

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

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Forename(s)

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Candidate signature

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# GCSE COMBINED SCIENCE: TRILOGY

# H

Higher Tier  
Chemistry Paper 1H

Thursday 17 May 2018

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.
- Fill in the boxes at the top of this page.
- 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.

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



J U N 1 8 8 4 6 4 C 1 H O 1

IB/M/Jun18/E10

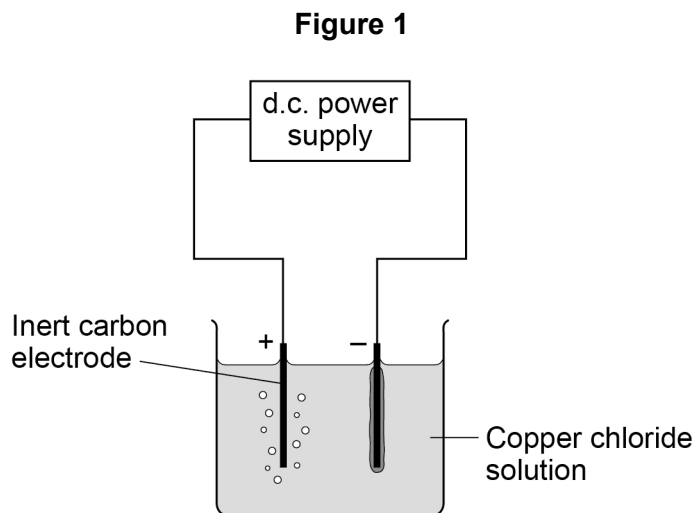
**8464/C/1H**

**0 1**

This question is about electrolysis.

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

**Figure 1** shows the apparatus.

**0 1 . 1**

Which gas is produced at the positive electrode (anode)?

**[1 mark]**

Tick **one** box.

carbon dioxide

☐

chlorine

☐

hydrogen

☐

oxygen

☐

**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

☐

**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 |
| <b>1</b>     | 0.60                                | 0.58         | 0.62         | 0.60 |
| <b>2</b>     | 1.17                                | 1.22         | 1.21         | 1.20 |
| <b>4</b>     | 2.40                                | 2.41         | 2.39         | 2.40 |
| <b>5</b>     | 3.02                                | <b>X</b>     | 3.01         | 3.06 |

**0 1 . 3** Determine the **mean** mass of copper produced after 3 minutes.

**[1 mark]**

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Mass = \_\_\_\_\_ mg

**Question 1 continues on the next page**

**Turn over ►**



0 1 . 4

Calculate the mass **X** of copper produced in **Experiment 2** after 5 minutes.Use **Table 1** on page 3**[2 marks]**


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Mass **X** = \_\_\_\_\_ mg

0 1 . 5

The copper chloride solution used in the investigation contained 300 grams per  $\text{dm}^3$  of solid  $\text{CuCl}_2$  dissolved in  $1 \text{ dm}^3$  of water.The student used  $50 \text{ cm}^3$  of copper chloride solution in each experiment.

Calculate the mass of solid copper chloride used in each experiment.

**[3 marks]**


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Mass = \_\_\_\_\_ g





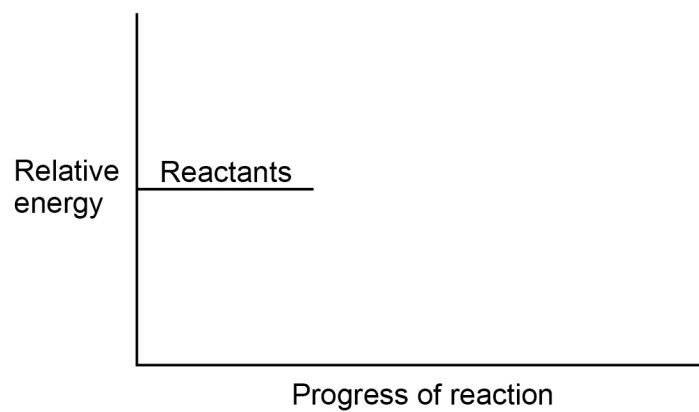
0 2 . 3

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



The student's method is:

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

**[6 marks]**

[illegible]

**Turn over ►**



0 4

This question is about the halogens.

0 4 . 1

Write the state symbol for chlorine at room temperature.

[1 mark]

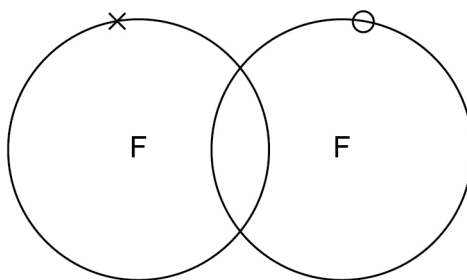
 $\text{Cl}_2$  (       )

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**

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 ( $\text{F}_2$ )?

[1 mark]

Tick **one** box.

|   |                          |    |                          |    |                          |    |                          |
|---|--------------------------|----|--------------------------|----|--------------------------|----|--------------------------|
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|---|--------------------------|----|--------------------------|----|--------------------------|----|--------------------------|

0 4 . 4

Aluminium reacts with bromine to produce aluminium bromide.

Complete the balanced chemical equation for this reaction.

