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**

[Turn over]

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 = _____ %

[Turn over]

Magnesium carbonate decomposes to produce magnesium oxide and carbon dioxide.

The word equation for the reaction is:

magnesium carbonate ⟶ 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

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[Turn over]

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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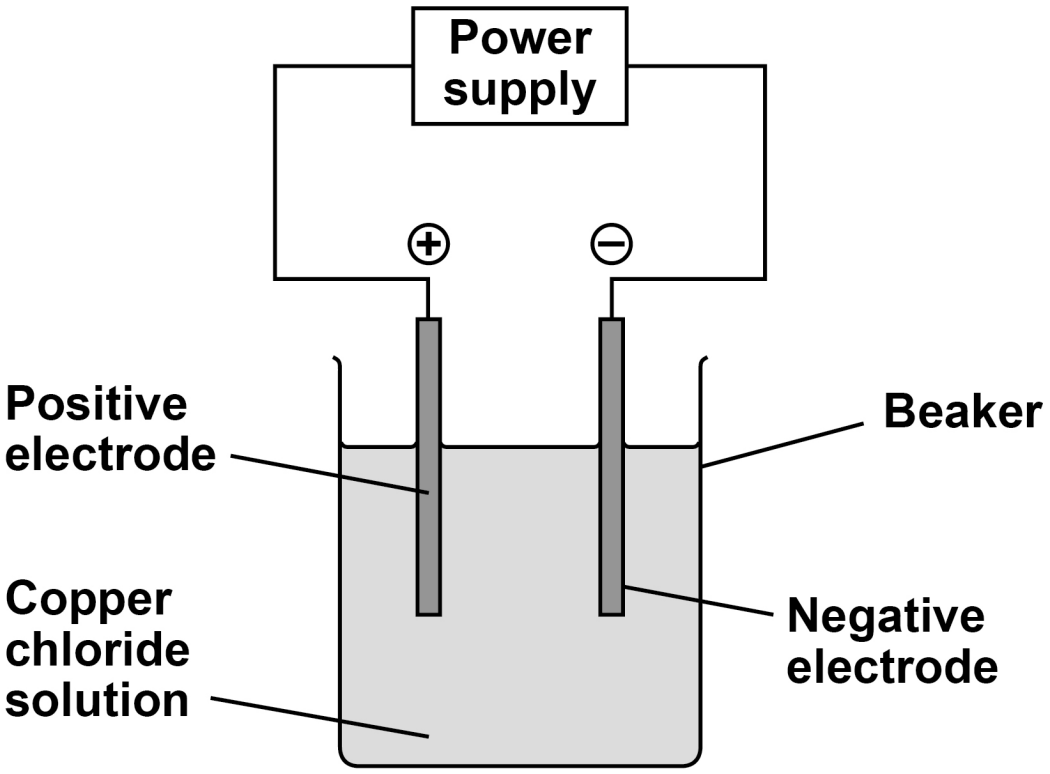
[Turn over]

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.

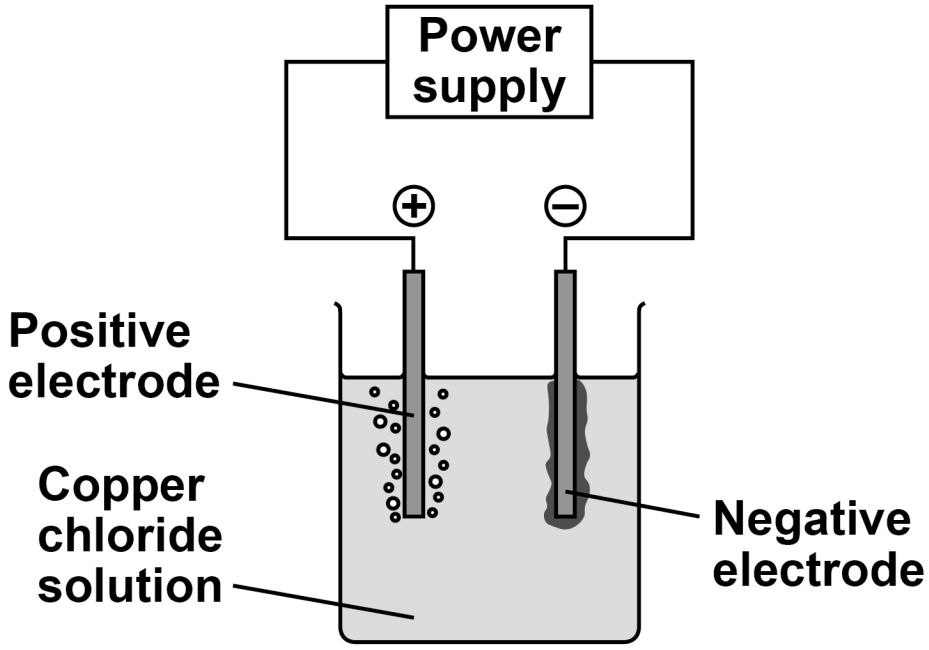
- ☐ Cu^{2+}
- ☐ Cl^{-}
- ☐ H^{+}
- ☐ OH^{-}

