AQA

Please write clearly in block capitals.

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

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I declare this is my own work.

GCSE
COMBINED SCIENCE: TRILOGY

F

Foundation Tier
Chemistry Paper 1F

Friday 17 May 2024 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 Potassium is in Group 1 of the periodic table.

0 1 . 1 What name is given to Group 1 elements?

[1 mark]

Tick (✓) **one** box.

Alkali metals ☐

Halogens ☐

Noble gases ☐

0 1 . 2 A potassium atom is very small.

What is the radius of a potassium atom?

[1 mark]

Tick (✓) **one** box.

0.2 cm ☐

0.2 mm ☐

0.2 nm ☐

0 1 . 3 What name is given to the number of protons in an atom?

[1 mark]

Tick (✓) **one** box.

Atomic number ☐

Group number ☐

Mass number ☐

Do not write outside the box

0 1 . 4 **Table 1** shows the name and the relative charge of the particles in a potassium atom.

Table 1

Name of particle	**Relative charge**
Proton	
	0
Electron	–1

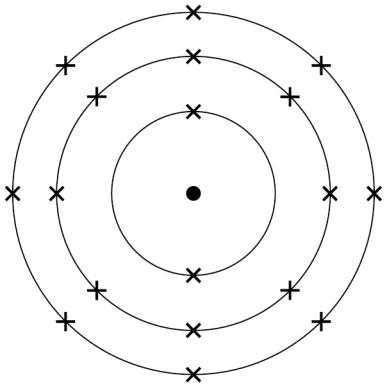
Complete **Table 1**.

[2 marks]

0 1 . 5 The electronic structure of a potassium atom is 2,8,8,1

Figure 1 represents the electronic structure of a potassium **ion**.

Figure 1



What is the charge on a potassium **ion**?

[1 mark]

Tick (✓) **one** box.

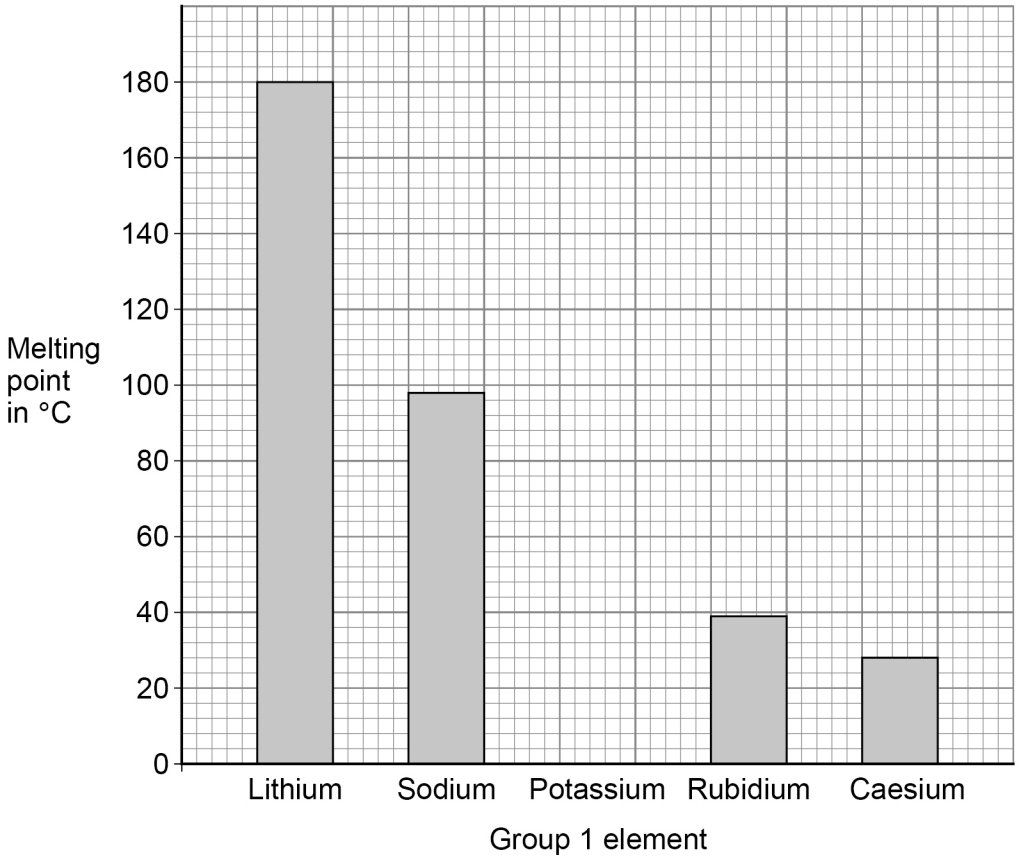
–1 ☐ 0 ☐ +1 ☐

Turn over ►

Do not write outside the box

0 1 . 6 **Figure 2** shows the melting points of some Group 1 elements.

