Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname ______________________

Forename(s) ______________________

Candidate signature ______________________

GCSE
COMBINED SCIENCE: TRILOGY

F

Foundation Tier
Chemistry Paper 1F

Specimen 2018 (set 2)
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.

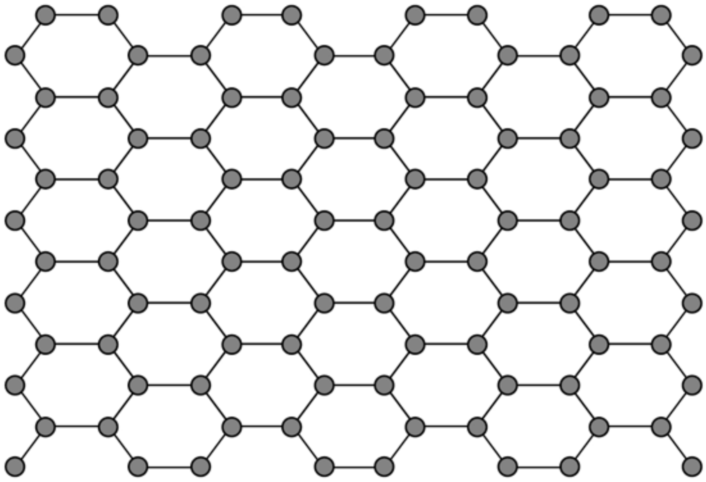
Information
- The maximum mark for this paper is 70.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

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

0 1 This question is about structure and bonding.

0 1 . 1 **Figure 1** shows part of one layer of graphene.

Figure 1



Which element is graphene made from?

[1 mark]

Tick **one** box.

Carbon ☐

Copper ☐

Hydrogen ☐

Sodium ☐

Do not write outside the box

0 1 . 2 Each atom in graphene has one delocalised electron.

Complete the sentence.

Choose the answer from the box.

[1 mark]

act as a lubricant	**be used as a fuel**
conduct electricity	**dissolve in water**

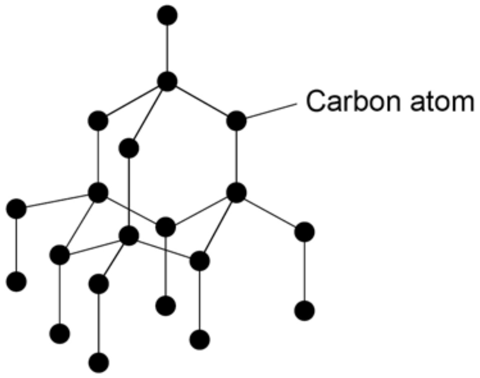
Delocalised electrons allow graphene to ______________________________ .

Question 1 continues on the next page

0 1 . 3 Which structure is a fullerene?

[1 mark]

Tick **one** box.



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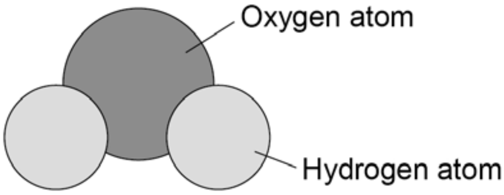

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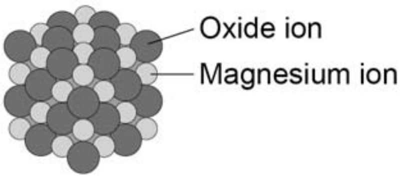

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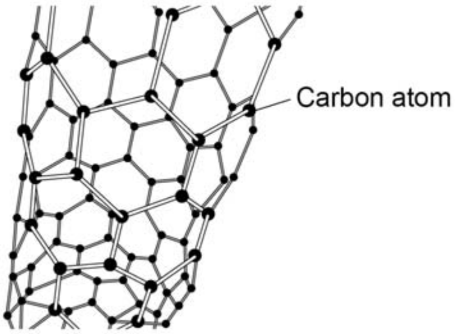

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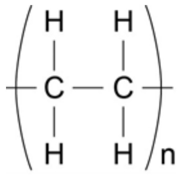
Figure 2 shows part of a large hydrocarbon molecule.

