AQA

GCSE
COMBINED SCIENCE: TRILOGY

F

Foundation Tier
Chemistry Paper 1F

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.
- Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- 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.

MME.

Revision Products - GCSE Science
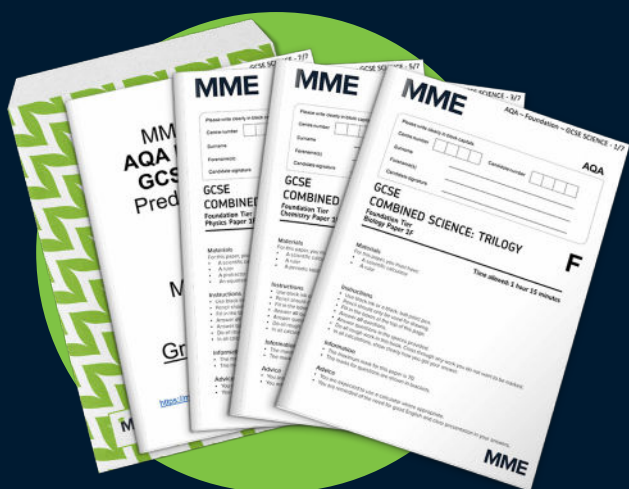
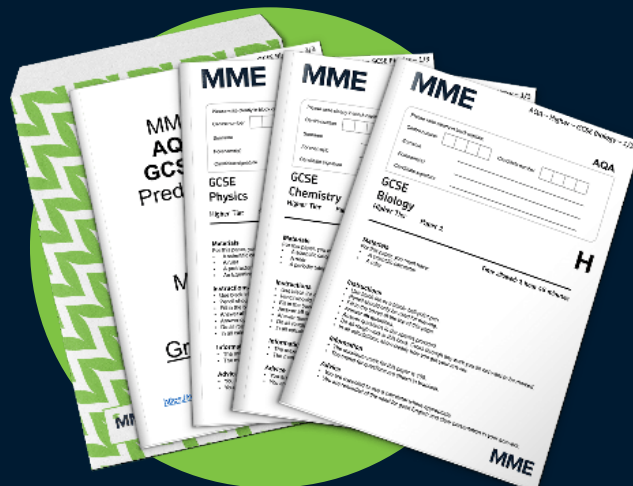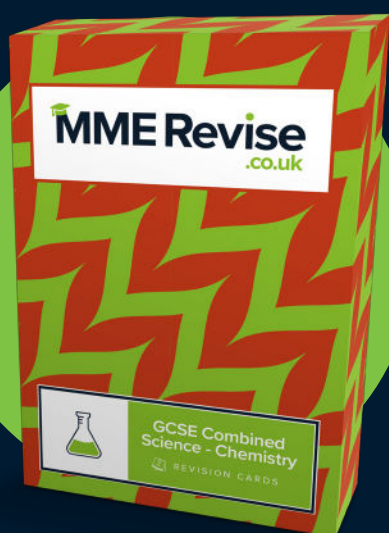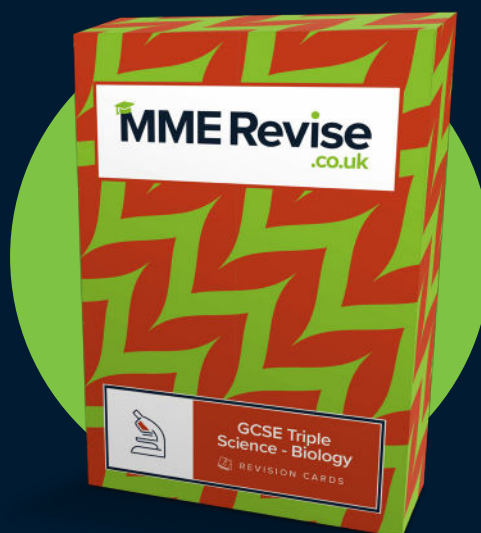**GCSE Combined Science
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0 1 This question is about Group 1 elements.

0 1 . 1 What are the Group 1 elements known as? [1 mark]

Tick (✓) **one** box.

Alkali metals ☑

Halogens ☐

Noble gases ☐

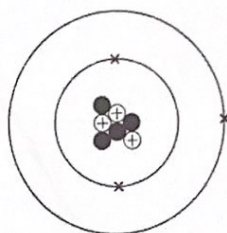**0 1 . 2** **Figure 1** shows a lithium atom.

