A

Surname _____

Other Names _____

Centre Number _____

Candidate Number _____

Candidate Signature _____

I declare this is my own work.

GCSE

COMBINED SCIENCE: TRILOGY

Foundation Tier

Chemistry Paper 2F

F

8464/C/2F

Wednesday 10 June 2020 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]

JUN208464C2F01

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

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0 1

Crude oil is a mixture of hydrocarbons.

0 1 . 1

Complete the sentences.

Choose answers from the list. [2 marks]

- **air**
- **enzymes**
- **mud**
- **plankton**
- **trees**

Crude oil is the remains of

_____ .

Millions of years ago biomass was buried under _____ .

[Turn over]

0 1 . 2

There are three stages, A, B and C, in separating hydrocarbons from crude oil.

Stage A Hydrocarbons evaporate

Stage B Crude oil is heated

Stage C Vapours condense

Give the correct order for stages A, B and C. [1 mark]

First stage _____

Second stage _____

Third stage _____

0 1 . 3

What is the name of the process used in separating hydrocarbons from crude oil? [1 mark]

Tick (✓) ONE box.

☐ **Chromatography**

☐ **Filtration**

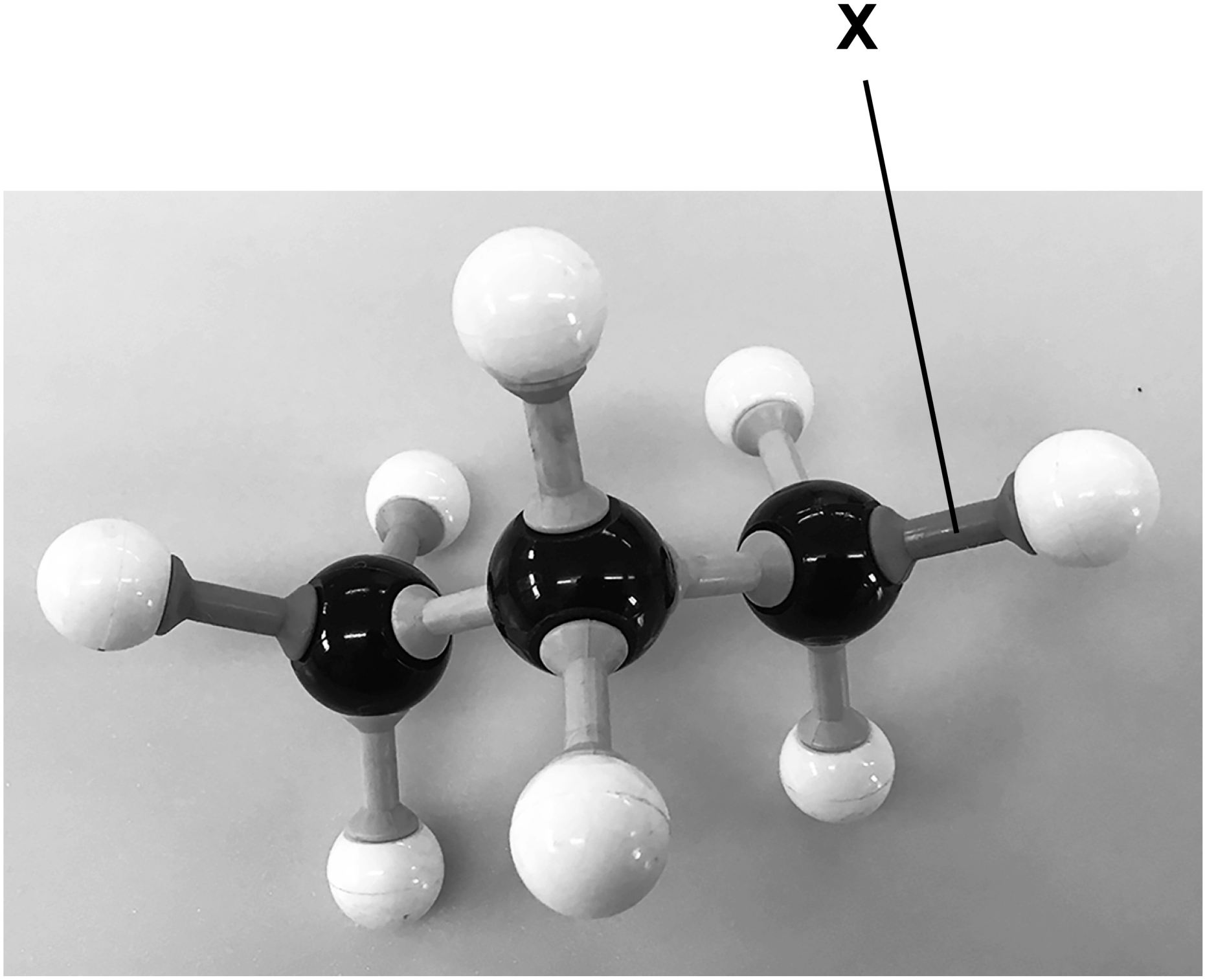
☐ **Fractional distillation**

0 1 . 4

Alkanes are hydrocarbons.

FIGURE 1 represents an alkane.

FIGURE 1



What is the formula of the alkane in FIGURE 1? [1 mark]

C _____ H _____

0 1 . 5

What does X represent in FIGURE 1? [1 mark]

Tick (✓) ONE box.

☐ **Covalent bond**

☐ **Ionic bond**

☐ **Metallic bond**

[Turn over]

0 1 . 6

What is the general formula for alkanes?
[1 mark]

Tick (✓) ONE box.

☐ C_nH_{2n-2}

☐ C_nH_{2n}

☐ C_nH_{2n+2}

0 1 . 7

Hydrocarbons are used to make polymers.
Polymers are used to make plastic bags.

In one year 8.0 billion plastic bags were used.

The next year there was a charge for plastic bags and only 1.3 billion plastic bags were used.

Calculate the decrease in the number of plastic bags used. [1 mark]

Decrease = _____ billion

[Turn over]

8

0 2

This question is about carbon dioxide in the Earth's atmosphere.

FIGURE 2, on the opposite page, shows how the percentage of carbon dioxide in the Earth's atmosphere has changed over 4.6 billion years.