Figure 2



Predict the melting point of potassium.

[1 mark]

Melting point = _____ °C

Do not write outside the box

0 1 . 7 Potassium has two isotopes.

Table 2 shows the percentage (%) abundance of the two isotopes.

Table 2

Isotope	Percentage (%) abundance
$^{39}_{19}K$	93
$^{41}_{19}K$	7

How is the relative atomic mass (A_r) of potassium calculated?

[1 mark]

Tick (✓) **one** box.

$A_r = \dfrac{(39 \times 7) + (41 \times 93)}{100}$ ☐

$A_r = \dfrac{(39 \times 93) + (41 \times 7)}{100}$ ☐

$A_r = \dfrac{(39 \times 41) + (93 \times 7)}{100}$ ☐

—
8

Turn over for the next question

Do not write outside the box

0 2 Carbon is in Group 4 of the periodic table.

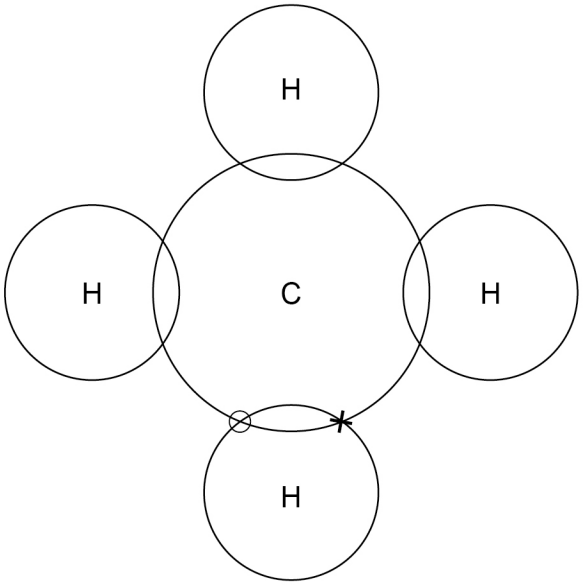
0 2 . 1 Methane contains carbon and hydrogen atoms.

A carbon atom has 4 electrons in the outer shell.

A hydrogen atom has 1 electron in the outer shell.

Complete the dot and cross diagram for a methane molecule.

[2 marks]



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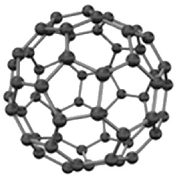
0 2 . 2 Which diagram represents the structure of diamond?

[1 mark]

Tick (✓) **one** box.



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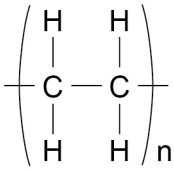

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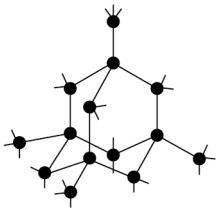

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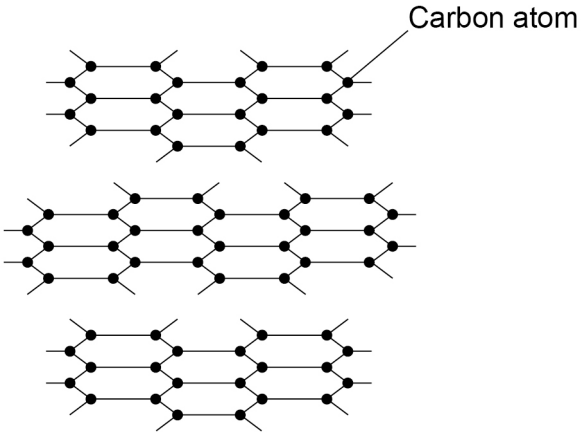
Question 2 continues on the next page

Do not write outside the box

Figure 3 represents part of the structure of graphite.

Figure 3



0 2 . 3 In graphite each carbon atom forms covalent bonds.

