



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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# GCSE COMBINED SCIENCE: TRILOGY

# H

Higher Tier

Chemistry Paper 1H

Specimen 2018 (set 2)

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.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- 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.

0 1

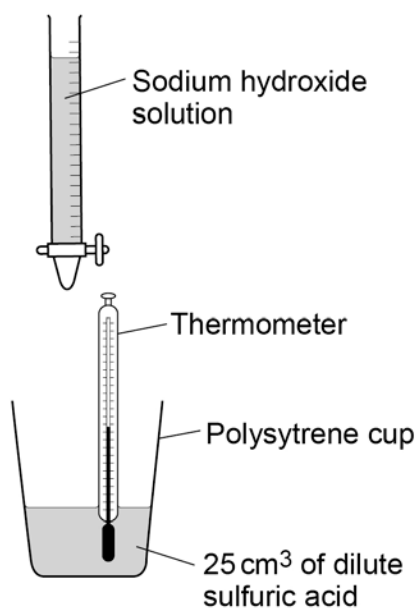
Some students investigated the change in temperature as sodium hydroxide solution is added to dilute sulfuric acid.

This is the method used.

1. Put  $25\text{ cm}^3$  of dilute sulfuric acid into a polystyrene cup.
2. Measure the initial temperature of the dilute sulfuric acid.
3. Add  $4\text{ cm}^3$  of sodium hydroxide solution to the dilute sulfuric acid.
4. Stir the mixture.
5. Measure the highest temperature of the mixture.
6. Repeat steps 3–5 until  $40\text{ cm}^3$  of sodium hydroxide solution have been added.

**Figure 1** shows the apparatus the student used.

**Figure 1**



0 1 . 1

The volume of sodium hydroxide solution is a variable.

Which **two** words can be used to describe this type of variable?

**[2 marks]**

Tick **two** boxes.

Categoric

Continuous

Control

Dependent

Independent

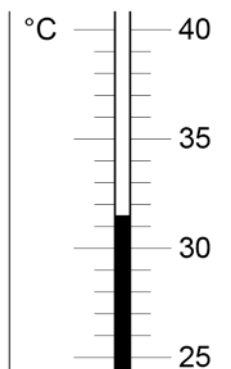
**Question 1 continues on the next page**

**Turn over ►**

**0 1 . 2** The dilute sulfuric acid has an initial temperature of 24.0 °C

**Figure 2** shows the highest temperature.

**Figure 2**



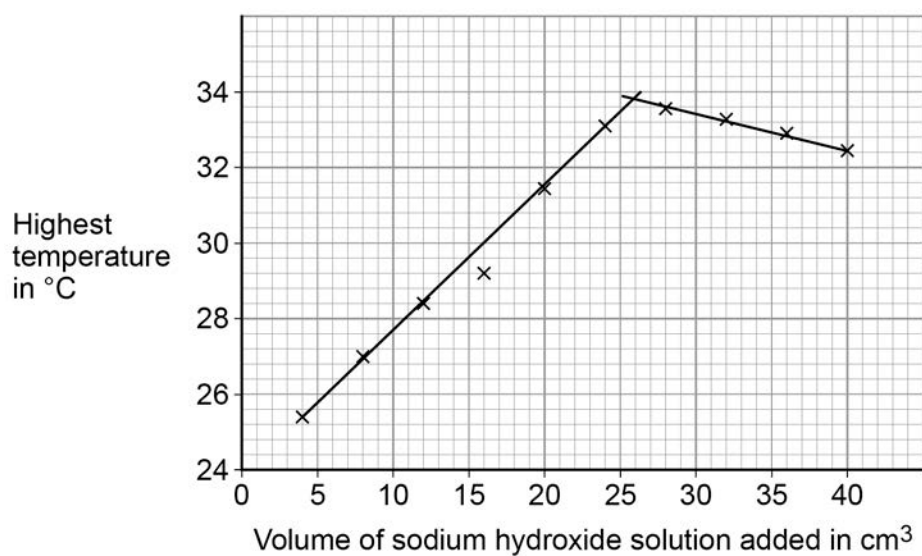
Calculate the change in temperature.

