A

AQA

Surname _____

Other Names _____

Centre Number _____

Candidate Number _____

Candidate Signature _____

I declare this is my own work.

GCSE
COMBINED SCIENCE: TRILOGY

Foundation Tier
Chemistry Paper 1F

F

8464/C/1F

Time allowed: 1 hour 15 minutes

At the top of the page, write your surname and other names, your centre number, your candidate number and add your signature.

[Turn over]

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

Magnesium is in Group 2 of the periodic table.

1.0 g of magnesium reacted with chlorine to produce magnesium chloride.

0 1 . 1

Which types of element react when magnesium reacted with chlorine?
[1 mark]

Tick (✓) ONE box.

☐ **A metal and a metal**

☐ **A metal and a non-metal**

☐ **A non-metal and a non-metal**

0 1 . 2

Write the word equation for the reaction when magnesium reacts with chlorine.
[1 mark]

_____ + _____ ⟶ _____

0 1 . 3

What apparatus was used to measure the mass of 1.0 g of magnesium? [1 mark]

Tick (✓) ONE box.

☐ **Balance**

☐ **Beaker**

☐ **Ruler**

0 1 . 4

What mass of magnesium chloride was produced? [1 mark]

Tick (✓) ONE box.

☐ **Less than 1.0 g**

☐ **1.0 g**

☐ **More than 1.0 g**

0 1 . 5

Magnesium reacts with oxygen to produce magnesium oxide.

Calculate the percentage mass of magnesium in magnesium oxide (MgO).

Relative atomic mass (A_r): Mg = 24

Relative formula mass (M_r): MgO = 40

[2 marks]

Percentage mass of magnesium =

_____ %

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[Turn over]

Magnesium carbonate decomposes to produce magnesium oxide and carbon dioxide.

The word equation for the reaction is:

magnesium carbonate $\longrightarrow$ magnesium oxide + carbon dioxide

Four students heated 2.00 g of magnesium carbonate for 10 minutes.

TABLE 1 shows the results.

TABLE 1

Mass of carbon dioxide produced in g				
Student 1	**Student 2**	**Student 3**	**Student 4**	**Mean**
0.97	**0.91**	**0.50**	**0.95**	**X**

0 1 . 6

What is the most likely reason for STUDENT 3's anomalous result? [1 mark]

Tick (✓) ONE box.

☐ **The student heated more than 2.00 g of magnesium carbonate.**

☐ **The student heated the magnesium carbonate for less than 10 minutes.**

☐ **The student used a higher temperature.**

[Turn over]

REPEAT OF TABLE 1

Mass of carbon dioxide produced in g				
Student 1	Student 2	Student 3	Student 4	Mean
0.97	0.91	0.50	0.95	X

0 1 . 7

Calculate value X in TABLE 1.

Do NOT use the anomalous result.

Give your answer to 2 significant figures. [3 marks]

X (2 significant figures) = _____ g

10

0 2

This question is about electrolysis.

0 2 . 1

Complete the sentence.

Choose the answer from the list. [1 mark]

- **gaseous**
- **molten**
- **solid**

Copper chloride can conduct electricity when in solution or when

_____ .

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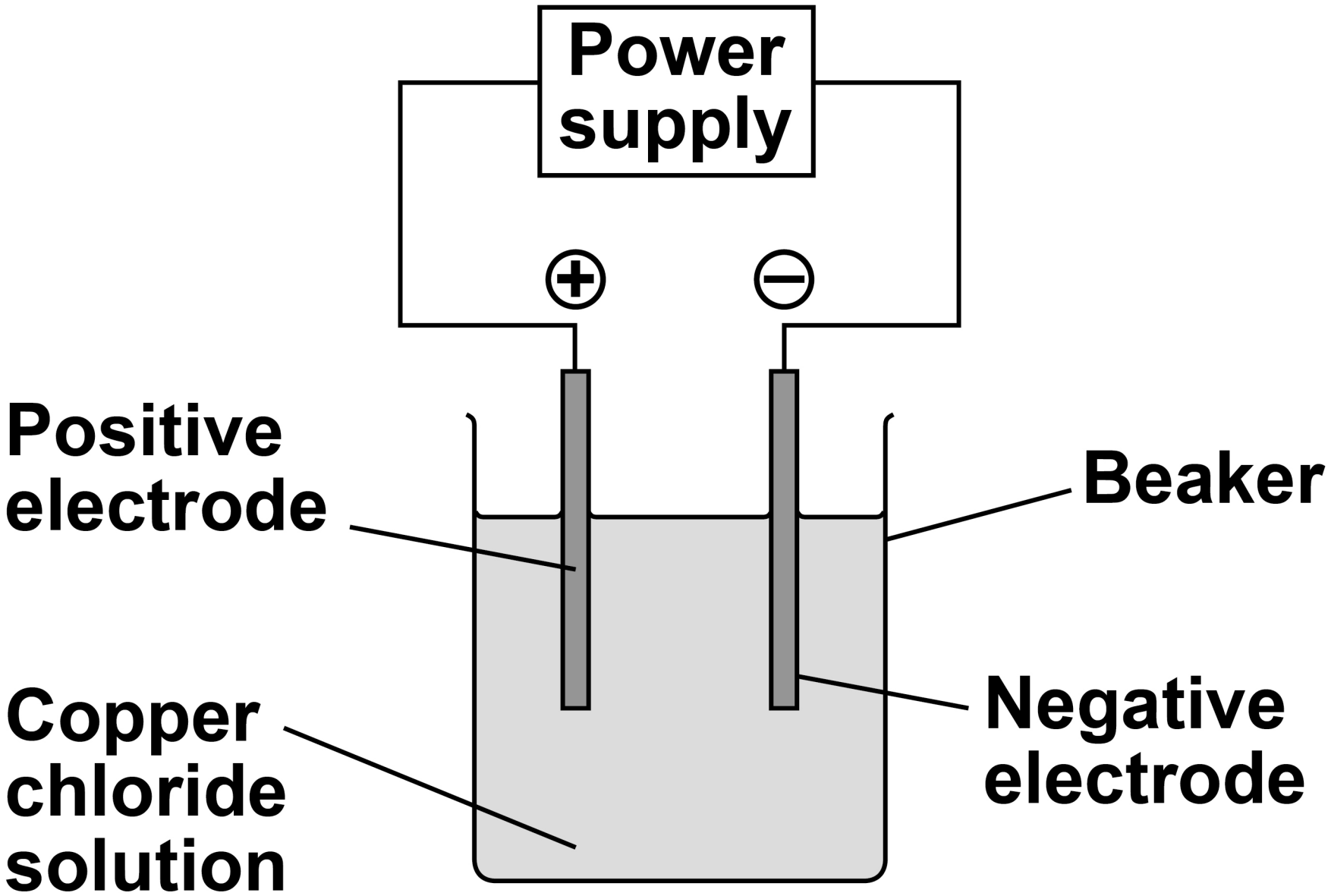
[Turn over]

FIGURE 1 shows the apparatus used for the electrolysis of copper chloride solution.

FIGURE 1



There are four ions in copper chloride solution:

- Cu^{2+}
- Cl^{-}
- H^{+}
- OH^{-}

0 2 . 2

Why do Cl^{-} ions and OH^{-} ions move to the positive electrode? [1 mark]

0 2 . 3

Where do the H^+ and OH^- ions come from in the electrolysis of copper chloride solution? [1 mark]

Tick (✓) ONE box.

- ☐ **Air**
- ☐ **Copper chloride**
- ☐ **Water**

0 2 . 4

Which ion produces a metal? [1 mark]

Tick (✓) ONE box.

