AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

# 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.

| 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 energy changes.

**0 1 . 1** Which of these items uses an endothermic reaction?

**[1 mark]**

Tick (✓) **one** box.

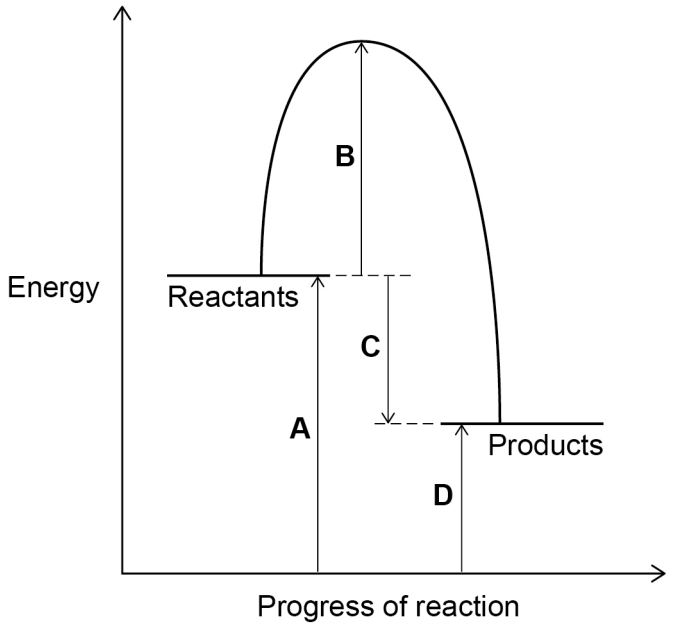
Hand warmer ☐

Sports injury pack ☐

Self-heating can ☐

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

**Figure 1**



*Do not write outside the box*

**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]**

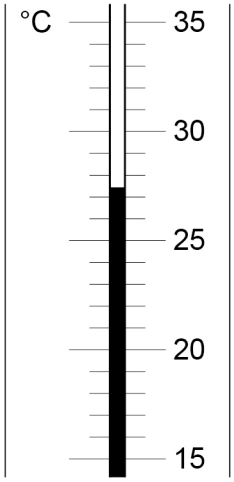
_____

**Question 1 continues on the next page**

*Do not write outside the box*

**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 | |

7

*Do not write outside the box*

**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]**

**Question 2 continues on the next page**

*Do not write outside the box*

**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 _____

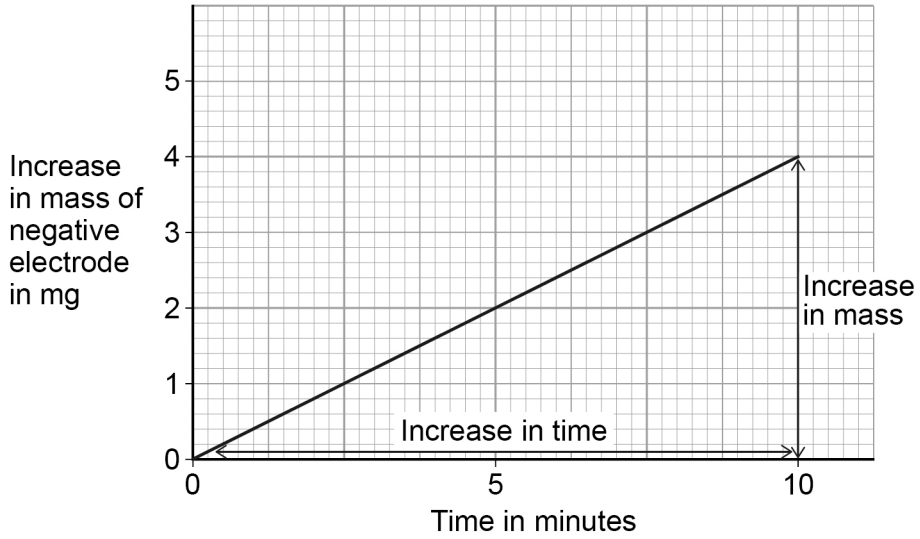
*Do not write outside the box*

**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 ►**

*Do not write outside the box*

**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**

*Do not write outside the box*

**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**

*Do not write outside the box*

**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 $^{40}_{18}Ar$

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, $^{39}_{18}Ar$ and $^{38}_{18}Ar$

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

**[1 mark]**

Tick (✓) **one** box.

Fullerenes ☐

Ions ☐

Isotopes ☐

Molecules ☐

*Do not write outside the box*

**0 3 . 6** What is the electronic structure of an argon atom, $^{40}_{18}Ar$?

**[1 mark]**

Tick (✓) **one** box.

