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.

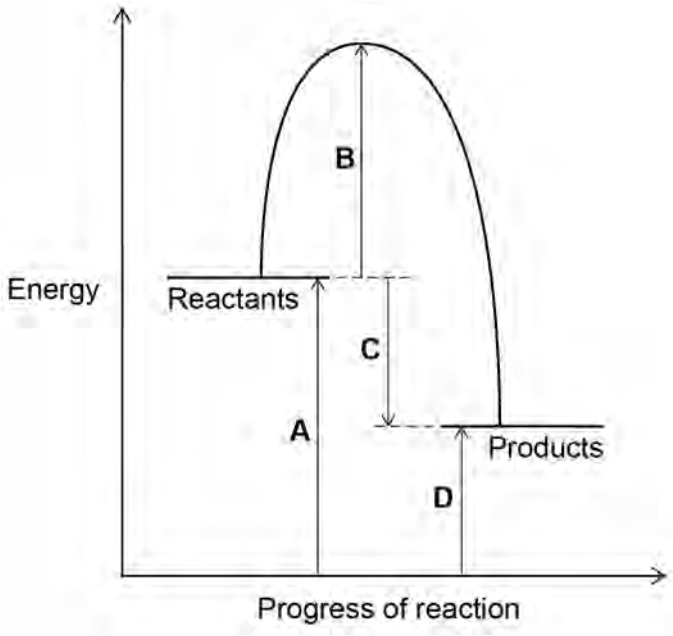
Hand warmer ☐

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]

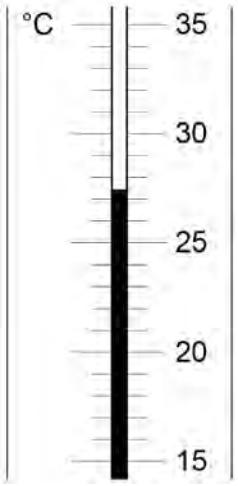
_____

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 _____

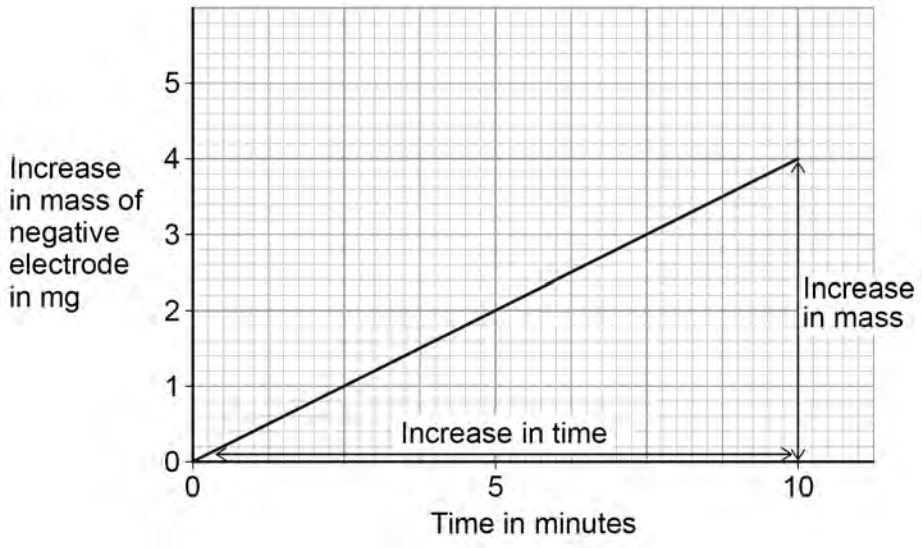
Do not write outside the box

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

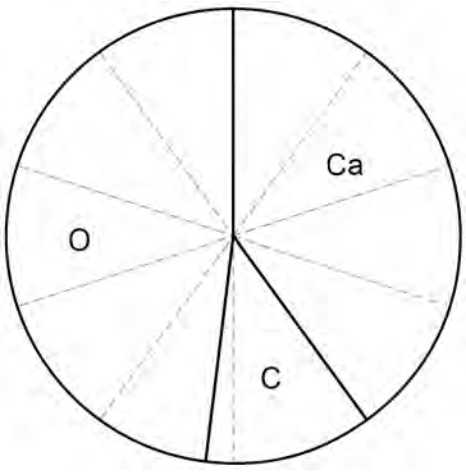
0 5 This question is about oxygen and compounds of oxygen.

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

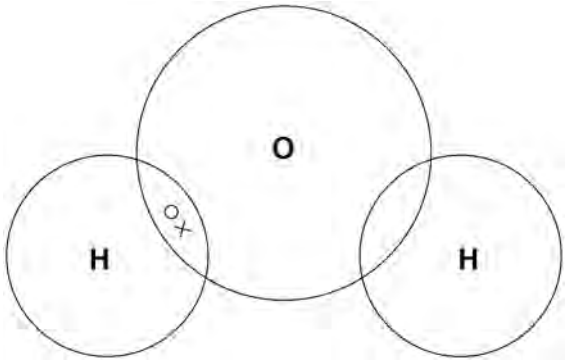
Figure 5 shows part of a dot and cross diagram of a molecule of water (H_2O).

