



Surname \_\_\_\_\_

Forename(s) \_\_\_\_\_

Centre Number \_\_\_\_\_

Candidate Number \_\_\_\_\_

Candidate Signature \_\_\_\_\_

I declare this is my own work.

**GCSE**

**COMBINED SCIENCE: TRILOGY**

**F**

Foundation Tier

Chemistry Paper 1F

**8464/C/1F**

Friday 17 May 2024

Morning

Time allowed: 1 hour 15 minutes

At the top of the page, write your surname and forename(s), your centre number, your candidate number and add your signature.

[Turn over]



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

## **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.**
- **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.**



## **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 TURN OVER UNTIL TOLD TO DO SO**



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

[Turn over]



01.4

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]

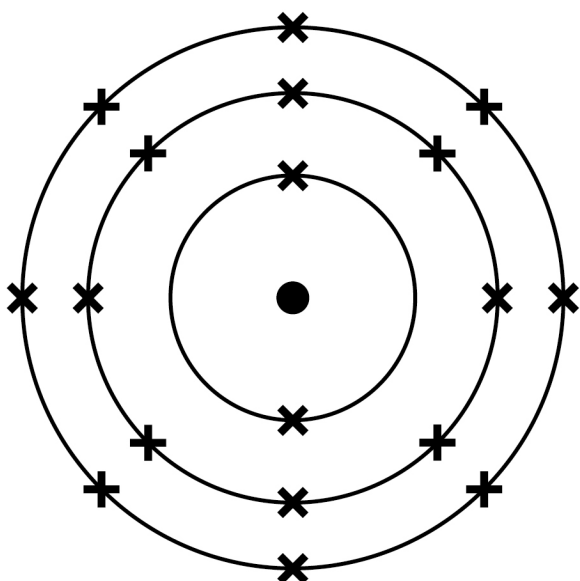


01.5

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]

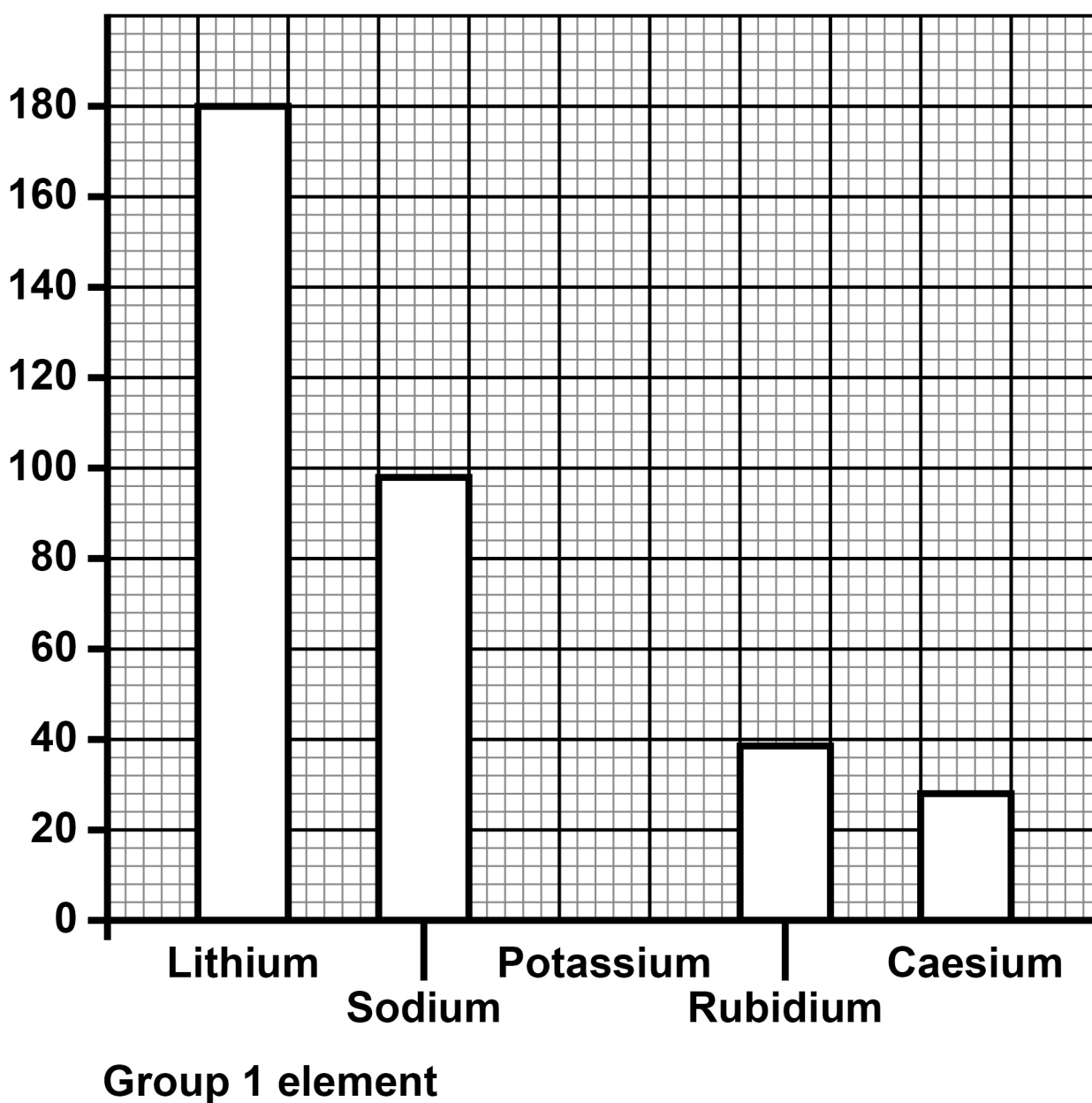


01.6

FIGURE 2 shows the melting points of some Group 1 elements.

