

AQA **Surname** _____**Other Names** _____**Centre Number** _____**Candidate Number** _____**Candidate Signature** _____**GCSE****COMBINED SCIENCE: TRILOGY****Higher Tier****Chemistry Paper 1H****8464/C/1H****H****Thursday 17 May 2018****Morning****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.**
- **Answer ALL questions in the spaces provided.**
- **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



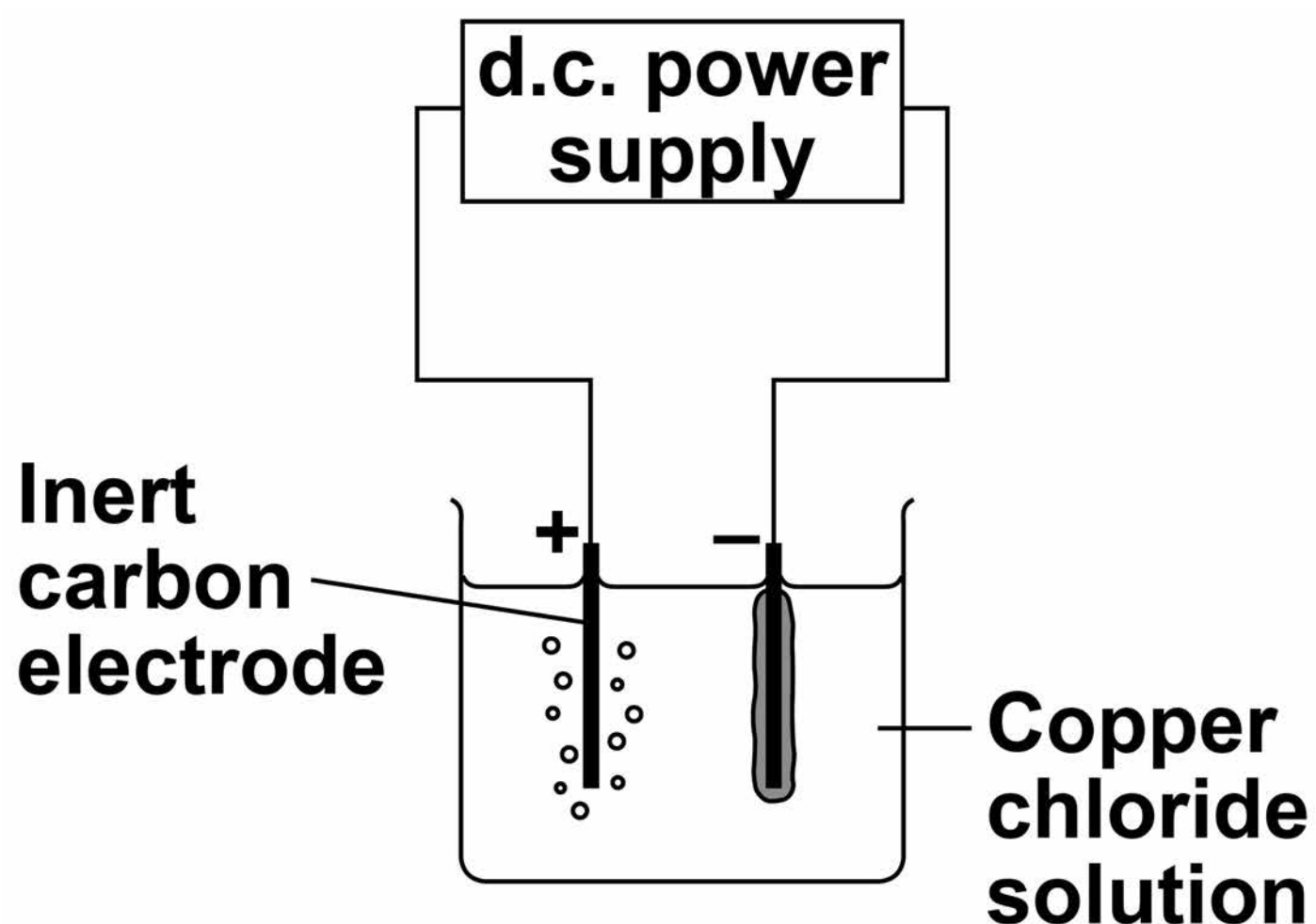
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This question is about electrolysis.

