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

Thursday 14 May 2020 Morning 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.

Do not write outside the box

0 1 This question is about the extraction of aluminium.

0 1 . 1 An aluminium atom is represented as:

$$^{27}_{13}Al$$

Give the number of electrons and neutrons in the aluminium atom.

[2 marks]

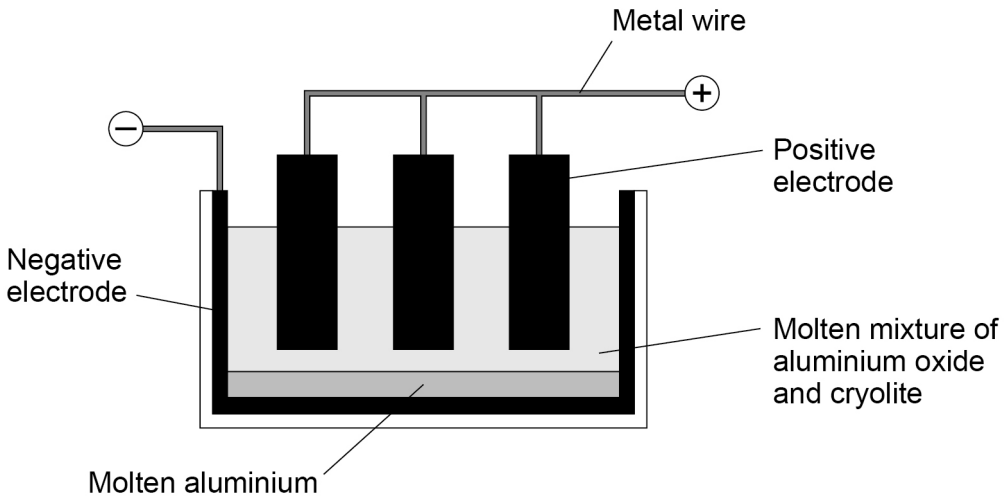
Number of electrons _____

Number of neutrons _____

Aluminium is extracted by the electrolysis of a molten mixture of aluminium oxide and cryolite.

Figure 1 shows the cell used for the electrolysis.

Figure 1



0 1 . 2 Aluminium is produced by the reduction of aluminium oxide (Al_2O_3).

What is meant by the term reduction?

[1 mark]

_____

_____

Do not write outside the box

0 1 . 3 Oxygen is formed at the positive carbon electrodes.

Explain why the positive carbon electrodes must be continually replaced.

[3 marks]

0 1 . 4 A substance conducts electricity because of free moving, charged particles.

What are the free moving, charged particles in a:

- carbon electrode (made from graphite)
- molten mixture of aluminium oxide and cryolite
- metal wire?

[3 marks]

Carbon electrode (made from graphite) _____

Molten mixture of aluminium oxide and cryolite _____

Metal wire _____

9

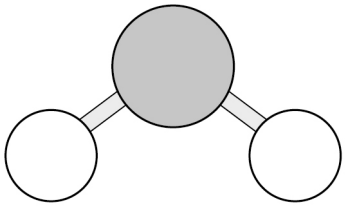
Turn over for the next question

Do not write outside the box

0 2 This question is about substances with covalent bonding.

0 2 . 1 **Figure 2** shows a ball and stick model of a water molecule (H_2O).

Figure 2



Suggest **one** limitation of using a ball and stick model for a water molecule.

[1 mark]

_____

_____

_____

0 2 . 2 Ice has a low melting point.

Water molecules in ice are held together by intermolecular forces.

Complete the sentence.

[1 mark]

