A

Surname _____

Other Names _____

Centre Number _____

Candidate Number _____

Candidate Signature _____

GCSE

COMBINED SCIENCE: TRILOGY

Foundation Tier

Chemistry Paper 1F

F

8464/C/1F

Thursday 16 May 2019 Morning

Time allowed: 1 hour 15 minutes

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

[Turn over]

For this paper you must have:

- **a ruler**
- **a scientific calculator**
- **the periodic table (enclosed).**

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

4

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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**

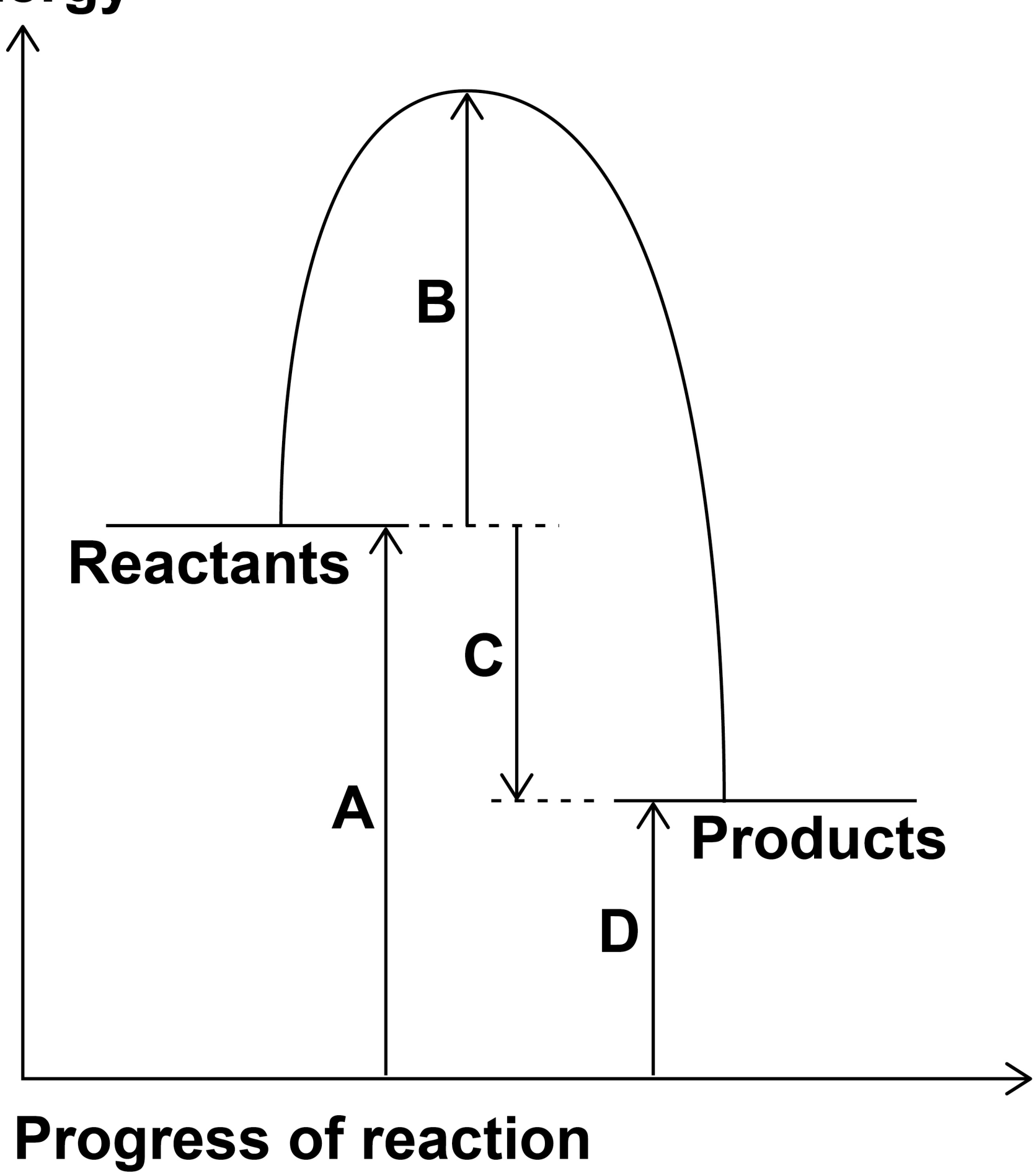
☐ **Sports injury pack**

☐ **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**

8

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0 1 . 3

Which letter represents the overall energy change for the reaction? [1 mark]

Tick (✓) ONE box.

