A

AQA

Surname _____

Other Names _____

Centre Number _____

Candidate Number _____

Candidate Signature _____

GCSE

COMBINED SCIENCE: TRILOGY

F

Foundation Tier

Chemistry Paper 1F

8464/C/1F

Thursday 16 May 2019 Morning

Time allowed: 1 hour 15 minutes

For this paper you must have:
- **a ruler**
- **a scientific calculator**
- **the periodic table (enclosed).**

At the top of the page, write your surname and other names, your centre number, your candidate number and add your signature.

[Turn over]

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INSTRUCTIONS

- **Use black ink or black ball-point pen.**
- **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.**

DO NOT TURN OVER UNTIL TOLD TO DO SO

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0 1 **This question is about energy changes.**

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

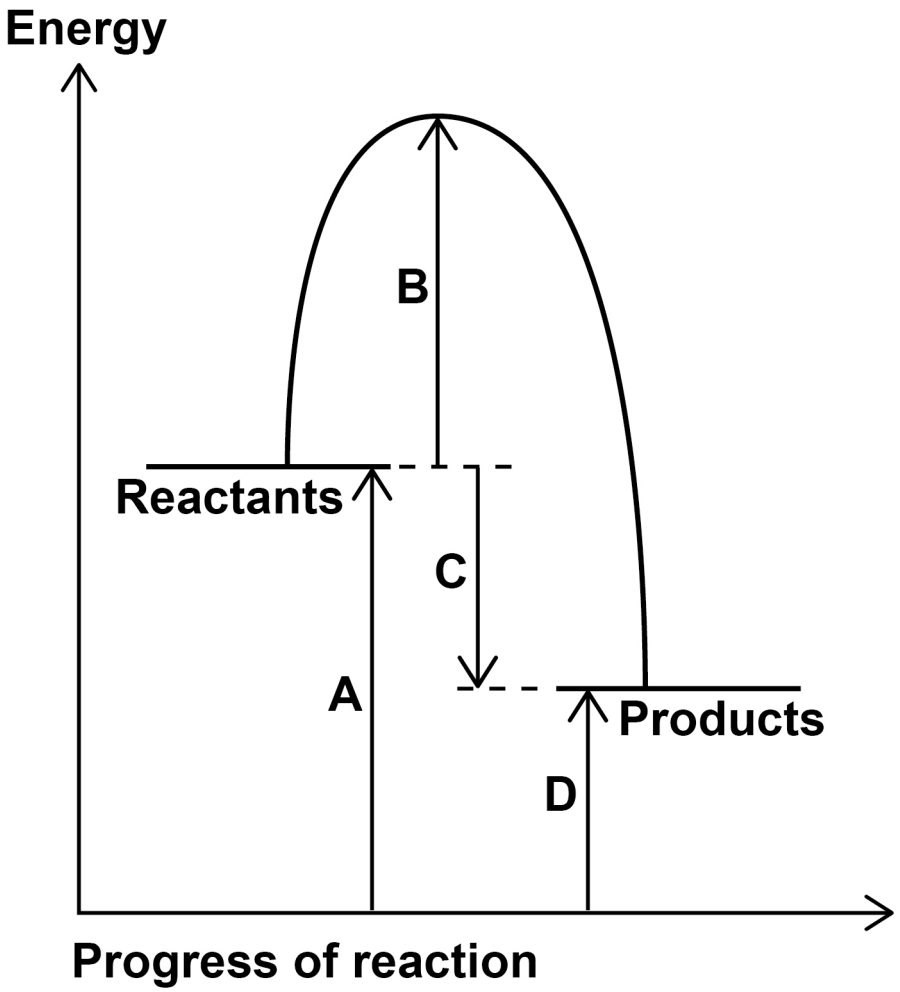
Tick (✓) ONE box.

