

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

# F

Foundation Tier  
Chemistry Paper 1F

Thursday 16 May 2019

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.
- 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.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
<b>TOTAL</b>	



0 1

This question is about energy changes.

0 1 . 1

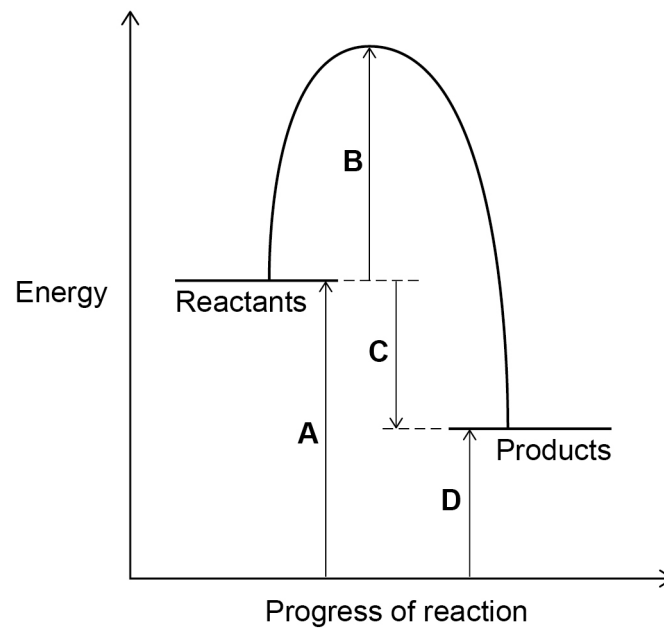
Which of these items uses an endothermic reaction?

**[1 mark]**Tick (✓) **one** box.

Hand warmer

Sports injury pack

Self-heating can

**Figure 1** shows the reaction profile for an exothermic reaction.**Figure 1**

**0 1 . 2** Which letter represents the activation energy for the reaction?

[1 mark]

Tick (✓) **one** box.

A       B       C       D

**0 1 . 3** Which letter represents the overall energy change for the reaction?

[1 mark]

Tick (✓) **one** box.

A       B       C       D

**0 1 . 4** Complete the sentence.

Choose the answer from the box.

[1 mark]

lower than

the same as

higher than

In an exothermic reaction the energy of the products

is \_\_\_\_\_ the energy of the reactants.

**0 1 . 5** A student measured the temperature at the start and at the end of a reaction.

Name the apparatus used to measure the temperature.

[1 mark]

\_\_\_\_\_

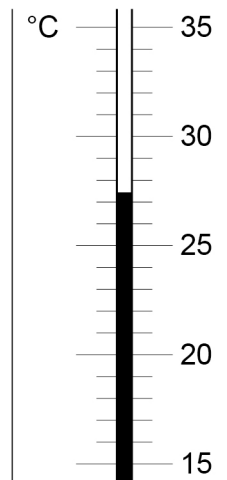
**Question 1 continues on the next page**

**Turn over ►**



0 1 . 6 Figure 2 shows the temperature at the end of the reaction.

Figure 2



Complete **Table 1**.

Use **Figure 2**.

[2 marks]

Table 1

Temperature at start in °C	14.3
Temperature at end in °C	
Change in temperature in °C	



**0 2**

This question is about salts and electrolysis.

A student wants to make copper chloride crystals.

The student adds excess copper oxide to some hot acid.

The student stirs the mixture.

**0 2****1**

Which acid should the student use?

**[1 mark]**

Tick (✓) **one** box.

Hydrochloric acid

Nitric acid

Sulfuric acid

**0 2****2**

Suggest how the student would know that excess copper oxide has been added.

**[1 mark]**

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**Question 2 continues on the next page**

**Turn over ►**

**0 2 . 3** There are four more stages, **A**, **B**, **C** and **D**, to make copper chloride crystals.

The stages **A**, **B**, **C** and **D** are not in the correct order.

Stage **A**                      Partially evaporate by heating with a water bath

Stage **B**                      Filter the mixture into an evaporating basin

Stage **C**                      Leave to crystallise

Stage **D**                      Remove and dry the crystals

Put stages **A**, **B**, **C** and **D** in the correct order.

**[2 marks]**

First stage                      \_\_\_\_\_

Second stage                      \_\_\_\_\_

Third stage                      \_\_\_\_\_

Fourth stage                      \_\_\_\_\_

**0 2 . 4** Molten copper chloride can be electrolysed.

State the product at each electrode when molten copper chloride is electrolysed.

