A

Surname _____

Other Names _____

Centre Number _____

Candidate Number _____

Candidate Signature _____

I declare this is my own work.

GCSE

COMBINED SCIENCE: TRILOGY

Higher Tier

Chemistry Paper 2H

H

8464/C/2H

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]

JUN208464C2H01

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

BLANK PAGE

0 1

This question is about the Earth's resources.

When most fuels burn, carbon dioxide is produced.

Propane (C_3H_8) is a fuel.

0 1 . 1

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

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

[Turn over]

0 1 . 2

Describe the test for carbon dioxide.

Give the result of the test. [2 marks]

Test _____

Result _____

_____

_____

0 1 . 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 1 . 4

Describe the test for hydrogen.

Give the result of the test. [2 marks]

Test _____

Result _____

_____

0 1 . 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 2

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

0 2 . 1

The students reacted sodium thiosulfate solution with hydrochloric acid.

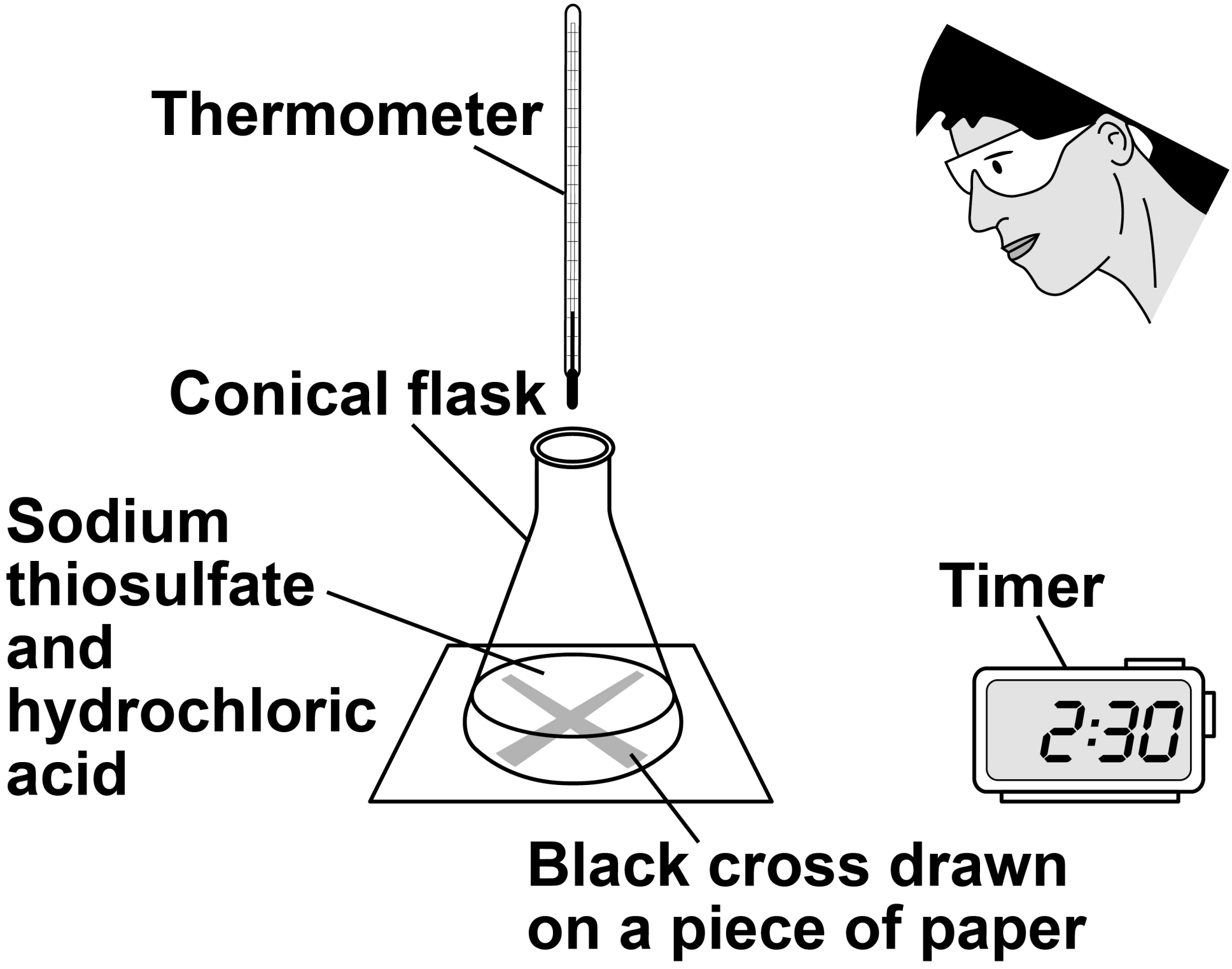
This is the method used.

