A

AQA

Surname _____

Other Names _____

Centre Number _____

Candidate Number _____

Candidate Signature _____

I declare this is my own work.

GCSE
COMBINED SCIENCE: TRILOGY

Higher Tier
Chemistry Paper 1H

H

8464/C/1H

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.**
- **Pencil should only be used for drawing.**
- **Answer ALL questions in the spaces provided.**
- **If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).**
- **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

0 1

This question is about the periodic table.

0 1 . 1

FIGURE 1, on the opposite page, shows part of Mendeleev's version of the periodic table.

Which group of elements had NOT been discovered when Mendeleev's version of the periodic table was published? [1 mark]

FIGURE 1

H							
Li	Be	B	C	N	O	F	
Na	Mg	Al	Si	P	S	Cl	
K Cu	Ca Zn		Ti	V As	Cr Se	Mn Br	Fe Co Ni
Rb Ag	Sr Cd	Y In	Zr Sn	Nb Sb	Mo Te	I	Ru Rh Pd

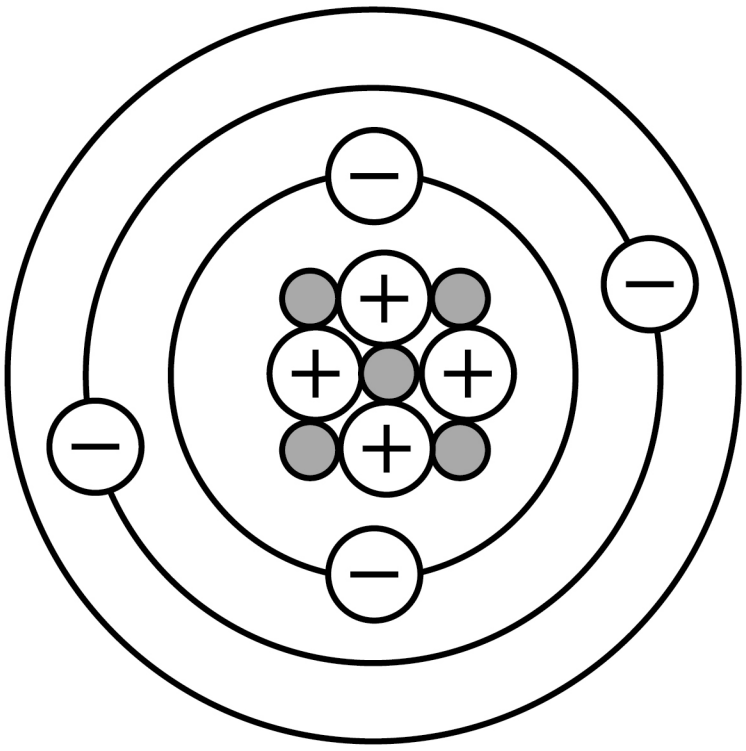
5

[Turn over]

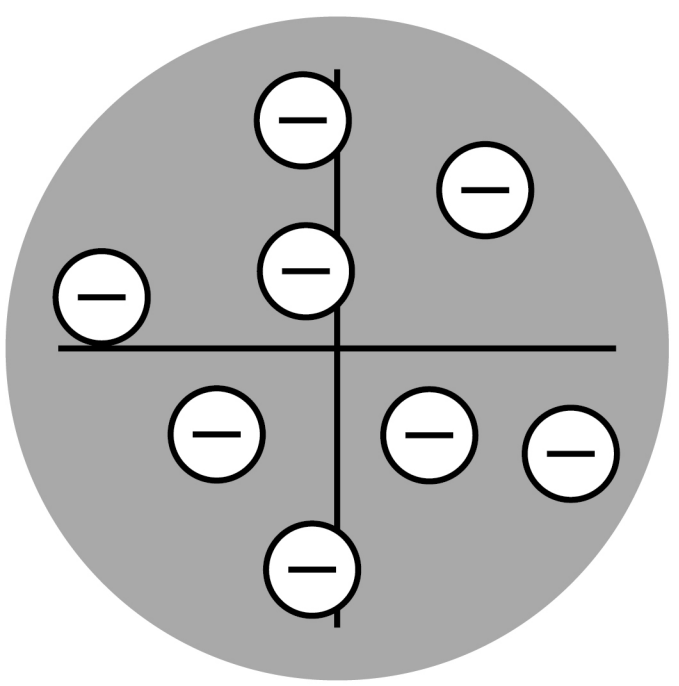
FIGURE 2 represents different models of the atom.

