

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

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Forename(s)

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Candidate signature

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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.

## 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	
<b>TOTAL</b>	



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ANSWER IN THE SPACES PROVIDED**



**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]**

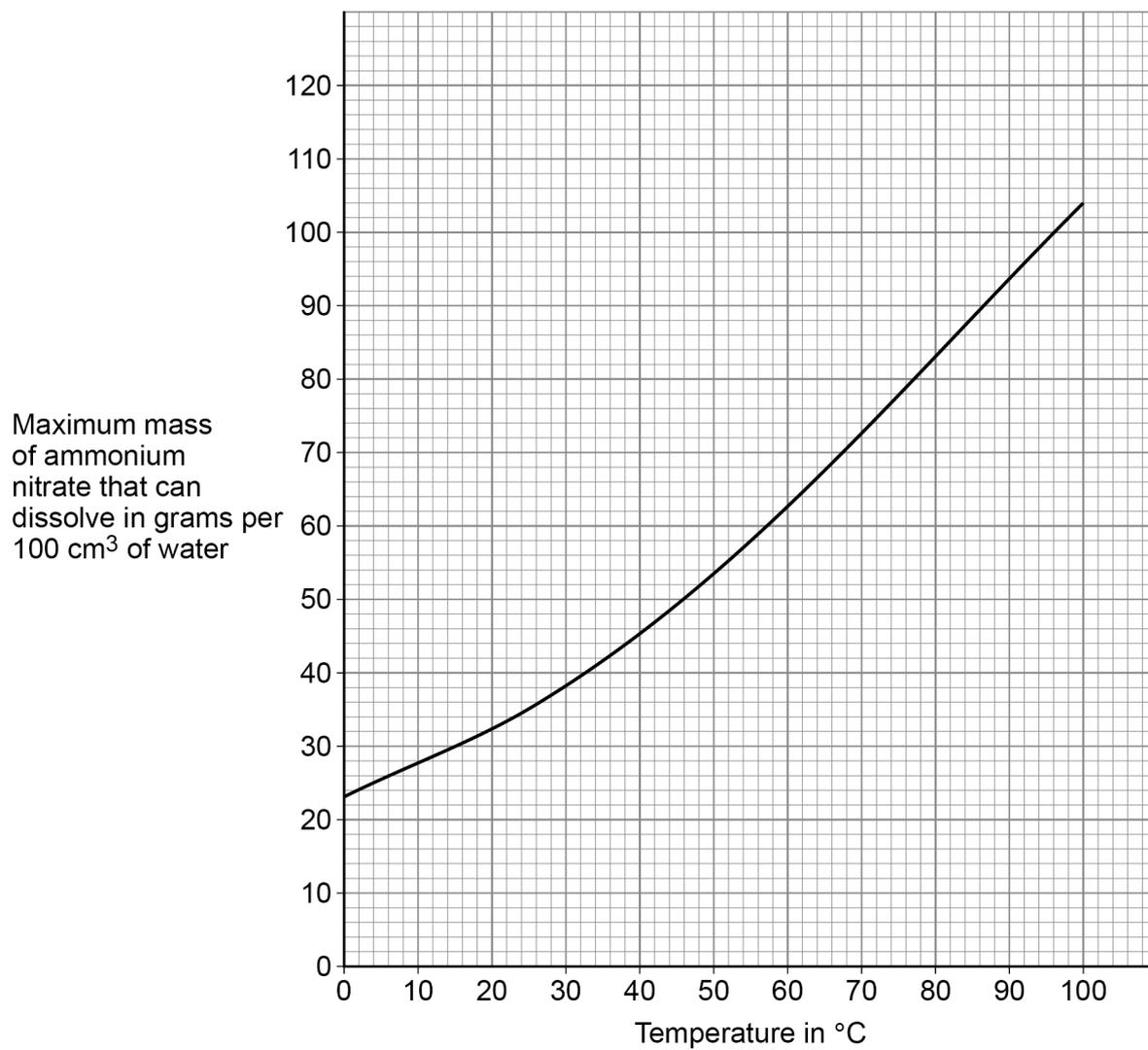
\_\_\_\_\_

**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<sup>3</sup> of water at different temperatures.

**Figure 1**



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

9

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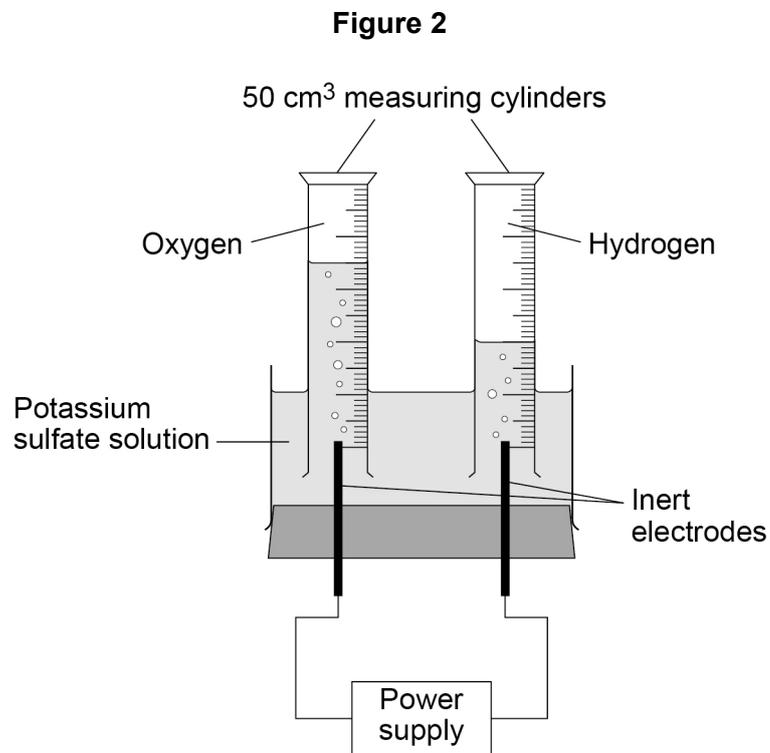
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0 2

This question is about electrolysis.