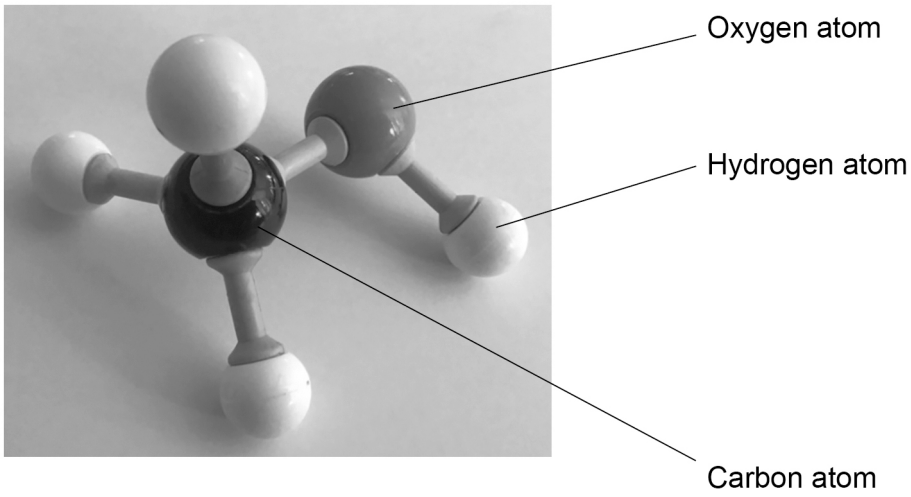
Ice has a low melting point because the

intermolecular forces are _____.

Do not write outside the box

0 2 . 3 **Figure 3** shows the structure of a molecule.

Figure 3



What is the molecular formula of the molecule in **Figure 3**?

[1 mark]

Question 2 continues on the next page

Do not write outside the box

Diamond has a giant covalent structure.

0 2 . 4 What is the number of bonds formed by each carbon atom in diamond?

[1 mark]

Tick (✓) **one** box.

2 ☐ 3 ☐ 4 ☐ 8 ☐

0 2 . 5 Give **two** physical properties of diamond.

[2 marks]

1 _____

2 _____

0 2 . 6 Name **two** other substances with giant covalent structures.

[2 marks]

1 _____

2 _____

8

Do not write outside the box

Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

0 3 Some students investigated the thermal decomposition of metal carbonates.

The word equation for the reaction is:

metal carbonate → metal oxide + carbon dioxide

The students made the following hypothesis:

'When heated the same mass of any metal carbonate produces the same mass of carbon dioxide.'

The students heated a test tube containing copper carbonate.

Table 1 shows their results.

Table 1

Time the test tube containing copper carbonate was heated in mins	0	2	4	6
Mass of test tube and contents in g	17.7	17.1	17.0	17.0

Do not write outside the box

Plan a method the students could use to test their hypothesis.

You should show how the students use their results to test the hypothesis.

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

[6 marks]

6

Turn over for the next question

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0 4 This question is about acids, alkalis and bases.

A student reacted zinc oxide powder with hydrochloric acid to produce zinc chloride solution.

0 4 . 1 Complete the equation for the reaction by writing the state symbols.

[2 marks]

$$ZnO(\_\_\_\_\_) + 2\,HCl(\_\_\_\_\_) \rightarrow ZnCl_2(\_\_\_\_\_) + H_2O(\_\_\_\_\_)$$

0 4 . 2 Give **one** way that the student could speed up the reaction between zinc oxide powder and hydrochloric acid.

[1 mark]

Hydrochloric acid was the limiting reactant.

0 4 . 3 How could the student know when all the hydrochloric acid has reacted?

[1 mark]

0 4 . 4 How could the student obtain zinc chloride solution from the reaction mixture when all the hydrochloric acid has reacted?

[1 mark]

Do not write outside the box

0 4 . 5 Describe how zinc chloride crystals are produced from zinc chloride solution.

[2 marks]

Sulfuric acid and sodium hydroxide react to produce sodium sulfate.

0 4 . 6 Sulfuric acid is gradually added to sodium hydroxide solution.

The pH of the mixture changes as the sulfuric acid is added until in excess.

Suggest the pH at:

- the start before sulfuric acid is added
- the end when sulfuric acid is in excess.

[2 marks]

pH at start = _____

pH at end = _____

0 4 . 7 Complete the symbol equation for the preparation of sodium sulfate.

You should balance the equation.

[2 marks]

_____ $NaOH + H_2SO_4 \rightarrow$ _____ + _____

Question 4 continues on the next page

Do not write outside the box

0 4 . 8 A solution of hydrochloric acid had a hydrogen ion concentration of 1.0 mol/dm^3

Water was added to the hydrochloric acid until the pH increased by 1

What was the hydrogen ion concentration of the hydrochloric acid after water had been added?

[1 mark]

Tick (✓) **one** box.

100 mol/dm^3 ☐

10 mol/dm^3 ☐

0.10 mol/dm^3 ☐

0.010 mol/dm^3 ☐

12

Do not write outside the box

0 5 A student investigated the temperature change when magnesium was added to copper sulfate solution.