0 2 . 1

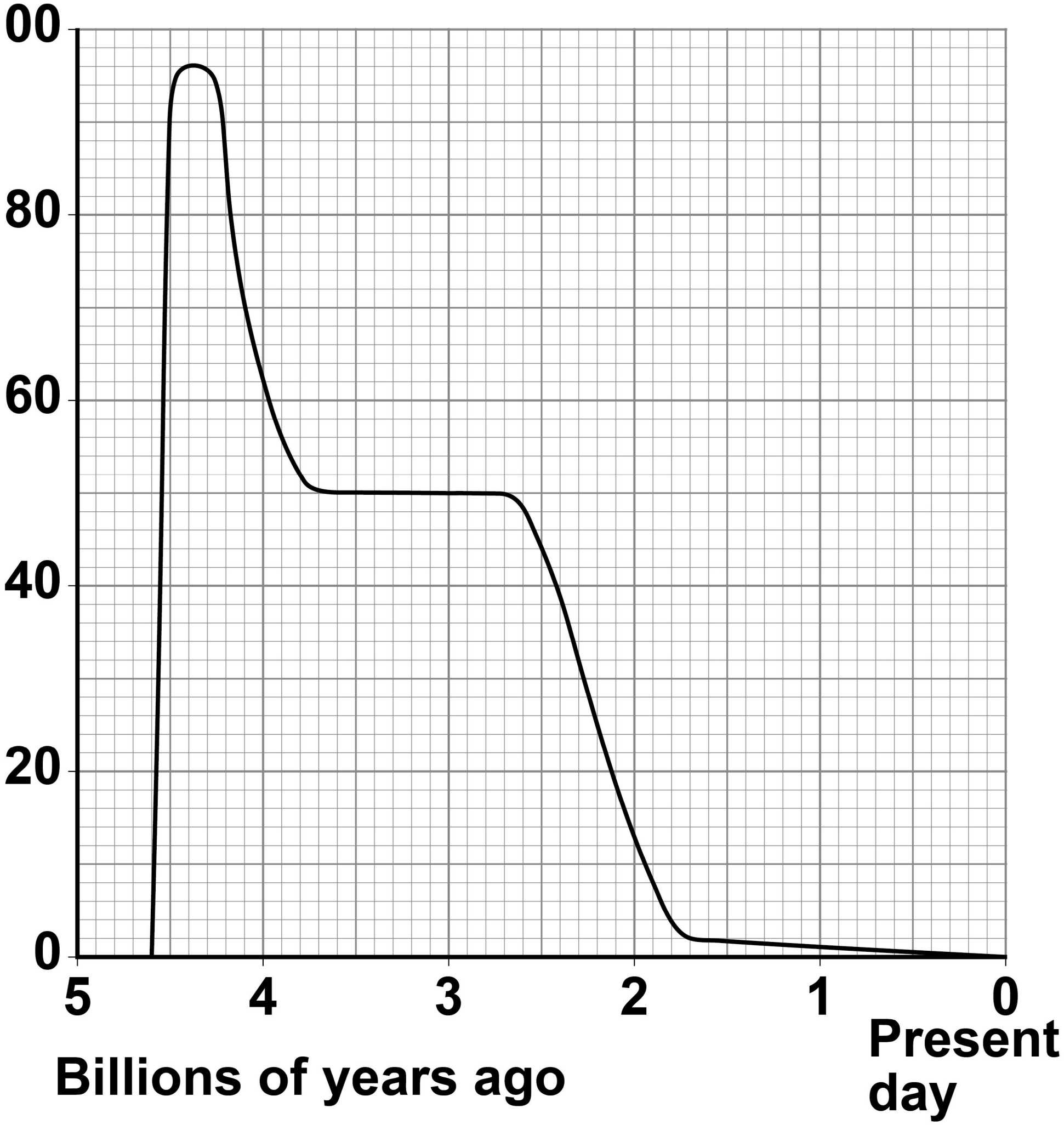
What was the highest percentage of carbon dioxide in the Earth's atmosphere?

Use FIGURE 2. [1 mark]

Highest percentage = _____ %

FIGURE 2

Percentage of carbon dioxide in the Earth's atmosphere



0 2 . 2

The percentage of carbon dioxide in the atmosphere has decreased since Earth's early atmosphere.

Which TWO processes have decreased the percentage of carbon dioxide in the Earth's atmosphere? [2 marks]

Tick (✓) TWO boxes.

- ☐ **Combustion of fuels**
- ☐ **Formation of sedimentary rocks**
- ☐ **Photosynthesis**
- ☐ **Volcanic activity**

0 2 . 3

The total amount of carbon dioxide emitted over the life cycle of a product can be measured.

What name is given to the total amount of carbon dioxide emitted during the life cycle of a product? [1 mark]

Tick (✓) ONE box.

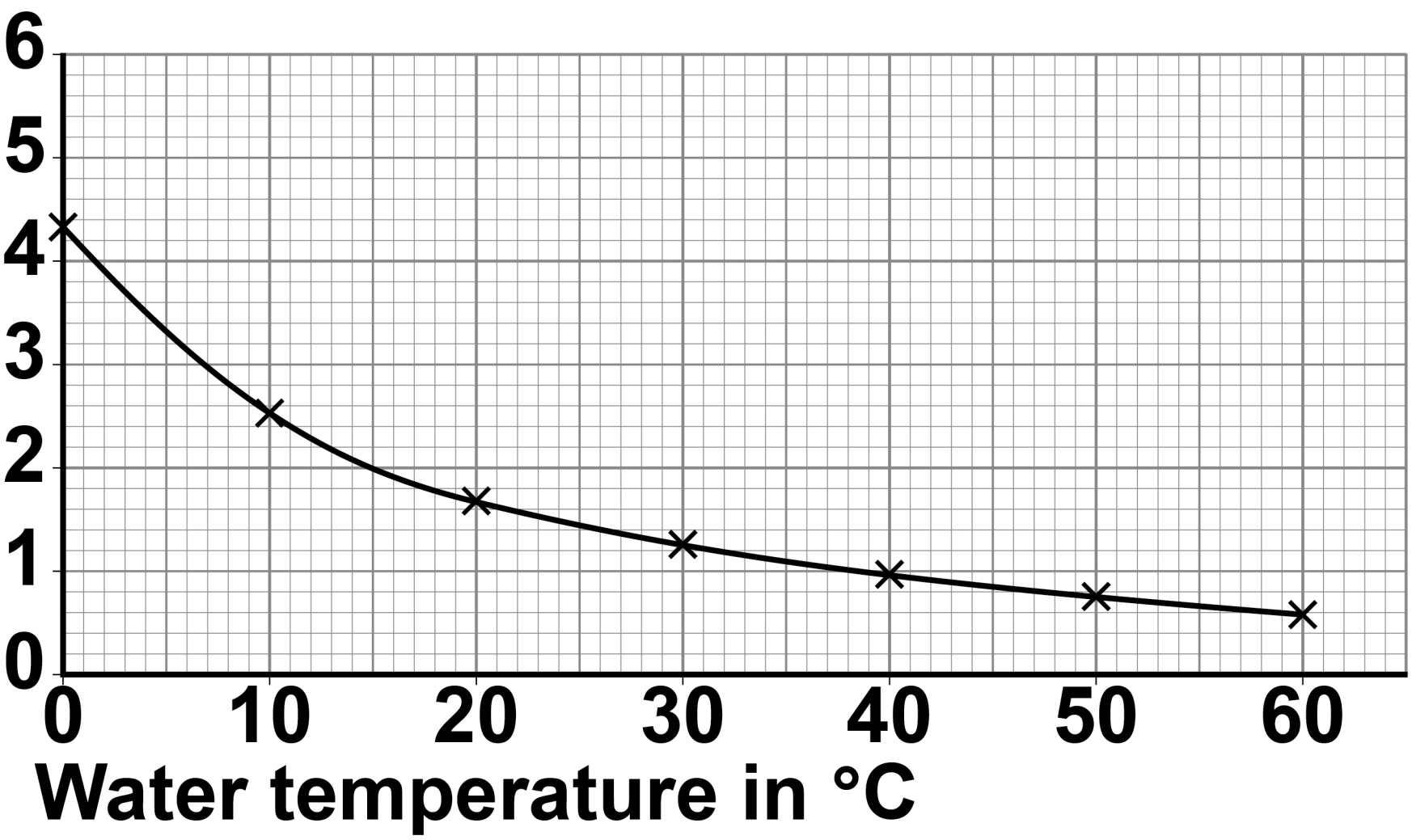
- ☐ **Carbon footprint**
- ☐ **Global dimming**
- ☐ **Greenhouse effect**