FIGURE 2

A



B



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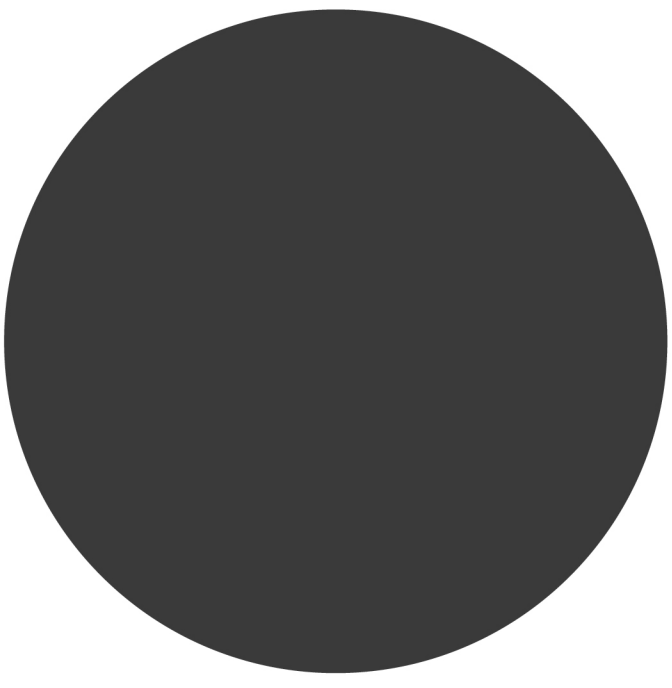

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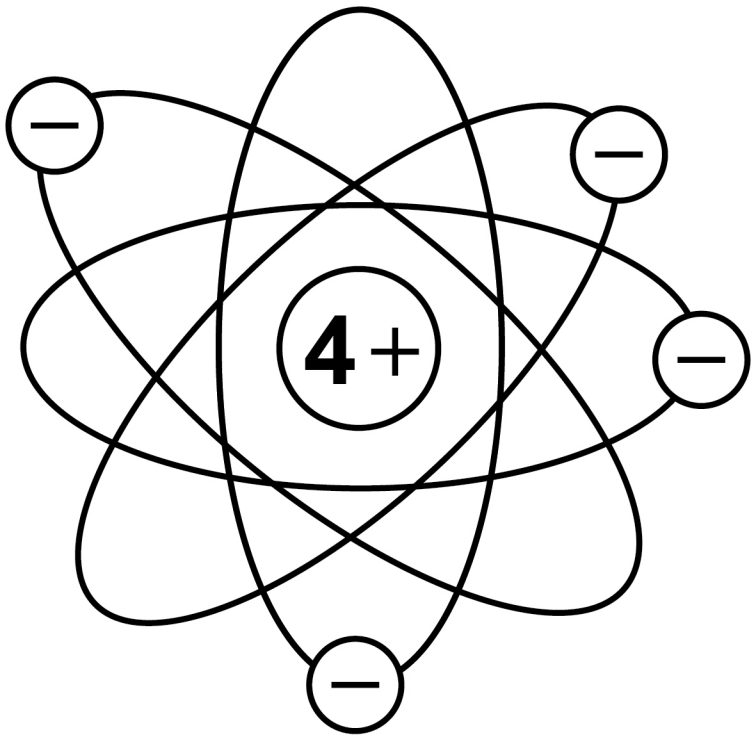


0 1 . 2

Which model represents the plum pudding model? [1 mark]

Tick (✓) ONE box.

☐ **A**

☐ **B**

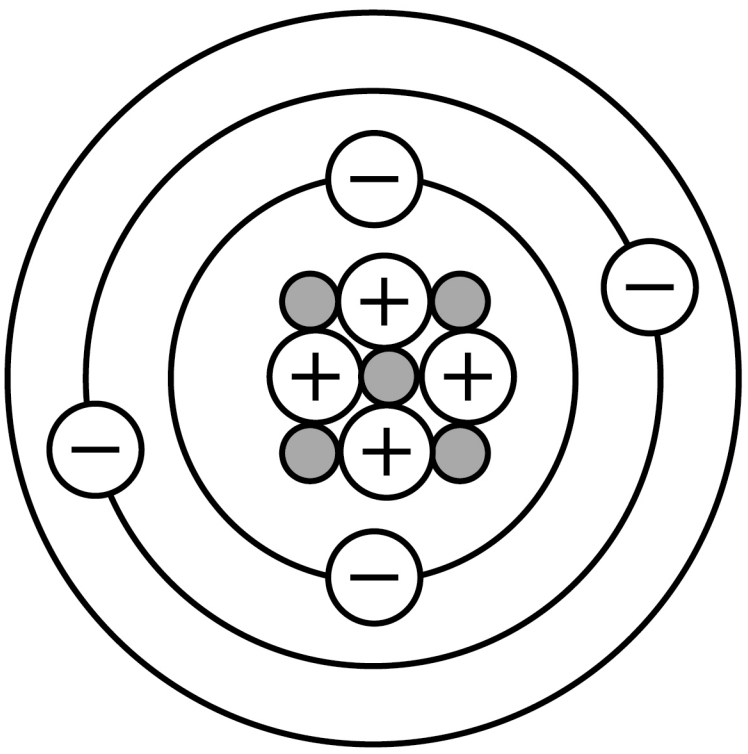
☐ **C**

☐ **D**

[Turn over]