Figure 1

What is the number of electrons and neutrons in the atom of lithium? [2 marks]

Number of electrons _____3_____

Number of neutrons _____4_____

0 1 . 3 What is the relative charge on a lithium ion? [1 mark]

Tick (✓) **one** box.

+1 ☑   0 ☐   −1 ☐
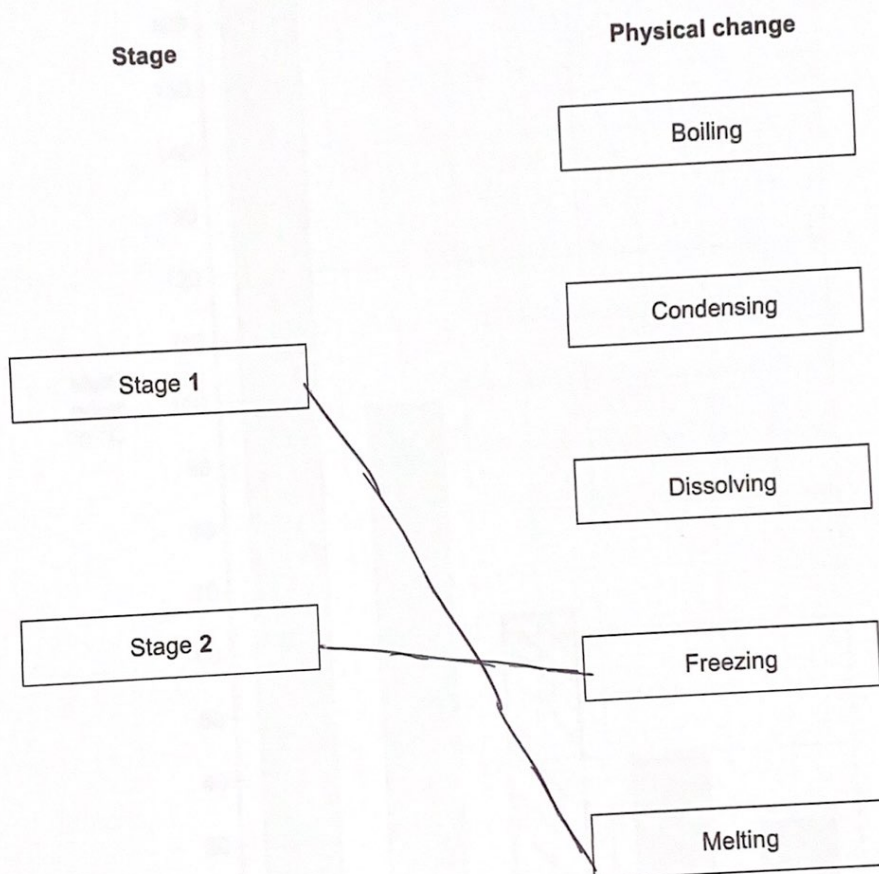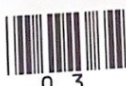
Figure 2 represents the melting points of some Group 1 elements.

