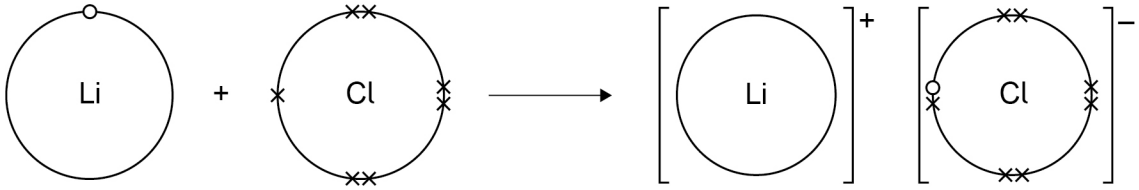
Do not write outside the box

0 5 . 5 Lithium reacts with chlorine to produce lithium chloride.

Figure 9 shows what happens to the electrons in the outer shells when a lithium atom reacts with a chlorine atom.

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

Figure 9



Describe what happens to a lithium atom and to a chlorine atom when they react.

Use **Figure 9** to answer in terms of electrons.

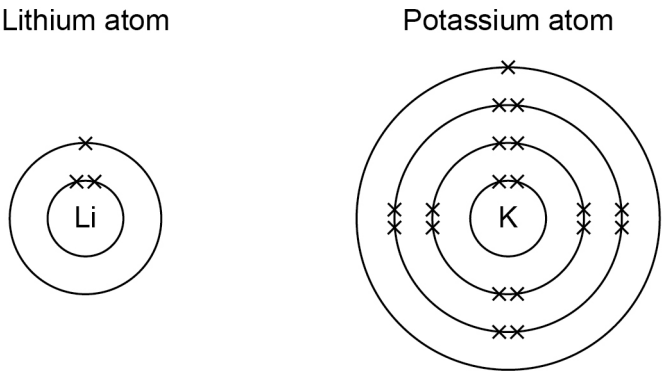
[3 marks]

Do not write outside the box

0 5 . 6 Lithium and potassium are in the same group of the periodic table.

Figure 10 represents the electronic structures of a lithium atom and of a potassium atom.

Figure 10



Give **two** reasons why potassium is more reactive than lithium.

[2 marks]

1 _____

_____

2 _____

_____

11

Turn over ►

Do not write outside the box

0 6 This question is about the extraction of aluminium.

0 6 . 1 An aluminium atom is represented as:

$$^{27}_{13}Al$$

Give the number of electrons and neutrons in the aluminium atom.

[2 marks]

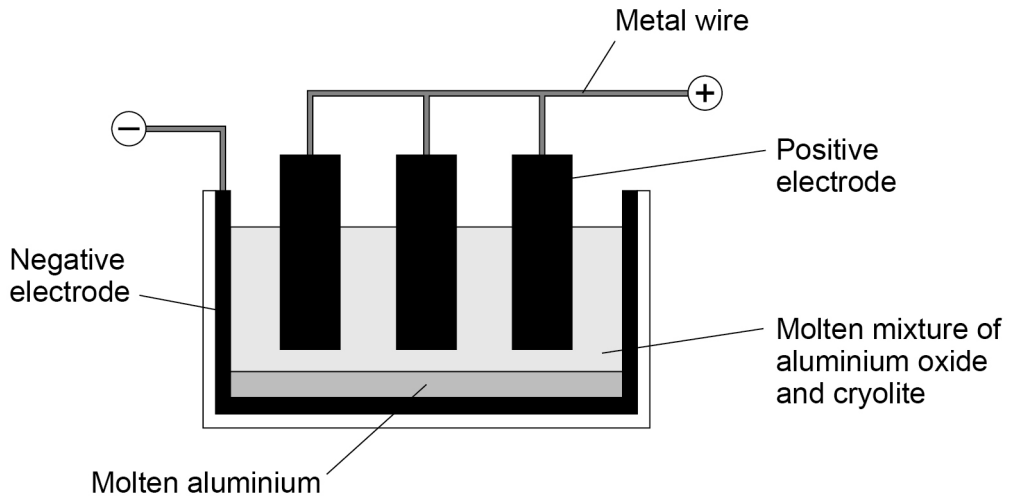
Number of electrons _____

Number of neutrons _____

Aluminium is extracted by the electrolysis of a molten mixture of aluminium oxide and cryolite.

Figure 11 shows the cell used for the electrolysis.