[Turn over]

Carbon dioxide dissolves in water.

FIGURE 3 shows the mass of carbon dioxide dissolved in water at different temperatures.

FIGURE 3



0 2 . 4

Complete TABLE 1.

Use FIGURE 3. [2 marks]

TABLE 1

Water temperature in °C	Mass of carbon dioxide in g dissolved in 1 dm^3 of water
5	
15	

BLANK PAGE

0 2 . 5

Calculate the difference in the mass of carbon dioxide dissolved in 1 dm^3 of water at 5 °C and at 15 °C

Use TABLE 1 on page 17. [1 mark]

_____

_____

Mass = _____ g

0 2 . 6

Carbon dioxide is a greenhouse gas.

The greenhouse effect happens in four stages.

The four stages are:

Stage A Carbon dioxide stops longer wavelength radiation escaping

Stage B Radiation is absorbed by the Earth

Stage C Longer wavelength radiation is emitted

Stage D Shorter wavelength radiation enters the atmosphere.

What is the correct order of stages A, B, C and D? [1 mark]

Tick (✓) ONE box.

- ☐ **C, A, B, D**
- ☐ **C, D, B, A**
- ☐ **D, B, C, A**
- ☐ **D, C, B, A**

0 2 . 7

Changes in the percentage of carbon dioxide in the Earth's atmosphere cause climate change.

Give TWO effects of climate change.

[2 marks]

1 _____

_____

_____

2 _____

_____

_____

10

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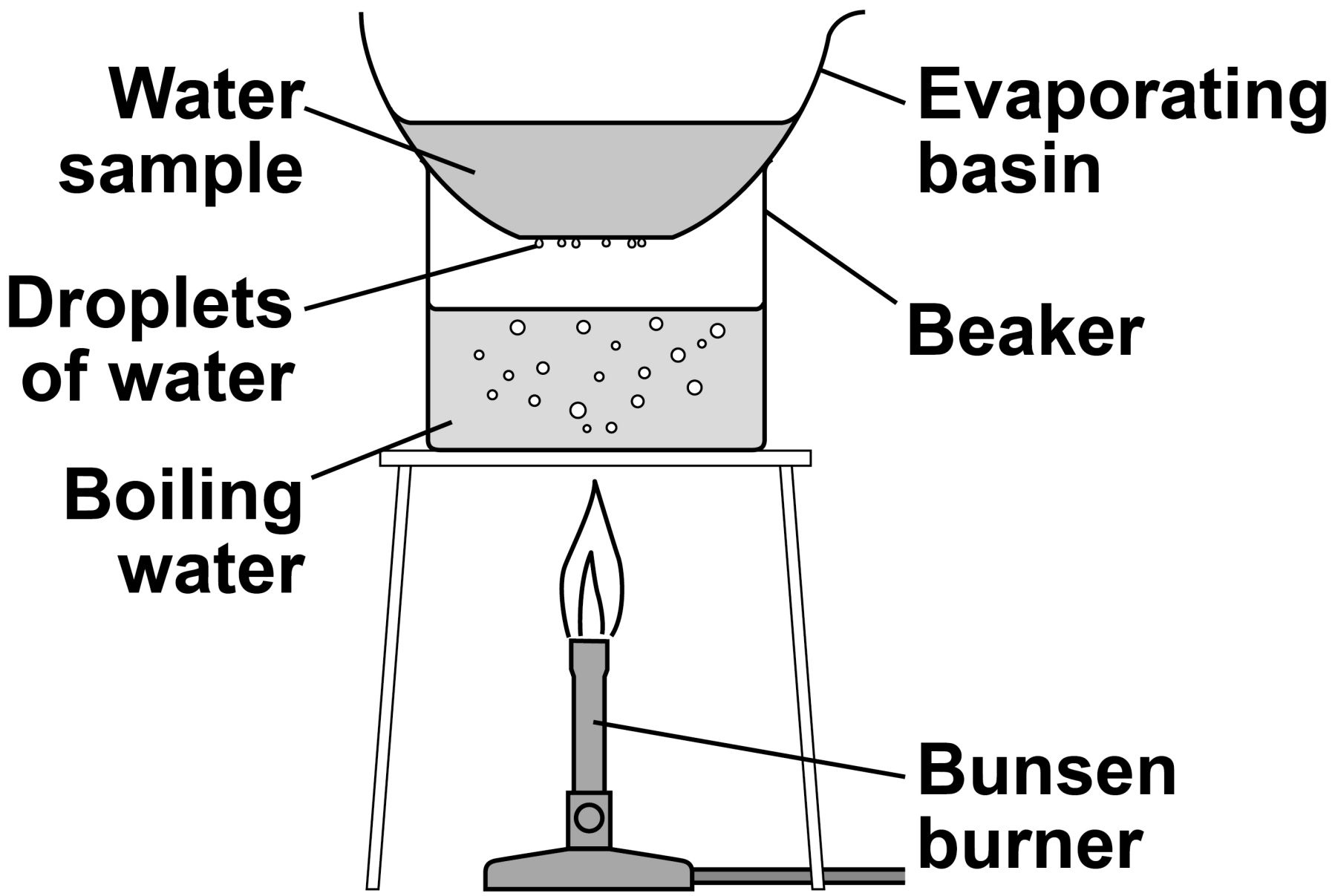
[Turn over]

0 3

A student investigated the mass of dissolved solids in water samples.

FIGURE 4 shows the apparatus used.

FIGURE 4



This is the method used.

