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.

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	

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.

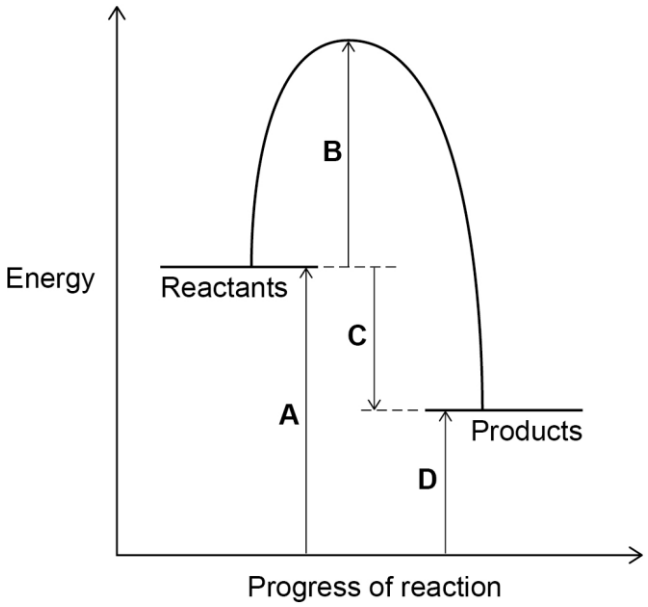
Hand warmer ☐

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 lower than 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]

Thermometer

Question 1 continues on the next page

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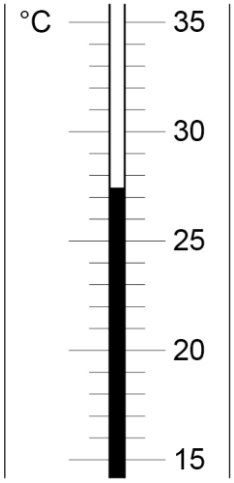
0 1 . 6 **Figure 2** shows the temperature at the end of the reaction.

Figure 2



Complete **Table 1**.

Use **Figure 2**.

[2 marks]

Table 1

Temperature at start in °C	14.3
Temperature at end in °C	27.4 (°C)
Change in temperature in °C	(27.4–14.3 =) 13.1 (°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]

(black) solid remains (after stirring)

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 B

Second stage A

Third stage C

Fourth stage D

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 copper

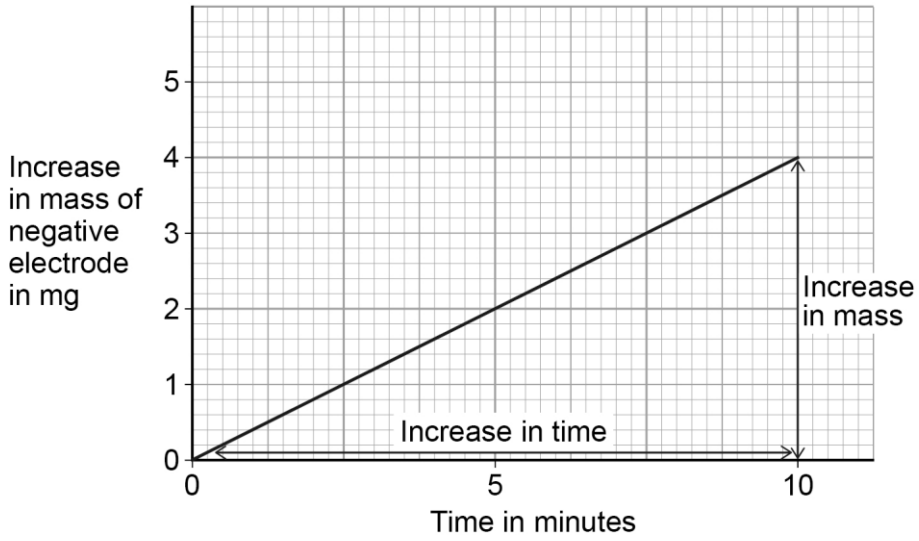
Positive electrode chlorine

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 cryolite and

aluminium oxide .

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 gaps 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 18

Number of neutrons 22

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]

stable arrangement (of electrons) OR full outer shell

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]

$$\underline{2}\ Na + Cl_2 \rightarrow \underline{2}\ NaCl$$

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]

11.7-4.6 = 7.1

Mass of chlorine = 7.1 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 silver solid.