REPEAT OF FIGURE 2

A



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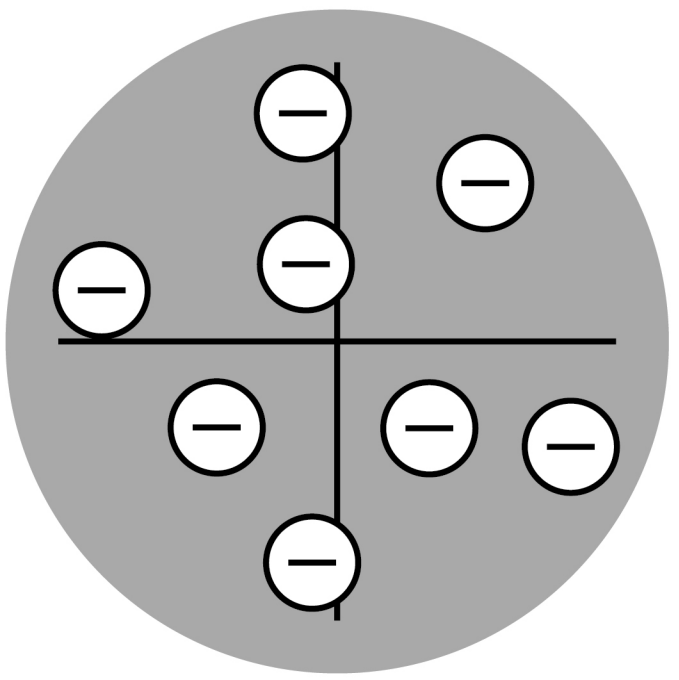

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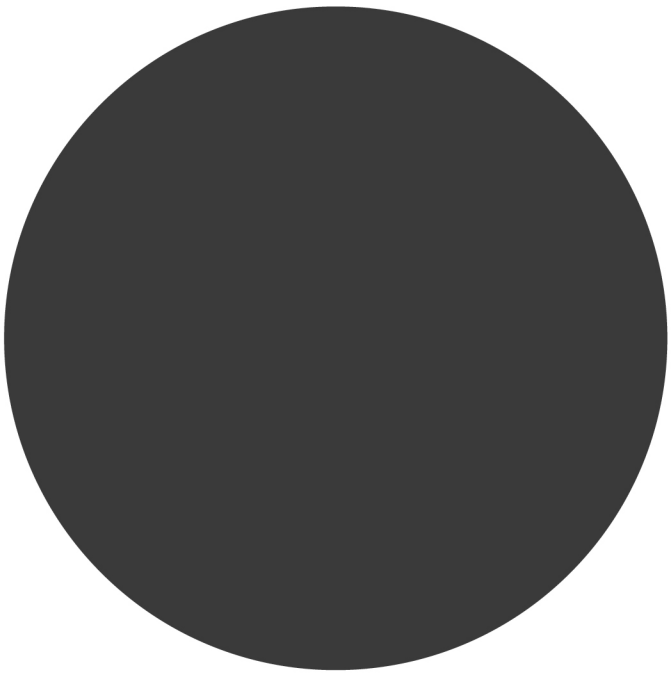

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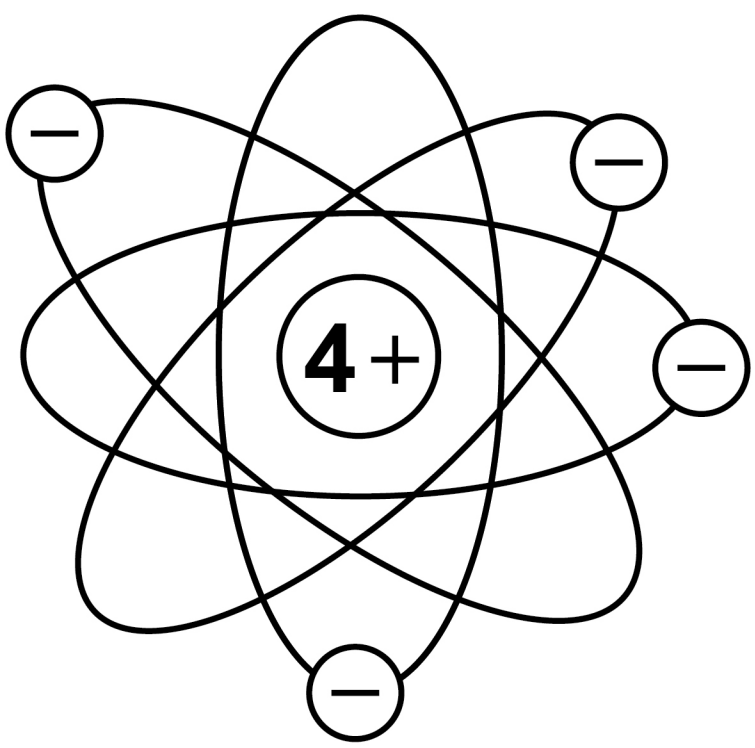

0 1 . 3

Which model resulted from Chadwick's experimental work? [1 mark]

Tick (✓) ONE box.