FIGURE 2

Melting  
point  
in °C



**Predict the melting point of potassium. [1 mark]**

**Melting point = \_\_\_\_\_ °C**

**[Turn over]**



01.7

Potassium has two isotopes.

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

TABLE 2

ISOTOPE	PERCENTAGE (%) ABUNDANCE
${}^{39}_{19}\text{K}$	93
${}^{41}_{19}\text{K}$	7

How is the relative atomic mass ( $A_r$ ) of potassium calculated? [1 mark]

Tick (✓) ONE box.

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

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

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



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**[Turn over]**



0	2
---	---

**Carbon is in Group 4 of the periodic table.**

0	2	.	1
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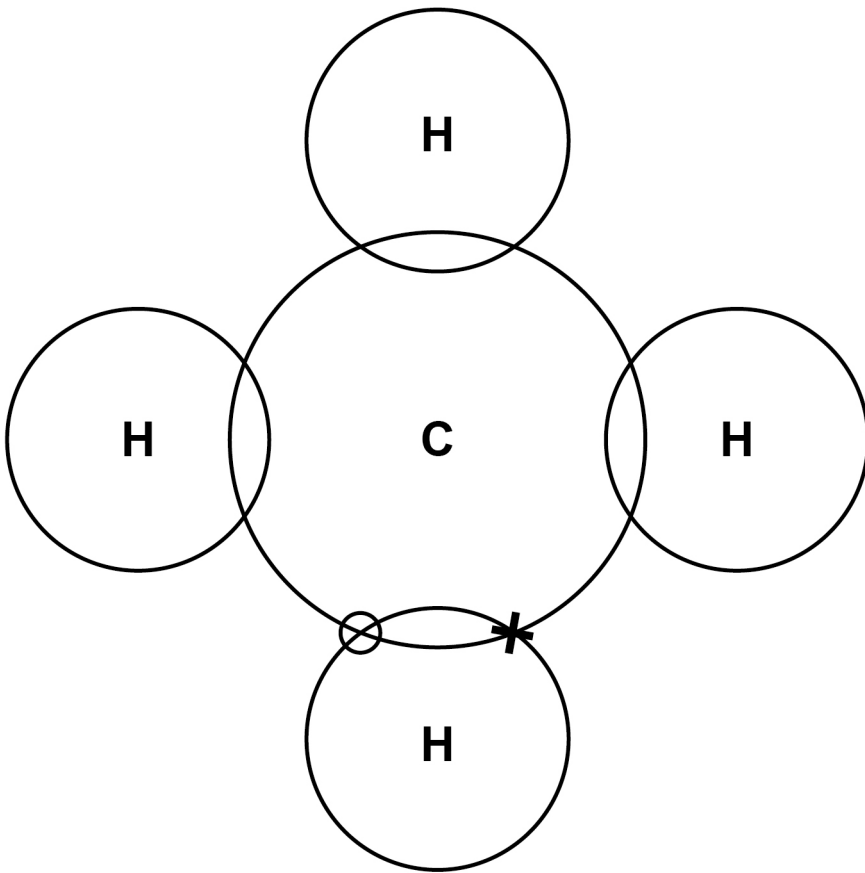
**Methane contains carbon and hydrogen atoms.**

**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 on the opposite page. [2 marks]**





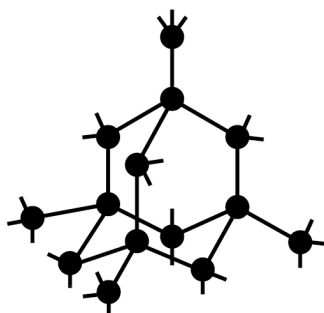
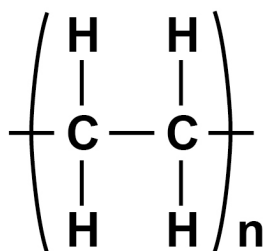
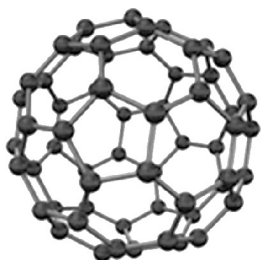
[Turn over]



0 2 . 2

Which diagram represents the structure of diamond?  
[1 mark]

Tick (✓) ONE box.



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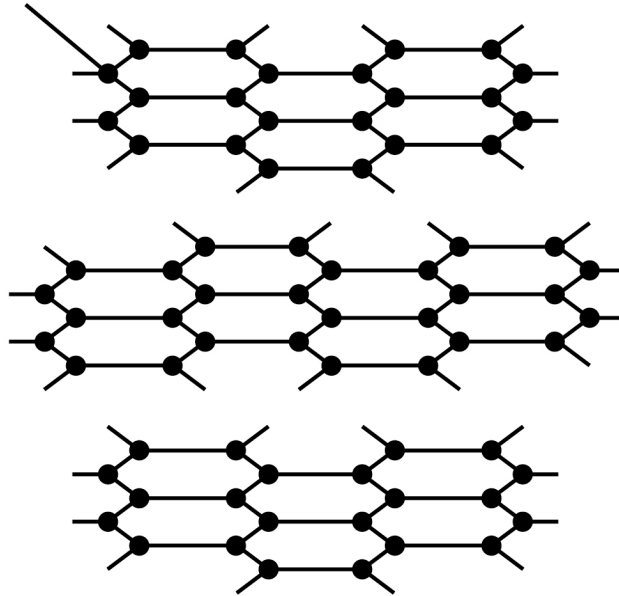
**[Turn over]**



FIGURE 3 represents part of the structure of graphite.