This is the method used.

1. Pour 30 cm^3 of copper sulfate solution into a polystyrene cup.
2. Measure the temperature of copper sulfate solution every minute for 3 minutes.
3. Add magnesium on the fourth minute.
4. Measure the temperature of the mixture at 5 minutes and then every minute up to 14 minutes.

0 5 . 1 What is the dependent variable in this investigation?

[1 mark]

Question 5 continues on the next page

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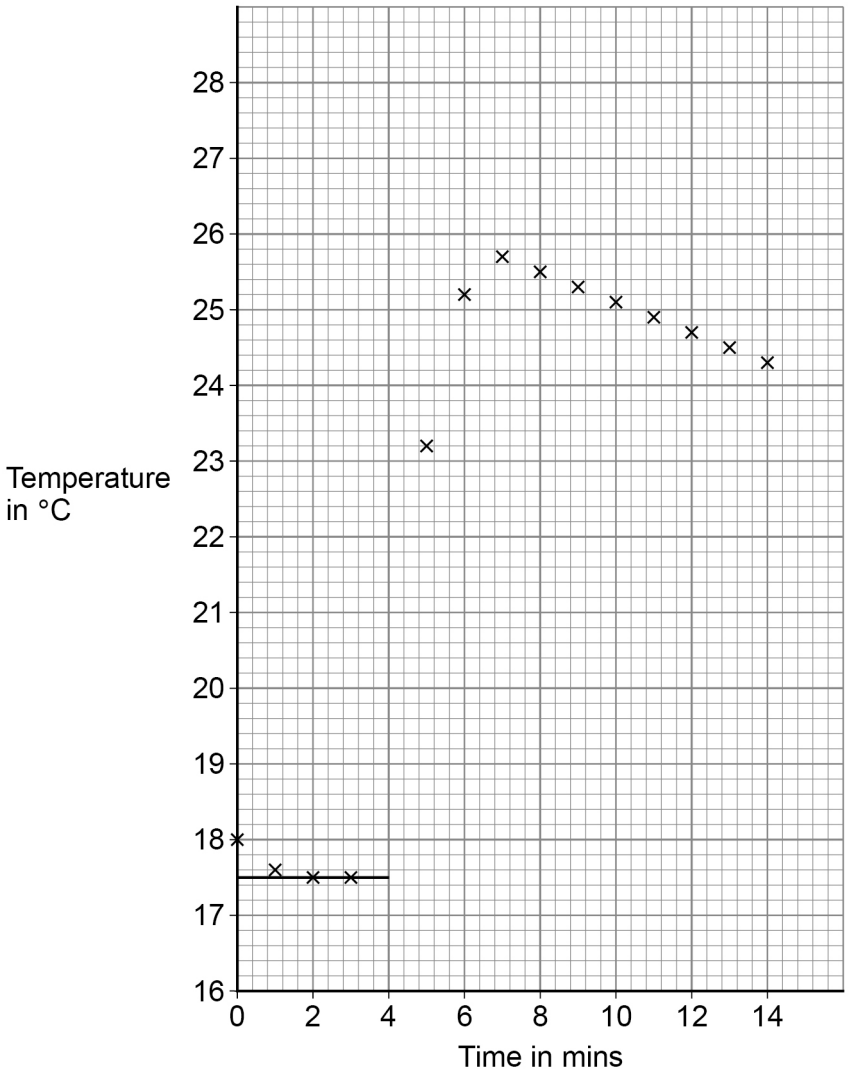
The student used the results to plot a graph.

Figure 4 shows the graph.

Figure 4



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0 5 . 2 Suggest why the copper sulfate solution was left for four minutes before adding the magnesium.

[1 mark]

0 5 . 3 Complete **Figure 4** by:

- drawing a line of best fit through all the points after 7 minutes
- extending the line back to 4 minutes.

[2 marks]

0 5 . 4 The temperature change for the reaction is the temperature difference between the two graph lines at 4 minutes.

Determine the temperature change for the reaction.

Use **Figure 4**.

[2 marks]

Temperature change = _____ °C

0 5 . 5 Explain why the temperature of the mixture decreases after 7 minutes.

[2 marks]

Do not write outside the box

0 5 . 6 The student repeated the experiment with an unknown metal **Q** instead of magnesium.

All the other variables were kept the same.

