



Surname _____

Other Names _____

Centre Number _____

Candidate Number _____

Candidate Signature _____

GCSE

COMBINED SCIENCE: TRILOGY

F

Foundation Tier

Chemistry Paper 2F

8464/C/2F

Wednesday 12 June 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



0	1	.	1
---	---	---	---

This question is about gases.

On the opposite page, draw ONE line from each substance to the description of the substance. [3 marks]

SUBSTANCE

**DESCRIPTION
OF SUBSTANCE**

Compound

Air

Element

Carbon dioxide

Hydrocarbon

Oxygen

Metal

Mixture

[Turn over]



0 1 . 2

What is used to test for each of the gases?

Draw ONE line from each gas to the test for the gas. [2 marks]

GAS**TEST****A glowing splint****Carbon dioxide****A lighted splint****Oxygen****Limewater****Litmus paper**

0	1	.	3
---	---	---	---

**Give TWO reasons why the percentage of carbon dioxide in the air has decreased in the last 2.7 billion years.
[2 marks]**

Tick (✓) TWO boxes.

Combustion

Dissolved in oceans

Intense volcanic activity

Photosynthesis

Respiration

[Turn over]



8

Oxygen reacts with sulfur dioxide.

The reaction is reversible.

0 1 . 4

What is the symbol for a reversible reaction? [1 mark]

0 1 . 5

Complete the sentence. [1 mark]

In a reversible reaction the forward reaction is exothermic, so the reverse reaction is _____.

0	1	.	6
---	---	---	---

A reversible reaction happens in apparatus which stops the escape of reactants and products.

Complete the sentence. [1 mark]

Equilibrium is reached when the forward and reverse reactions happen at exactly the same _____.

[Turn over]

10

0	2
---	---

Concrete contains cement, water, sand and small stones.

0	2	.	1
---	---	---	---

Concrete is a mixture designed as a useful product.

**What do we call a mixture which has been designed as a useful product?
[1 mark]**

Tick (✓) ONE box.

Finite

Formula

Formulation

Fraction



0	2	.	2
---	---	---	---

Concrete contains cement.

Cement is made by heating a mixture containing silicon dioxide (SiO_2).

Why does silicon dioxide have a very high melting point? [2 marks]

Tick (✓) TWO boxes.

It has a giant structure

It has a simple molecular structure

It has strong covalent bonds

It has strong ionic bonds

It has weak intermolecular forces

[Turn over]



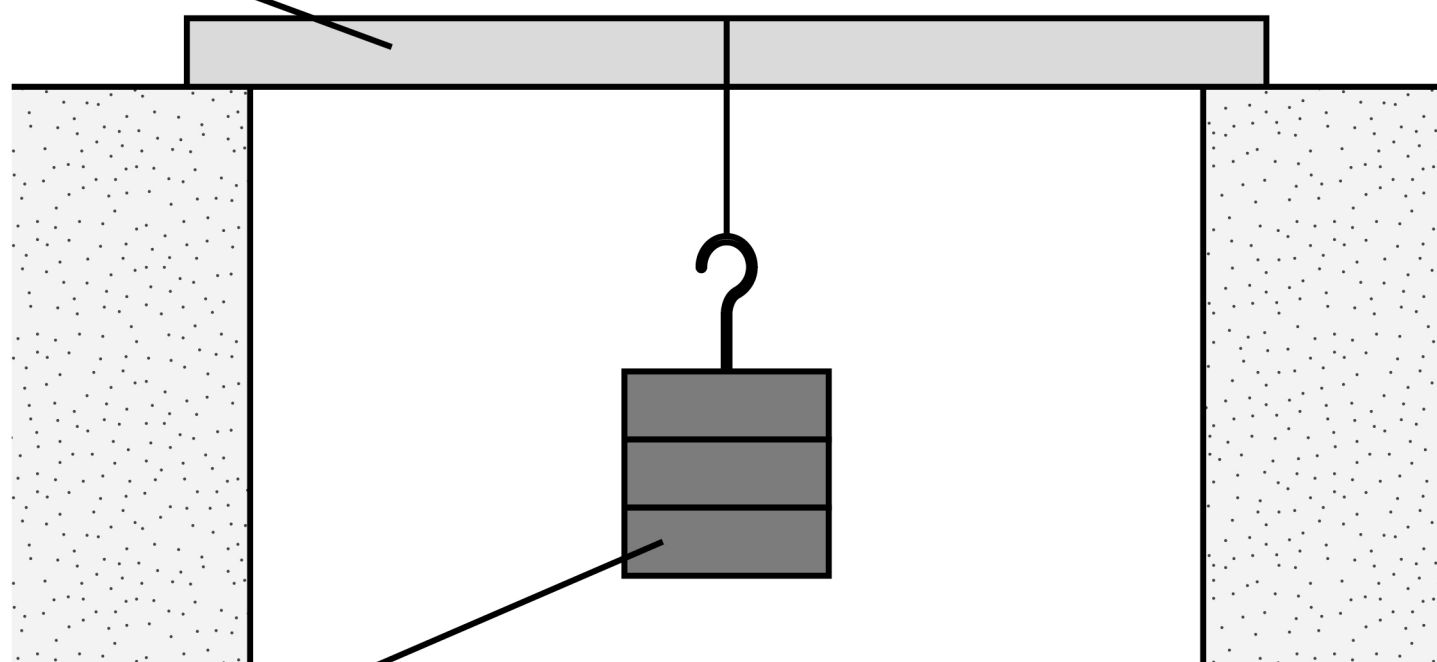
Student A investigated how the mass of the small stones in concrete affects the strength of a concrete beam. All other variables were kept the same.