**[2 marks]**

Temperature = \_\_\_\_\_ °C

**Figure 3** shows the students' results.

**Figure 3**



- 0 1 . 3** Determine the volume of sodium hydroxide solution that gives the highest temperature change.

Use **Figure 3** to help you answer this question.

[1 mark]

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

- 0 1 . 4** In **Figure 3** the temperature when 16 cm<sup>3</sup> of sodium hydroxide solution is added is anomalous.

Suggest an error that could have been made in the method which would cause this anomalous result.

[1 mark]

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- 0 1 . 5** The sodium hydroxide solution in this investigation contains 80 grams per dm<sup>3</sup>.  
The students use 40 cm<sup>3</sup> of sodium hydroxide solution.

Calculate the mass of sodium hydroxide in 40 cm<sup>3</sup>

[3 marks]

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

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Turn over for the next question

Turn over ►

**0 2**

This question is about metals and metal compounds.

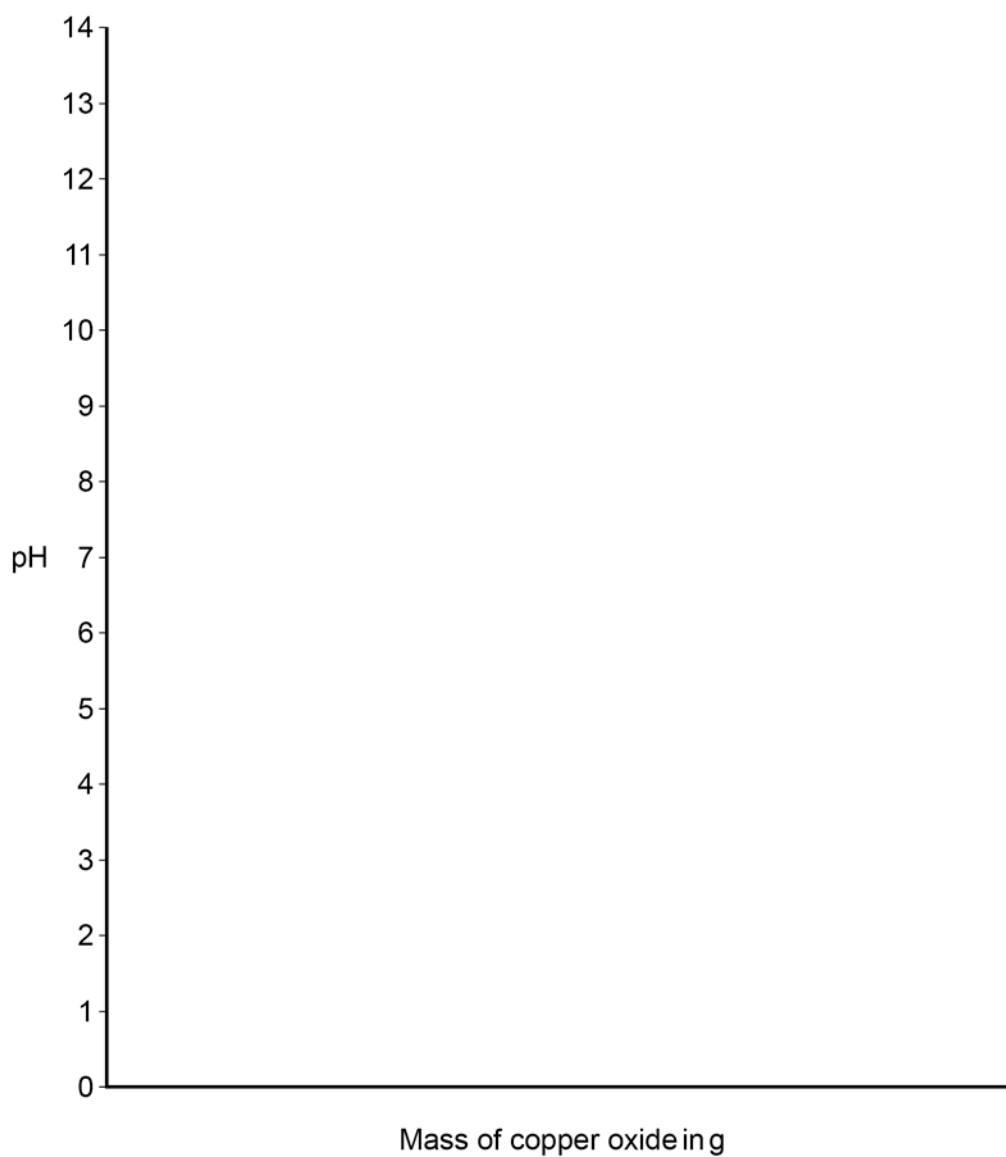
**0 2 . 1**

Copper oxide reacts with hydrochloric acid to produce copper chloride and water.