☐ **A**

☐ **B**

☐ **C**

☐ **D**

[Turn over]

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]

_____

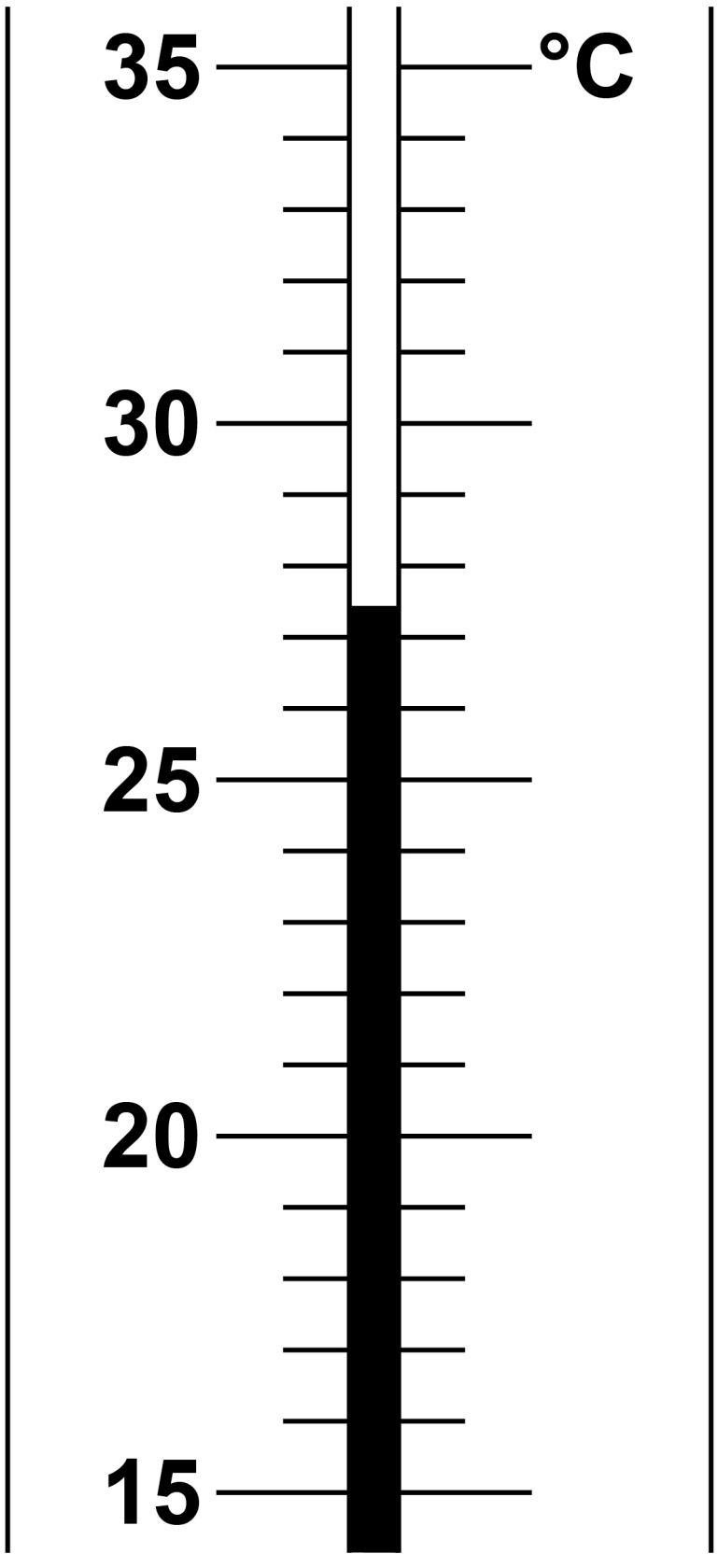
_____

[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	

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]

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[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 _____

[Turn over]

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

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[Turn over]