☐ Cu^{2+}

☐ Cl^{-}

☐ H^{+}

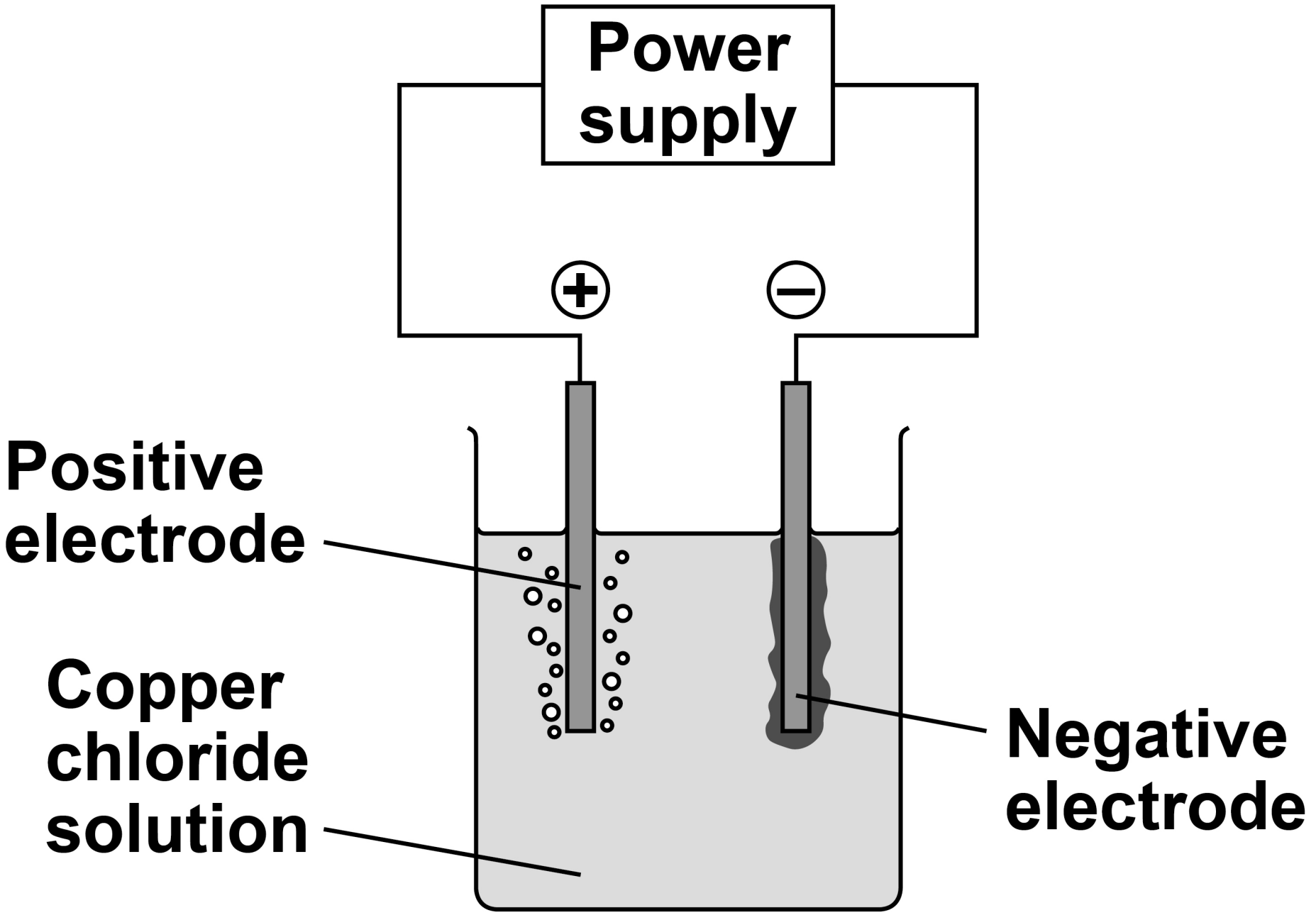
☐ OH^{-}

[Turn over]

0 2 . 5

FIGURE 2 shows the apparatus during the electrolysis of copper chloride solution.

FIGURE 2



Describe what is seen at each electrode during the electrolysis of copper chloride solution. [2 marks]

Positive electrode _____

_____

Negative electrode _____

_____

_____

0 2 . 6

500 cm^3 of copper chloride solution contains 6.50 g of copper chloride.

Calculate the mass of copper chloride in 40.0 cm^3 of this copper chloride solution.

[2 marks]

Mass = _____ g

8

0 3

Carbon can exist in a number of different structures.

0 3 . 1

What is the approximate radius of a carbon atom? [1 mark]

Tick (✓) ONE box.

☐ **0.1 m**

☐ **0.1 mm**

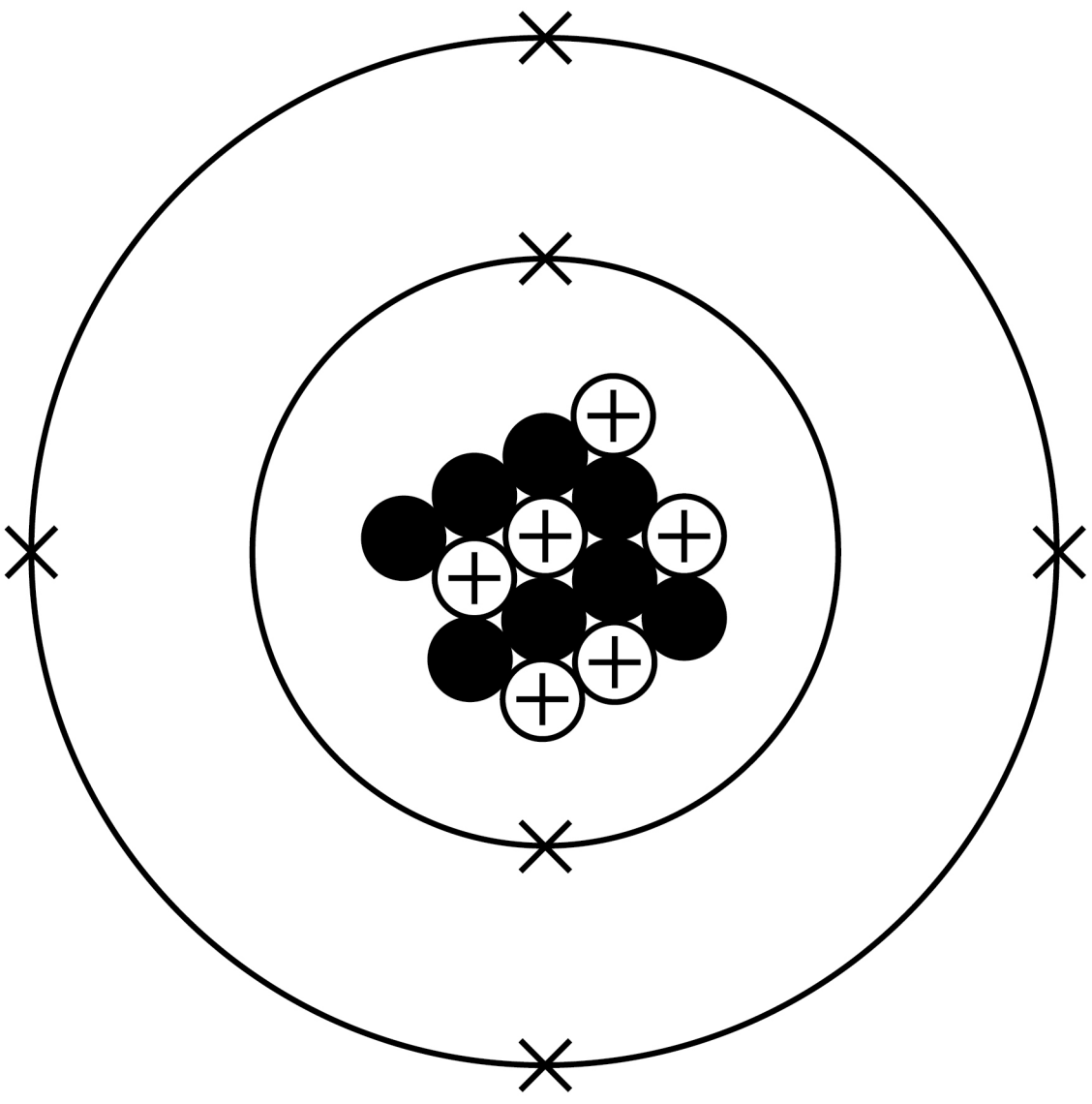
☐ **0.1 nm**

[Turn over]

0 3 . 2

FIGURE 3 shows an atom of carbon.

FIGURE 3



Describe the atomic structure of this carbon atom.

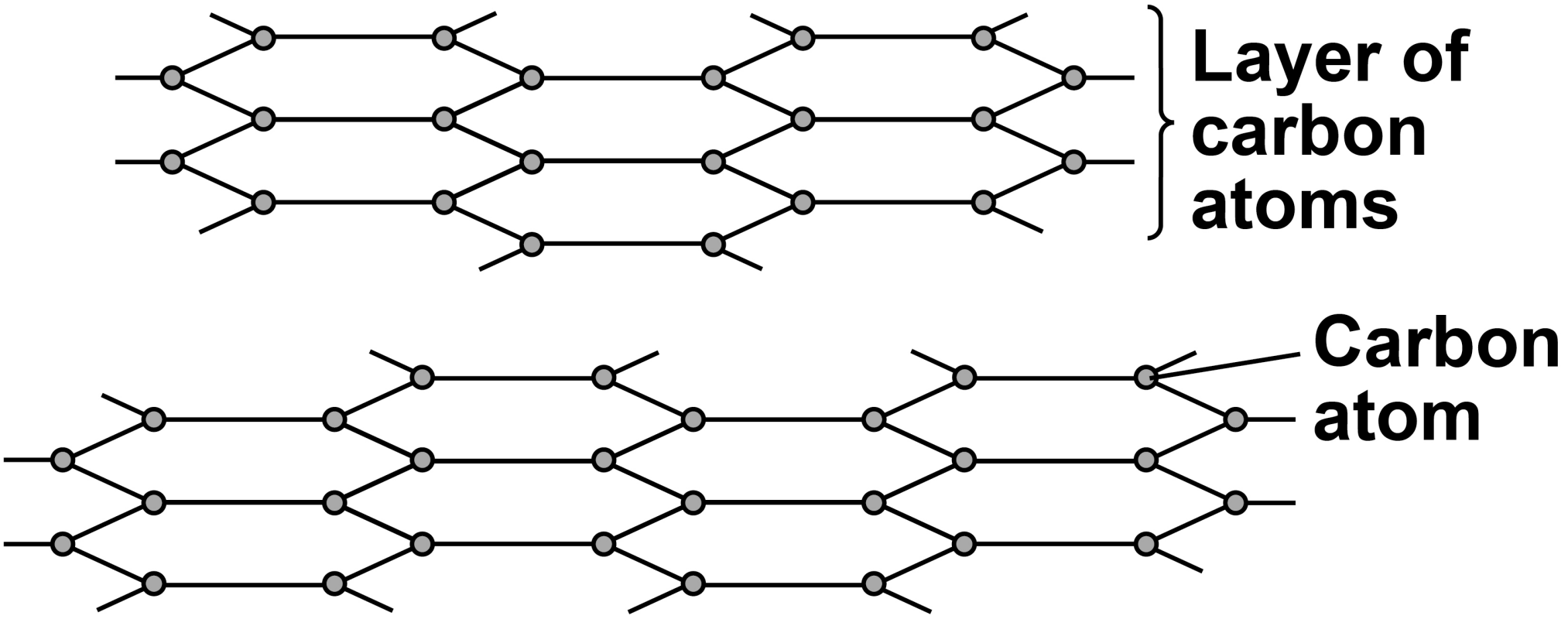
You should include the number of electrons, neutrons and protons. [6 marks]

[Turn over]

In graphite the carbon atoms are held together by bonds.