☐ **A**

☐ **B**

☐ **C**

☐ **D**

[Turn over]

Potassium has different isotopes.

0 1 . 4

What is meant by ‘isotopes’?

You should refer to subatomic particles.
[2 marks]

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[Turn over]

0 1 . 5

TABLE 1 shows the mass numbers and the percentage abundance of two isotopes of potassium.

TABLE 1

Mass number	Percentage abundance
39	93.1
41	6.9

Calculate the relative atomic mass (A_r) of potassium.

Give your answer to 1 decimal place.
[3 marks]

Relative atomic mass (1 decimal place) =

8

0 2

Acids react to produce salts.

Universal indicator is added to water and then nitric acid is added to the mixture.

0 2 . 1

Give the colour change when nitric acid is added to the mixture of universal indicator and water. [1 mark]

Tick (✓) ONE box.

☐ **Blue to red**

☐ **Green to purple**

☐ **Green to red**

☐ **Red to purple**

0 2 . 2

What happens to the pH of water when nitric acid is added? [1 mark]

Tick (✓) ONE box.

☐ **Decreases**

☐ **Stays the same**

☐ **Increases**

0 2 . 3

What is the state symbol for nitric acid? [1 mark]

Zinc carbonate reacts with nitric acid.

The word equation for the reaction is:

zinc carbonate + nitric acid ⟶ zinc nitrate + water + carbon dioxide

white solid colourless solution

0 2 . 4

Give TWO observations that would be made when zinc carbonate is added to nitric acid until the zinc carbonate is in excess. [2 marks]

1 _____

_____

2 _____

_____

[Turn over]

0 2 . 5

The formula of the zinc ion is Zn^{2+}

The formula of the nitrate ion is NO_3^-

What is the formula for zinc nitrate?

[1 mark]

Tick (✓) ONE box.

☐ **$ZnNO_3$**

☐ **$Zn(NO_3)_2$**

☐ **Zn_2NO_3**

☐ **$Zn_2(NO_3)_2$**

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[Turn over]

0 2 . 6

Acids react with insoluble metal oxides to produce salts.

Plan a method to produce a pure, dry sample of the soluble salt copper chloride from an acid and a metal oxide. [6 marks]

[Turn over]

0 3

This question is about energy change.

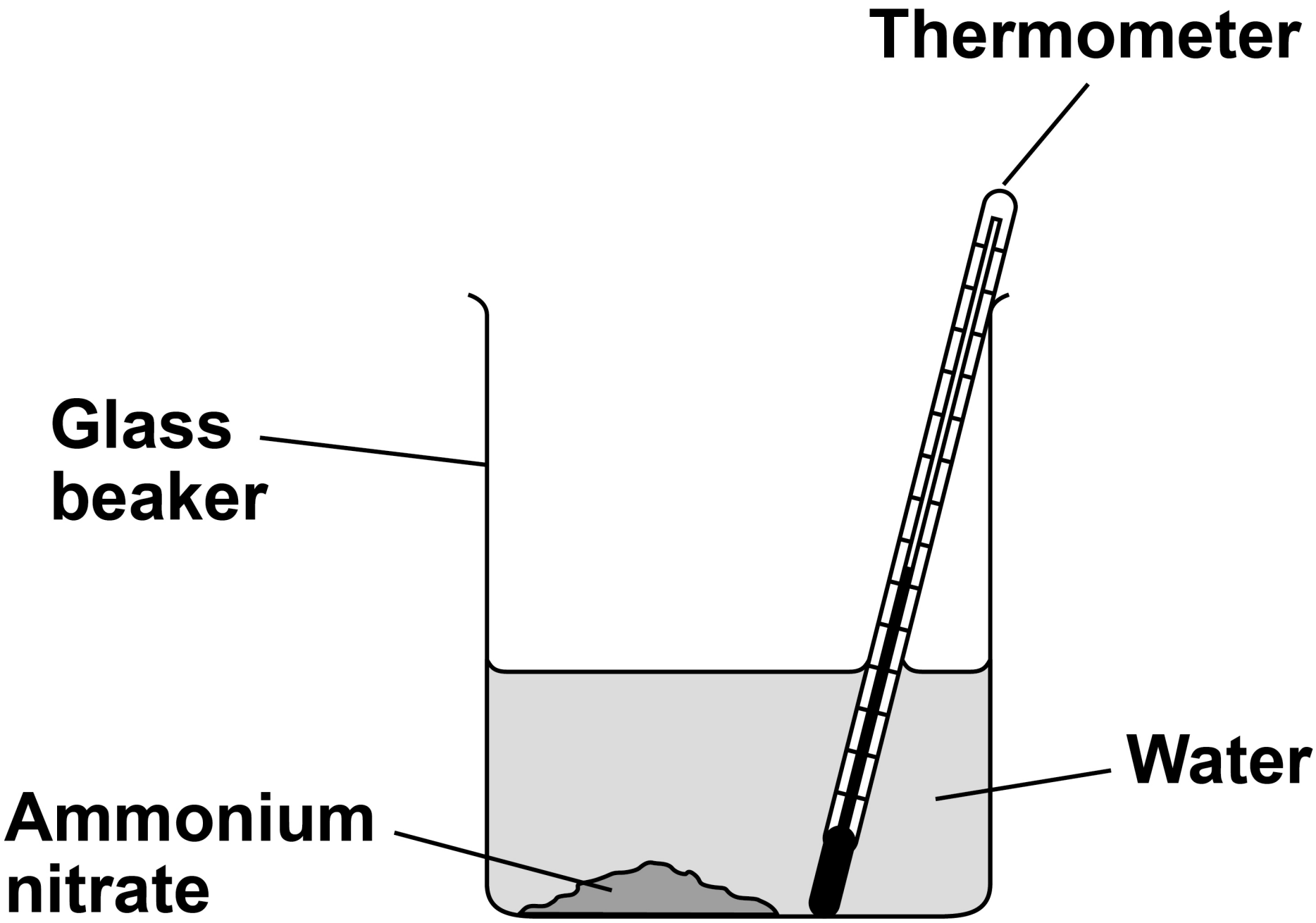
A student investigated the temperature change when 10 g of ammonium nitrate was added to 100 cm^3 of water.