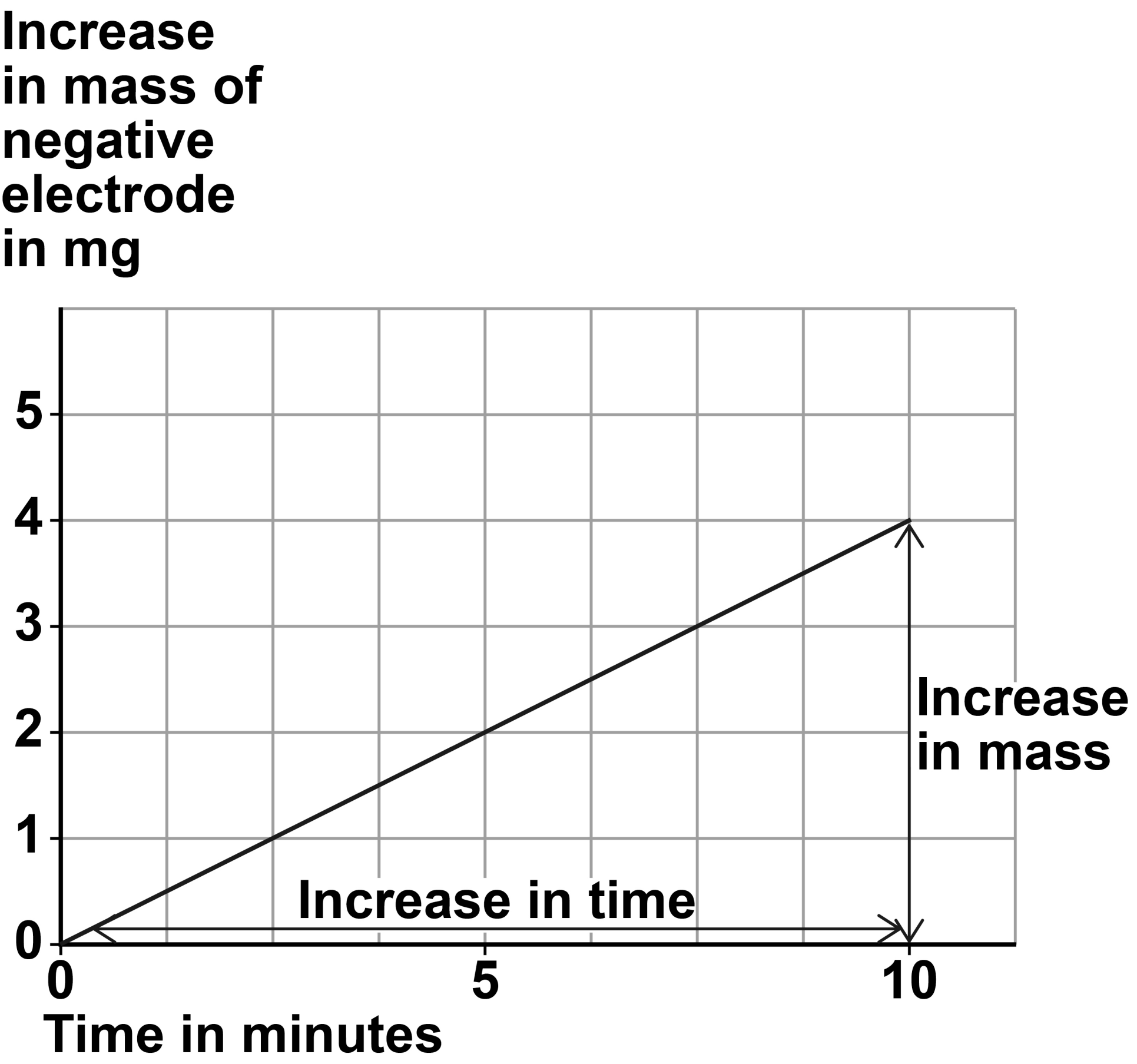
0 2 . 5

A solution of copper chloride is electrolysed.

FIGURE 3 on the opposite page shows a graph of the increase in mass of the negative electrode.

This increase is shown over a time of 10 minutes.

FIGURE 3



[Turn over]

Calculate the gradient of the line in FIGURE 3 on page 23.