FIGURE 3

Carbon atom



**02.3**

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

**02.4**

Graphite conducts electricity.

Which particles carry electrical charge through graphite? [1 mark]

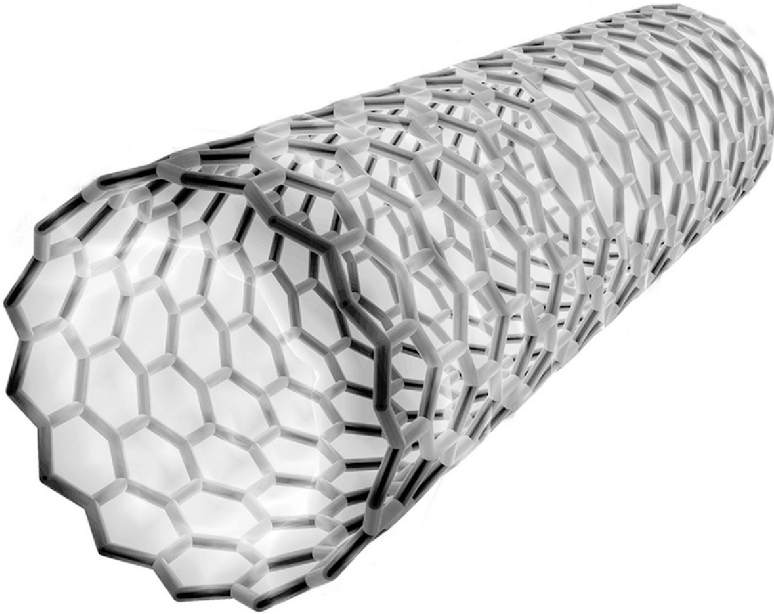
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[Turn over]



**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]**

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**[Turn over]**

8

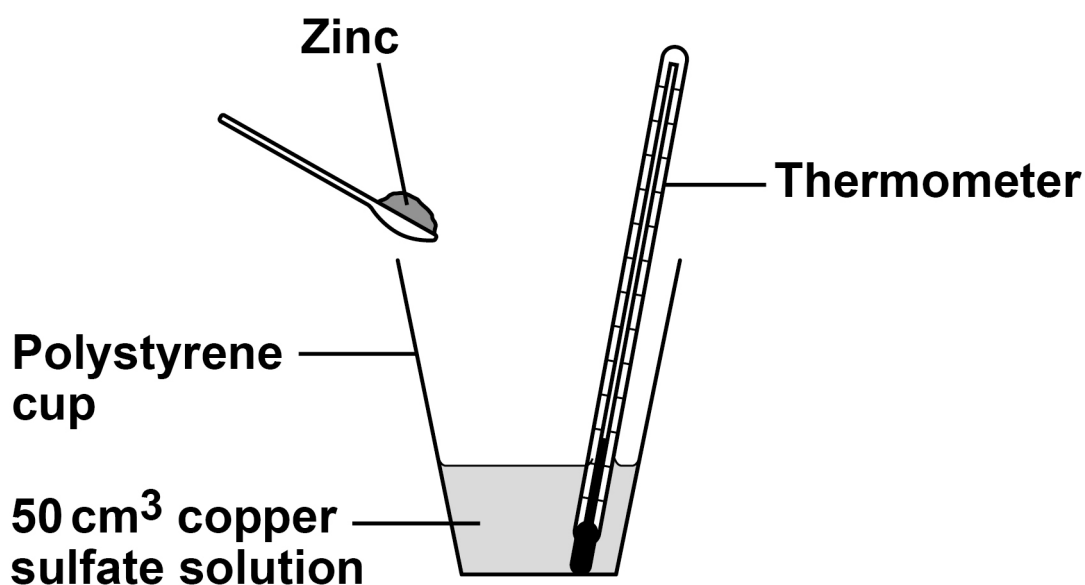


03

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<sup>3</sup> 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.

03.1

The student varied the mass of zinc.

What type of variable is the mass of zinc? [1 mark]

Tick (✓) ONE box.

Control

Dependent

Independent

[Turn over]



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

The word equation for the reaction is:

zinc + copper sulfate  $\longrightarrow$  salt A + copper

03.2

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

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2

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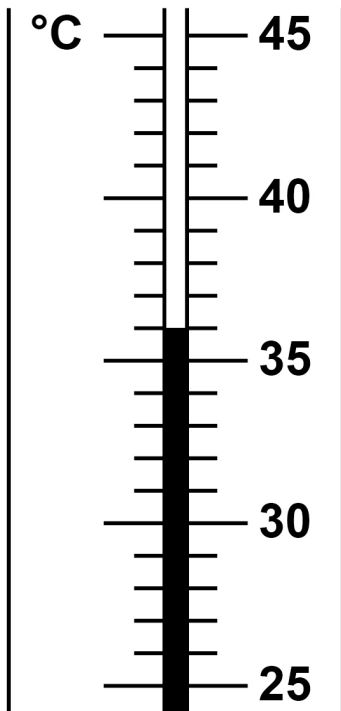
[Turn over]



0	3	.	4
---	---	---	---

**FIGURE 6** shows the highest temperature reached in one experiment.

**FIGURE 6**



**Complete TABLE 3 on the opposite page.**

**Use FIGURE 6. [2 marks]**



**TABLE 3**

<b>Starting temperature in °C</b>	<b>21</b>
<b>Highest temperature reached in °C</b>	
<b>Temperature increase in °C</b>	

**[Turn over]**





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

[Turn over]