The student added weights until the concrete beam broke.

FIGURE 1 shows the apparatus Student A used.

FIGURE 1

**Concrete
beam**



Weights

0 2 . 3

**Draw ONE line from each type of variable to the correct example of the variable.
[2 marks]**

TYPE OF VARIABLE**EXAMPLE OF VARIABLE****Control****Length of concrete beam****Mass of small stones in concrete****Time taken to add weights****Independent****Weight needed to break concrete beam****[Turn over]**

TABLE 1 shows Student A's results.

TABLE 1

Mass of small stones in grams (g)	Weight needed to break concrete beam in newtons (N)
500	70
1000	100
1500	110
2000	100
2250	85
2500	65
2750	35

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[Turn over]

0	2	.	4
---	---	---	---

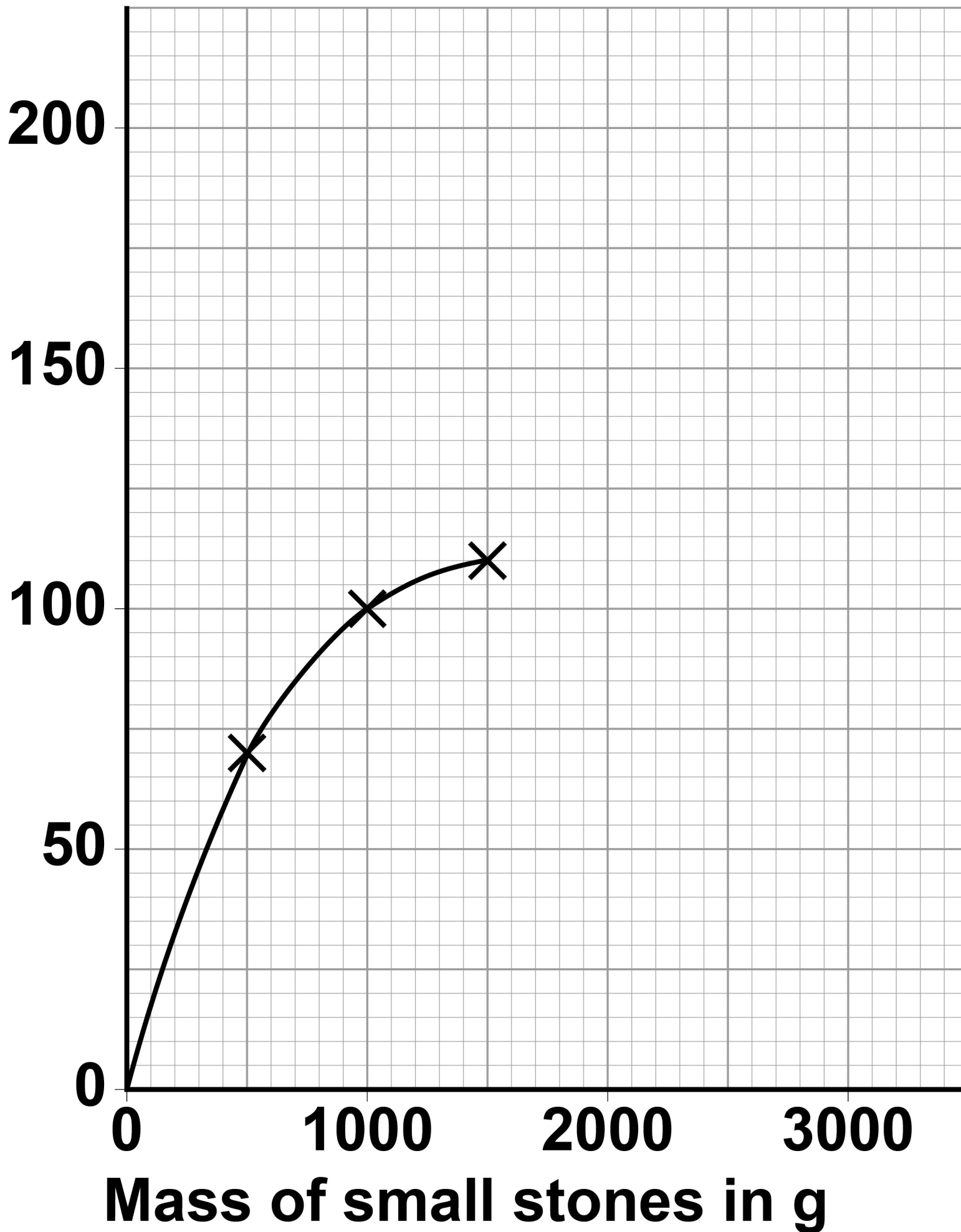
Plot the data from TABLE 1, on page 14, on FIGURE 2, on the opposite page.