Chlorine is a green gas.

The hot sodium burns with a yellow flame.

The product sodium chloride is a white 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 Na+

Chloride ion Cl–

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 an electron 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 Potassium atom is larger and potassium atom has more energy levels/ shells of electrons

11

Turn over for the next question

Do not write outside the box

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

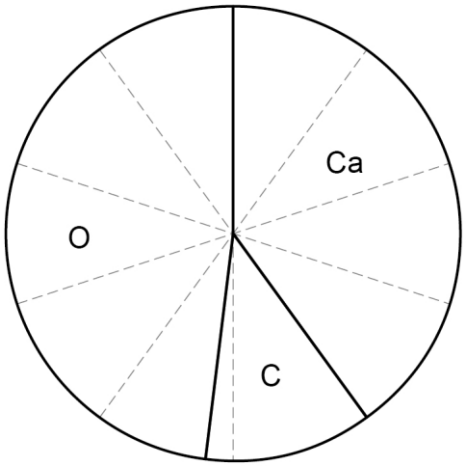
0 5 . 1 What is the state symbol of oxygen at room temperature?

[1 mark]

(g)

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 = 40 (%) %

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]

$$\frac{3.76 + 3.98 + 4.09}{3}$$

$= 3.943$

$= 3.94$ (g)

Mean mass of solid after heating = 3.94 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

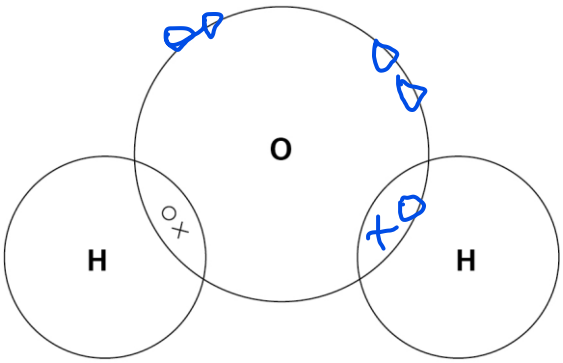
Figure 5 shows part of a dot and cross diagram of a molecule of water (H_2O).

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]