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 on the opposite page.

Choose the answers from the list below.
[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.

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

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

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[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]

_____ **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

[Turn over]

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.

[Turn over]

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]

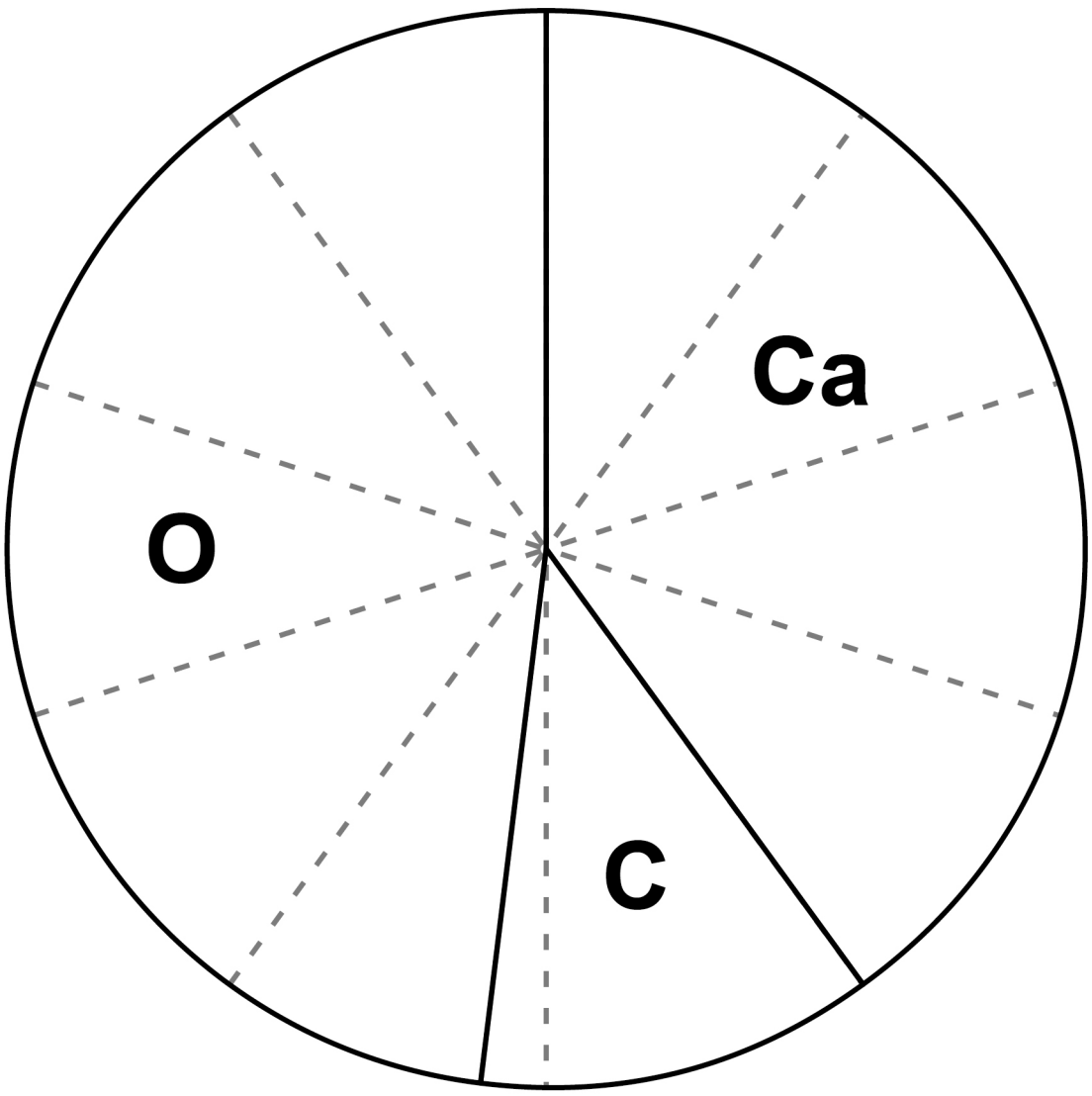
_____

_____

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

[Turn over]

0 5 . 4

TABLE 3 shows the electronic structure of hydrogen and oxygen.

