

A



Surname \_\_\_\_\_

Other Names \_\_\_\_\_

Centre Number \_\_\_\_\_

Candidate Number \_\_\_\_\_

Candidate Signature \_\_\_\_\_

I declare this is my own work.

**GCSE**

**COMBINED SCIENCE: TRILOGY**

**H**

Higher Tier

Chemistry Paper 1H

**8464/C/1H**

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]



J U N 2 2 8 4 6 4 C 1 H 0 1

**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.
- 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.**

**DO NOT TURN OVER UNTIL TOLD TO DO SO**



0	1
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This question is about salts.

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

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**EXCESS** copper carbonate is added to sulfuric acid.

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

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**0 1 . 2**

**How can the excess copper carbonate be removed?**  
**[1 mark]**

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**0 1 . 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 =** \_\_\_\_\_

**[Turn over]**



**0 1 . 4**

**Copper carbonate and sulfuric acid react to produce copper sulfate.**

**What type of reaction is this? [1 mark]**

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**0 1 . 5**

**Ammonium nitrate is a salt.**

**FIGURE 1, on page 8, shows the maximum mass of ammonium nitrate that can dissolve in 100 cm<sup>3</sup> of water at different temperatures.**



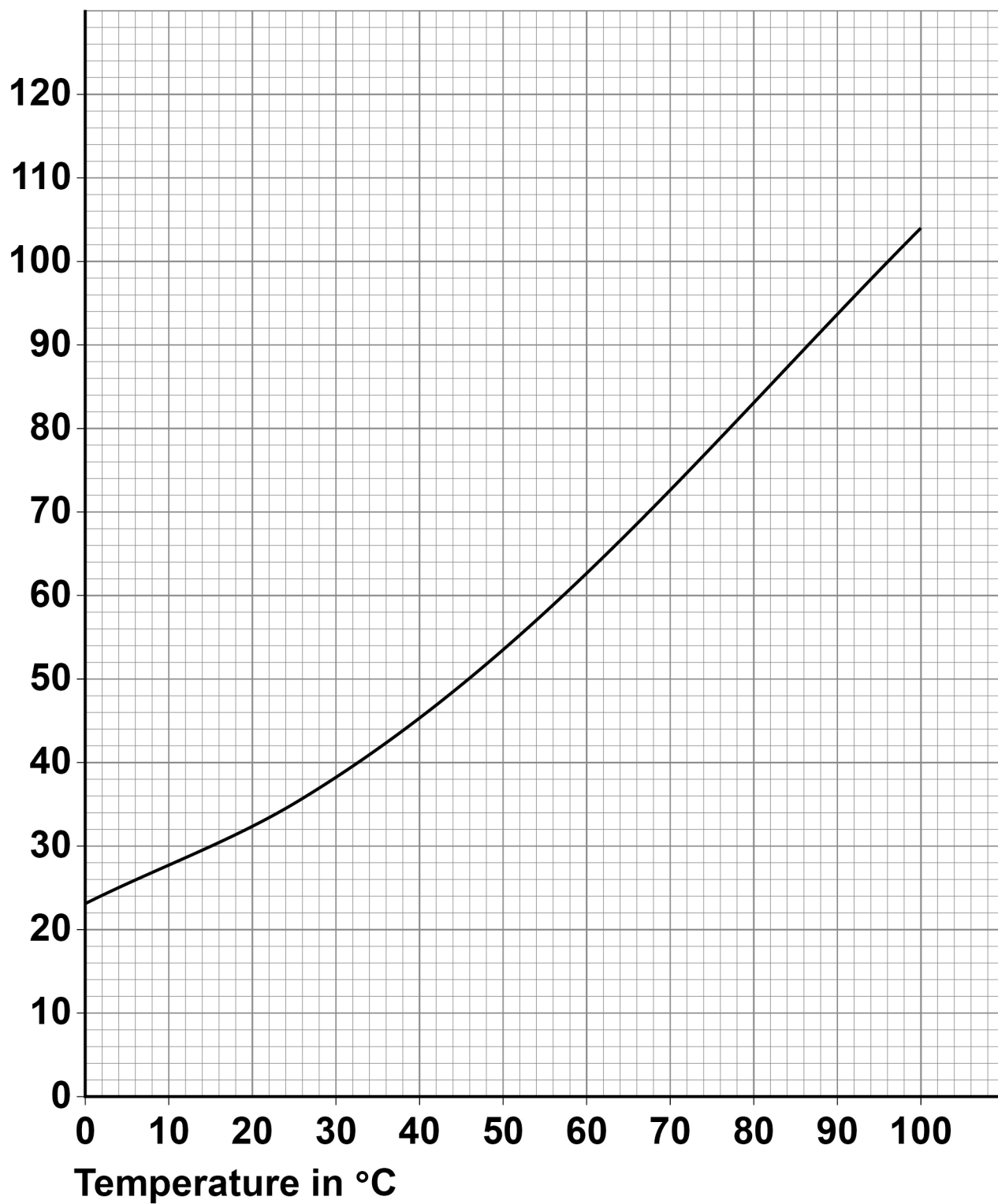
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**[Turn over]**