Figure 2
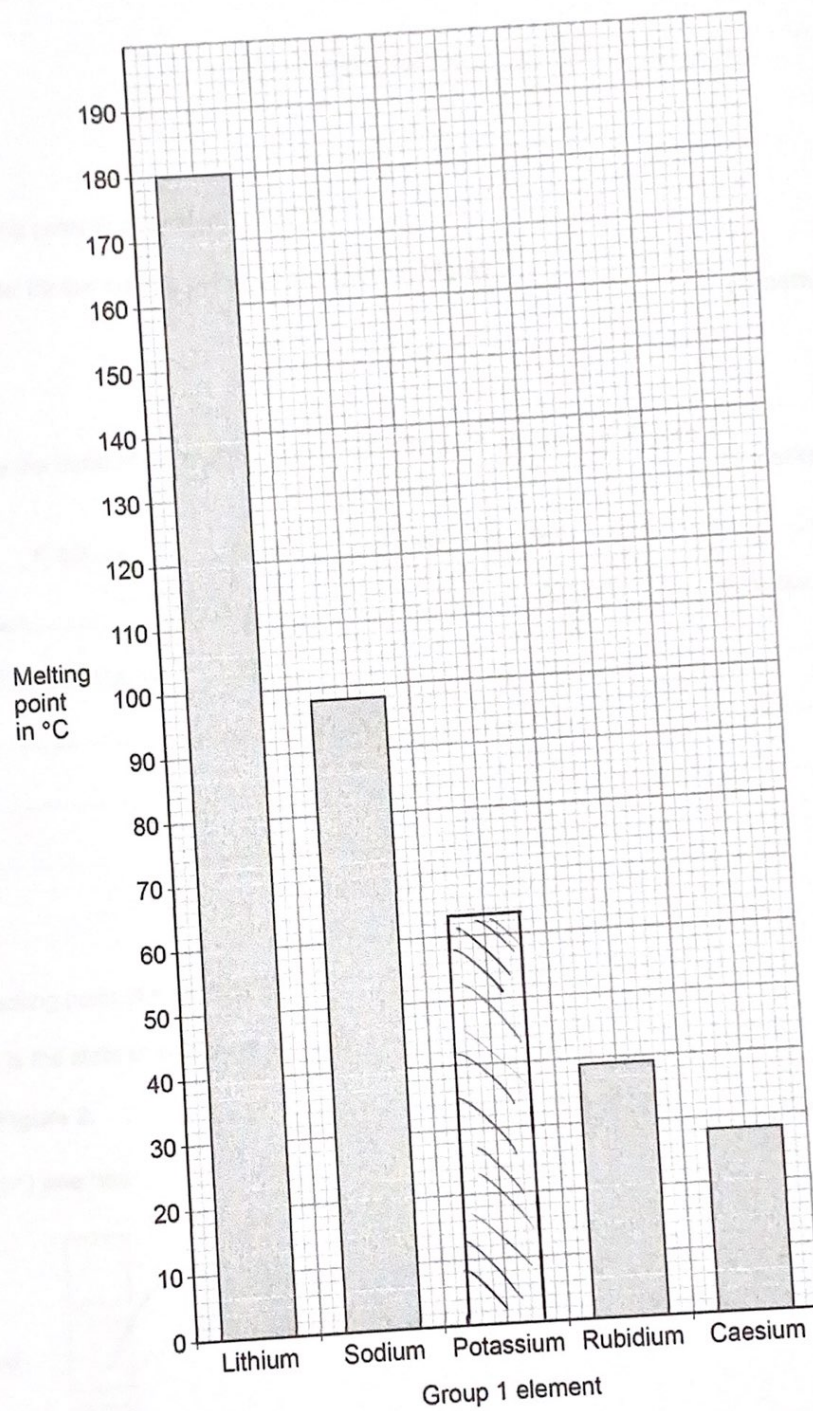
0 1 . 5 What is the melting point of caesium?

Use **Figure 2.** [1 mark]

Melting point = ___28___ °C

0 1 . 6 The melting point of potassium is 63 °C

Draw a bar for the melting point of potassium on **Figure 2.** [1 mark]

0 1 . 7 Describe the trend of the melting points of the Group 1 elements in **Figure 2.** [3 marks]

The melting point decreases as you go down Group 1. The differences between get smaller each time.

0 1 . 8 The boiling point of sodium is 883 °C

What is the state of sodium at 150 °C?

Use **Figure 2.** [1 mark]

Tick (✓) **one** box.

Gas ☐

Liquid ☑

Solid ☐

Turn over ▶

0 1 . 9 **Figure 3** represents the electronic structure of a sodium atom and of a potassium atom.

Figure 3

Sodium atom   Potassium atom
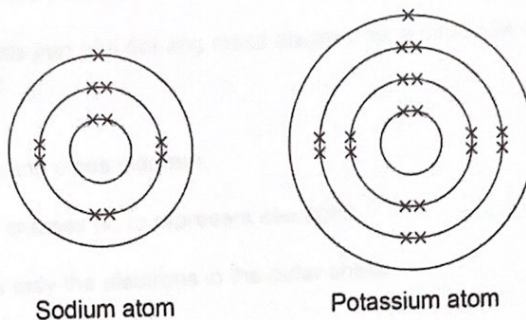
Complete the sentence.

Choose the answer from the box.

[1 mark]

| gains an electron | loses an electron | shares an electron |

Potassium is more reactive than sodium because potassium more easily __loses   an   electron__ .

13

0 2 This question is about hydrogen chloride and sodium hydroxide.

0 2 . 1 A chlorine atom has 7 electrons in the outer shell.

A hydrogen atom has 1 electron in the outer shell.

Figure 4 represents part of a dot and cross diagram for a molecule of hydrogen chloride.

Complete the dot and cross diagram.

Use dots (o) and crosses (x) to represent electrons.