Copper oxide is insoluble in water.

Copper oxide is gradually added to dilute hydrochloric acid until in excess.

Sketch a graph on **Figure 4** to show how the pH of the hydrochloric acid would change.

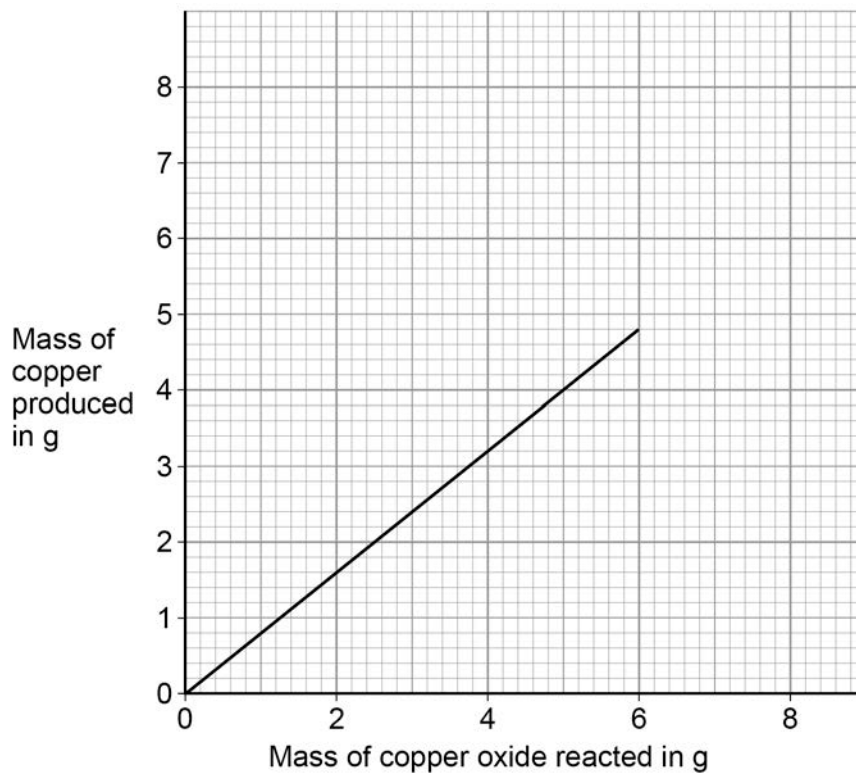
**[3 marks]****Figure 4**



A student reacts different masses of copper oxide with excess zinc to produce copper.

**Figure 5** shows the student's results.

**Figure 5**



**0 2 . 3** Calculate the gradient (slope) of the line on **Figure 5**.

**[2 marks]**

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Gradient = \_\_\_\_\_ g of copper per g of copper oxide



0 2 . 4

Determine the mass of copper that can be produced from 75 g of copper oxide.

Use **Figure 5**.**[3 marks]**

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

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

0 3

Three substances are all solid at room temperature.

**Table 1** describes tests and the result of each test on the three substances.

**Table 1**

Substance	Effect of large force applied	Effect of heating gently at first, then strongly	Effect of passing electricity through solid	Effect of passing electricity through liquid
<b>A</b>	Breaks into many pieces	Easily melts and then boils	Does not conduct	Does not conduct
<b>B</b>	Breaks into many pieces	No change	Does not conduct	Conducts
<b>C</b>	Becomes thinner	No change	Conducts	Conducts

0 3 . 1

The covalent bonds in the molecules are not overcome when substance **A** is heated.

What forces are overcome when substance **A** melts?

[1 mark]

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0 3 . 2

What could substance **A** be?

[1 mark]

Tick **one** box.

Graphite

Iron

Sodium chloride

Sulfur

**0 3 . 3** Suggest why substance **B** conducts electricity as a liquid but does **not** conduct electricity as a solid.