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 1 shows the apparatus.

FIGURE 1



[Turn over]

BLANK PAGE

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]

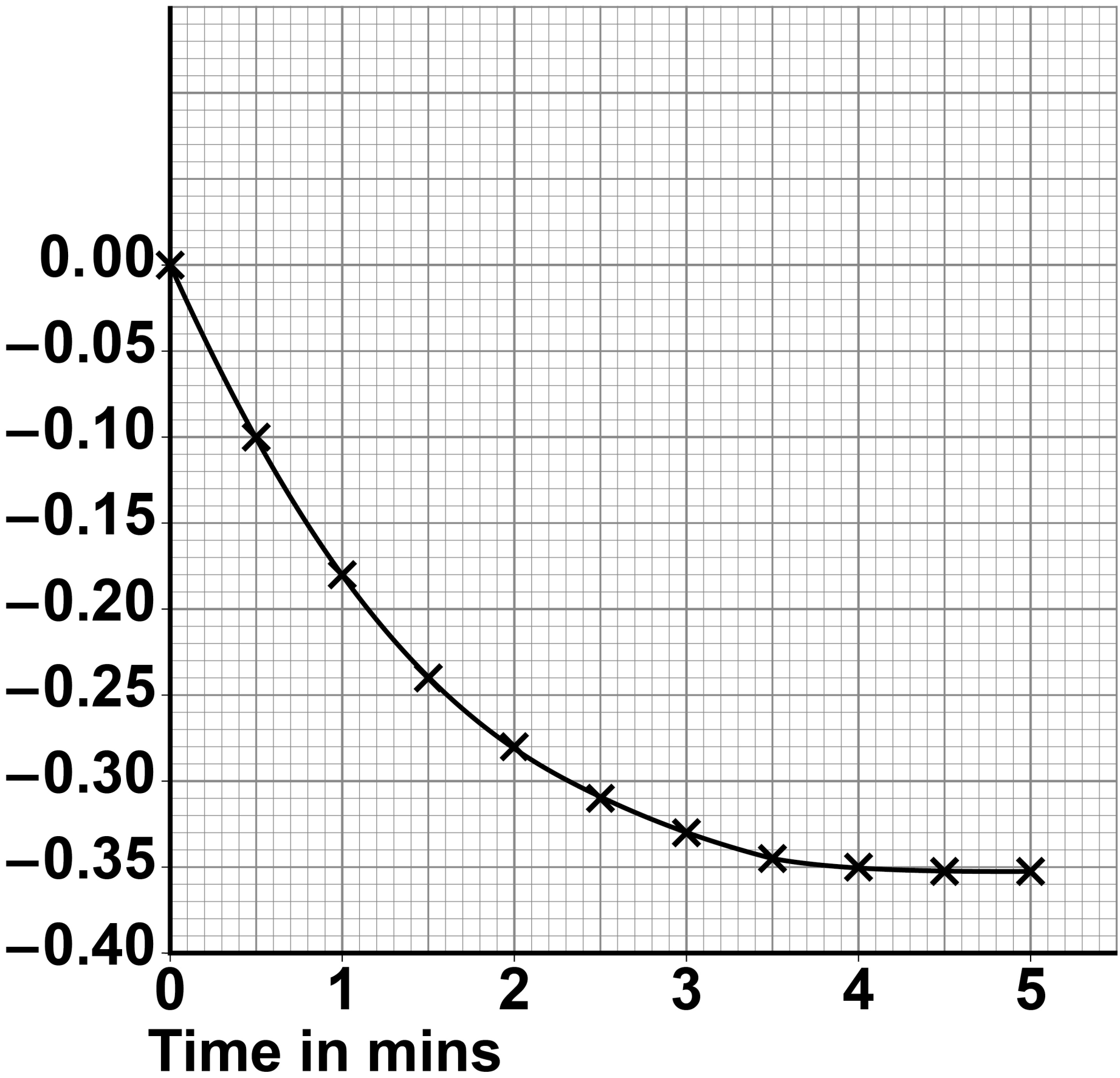
Some students investigated the effect of temperature on the rate of a different reaction.

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

FIGURE 2, on page 14, shows the results.

