AQA

Please write clearly in block capitals.

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

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

# GCSE
# COMBINED SCIENCE: TRILOGY

**H**

## Higher Tier
## Chemistry Paper 1H

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.

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

**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.

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**ANSWER IN THE SPACES PROVIDED**

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**0 1** This question is about salts.

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

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

Give **three** observations you would make.

**[3 marks]**

1 _____

_____

2 _____

_____

3 _____

_____

**0 1 . 2** How can the excess copper carbonate be removed?

**[1 mark]**

_____

_____

**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 = _____

**0 1 . 4** Copper carbonate and sulfuric acid react to produce copper sulfate.

What type of reaction is this?

**[1 mark]**

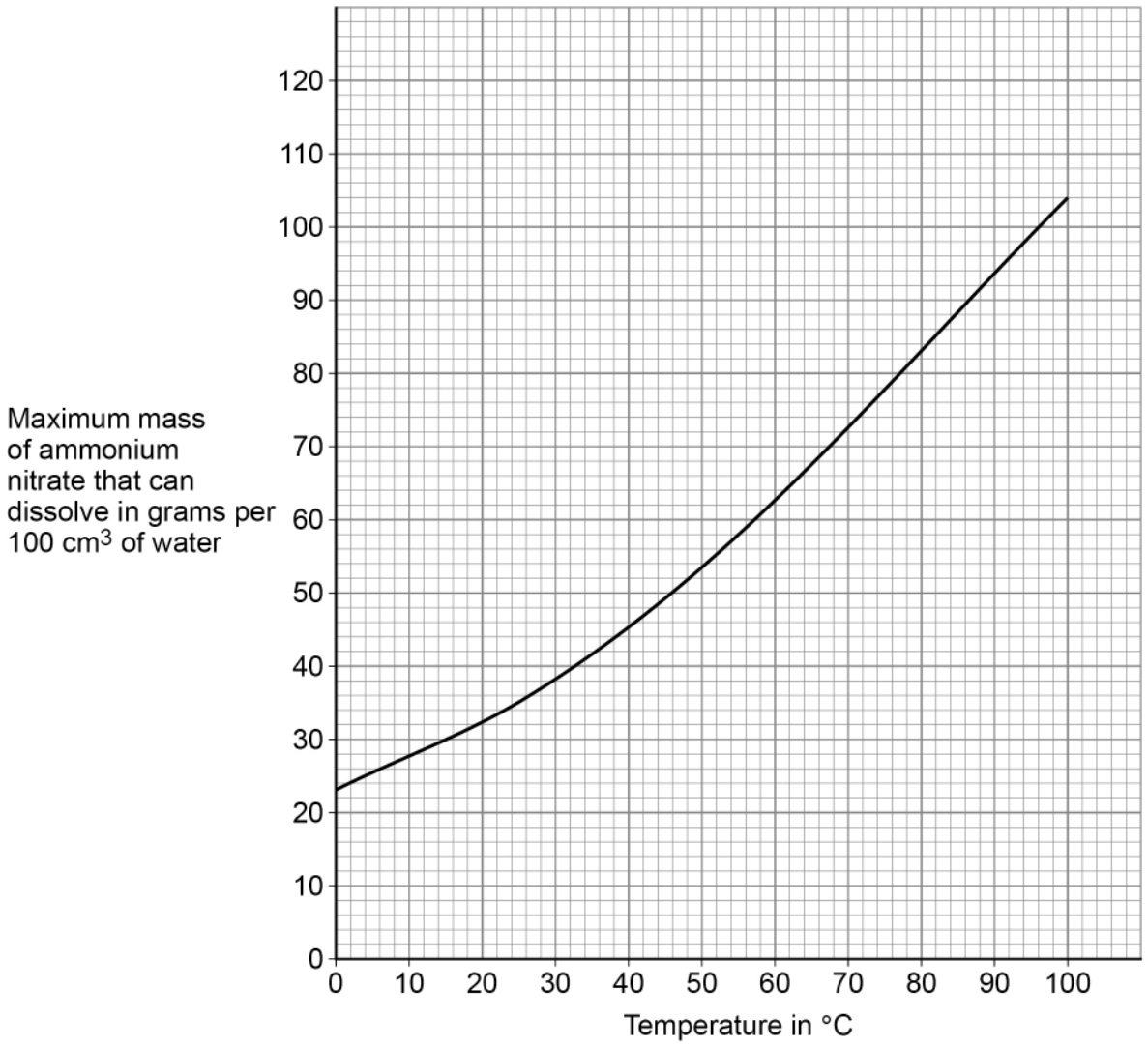
_____

**Turn over ►**

**0 1 . 5** Ammonium nitrate is a salt.

**Figure 1** shows the maximum mass of ammonium nitrate that can dissolve in 100 $cm^3$ of water at different temperatures.