How many covalent bonds does each carbon atom form in graphite?

[1 mark]

Tick (✓) **one** box.

1 ☐ 2 ☐ 3 ☐ 4 ☐

0 2 . 4 Graphite conducts electricity.

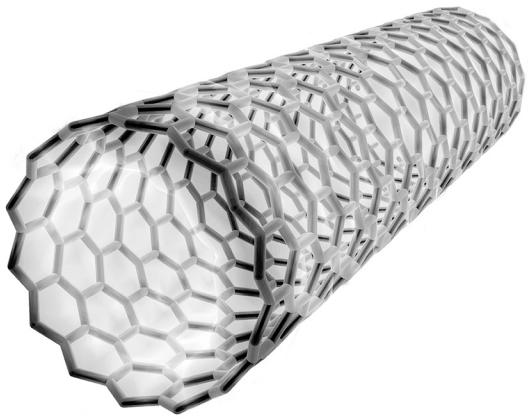
Which particles carry electrical charge through graphite?

[1 mark]

Do not write outside the box

Figure 4 represents the structure of a fullerene.

Figure 4



0 2 . 5 Where are fullerenes used?

[1 mark]

Tick (✓) **one** box.

In electronic components ☐

In self-heating cans ☐

In sports injury packs ☐

0 2 . 6 Describe the structure of the fullerene shown in **Figure 4**.

[2 marks]

_____

_____

_____

_____

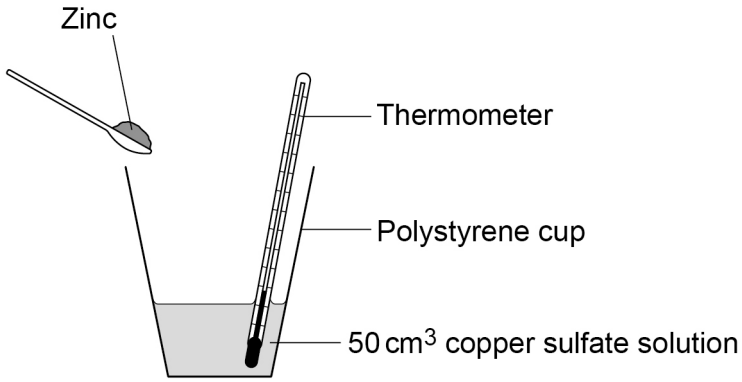
8

Do not write outside the box

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.

Do not write outside the box

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

Do not write outside the box

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 _____

_____

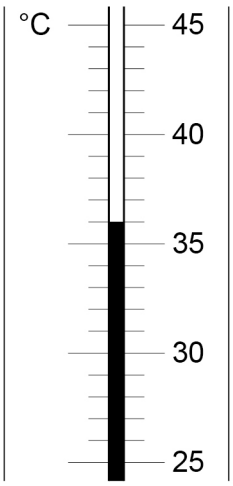
2 _____

_____

Do not write outside the box

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

Do not write outside the box

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

Do not write outside the box

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 _____

_____

_____

11

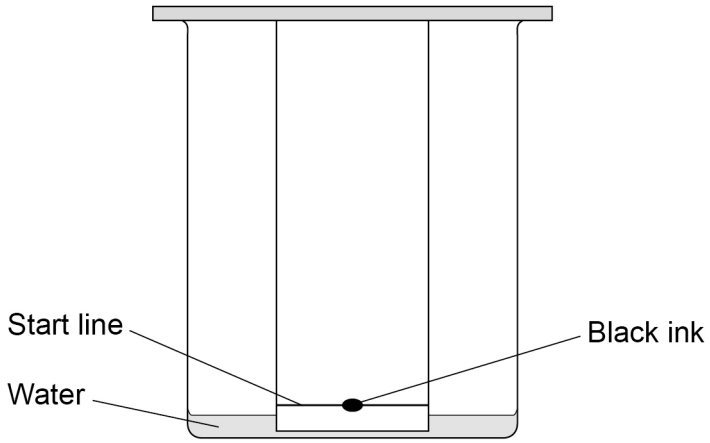
Turn over for the next question

Do not write outside the box

0 4 Mixtures can be separated by different methods.

0 4 . 1 **Figure 7** shows the apparatus used to separate the dyes in a black ink.

Figure 7



What is the name of this method?