This is the method used.

1. **Measure the temperature of 100 cm^3 of water.**
2. **Add 10 g of ammonium nitrate.**
3. **Stir once.**
4. **Measure the temperature of the solution every minute for 7 minutes.**

FIGURE 3, on the opposite page, shows the apparatus.

FIGURE 3



0 3 . 1

What is the dependent variable in this investigation? [1 mark]

_____

_____

[Turn over]

0 3 . 2

Give THREE improvements to the investigation to make the results more accurate. [3 marks]

1

2

3

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[Turn over]

0 3 . 3

FIGURE 4, on the opposite page, shows the results.

Explain the results. [4 marks]

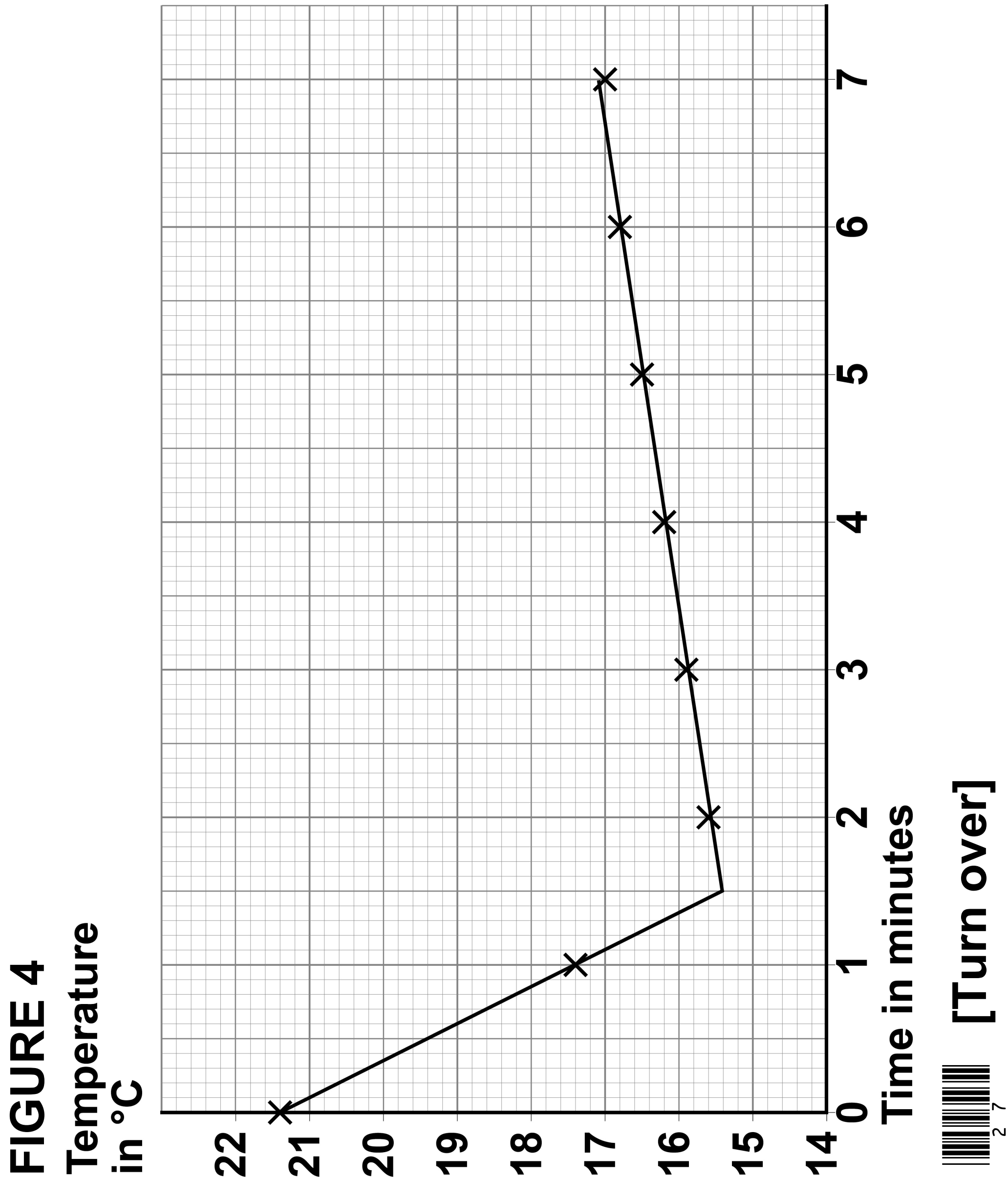


FIGURE 4
Temperature in °C
22
21
20
19
18
17
16
15
14
0
1
2
3
4
5
6
7
Time in minutes

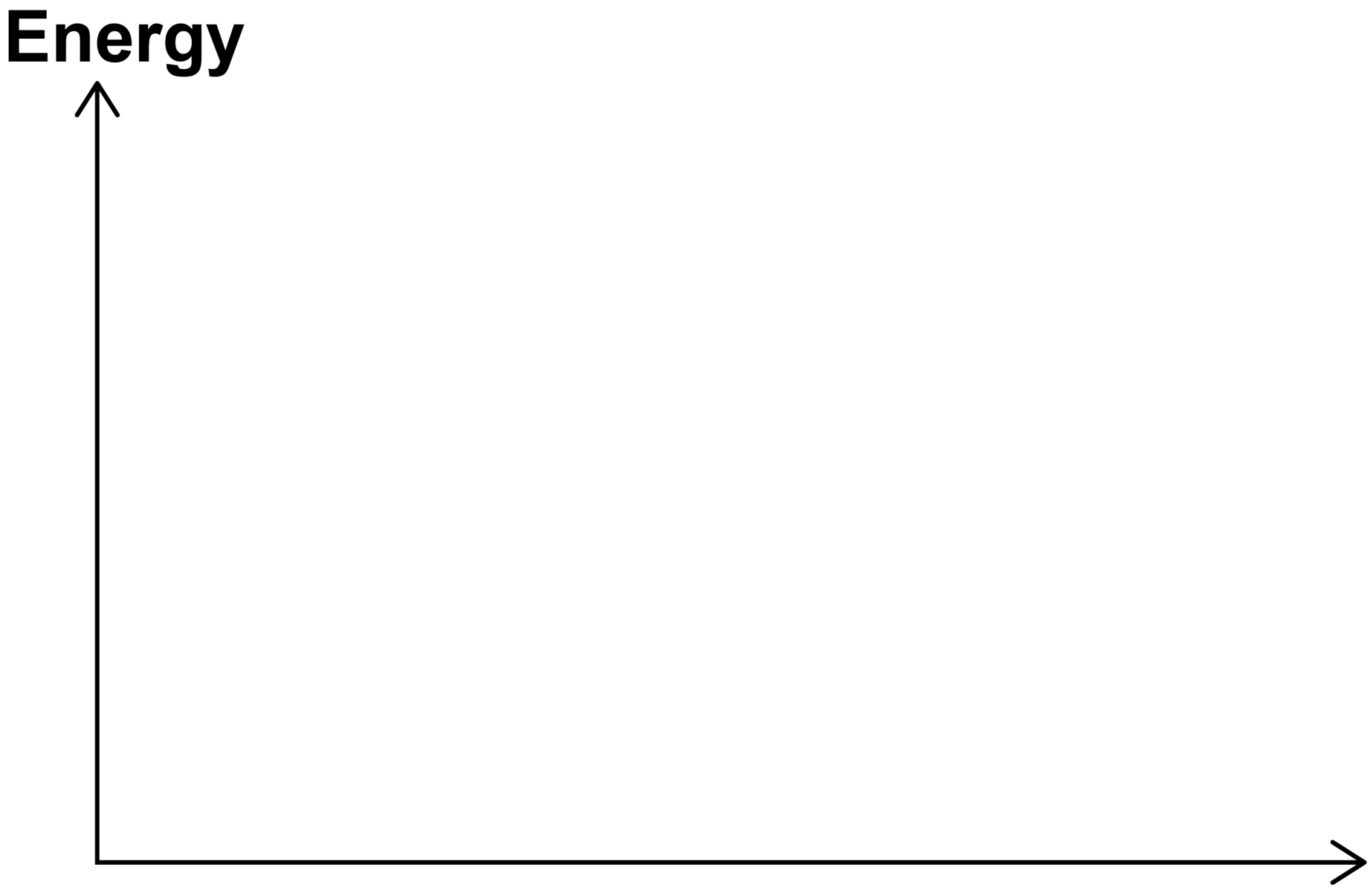
0 3 . 4

On the opposite page, draw a reaction profile for an exothermic reaction.

You should label:

- **the energy level of the reactants and of the products**
- **the activation energy**
- **the overall energy change.**

[4 marks]



[Turn over]

12

0 4

Carbon can exist in a number of different structures.