A student investigates the mass of copper produced during electrolysis of copper chloride solution.

FIGURE 1 shows the apparatus.

FIGURE 1



0 1 . 1 Which gas is produced at the positive electrode (anode)?
[1 mark]

Tick ONE box.

carbon dioxide

chlorine

hydrogen

oxygen

[Turn over]



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0 1 . 2 Copper is produced at the negative electrode (cathode).

**What does this tell you about the reactivity of copper?
[1 mark]**

Tick ONE box.

Copper is less reactive than hydrogen

Copper is less reactive than oxygen

Copper is more reactive than carbon

Copper is more reactive than chlorine

[Turn over]



TABLE 1 shows the student's results.

TABLE 1

Total mass of copper produced in mg				
Time in mins	Experiment 1	Experiment 2	Experiment 3	Mean
1	0.60	0.58	0.62	0.60
2	1.17	1.22	1.21	1.20
4	2.40	2.41	2.39	2.40
5	3.02	X	3.01	3.06



01.3

Determine the MEAN mass of copper produced after 3 minutes. [1 mark]

Mass = _____ mg

9

[Turn over]

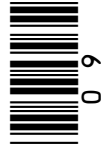


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5	3.02	X	3.01	3.06



01.4

**Calculate the mass X of copper produced in
EXPERIMENT 2 after 5 minutes.**

Use TABLE 1 on page 10 [2 marks]

Mass X = _____ mg

[Turn over]



0 1 . 5 The copper chloride solution used in the investigation contained 300 grams per dm^3 of solid CuCl_2 dissolved in 1 dm^3 of water.

The student used 50 cm^3 of copper chloride solution in each experiment.

Calculate the mass of solid copper chloride used in each experiment. [3 marks]

Mass = _____ g

[Turn over]

8



0	2
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This question is about sodium and chlorine.

FIGURE 2 shows the positions of sodium and chlorine in the periodic table.

FIGURE 2

Na																	

0 2 . 1 State ONE difference and ONE similarity in the electronic structure of sodium and of chlorine. [2 marks]

Difference _____

Similarity _____

[Turn over]

0 2 . 2

Sodium atoms react with chlorine atoms to produce sodium chloride (NaCl).

Describe what happens when a sodium atom reacts with a chlorine atom.

Write about electron transfer in your answer. [4 marks]

[Turn over]

0 2 . 3 The reaction between sodium and chlorine is an exothermic reaction.

**Complete the reaction profile for the reaction between sodium and chlorine.
[2 marks]**

FIGURE 3

Relative energy

Reactants

Progress of reaction

8



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[Turn over]



0	3
---	---

A student plans a method to prepare pure crystals of copper sulfate.

The student's method is:

- 1. Add one spatula of calcium carbonate to dilute hydrochloric acid in a beaker.**
- 2. When the fizzing stops, heat the solution with a Bunsen burner until all the liquid is gone.**

The method contains several errors and does not produce copper sulfate crystals.

**Explain the improvements the student should make to the method so that pure crystals of copper sulfate are produced.
[6 marks]**

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[Turn over]



0	4
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This question is about the halogens.