**REPEAT OF TABLE 4**

<b>Mass of zinc in grams</b>	<b>TEMPERATURE INCREASE IN °C</b>			
	<b>Experiment 1</b>	<b>Experiment 2</b>	<b>Experiment 3</b>	<b>MEAN</b>
<b>1.0</b>	<b>7.8</b>	<b>7.3</b>	<b>7.7</b>	<b>B</b>
<b>2.0</b>	<b>13.1</b>	<b>13.8</b>	<b>13.3</b>	<b>13.4</b>
<b>3.0</b>	<b>20.4</b>	<b>12.9</b>	<b>20.2</b>	<b>20.3</b>



03.7

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 \_\_\_\_\_

[Turn over]

11

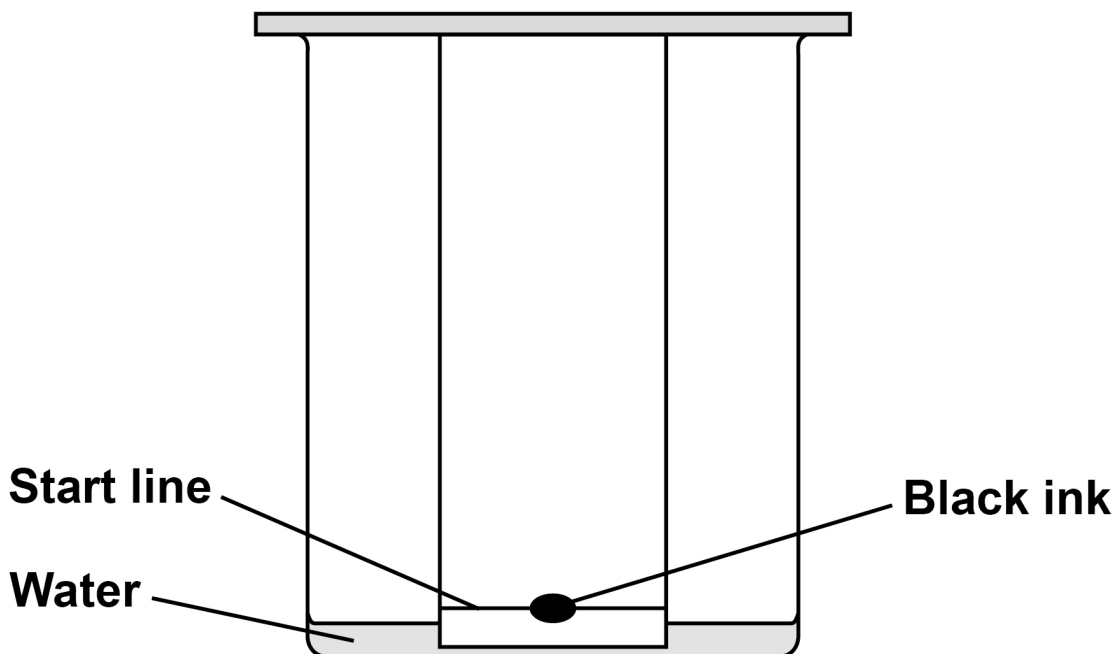
04

Mixtures can be separated by different methods.

04.1

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]

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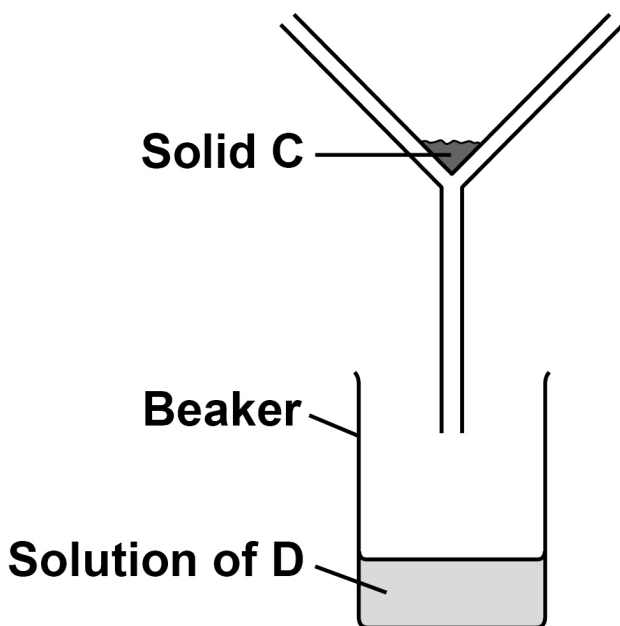
**[Turn over]**