Figure 2



0 1 . 4 Which **two** elements are in all hydrocarbons?

[2 marks]

1 ____

2 ____

0 1 . 5 Complete the sentence.

Choose the answer from the box.

[1 mark]

an atom	**an metal**	**a polymer**	**a salt**

The large molecule represented in **Figure 2** is ______________________ .

0 1 . 6 Complete the sentence.

Choose the answer from the box.

[1 mark]

attract	**bond**	**slide**	**vibrate**

Metals can be stretched into wires

because the layers of atoms can ______________________ .

7

Turn over ►

Do not write outside the box

There are no questions printed on this page

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ANSWER IN THE SPACES PROVIDED

Do not write outside the box

0 2 This question is about electrolysis.

0 2 . 1 How many different elements are in the formula $AgNO_3$?

[1 mark]

Tick **one** box.

2 ☐ 3 ☐ 5 ☐ 6 ☐

0 2 . 2 How many atoms are in the formula $AgNO_3$?

[1 mark]

Tick **one** box.

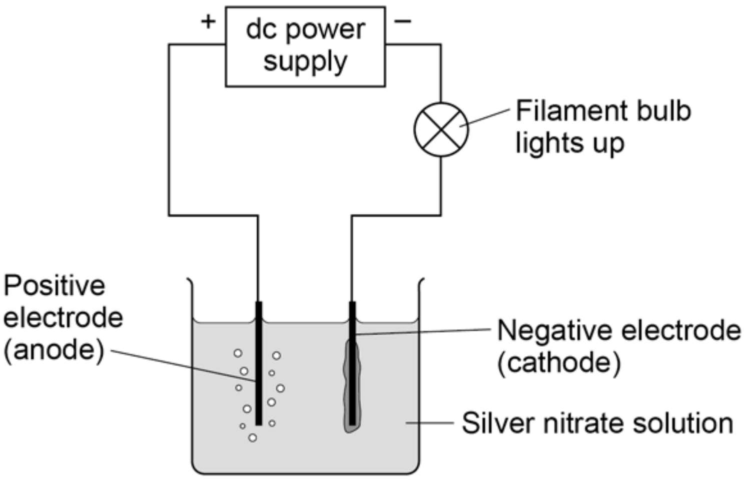
2 ☐ 3 ☐ 5 ☐ 6 ☐

Question 2 continues on the next page

An electric current is passed through silver nitrate solution.

Figure 3 shows the apparatus.

Figure 3



The solution contains four ions:

- Ag^+
- H^+
- NO_3^-
- OH^-

0 2 . 3 Where do the H^+ and OH^- ions come from?

[1 mark]

Tick **one** box.

Air ☐

Electrodes ☐

Silver nitrate ☐

Water ☐

0 2 . 4 Ag^+ ions and H^+ ions are attracted to the negative electrode (cathode).

Give a reason why.

[1 mark]

0 2 . 5 Silver is produced at the negative electrode (cathode) and not hydrogen.

What does this tell you about the reactivity of silver?

[1 mark]

Tick **one** box.

Silver is less reactive than hydrogen ☐

Silver is less reactive than oxygen ☐

Silver is more reactive than nitrate ☐

Silver is more reactive than water. ☐

0 2 . 6 The hydroxide ion (OH^-) is attracted to the positive electrode (anode).

The equation shows what happens at the positive electrode (anode).

$$4\,OH^- \rightarrow 2\,H_2O + O_2 + 4\,e^-$$

Name the gas produced at the positive electrode (anode).