FIGURE 4 represents part of the structure of graphite.

FIGURE 4



0 3 . 3

How many bonds does each carbon atom have in graphite?

Use FIGURE 4. [1 mark]

Tick (✓) ONE box.

☐ **1**

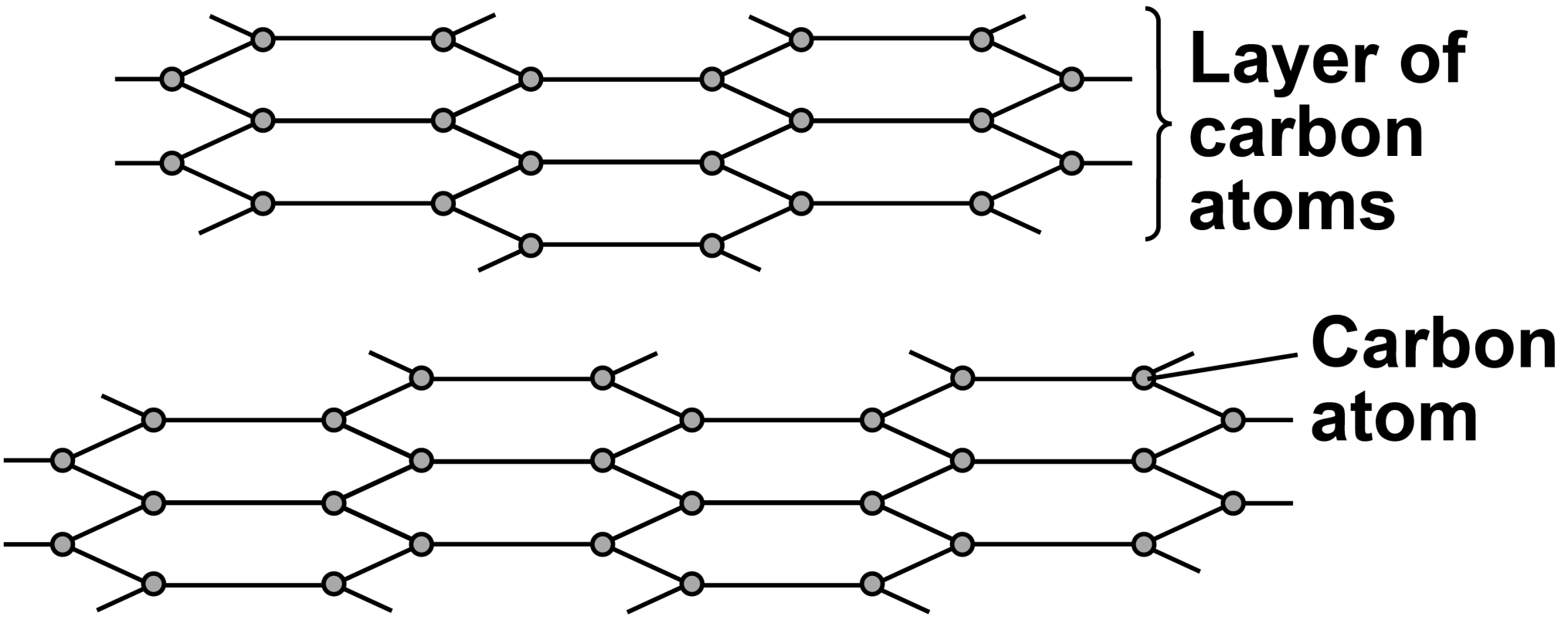
☐ **2**

☐ **3**

☐ **4**

[Turn over]

REPEAT OF FIGURE 4



0 3 . 4

What type of bonds hold the carbon atoms together in graphite? [1 mark]

Tick (✓) ONE box.

☐ **Covalent**

☐ **Ionic**

☐ **Metallic**

0 3 . 5

Lubricants allow objects to slide over each other easily.

Suggest why graphite can be used as a lubricant.

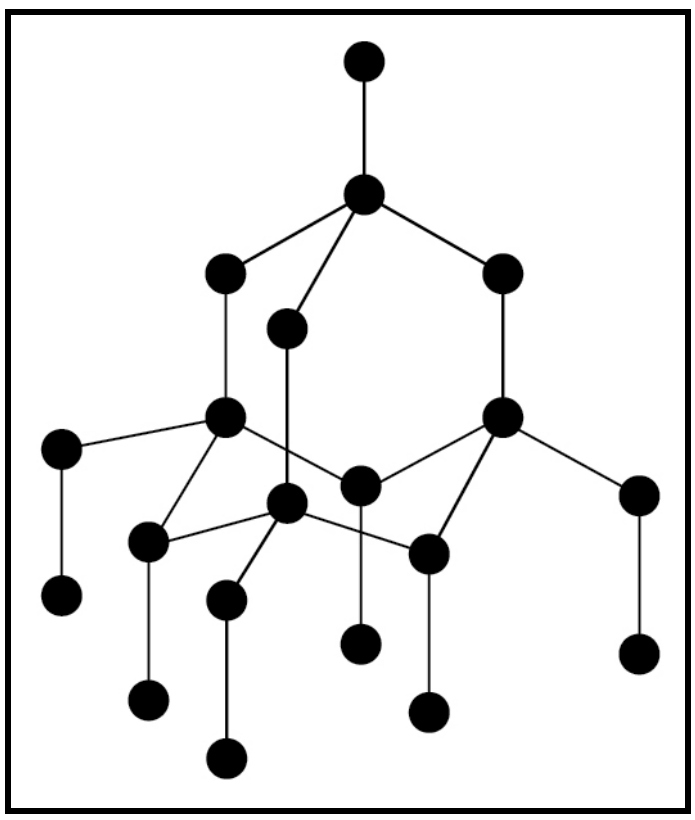
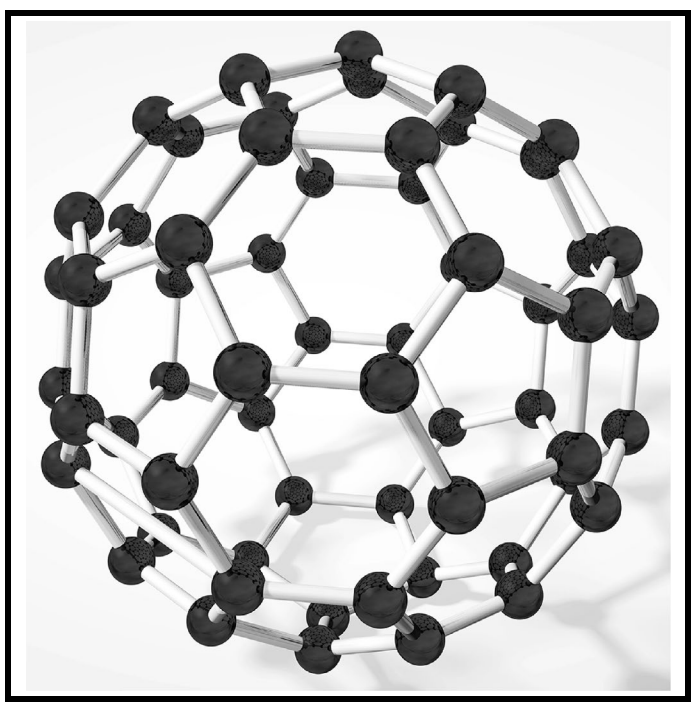
Use FIGURE 4. [1 mark]

0 3 . 6

The two structures, on the opposite page, represent different forms of carbon.

On the opposite page, draw ONE line from each structure to the form of carbon.

[2 marks]

STRUCTURE	FORM OF CARBON
	Buckminsterfullerene
	Diamond
	Graphene
	Nanotube

0 4

Sodium and potassium are Group 1 elements.

0 4 . 1

What is the name of Group 1 elements? [1 mark]

Tick (✓) ONE box.

☐ **Alkali metals**

☐ **Halogens**

☐ **Noble gases**

BLANK PAGE

[Turn over]

0 4 . 2

FIGURE 5, on the opposite page, represents the melting points of Group 1 elements.

What is the melting point of sodium?

[1 mark]

Melting point of sodium = _____ °C

0 4 . 3

Sodium reacts with water to produce sodium hydroxide and hydrogen.

Balance the equation for the reaction.