[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**

[Turn over]

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**

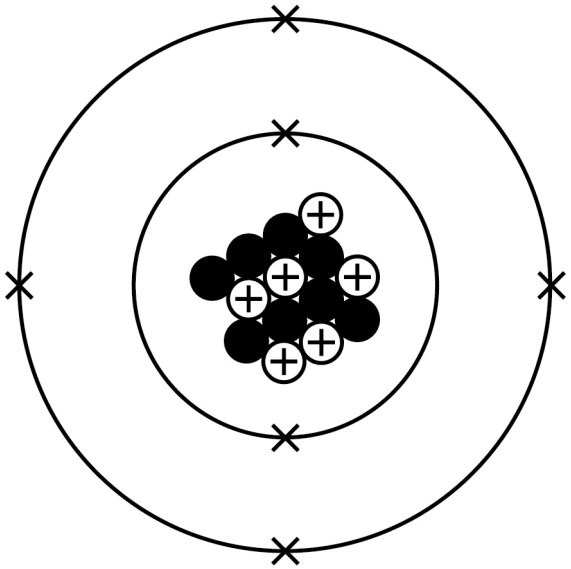
BLANK PAGE

[Turn over]

0 3 . 2

FIGURE 3 shows an atom of carbon.

FIGURE 3



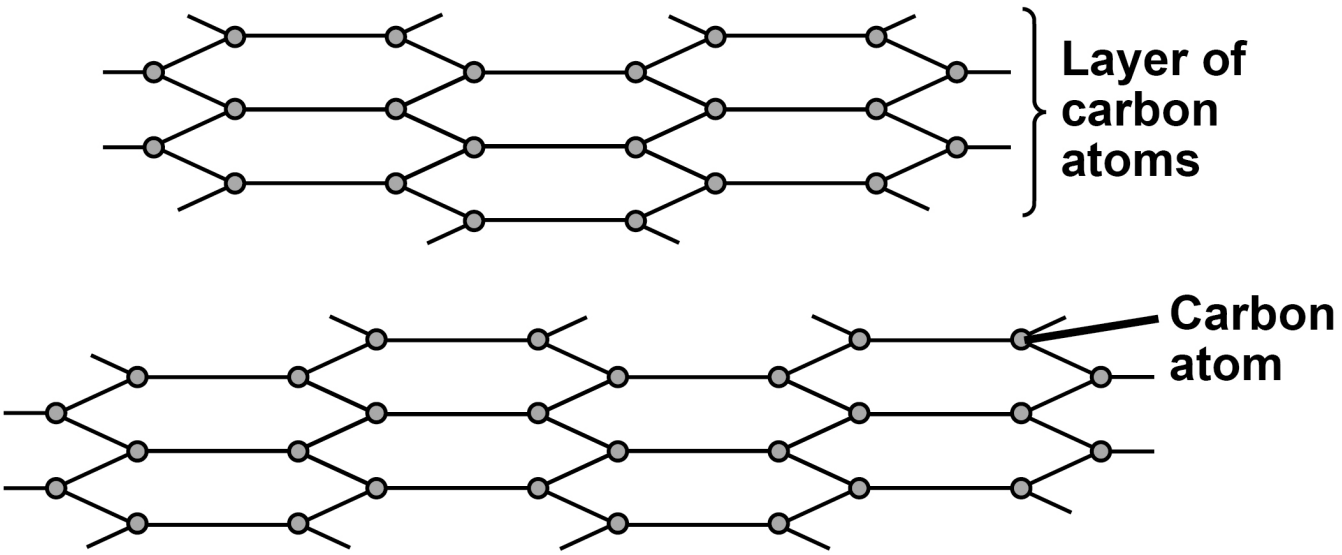
Describe the atomic structure of this carbon atom.

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

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?