[1 mark]

Question 2 continues on the next page

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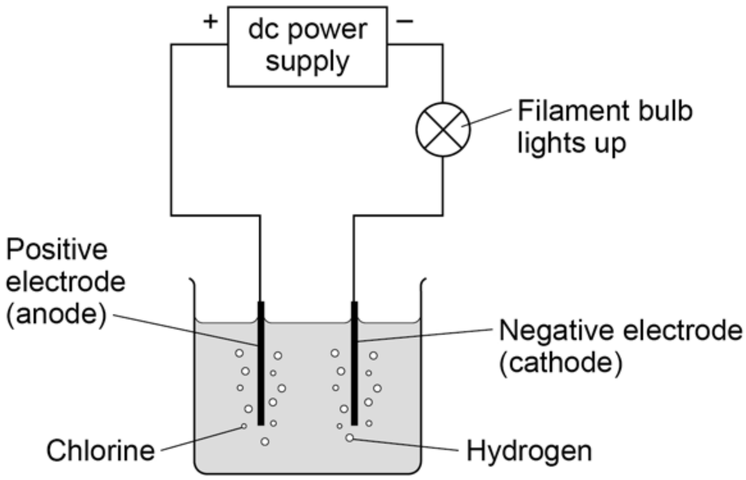
0 2 . 7 An electric current is passed through sodium chloride solution.

Figure 4 shows the apparatus.

Figure 4



After passing an electric current through sodium chloride solution one product is sodium hydroxide (NaOH) solution.

The presence of sodium hydroxide can be shown by adding an indicator.

Name an indicator.

Give the colour of the indicator in sodium hydroxide solution.

[2 marks]

Indicator ____

Colour ____

8

Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Turn over ►

0 3 This question is about compounds of fluorine.

0 3 . 1 A fluorine atom has 7 electrons in the outer shell.

Figure 5 shows part of a dot and cross diagram of a molecule of hydrogen fluoride (HF).

Complete the dot and cross diagram in **Figure 5**.

You should show only the electrons in the outer shells.

[2 marks]

Figure 5

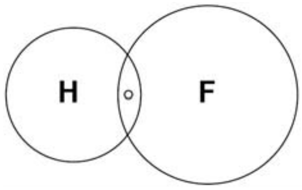
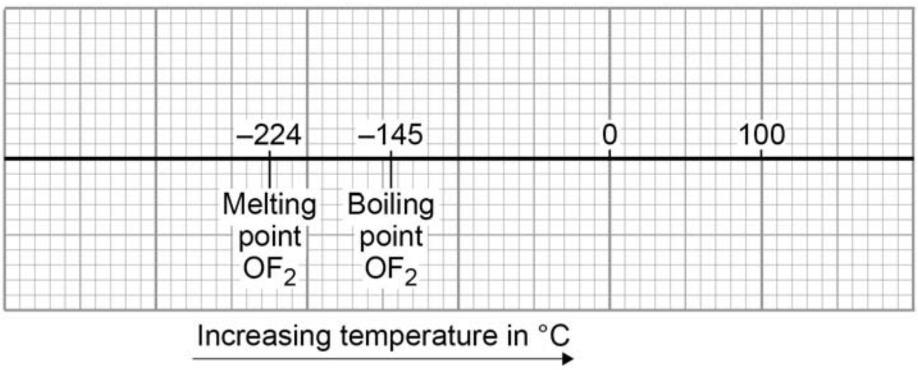


Figure 6 shows the boiling point and melting point of oxygen difluoride (OF_2).

Figure 6



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0 3 . 2 What is the state of oxygen difluoride at −200 °C?

[1 mark]

Tick **one** box.

Aqueous (aq) ☐

Gas (g) ☐

Liquid (l) ☐

Solid (s) ☐

0 3 . 3 What change of state occurs when oxygen difluoride is cooled from – 220 °C to – 230 °C?

[1 mark]

Tick **one** box.