- ☐ **Hand warmer**
- ☐ **Sports injury pack**
- ☐ **Self-heating can**

[Turn over]

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 list below.
[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.**

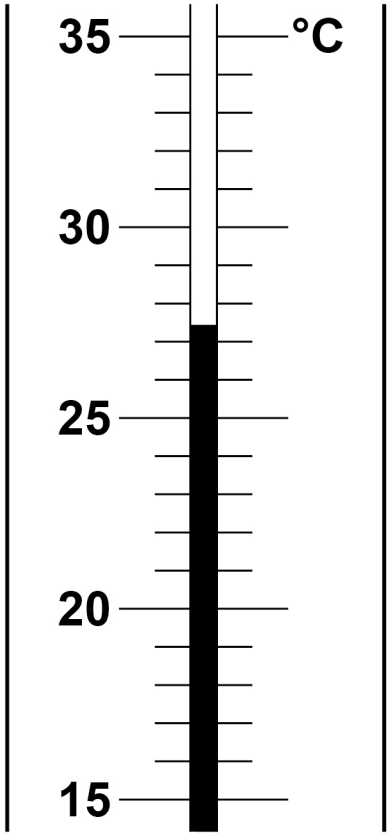
Name the apparatus used to measure the temperature. [1 mark]

_____

_____

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

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]

_____

_____

_____

[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

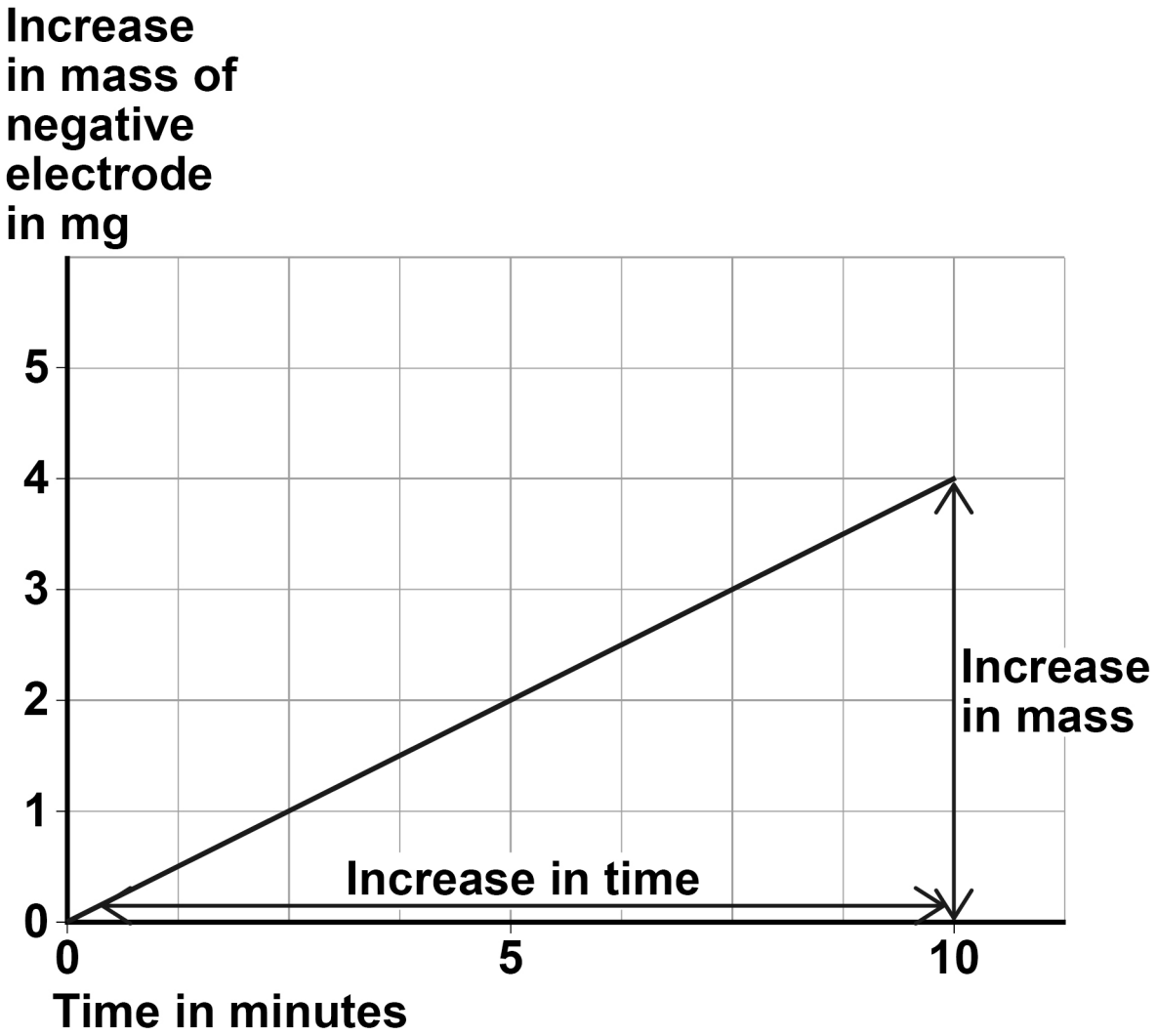
[Turn over]