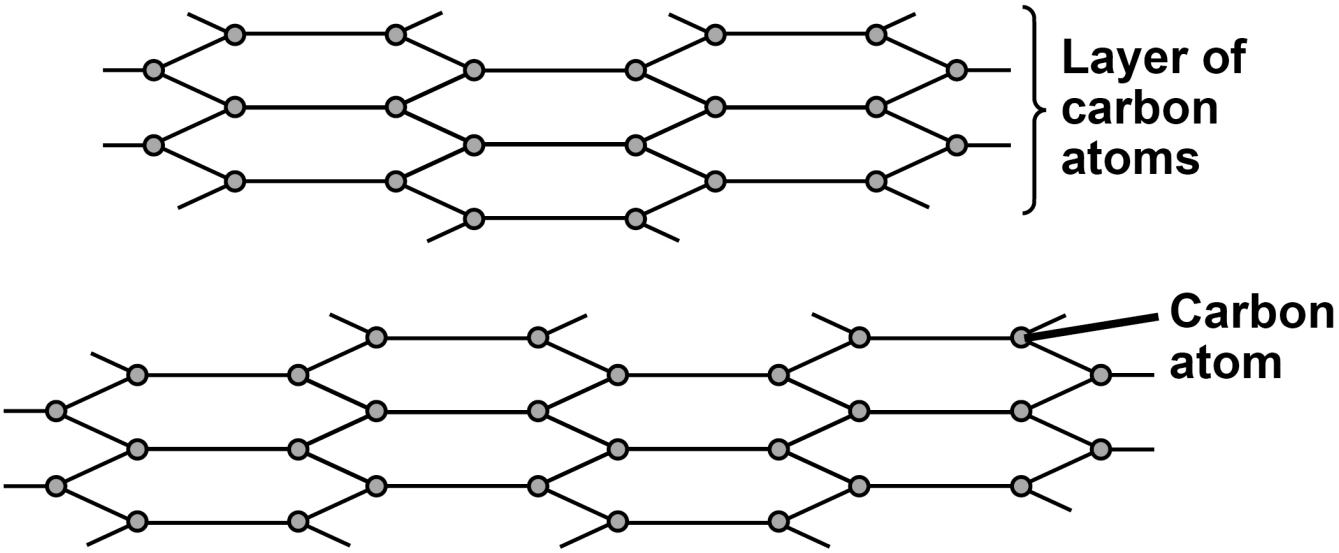
Use FIGURE 4. [1 mark]

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.

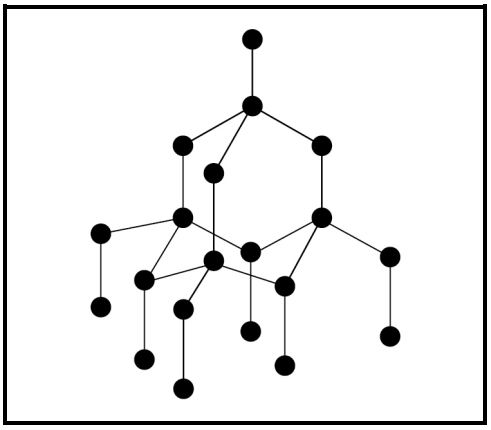
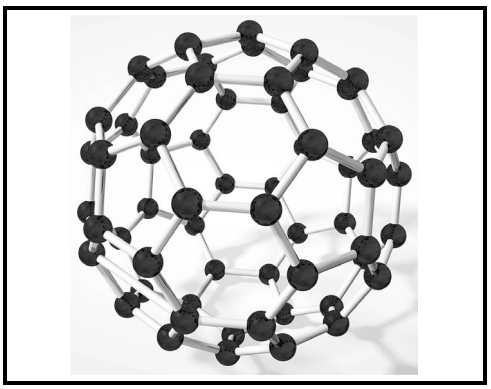
Suggest why graphite can be used as a lubricant.

Use FIGURE 4. [1 mark]

0 3 . 6

The two structures represent different forms of carbon.

Draw ONE line from each structure to the form of carbon. [2 marks]

