

Please write clearly in block capitals.

Centre number

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Candidate number

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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.

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	
TOTAL	



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

0 1

This question is about the extraction of aluminium.

0 1 . 1

An aluminium atom is represented as:



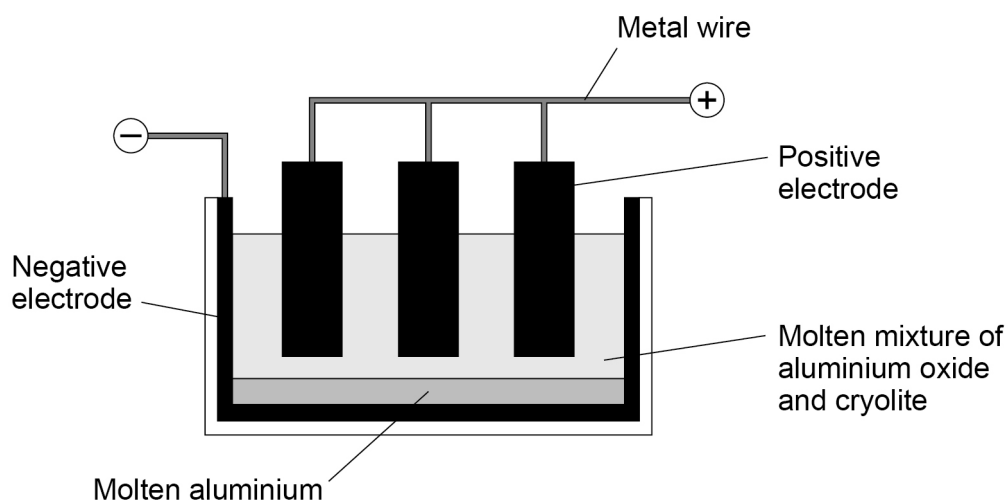
Give the number of electrons and neutrons in the aluminium atom.

[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]



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 _____

Turn over for the next question**Turn over ►**

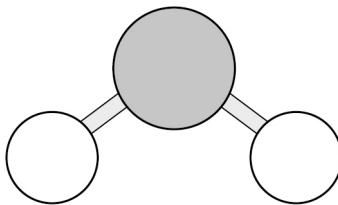
0 2

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]

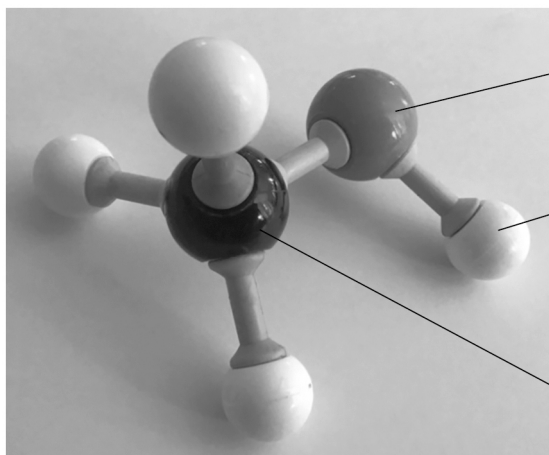
Ice has a low melting point because the

intermolecular forces are _____.



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

Figure 3



Oxygen atom

Hydrogen atom

Carbon atom

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

[1 mark]

Question 2 continues on the next page

Turn over ►



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



Turn over for the next question

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ANSWER IN THE SPACES PROVIDED**

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Turn over ►



0 3

Some students investigated the thermal decomposition of metal carbonates.

The word equation for the reaction is:



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



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

This image shows a single sheet of white paper with horizontal blue ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

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6

6

Turn over ►



0 4

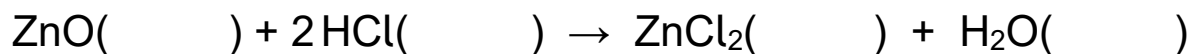
This question is about acids, alkalis and bases.

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]



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]



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]**Question 4 continues on the next page****Turn over ►**

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

☐

0 5

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

This is the method used.