[1 mark]

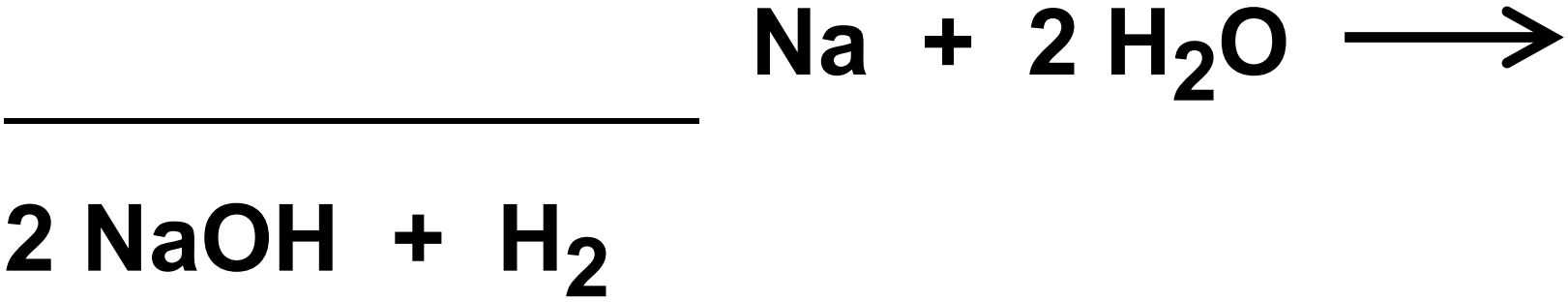
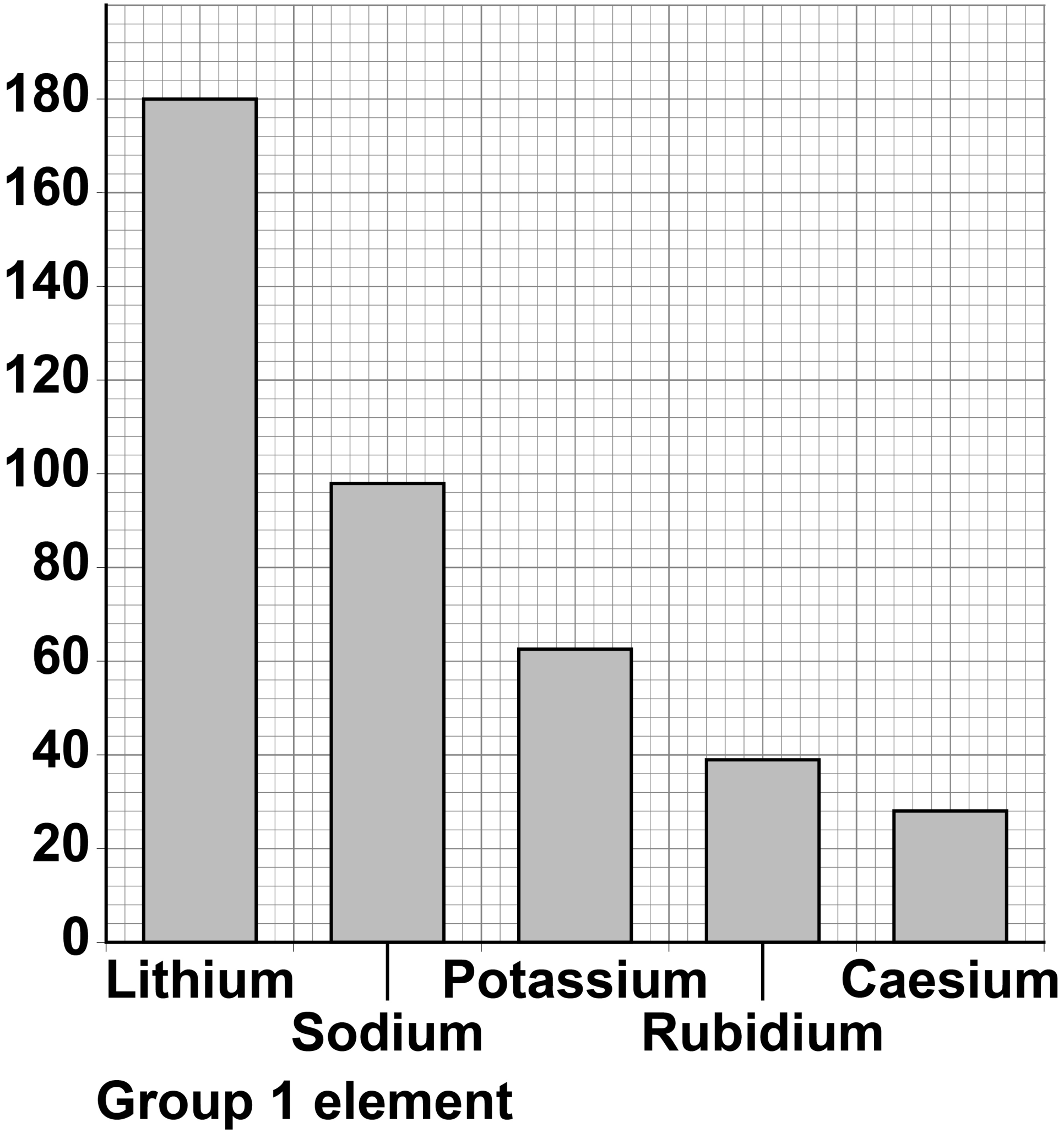


FIGURE 5


Melting point in °C
180
160
140
120
100
80
60
40
20
0
Lithium
Sodium
Potassium
Rubidium
Caesium
Group 1 element

0 4 . 4

Calculate the relative formula mass (M_r) of sodium hydroxide (NaOH).

Relative atomic masses (A_r):

H = 1 O = 16 Na = 23

[2 marks]

Relative formula mass (M_r) = _____

BLANK PAGE

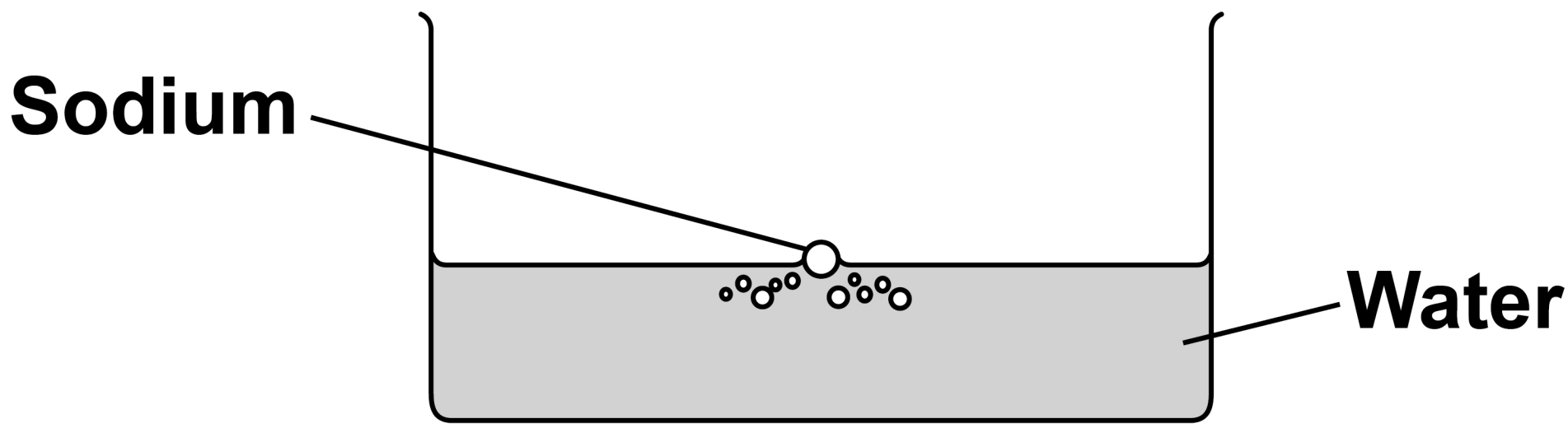
[Turn over]

0 4 . 5

Sodium and potassium both react with water.

FIGURE 6 shows sodium reacting with water.