**[2 marks]**

Negative electrode                      \_\_\_\_\_

Positive electrode                      \_\_\_\_\_



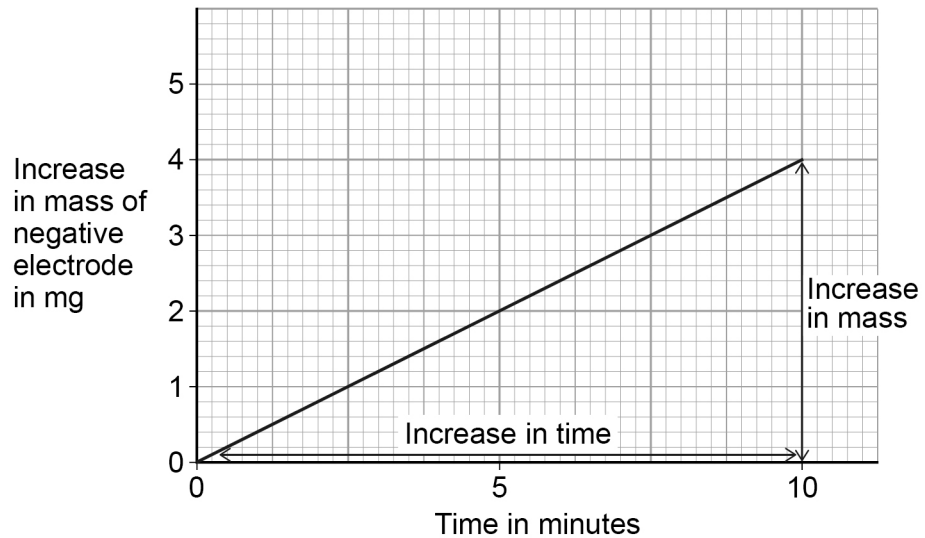
0 2 . 5

A solution of copper chloride is electrolysed.

**Figure 3** shows a graph of the increase in mass of the negative electrode.

This increase is shown over a time of 10 minutes.

**Figure 3**



Calculate the gradient of the line in **Figure 3**.

Use the equation:

$$\text{Gradient} = \frac{\text{increase in mass in mg}}{\text{increase in time in minutes}}$$

**[3 marks]**

Increase in mass \_\_\_\_\_

\_\_\_\_\_

Increase in time \_\_\_\_\_

\_\_\_\_\_

Gradient \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Gradient = \_\_\_\_\_ mg per minute

**Turn over ►**



**0 2 . 6** Aluminium is produced by electrolysis of a molten mixture.

Complete the sentence.

Choose the answers from the box.

**[2 marks]**

**carbon    chloride    cryolite    oxide    sulfate    water**

The molten mixture contains \_\_\_\_\_ and

aluminium \_\_\_\_\_ .

**11**





**0 3**

This question is about the periodic table and argon.

**0 3 . 1**

What order did scientists use to arrange elements in early periodic tables?

**[1 mark]**Tick (✓) **one** box.

Atomic weight of element

Number of neutrons in an atom of element

Size of atoms of element

Year element was discovered

**0 3 . 2**

In early periodic tables some elements were placed in the wrong groups.

Mendeleev overcame some of these problems in his periodic table.

Complete the sentence.

**[1 mark]**

Mendeleev did this by leaving \_\_\_\_\_ for elements that had not been discovered.

**Question 3 continues on the next page****Turn over ►**

0 3 . 3 What is the name of the group that contains argon?

[1 mark]

Tick (✓) **one** box.

Alkali metals

Halogens

Noble gases

0 3 . 4 An atom of argon is represented as  ${}^{40}_{18}\text{Ar}$

Determine the number of protons and the number of neutrons in one atom of argon.

[2 marks]

Number of protons \_\_\_\_\_

Number of neutrons \_\_\_\_\_

0 3 . 5 Different atoms of argon are,  ${}^{39}_{18}\text{Ar}$  and  ${}^{38}_{18}\text{Ar}$

What is the name given to these different atoms of argon?

[1 mark]

Tick (✓) **one** box.

Fullerenes

Ions

Isotopes

Molecules



0 3 . 6

What is the electronic structure of an argon atom,  ${}_{18}^{40}\text{Ar}$ ?

[1 mark]

Tick (✓) **one** box.2 2, 8 2, 8, 2 2, 8, 8 

0 3 . 7

Why is argon unreactive?

[1 mark]

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

0 4

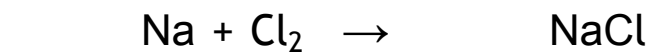
This question is about Group 1 elements.