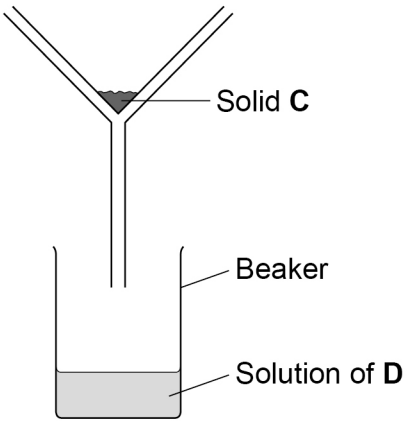
[1 mark]

Do not write outside the box

Some water was added to a mixture of two solids, **C** and **D**.

The mixture was stirred and then poured into the apparatus shown in **Figure 8**.

Figure 8



0 4 . 2 Name the separation method shown in **Figure 8**.

[1 mark]

0 4 . 3 Explain why solid **C** separated from the mixture of **C** and **D**.

Use **Figure 8**.

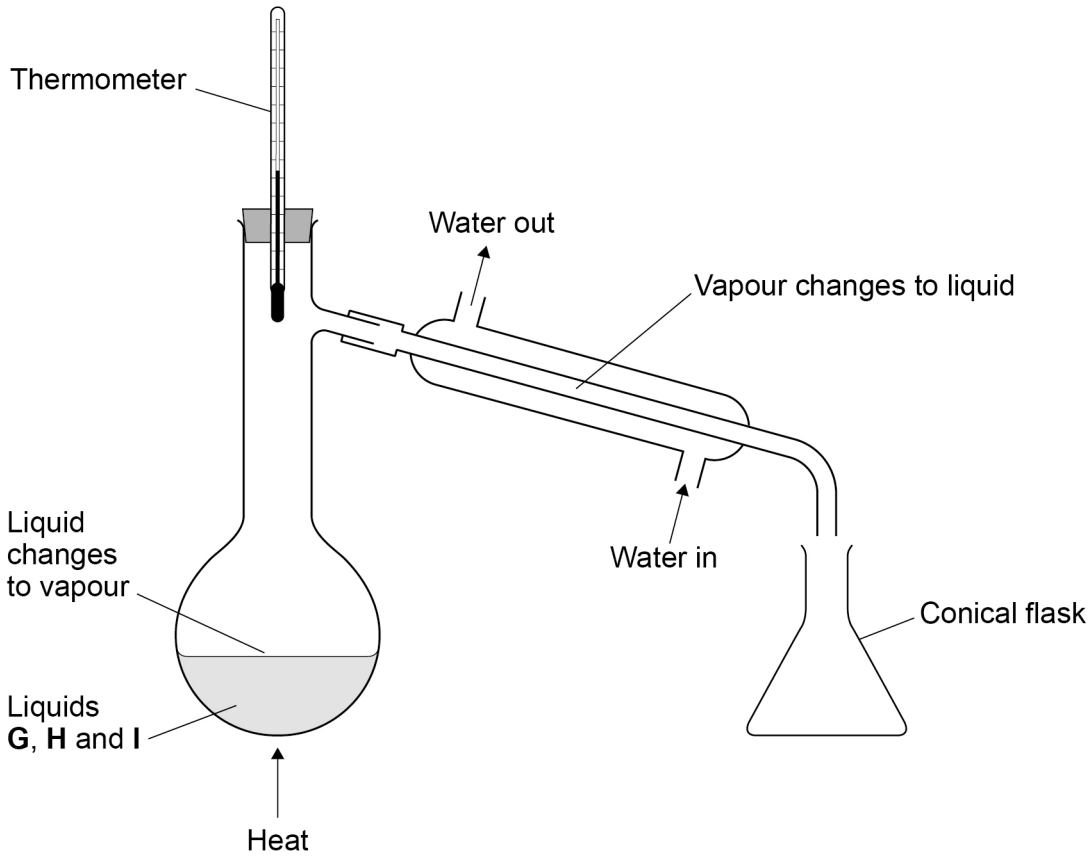
[2 marks]

Do not write outside the box

A student separated a mixture of three liquids, **G**, **H** and **I**.

Figure 9 shows the apparatus.

Figure 9



0 4 . 4 Name the separation method shown in **Figure 9**.