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 list below.
[2 marks]

- **carbon**
- **chloride**
- **cryolite**
- **oxide**
- **sulfate**
- **water**

The molten mixture contains

_____ and

aluminium _____ .

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[Turn over]

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.

0 3 . 3 **What is the name of the group that contains argon? [1 mark]**

Tick (✓) ONE box.

☐ **Alkali metals**

☐ **Halogens**

☐ **Noble gases**

[Turn over]

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

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

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 → _____ 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 list below.
[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.**

[Turn over]

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 list below. [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

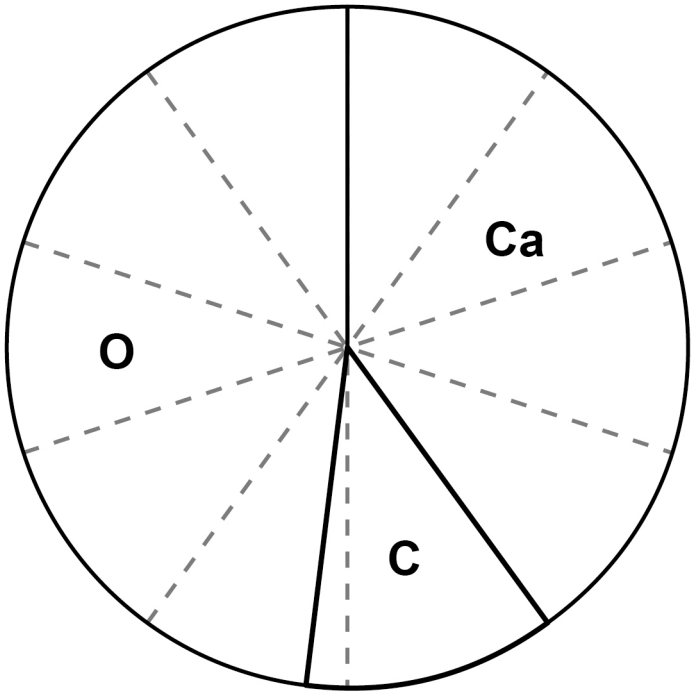
11

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 = _____ **%**

[Turn over]