Condensing ☐

Evaporating ☐

Freezing ☐

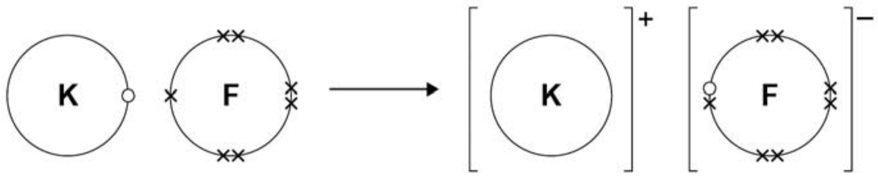
Melting ☐

Question 3 continues on the next page

Potassium reacts with fluorine to produce the ionic compound potassium fluoride (KF).

Figure 7 shows the transfer of electrons during the reaction.

Figure 7



0 3 . 4 Describe what happens when potassium reacts with fluorine to produce potassium fluoride.

Write about electron transfer in your answer.

[5 marks]

Do not write outside the box

0 3 . 5 Potassium fluoride is an ionic compound.

Explain why ionic compounds have high melting points.

Use the following words in your answer:

- attraction
- energy
- ions.

[4 marks]

13

Turn over for the next question

There are no questions printed on this page

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ANSWER IN THE SPACES PROVIDED

0 4 This question is about compounds of oxygen.

The reaction between carbon and oxygen is exothermic.

0 4 . 1 What does exothermic reaction mean?

[1 mark]

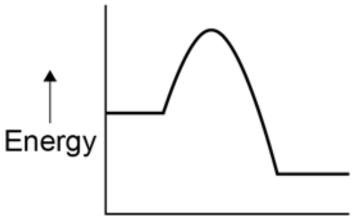
____

____

0 4 . 2 Which is the correct reaction profile (energy level diagram) for an exothermic reaction?

[1 mark]

Tick **one** box.



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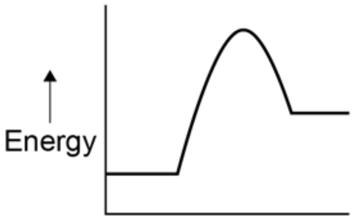

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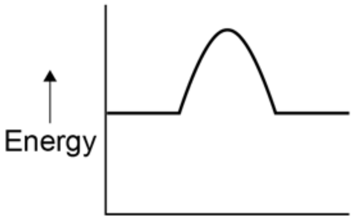

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Question 4 continues on the next page

Turn over ►

Do not write outside the box

0 4 . 3 The percentage by mass of oxygen in carbon dioxide (CO_2) is calculated by the equation:

$$\text{percentage by mass} = \frac{\text{number of atoms of O} \times \text{Relative atomic mass of oxygen (O)}}{\text{relative molecular mass of carbon dioxide } (CO_2)} \times 100$$

Relative atomic masses (A_r): C = 12 O = 16

Calculate the percentage by mass of oxygen in carbon dioxide (CO_2).

[3 marks]

Percentage by mass of oxygen = ____________________ %

Do not write outside the box

Hydrogen peroxide decomposes to produce water and oxygen.

0 4 . 4 Balance the chemical equation.

[1 mark]

$$\_\_\_\_\_\_ \ H_2O_2 \rightarrow \ \_\_\_\_\_\_ \ H_2O \ + \ O_2$$

0 4 . 5 6.8 g of hydrogen peroxide decomposes to produce 3.6 g of water.

Calculate the mass of oxygen produced when 68 g of hydrogen peroxide decomposes.

[2 marks]

Mass of oxygen = ____________________ g

8

Turn over for the next question

0 5 This question is about atoms and chemical elements.

Mendeleev's periodic table has groups of elements with similar properties.

Figure 8 shows part of Mendeleev's periodic table.

Figure 8

1	1 H							
2	7 Li	9.4 Be	11 B	12 C	14 N	16 O	19 F	
3	23 Na	24 Mg	27.3 Al	28 Si	31 P	32 S	35.5 Cl	
4	39 K	40 Ca	44	48 Ti	51 V	52 Cr	55 Mn	56 Fe, 59 Co, 59 Ni, 63 Cu

0 5 . 1 Compare Mendeleev's periodic table with the modern periodic table.