**[3 marks]**

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**0 3 . 4** Suggest why substance **C** becomes thinner when a large force is applied.

**[2 marks]**

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**0 3 . 5** What could substance **C** be?

**[1 mark]**

Tick **one** box.

Copper

Diamond

Iodine

Magnesium oxide

Turn over ►



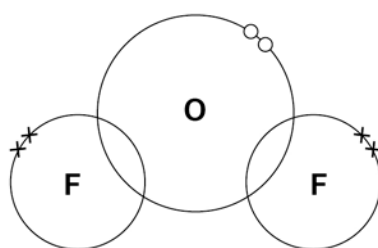


**0 5**

This question is about oxygen.

**0 5 . 1**One oxygen atom shares one pair of electrons with each fluorine atom in oxygen difluoride ( $\text{OF}_2$ ).Complete the dot and cross diagram of oxygen difluoride in **Figure 6**.

You should show only the electrons in the outer shells.

**[2 marks]****Figure 6****0 5 . 2**Oxygen difluoride ( $\text{OF}_2$ ) has a melting point of  $-224\text{ }^\circ\text{C}$  and a boiling point of  $-145\text{ }^\circ\text{C}$ 

What is the state of oxygen difluoride at room temperature?

Explain your answer in terms of structure and bonding.

**[4 marks]**

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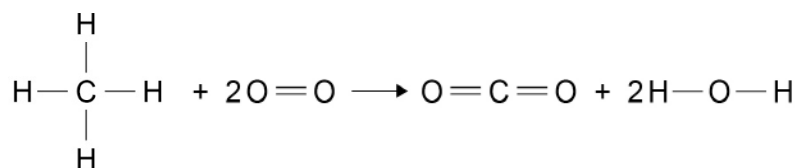
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**0 5 . 3** The equation shows the reaction of methane with oxygen.



**Table 2** shows the bond energies.

**Table 2**

Bond	C-H	O=O	C=O	O-H
Bond dissociation energy in kJ per mole	412	496	803	463

Calculate the overall energy change for the combustion of one mole of methane.

**[3 marks]**

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Energy change = \_\_\_\_\_ kJ mol<sup>-1</sup>

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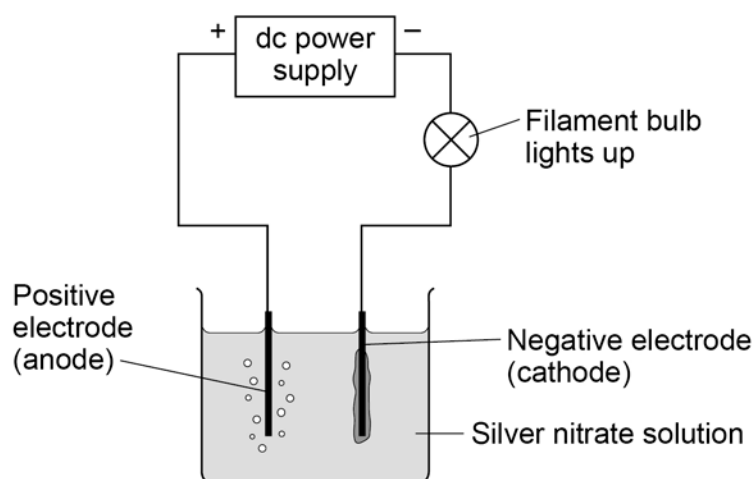
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**Turn over ►**

0 6

This question is about electrolysis.

0 6 . 1

**Figure 7** shows the apparatus used to electrolyse silver nitrate ( $\text{AgNO}_3$ ) solution.**Figure 7**

Name the product discharged at each electrode.

Write a half equation for the reaction at each electrode.