[1 mark]

Do not write outside the box

0 4 . 5 **Table 5** shows the boiling points of the three liquids, **G**, **H** and **I**.

Table 5

Liquid	Boiling point in °C
G	56
H	78
I	100

Which liquid collected **first** in the conical flask?

[1 mark]

Tick (✓) **one** box.

G ☐ **H** ☐ **I** ☐

0 4 . 6 Two processes occur in the apparatus shown in **Figure 9**.

Draw **one** line from each description to the name of the process.

[2 marks]

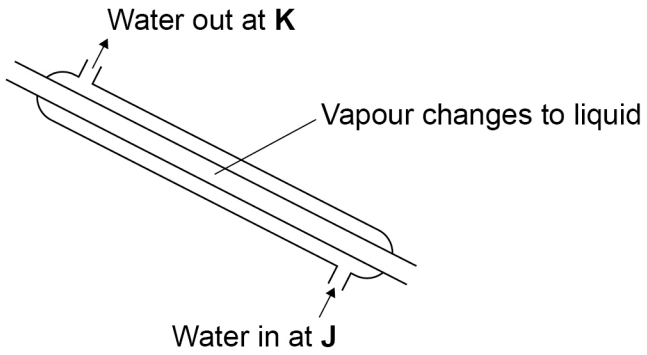
Description	Name of process
	Condensing
Liquid changes to vapour	Evaporating
Vapour changes to liquid	Freezing
	Melting

Turn over ►

Do not write outside the box

0 4 . 7 **Figure 10** shows part of the apparatus shown in **Figure 9**.

Figure 10



Which statement is correct?

[1 mark]

Tick (✓) **one** box.

The temperature of water at **K** is lower than at **J**. ☐

The temperature of water at **K** is the same as at **J**. ☐

The temperature of water at **K** is higher than at **J**. ☐

9

Do not write outside the box

0 5 Magnesium chloride is a soluble salt.

0 5 . 1 Magnesium reacts with hydrochloric acid to produce magnesium chloride and a gas.

Which gas is produced?

[1 mark]

Tick (✓) **one** box.

Hydrogen ☐

Nitrogen ☐

Oxygen ☐

Question 5 continues on the next page

Do not write outside the box

Magnesium chloride ($MgCl_2$) can be electrolysed when molten.

0 5 . 2 Which represents molten magnesium chloride?

[1 mark]

Tick (✓) **one** box.

$MgCl_2(g)$ ☐

$MgCl_2(l)$ ☐

$MgCl_2(s)$ ☐

0 5 . 3 Magnesium chloride contains Mg^{2+} ions and Cl^- ions.

Name the product at each electrode when molten magnesium chloride is electrolysed.

[2 marks]

Negative electrode _____

Positive electrode _____

Do not write outside the box

A student investigated the reactivity of three metals: copper, magnesium and iron.

The student mixed each metal with each metal chloride solution.

Table 6 shows the results.

Table 6

	Copper chloride solution	**Magnesium chloride solution**	**Iron chloride solution**
Copper	No reaction	No reaction	No reaction
Magnesium	Reaction	No reaction	Reaction
Iron	Reaction	No reaction	No reaction

0 5 . 4 What is the order of reactivity for copper, magnesium and iron?

Give **two** reasons for your answer.

Use **Table 6**.

[3 marks]

Most reactive _____

_____

Least reactive _____

Reason 1 _____

_____

Reason 2 _____

_____

Question 5 continues on the next page

Do not write outside the box

0 5 . 5 When heated 0.72 g of magnesium reacts with iron oxide to produce 2.32 g of products.

Calculate the mass of iron oxide that reacts with 0.72 g of magnesium.

[1 mark]

Mass of iron oxide = _____ g

0 5 . 6 The student used 30 cm^3 of magnesium chloride solution.

1 dm^3 of magnesium chloride solution contains 180 g of magnesium chloride.

1 dm^3 = 1000 cm^3

Calculate the mass of magnesium chloride in 30 cm^3 of magnesium chloride solution.

