

Please write clearly in block capitals.

Centre number

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Candidate number

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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.



J U N 2 0 8 4 6 4 C 1 F 0 1

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

☐

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

Turn over ►



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 _____.

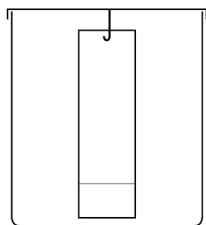
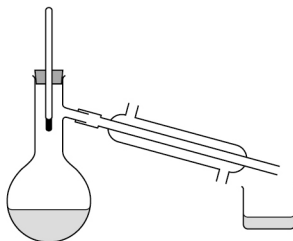
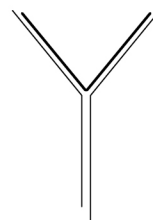


0 1 . 8

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

Turn over ►



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 cm³ 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.

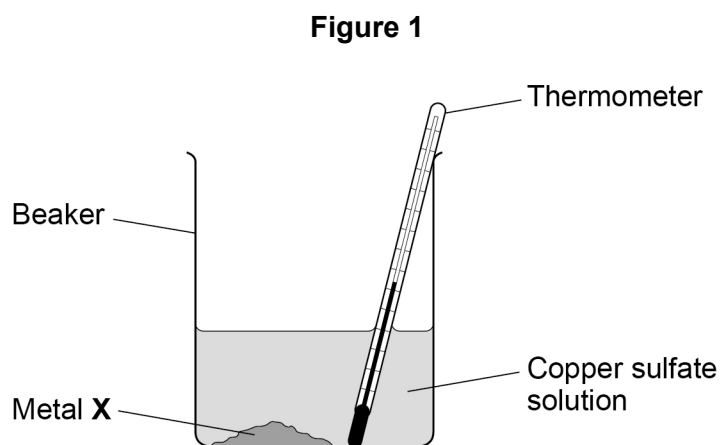
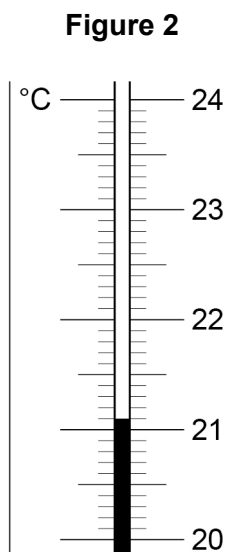


Figure 2 shows the thermometer reading of the copper sulfate solution at the start of the investigation.



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]

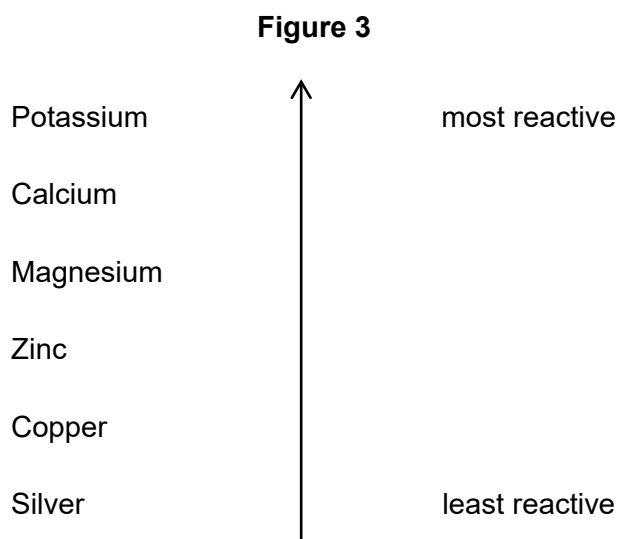
Mean temperature change = _____ °C

Turn over ►



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

Figure 3 shows a reactivity series.



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]



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 cm³ of the copper sulfate solution contains 1.8 g of copper sulfate.

Calculate the mass of copper sulfate in 25 cm³ of this copper sulfate solution.

[2 marks]

Mass = _____ g

11

Turn over for the next question

Turn over ►



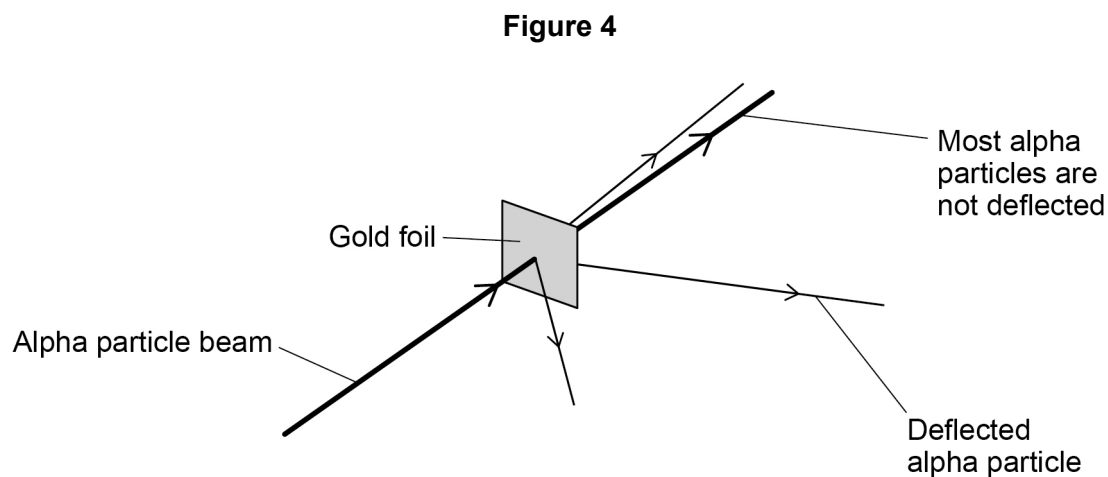
0 3

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.