Which group is missing from Mendeleev's periodic table?

[1 mark]

Tick **one** box.

Group 1 ☐

Group 2 ☐

Group 7 ☐

Group 0 ☐

Do not write outside the box

0 5 . 2 In the early periodic tables some elements were placed in the wrong groups.

Mendeleev overcame some of these problems in his periodic table.

Give **two** ways Mendeleev did this.

[2 marks]

1 ____

____

2 ____

____

Atoms were thought to be tiny spheres that could not be divided.

0 5 . 3 Draw **one** line from each scientist to the discovery the scientist made.

[2 marks]

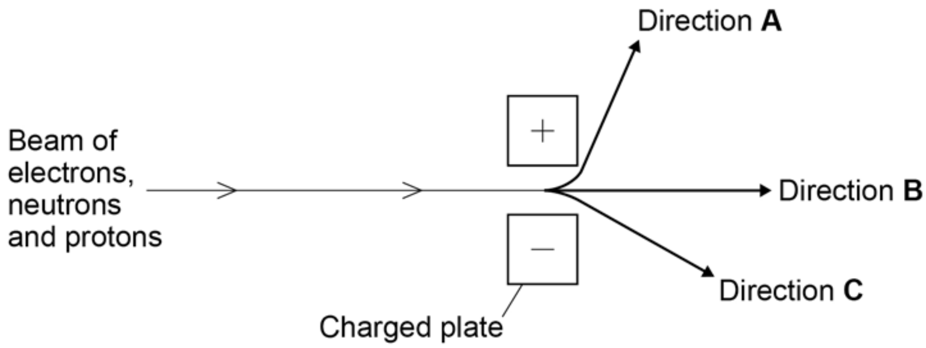
Scientist	**Discovery the scientist made**
	Discovered electrons
Neils Bohr	Electrons orbit the nucleus
	Existence of neutrons
James Chadwick	Mass of atom concentrated at centre
	Proton found in nucleus

Question 5 continues on the next page

0 5 . 4 A beam of electrons, neutrons and protons can be separated by passing them through an electric field.

Figure 9 shows the directions of the three particles after entering the electric field.

Figure 9



Charged particles are attracted to the oppositely charged plate in the electric field.

Which direction, **A**, **B** or **C**, does each particle follow?

Complete **Table 1**.

[2 marks]

Table 1

Particle	**Direction**
Electron	
Neutron	
Proton	

0 5 . 5 Calculate the mass of one atom of sodium.

Use the equation:

$$\text{mass of one atom of sodium} = \frac{\text{relative atomic mass}}{\text{Avogadro constant}}$$

Avogadro constant = 6.02×10^{23}

Give your answer to 2 significant figures.

[3 marks]

____

____

____

____

____

Mass = ______________________ g

0 5 . 6 The radius of a sodium atom is 227 picometres.

1 picometre = 10^{-12} metres (m)

The radius of a nucleus is $\frac{1}{10\,000}$ of that of the atom.

Which calculation shows the radius of a sodium atom's nucleus?

[1 mark]

Tick **one** box.