You should show only the electrons in the outer shells.

[2 marks]

Figure 4
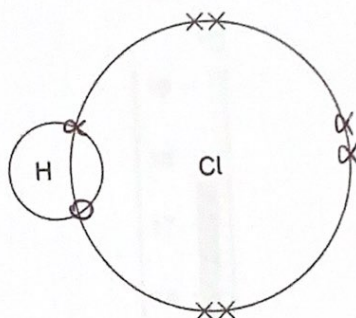
0 2 . 2 Hydrogen chloride dissolves in water to produce hydrochloric acid.

Hydrochloric acid reacts with sodium hydroxide solution.

Complete the word equation for the reaction between hydrochloric acid and sodium hydroxide.

[1 mark]

hydrochloric acid + sodium hydroxide → _Sodium chloride_ + water

Question 2 continues on the next page

Turn over ▶

Solutions of hydrochloric acid and sodium hydroxide are reacted and the temperature change is recorded.

0 2 . 3 In the reaction, 3.65 g of hydrogen chloride reacts with 4.00 g of sodium hydroxide.

1.80 g of water is produced.

Calculate the mass of the other product. **[1 mark]**

4 + 3.65 - 1.80 =

Mass = ___5.85___ g

0 2 . 4 **Figure 5** shows part of the thermometer used to measure the temperature.

Figure 5

°C

19

18

17

16
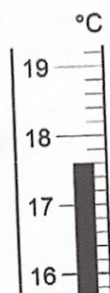
What is the temperature reading on the thermometer? **[1 mark]**

Temperature = ___17.6___ °C

0 2 . 5 In the reaction, the temperature increases.

What type of reaction is happening when the temperature increases? **[1 mark]**

It is exothermic

0 2 . 6 Sodium hydroxide is an alkali.

Which **two** ions are in sodium hydroxide solution? **[2 marks]**

Tick (✓) **two** boxes.

Cl⁻ ☐   H⁺ ☐   Na⁺ ☑   O²⁻ ☐   OH⁻ ☑

8

0 3 This question is about structure and bonding.

Figure 6 represents part of the structure of silicon dioxide.

Figure 6
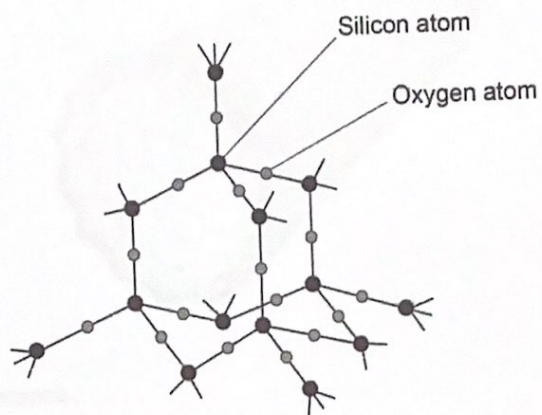
0 3 . 1 What type of structure is silicon dioxide? **[1 mark]**

Tick (✓) **one** box.

Giant covalent ☑

Ionic lattice ☐

Simple molecular ☐

0 3 . 2 Each oxygen atom forms two bonds.

What is the number of bonds formed by each silicon atom?

Use **Figure 6**. **[1 mark]**

4

Turn over ▶

Figure 7 represents part of a fullerene.

Figure 7
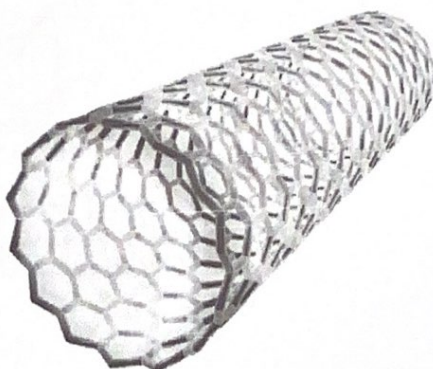
| 0 | 3 | . | 3 | Complete the sentence.

Choose the answer from the box. **[1 mark]**

| hexagons | octagons | squares | triangles |

The structure of fullerenes is based on ___hexagons___ .

| 0 | 3 | . | 4 | Complete the sentence.

Choose the answer from the box. **[1 mark]**

| carbon | hydrogen | oxygen |

The fullerene molecule shown in **Figure 7** is made from

atoms of ___carbon___ .

0 3 . 5 What is the fullerene molecule shown in **Figure 7** used for?

[1 mark]

Tick (✓) **one** box.