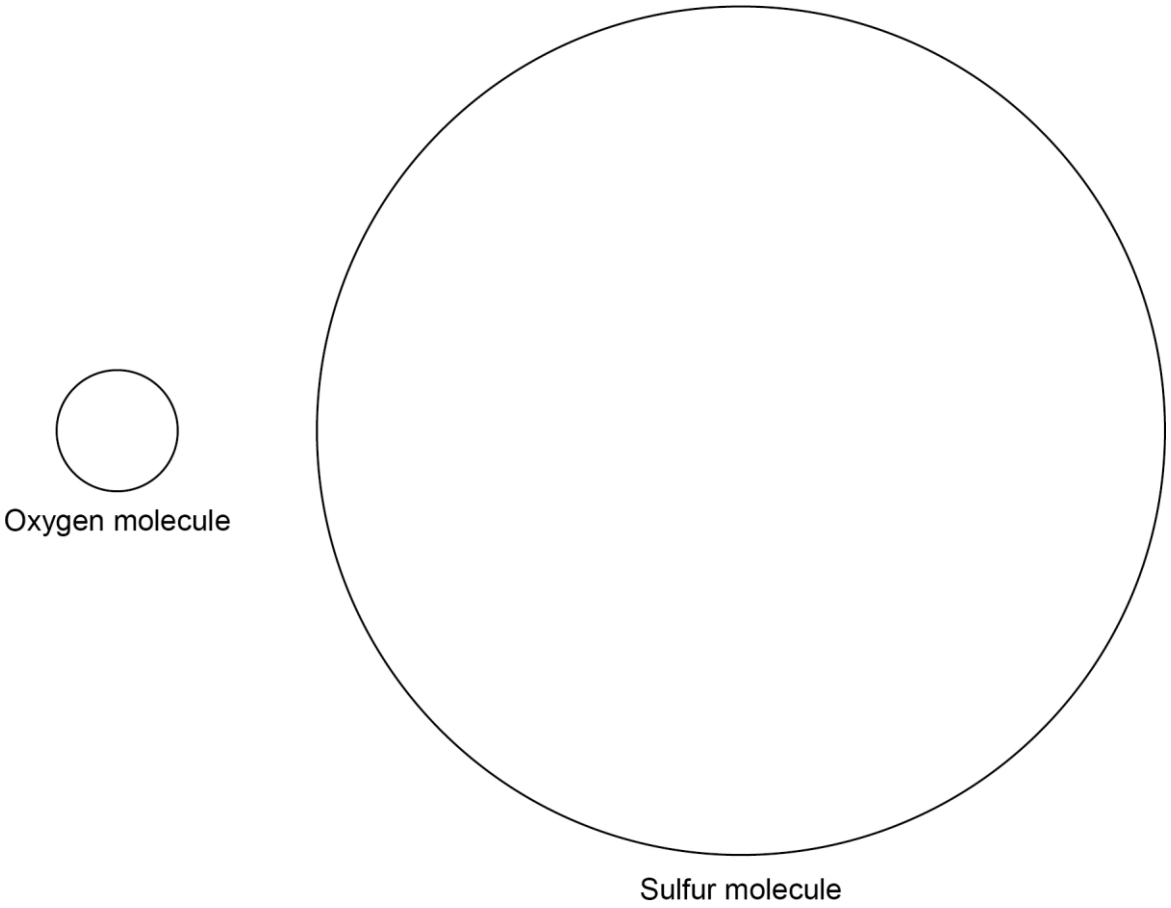
covalent	ionic	metallic

There are covalent 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 Higher than the boiling point of oxygen.

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

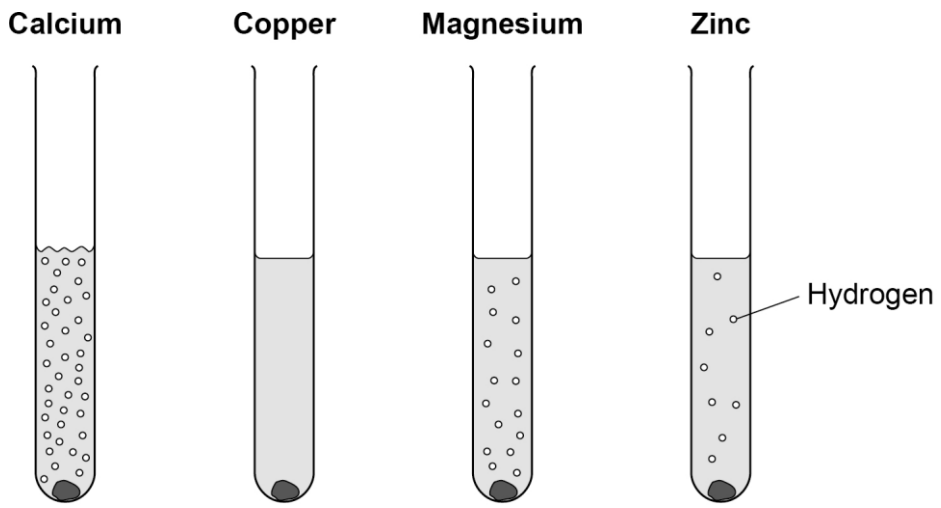
10

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 ☑

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 • mass (of metal / element) OR surface area (of metal / element)

2 concentration (of acid) OR volume (of acid) OR temperature (of acid)

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

[1 mark]

type of metal / element

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

Give a reason for your answer.

Use the periodic table.

[2 marks]

Reason beryllium is less reactive because there is greater attraction between nucleus and outer electrons and more energy is needed to remove electrons

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]

50/ 1000 (dm3) = 0.05 (dm3)

3.2/ 0.05 = 64 (g per dm3)

Concentration = 64 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]

(aq)

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: red

Colour in ammonia solution: purple

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]

3 × 16 = 48

48/ 80 (×100)

60 (%)

Percentage by mass of oxygen = 60 %

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]

use a suitable container e.g. test tube

• use insulation

• add water

• measure the initial water temperature (with a thermometer)

• add stated mass e.g. 1g or 1 spatula

• stir (to dissolve the solid)

• measure the final (allow lowest or highest) temperature of the solution

• calculate the temperature difference or determine graphically

• repeat with different masses

• repeat with the same volume of water

14

END OF QUESTIONS

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