STRUCTURE	FORM OF CARBON
	Buckminsterfullerene
	Diamond
	Graphene
	Nanotube

12

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**

[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

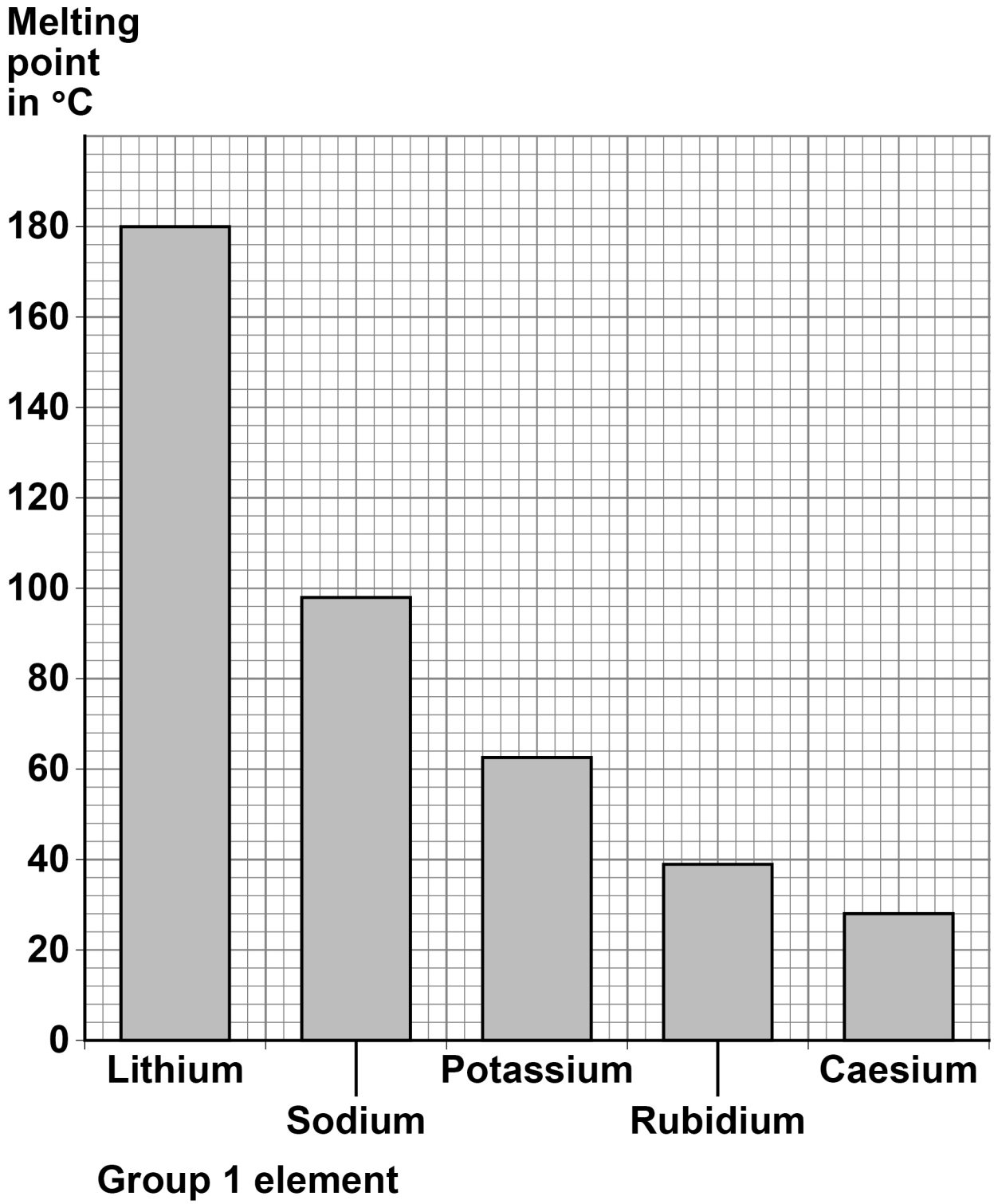
0 4 . 3

Sodium reacts with water to produce sodium hydroxide and hydrogen.

Balance the equation for the reaction. [1 mark]

_____ $Na + 2\,H_2O \longrightarrow 2\,NaOH + H_2$

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]

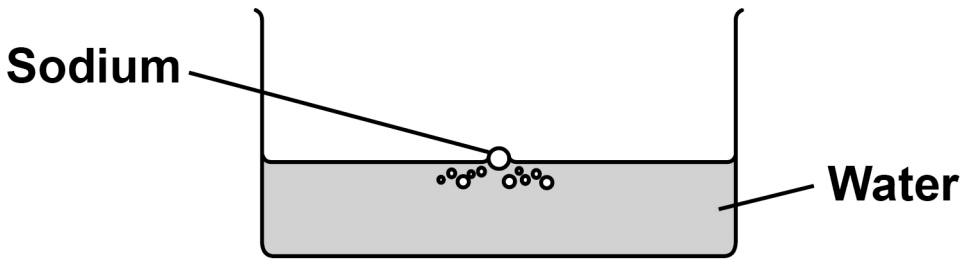
Relative formula mass (M_r) = _____

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]