$227 \times 10\,000$ m ☐

$227 \times \frac{1}{10\,000}$ m ☐

$227 \times 10^{-12} \times 10\,000$ m ☐

$227 \times 10^{-12} \times \frac{1}{10\,000}$ m ☐

11

Turn over ►

Do not write outside the box

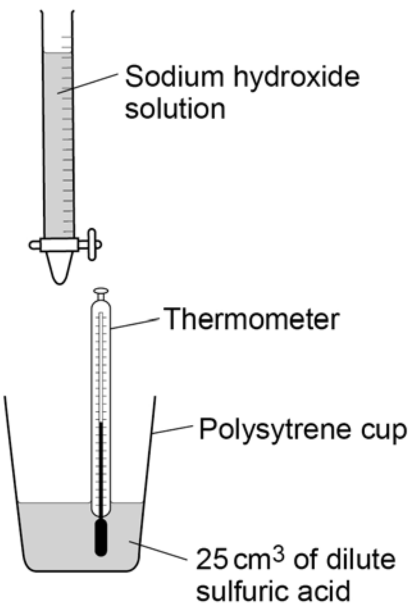
0 6 Some students investigated the change in temperature as sodium hydroxide solution Is added to dilute sulfuric acid.

This is the method used.

1. Put 25 cm^3 of dilute sulfuric acid into a polystyrene cup.
2. Measure the initial temperature of the dilute sulfuric acid.
3. Add 4 cm^3 of sodium hydroxide solution to the dilute sulfuric acid.
4. Stir the mixture.
5. Measure the highest temperature of the mixture.
6. Repeat steps 3–5 until 40 cm^3 of sodium hydroxide solution have been added.

Figure 10 shows the apparatus the student used.

Figure 10



Do not write outside the box

0 6 . 1 The volume of sodium hydroxide solution is a variable.

Which **two** words can be used to describe this type of variable?

[2 marks]

Tick **two** boxes.

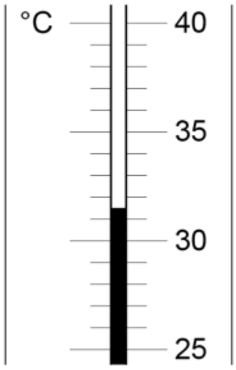
Categoric	☐
Continuous	☐
Control	☐
Dependent	☐
Independent	☐

Question 6 continues on the next page

0 6 . 2 The dilute sulfuric acid has an initial temperature of 24.0 °C

Figure 11 shows the highest temperature.

Figure 11



Calculate the change in temperature.

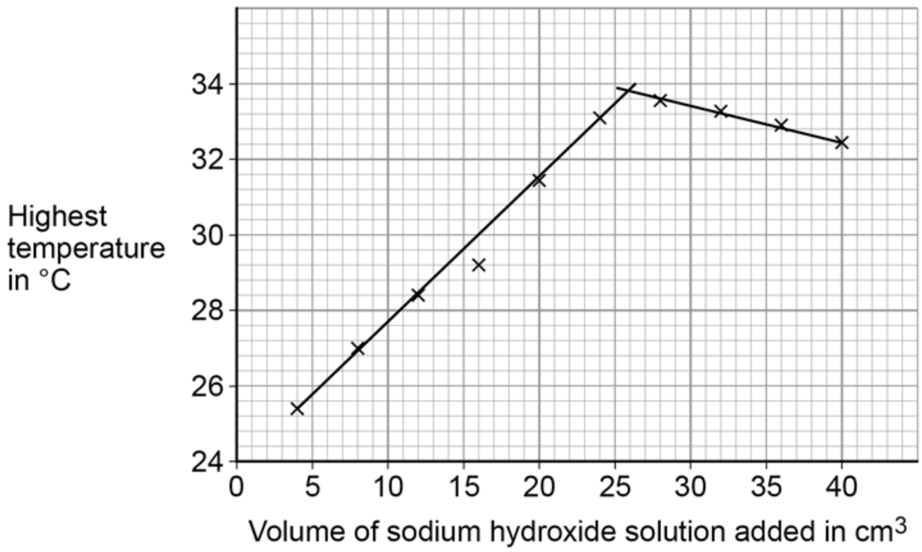
[2 marks]

____

Temperature = ____________________ °C

Figure 12 shows the students' results.

Figure 12



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0 6 . 3 Determine the volume of sodium hydroxide solution that gives the highest temperature change.

Use **Figure 12** to help you answer this question.