Figure 11



0 6 . 2 Aluminium is produced by the reduction of aluminium oxide (Al_2O_3).

What is meant by the term reduction?

[1 mark]

_____

_____

Do not write outside the box

0 6 . 3 Oxygen is formed at the positive carbon electrodes.

Explain why the positive carbon electrodes must be continually replaced.

[3 marks]

0 6 . 4 A substance conducts electricity because of free moving, charged particles.

What are the free moving, charged particles in a:

- carbon electrode (made from graphite)
- molten mixture of aluminium oxide and cryolite
- metal wire?

[3 marks]

Carbon electrode (made from graphite) _____

Molten mixture of aluminium oxide and cryolite _____

Metal wire _____

9

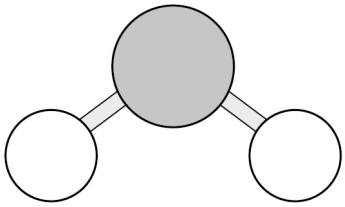
Turn over for the next question

Do not write outside the box

0 7 This question is about substances with covalent bonding.

0 7 . 1 **Figure 12** shows a ball and stick model of a water molecule (H_2O).

Figure 12



Suggest **one** limitation of using a ball and stick model for a water molecule.

[1 mark]

_____

_____

_____

0 7 . 2 Ice has a low melting point.

Water molecules in ice are held together by intermolecular forces.

Complete the sentence.

[1 mark]

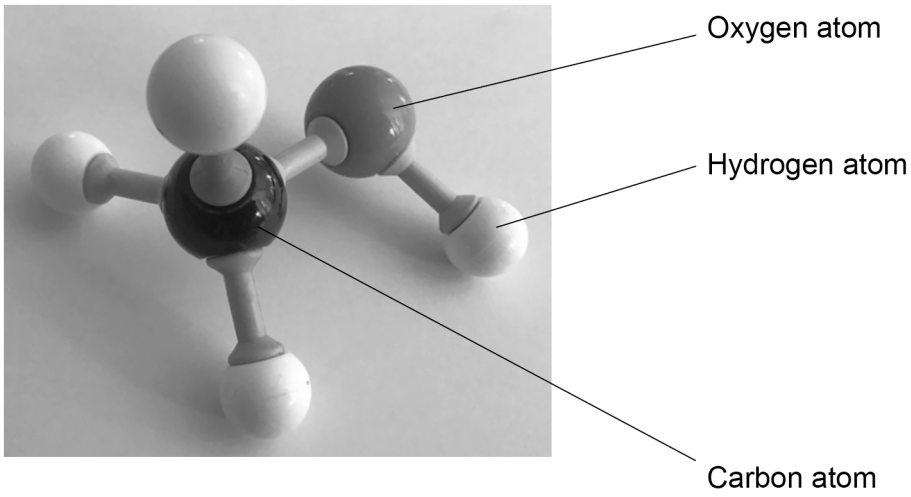
Ice has a low melting point because the

intermolecular forces are _____.

Do not write outside the box

0 7 . 3 **Figure 13** shows the structure of a molecule.

Figure 13



What is the molecular formula of the molecule in **Figure 13**?

[1 mark]

Question 7 continues on the next page

Do not write outside the box

Diamond has a giant covalent structure.

0 7 . 4 What is the number of bonds formed by each carbon atom in diamond?

[1 mark]

Tick (✓) **one** box.

2 ☐ 3 ☐ 4 ☐ 8 ☐

0 7 . 5 Give **two** physical properties of diamond.

[2 marks]

1 _____

2 _____

0 7 . 6 Name **two** other substances with giant covalent structures.

[2 marks]

1 _____

2 _____

8

Do not write outside the box

Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

Do not write outside the box

0 8 Some students investigated the thermal decomposition of metal carbonates.

The word equation for the reaction is:

metal carbonate → metal oxide + carbon dioxide

The students made the following hypothesis:

'When heated the same mass of any metal carbonate produces the same mass of carbon dioxide.'

The students heated a test tube containing copper carbonate.

Table 4 shows their results.

Table 4

Time the test tube containing copper carbonate was heated in mins	0	2	4	6
Mass of test tube and contents in g	17.7	17.1	17.0	17.0

Do not write outside the box

Plan a method the students could use to test their hypothesis.

You should show how the students use their results to test the hypothesis.

You do **not** need to write about safety precautions.

[6 marks]

6

END OF QUESTIONS

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