Electronics ☑

Hand warmers ☐

Sports injury packs ☐

Question 3 continues on the next page

Turn over ▶

Figure 8 represents part of the structure of a polymer.

Figure 8
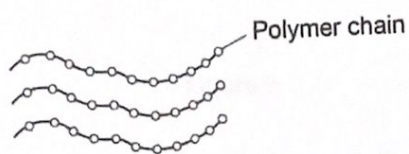
Polymer chain

0 3 . 6 What holds the atoms together in a polymer chain? [1 mark]

Tick (✓) **one** box.

Covalent bonds ☑

Ionic bonds ☐

Metallic bonds ☐

0 3 . 7 Complete the sentence.

Choose the answer from the box. [1 mark]

| atomic | intermolecular | macromolecular |

In **Figure 8** the polymer chains are held together by

intermolecular forces.

Figure 9 represents part of the structures of:

- magnesium metal
- a magnesium alloy.

Figure 9

Magnesium atom
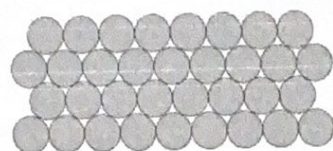
Copper atom
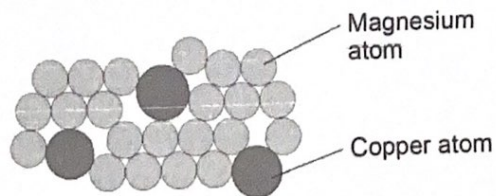
Magnesium metal   Magnesium alloy

| 0 | 3 |.| 8 | Calculate the percentage of copper atoms in the alloy.

[3 marks]

Number of magnesium atoms in the alloy = _____22_____

Number of copper atoms in the alloy = _____3_____

Total number of atoms in the alloy = _____25_____

3/25 × 100 = 12

Percentage of copper atoms in the alloy = _____12_____ %

| 0 | 3 |.| 9 | Explain why the magnesium alloy is harder than magnesium metal.

Use **Figure 9**.

[3 marks]

Alloy is harder because copper atoms
are large, so the layers of atoms
are distorted. Therefore the layers
cannot slide over each other easily.

13

Turn over ▶

0 4 This question is about elements and compounds.

0 4 . 1 Magnesium and oxygen react to produce magnesium oxide.

Balance the equation for the reaction. **[1 mark]**

$$\underline{2}\ Mg + O_2 \rightarrow 2\,MgO$$
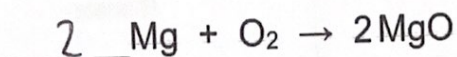
0 4 . 2 Suggest **one** safety precaution that should be taken when heating magnesium and oxygen. **[1 mark]**

Wear safety glasses.

0 4 . 3 Calculate the relative formula mass (M_r) of magnesium fluoride (MgF_2).

Relative atomic masses (A_r): F = 19 Mg = 24 **[2 marks]**

$M_r = 24 + (2 \times 19)$

$= 62$

Relative formula mass (M_r) = ___62___

0 4 . 4 Argon is a noble gas.

Explain why **no** product is formed when magnesium and argon are heated together. **[2 marks]**

Argon has a full outershell of 8 electrons, so it is unreactive.

Turn over ▶

0 4 . 5 Figure 10 shows a reactivity series.

Figure 10

Most reactive

Metal **D**

Sodium

Magnesium

Carbon

Metal **E**

Iron

Hydrogen

Copper

Least reactive
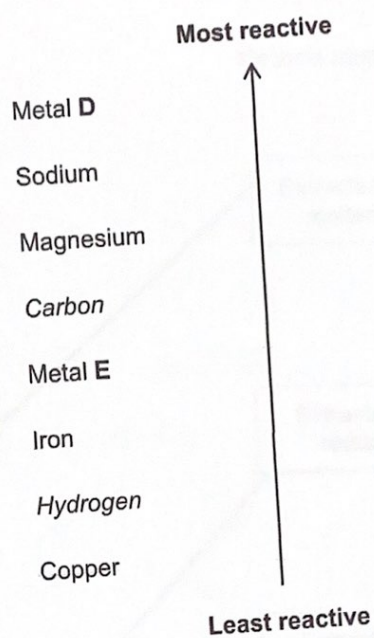
Draw **one** line from each metal to the method used to extract that metal.

Use **Figure 10**.

[2 marks]

Metal

Method used to extract that metal

Extracted by electrolysis of a molten ionic compound.