FIGURE 1

Maximum mass of ammonium nitrate that can dissolve in grams per 100 cm<sup>3</sup> of water





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

The student cools 100 cm<sup>3</sup> 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 cm<sup>3</sup> of this solution from 80 °C to 20 °C [3 marks]

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

[Turn over]

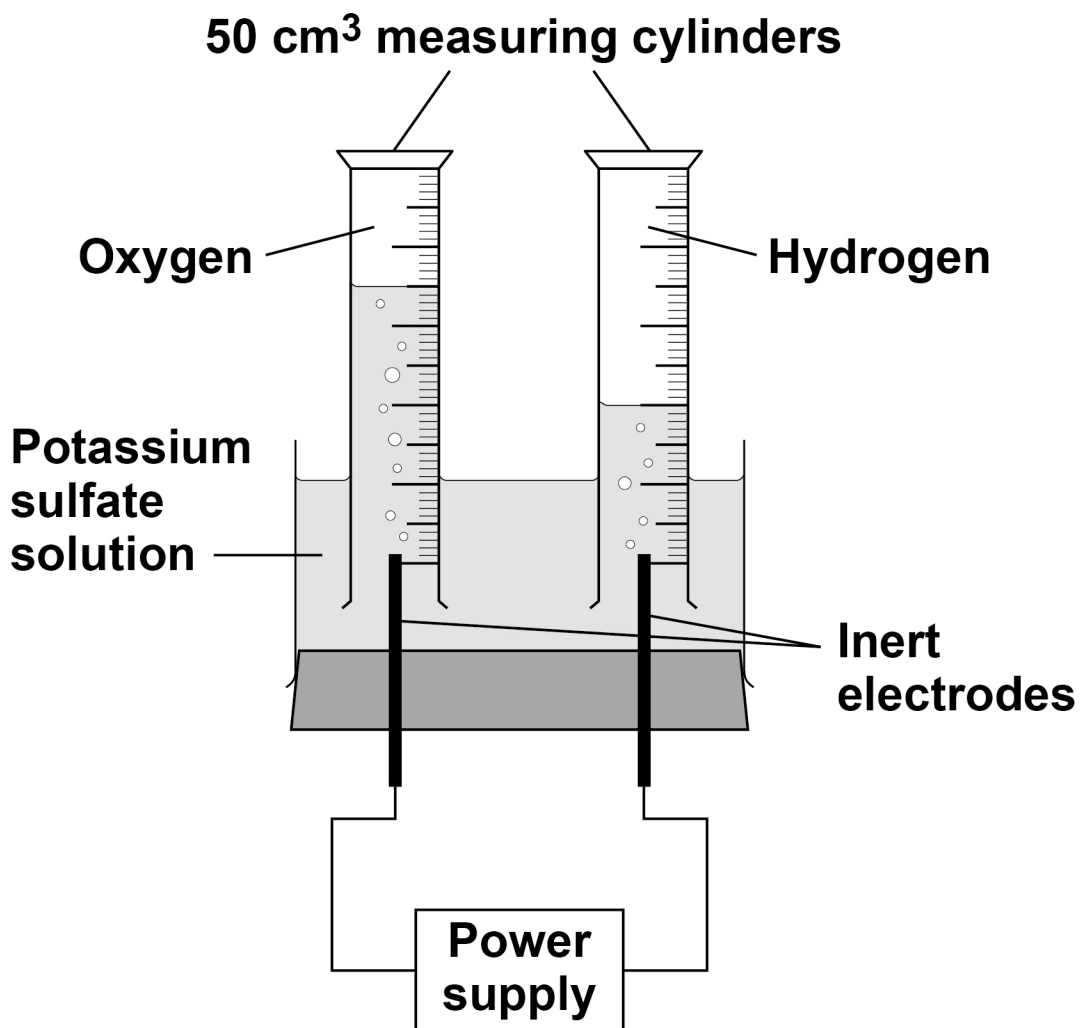


02

This question is about electrolysis.

FIGURE 2 shows the apparatus used to investigate the electrolysis of potassium sulfate solution.

FIGURE 2



02.1

Potassium sulfate contains  $\text{K}^+$  and  $\text{SO}_4^{2-}$  ions.

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

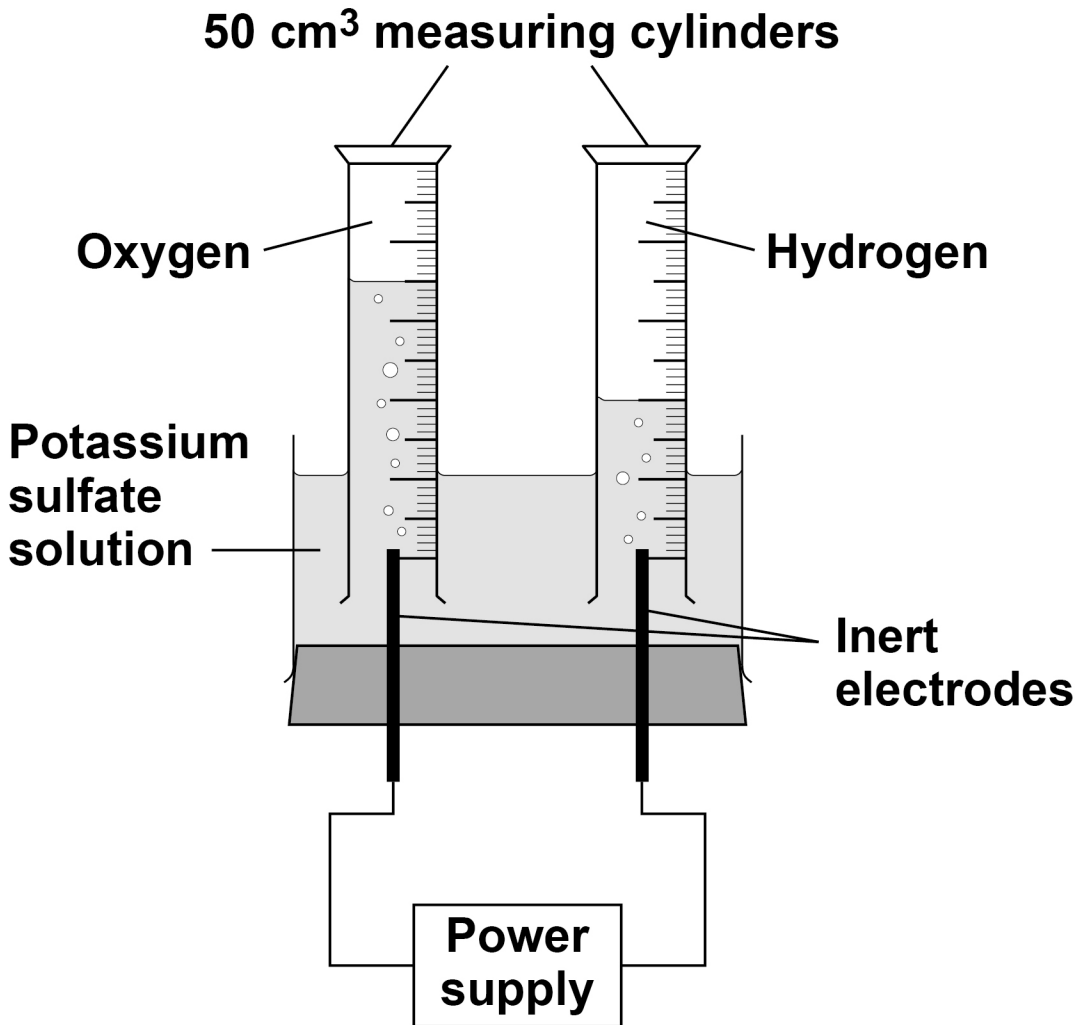
Tick (✓) ONE box.