0	4	.	1
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**Write the state symbol for chlorine at room temperature.
[1 mark]**

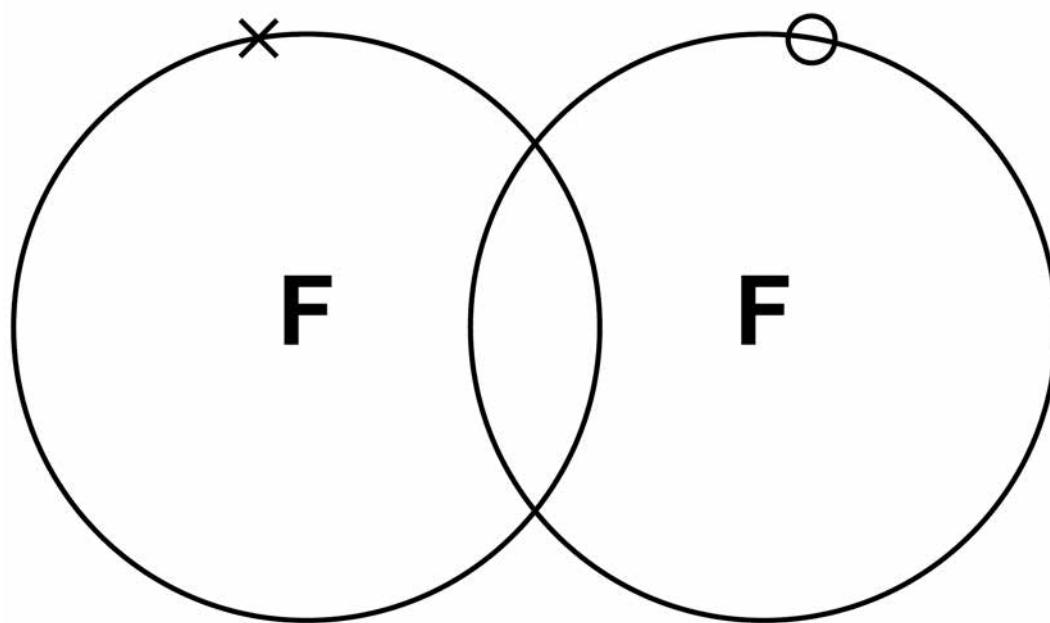
Cl₂ (_____)

0 4 . 2 FIGURE 4 represents one molecule of fluorine.

Complete the dot and cross diagram on FIGURE 4

**You should show only the electrons in the outer shells.
[2 marks]**

FIGURE 4



[Turn over]

0 4 . 3 A fluorine atom can be represented as ${}^{19}_{9}\text{F}$

What is the total number of electrons in a fluorine molecule (F_2)? [1 mark]

Tick ONE box.

9

14

18

38

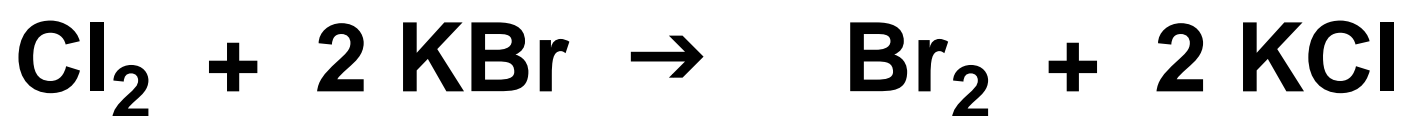
0 4 . 4 Aluminium reacts with bromine to produce aluminium bromide.

Complete the balanced chemical equation for this reaction. [2 marks]



[Turn over]

0 4 . 5 When chlorine reacts with potassium bromide, chlorine displaces bromine.



Explain why chlorine is more reactive than bromine.

[3 marks]

[Turn over]