9

0 5

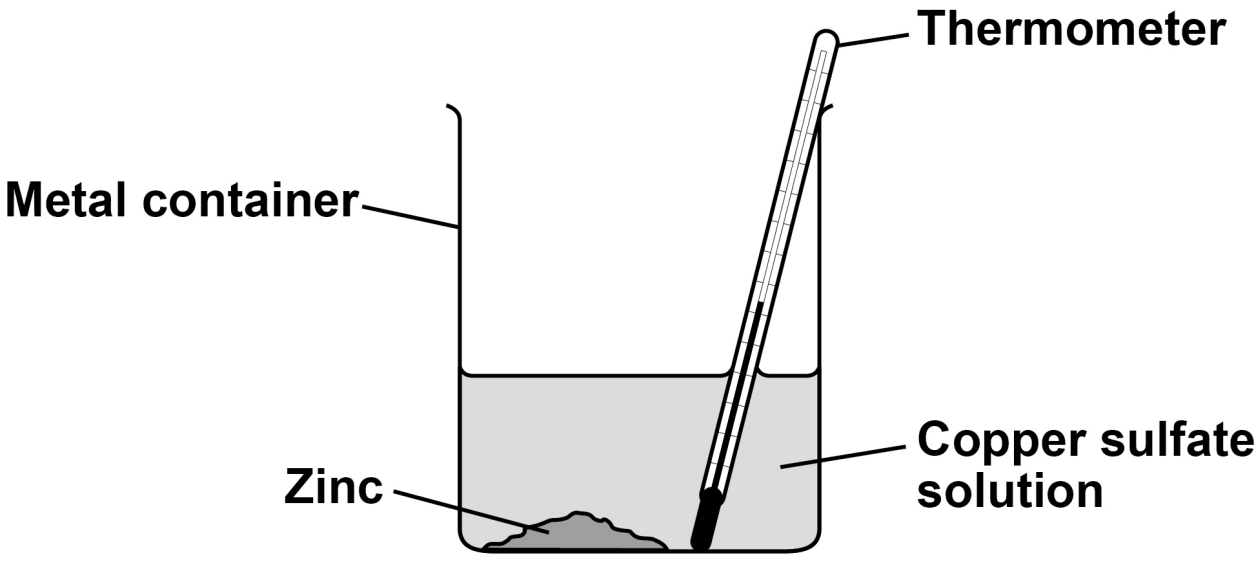
A student investigated the change in temperature when different masses of zinc were added to copper sulfate solution.

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 shows the apparatus.

FIGURE 7



0 5 . 1

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

1 _____

_____

_____

2 _____

_____

_____

3 _____

_____

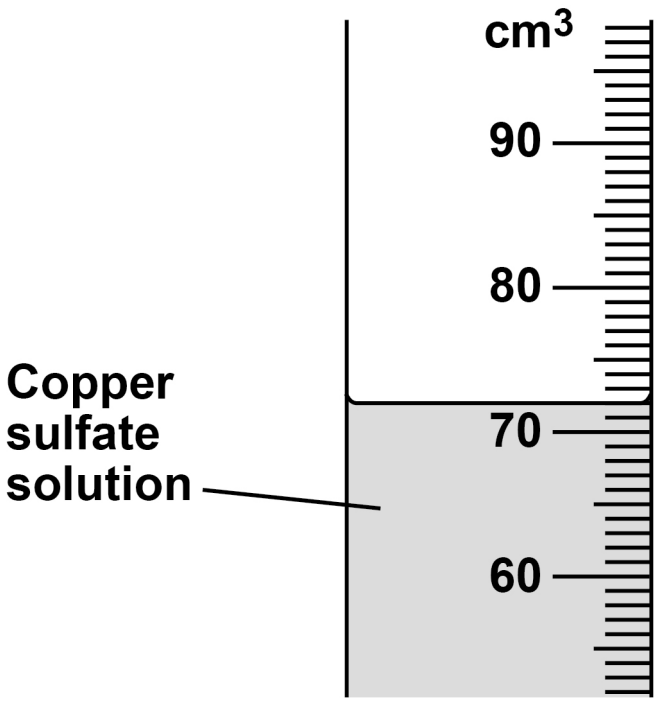
_____

[Turn over]

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]

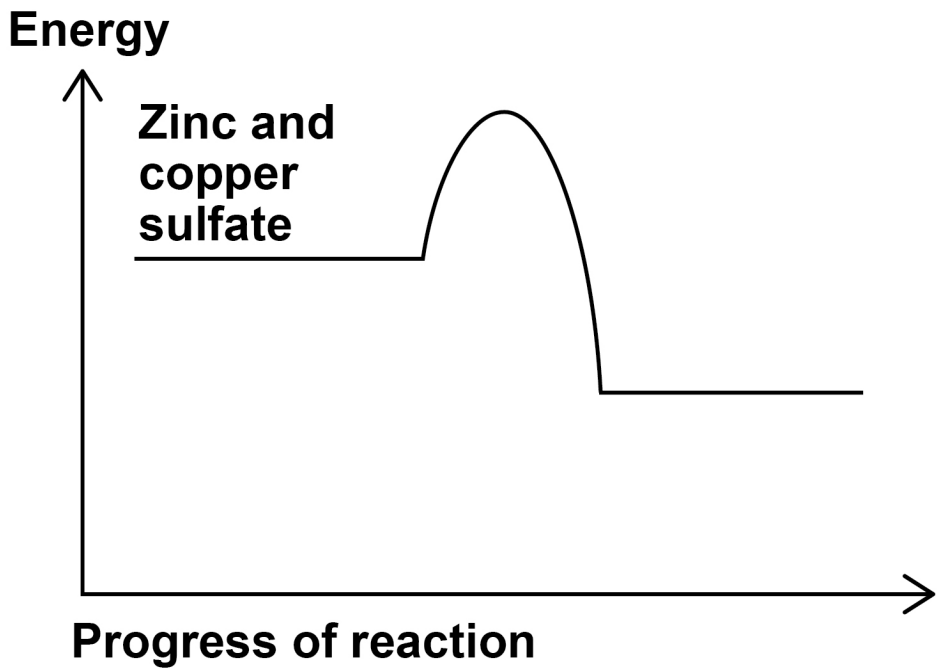
Volume = _____ cm^3

0 5 . 3

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

FIGURE 9, on the opposite page, shows the reaction profile.