The first three points are plotted for you.

Draw the line of best fit. [3 marks]

FIGURE 2

**Weight needed to break
concrete beam in N**



[Turn over]



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0 2 . 5

What mass of small stones would be needed to make the strongest concrete?

Give a reason for your answer.

Use FIGURE 2, on page 17. [2 marks]

Mass = _____ g

Reason _____

[Turn over]

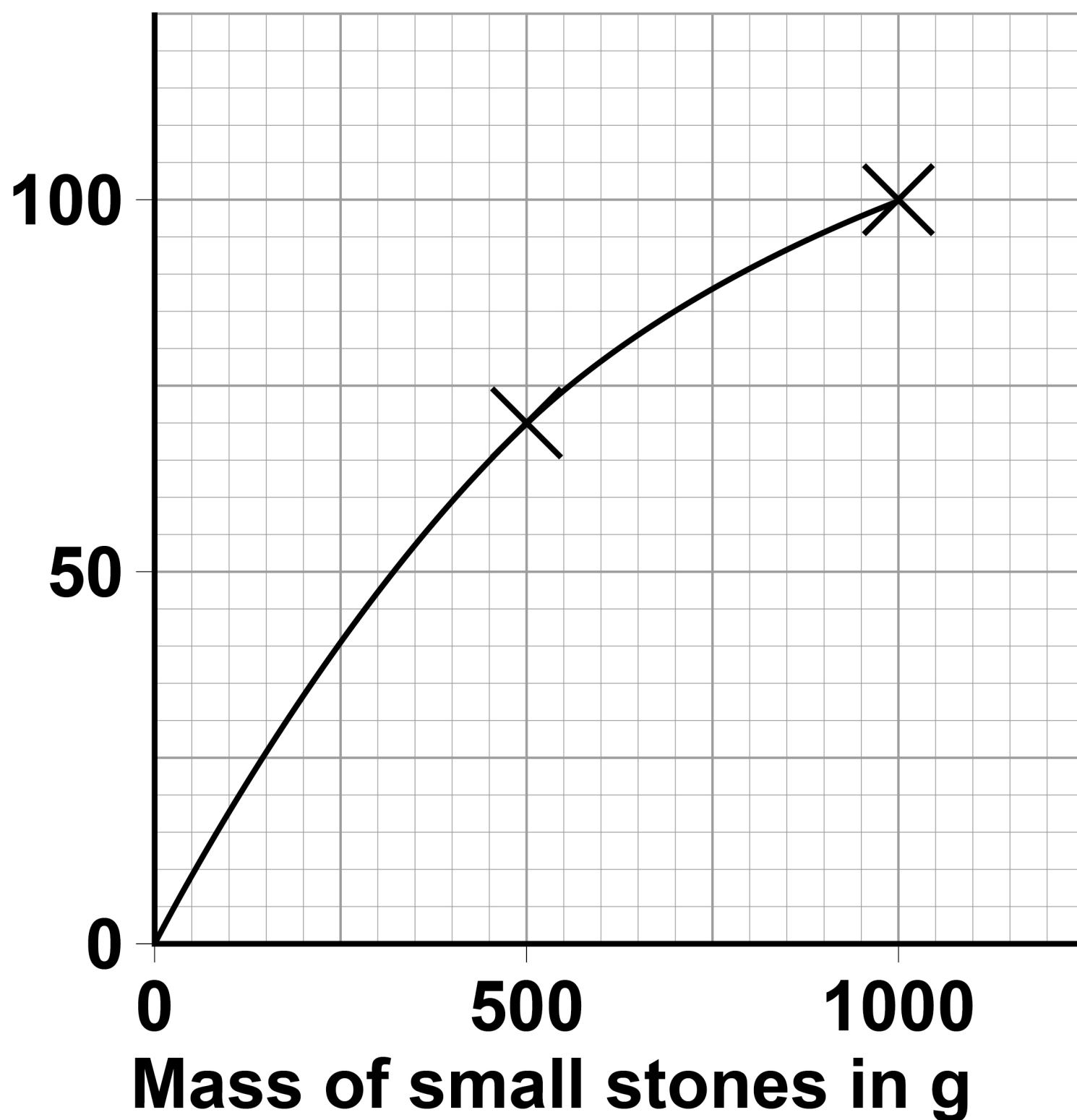
02.6

Student B did a similar investigation.

FIGURE 3 shows Student B's results.