<hr/>
9



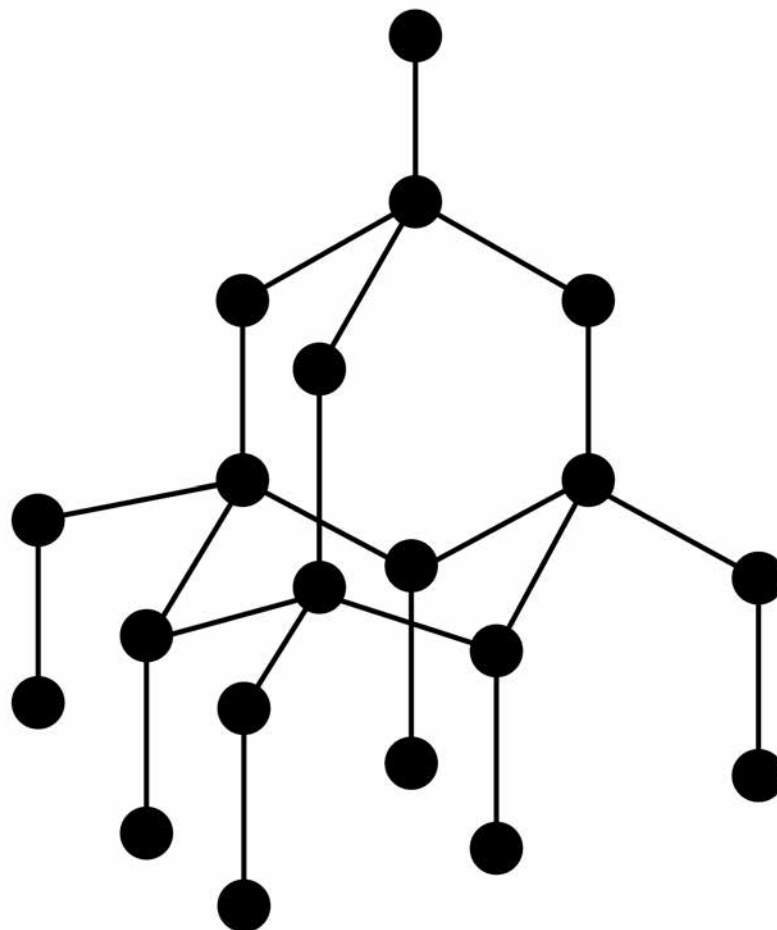
0	5
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This question is about structure and bonding.

0	5	.	1
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FIGURE 5 shows part of the structure and bonding in diamond.

FIGURE 5



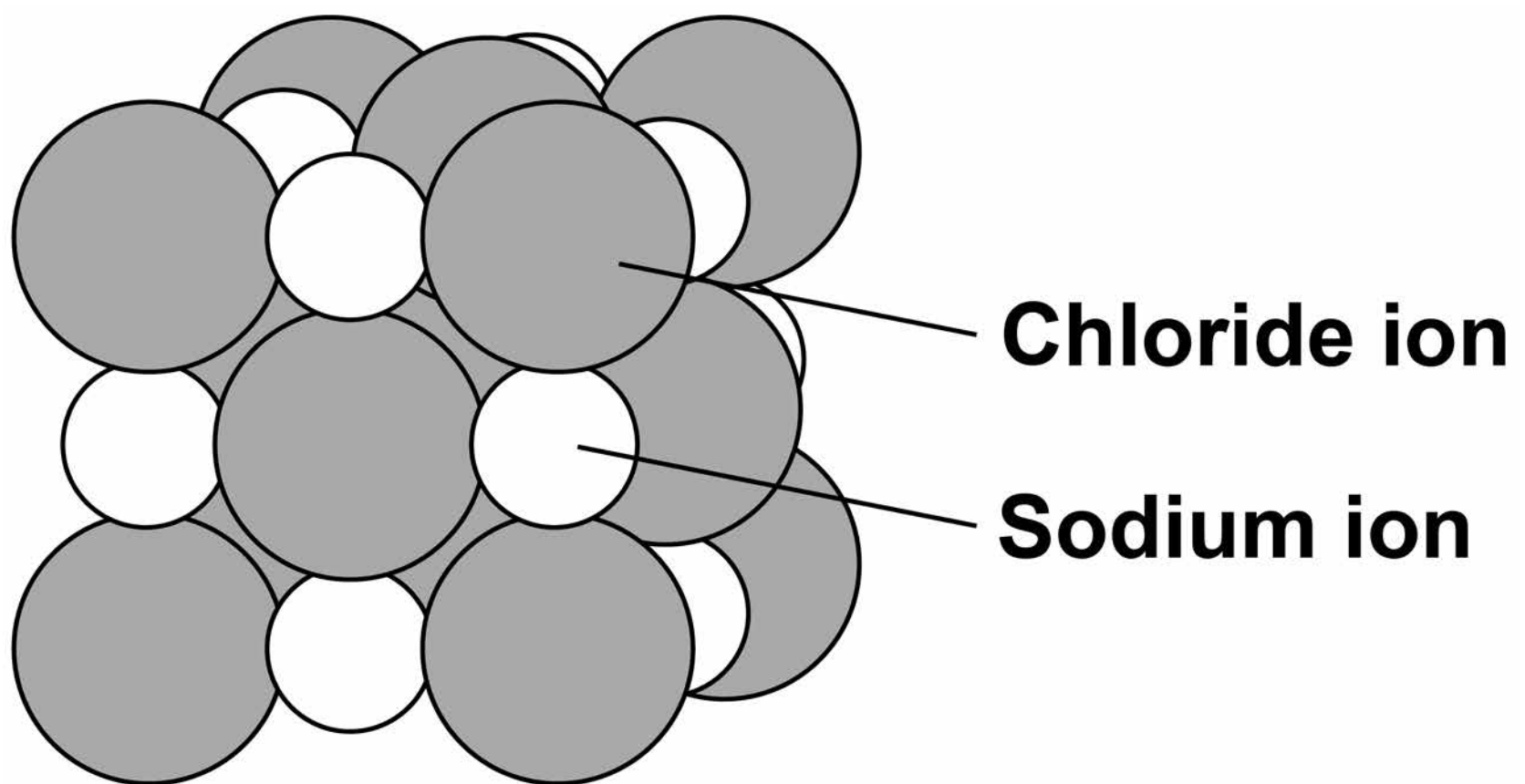
Explain why diamond has a high melting point. [3 marks]