TABLE 3

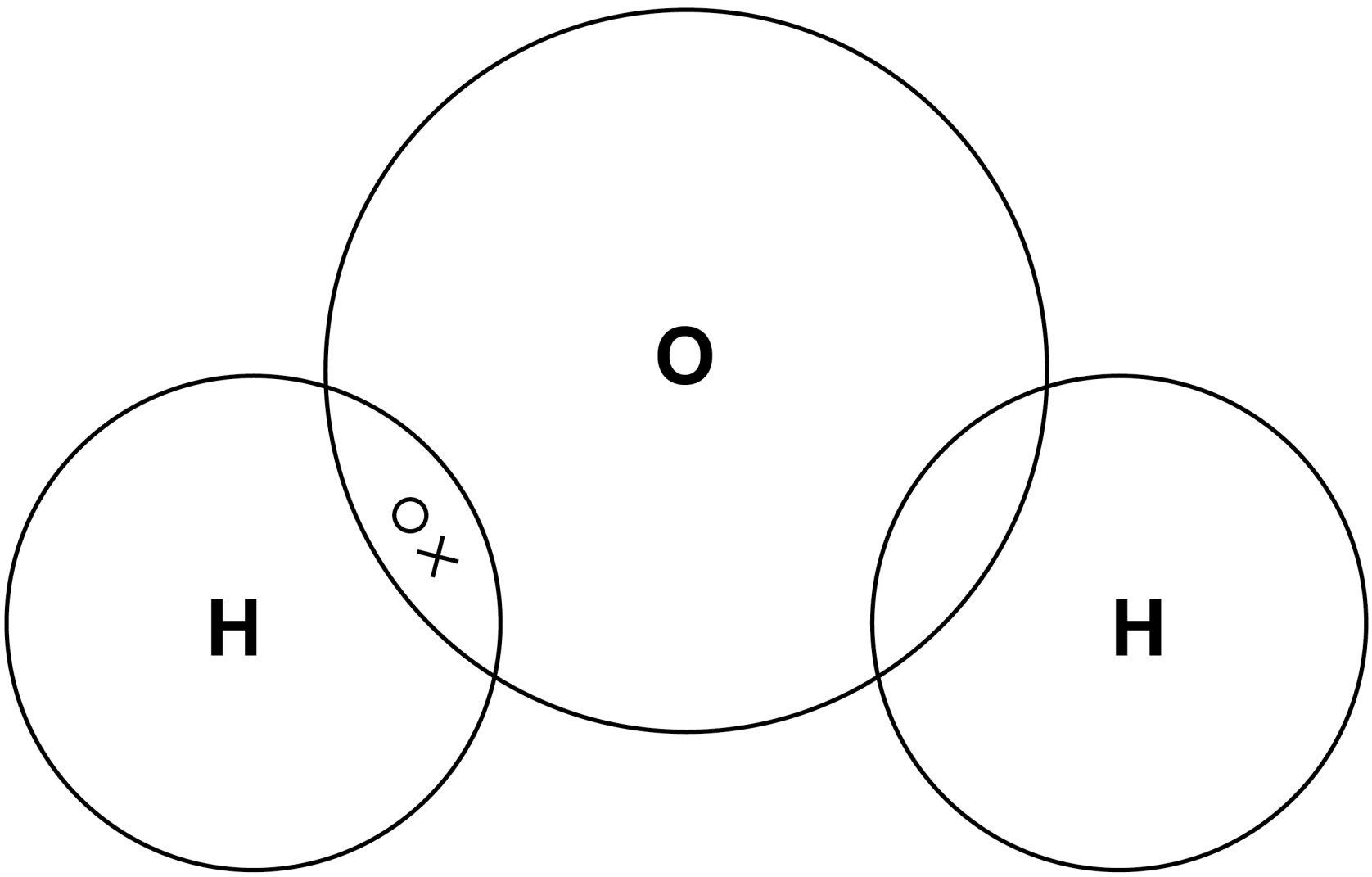
Element	Electronic structure
Hydrogen	1
Oxygen	2,6

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

Complete the dot and cross diagram.

You should show only the electrons in the outer energy levels. [2 marks]

FIGURE 5



[Turn over]

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.