0 4 . 1

Sodium reacts with chlorine to produce sodium chloride.

Balance the equation for the reaction.

[1 mark]



0 4 . 2

4.6 g of sodium reacts with chlorine to produce 11.7 g of sodium chloride.

What mass of chlorine reacted?

[1 mark]

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Mass of chlorine = \_\_\_\_\_ g

0 4 . 3

A teacher puts hot sodium into a gas jar of chlorine.

The changes seen before, during and after this reaction were observed.

Complete the sentences.

Choose the answers from the box.

[4 marks]

colourless	green	lilac	silver	white	yellow
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Sodium is a \_\_\_\_\_ solid.

Chlorine is a \_\_\_\_\_ gas.

The hot sodium burns with a \_\_\_\_\_ flame.

The product sodium chloride is a \_\_\_\_\_ solid.



**0 4 . 4** Sodium chloride (NaCl) is an ionic compound.

Write the formulae of the ions in sodium chloride.

**[2 marks]**

Sodium ion \_\_\_\_\_

Chloride ion \_\_\_\_\_

**0 4 . 5** Complete the sentence.

Choose the answer from the box.

**[1 mark]**

**an atom      an electron      a neutron      a proton**

Potassium is more reactive than sodium.

This is because potassium loses \_\_\_\_\_ more easily than sodium.

**0 4 . 6** How does the size of a potassium atom compare with the size of a sodium atom?

Give a reason for your answer.

**[2 marks]**

\_\_\_\_\_

Reason \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**11**

**Turn over for the next question**

**Turn over ►**



**0 5**

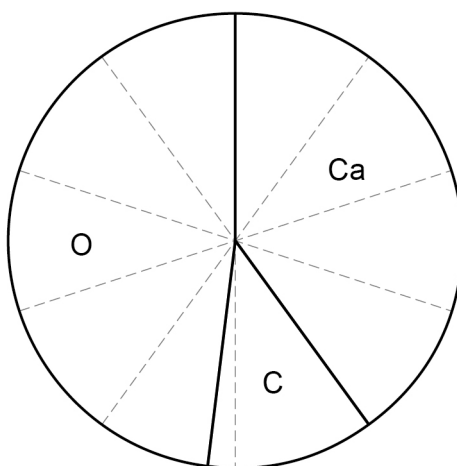
This question is about oxygen and compounds of oxygen.

**0 5 . 1**

What is the state symbol of oxygen at room temperature?

**[1 mark]**

---

**0 5 . 2****Figure 4** shows the percentage by mass of the elements calcium, carbon and oxygen in calcium carbonate.**Figure 4**

What is the percentage by mass of calcium in calcium carbonate?

**[1 mark]**

---

Percentage = \_\_\_\_\_ %



**0 5 . 3**

At high temperature, sodium nitrate decomposes into sodium nitrite and oxygen.

A student heats three samples of sodium nitrate.

The mass of each sample was 4.50 g

The mass of solid after heating was recorded.

**Table 2** shows the mass of solid after heating in each experiment.

**Table 2**

Experiment	Mass of solid after heating in g
1	3.76
2	3.98
3	4.09

Calculate the mean mass of solid after heating.

Give your answer to 3 significant figures.

**[3 marks]**

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Mean mass of solid after heating = \_\_\_\_\_ g

**Question 5 continues on the next page**

**Turn over ►**



0 5 . 4

**Table 3** shows the electronic structure of hydrogen and oxygen.

**Table 3**

Element	Electronic structure
Hydrogen	1
Oxygen	2,6

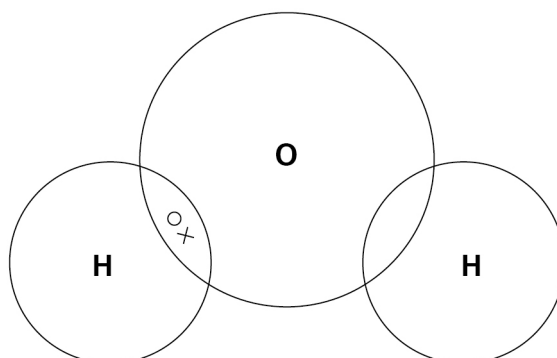
**Figure 5** shows part of a dot and cross diagram of a molecule of water ( $\text{H}_2\text{O}$ ).

Complete the dot and cross diagram.

You should show only the electrons in the outer energy levels.