[Turn over]



0 5 . 2 **FIGURE 6** shows part of the structure and bonding in sodium chloride (NaCl).

FIGURE 6

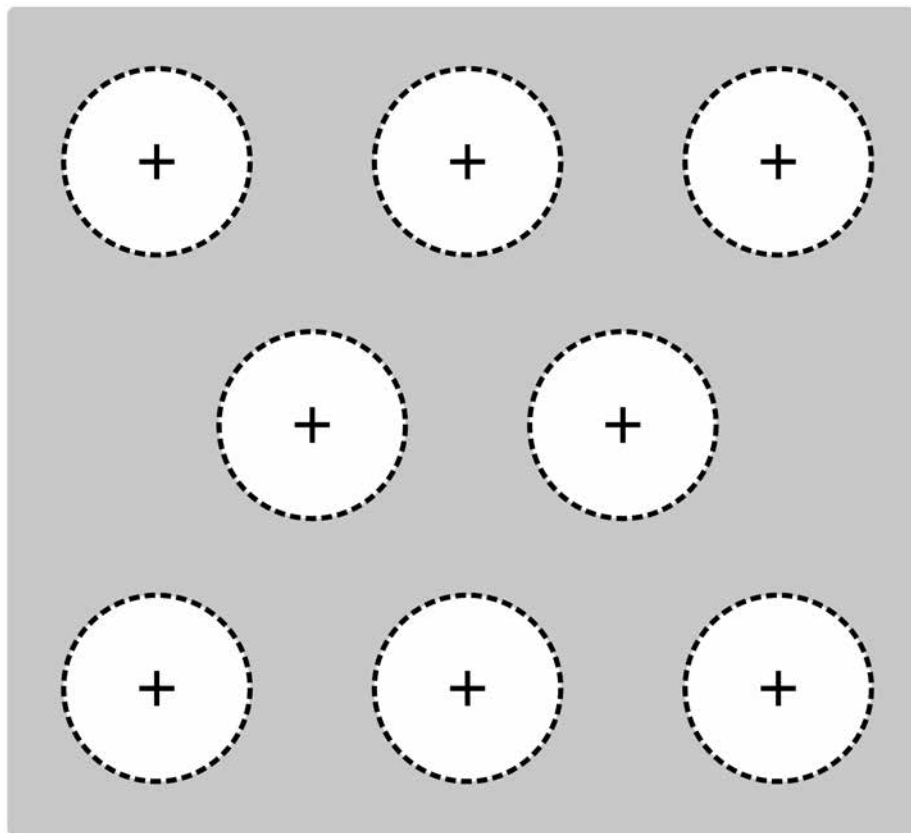


Explain the conditions needed for sodium chloride to conduct electricity. [3 marks]

[Turn over]

0 5 . 3 FIGURE 7 shows the structure of sodium.