2 ☐ 2, 8 ☐ 2, 8, 2 ☐ 2, 8, 8 ☐

**0 3 . 7** Why is argon unreactive?

**[1 mark]**

_____

_____

**8**

**Turn over for the next question**

*Do not write outside the box*

**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]**

$$\_\_\_\_ Na + Cl_2 \rightarrow \_\_\_\_ NaCl$$

**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]**

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** |

Sodium is a _____ solid.

Chlorine is a _____ gas.

The hot sodium burns with a _____ flame.

The product sodium chloride is a _____ solid.

*Do not write outside the box*

**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**

*Do not write outside the box*

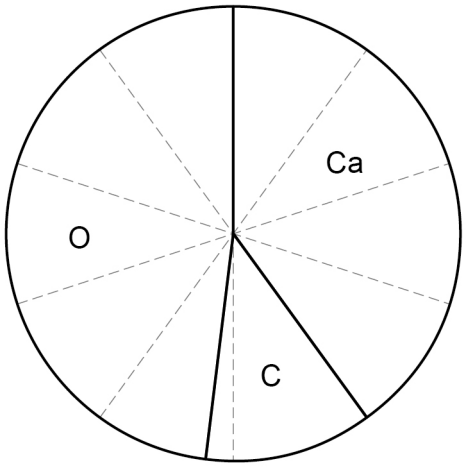
**0 5** This question is about oxygen and compounds of oxygen.

**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 = _____ %

*Do not write outside the box*

**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]**

Mean mass of solid after heating = _____ g

**Question 5 continues on the next page**

*Do not write outside the box*

**0 5 . 4** **Table 3** shows the electronic structure of hydrogen and oxygen.

**Table 3**

| Element | Electronic structure |
|---|---|
| Hydrogen | 1 |
| Oxygen | 2,6 |

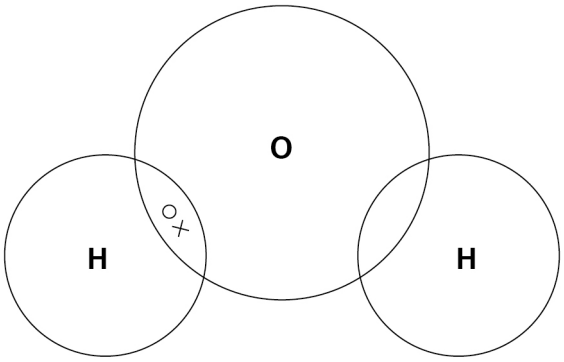
**Figure 5** shows part of a dot and cross diagram of a molecule of water ($H_2O$).

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]**

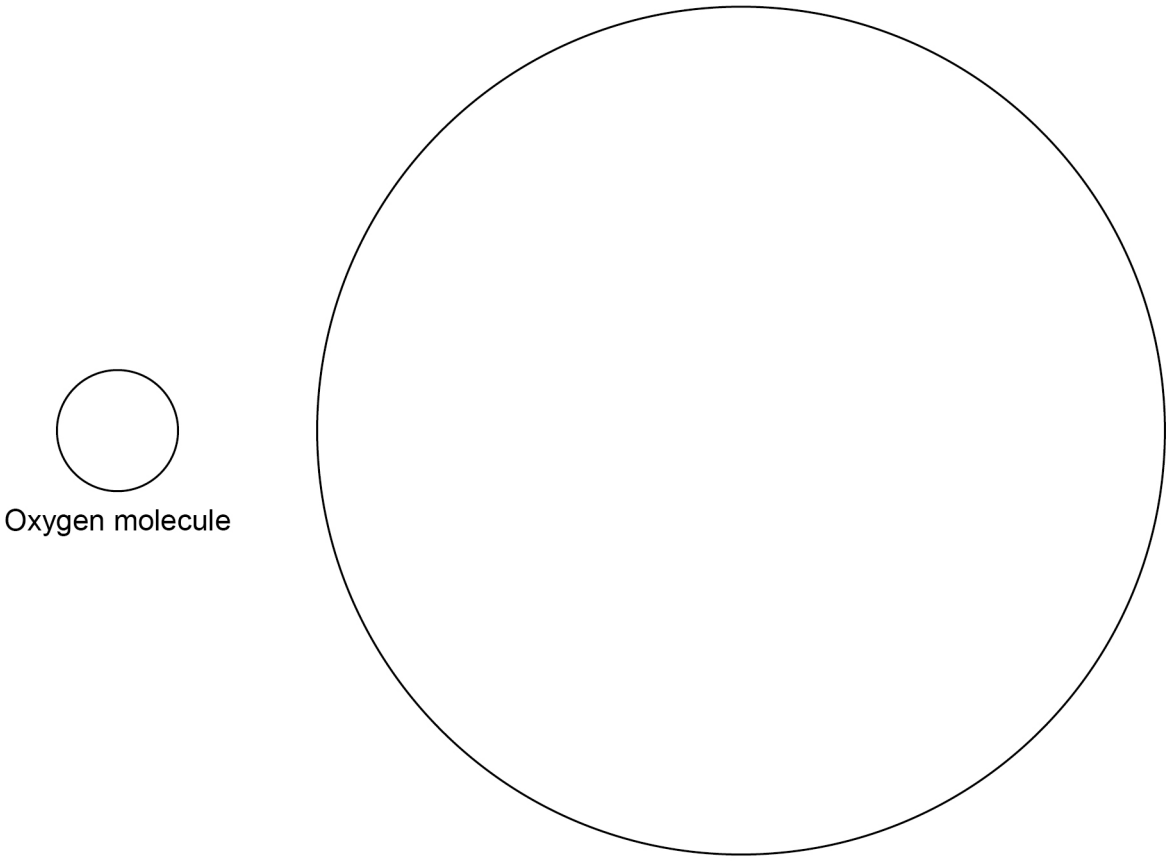
| covalent | ionic | metallic |
|---|---|---|