Metal **D**

Extracted from its oxide by reduction with carbon.

Extracted from its oxide by reduction with hydrogen.

Metal **E**

Removed from the Earth as the metal itself.
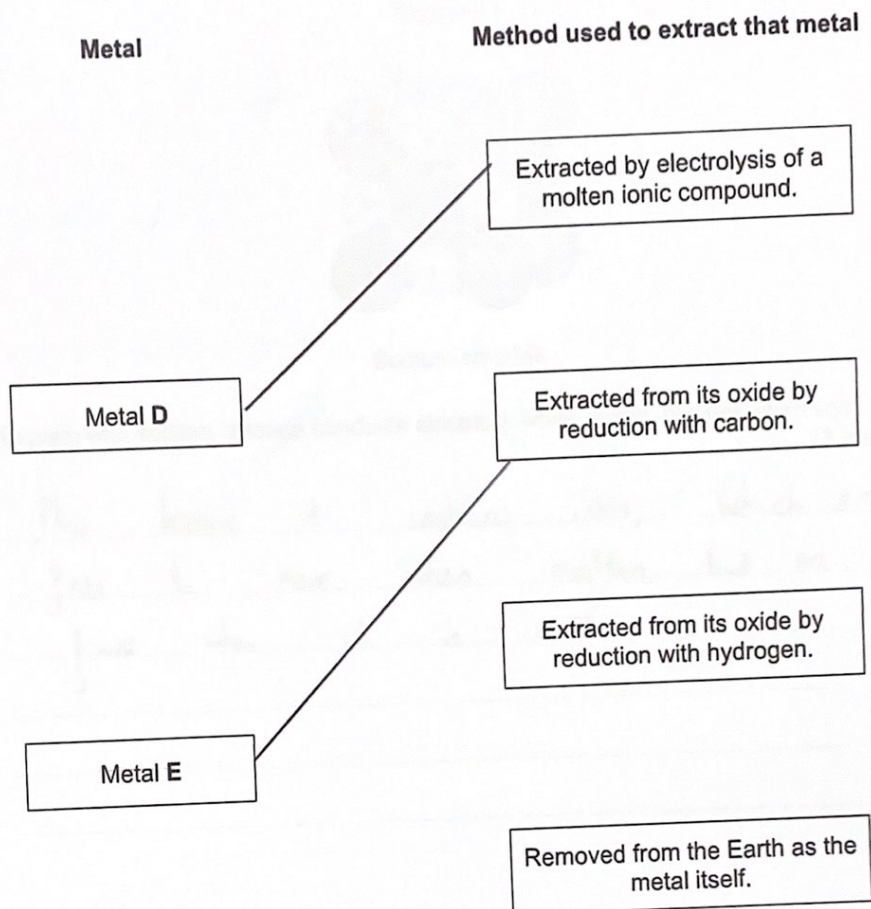
Question 4 continues on the next page

Turn over ▶

A substance conducts electricity when it has charged particles that are free to move.

0 4 . 6 **Figure 11** represents the structure of sodium chloride.

Figure 11
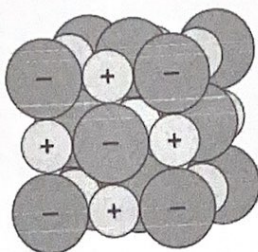
Sodium chloride

Explain why sodium chloride conducts electricity when molten but **not** when solid.

[3 marks]

This becaue it contains ions, which are
free to move when molten but are
fixed when it is solid.

0 4 . 7 Figure 12 represents the structure of sodium metal.

Figure 12
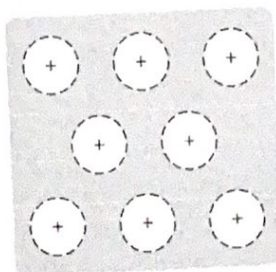
Sodium metal

Explain why sodium metal conducts electricity when solid.

[2 marks]

Sodium contains delocalised electrons.
They carry electrical charge through
the metal.

13

Turn over for the next question

0 5   This question is about salts.

Green copper carbonate and sulfuric acid can be used to produce blue copper sulfate crystals.

0 5 . 1   **Excess** copper carbonate is added to sulfuric acid.

Give **three** observations you would make.   **[3 marks]**

1   There will be a Colourless Solution

2   The copper carbonate will dissapear

3   There will be bubbles of gas.

0 5 . 2   How can the excess copper carbonate be removed?   **[1 mark]**

By using filtration

0 5 . 3   The pH of the solution changes during the reaction.