FIGURE 6



Compare what is seen when sodium reacts with water and when potassium reacts with water. [4 marks]

[Turn over]

0 5

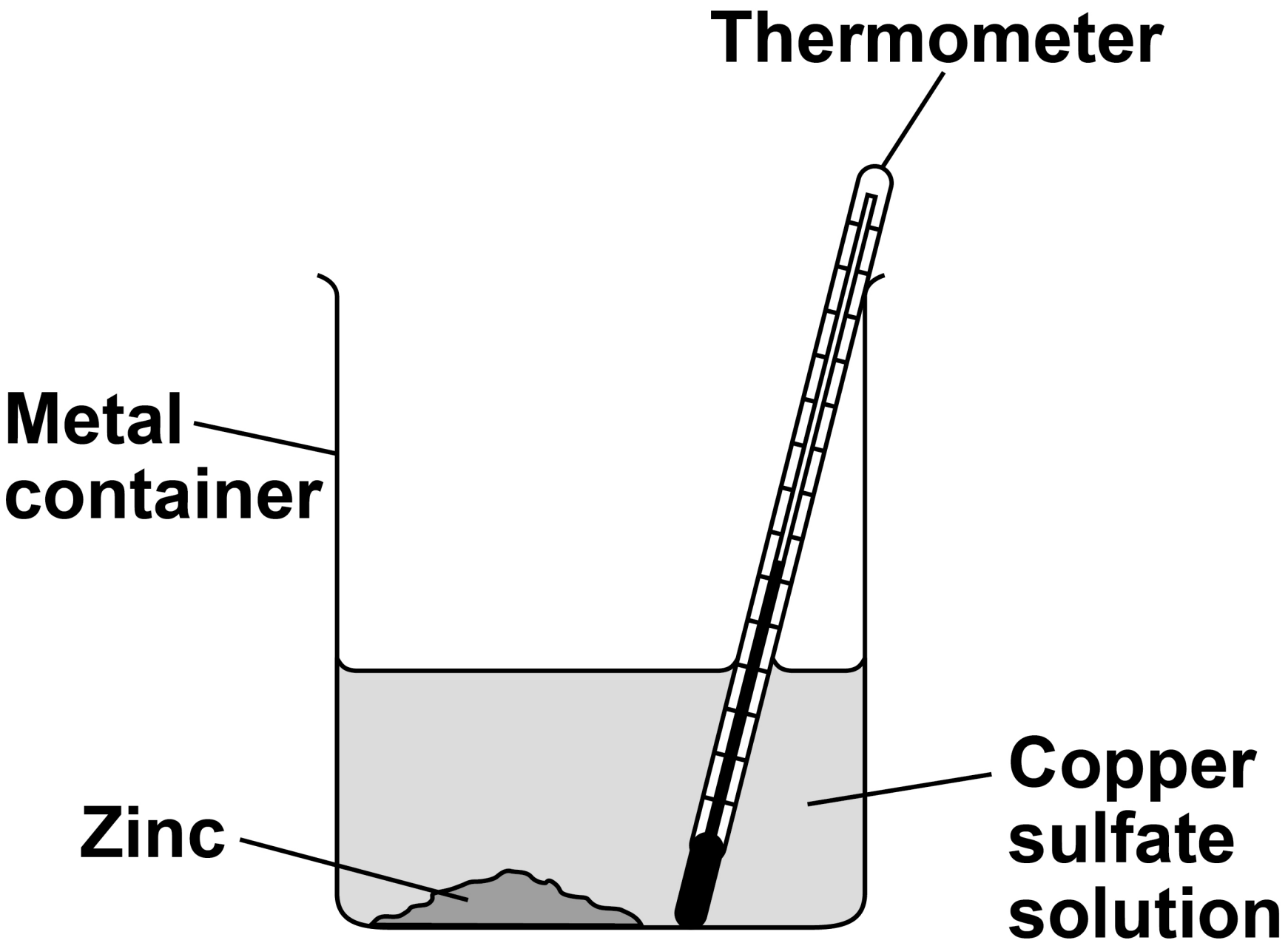
A student investigated the change in temperature when different masses of zinc were added to copper sulfate solution.

This is the method used.

1. **Measure the volume of copper sulfate solution using a measuring cylinder.**
2. **Pour the copper sulfate solution into a metal container.**
3. **Add 2 g of zinc.**
4. **Measure the temperature of the solution.**
5. **Repeat steps 1 to 4 with different masses of zinc.**

FIGURE 7, on the opposite page, shows the apparatus.

FIGURE 7



[Turn over]

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0 5 . 1

Give THREE improvements to the investigation to make the results more accurate. [3 marks]

1 _____

_____

2 _____

_____

_____

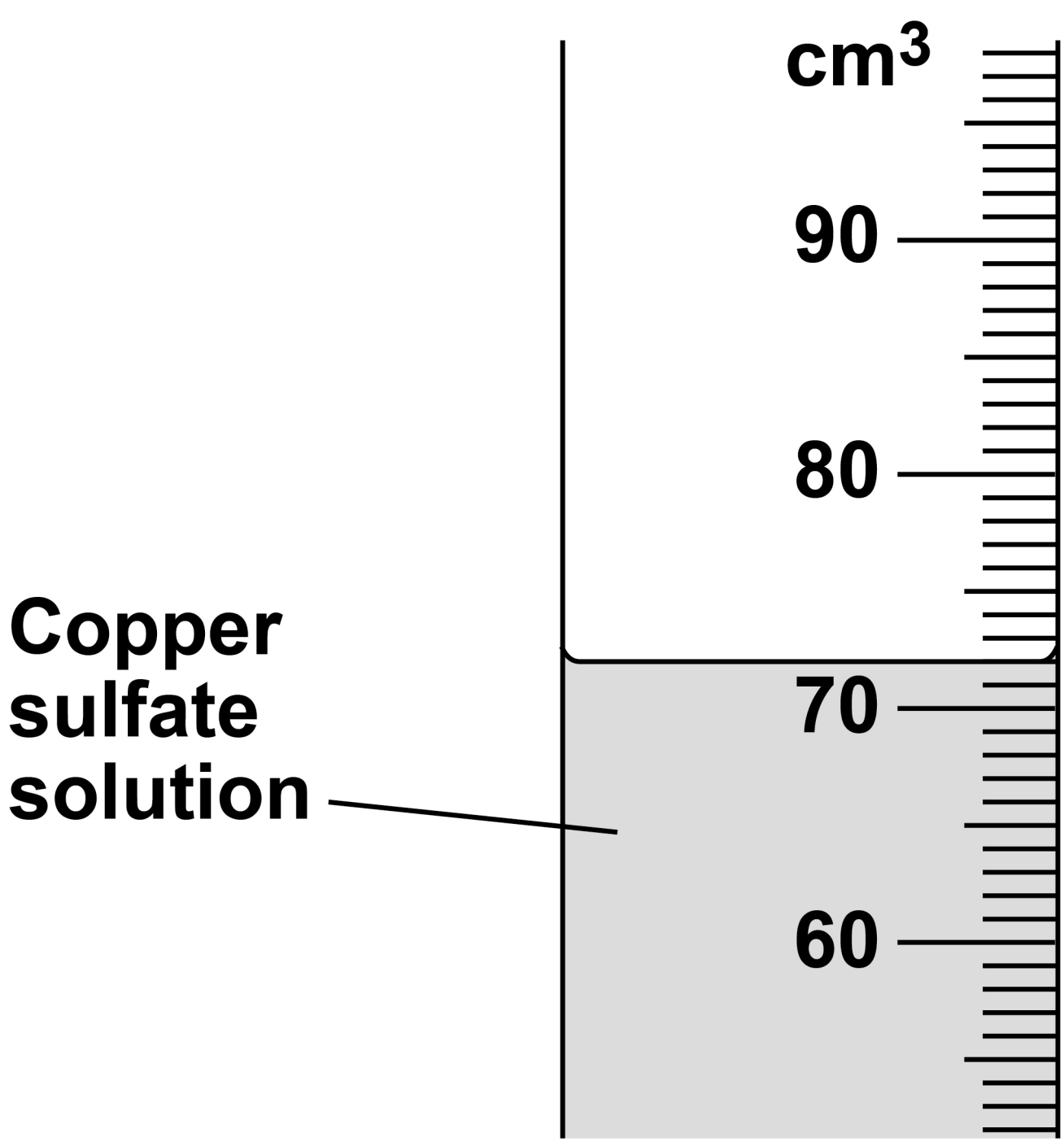
3 _____

_____

0 5 . 2

FIGURE 8 shows part of the measuring cylinder.

FIGURE 8



What is the volume of copper sulfate solution in FIGURE 8? [1 mark]