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]**

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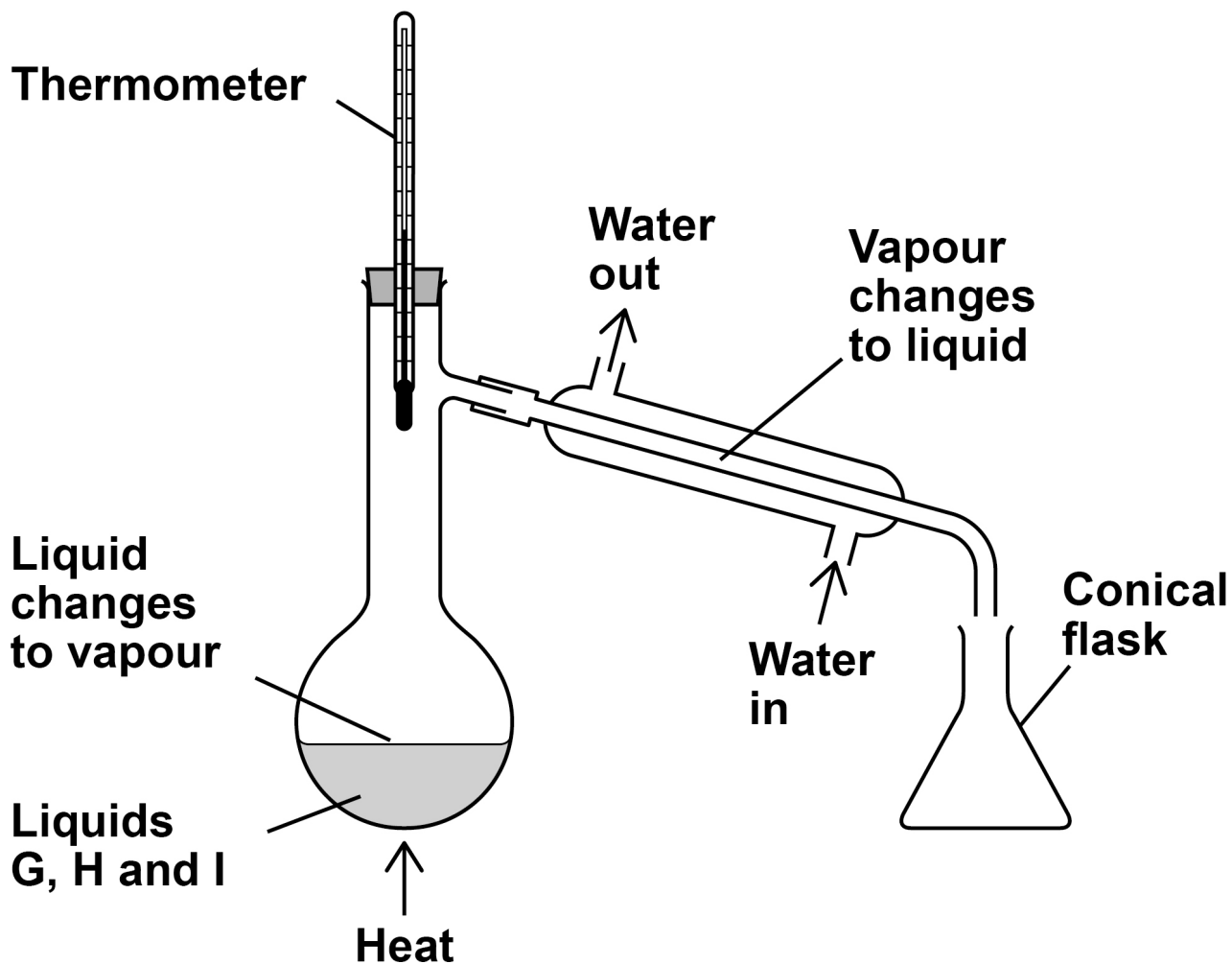
**[Turn over]**



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

FIGURE 9 shows the apparatus.

FIGURE 9



04.4

Name the separation method shown in FIGURE 9.  
[1 mark]



04.5

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

[Turn over]



04.6

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**

Liquid changes to vapour

Condensing

Evaporating

Vapour changes to liquid

Freezing

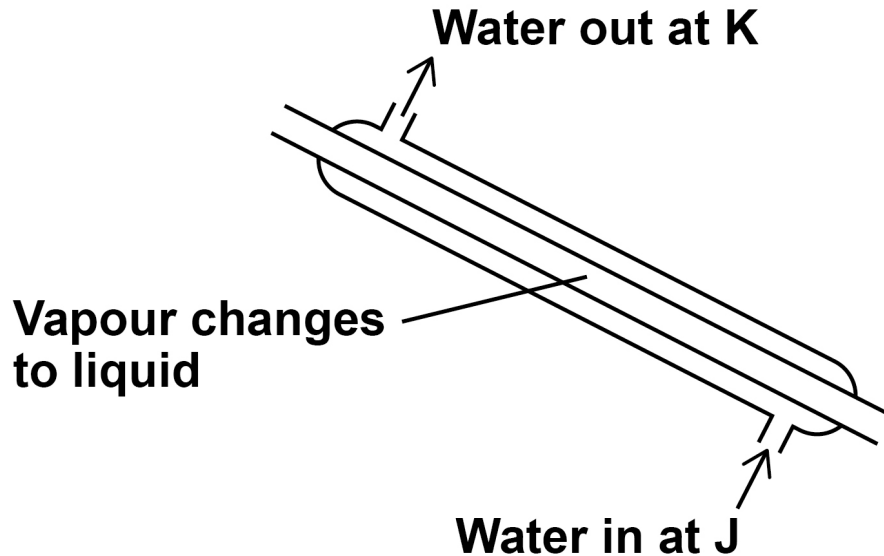
Melting



04.7

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.

[Turn over]



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**



Magnesium chloride ( $\text{MgCl}_2$ ) can be electrolysed when molten.

05.2

Which represents molten magnesium chloride?  
[1 mark]

Tick (✓) ONE box.

$\text{MgCl}_2(\text{g})$

$\text{MgCl}_2(\text{l})$

$\text{MgCl}_2(\text{s})$

05.3

Magnesium chloride contains  $\text{Mg}^{2+}$  ions and  $\text{Cl}^-$  ions.

Name the product at each electrode when molten magnesium chloride is electrolysed. [2 marks]

Negative electrode \_\_\_\_\_

Positive electrode \_\_\_\_\_

[Turn over]



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 \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

[Turn over]



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  $30 \text{ cm}^3$  of magnesium chloride solution.

$1 \text{ dm}^3$  of magnesium chloride solution contains  $180 \text{ g}$  of magnesium chloride.

$$1 \text{ dm}^3 = 1000 \text{ cm}^3$$

Calculate the mass of magnesium chloride in  $30 \text{ cm}^3$  of magnesium chloride solution. [3 marks]

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---

Mass of magnesium chloride = \_\_\_\_\_ g

[Turn over]

11



0	6
---	---

Copper is a useful metal.