FIGURE 3

**Weight needed to break
concrete beam in N**



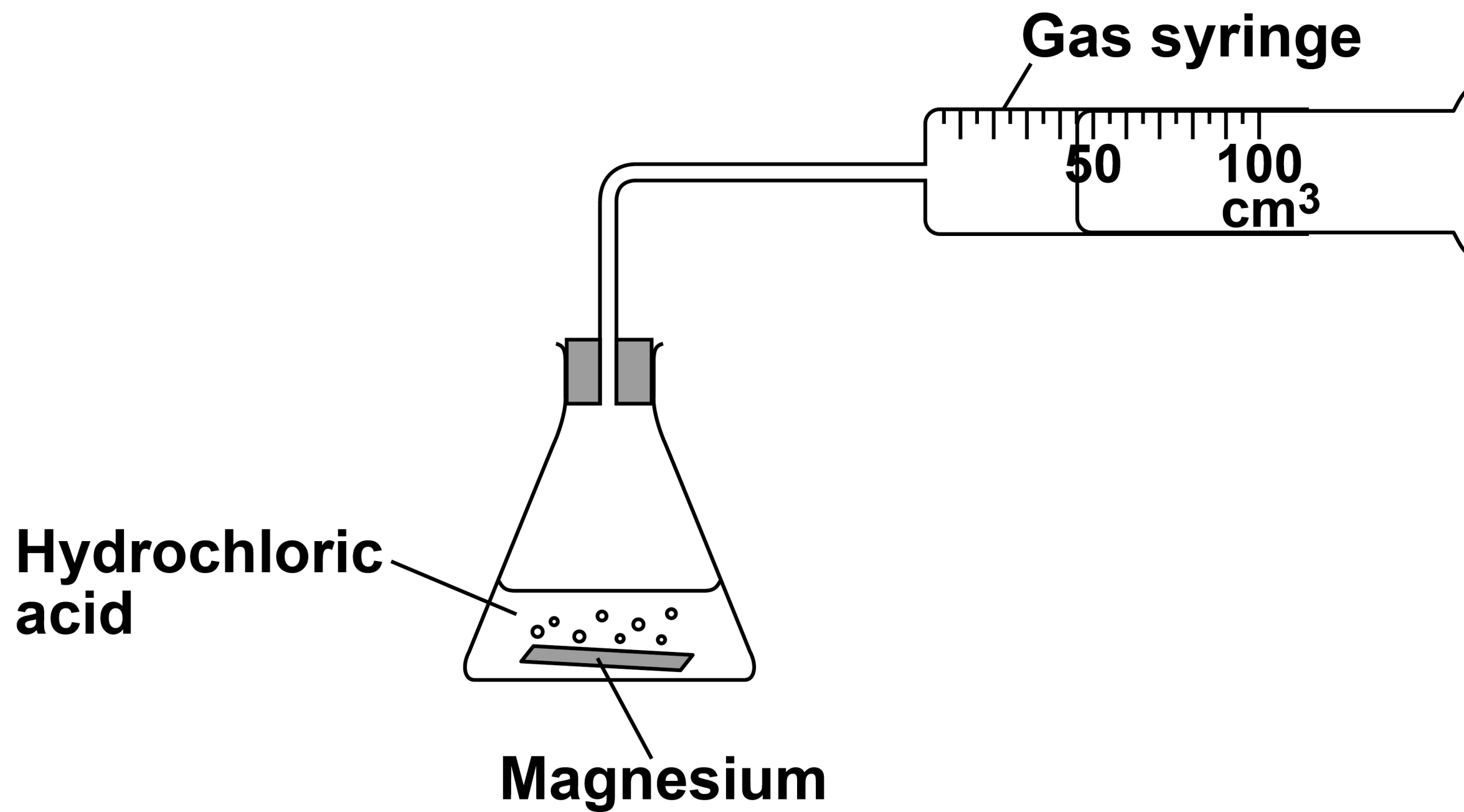
How could Student B improve their investigation?

Use FIGURE 2, on page 17, and FIGURE 3, on page 20. [1 mark]

[Turn over]

11

FIGURE 4



03

A student investigated the rate of the reaction between magnesium and hydrochloric acid.

FIGURE 4, on page 22, shows the apparatus the student used.

03.1

Balance the equation for the reaction. [1 mark]



[Turn over]



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0	3	.	2
---	---	---	---

The student used 50 cm^3 of hydrochloric acid.

Which apparatus would measure 50 cm^3 of hydrochloric acid with the greatest accuracy? [1 mark]

Tick (✓) ONE box.

50 cm^3 beaker

50 cm^3 conical flask

50 cm^3 measuring cylinder

[Turn over]

0	3	.	3
---	---	---	---

The student measured the volume of gas produced every 20 seconds for 2 minutes.

The volume of gas was zero at the start of the experiment.

The measured volumes of gas were:

26 cm³

38 cm³

47 cm³

55 cm³

59 cm³

60 cm³

Complete TABLE 2, on the opposite page, to show these results. [4 marks]

TABLE 2

0	0

[Turn over]

03.4

The volumes of gas were lower than expected.