The student recorded a smaller temperature change.

Suggest the identity of metal **Q**.

Give **one** reason for your answer.

[2 marks]

Metal **Q** _____

Reason _____

_____

0 5 . 7 A copper sulfate solution contained 0.100 moles of copper sulfate dissolved in 0.500 dm^3 of water.

Calculate the mass of copper sulfate in 30.0 cm^3 of this solution.

Relative formula mass (M_r): $CuSO_4$ = 159.5

[4 marks]

_____

_____

_____

_____

_____

_____

Mass = _____ g

14

Do not write outside the box

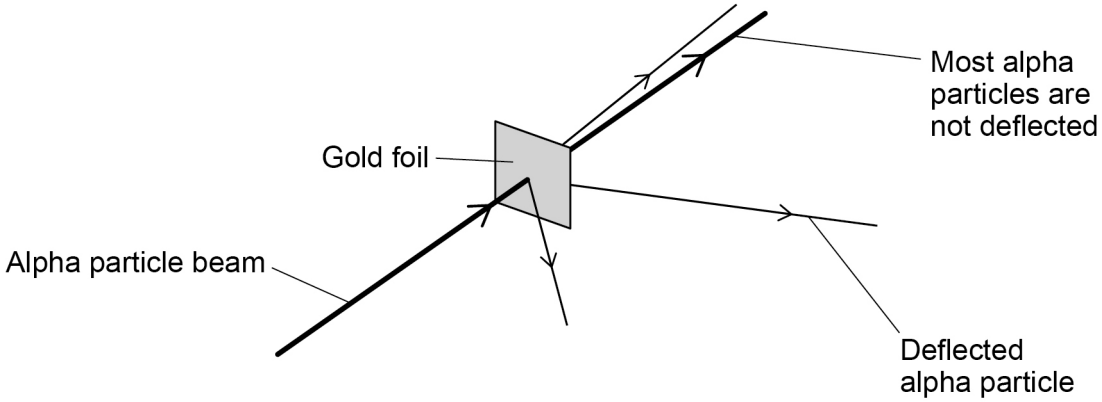
0 6 This question is about gold and compounds of gold.

0 6 . 1 In the alpha particle scattering experiment alpha particles are fired at gold foil.

Alpha particles are positively charged.

Figure 5 shows the results.

Figure 5



What **two** conclusions can be made from the results?

[2 marks]

Tick (✓) **two** boxes.

Atoms are balls of positive charge with embedded electrons. ☐

Atoms are tiny spheres that cannot be divided. ☐

Atoms have a positively charged nucleus. ☐

Mass is concentrated in the nucleus in the centre of atoms. ☐

Neutrons exist within the nucleus. ☐

Question 6 continues on the next page

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0 6 . 2 The gold foil is:

- 4.00×10^{-7} metres thick
- 2400 atoms thick.

What is the diameter of one gold atom in metres?

Give your answer to 3 significant figures.

[3 marks]

Diameter of one gold atom (3 significant figures) = _____ m

Do not write outside the box

0 6 . 3 Gold reacts with the elements in Group 7 of the periodic table.

0.175 g of gold reacts with chlorine.

The equation for the reaction is:

$$2\ Au + 3\ Cl_2 \rightarrow 2\ AuCl_3$$

Calculate the mass of chlorine needed to react with 0.175 g of gold.

Give your answer in mg

Relative atomic masses (A_r): Cl = 35.5 Au = 197

[5 marks]

Mass of chlorine = _____ mg

10

Turn over for the next question

Do not write outside the box

0 7 This question is about elements.

Caesium is in Group 1 of the periodic table.

0 7 . 1 Explain what happens to caesium atoms and to oxygen atoms when caesium reacts with oxygen to produce caesium oxide.

You should answer in terms of electrons.

[4 marks]

0 7 . 2 Explain why caesium is more reactive than sodium.

You should answer in terms of electrons.

[4 marks]

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0 7 . 3 **Figure 6** shows part of Mendeleev's periodic table.

Figure 6

16 **O**	19 **F**
32 **S**	35.5 **Cl**
79 **Se**	80 **Br**
128 **Te**	127 **I**

Explain why the early periodic tables placed iodine (I) before tellurium (Te), but then Mendeleev placed tellurium before iodine.

[3 marks]

11

END OF QUESTIONS

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