0	6	.	1
---	---	---	---

FIGURE 11, on the opposite page, shows the mass of copper produced between 1900 and 2010.

Give TWO conclusions that can be made from FIGURE 11. [2 marks]

1

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---

---

2

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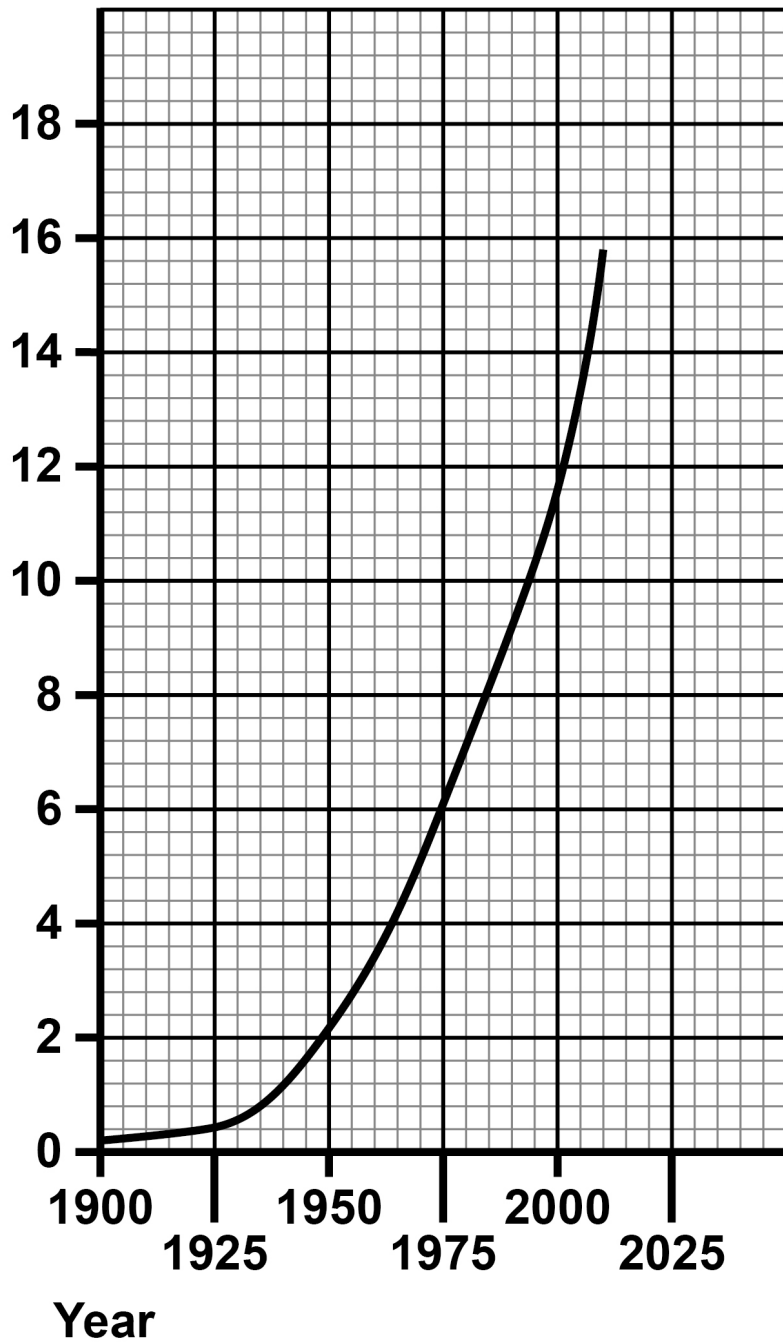
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FIGURE 11

Mass of  
copper  
produced  
each year in  
 $10^9$  kilograms



[Turn over]



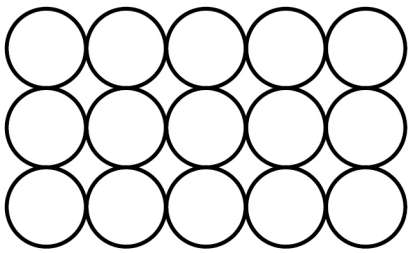
Mixtures of copper and zinc are heated to produce alloys.

06.2

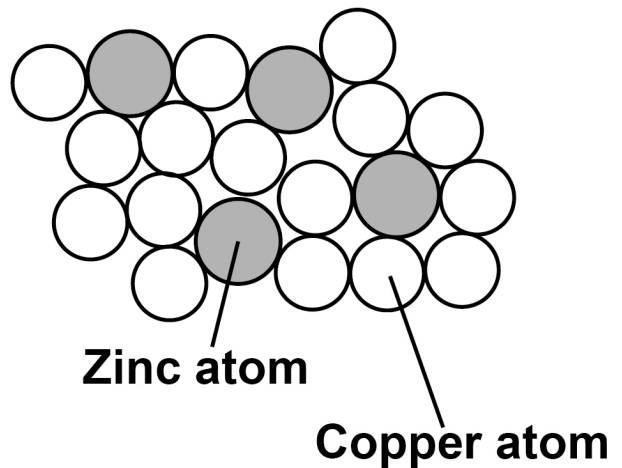
FIGURE 12 represents the structures of pure copper and of an alloy of copper and zinc.