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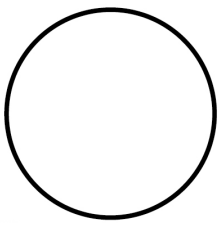
[Turn over]

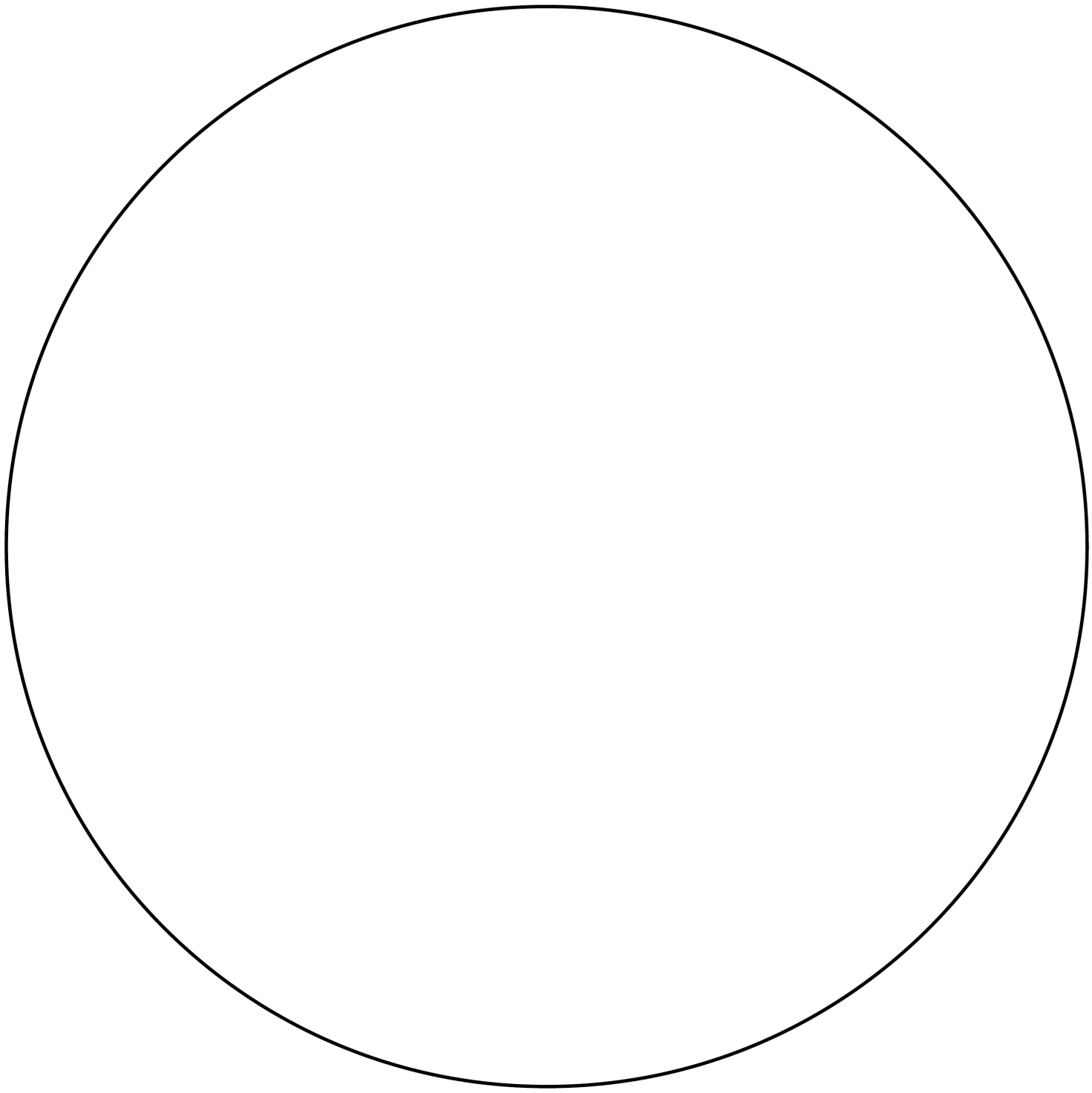
0 5 . 6

FIGURE 6 shows the relative sizes of an oxygen molecule and a sulfur molecule.