**Figure 1**



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

The student cools 100 $cm^3$ 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 $cm^3$ of this solution from 80 °C to 20 °C

**[3 marks]**

Mass = _____ g

9

**Turn over for the next question**

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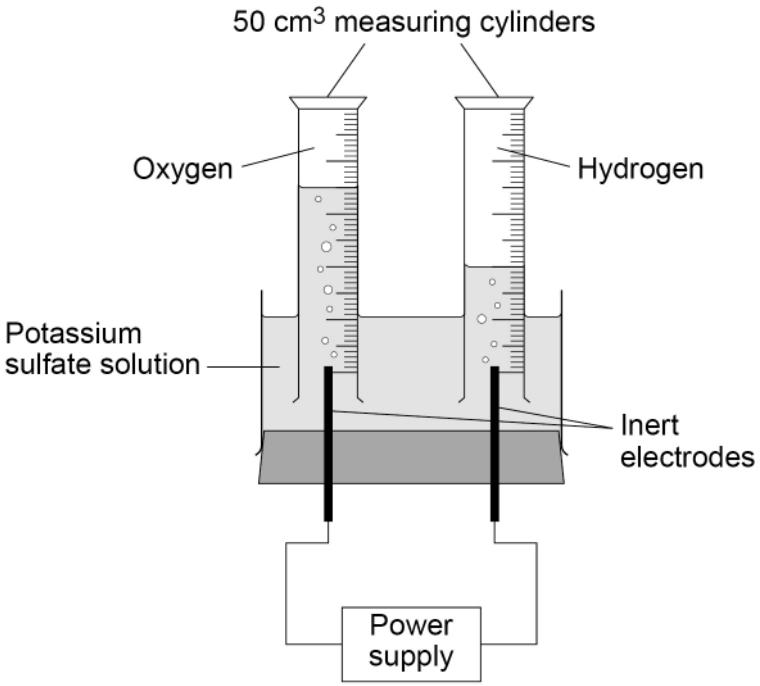
**0 2** This question is about electrolysis.

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

**Figure 2**




**0 2 . 1** Potassium sulfate contains $K^+$ and $SO_4^{2-}$ ions.

What is the formula of potassium sulfate?

**[1 mark]**

Tick (✓) **one** box.

$KSO_4$ ☐

$K_2SO_4$ ☐

$K(SO_4)_2$ ☐

$K_2(SO_4)_2$ ☐

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

Use **Figure 2**.

**[1 mark]**

Volume of hydrogen = _____ $cm^3$

Volume of oxygen = _____ $cm^3$

**0 2 . 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]**

**Question 2 continues on the next page**

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**0 2 . 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 ± 1 $cm^3$ ☐

9 ± 2 $cm^3$ ☐

9 ± 3 $cm^3$ ☐

**0 2 . 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]**

Mass = _____ g

**8**

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**0 3** 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]**

6

**Turn over for the next question**

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**0 4** This question is about Group 7 elements.