FIGURE 12

PURE COPPER



ALLOY OF  
COPPER AND ZINC







0	7
---	---

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

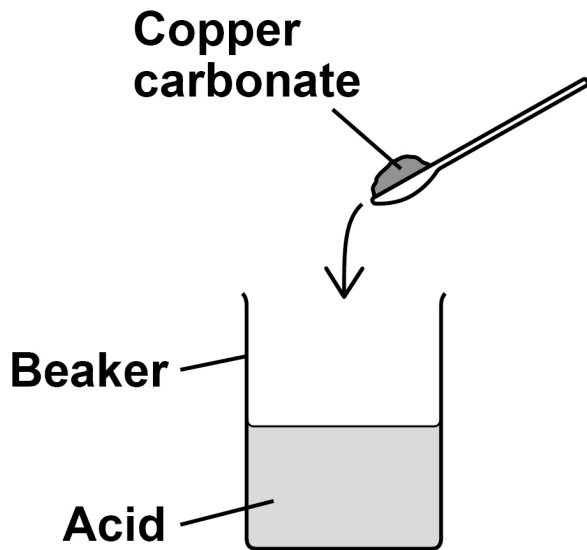
**FIGURE 13, on page 50, shows the first two stages in the preparation of copper sulfate.**

**[Turn over]**

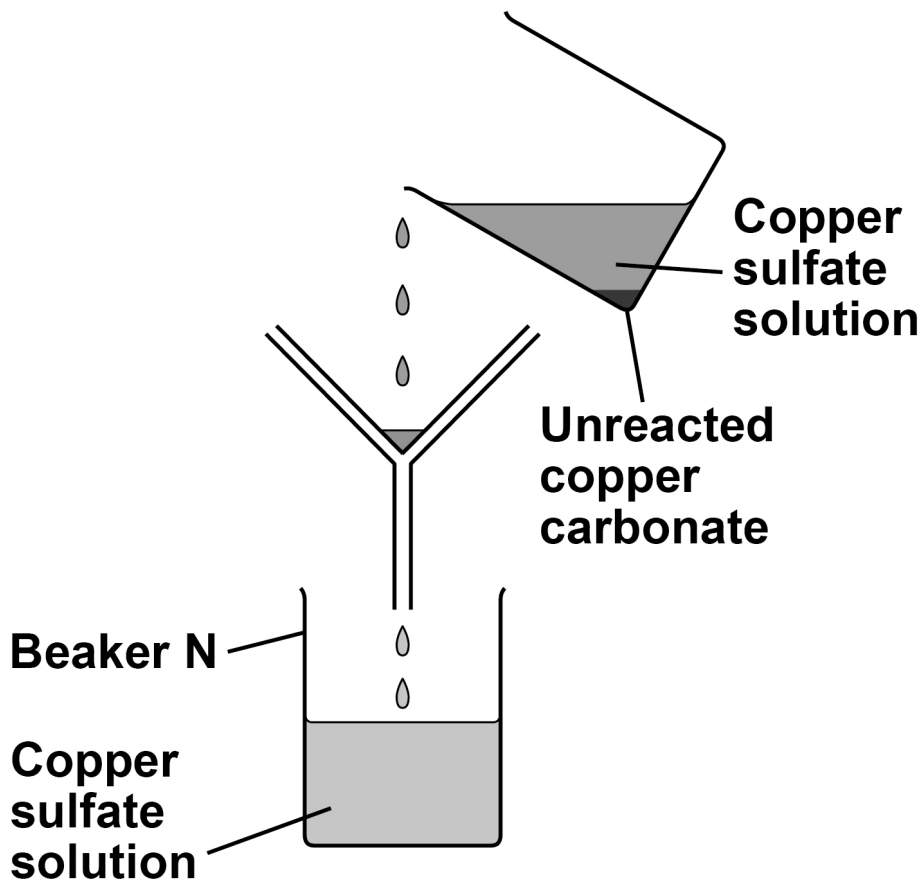


## FIGURE 13

## STAGE 1



## STAGE 2



**07.1**

**What is the formula of the acid used to prepare copper sulfate? [1 mark]**

**Tick (✓) ONE box.**

**HCl****HNO<sub>3</sub>****H<sub>2</sub>SO<sub>4</sub>****07.2**

**Why is excess copper carbonate used in STAGE 1?  
[1 mark]**

---

---

---

**[Turn over]**



0	7	.	3
---	---	---	---

**Beaker N, on page 50, contained copper sulfate solution.**

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

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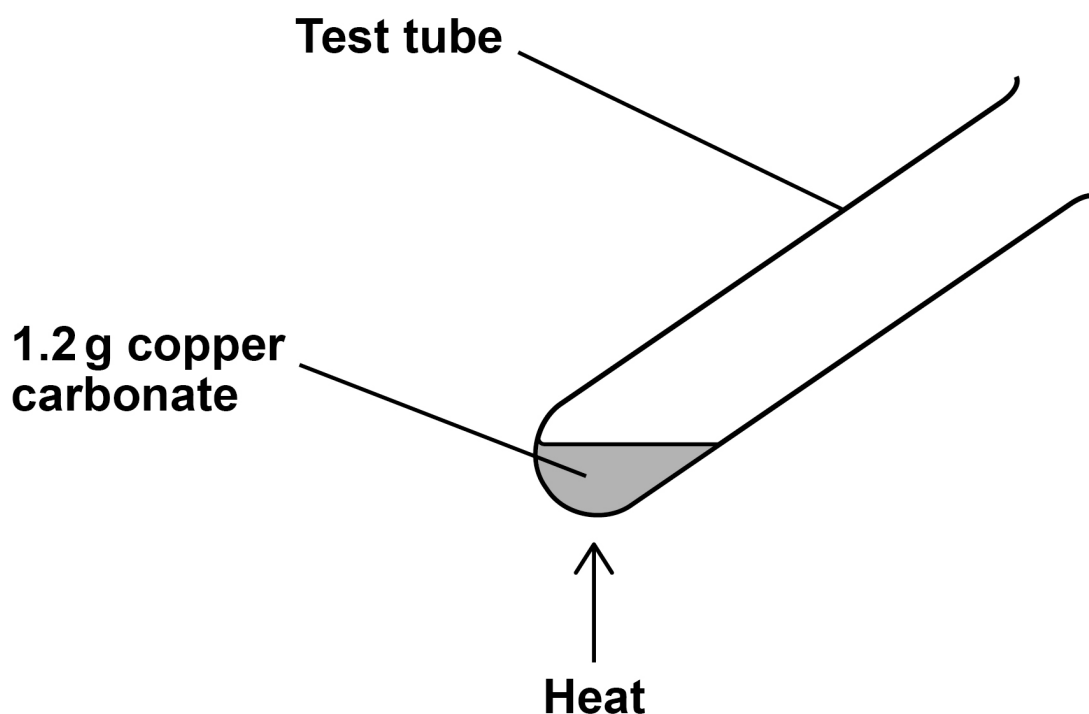
**A student investigated the thermal decomposition of copper carbonate.**