FIGURE 6



Oxygen molecule



Sulfur molecule

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.

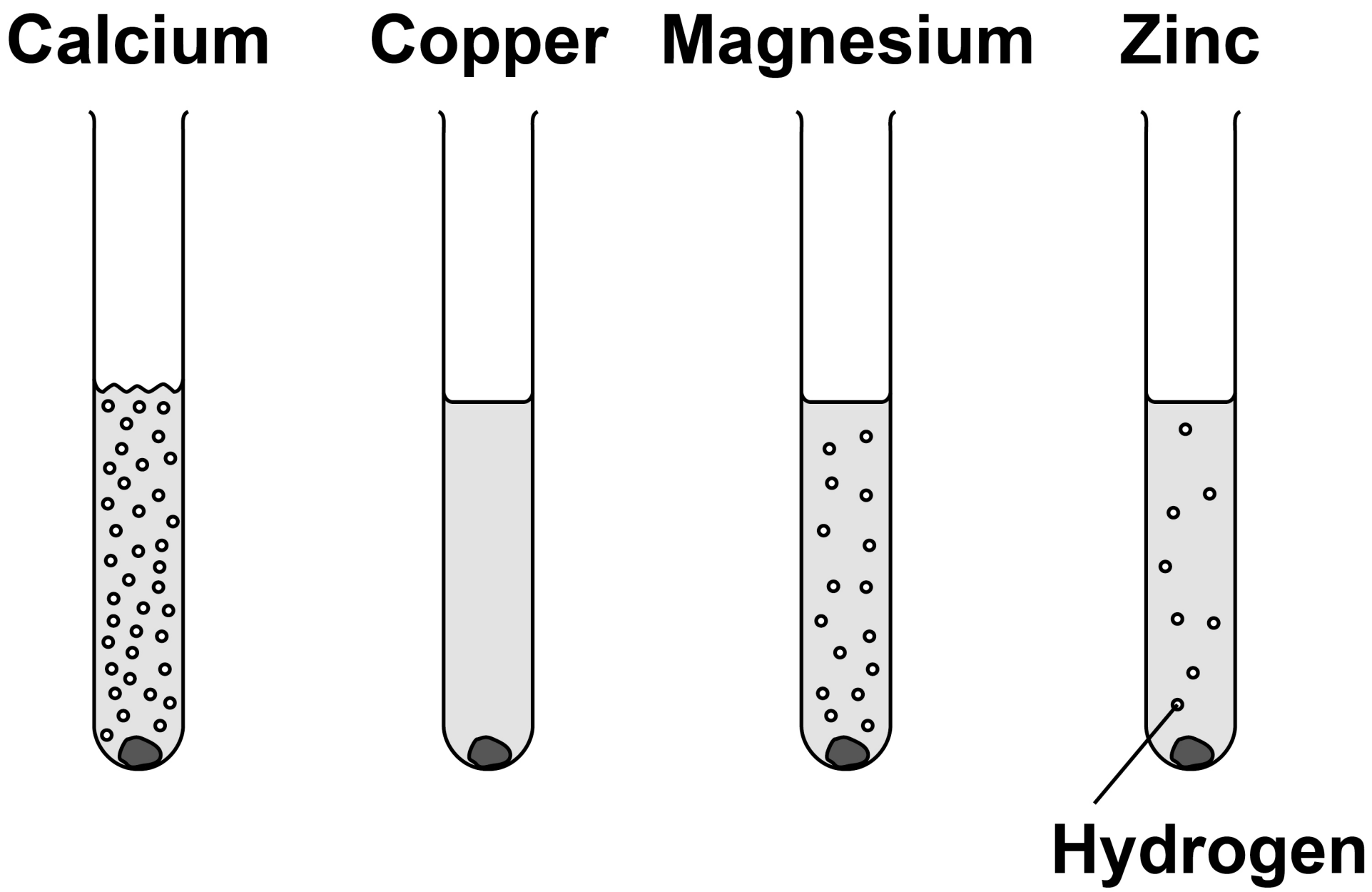
10

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]

_____

_____

_____

[Turn over]

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

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**

[Turn over]

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

BLANK PAGE

[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 in the table on the opposite page.

	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

[Turn over]

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	