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**

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

TABLE 3

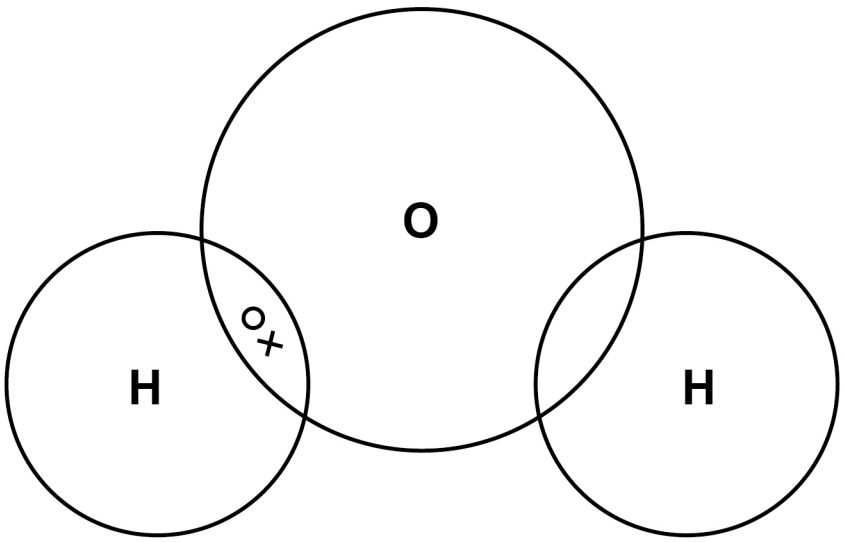
Element	Electronic structure
Hydrogen	1
Oxygen	2,6

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 list below.
[1 mark]