**[2 marks]**

**Figure 5**



Oxygen and sulfur are examples of simple molecules.

0 5 . 5

Complete the sentence.

Choose the answer from the box.

**[1 mark]**

covalent	ionic	metallic
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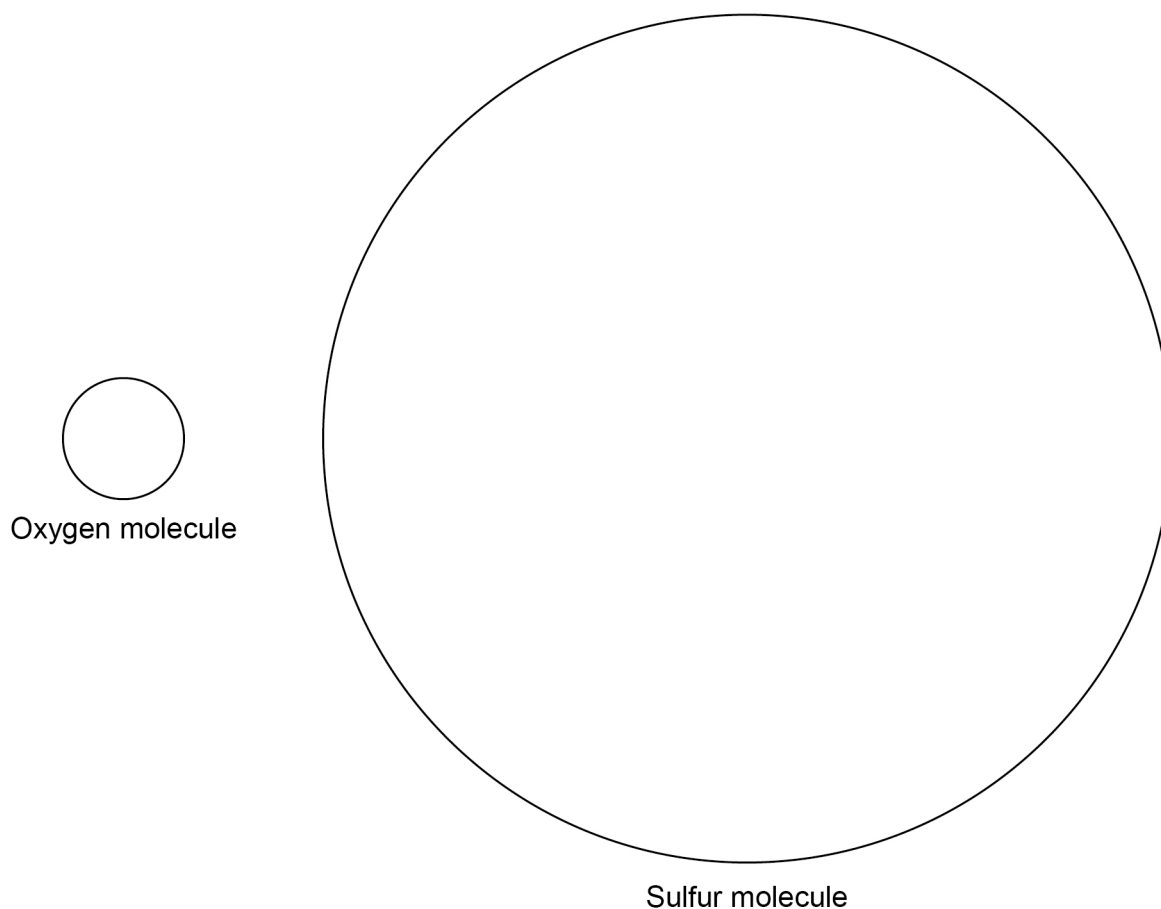
There are \_\_\_\_\_ bonds between the atoms of oxygen in an oxygen molecule.





**0 5 . 6** Figure 6 shows the relative sizes of an oxygen molecule and a sulfur molecule.

**Figure 6**



How does the boiling point of sulfur compare with the boiling point of oxygen?

Complete the sentences.

**[2 marks]**

The boiling point of sulfur is \_\_\_\_\_ the boiling point of oxygen.

This is because in sulfur the intermolecular forces are \_\_\_\_\_  
than the intermolecular forces in oxygen.