1. **Record the mass of a dry evaporating basin.**

2. Pour 25 cm^3 of the water sample into the evaporating basin.

3. Place the evaporating basin on the beaker for 10 minutes.

4. Record the mass of the evaporating basin and contents.

0 3 . 1

What is used to find the mass of the evaporating basin? [1 mark]

Tick (✓) ONE box.

- ☐ Balance
- ☐ Beaker
- ☐ Measuring cylinder
- ☐ Thermometer

One error is that droplets of water collect on the bottom of the evaporating basin.

0 3 . 2

Suggest how this error affects the mass of the evaporating basin and contents.

[1 mark]

0 3 . 3

How can this error be corrected?

[1 mark]

0 3 . 4

Another error in the method is that not all the water was removed from the water sample.

How can this error be corrected?

[1 mark]

Tick (✓) ONE box.

- ☐ **Add more boiling water to the beaker.**
- ☐ **Heat until the mass of the evaporating basin and contents is constant.**
- ☐ **Stir the water sample in the evaporating basin with a glass rod.**

[Turn over]

0 3 . 5

The water in the water sample turns into steam.

What is the name of this process?
[1 mark]

BLANK PAGE

[Turn over]

Another student did the experiment correctly with three water samples A, B and C.

TABLE 2 shows the results.

TABLE 2

Water sample	Mass of dissolved solids in g			
	Test 1	Test 2	Test 3	Mean
A	0.23	0.23	0.20	X
B	0.03	0.07	0.02	0.04
C	1.45	1.60	1.45	1.50

0 3 . 6

The range is the difference between the largest value and the smallest value.

Which water sample has the greatest range of results? [1 mark]

Tick (✓) ONE box.

- ☐ **A**
- ☐ **B**
- ☐ **C**

[Turn over]

REPEAT OF TABLE 2

Water sample	Mass of dissolved solids in g			
	Test 1	Test 2	Test 3	Mean
A	0.23	0.23	0.20	X
B	0.03	0.07	0.02	0.04
C	1.45	1.60	1.45	1.50

0 3 . 7

Calculate the mean mass X for water sample A.

Use TABLE 2. [2 marks]

X = _____ g

0 3 . 8

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

Tick (✓) ONE box.

- ☐ **Mass of dissolved solids**
- ☐ **Time taken for water to heat**
- ☐ **Type of water sample**
- ☐ **Volume of boiling water**

0 3 . 9

A different water sample contains 3.6 g of dissolved solids in 150 cm^3

Calculate the mass of dissolved solids in 25 cm^3 of this sample. [2 marks]

Mass = _____ g

0 4

This question is about hydrogen peroxide.

0 4 . 1

The symbol equation for the decomposition of hydrogen peroxide (H_2O_2) is:

$$2\ H_2O_2 \longrightarrow 2\ H_2O + O_2$$

Complete the word equation for the decomposition of hydrogen peroxide. [2 marks]

hydrogen peroxide →

_____ **+** _____

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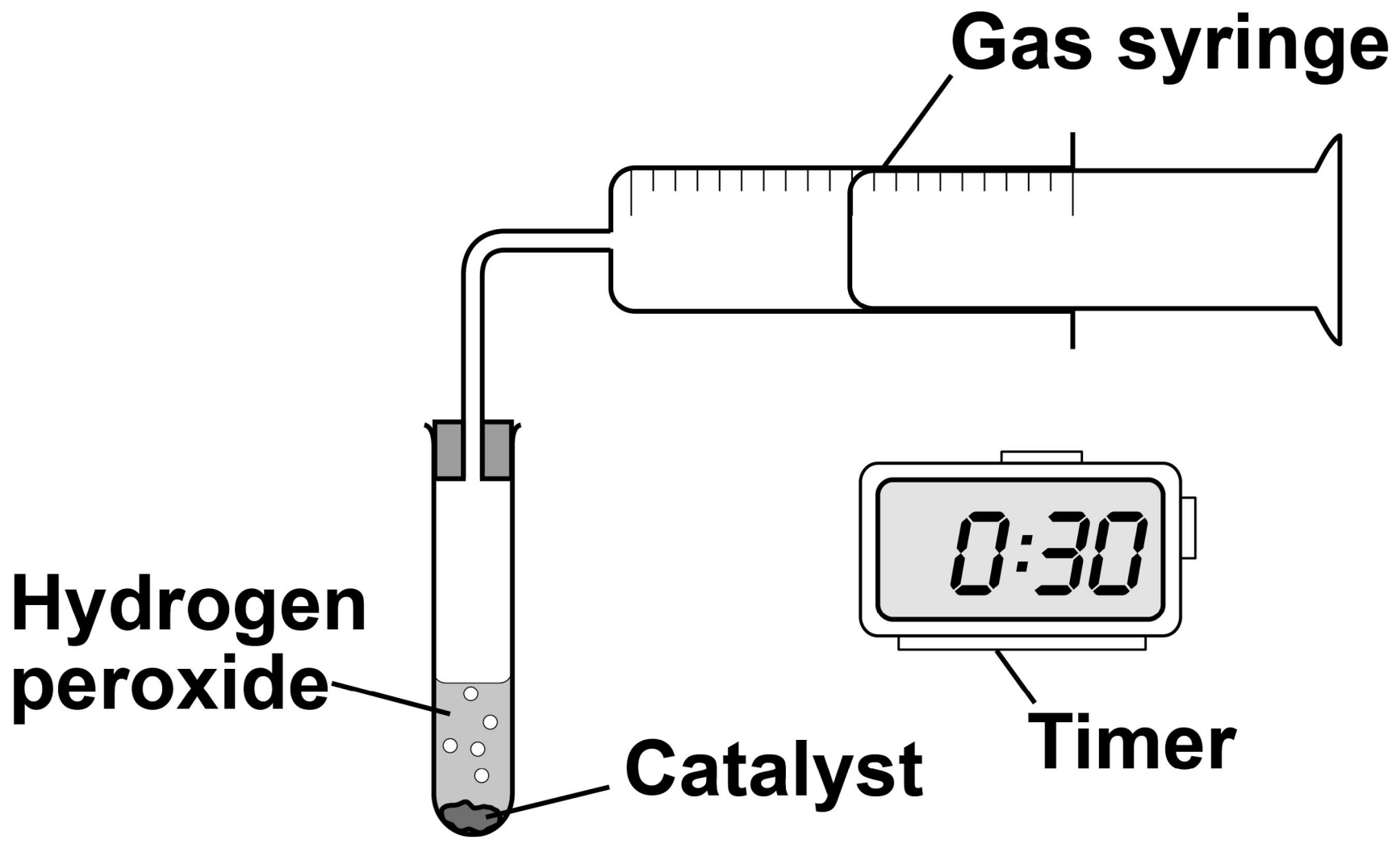
[Turn over]

A student investigated the effect of different catalysts on the decomposition of hydrogen peroxide.