0 4 . 1

The first fullerene to be discovered was Buckminsterfullerene.

What is the formula of Buckminsterfullerene? [1 mark]

Tick (✓) ONE box.

- ☐ C_{40}
- ☐ C_{50}
- ☐ C_{60}
- ☐ C_{70}

0 4 . 2

Graphite is a form of carbon.

Explain why graphite conducts electricity.
[2 marks]

Steel is an alloy of iron and carbon.

0 4 . 3

Explain why steel is harder than iron.
[3 marks]

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[Turn over]

0 4 . 4

Iron is alloyed with carbon and other metals to make stainless steel.

A stainless steel fork contains 71.92% iron.

TABLE 2 shows the mass of each element in the fork.

TABLE 2

Element	Iron	Carbon	Chromium	Nickel
Mass of element in g	X	0.05	10.44	5.80

Calculate the mass of iron (X) in the fork.
[4 marks]

X = _____ g

[Turn over]

10

0 5

This question is about the electrolysis of aqueous solutions.

Hydrogen gas and chlorine gas are produced when sodium chloride solution is electrolysed.

0 5 . 1

Hydrogen ions (H^+) are attracted to the negative electrode.

The half equation for the reaction at the negative electrode is:

$$2\,H^+ + 2\,e^- \longrightarrow H_2$$

What type of reaction happens at the negative electrode?

Give the reason for your answer.
[2 marks]

Type of reaction _____

_____

Reason _____

_____

_____

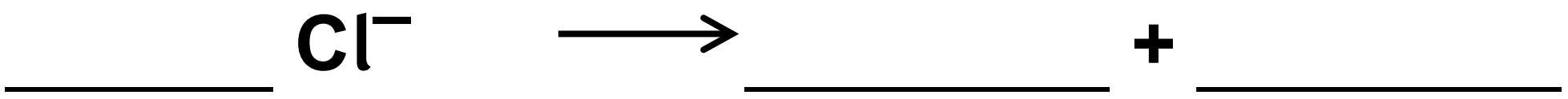
[Turn over]

0 5 . 2

Chloride ions are attracted to the positive electrode.

Complete the half equation for the production of chlorine gas (Cl_2).

[2 marks]



[Turn over]

0 5 . 3

Hydrogen gas and oxygen gas are produced when sodium sulfate solution is electrolysed.

Explain how oxygen gas is produced in the electrolysis of sodium sulfate solution. [4 marks]