What is the pH of the solution at the end of the reaction?   **[1 mark]**

pH =   7

0 5 . 4   Copper carbonate and sulfuric acid react to produce copper sulfate.

What type of reaction is this?   **[1 mark]**
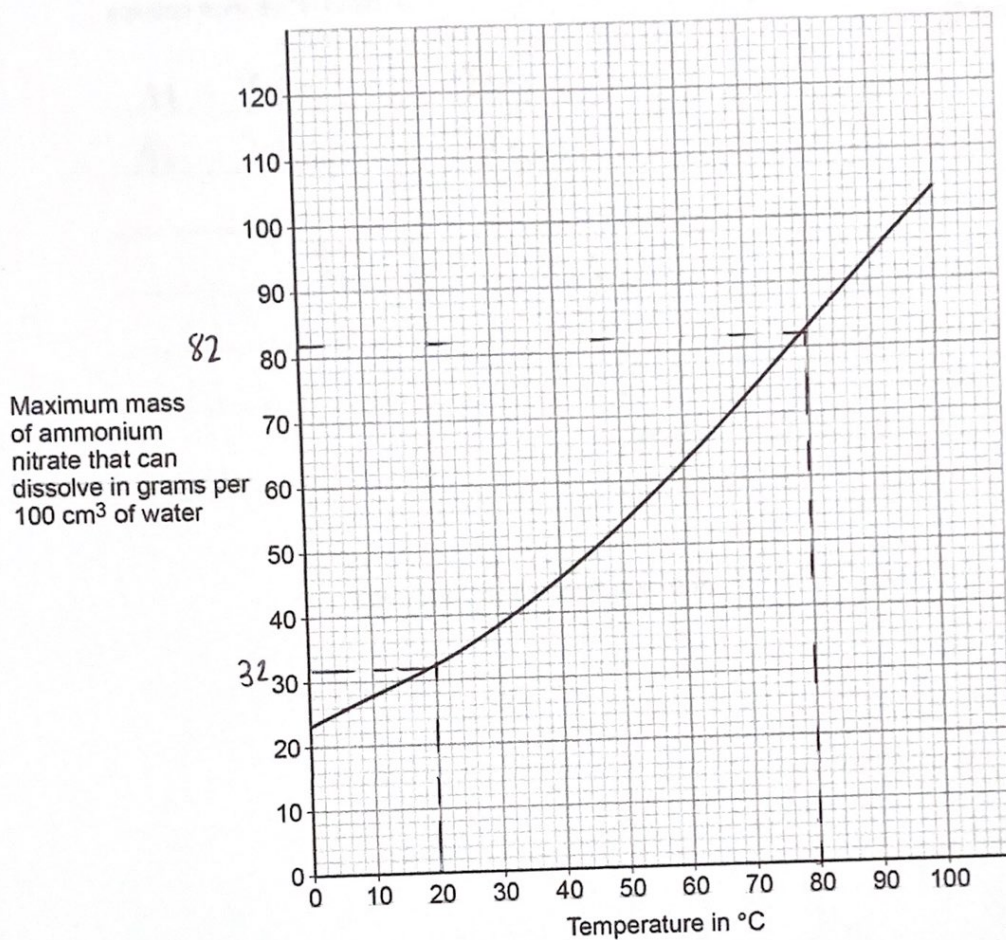
It is a neutralisation reaction.

Turn over ▶

0 5 . 5 Ammonium nitrate is a salt.

Figure 13 shows the maximum mass of ammonium nitrate that can dissolve in 100 cm³ of water at different temperatures.

Figure 13

82

32

Maximum mass of ammonium nitrate that can dissolve in grams per 100 cm³ of water

Temperature in °C

A student adds ammonium nitrate to water at 80 °C until no more dissolves.

The student cools 100 cm³ of this solution of ammonium nitrate from 80 °C to 20 °C to produce crystals of ammonium nitrate.

Determine the mass of ammonium nitrate that crystallises on cooling 100 cm³ of this solution from 80 °C to 20 °C

[3 marks]

At 80°C :   82g   (read off graph)
At 30°C :   32g

82 - 32 = 50 g

Mass = _____50_____ g

9

Turn over for the next question

0 6 This question is about electrolysis.

Figure 14 shows the apparatus used to investigate the electrolysis of potassium sulfate solution.