Suggest ONE reason. [1 mark]

03.5

The student repeated the experiment using different concentrations of hydrochloric acid.

Give TWO variables the student should keep the same. [2 marks]

1

2

0	3	.	6
---	---	---	---

Complete the sentences. [3 marks]

As the concentration of the hydrochloric acid increased, the rate of the reaction

_____.

This is because there were more acid

_____ **in each cubic centimetre (cm³).**

So the collisions happened more

_____.

[Turn over]

12



0	4
---	---

Large hydrocarbon molecules can be cracked to produce smaller, more useful molecules.

Alkanes and alkenes are produced when hydrocarbons are cracked.

0	4	.	1
---	---	---	---

**Give TWO conditions used for cracking.
[2 marks]**

1 _____

2 _____

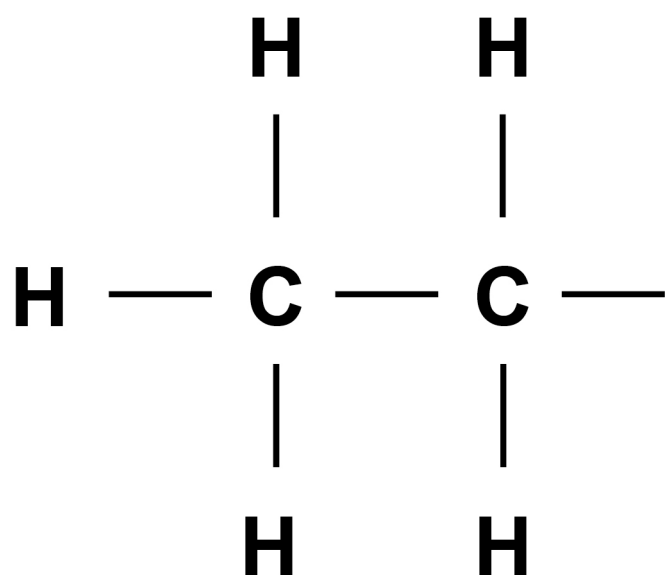
0	4	.	2
---	---	---	---

Butane (C_4H_{10}) is an alkane.

FIGURE 5 shows part of the displayed structural formula of butane.

Complete the displayed structural formula of butane in FIGURE 5. [1 mark]

FIGURE 5



[Turn over]



0	4	.	3
---	---	---	---

Butane burns in oxygen.

Complete the word equation for the complete combustion of butane.

[2 marks]

butane + oxygen →

+

04.4

Ethene is an alkene.

Give a test for alkenes.

Give the result of the test if an alkene is present. [2 marks]

Test _____

Result _____

[Turn over]

0	4	.	5
---	---	---	---

Each year many tonnes of crude oil are extracted from the Earth.

It took millions of years for the crude oil to be formed.

What do we call development that meets the needs of current generations without compromising the resources for future generations? [1 mark]

Tick (✓) ONE box.

Finite development

Global development

Natural development

Sustainable development

8



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[Turn over]