Volume = _____ cm^3

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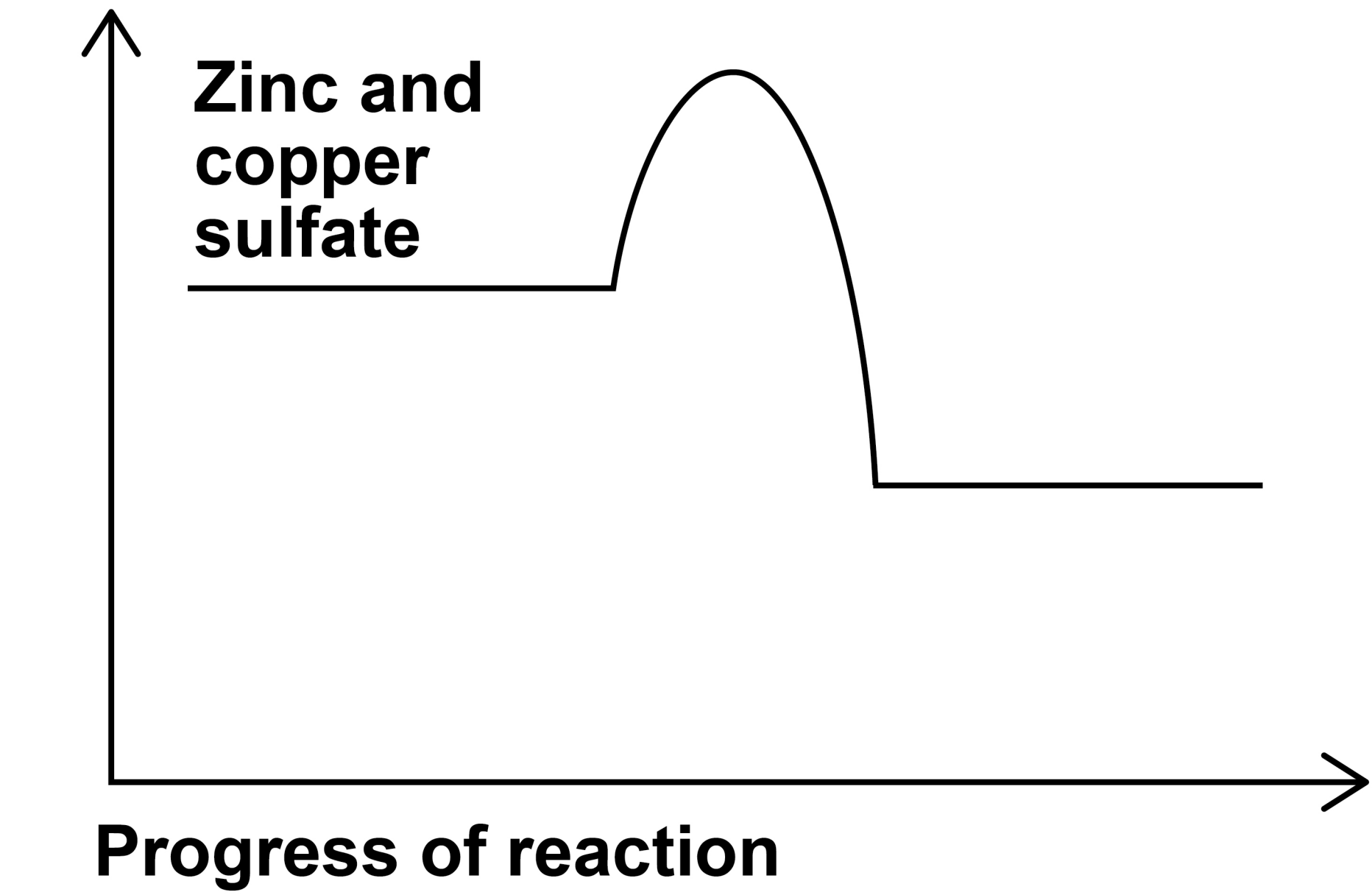
[Turn over]

0 5 . 3

When zinc was added to copper sulfate solution the temperature increased.

FIGURE 9 shows the reaction profile.

FIGURE 9



What type of reaction is shown in FIGURE 9? [1 mark]

Tick (✓) ONE box.

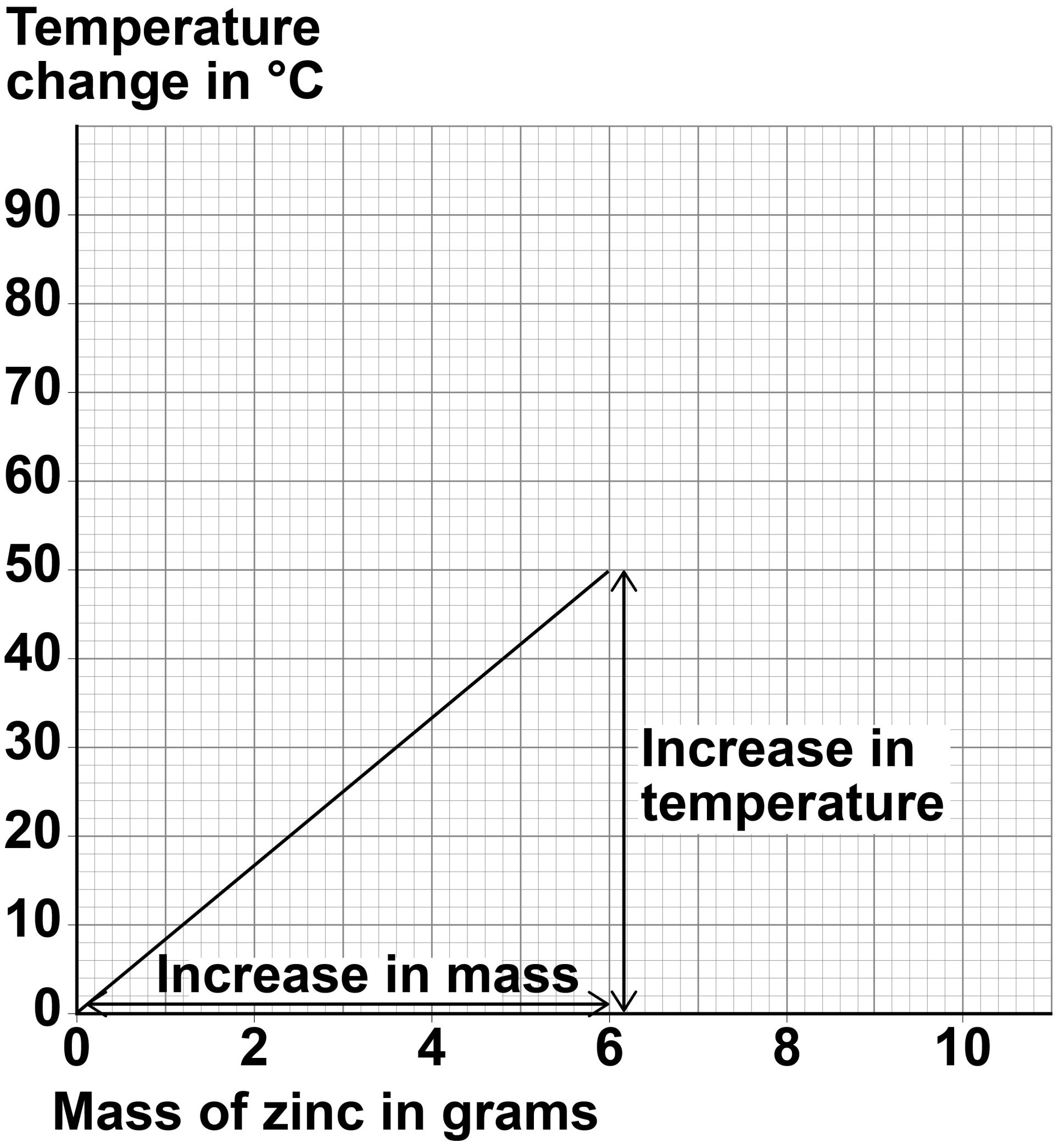
☐ **Endothermic**

☐ **Exothermic**

☐ **Neutralisation**

FIGURE 10 shows the results.

FIGURE 10



0 5 . 4

Determine the gradient of the line in FIGURE 10.

Use the equation:

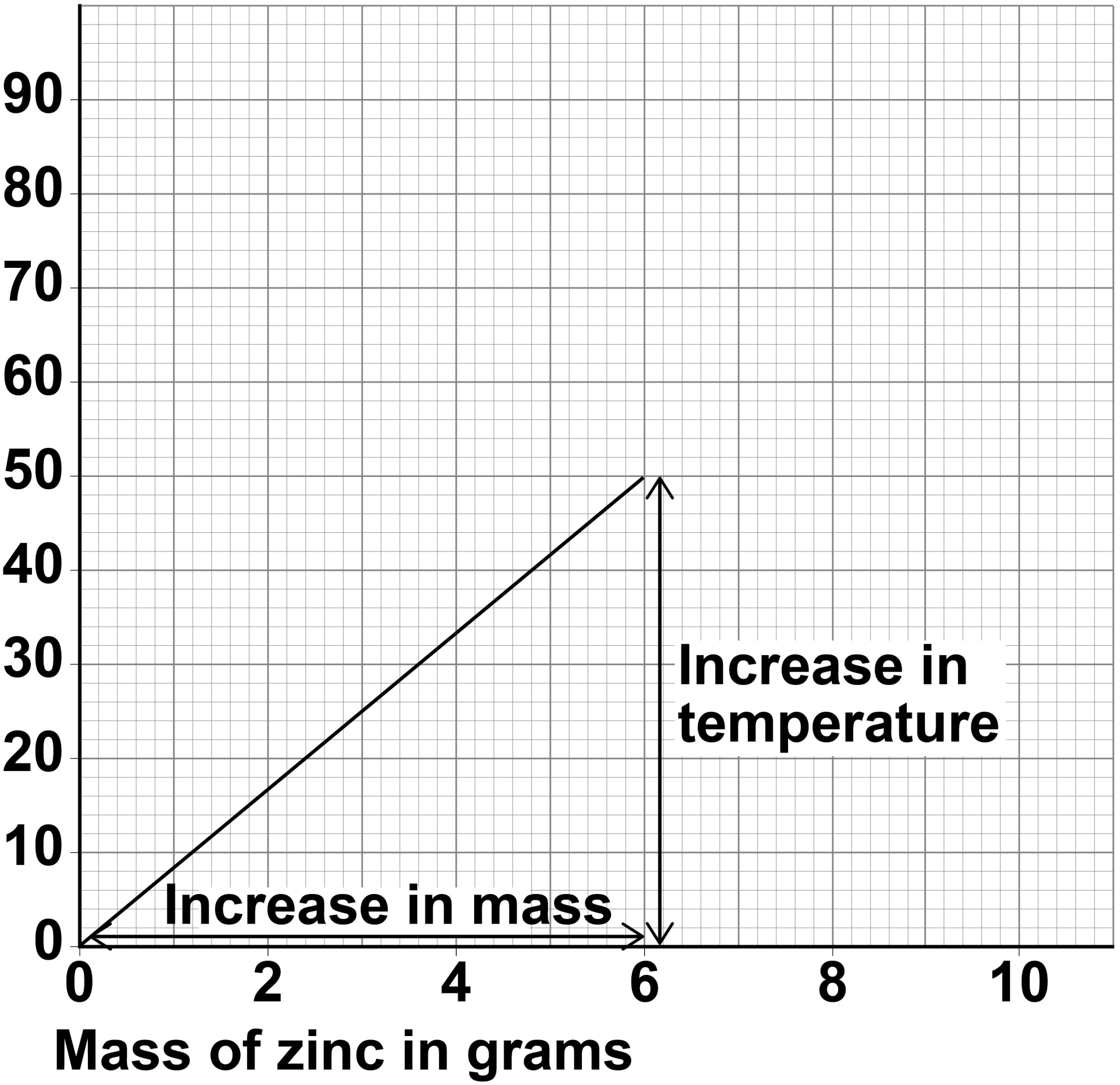
$$\text{gradient} = \frac{\text{increase in temperature in °C}}{\text{increase in mass in grams}}$$