1. Pour 30 cm³ 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]

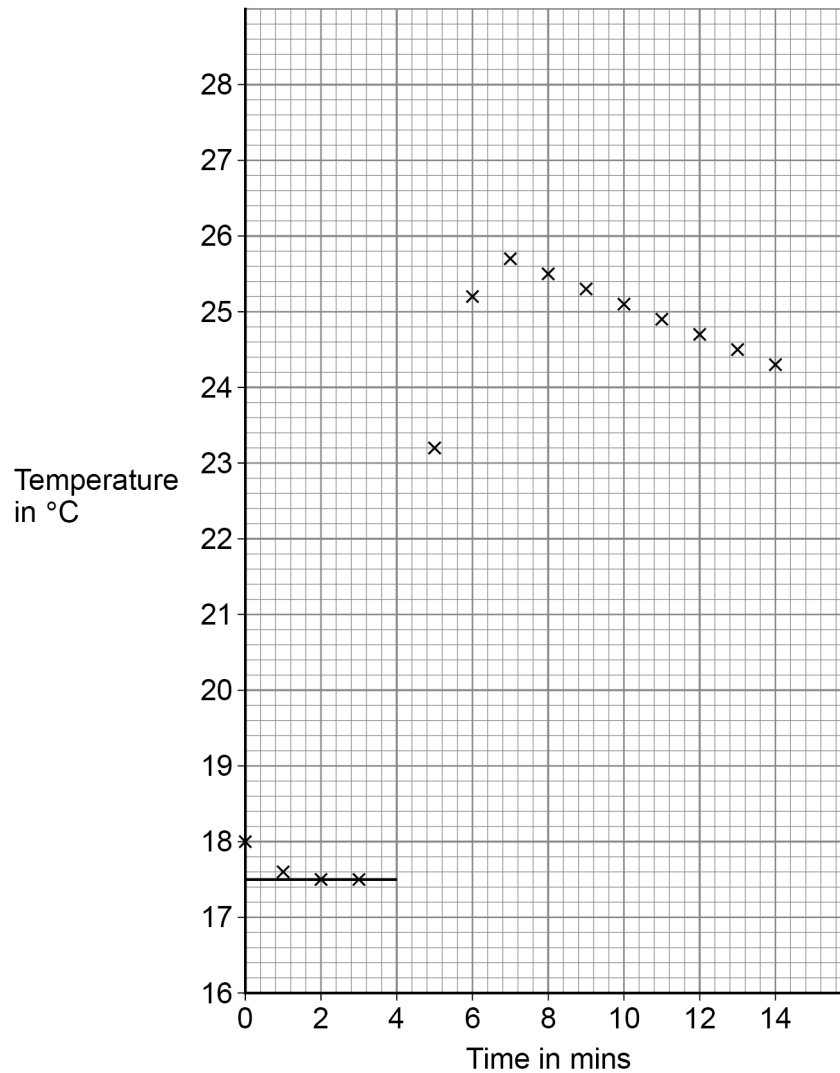
Question 5 continues on the next page

Turn over ►

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]

Turn over ►



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 dm³ of water.

Calculate the mass of copper sulfate in 30.0 cm³ of this solution.

Relative formula mass (M_r): CuSO₄ = 159.5

[4 marks]

Mass = _____ g



0 6

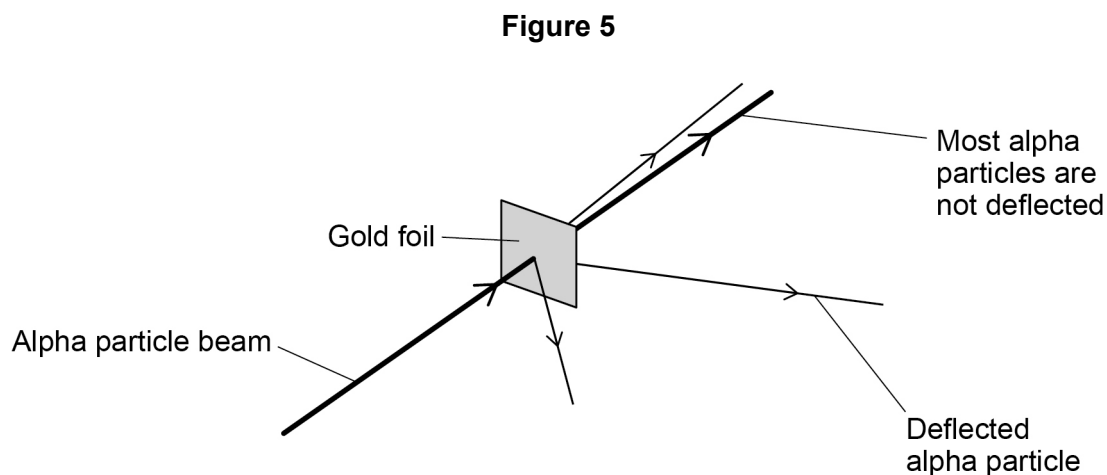
This question is about gold and compounds of gold.

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.



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

Turn over ►



0	6	.	2
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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



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]



07.3

Figure 6 shows part of Mendeleev's periodic table.

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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]

END OF QUESTIONS

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