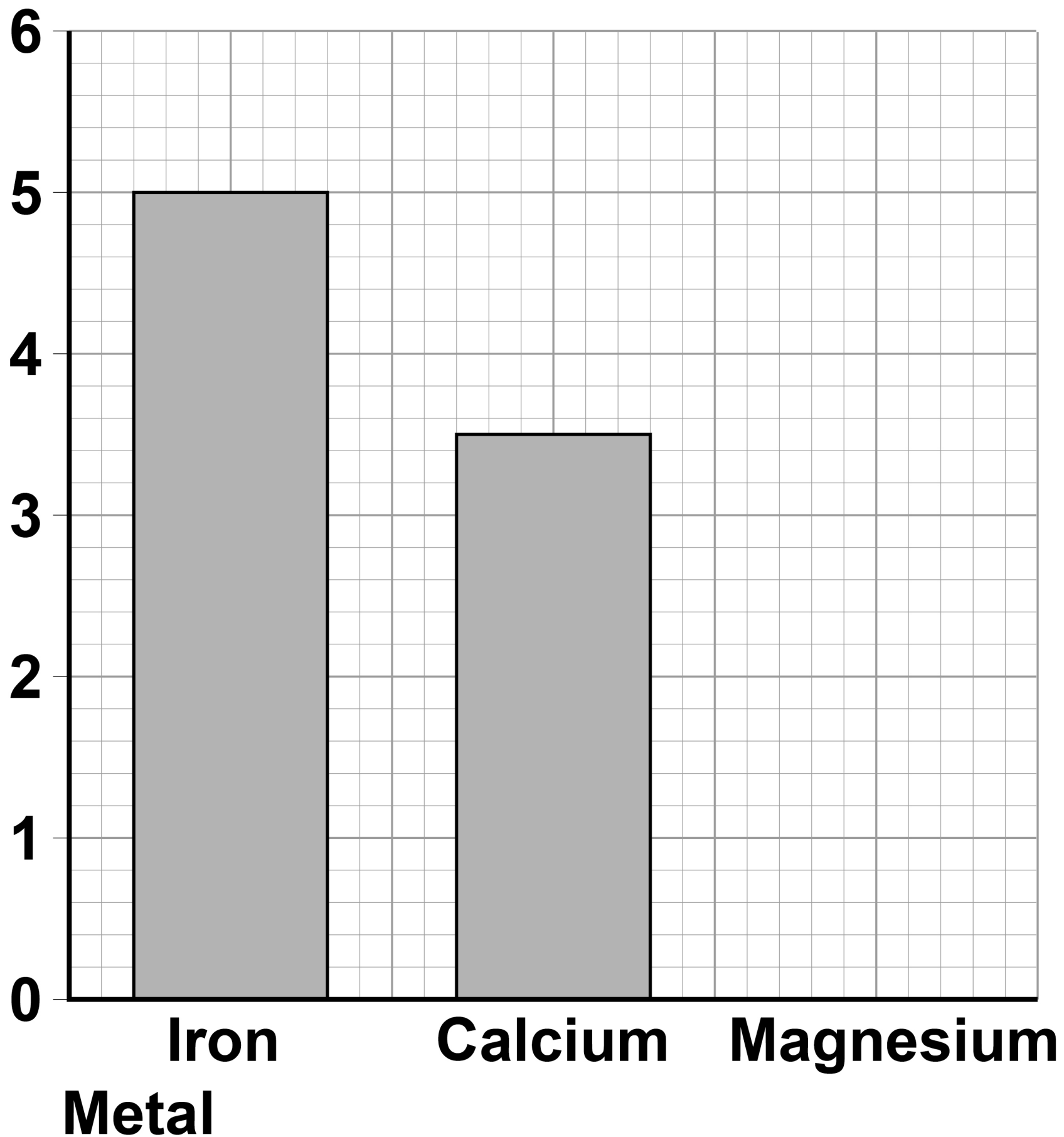


05

FIGURE 6 shows the percentage by mass of some metals in the Earth's crust.

FIGURE 6

**Percentage by mass
of metal (%)**



0	5	.	1
---	---	---	---

What is the percentage by mass of calcium in the Earth's crust? [1 mark]

Tick (✓) ONE box.

3.25%

3.50%

4.50%

5.00%

[Turn over]



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0	5	.	2
---	---	---	---

The percentage by mass of magnesium in the Earth's crust is 2.1%

Draw the bar for magnesium on FIGURE 6, on page 36. [1 mark]

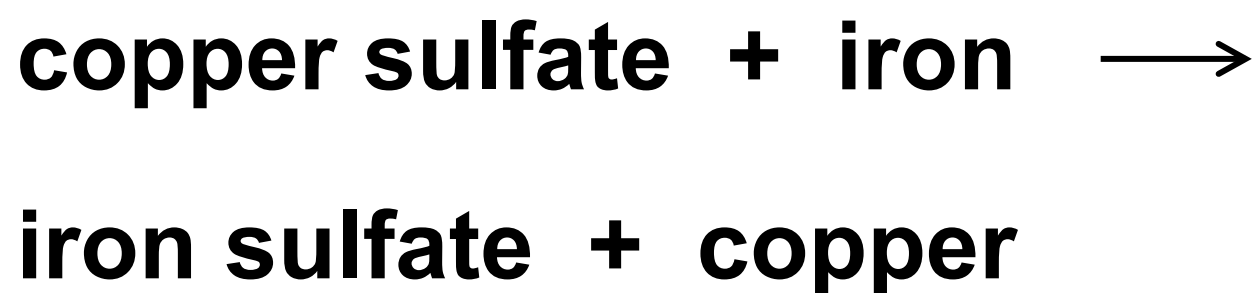
[Turn over]

0	5	.	3
---	---	---	---

Copper sulfate is produced during the extraction of copper from the Earth's crust.

Copper is produced from copper sulfate solution using iron.

The word equation for the reaction is:



From the equation a company calculated that 648 kg of copper sulfate are needed to produce 617 kg of iron sulfate and 258 kg of copper.