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]

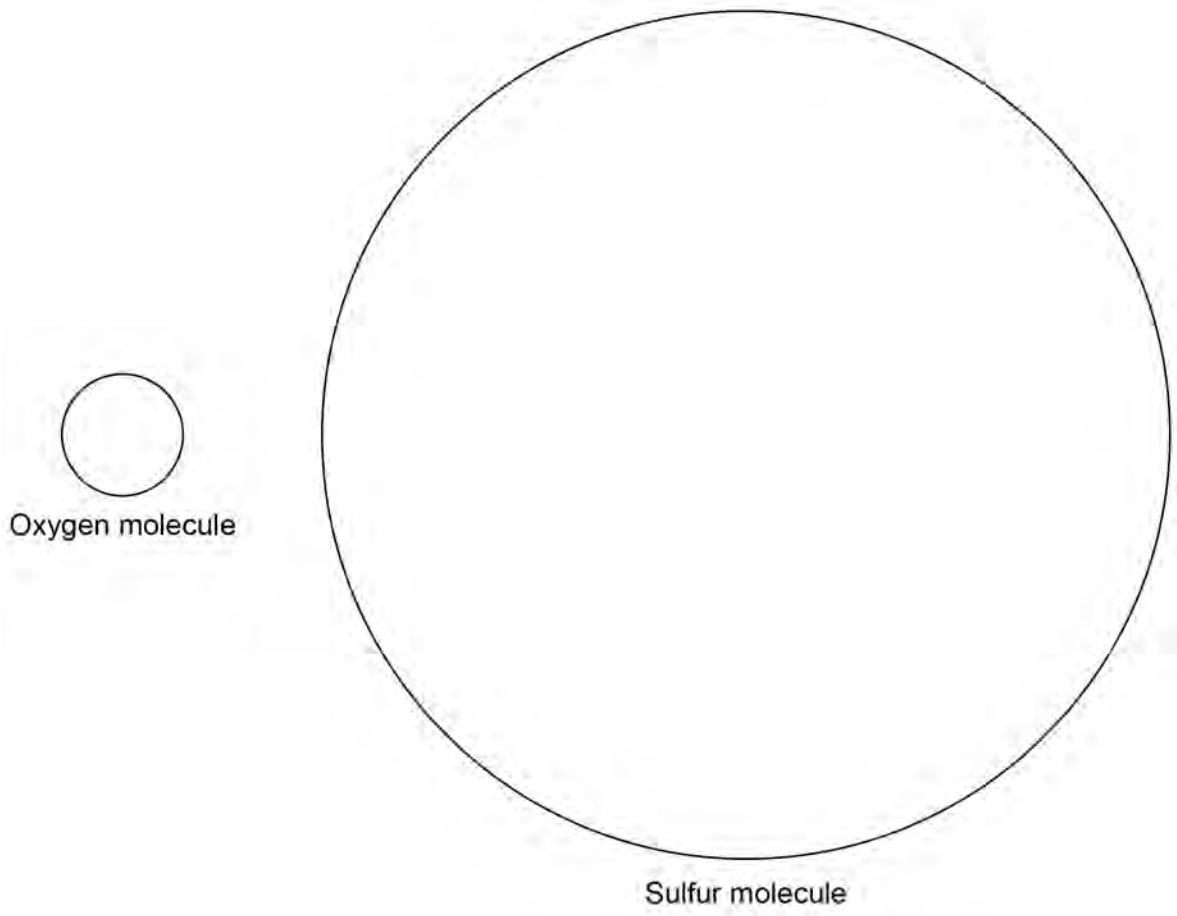
covalent	ionic	metallic

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.

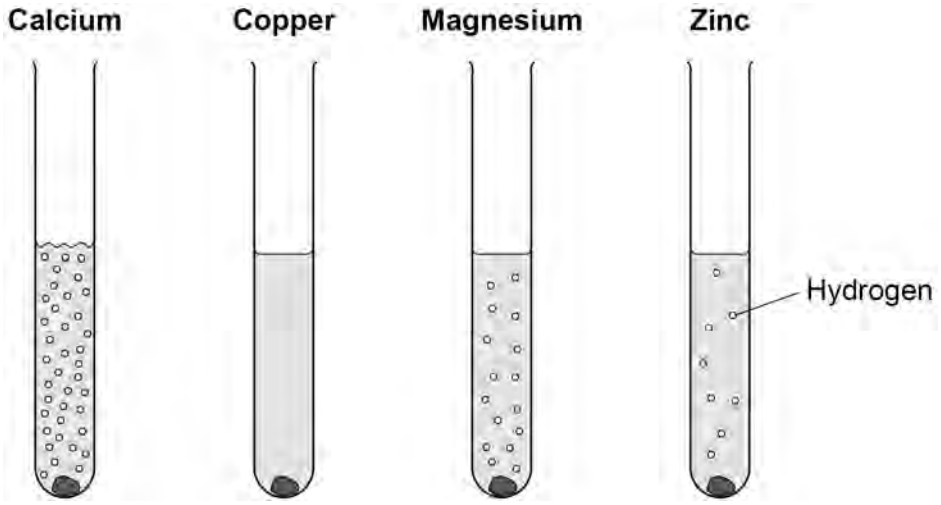
10

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

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

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