[3 marks]

Mass of magnesium chloride = _____ g

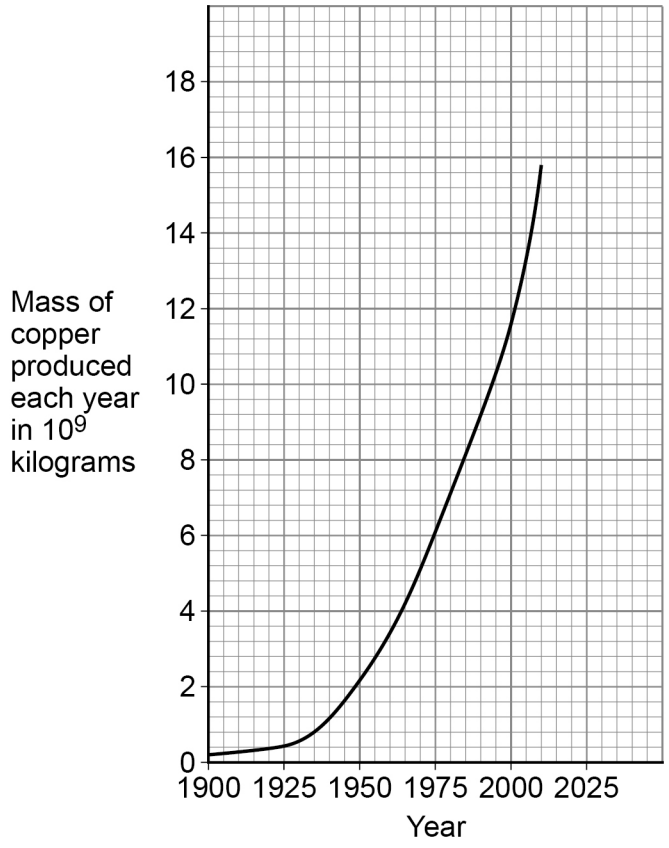
11

Do not write outside the box

0 6 Copper is a useful metal.

0 6 . 1 **Figure 11** shows the mass of copper produced between 1900 and 2010.

Figure 11



Give **two** conclusions that can be made from **Figure 11**.

[2 marks]

1 _____

_____

2 _____

_____

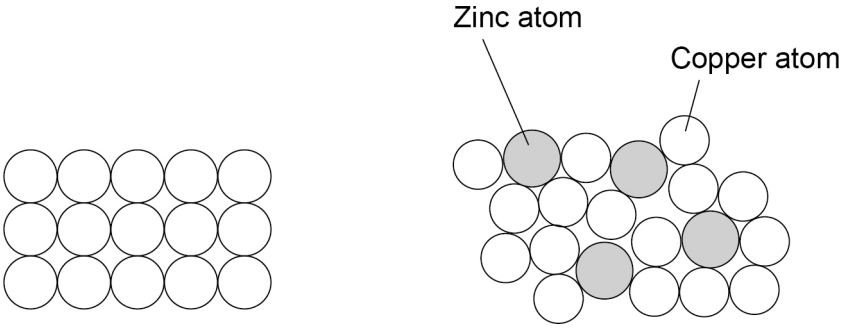
Question 6 continues on the next page

Do not write outside the box

Mixtures of copper and zinc are heated to produce alloys.

0 6 . 2 **Figure 12** represents the structures of pure copper and of an alloy of copper and zinc.

Figure 12



Explain why the alloy of copper and zinc is harder than pure copper.

Use **Figure 12**.

[3 marks]

Do not write outside the box

0 6 . 3 A 5.25 g sample of an alloy of copper and zinc contains 13.5% zinc by mass.

Calculate the mass of **copper** in the 5.25 g sample.

Give your answer to 3 significant figures.

[4 marks]