Calculate the mass of iron needed to make 258 kg of copper. [2 marks]

Mass = _____ kg

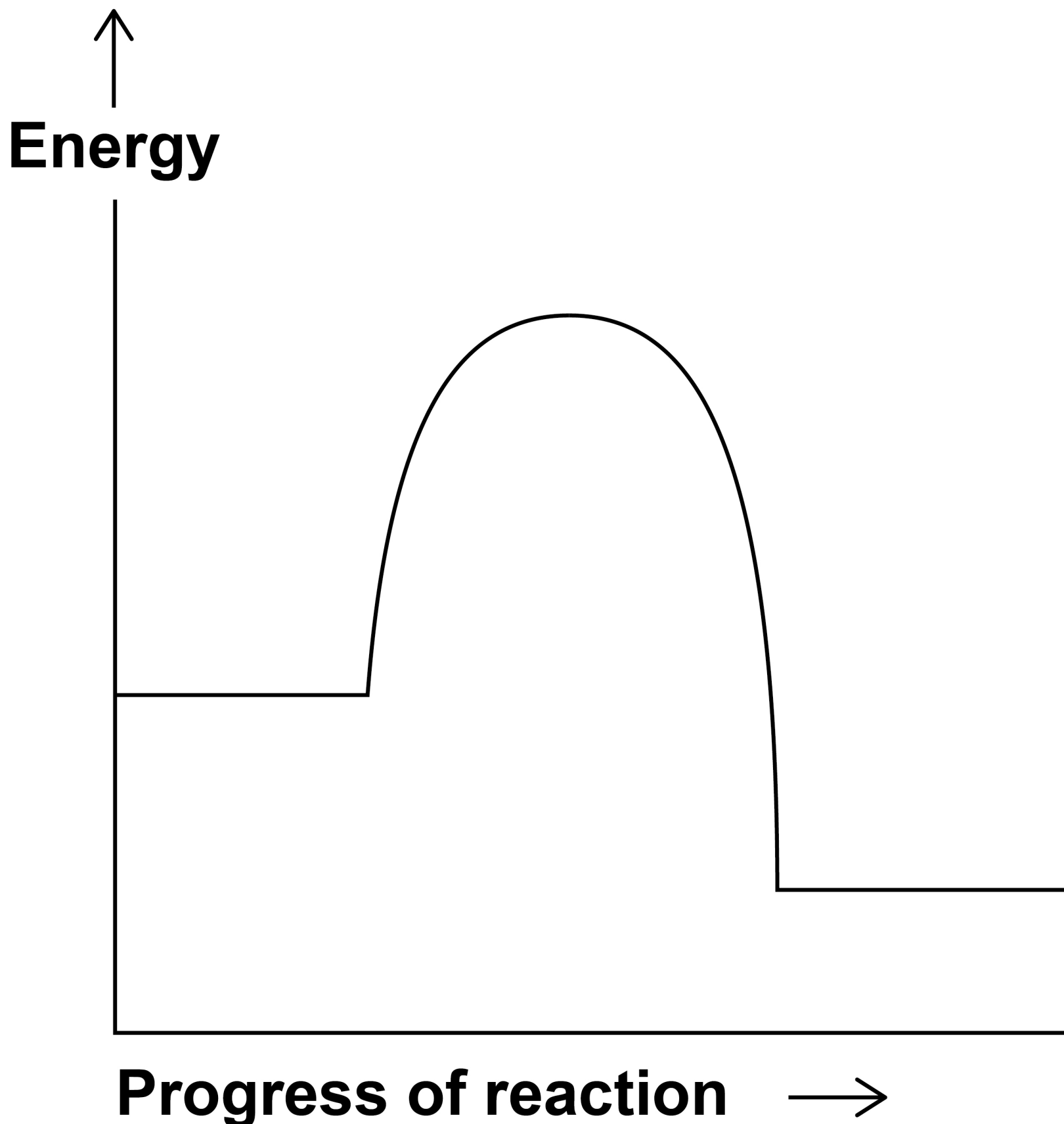
[Turn over]

Copper is used as a catalyst.

0 5 . 4

FIGURE 7 shows the reaction profile for a reaction without a catalyst.