 $\text{KSO}_4$  $\text{K}_2\text{SO}_4$  $\text{K}(\text{SO}_4)_2$  $\text{K}_2(\text{SO}_4)_2$ 

[Turn over]



## REPEAT OF FIGURE 2



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

Use FIGURE 2. [1 mark]

Volume of hydrogen = \_\_\_\_\_ cm<sup>3</sup>

Volume of oxygen = \_\_\_\_\_ cm<sup>3</sup>



02.3

**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 2 support the student's hypothesis.**

**Use your answer to Question 02.2. [2 marks]**

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**[Turn over]**



0	2	.	4
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The experiment is repeated 4 times.

The volumes of oxygen collected in the 4 experiments are:

6 cm<sup>3</sup>      9 cm<sup>3</sup>      10 cm<sup>3</sup>      11 cm<sup>3</sup>

The mean volume of oxygen collected in the 4 experiments is 9 cm<sup>3</sup>

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 ± 1 cm<sup>3</sup>

9 ± 2 cm<sup>3</sup>

9 ± 3 cm<sup>3</sup>



0 2 . 5

The potassium sulfate solution has 0.86 g of potassium sulfate dissolved in 25 cm<sup>3</sup> of water.

Calculate the mass of potassium sulfate needed to make 1.0 dm<sup>3</sup> of solution. [3 marks]

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

[Turn over]

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03

**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]**

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**[Turn over]**





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**[Turn over]**



0	4
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This question is about Group 7 elements.

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What are the Group 7 elements known as? [1 mark]

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Why do Group 7 elements react in similar ways?  
[1 mark]

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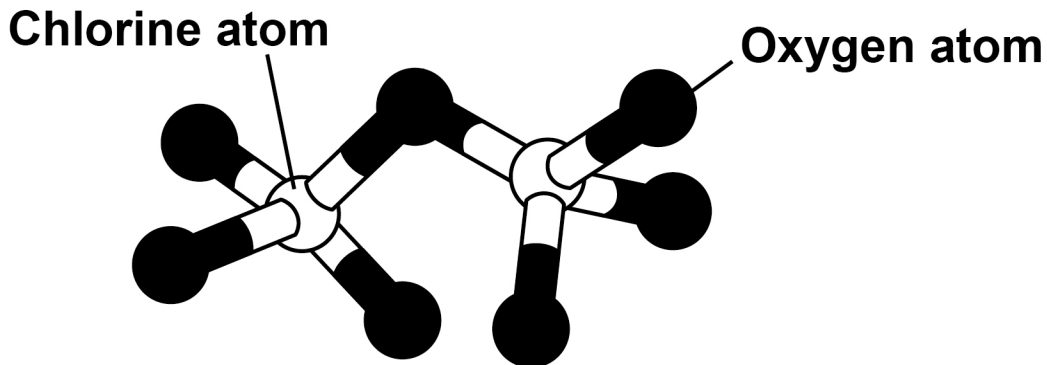
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04.3

FIGURE 3 shows the structure of a molecule of chlorine oxide.