Mass of **copper** (3 significant figures) = _____ g

9

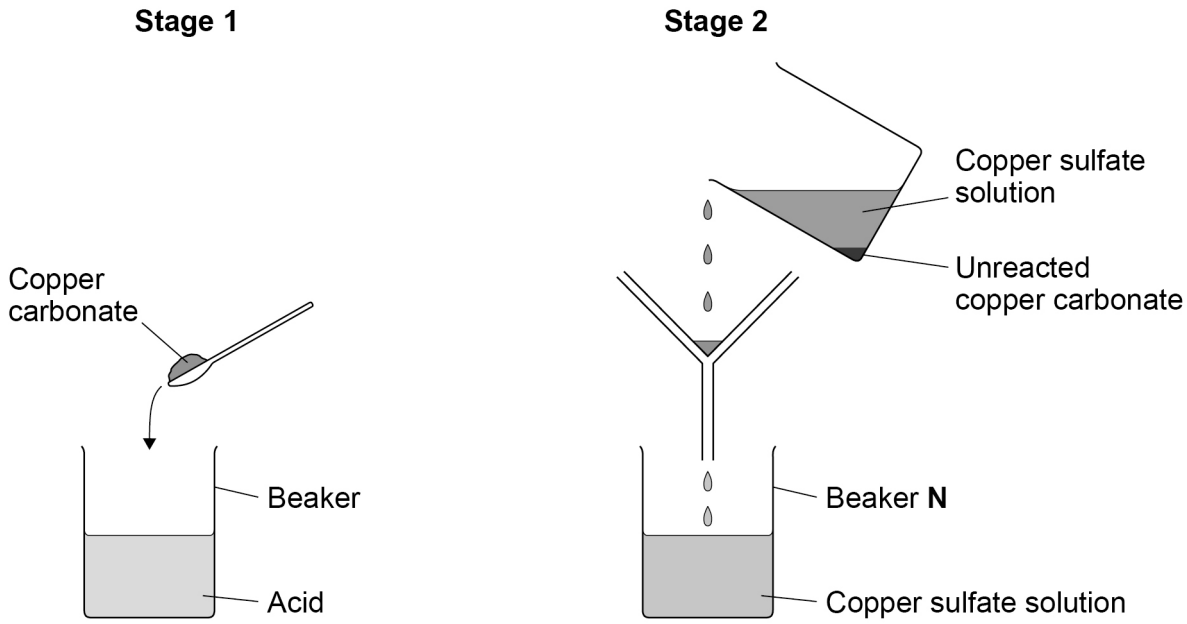
Turn over for the next question

Do not write outside the box

0 7 A student prepared copper sulfate by reacting an acid with excess copper carbonate.

Figure 13 shows the first two stages in the preparation of copper sulfate.

Figure 13



0 7 . 1 What is the formula of the acid used to prepare copper sulfate?

[1 mark]

Tick (✓) **one** box.

HCl ☐

HNO_3 ☐

H_2SO_4 ☐

Do not write outside the box

0 7 . 2 Why is excess copper carbonate used in **stage 1**?

[1 mark]

0 7 . 3 Beaker **N** contained copper sulfate solution.

Describe how the student could produce copper sulfate crystals from the copper sulfate solution in beaker **N**.

[2 marks]

Question 7 continues on the next page

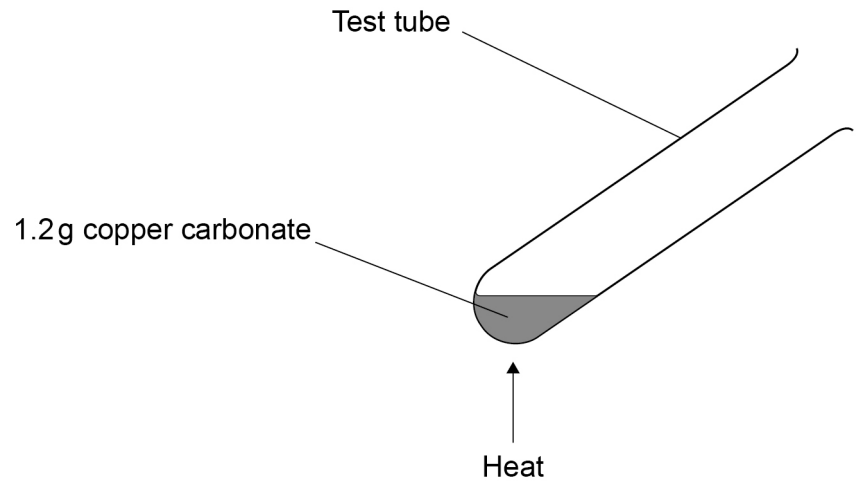
Do not write outside the box

A student investigated the thermal decomposition of copper carbonate.

Copper carbonate decomposes to form two products.

Figure 14 shows the apparatus.

Figure 14



This is the method used.

1. Add 1.2 g of copper carbonate to a test tube.

2. Heat the test tube and contents until the mass does not change.

3. Record the mass of the contents of the test tube after heating.

4. Repeat steps 1 to 3 with different masses of copper carbonate.

Table 7 shows the results.