**Copper carbonate decomposes to form two products.**

**FIGURE 14, on the opposite page, 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.

[Turn over]



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

0 7 . 4

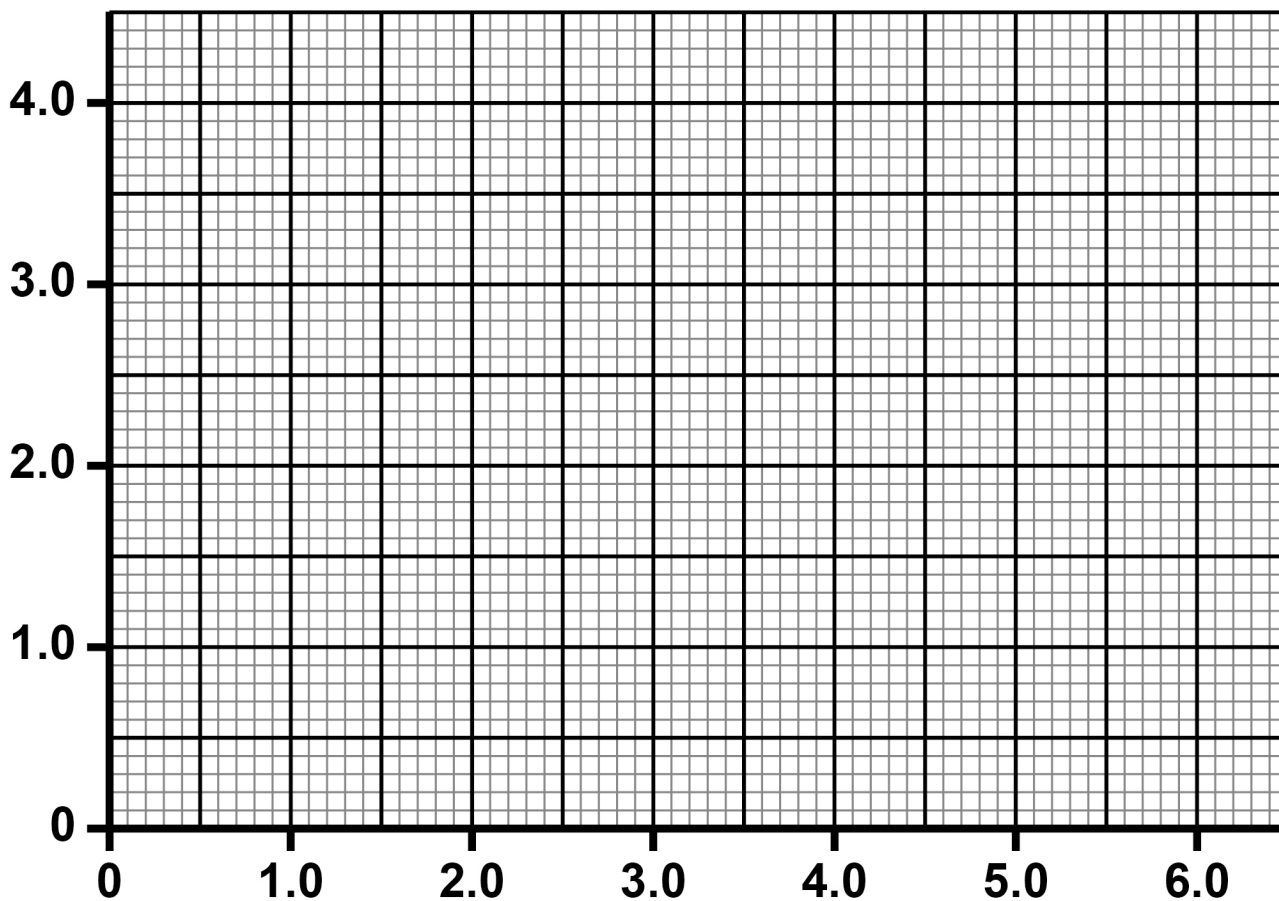
Plot the data from TABLE 7 on FIGURE 15, on the opposite page.

Draw a line of best fit. [3 marks]



**FIGURE 15**

**Mass of the  
contents of  
test tube  
after heating  
in grams**



**Mass of copper carbonate in test tube  
before heating in grams**

**[Turn over]**



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



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**[Turn over]**



08

TABLE 8 shows diagrams which represent the structures of two substances.

TABLE 8

SUBSTANCE	STRUCTURE
Sodium chloride NaCl	
Oxygen O <sub>2</sub>	

Compare the structure and bonding of sodium chloride and oxygen. [6 marks]

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**END OF QUESTIONS**

<hr/>
<b>6</b>









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

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