FIGURE 7



**Describe how sodium
conducts thermal energy.
[3 marks]**

9

[Turn over]



0	6
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Group 2 metal carbonates thermally decompose to produce a metal oxide and a gas.

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

**Give the formula of each product when calcium carbonate (CaCO_3) is heated.
[2 marks]**

_____ and _____

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[Turn over]



0 6 . 2 The relative formula mass (M_r) of a Group 2 metal carbonate is 197

Relative atomic masses (A_r):

C = 12 O = 16

Calculate the relative atomic mass (A_r) of the Group 2 metal in the metal carbonate.

**Name the Group 2 metal.
[3 marks]**

Relative atomic mass (A_r) =

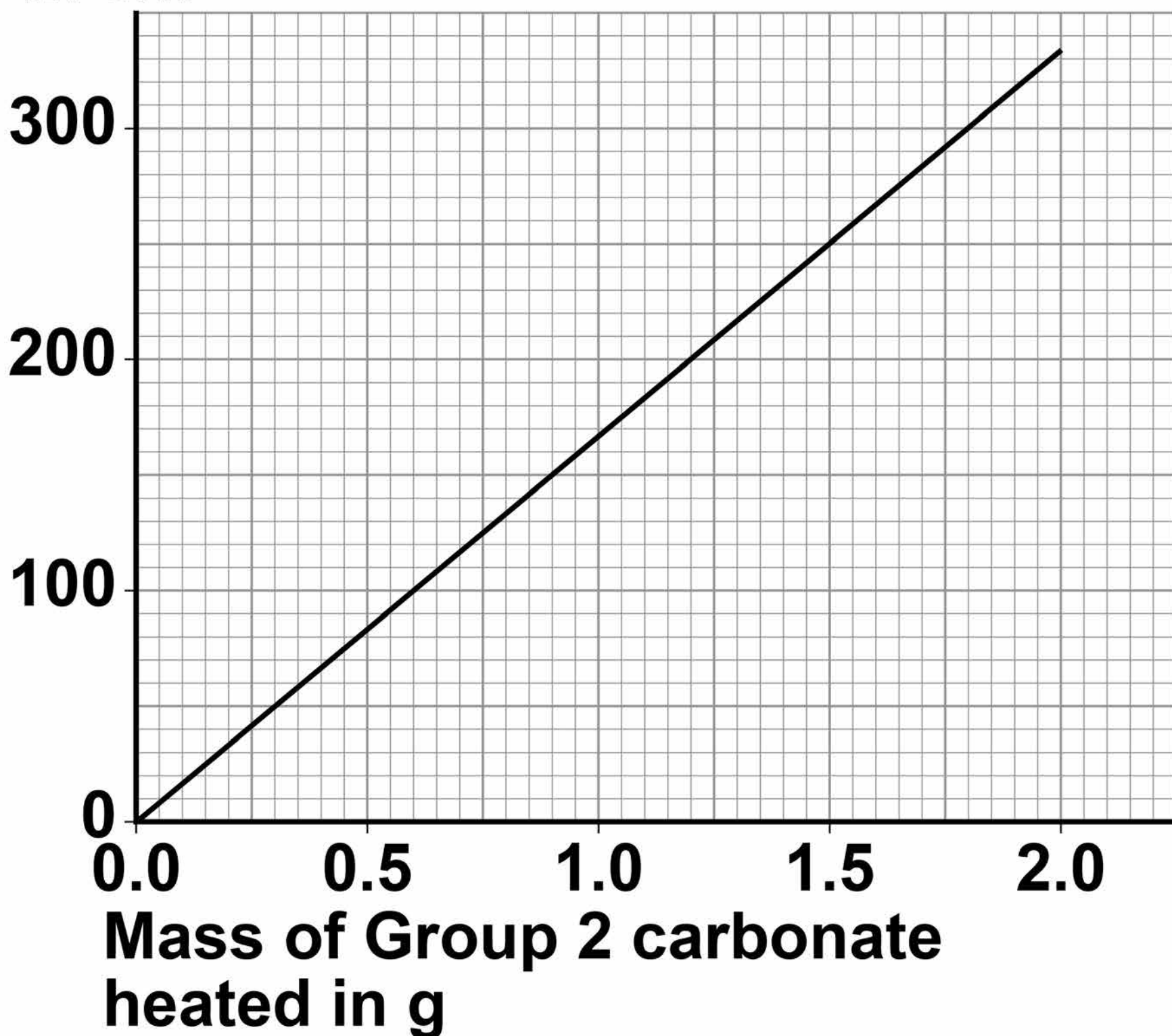
Metal _____

[Turn over]

FIGURE 8 shows the volume of gas produced when a different Group 2 carbonate, **W**, is heated.

FIGURE 8

**Volume
of gas
in cm³**



0 6 . 3 Calculate the gradient of the line in FIGURE 8, on page 40.

Give the unit. [3 marks]

Gradient _____

Unit _____

[Turn over]

0 6 . 4 24 dm³ of gas is produced when one mole of a Group 2 carbonate is heated.

Determine the relative formula mass of the Group 2 carbonate W.

**Use FIGURE 8, on page 40.
[4 marks]**

Relative formula mass (M_r) =

[Turn over]

<hr/>
12



07

A scientist does two tests on four white solids. The solids are labelled A, B, C and D.

TEST 1 Adds the sample of the solid to distilled water and stirs.

TEST 2 Measures the pH of the solution after TEST 1

TABLE 2 shows the results.

TABLE 2

Solid	Appearance after stirring	pH
A	colourless solution, no solid	14
B	colourless solution, no solid	3
C	colourless solution, solid remains	9
D	colourless liquid, solid remains	7

These four solids are:

- **magnesium oxide**
- **phosphorus oxide**
- **silicon dioxide**
- **sodium oxide.**

TABLE 3 shows the solubility of these four solids in water.

TABLE 3

Solid	Solubility in grams per 100 cm³ of water
Magnesium oxide	0.01
Phosphorus oxide	52
Silicon dioxide	0
Sodium oxide	109

[Turn over]



[Turn over]



07.2 10 cm³ of solution B is added to a beaker.

Distilled water is added to the beaker until the final volume in the beaker is 1000 cm³

The pH of the solution is measured before and after distilled water is added.

TABLE 4 shows the results.

TABLE 4

Volume of solution in beaker	pH of solution B
10 cm³	3
1000 cm³	X

49

Calculate the value of X.
[2 marks]

X = _____

[Turn over]

8

0 8

This question is about iron.

Iron reacts with dilute hydrochloric acid to produce iron chloride solution and one other product.

0 8 . 1

**Name the other product.
[1 mark]**

0 8 . 2

Suggest how any unreacted iron can be separated from the mixture. [1 mark]

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[Turn over]



Magnesium reacts with iron chloride solution.



0 8 . 3 0.120 g of magnesium reacts with excess iron chloride solution.

Relative atomic masses (A_r):

Mg = 24 Fe = 56

Calculate the mass of iron produced, in mg [5 marks]

Mass of iron = _____

[Turn over]

0 8 . 4 Explain which species is reduced in the reaction between magnesium and iron chloride.



Your answer should include the half equation for the reduction. [3 marks]

END OF QUESTIONS

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There are no questions printed on this page

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Question	Mark
1	
2	
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TOTAL	

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