[2 marks]

\_\_\_\_\_  $\text{Al}$  + \_\_\_\_\_  $\text{Br}_2$   $\rightarrow$  2 \_\_\_\_\_

$$\text{Cl}_2 + 2 \text{KBr} \rightarrow \text{Br}_2 + 2 \text{KCl}$$

**[3 marks]**

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9

**Turn over for the next question**

**Turn over ►**



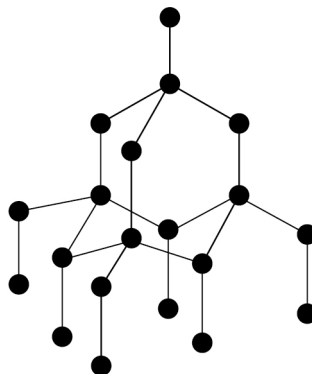
|   |   |
|---|---|
| 0 | 5 |
|---|---|

This question is about structure and bonding.

|   |   |   |   |
|---|---|---|---|
| 0 | 5 | . | 1 |
|---|---|---|---|

**Figure 5** shows part of the structure and bonding in diamond.

**Figure 5**



Explain why diamond has a high melting point.

**[3 marks]**

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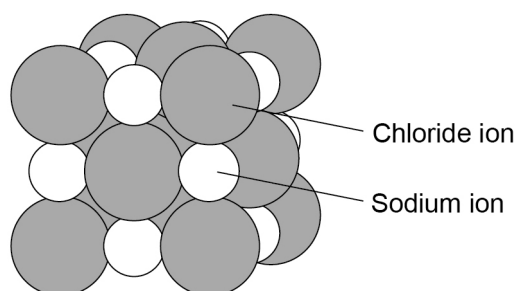
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0 5 . 2

**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]**

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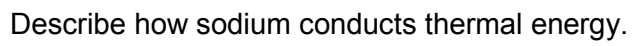
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**Question 5 continues on the next page**

**Turn over ►**



**[3 marks]**

[illegible]

**0 6**

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 ( $\text{CaCO}_3$ ) is heated.**[2 marks]**

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 and 

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**0 6 . 2**The relative formula mass ( $M_r$ ) of a Group 2 metal carbonate is 197Relative atomic masses ( $A_r$ ): C = 12 O = 16Calculate the relative atomic mass ( $A_r$ ) of the Group 2 metal in the metal carbonate.

Name the Group 2 metal.

**[3 marks]**

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Relative atomic mass ( $A_r$ ) = 

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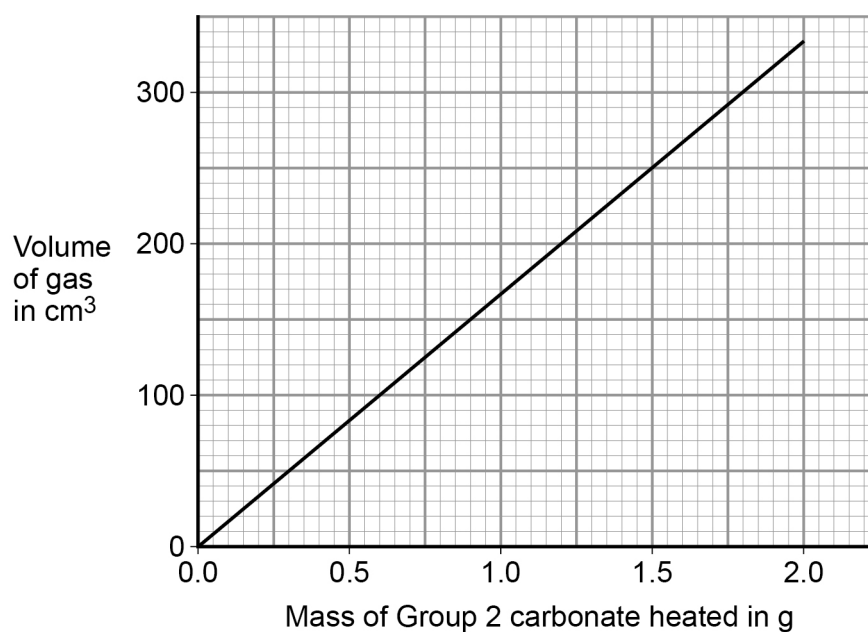
Metal 

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**Question 6 continues on the next page****Turn over ►**

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

**Figure 8**



**0 6 . 3** Calculate the gradient of the line in **Figure 8**

Give the unit.

**[3 marks]**

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Gradient \_\_\_\_\_

Unit \_\_\_\_\_





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 |
|----------|------------------------------------|----|
| <b>A</b> | colourless solution, no solid      | 14 |
| <b>B</b> | colourless solution, no solid      | 3  |
| <b>C</b> | colourless solution, solid remains | 9  |
| <b>D</b> | 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 cm <sup>3</sup> of water |
|------------------|------------------------------------------------------|
| Magnesium oxide  | 0.01                                                 |
| Phosphorus oxide | 52                                                   |
| Silicon dioxide  | 0                                                    |
| Sodium oxide     | 109                                                  |

Do not write  
outside the  
box



**[6 marks]**

[illegible]

**Turn over ►**



**0 7 . 2** 10 cm<sup>3</sup> of solution **B** is added to a beaker.

Distilled water is added to the beaker until the final volume in the beaker is 1000 cm<sup>3</sup>

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 cm <sup>3</sup>           | 3                |
| 1000 cm <sup>3</sup>         | <b>X</b>         |

Calculate the value of **X**.

**[2 marks]**

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**X** = \_\_\_\_\_



**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]**


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**0 8 . 2**

Suggest how any unreacted iron can be separated from the mixture.

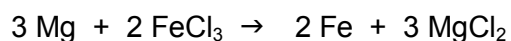
**[1 mark]**


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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]**


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Mass of iron = \_\_\_\_\_ mg

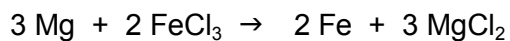
**Question 8 continues on the next page**

**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]

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10

**END OF QUESTIONS**

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