FIGURE 9



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

Tick (✓) ONE box.

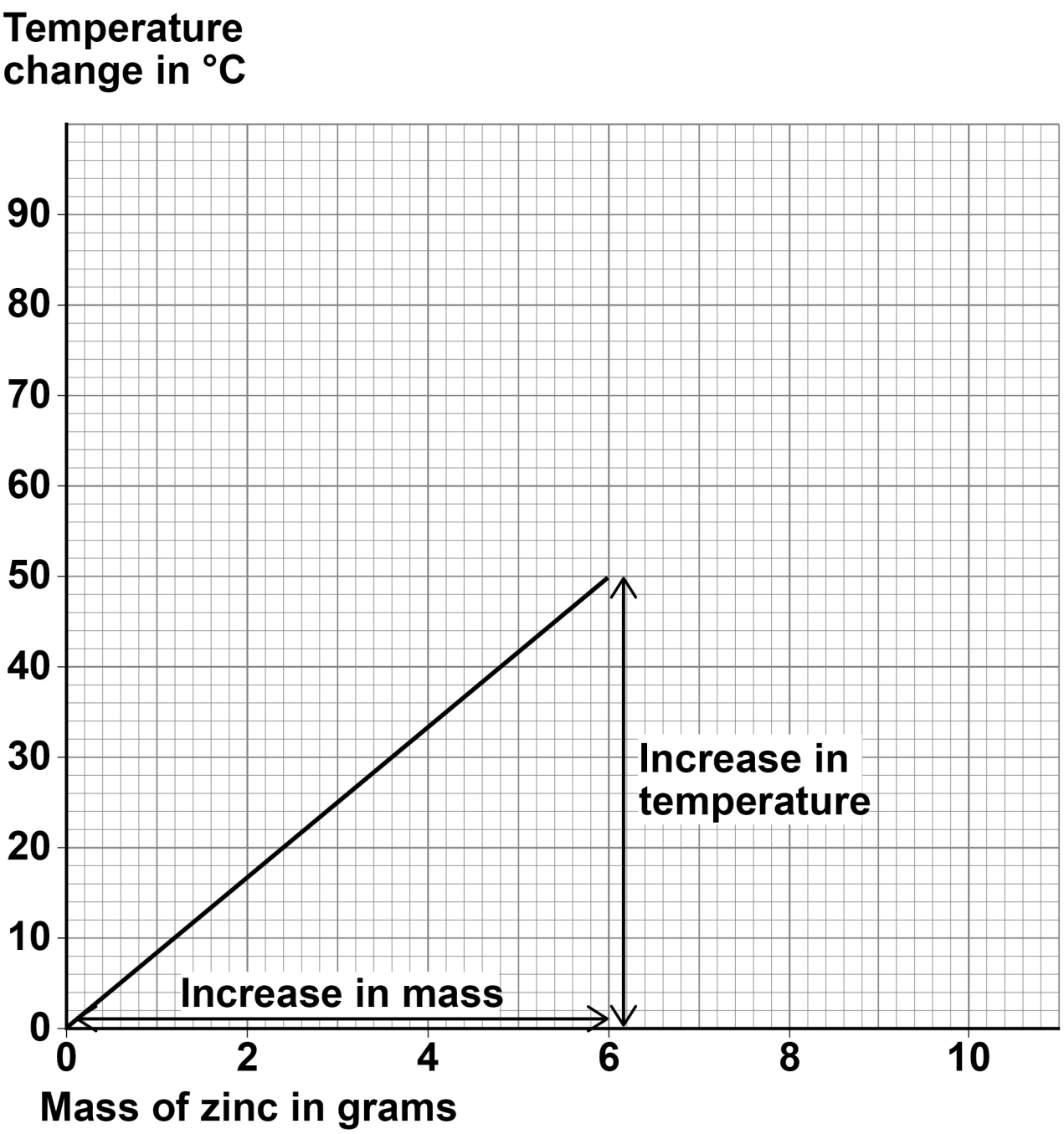
☐ **Endothermic**

☐ **Exothermic**

☐ **Neutralisation**

FIGURE 10 shows the results.

