

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

Forename(s)

Candidate signature

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	
TOTAL	

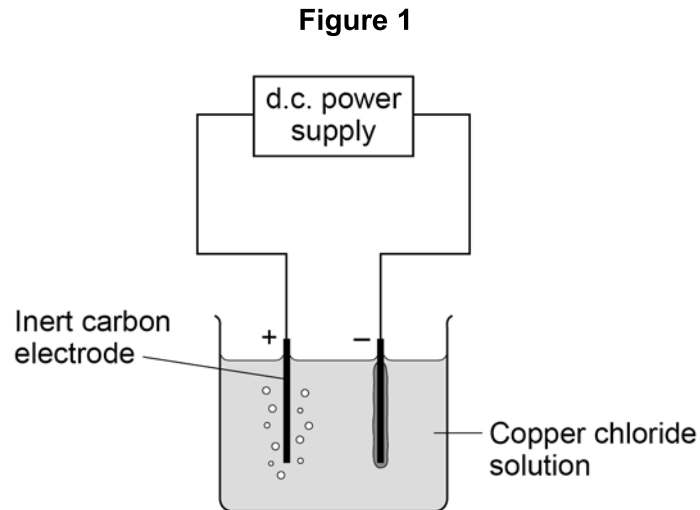


0 1

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

Time in mins	Total mass of copper produced in mg			
	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

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

[1 mark]

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]**

Mass **X** = _____ mg

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

8



0 2

This question is about sodium and chlorine.

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

Figure 2

Na															Cl		

0 2 . 1

State **one** difference and **one** similarity in the electronic structure of sodium and of chlorine.

[2 marks]

Difference _____

Similarity _____

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 ►



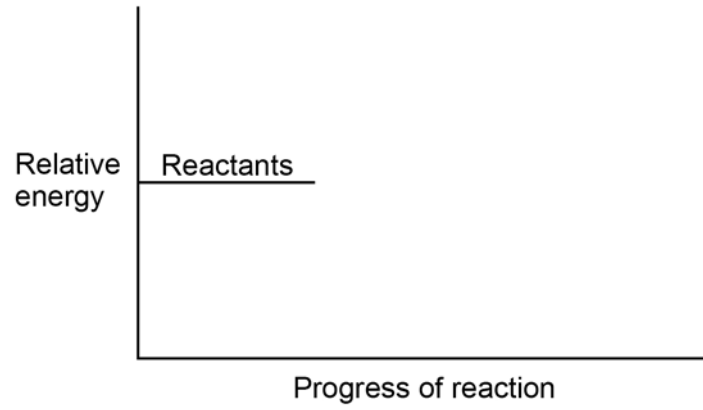
0 2 . 3

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



8



0 4 This question is about the halogens.

0 4 . 1 Write the state symbol for chlorine at room temperature.

[1 mark]

Cl₂ (_____)

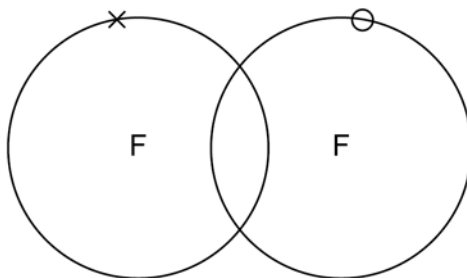
0 4 . 2 **Figure 4** represents one molecule of fluorine.

Complete the dot and cross diagram on **Figure 4**

You should show only the electrons in the outer shells.

[2 marks]

Figure 4



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 (F₂)?

[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]

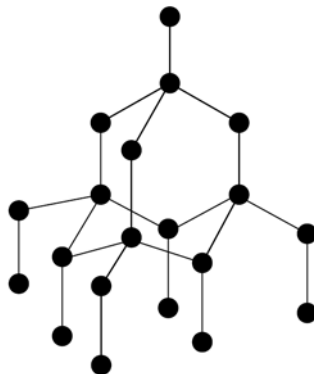
_____ Al + _____ Br₂ → 2 _____



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]



0 6

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

0 6 . 1Give the formula of each product when calcium carbonate (CaCO_3) is heated.**[2 marks]**

_____ and _____

0 6 . 2The 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]

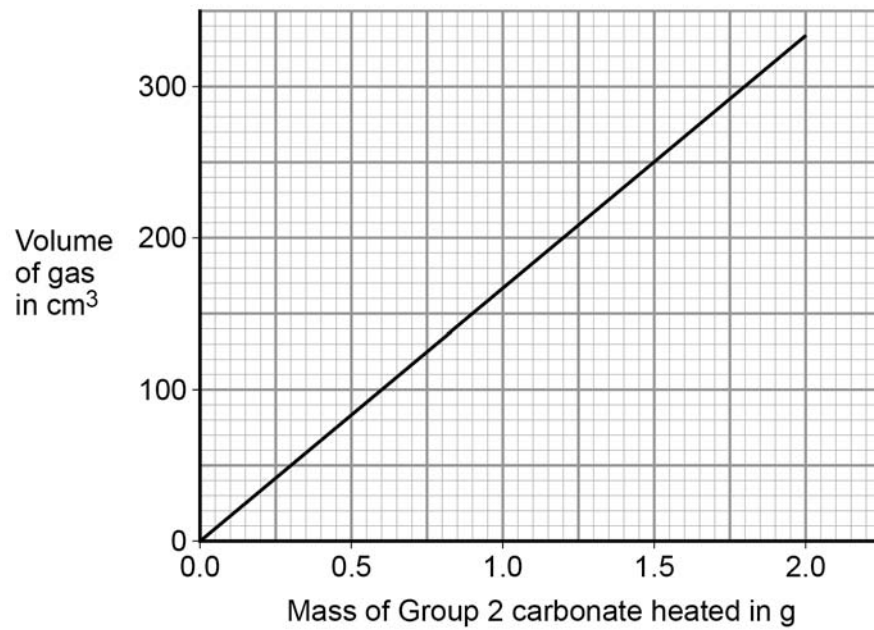
Relative atomic mass (A_r) = _____

Metal _____

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]

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
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 cm ³ of water
Magnesium oxide	0.01
Phosphorus oxide	52
Silicon dioxide	0
Sodium oxide	109

Do not write
outside the
box



0 7 . 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 cm ³	3
1000 cm ³	X

Calculate the value of **X**.

[2 marks]

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.

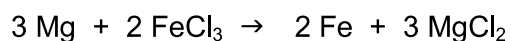
[1 mark]

0 8 . 2

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

[1 mark]

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

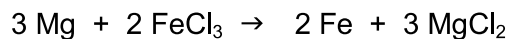
[5 marks]

Mass of iron = _____ mg

Question 8 continues on the next page**Turn over ►**

08.4

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]

10

END OF QUESTIONS

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