The student measured the volume of gas collected every 30 seconds for 5 minutes.

FIGURE 5 shows the apparatus used.

FIGURE 5



0 4 . 2

Which TWO variables should the student keep the same to make the investigation a fair test? [2 marks]

Tick (✓) TWO boxes.

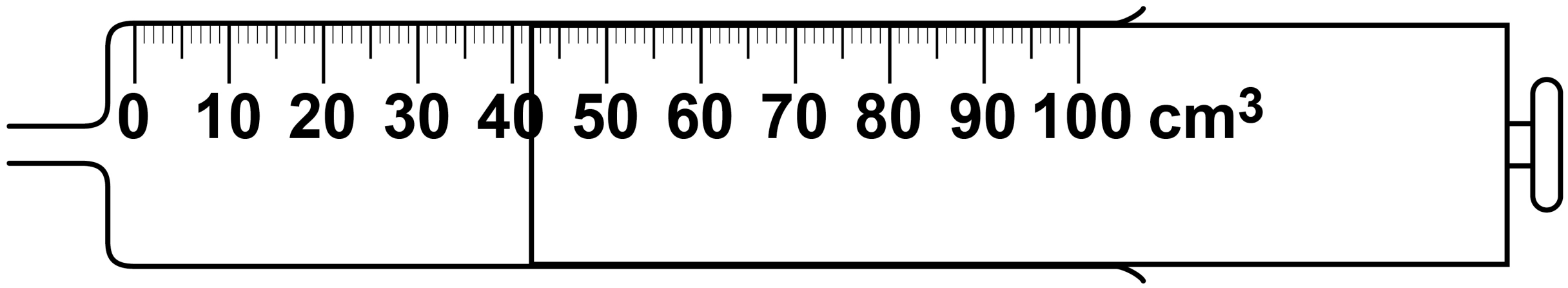
- ☐ **Concentration of hydrogen peroxide**
- ☐ **Mass of catalyst**
- ☐ **Size of gas syringe**
- ☐ **Type of catalyst**
- ☐ **Volume of gas collected**

[Turn over]

0 4 . 3

FIGURE 6 shows a gas syringe.

FIGURE 6



What is the volume of gas in the syringe? [1 mark]

Volume = _____ cm^3

BLANK PAGE

[Turn over]

TABLE 3 shows the student's results for one catalyst.

TABLE 3

Time in minutes	0.0	0.5	1.0	1.5	2.0
Volume of gas in cm^3	0	34	54	68	78

0 4 . 4

Six of the other results have been plotted on FIGURE 7, on the opposite page.

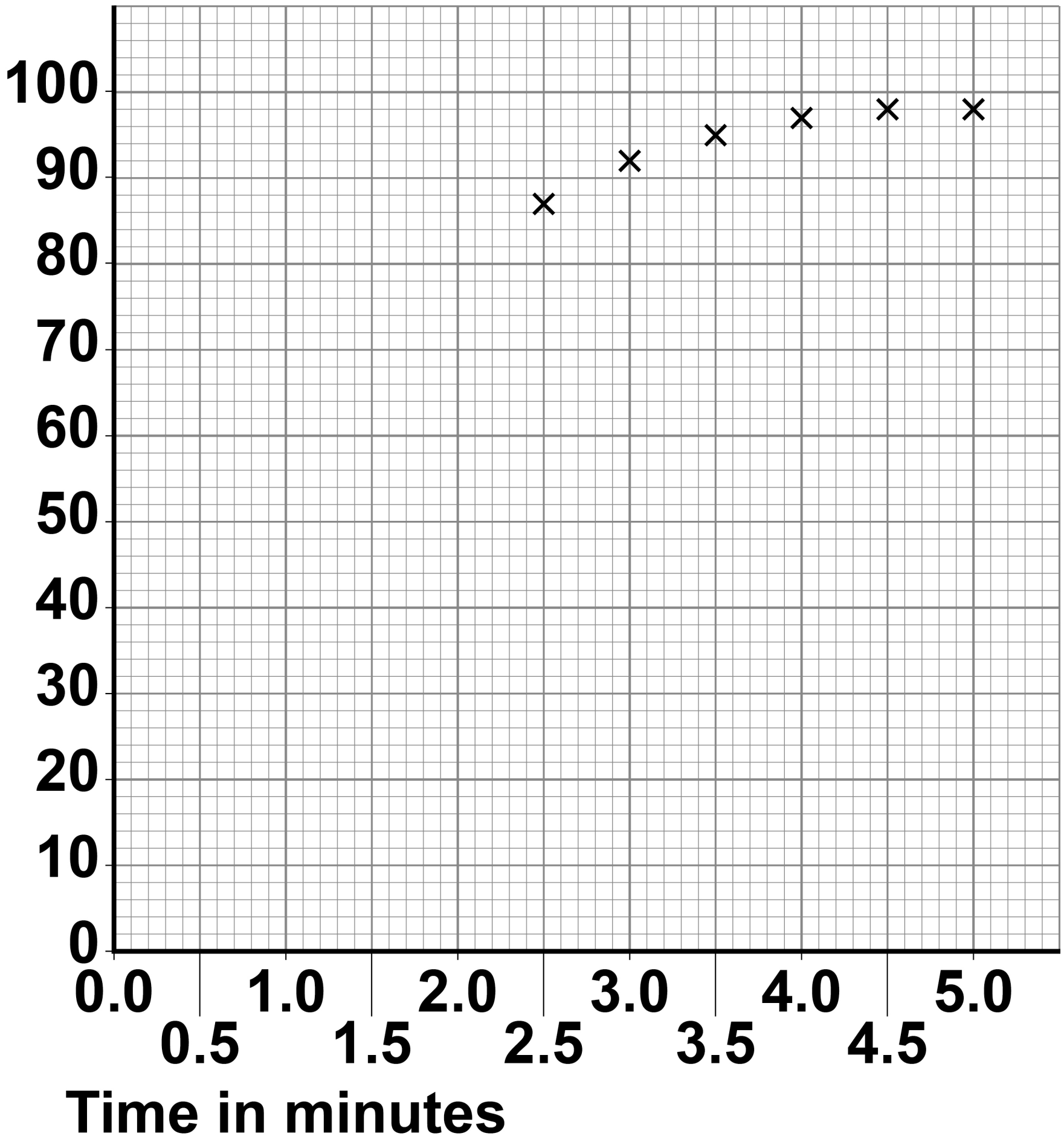
Complete the graph in FIGURE 7.

You should:

- **plot the results from TABLE 3**
- **draw a line of best fit for all of the results.**

[3 marks]

FIGURE 7



[Turn over]

The student repeated the experiment with other catalysts and plotted a graph for each of the catalysts used.

0 4 . 5

Suggest how the student could use these graphs to identify the best catalyst.
[1 mark]

0 4 . 6

All the graphs level off at the same volume of gas.