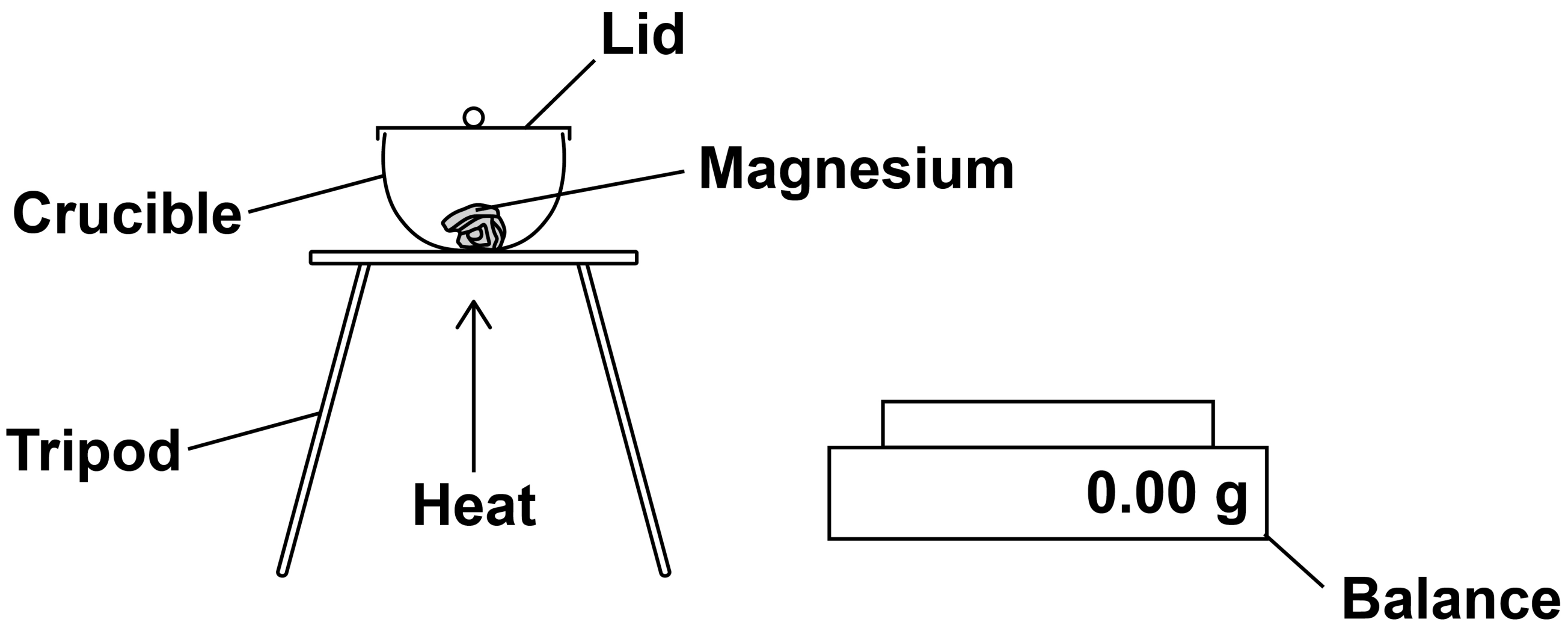
0 6

Metal oxides are produced when metals are heated in air.

A student investigated the change in mass when 0.12 g of magnesium was heated in air.

FIGURE 5, on the opposite page, shows the apparatus.

FIGURE 5



The student measured the mass of magnesium oxide produced.

[Turn over]

0 6 . 1

0.12 g of magnesium reacted to produce 0.20 g of magnesium oxide.

Calculate the number of moles of oxygen gas (O_2) that reacted.

Relative atomic mass (A_r): O = 16 [3 marks]

4

Moles of oxygen gas = _____

0 6 . 2

The student repeated the experiment WITHOUT a lid on the crucible.

Suggest why the mass of magnesium oxide produced would be different without a lid on the crucible. [2 marks]

0 6 . 3

Copper reacts with oxygen to produce copper oxide.

63.5 g of copper produces 79.5 g of copper oxide.

Calculate the mass of copper oxide produced when 0.50 g of copper reacts with oxygen.

Give your answer to 3 significant figures.
[3 marks]

Mass (3 significant figures) =

_____ g

[Turn over]

0 6 . 4

Iron reacts with oxygen to produce an oxide of iron.

0.015 moles of iron reacts with 0.010 moles of oxygen gas (O_2).

Determine:

- **the formula of the iron oxide produced**
- **the balanced symbol equation for the reaction.**

[4 marks]

Formula of iron oxide = _____

Balanced symbol equation _____

_____

[Turn over]

12

0 7

Methane, ethane, propane and butane all react with oxygen to produce carbon dioxide and water.

0 7 . 1

Suggest why a mixture of methane and oxygen does NOT react at room temperature.

Answer in terms of particles. [2 marks]

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[Turn over]

0 7 . 2

TABLE 3 shows the energy released when methane, ethane and propane react with oxygen to produce carbon dioxide and water.

TABLE 3

	Compound reacted with oxygen		
	Methane	Ethane	Propane
Formula of compound	CH_4	C_2H_6	C_3H_8
Energy released in kJ/mol	680	1160	1640

Predict the energy released when butane (C_4H_{10}) reacts with oxygen to produce carbon dioxide and water. [1 mark]

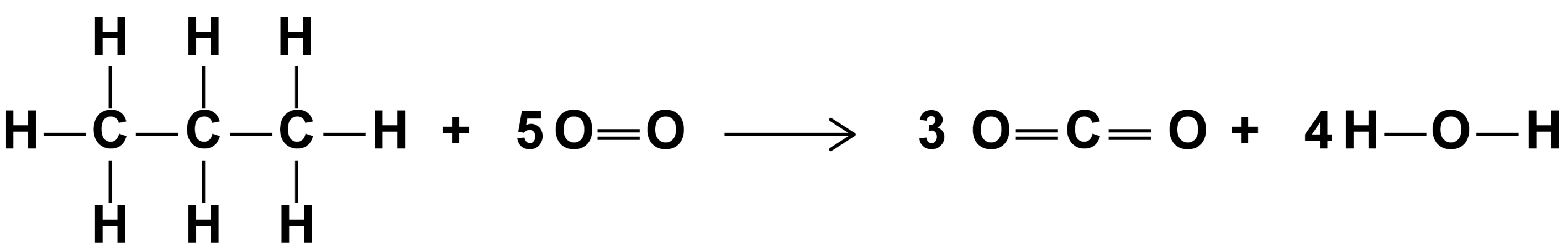
Energy released = _____ kJ/mol

[Turn over]

0 7 . 3

Propane reacts with oxygen to produce carbon dioxide and water.

The displayed formula equation for the reaction is:



The reaction is exothermic.

In the reaction, the energy released when forming new bonds is 1640 kJ/mol greater than the energy needed when breaking bonds.

TABLE 4, on page 54, shows bond energies.

[Turn over]

TABLE 4

Bond	H–C	C–C	O=O	C=O	O–H
Bond energy in kJ/mol	410	X	500	740	460

Calculate the C—C bond energy (X). [5 marks]

X = _____ kJ/mol

END OF QUESTIONS

Additional page, if required.

Write the question numbers in the left-hand margin.

Additional page, if required.

Write the question numbers in the left-hand margin.

Additional page, if required.

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For Examiner's Use	
Question	Mark
1	
2	
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TOTAL	