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 _____.



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

☐

Turn over ►



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]

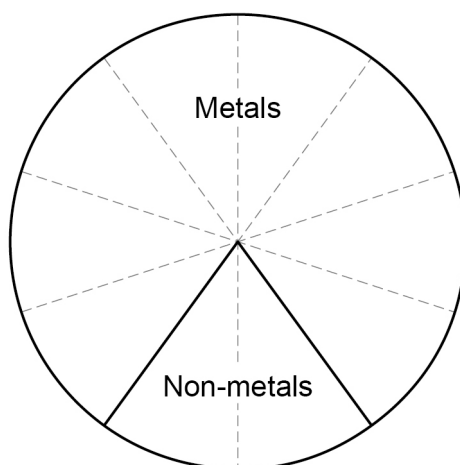
Relative formula mass (M_r) = _____



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.

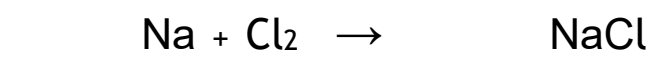
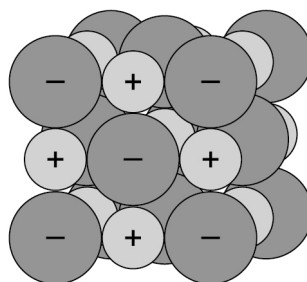
[1 mark]**Turn over ►**

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 _____



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]

Turn over ►



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**.

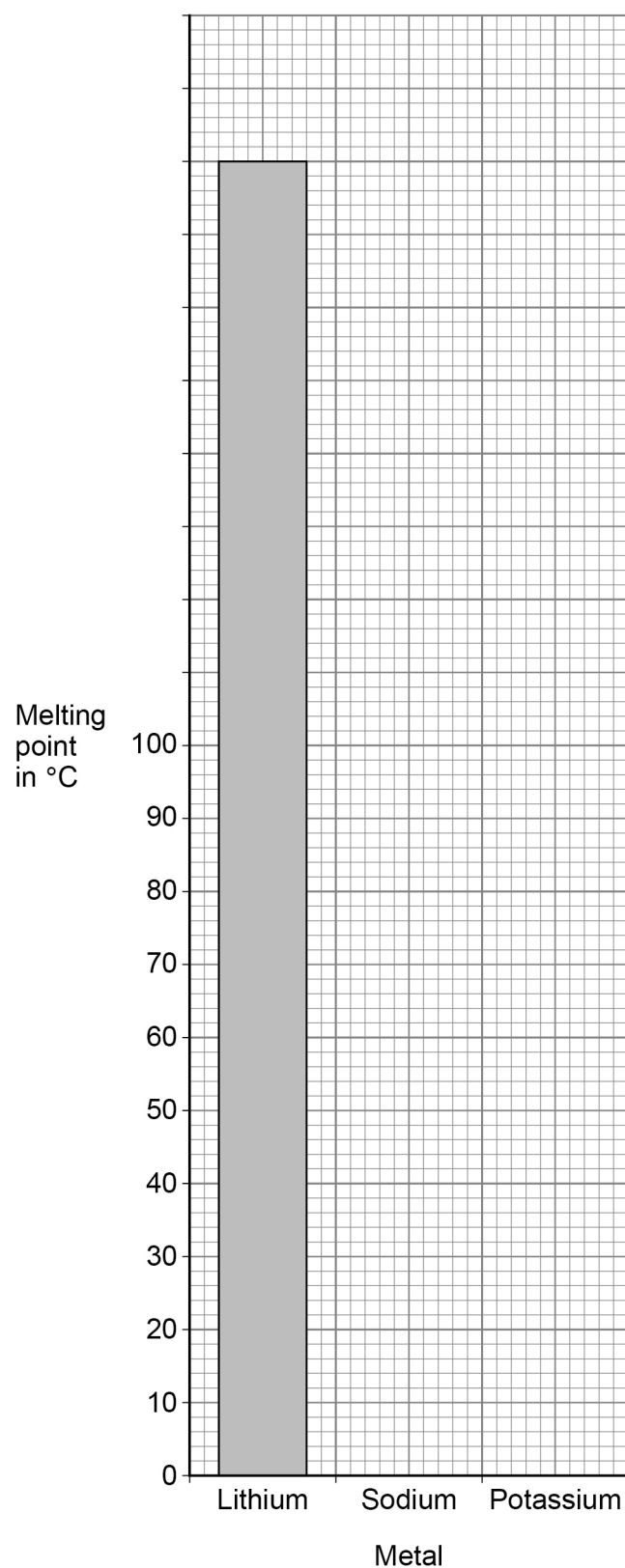
Use **Table 3**.