Suggest why. [1 mark]

0 4 . 7

In another investigation, a student increased the temperature of the hydrogen peroxide.

Why is the rate of reaction faster when the temperature of the hydrogen peroxide is increased? [2 marks]

Tick (✓) TWO boxes.

- ☐ **The concentration of hydrogen peroxide decreases.**
- ☐ **The particles are moving more slowly.**
- ☐ **The particles have more energy.**
- ☐ **There are more particle collisions per second.**
- ☐ **There are more particles per unit volume.**

0 5

This question is about mixtures.

0 5 . 1

Which substance is a mixture? [1 mark]

Tick (✓) ONE box.

☐ **Air**

☐ **Gold**

☐ **Methane**

☐ **Nitrogen**

0 5 . 2

Food colourings are often mixtures of dyes.

What name is given to mixtures that are designed as useful products? [1 mark]

_____

_____

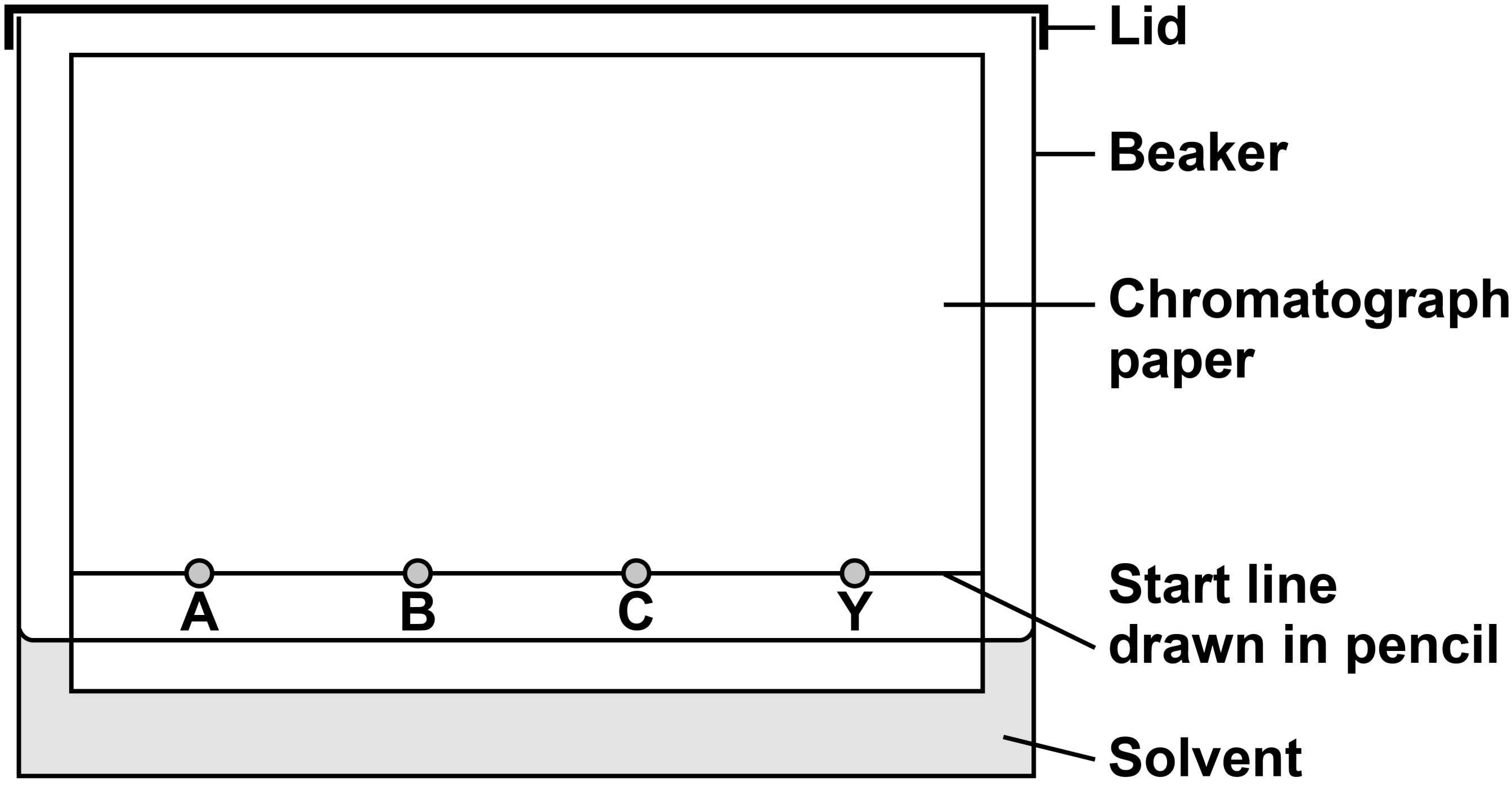
A student investigated a purple food colouring, Y, using chromatography.

The student compares Y with dyes A, B and C.

0 5 . 3

FIGURE 8, on the opposite page, shows the apparatus used.

FIGURE 8


Lid
Beaker
Chromatography paper
A
B
C
Y
Start line drawn in pencil
Solvent

Chromatography involves a stationary phase and a mobile phase.

On the opposite page, draw ONE line from each phase to what is used for that phase.

Use FIGURE 8, on page 51. [2 marks]

PHASE	WHAT IS USED
	Beaker
Mobile phase	Chromatography paper
	Food colouring
Stationary phase	Pencil line
	Solvent

FIGURE 9 shows the student's results.

FIGURE 9

0 5 . 4

What THREE conclusions can you make about the dyes in food colouring Y?
[3 marks]

1

2

3

0 5 . 5

In a different experiment a student recorded these results:

Distance moved by dye G = 60 mm

Distance moved by solvent = 80 mm

Calculate the R_f value of dye G.

$$R_f = \frac{\text{distance moved by dye G}}{\text{distance moved by solvent}}$$

[2 marks]

R_f

9

0 6

This question is about the Earth's resources.

When most fuels burn, carbon dioxide is produced.

Propane (C_3H_8) is a fuel.

0 6 . 1

Balance the equation for the combustion of propane. [1 mark]

$$C_3H_8 + \_\_\_\_ O_2 \longrightarrow 3\ CO_2 + 4\ H_2O$$

0 6 . 2

Describe the test for carbon dioxide.

Give the result of the test. [2 marks]

Test _____

Result _____

_____

_____

0 6 . 3

Propane can be cracked to produce propene and hydrogen.

Complete the symbol equation for the reaction. [1 mark]

$C_3H_8 \rightarrow$ _____ $+ H_2$

propane propene hydrogen

0 6 . 4

Describe the test for hydrogen.

Give the result of the test. [2 marks]

Test _____

Result _____

_____

0 6 . 5

Propene is an alkene.