FIGURE 3



What is the molecular formula of the chlorine oxide molecule in FIGURE 3? [1 mark]

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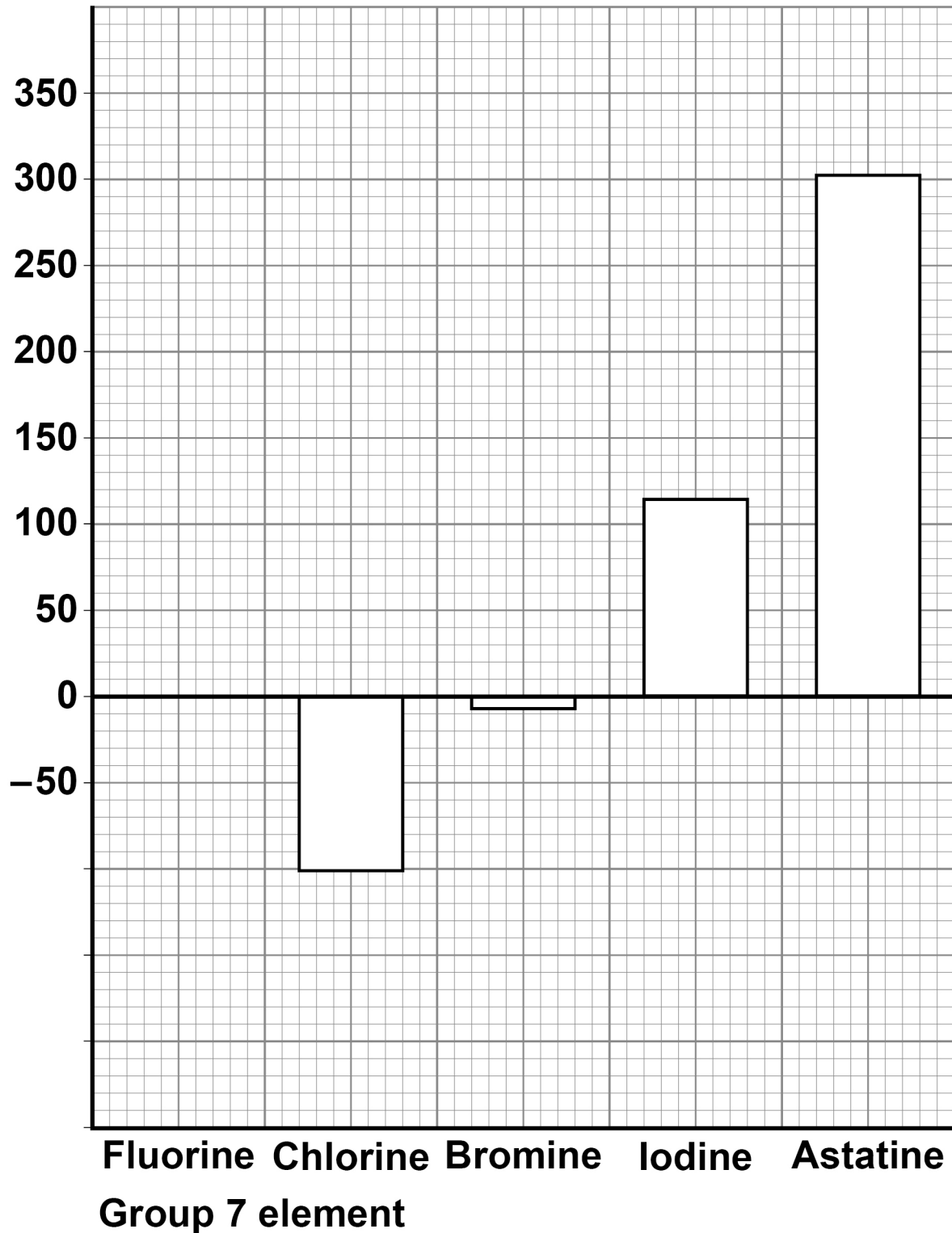
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FIGURE 4 shows the melting points of some Group 7 elements.