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



0 2 . 1

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

What is the formula of potassium sulfate?

[1 mark]

Tick (✓) **one** box.

$KSO_4$

$K_2SO_4$

$K(SO_4)_2$

$K_2(SO_4)_2$



**0 2 . 2** 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>

**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]**

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**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<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

8





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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]

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

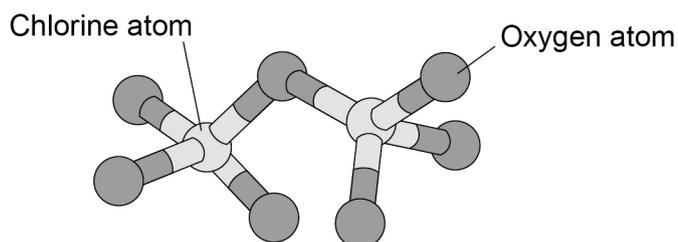
[1 mark]

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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]

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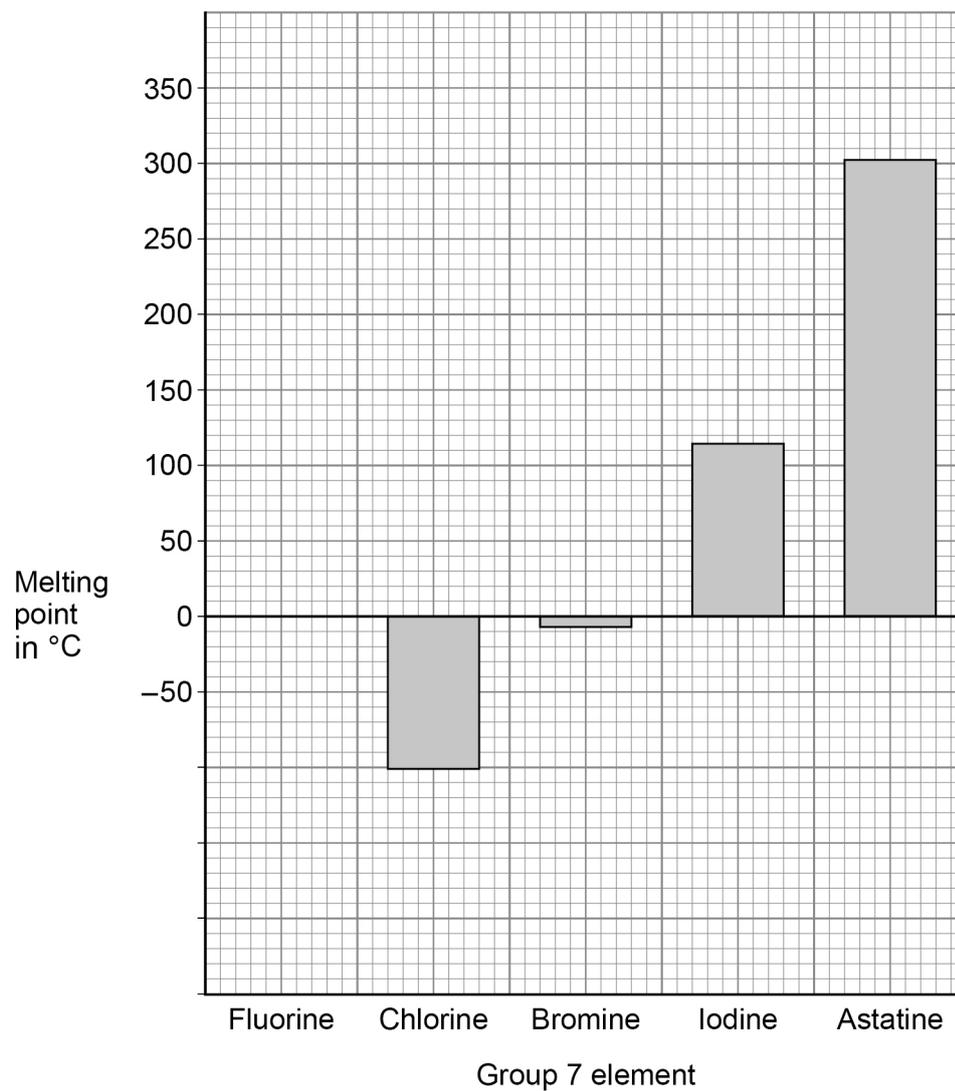
**Question 4 continues on the next page**