Describe the test for alkenes.

Give the colour change in the test. [3 marks]

Test _____

Colour change _____ **to** _____

[Turn over]

9

0 7

Some students investigated the effect of temperature on the rate of reaction.

0 7 . 1

The students reacted sodium thiosulfate solution with hydrochloric acid.

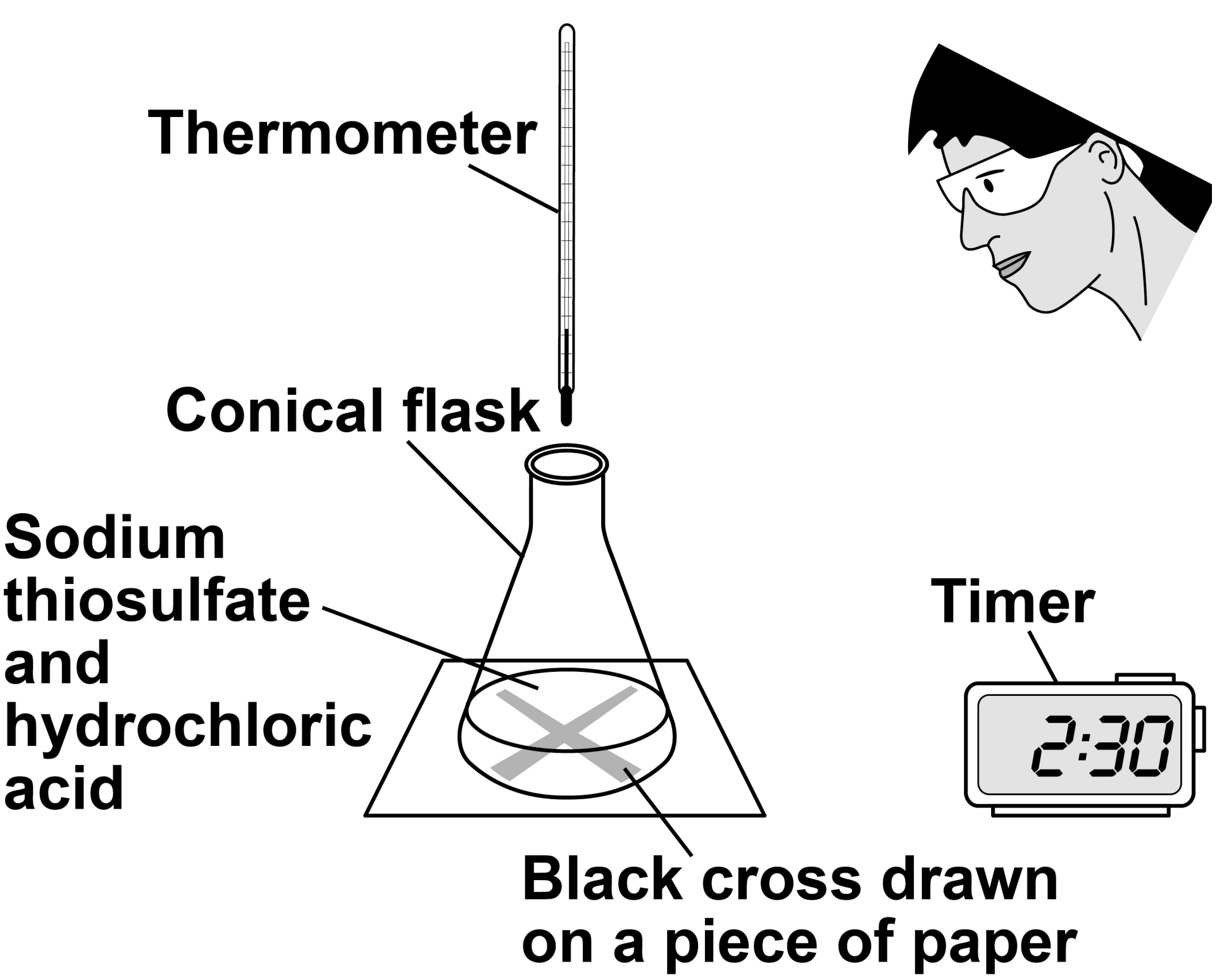
This is the method used.

1. **Use a beaker to measure 50 cm^3 of heated sodium thiosulfate solution into a conical flask.**
2. **Measure the temperature of the room.**
3. **Put the conical flask on a black cross drawn on a piece of paper.**
4. **Start a timer.**
5. **Use the same beaker to measure 10 cm^3 of hydrochloric acid into the conical flask.**
6. **Stop the timer when the cross is no longer visible.**

The students repeated the experiment at a different room temperature.

FIGURE 10 shows the apparatus.

FIGURE 10



[Turn over]

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The method contains errors and does NOT produce accurate results.

Describe a method the students should use to produce accurate results.

You do NOT need to write about safety precautions. [6 marks]