FIGURE 4

Melting point  
in °C



0	4	.	4
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The melting point of fluorine is  $-220\text{ }^{\circ}\text{C}$

Complete FIGURE 4, on the opposite page.

You should:

- complete the scale on the y-axis
- draw the bar for the melting point of fluorine.

[2 marks]

[Turn over]



**0 4 . 5**

**Explain the trend in the melting points of the Group 7 elements.**

**Use FIGURE 4, on page 22. [3 marks]**

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04.6

What is the state symbol for bromine at  $-50\text{ }^{\circ}\text{C}$ ?

Use FIGURE 4, on page 22. [1 mark]

Tick (✓) ONE box.

(aq)

(g)

(l)

(s)

04.7

Evaporation and boiling occur at the surface of bromine at its boiling point.

Name ONE more process that happens at the surface of bromine at its boiling point. [1 mark]

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[Turn over]

10



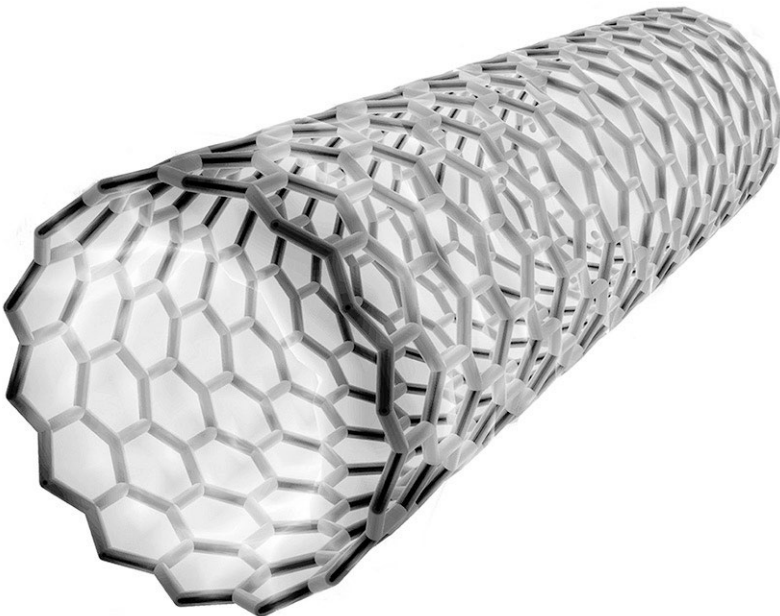
0	5
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This question is about structure and bonding.

0	5	.	1
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FIGURE 5 represents part of a carbon molecule.

FIGURE 5



Name the type of carbon molecule in FIGURE 5.  
[1 mark]

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0	5	.	2
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**Suggest ONE property that makes the carbon molecule in FIGURE 5 useful in nanotechnology. [1 mark]**

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**[Turn over]**



05.3

An alloy of aluminium contains small amounts of other metals.

Explain why other metals are added to aluminium.  
[4 marks]

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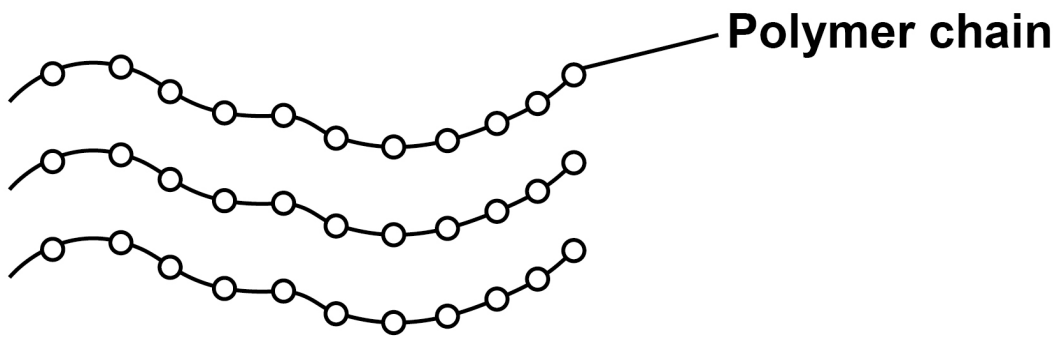
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05.4

FIGURE 6 represents part of the structure of a polymer.