FIGURE 7

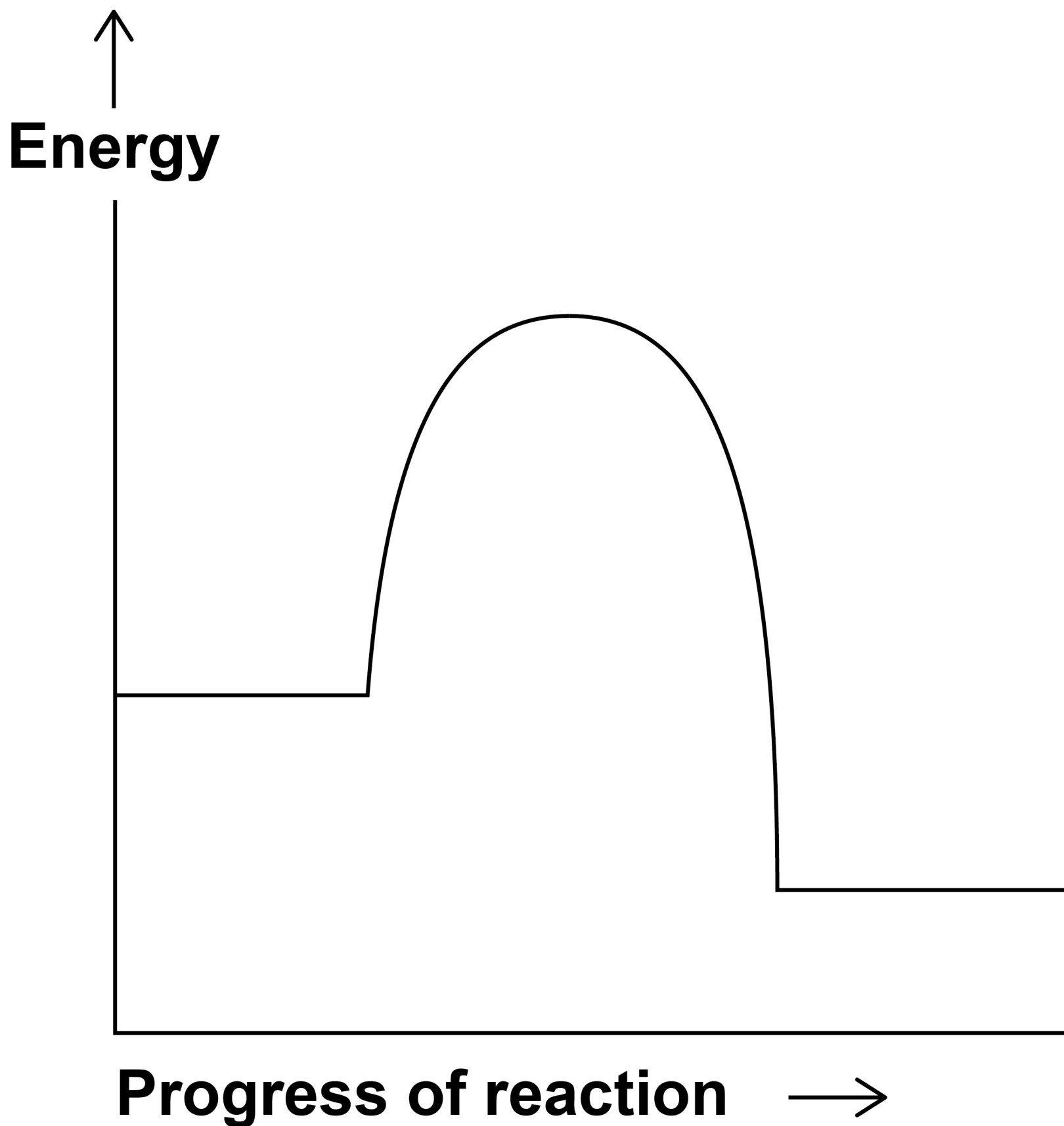


Draw an arrow on FIGURE 7 to show the activation energy. [1 mark]

[Turn over]

05.5

The reaction profile for the reaction without a catalyst is shown again in **FIGURE 8**.

FIGURE 8

Draw a reaction profile on FIGURE 8 for the same reaction with a catalyst.
[2 marks]

0 5 . 6

What are catalysts in biological systems called? [1 mark]

Tick (✓) ONE box.

Detergents

Enzymes

Polymers

Solvents

[Turn over]



0	6
---	---

Water that is safe to drink contains dissolved substances.

0	6	.	1
---	---	---	---

What do we call water that is safe to drink? [1 mark]

Tick (✓) ONE box.

Desalinated

Filtered

Fresh

Potable

06.2

Describe a test for pure water.

Give the result of the test if the water is pure. [2 marks]

Test _____

Result _____

[Turn over]

[Turn over]

0 6 . 4

A sample of river water contains 125 mg per dm³ of dissolved solids.

Calculate the mass of dissolved solids in grams in 250 cm³ of this sample of river water.

**Give your answer to 2 significant figures.
[4 marks]**

Mass of dissolved solids = _____ g

[Turn over]

0	6	.	5
---	---	---	---

A water company allows a maximum of 500 mg per dm³ of sulfate ions in drinking water.

A sample of drinking water contains 44 mg per dm³ of sulfate ions.

Calculate the percentage (%) of the maximum allowed mass of sulfate ions in the sample of drinking water. [2 marks]

Percentage (%) of the maximum allowed

mass = _____ %

[Turn over]

13

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07

This question is about atmospheric pollutants from fuels.

07.1

Fuel burns in a car engine.

Describe how oxides of nitrogen are produced in a car engine. [2 marks]

[Turn over]

TABLE 3

Car	Mass of CO₂ produced during manufacture in kg	Mass of CO₂ produced when driving in kg per km	Total mass of CO₂ produced from manufacture and 40 000 km driving in kg	Total mass of CO₂ produced from manufacture and 100 000 km driving in kg
Car A	14 000	0.123	18 920	26 300
Car B	20 000	0.085	23 400	28 500
Car C	23 000	0.044	24 760	27 400



07.2

TABLE 3, on page 56, shows the carbon footprint during the manufacture and use of three cars.

Evaluate the carbon footprint of the cars.

Use information from TABLE 3. [6 marks]

57

[Turn over]



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Question	Mark
1	
2	
3	
4	
5	
6	
7	
TOTAL	

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