10

Turn over ►

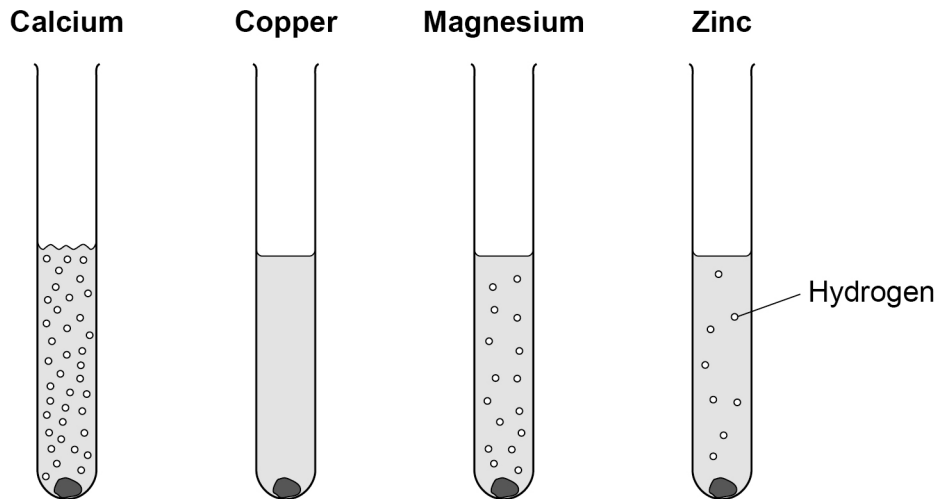


0 6

This question is about reactions of metals.

**Figure 7** shows what happens when calcium, copper, magnesium and zinc are added to hydrochloric acid.

**Figure 7**



0 6 . 1

What is the order of decreasing reactivity of these four metals?

**[1 mark]**

Tick (✓) **one** box.

Zn Ca Cu Mg

Ca Cu Mg Zn

Cu Zn Ca Mg

Ca Mg Zn Cu



A student wants to make a fair comparison of the reactivity of the metals with hydrochloric acid.

**0 6 . 2** Name **two** variables that must be kept constant.

**[2 marks]**

1 \_\_\_\_\_

\_\_\_\_\_

2 \_\_\_\_\_

\_\_\_\_\_

**0 6 . 3** What is the independent variable in this reaction?

**[1 mark]**

\_\_\_\_\_

\_\_\_\_\_

**0 6 . 4** Predict the reactivity of beryllium compared with magnesium.

Give a reason for your answer.

Use the periodic table.

**[2 marks]**

\_\_\_\_\_

Reason \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**0 6 . 5** A solution of hydrochloric acid contains 3.2 g of hydrogen chloride in 50 cm<sup>3</sup>

Calculate the concentration of hydrogen chloride in g per dm<sup>3</sup>

**[3 marks]**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Concentration = \_\_\_\_\_ g per dm<sup>3</sup>



**0 7**

This question is about salts.

Ammonium nitrate solution is produced when ammonia gas reacts with nitric acid.

**0 7 . 1**

Give the state symbol for ammonium nitrate solution.

**[1 mark]**

---

**0 7 . 2**

What is the formula of nitric acid?

**[1 mark]**Tick (✓) **one** box.

HCl

HNO<sub>3</sub>H<sub>2</sub>SO<sub>4</sub>NH<sub>4</sub>OH**0 7 . 3**

Ammonia gas dissolves in water to produce ammonia solution.

Ammonia solution contains hydroxide ions, OH<sup>-</sup>

A student adds universal indicator to solutions of nitric acid and ammonia.

What colour is observed in each solution?

**[2 marks]**

Colour in nitric acid

---

Colour in ammonia solution

---



**0 7 . 4** The student gradually added nitric acid to ammonia solution.

Which row, **A**, **B**, **C** or **D**, shows the change in pH as the nitric acid is added until in excess?

[1 mark]

Tick (✓) **one** box.

	pH of ammonia solution at start	pH after addition of excess nitric acid	
<b>A</b>	10	7	<input type="checkbox"/>
<b>B</b>	2	10	<input type="checkbox"/>
<b>C</b>	7	1	<input type="checkbox"/>
<b>D</b>	10	2	<input type="checkbox"/>

**0 7 . 5** Calculate the percentage by mass of oxygen in ammonium nitrate ( $\text{NH}_4\text{NO}_3$ ).

Relative atomic masses ( $A_r$ ): H = 1 N = 14 O = 16

Relative formula mass ( $M_r$ ):  $\text{NH}_4\text{NO}_3 = 80$

[3 marks]

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Percentage by mass of oxygen = \_\_\_\_\_ %

Question 7 continues on the next page

Turn over ►





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2 4



1 9 6 G 8 4 6 4 / C / 1 F

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