FIGURE 6



Compare the bonding within the chains with the forces between the chains in this polymer. [3 marks]

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[Turn over]

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9



0	6
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This question is about hydrogen chloride and hydrochloric acid.

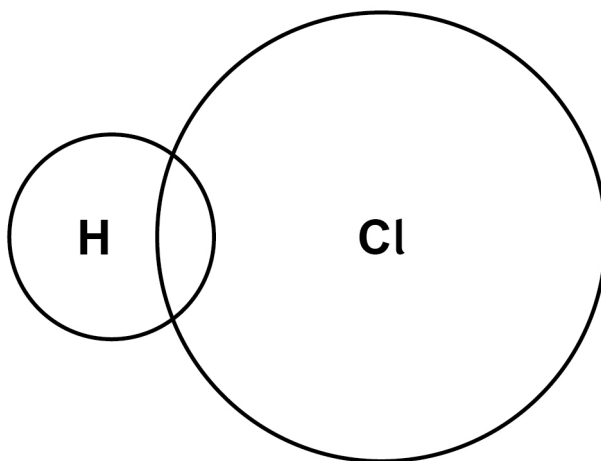
0	6	.	1
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Complete the dot and cross diagram to represent the bonding in hydrogen chloride on FIGURE 7.

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

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

**FIGURE 7**





**06.2**

**Hydrogen chloride dissolves in water to produce hydrochloric acid.**

**Hydrochloric acid is a strong acid.**

**What is meant by the term strong acid? [1 mark]**

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**[Turn over]**



0	6	.	3
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**Describe how magnesium can be used to distinguish between a strong acid and a weak acid of the same concentration. [2 marks]**

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0	6	.	4
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The concentration of hydrochloric acid is increased by a factor of 100

What is the change in pH? [2 marks]

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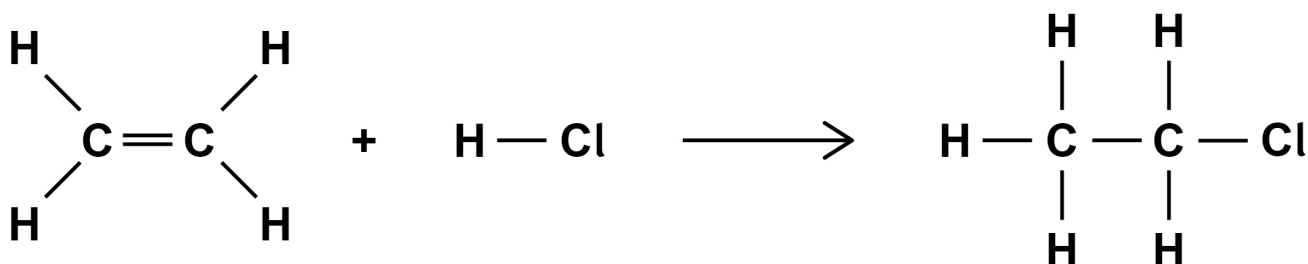
[Turn over]



06.5

Ethene and hydrogen chloride react to produce chloroethane.

The displayed formulae equation for the reaction is:



The reaction is exothermic.

In the reaction the energy released forming new bonds is 56 kJ/mol greater than the energy needed to break existing bonds.

TABLE 1 shows some bond energies.