[4 marks]

Gradient = _____ °C per g

[Turn over]

REPEAT OF FIGURE 10



0 5 . 5

Suggest why the student should NOT use more than 10 g of zinc.

Use FIGURE 10.

You should extend the graph line.
[2 marks]

0 6

This question is about the periodic table.

0 6 . 1

FIGURE 11, on the opposite page, shows part of Mendeleev's version of the periodic table.

Which group of elements had NOT been discovered when Mendeleev's version of the periodic table was published? [1 mark]

FIGURE 11

H							
Li	Be	B	C	N	O	F	
Na	Mg	Al	Si	P	S	Cl	
K Cu	Ca Zn		Ti	V As	Cr Se	Mn Br	Fe Co Ni
Rb Ag	Sr Cd	Y In	Zr Sn	Nb Sb	Mo Te	I	Ru Rh Pd

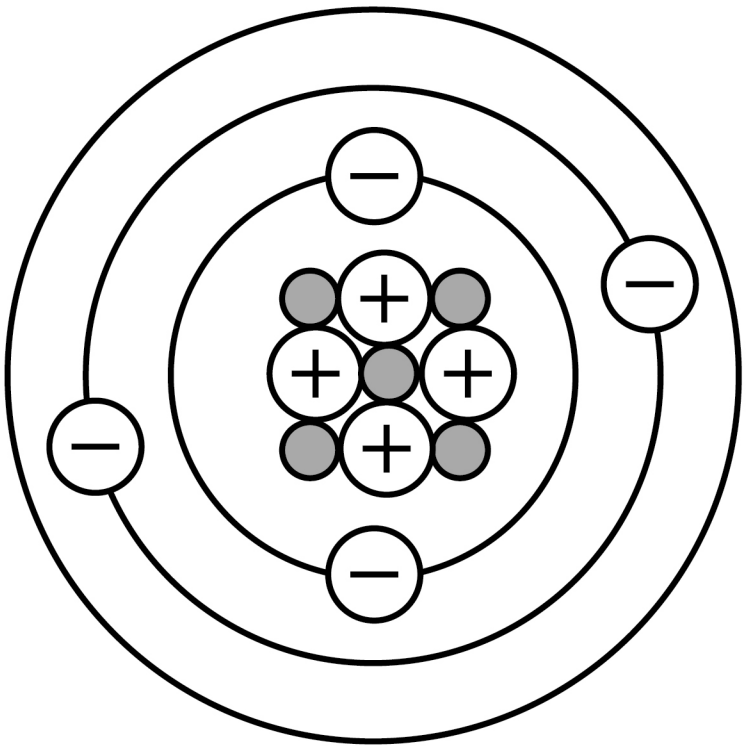
53

[Turn over]

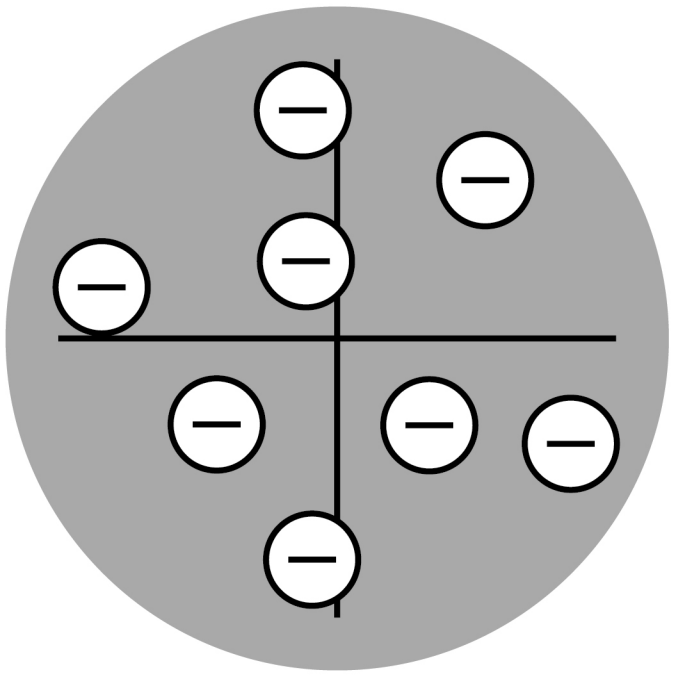
FIGURE 12 represents different models of the atom.

FIGURE 12

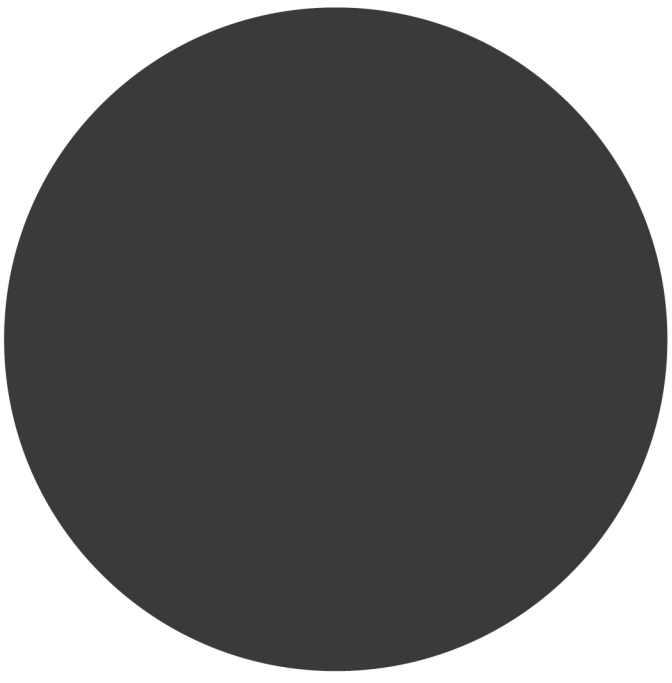
A



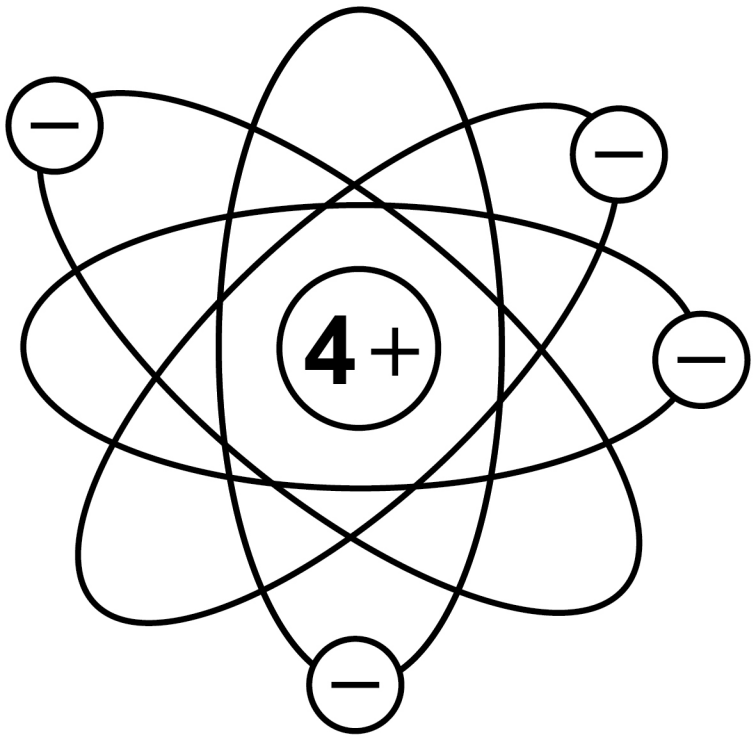
B



C



D



0 6 . 2

Which model represents the plum pudding model? [1 mark]