6 4

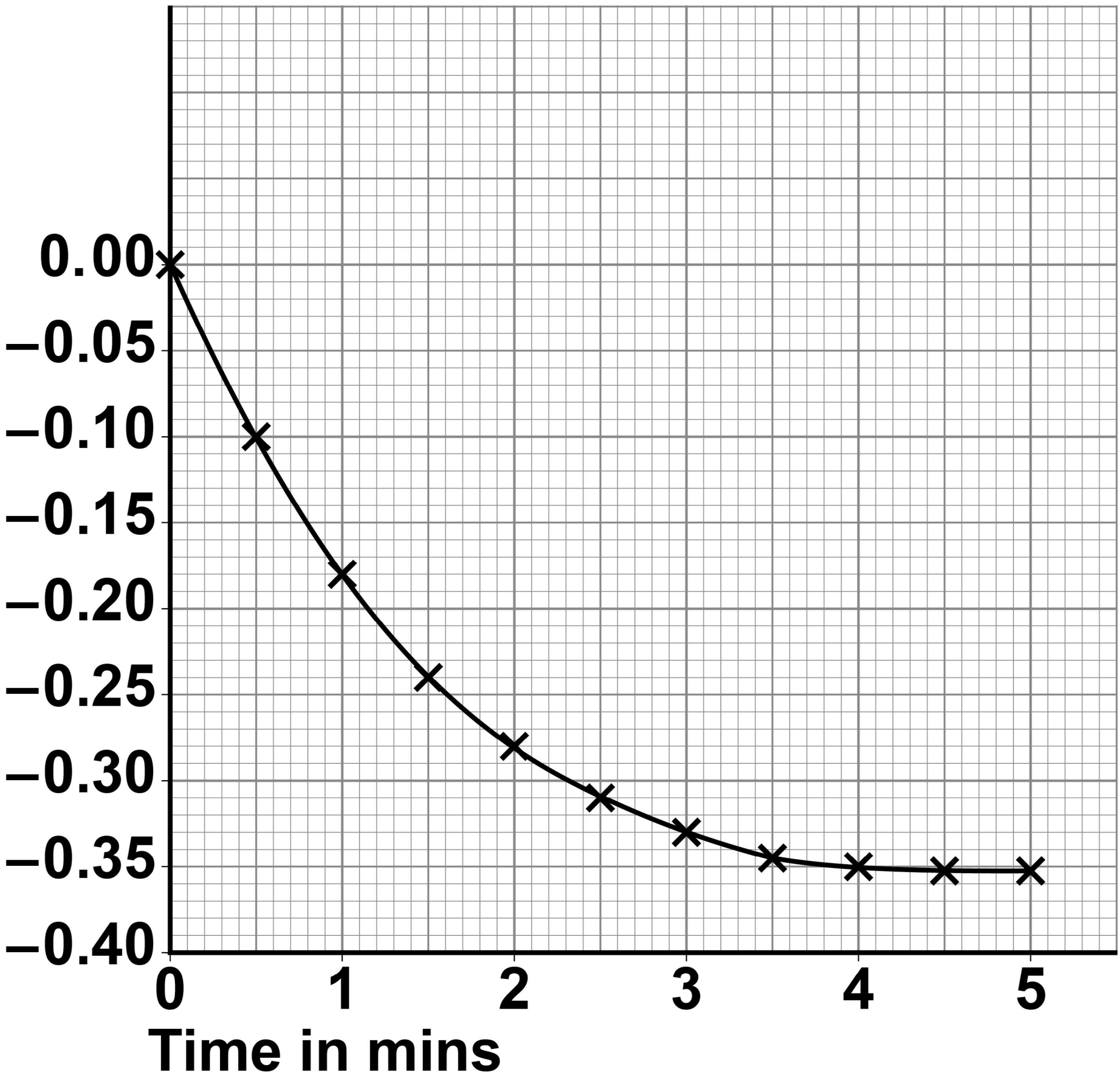
Some students investigated the effect of temperature on the rate of a different reaction.

They recorded the loss of mass from their apparatus at 40 °C

FIGURE 11, on page 66, shows the results.

[Turn over]

FIGURE 11


Loss
of mass
in grams
0.00
–0.05
–0.10
–0.15
–0.20
–0.25
–0.30
–0.35
–0.40
0
1
2
3
4
5
Time in mins

0 7 . 2

Calculate the mean rate of reaction between 1 minute and 3 minutes at 40 °C

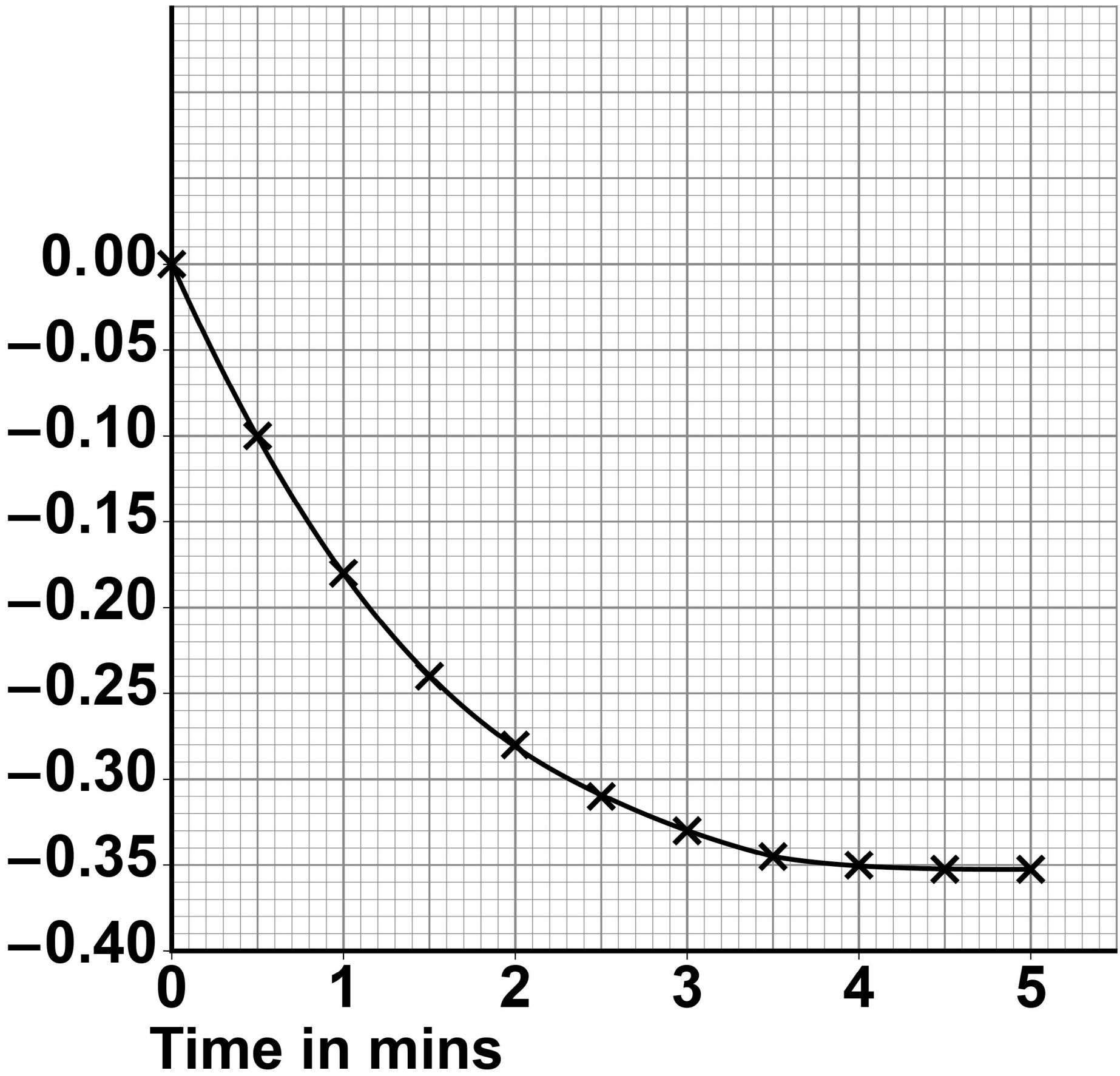
Use FIGURE 11 and the equation:

$$\text{Mean rate of reaction} = \frac{\text{change in mass of gas in g}}{\text{time in mins}}$$

[3 marks]

Mean rate of reaction = _____ g/min

REPEAT OF FIGURE 11



0 7 . 3

Draw a curve on FIGURE 11, on the opposite page, for the results you would expect at a temperature of 50 °C instead of 40 °C [2 marks]

END OF QUESTIONS

11

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.

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