TABLE 1

Bond	H-C	C=C	H-Cl	C-C	C-Cl
Bond energy in kJ/mol	413	X	431	346	339



Calculate the bond energy X. [4 marks]

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X = \_\_\_\_\_ kJ/mol

[Turn over]

11



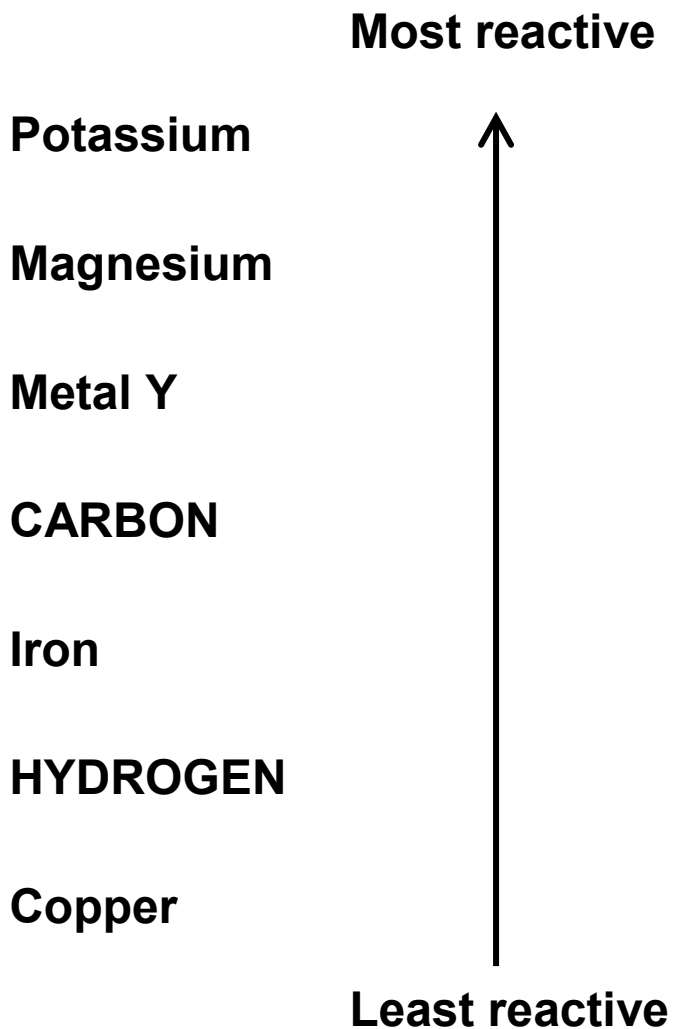
07

This question is about elements and compounds.

07.1

FIGURE 8 shows a reactivity series.

FIGURE 8



**Give the method and conditions used to extract metal Y from a compound of metal Y. [2 marks]**

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**[Turn over]**

Sodium reacts with titanium chloride ( $\text{TiCl}_4$ ) to produce titanium.

07.2

Complete the equation.

You should balance the equation. [2 marks]



07.3

The reaction between sodium and titanium chloride is a redox reaction.

Write a half-equation to show that sodium is oxidised in this reaction. [2 marks]

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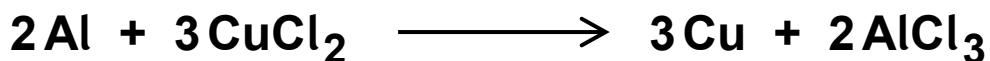
**[Turn over]**



0	7	.	4
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108 g of aluminum reacts with 1.21 kg of copper chloride to produce copper.

The equation for the reaction is:



Calculate the maximum mass of copper produced in grams (g).

You should determine the limiting reactant.

Relative atomic masses ( $A_r$ ): Al = 27    Cu = 63.5

Relative formula masses ( $M_r$ ):

$\text{CuCl}_2 = 134.5$      $\text{AlCl}_3 = 133.5$

[6 marks]

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Limiting reactant is \_\_\_\_\_

Mass of copper = \_\_\_\_\_ g

[Turn over]



**Sodium metal and sodium chloride are both able to conduct electricity.**

**07.5**

**Describe how sodium metal conducts electricity.  
[2 marks]**

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**Explain how sodium chloride can conduct electricity.  
[3 marks]**

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**END OF QUESTIONS**

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17



**Additional page, if required.**

**Write the question numbers in the left-hand margin.**

A series of horizontal lines for writing, with a vertical line on the left side defining a margin. The lines are evenly spaced and extend across the width of the page.



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For Examiner's Use	
Question	Mark
1	
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<b>TOTAL</b>	

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