**Turn over ►**



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

Figure 4



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

Complete **Figure 4**.

You should:

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

[2 marks]



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

Use **Figure 4**.

**[3 marks]**

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**0 4 . 6** What is the state symbol for bromine at  $-50\text{ }^{\circ}\text{C}$ ?

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]**

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**Turn over for the next question**

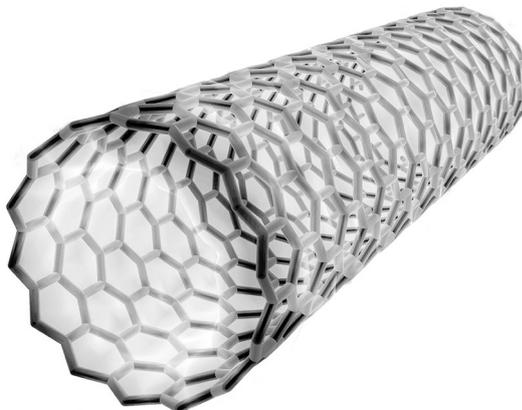
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0 5

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]**

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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]

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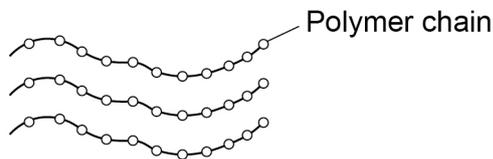
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0 5 . 4

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]

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Turn over ►



0 6

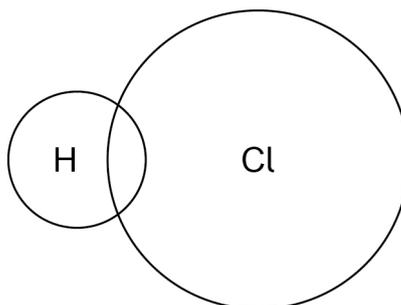
This question is about hydrogen chloride and hydrochloric acid.

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]**


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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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06.4

The concentration of hydrochloric acid is increased by a factor of 100

What is the change in pH?

[2 marks]

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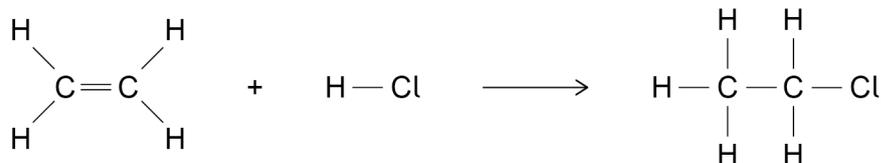


06.5

Ethene and hydrogen chloride react to produce chloroethane.

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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

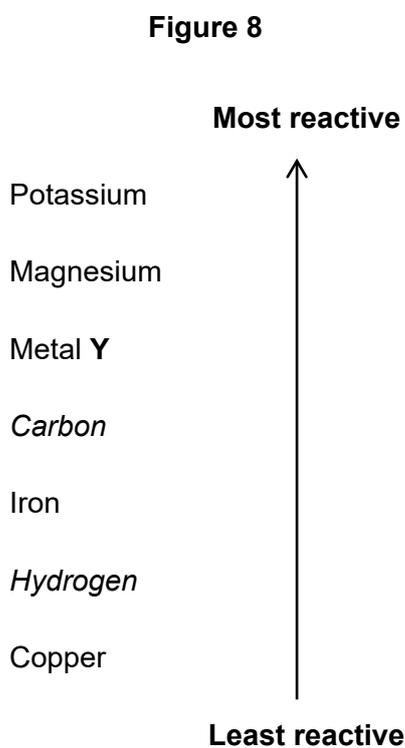
11



0 7

This question is about elements and compounds.

0 7 . 1

**Figure 8** shows a reactivity series.

Give the method and conditions used to extract metal Y from a compound of metal Y.

**[2 marks]**

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**Question 7 continues on the next page****Turn over ►**

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

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

You should balance the equation.

**[2 marks]**



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

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

**[2 marks]**

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

**[3 marks]**

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**17**

**END OF QUESTIONS**



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2 8



2 2 6 G 8 4 6 4 / C / 1 H

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