You should:

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

[3 marks]



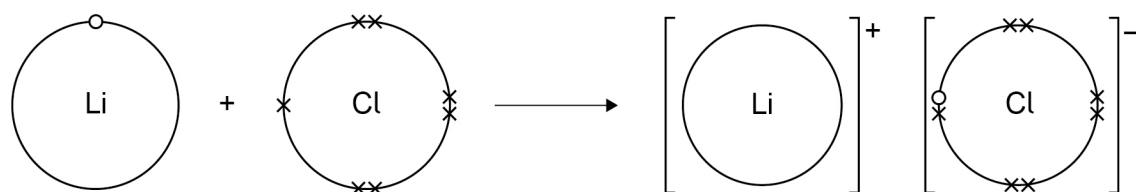
Figure 8**Turn over ►**

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]



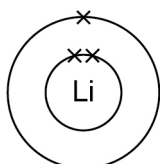
0 5 . 6

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

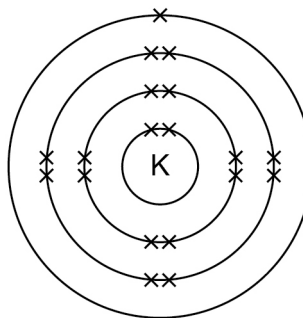
Figure 10 represents the electronic structures of a lithium atom and of a potassium atom.

Figure 10

Lithium atom



Potassium atom



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

[2 marks]

1 _____

2 _____

11

Turn over ►



0 6

This question is about the extraction of aluminium.

0 6 . 1

An aluminium atom is represented as:



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

[2 marks]

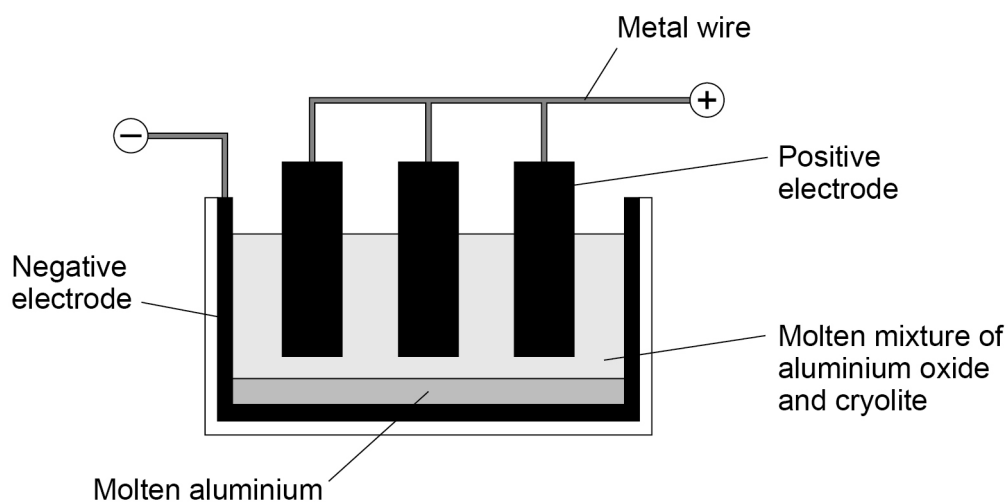
Number of electrons _____

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]



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

Turn over ►



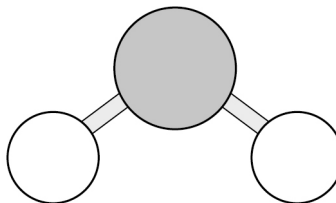
0 7

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]

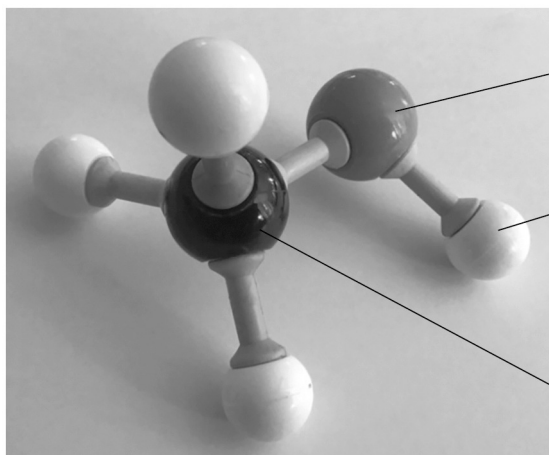
Ice has a low melting point because the

intermolecular forces are _____.



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

Figure 13



Oxygen atom

Hydrogen atom

Carbon atom

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

[1 mark]

Question 7 continues on the next page

Turn over ►



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



Turn over for the next question

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Turn over ►



0 8

Some students investigated the thermal decomposition of metal carbonates.

The word equation for the reaction is:



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



[6 marks]

[illegible]

6

END OF QUESTIONS



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3 2



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