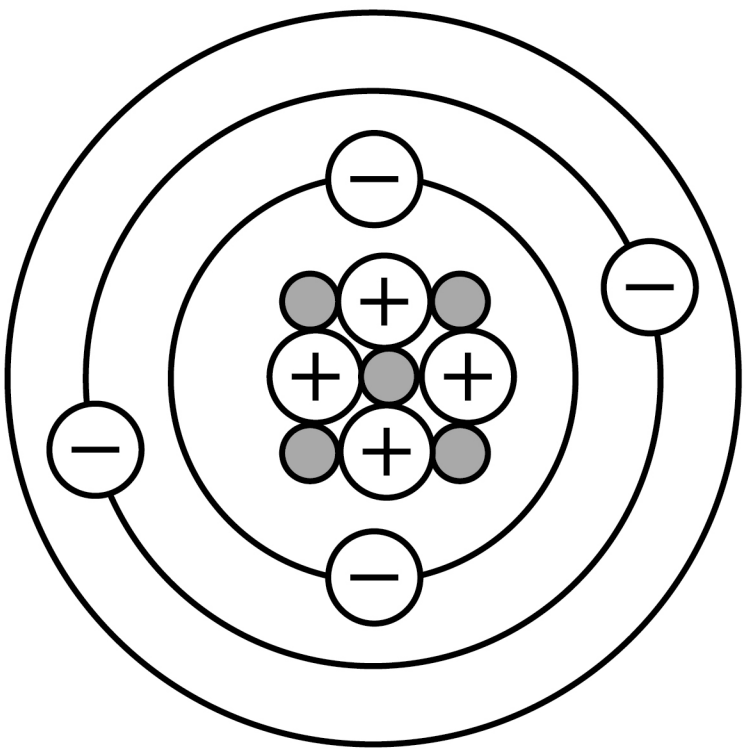
Tick (✓) ONE box.

- ☐ **A**
- ☐ **B**
- ☐ **C**
- ☐ **D**

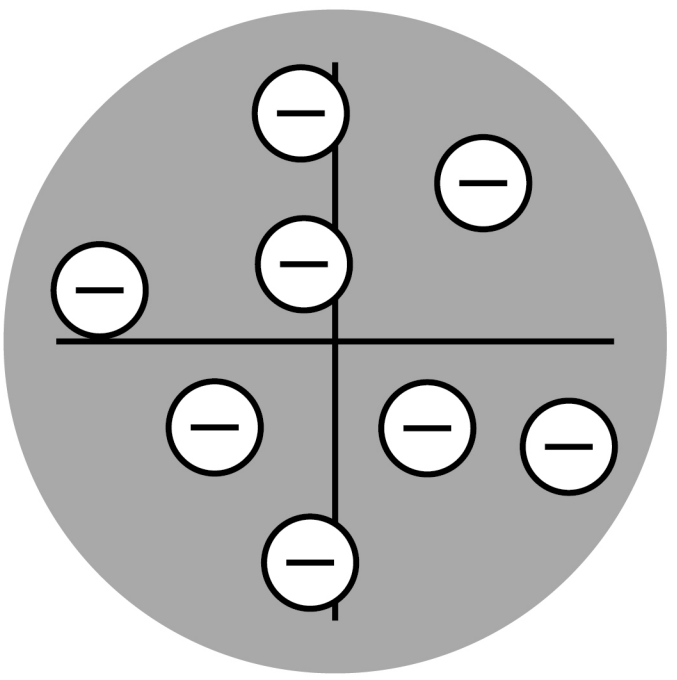
[Turn over]

REPEAT OF FIGURE 12

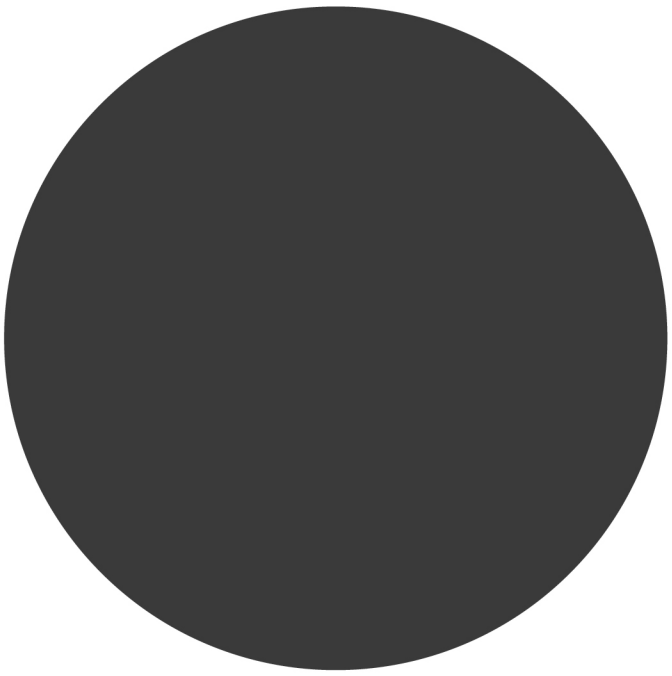
A



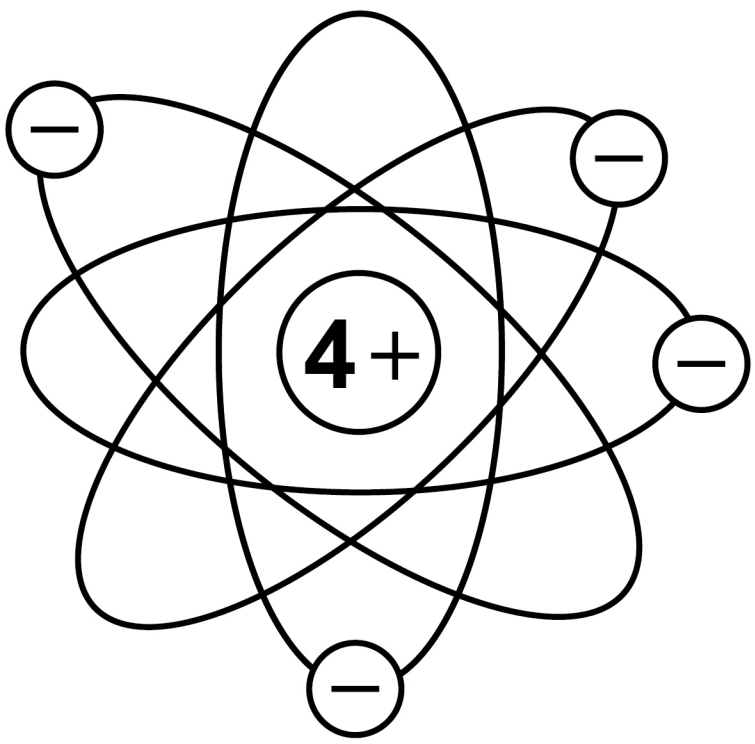
B



C



D



0 6 . 3

Which model resulted from Chadwick's experimental work? [1 mark]

Tick (✓) ONE box.

☐ **A**

☐ **B**

☐ **C**

☐ **D**

[Turn over]

Potassium has different isotopes.

0 6 . 4

What is meant by ‘isotopes’?

You should refer to subatomic particles.
[2 marks]

BLANK PAGE

[Turn over]

0 6 . 5

TABLE 2 shows the mass numbers and the percentage abundance of two isotopes of potassium.

TABLE 2

Mass number	Percentage abundance
39	93.1
41	6.9

Calculate the relative atomic mass (A_r) of potassium.

Give your answer to 1 decimal place.
[3 marks]

Relative atomic mass (1 decimal place) =

[Turn over]

8

0 7

Acids react to produce salts.

Universal indicator is added to water and then nitric acid is added to the mixture.

0 7 . 1

Give the colour change when nitric acid is added to the mixture of universal indicator and water. [1 mark]

Tick (✓) ONE box.

☐ **Blue to red**

☐ **Green to purple**

☐ **Green to red**

☐ **Red to purple**

0 7 . 2

What happens to the pH of water when nitric acid is added? [1 mark]

Tick (✓) ONE box.

☐ **Decreases**

☐ **Stays the same**

☐ **Increases**

0 7 . 3

What is the state symbol for nitric acid? [1 mark]

[Turn over]

Zinc carbonate reacts with nitric acid.

The word equation for the reaction is:

zinc carbonate + nitric acid ⟶ zinc nitrate + water + carbon dioxide

white solid **colourless solution**

0 7 . 4

Give TWO observations that would be made when zinc carbonate is added to nitric acid until the zinc carbonate is in excess. [2 marks]

1 _____

_____

2 _____

6

[Turn over]

0 7 . 5

The formula of the zinc ion is Zn^{2+}

The formula of the nitrate ion is NO_3^-

What is the formula for zinc nitrate?

[1 mark]

Tick (✓) ONE box.

- ☐ **$ZnNO_3$**
- ☐ **$Zn(NO_3)_2$**
- ☐ **Zn_2NO_3**
- ☐ **$Zn_2(NO_3)_2$**

BLANK PAGE

[Turn over]

0 7 . 6

Acids react with insoluble metal oxides to produce salts.

Plan a method to produce a pure, dry sample of the soluble salt copper chloride from an acid and a metal oxide. [6 marks]

END OF QUESTIONS

12

Additional page, if required.

Write the question numbers in the left-hand margin.

Additional page, if required.

Write the question numbers in the left-hand margin.

Additional page, if required.

Write the question numbers in the left-hand margin.

Additional page, if required.

Write the question numbers in the left-hand margin.

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Question	Mark
1	
2	
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6	
7	
TOTAL	

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