Table 7

Mass of copper carbonate in test tube before heating in grams	Mass of the contents of test tube after heating in grams
1.2	0.8
2.4	1.7
3.6	2.2
4.8	3.1
6.0	3.9

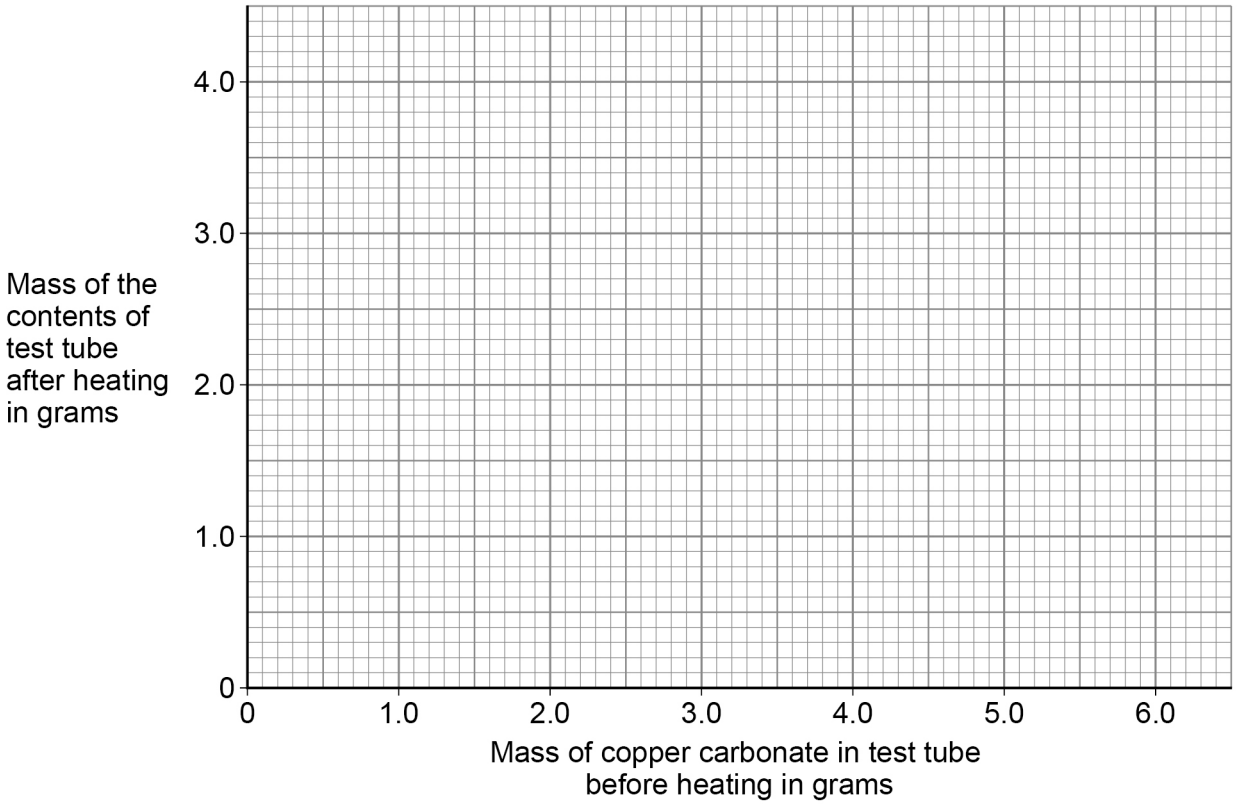
Do not write outside the box

0 7 . 4 Plot the data from **Table 7** on **Figure 15**.

Draw a line of best fit.

[3 marks]

Figure 15



0 7 . 5 Why does the mass of the contents of the test tube decrease in mass when copper carbonate is thermally decomposed?

[1 mark]

_____

_____

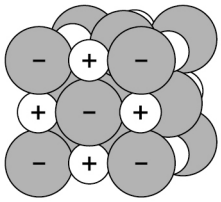
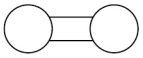
8

Turn over for the next question

Do not write outside the box

0 8 **Table 8** shows diagrams which represent the structures of two substances.

Table 8

Substance	Structure
Sodium chloride NaCl	
Oxygen O_2	

Compare the structure and bonding of sodium chloride and oxygen.

[6 marks]

6

END OF QUESTIONS

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ANSWER IN THE SPACES PROVIDED

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Question number	**Additional page, if required.** **Write the question numbers in the left-hand margin.**

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