[1 mark]

Volume = ____________________ cm^3

0 6 . 4 In **Figure 12** the temperature when 16 cm^3 of sodium hydroxide solution is added is anomalous.

Suggest **one** error that could have been made in the method which would cause this anomalous result.

[1 mark]

____

____

0 6 . 5 The sodium hydroxide solution in this investigation contains 80 grams per dm^3

The students use 40 cm^3 of sodium hydroxide solution.

Calculate the mass of sodium hydroxide in 40 cm^3

[3 marks]

____

____

____

____

____

Mass = ____________________ g

9

Turn over for the next question

Do not write outside the box

0 7 This question is about metals and metal compounds.

0 7 . 1 Copper oxide reacts with hydrochloric acid to produce copper chloride and water.

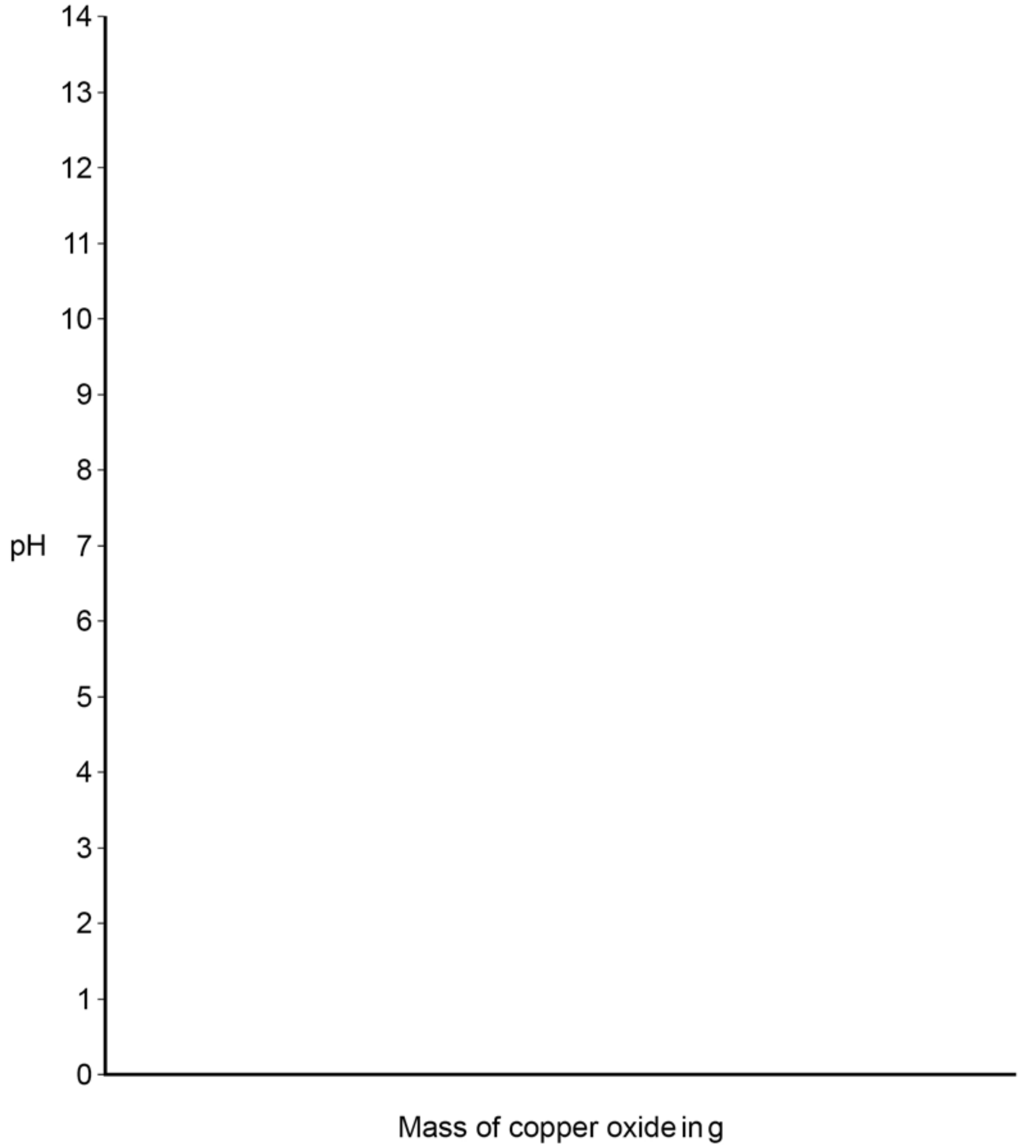
Copper oxide is insoluble in water.