FIGURE 10



0 5 . 4

Determine the gradient of the line in FIGURE 10.

Use the equation:

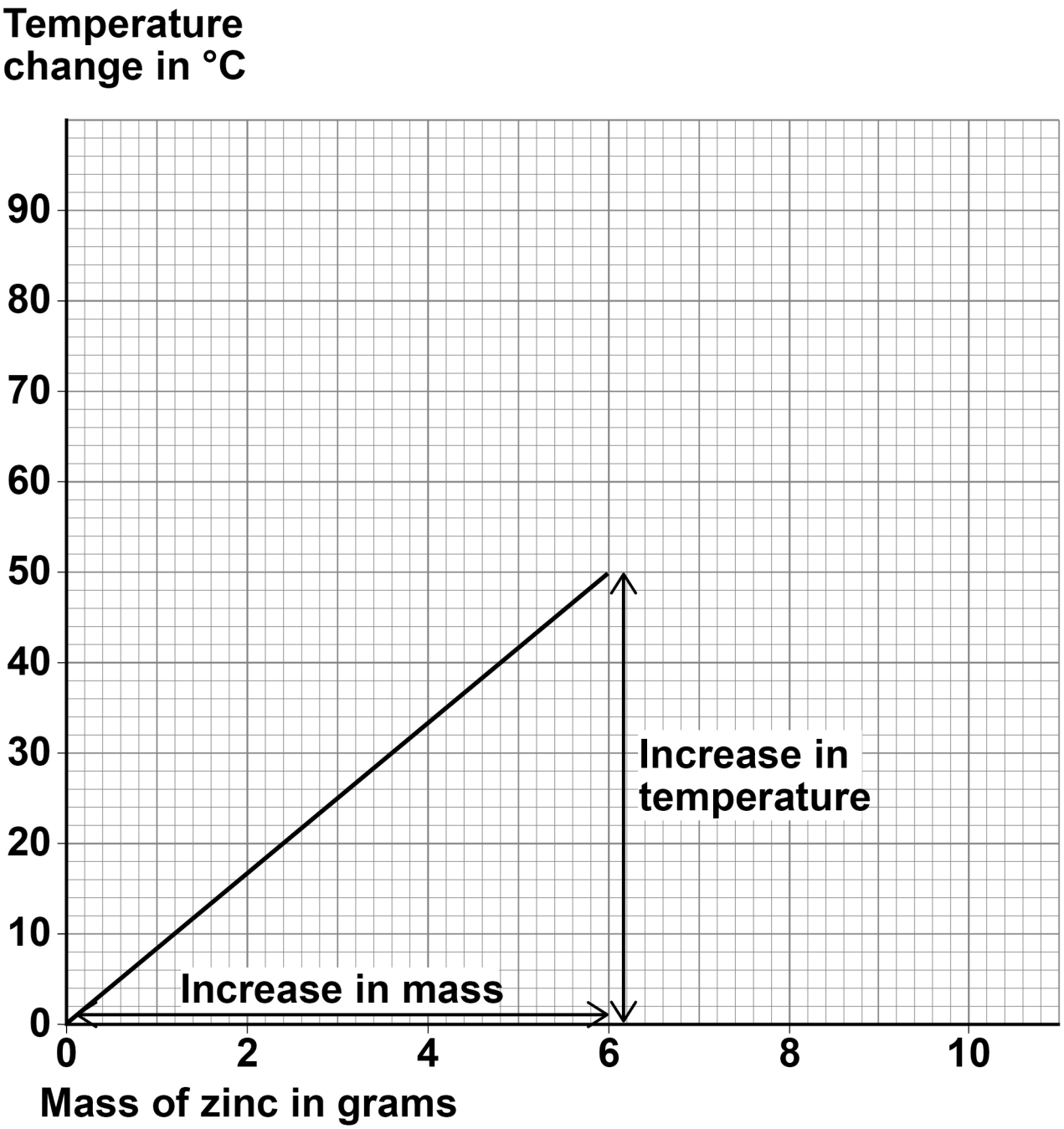
$$\text{gradient} = \frac{\text{increase in temperature in °C}}{\text{increase in mass in grams}}$$

[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]

11

0 6

This question is about the periodic table.

0 6 . 1

FIGURE 11 shows part of Mendeleev's version of the periodic table.