**[4 marks]**

Product at negative electrode (cathode) \_\_\_\_\_

Half equation for negative electrode

\_\_\_\_\_

Product at positive electrode (anode) \_\_\_\_\_

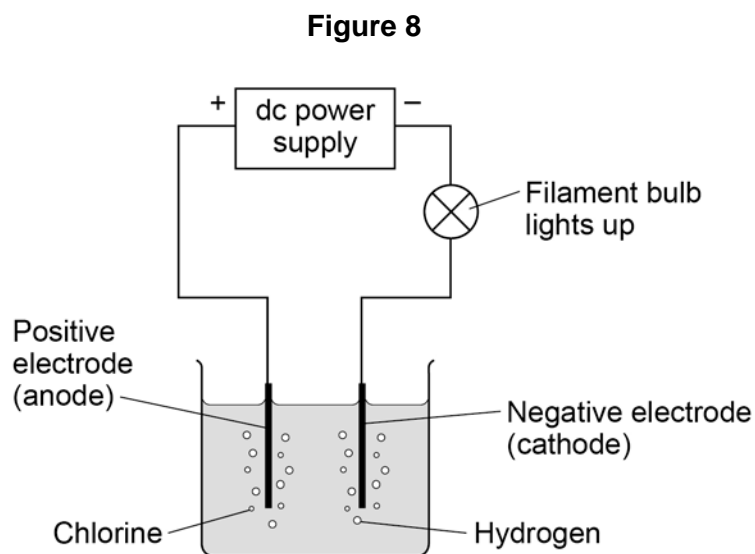
Half equation for positive electrode

\_\_\_\_\_



0 6 . 2

Figure 8 shows the apparatus used to electrolyse sodium chloride (NaCl) solution.



Hydrogen and chlorine are produced.

Explain how another different product is formed in solution during this electrolysis.

[4 marks]

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Turn over for the next question

Turn over ►

**0 7**

This question is about subatomic particles.

**0 7 . 1**

Subatomic particles in an atom are electrons, protons and neutrons.

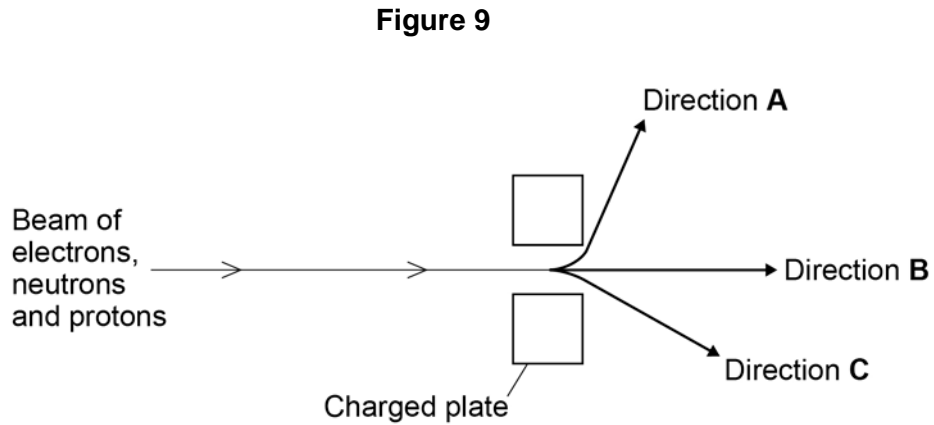
Complete **Table 3** to show when each subatomic particle was discovered.**[2 marks]****Table 3**

<b>Date of discovery</b>	<b>Subatomic particle</b>
1897	
1920	
1932	

07.2

A beam of electrons, neutrons and protons travelling at the same speed is passed through two oppositely charged plates.

**Figure 9** shows the directions of three particles after passing through the charged plates.



The charges on the electric plates are **not** shown.

The heavier the particle the less the deflection.

Explain which directions the electrons, neutrons and protons will take.

**[4 marks]**

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**Question 7 continues on the next page**

**Turn over ►**

**0 7 . 3** Calculate the mass of one atom of sodium.

Avogadro constant =  $6.02 \times 10^{23}$  per mole.

Give your answer to 3 significant figures.

**[2 marks]**

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Mass of one atom of sodium = \_\_\_\_\_ g

**0 7 . 4** The radius of a sodium atom is 227 picometres (pm)

1 picometre =  $1 \times 10^{-12}$  m

What is the approximate radius of the nucleus of a sodium atom?

Tick **one** box.

**[1 mark]**

$2.27 \times 10^{-12}$  m

$2.27 \times 10^{-14}$  m

$2.27 \times 10^{-24}$  m

$4.54 \times 10^{-14}$  m

**END OF QUESTIONS**

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