**0 4 . 1** What are the Group 7 elements known as?

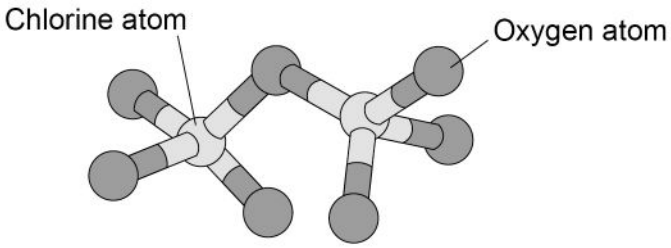
**[1 mark]**

**0 4 . 2** Why do Group 7 elements react in similar ways?

**[1 mark]**

**0 4 . 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]**

**Question 4 continues on the next page**

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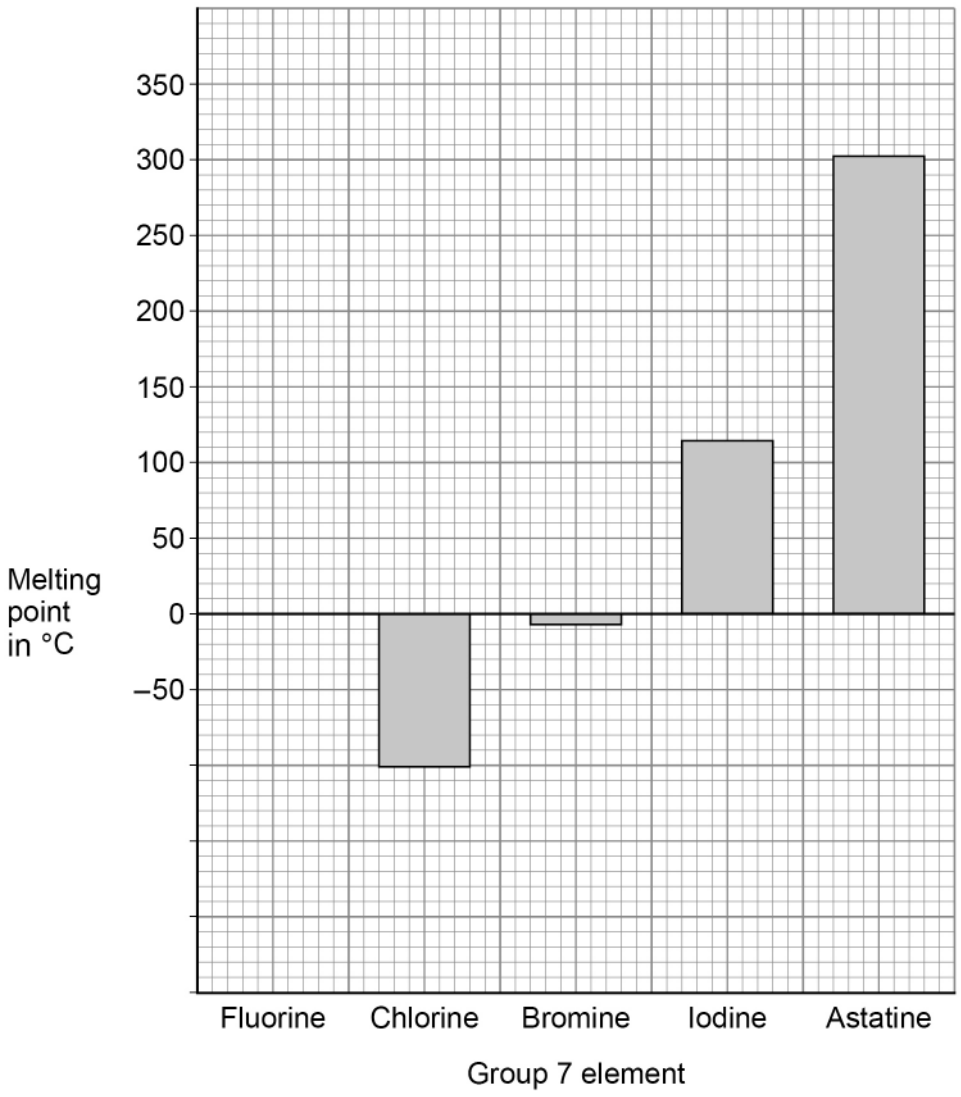
**Figure 4** shows the melting points of some Group 7 elements.

**Figure 4**




**0 4 . 4** The melting point of fluorine is –220 °C

Complete **Figure 4**.

You should:

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

**[2 marks]**

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**0 4 . 5** Explain the trend in the melting points of the Group 7 elements.

Use **Figure 4**.

**[3 marks]**

**0 4 . 6** What is the state symbol for bromine at –50 °C?

Use **Figure 4**.

**[1 mark]**

Tick (✓) **one** box.

(aq) ☐ (g) ☐ (l) ☐ (s) ☐

**0 4 . 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]**

**10**

**Turn over for the next question**

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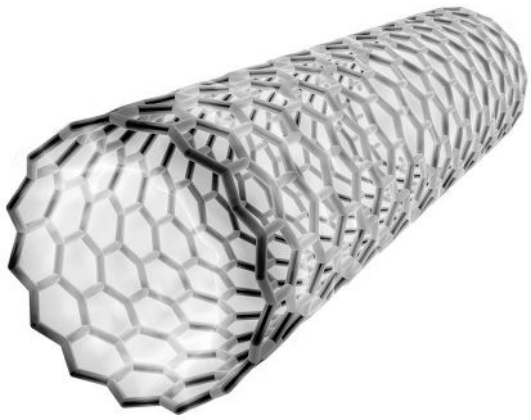
**0 5** This question is about structure and bonding.