Figure 14

50 cm³ measuring cylinders

Oxygen

Hydrogen

Potassium sulfate solution

Inert electrodes

Power supply
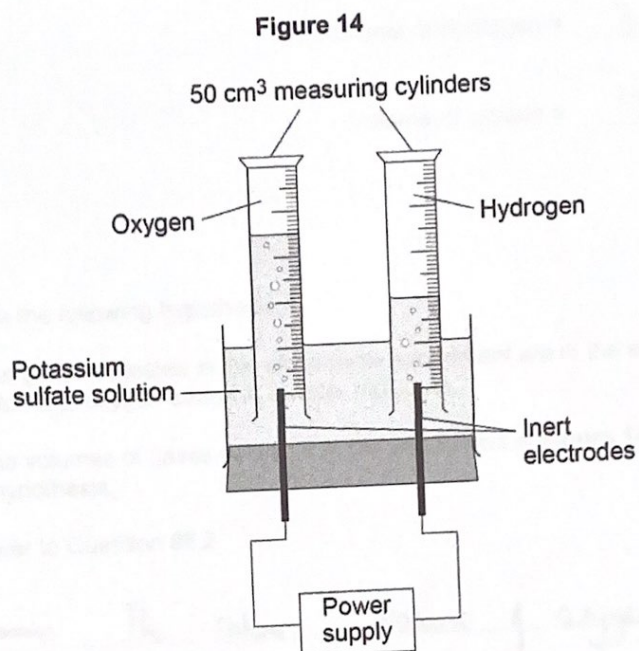
0 6 . 1 Potassium sulfate contains K^+ and SO_4^{2-} ions.

What is the formula of potassium sulfate?   **[1 mark]**

Tick (✓) **one** box.

KSO₄ ☐

K₂SO₄ ☑

K(SO₄)₂ ☐

K₂(SO₄)₂ ☐

0 6 . 2 What are the volumes of gases collected in the electrolysis experiment?

Use **Figure 14**.

[1 mark]

Volume of hydrogen = ___30___ cm³

Volume of oxygen = ___15___ cm³

0 6 . 3 A student made the following hypothesis:

'The volumes of gases collected in this electrolysis experiment are in the same ratio as hydrogen atoms to oxygen atoms in a water molecule.'

Explain how the volumes of gases collected in the experiment in **Figure 14** support the student's hypothesis.

Use your answer to Question **06.2**

[2 marks]

This is The ratios Volume of oxygen : hydrogen

is And 1:2

This is the sone as the ratios

of number of oxygen : hydrogen

atoms.

Question 6 continues on the next page

Turn over ▶

0 6 . 4 The experiment is repeated 4 times.

The volumes of oxygen collected in the 4 experiments are:

$6 \, cm^3$ $9 \, cm^3$ $10 \, cm^3$ $11 \, cm^3$

The mean volume of oxygen collected in the 4 experiments is $9 \, cm^3$

The measure of uncertainty is the range of a set of measurements about the mean.

What is the measure of uncertainty in the 4 experiments?   **[1 mark]**

Tick (✓) **one** box.

$9 \pm 1 \, cm^3$ ☐

$9 \pm 2 \, cm^3$ ☐

$9 \pm 3 \, cm^3$ ☑

0 6 . 5 The potassium sulfate solution has 0.86 g of potassium sulfate dissolved in $25 \, cm^3$ of water.

Calculate the mass of potassium sulfate needed to make $1.0 \, dm^3$ of solution.
  [3 marks]

$25 \, cm^3$ in dm^3 : $\dfrac{25}{1000} = 0.025 \, dm^3$

Concentration $= \dfrac{0.86}{0.025}$ $= 34.4$ g per dm^3

Mass = _____34.4_____ g

8

0 7   Plan an investigation to find the order of reactivity of three metals.

You should use the temperature change when each metal reacts with
hydrochloric acid.

[6 marks]

Firstly, measure a volume of hydrochoric acid. Pour this into a suitable container, such as a polystyrene cup. Using a thermometer, measure initial temperature of the acid before anything is added to it. Add 5g of metal, for example aluminum. Measure the highest temperature the solution reaches, and determine the difference in temperature from the initial reading. Repeat this process two more times and calculate an average temperature difference. Repeat this for other metals, ensuring the metal each time is 5g and in the same form, such as a powder. Also make sure the volume of the acid each time is the same, 10 ml. The larger the temperature difference, the more reactive the metal. Use these results to organise the metals in order of reactivity.

END OF QUESTIONS

6