- covalent
- ionic
- metallic

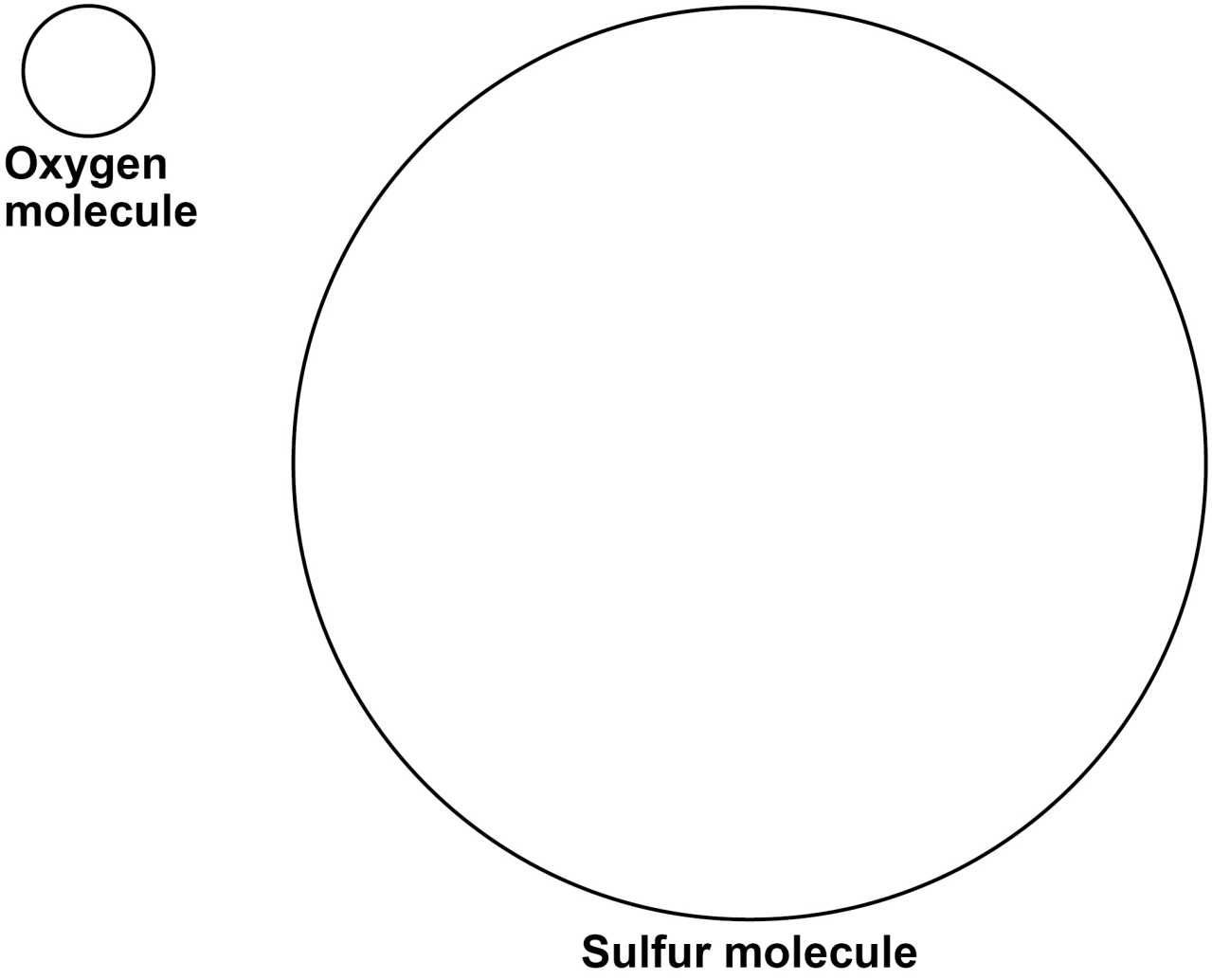
There are _____

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.

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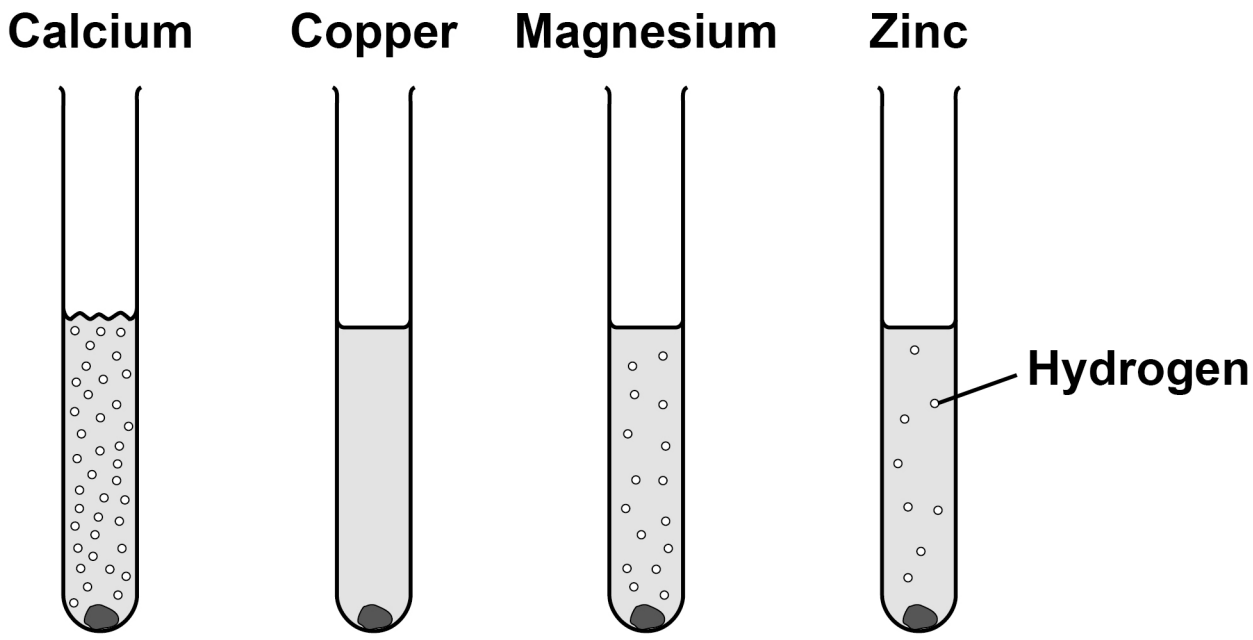
0 6 **This question is about reactions of metals.**

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**

[Turn over]

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 _____

_____

_____

_____

_____

[Turn over]

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

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[Turn over]

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

[Turn over]

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 = _____ %

[Turn over]

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]

END OF QUESTIONS

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For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
TOTAL	