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

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

_____

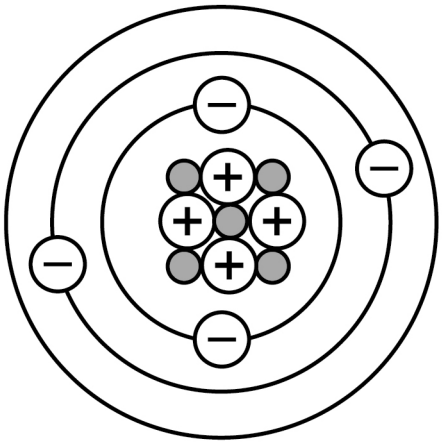
_____

[Turn over]

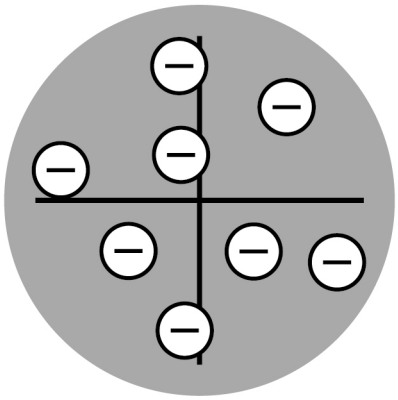
FIGURE 12 represents different models of the atom.

FIGURE 12

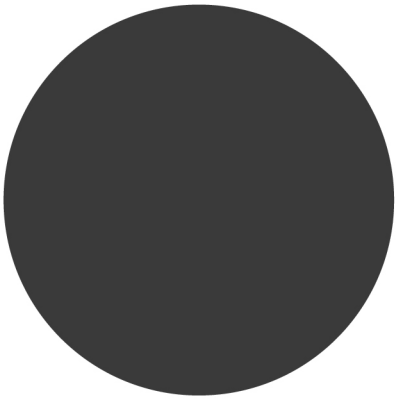
A



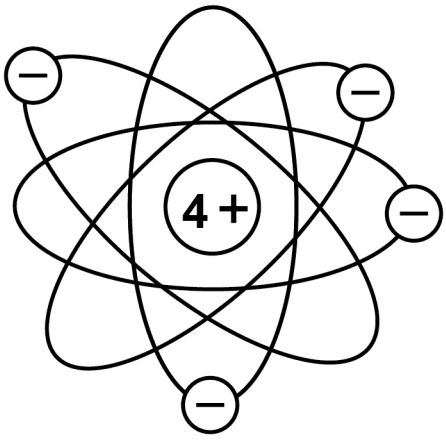
B



C



D



0 6 . 2

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

Tick (✓) ONE box.

☐ **A**

☐ **B**

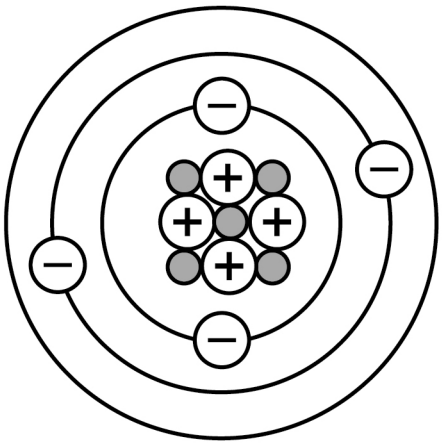
☐ **C**

☐ **D**

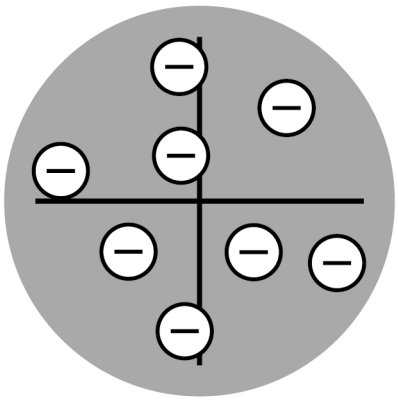
[Turn over]

REPEAT OF FIGURE 12

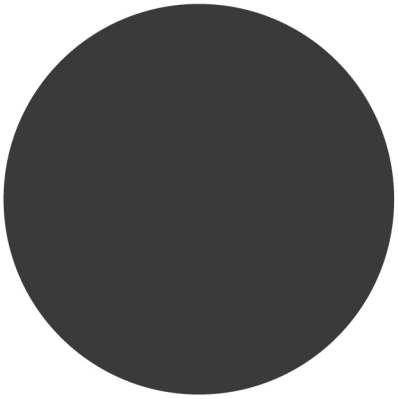
A



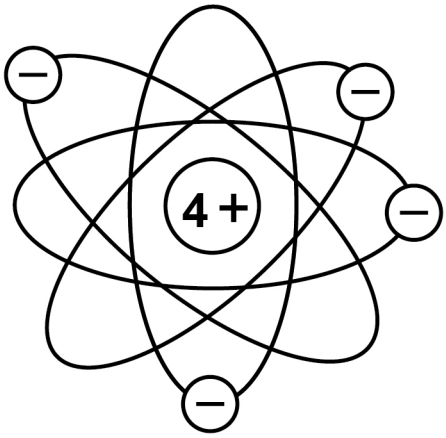
B



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]

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 _____

_____

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**
- ☐ **$Zn_2(NO_3)_2$**

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