There are _____ bonds between the atoms of oxygen in an oxygen molecule.

*Do not write outside the box*

**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.

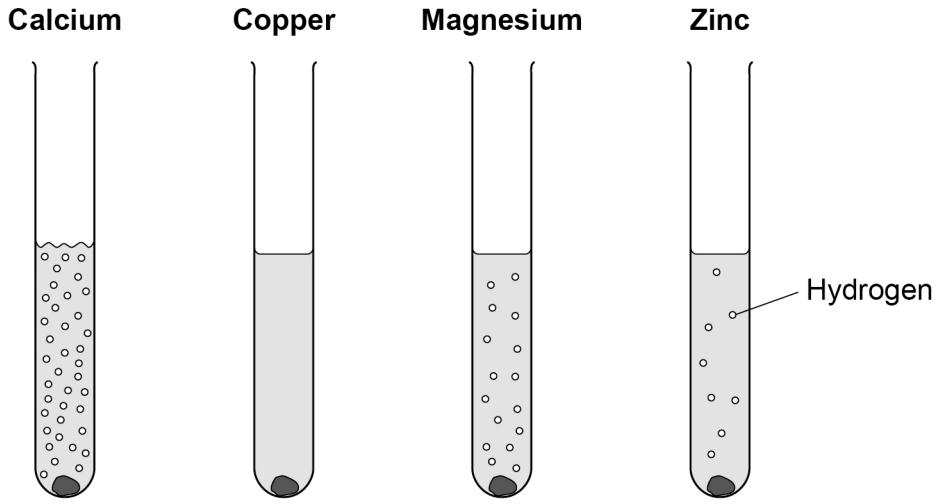
**10**

*Do not write outside the box*

**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 ☐

*Do not write outside the box*

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 $cm^3$

Calculate the concentration of hydrogen chloride in g per $dm^3$

**[3 marks]**

_____

_____

_____

_____

Concentration = _____ g per $dm^3$

**9**

**Turn over ►**

*Do not write outside the box*

**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 ☐

$HNO_3$ ☐

$H_2SO_4$ ☐

$NH_4OH$ ☐

**0 7 . 3** Ammonia gas dissolves in water to produce ammonia solution.

Ammonia solution contains hydroxide ions, $OH^-$

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 _____

*Do not write outside the box*

**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 | |
|---|---|---|---|
| **A** | 10 | 7 | |
| **B** | 2 | 10 | |
| **C** | 7 | 1 | |
| **D** | 10 | 2 | |

**0 7 . 5** Calculate the percentage by mass of oxygen in ammonium nitrate ($NH_4NO_3$).

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

Relative formula mass ($M_r$): $NH_4NO_3$ = 80

**[3 marks]**

Percentage by mass of oxygen = _____ %

**Question 7 continues on the next page**

*Do not write outside the box*

**0 7 . 6** Describe a method to investigate how the temperature changes when different masses of ammonium nitrate are dissolved in water.

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

**[6 marks]**

**14**

**END OF QUESTIONS**

*Do not write outside the box*

**There are no questions printed on this page**

**DO NOT WRITE ON THIS PAGE**
**ANSWER IN THE SPACES PROVIDED**

*Do not write outside the box*

**There are no questions printed on this page**

**DO NOT WRITE ON THIS PAGE**
**ANSWER IN THE SPACES PROVIDED**