**0 5 . 1** **Figure 5** represents part of a carbon molecule.

**Figure 5**



Name the type of carbon molecule in **Figure 5**.

**[1 mark]**

**0 5 . 2** Suggest **one** property that makes the carbon molecule in **Figure 5** useful in nanotechnology.

**[1 mark]**

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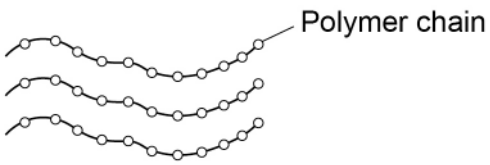
**0 5 . 3** An alloy of aluminium contains small amounts of other metals.

Explain why other metals are added to aluminium.

**[4 marks]**

**0 5 . 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]**

**9**

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

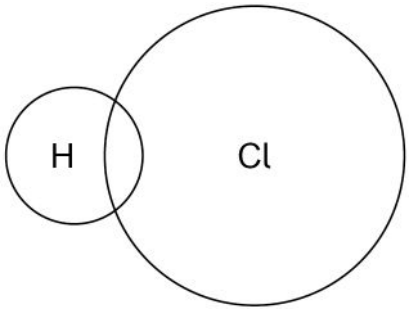
**0 6 . 1** Complete the dot and cross diagram to represent the bonding in hydrogen chloride on **Figure 7**.

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

You should show only the electrons in the outer shells.

**[2 marks]**

**Figure 7**




**0 6 . 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]**

**0 6 . 3** 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** The concentration of hydrochloric acid is increased by a factor of 100

What is the change in pH?

**[2 marks]**

**Question 6 continues on the next page**

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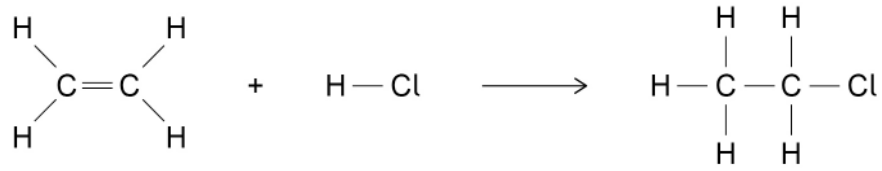
**0 6 . 5** Ethene and hydrogen chloride react to produce chloroethane.

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]**

**X** = _____ kJ/mol

**11**

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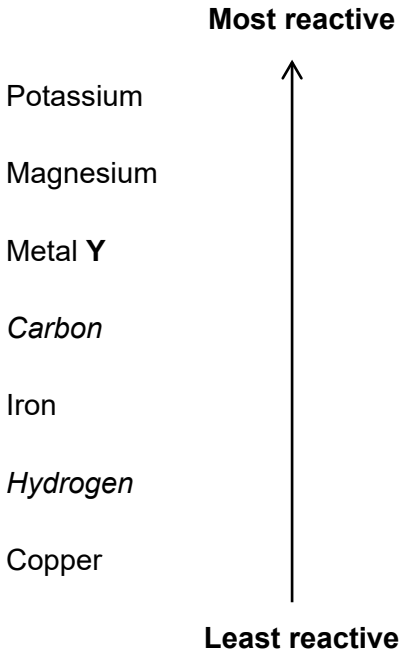
**0 7** This question is about elements and compounds.

**0 7 . 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]**

**Question 7 continues on the next page**

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Sodium reacts with titanium chloride ($TiCl_4$) to produce titanium.

**0 7 . 2** Complete the equation.

You should balance the equation.

**[2 marks]**

____ Na + $TiCl_4$ → _____ + _____

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

The equation for the reaction is:

$$2\,Al + 3\,CuCl_2 \rightarrow 3\,Cu + 2\,AlCl_3$$

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 ($M_r$): $CuCl_2$ = 134.5 $AlCl_3$ = 133.5

**[6 marks]**

Limiting reactant is _____

Mass of copper = _____ g

**Question 7 continues on the next page**

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

**0 7 . 5** Describe how sodium metal conducts electricity.

**[2 marks]**

**0 7 . 6** Explain how sodium chloride can conduct electricity.

**[3 marks]**

**17**

**END OF QUESTIONS**

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