Copper oxide is gradually added to hydrochloric acid until in excess.

Sketch a graph on **Figure 13** to show how the pH of the hydrochloric acid would change.

[3 marks]

Figure 13



0 7 . 2 Magnesium reacts with hydrochloric acid to produce magnesium chloride and hydrogen.

Plan an investigation to find the accurate volume of hydrogen produced from magnesium.

You do **not** need to write about safety precautions.

[6 marks]

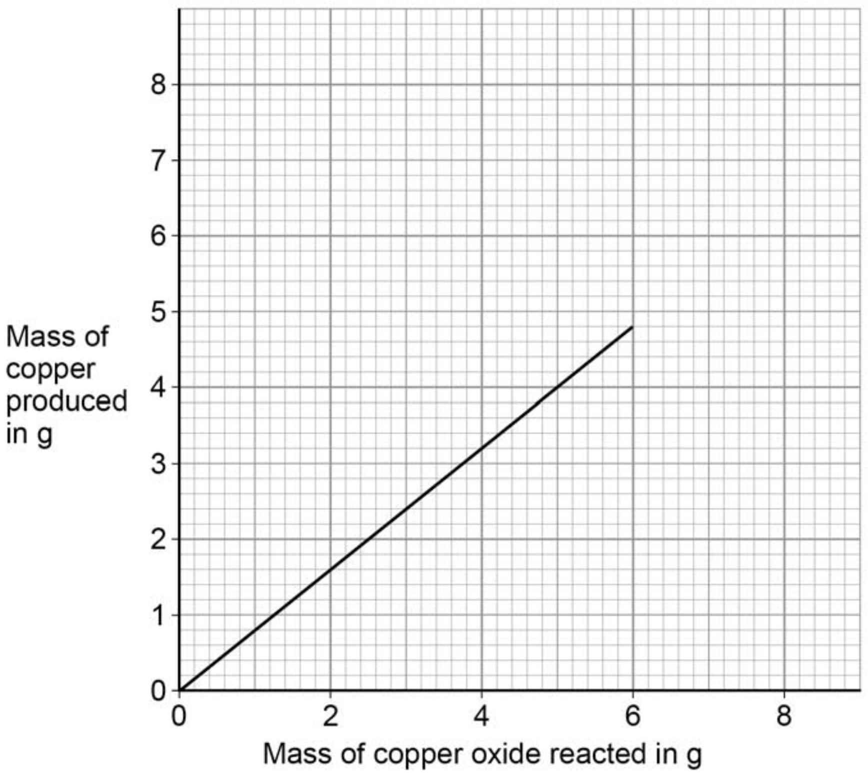
Question 7 continues on the next page

Turn over ►

A student reacts different masses of copper oxide with excess zinc to produce copper.

Figure 14 shows the student's results.

Figure 14



0 7 . 3 Calculate the gradient (slope) of the line on **Figure 14**.

[2 marks]

____

____

____

____

Gradient = ____________________ g of copper per g of copper oxide

Do not write outside the box

0 7 . 4 Determine the mass of copper that can be produced from 75 g of copper oxide.

Use **Figure 14**.

[3 marks]

Mass = ____________________ g

14

END OF QUESTIONS

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ANSWER IN THE SPACES PROVIDED