[Turn over]

FIGURE 2


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 2 . 2

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

Use FIGURE 2 and the equation:

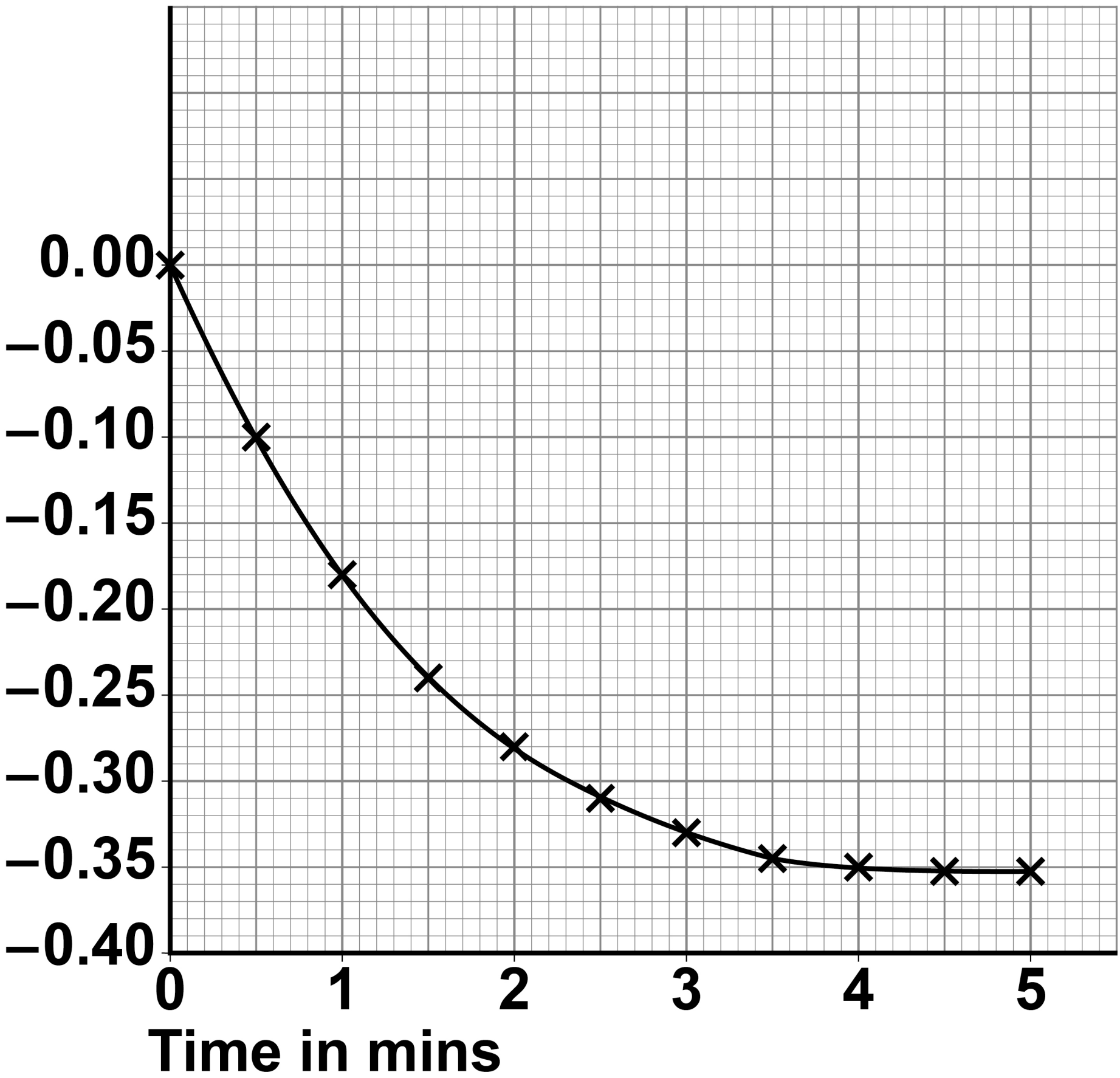
$$\text{Mean rate of reaction} = \frac{\text{change in mass of gas in g}}{\text{time in mins}}$$

[3 marks]

Mean rate of reaction = _____ g/min

[Turn over]

REPEAT OF FIGURE 2



0 2 . 3

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

0 3

This question is about pollutants.

0 3 . 1

Waste water has harmful substances removed before being released into the environment.

Complete the sentences. [2 marks]

Agricultural waste water requires the removal of harmful _____ .

Industrial waste water may require the removal of harmful _____ .

0 3 . 2

How is sewage sludge treated before being released into the environment? [1 mark]

Tick (✓) ONE box.

- ☐ **Aerobic biological treatment**
- ☐ **Anaerobic digestion**
- ☐ **Grit removal**
- ☐ **Screening**

[Turn over]

0 3 . 3

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 percentage decrease in the number of plastic bags used. [3 marks]

Percentage decrease = _____ %

Oxides of nitrogen are pollutants formed in car engines.

0 3 . 4

Give ONE problem oxides of nitrogen cause. [1 mark]

0 3 . 5

FIGURE 3, on the opposite page, shows the mass of oxides of nitrogen produced from car engines from 1986 to 2016.

Suggest why the mass of oxides of nitrogen produced from car engines increased and then decreased. [2 marks]

Increased _____

_____

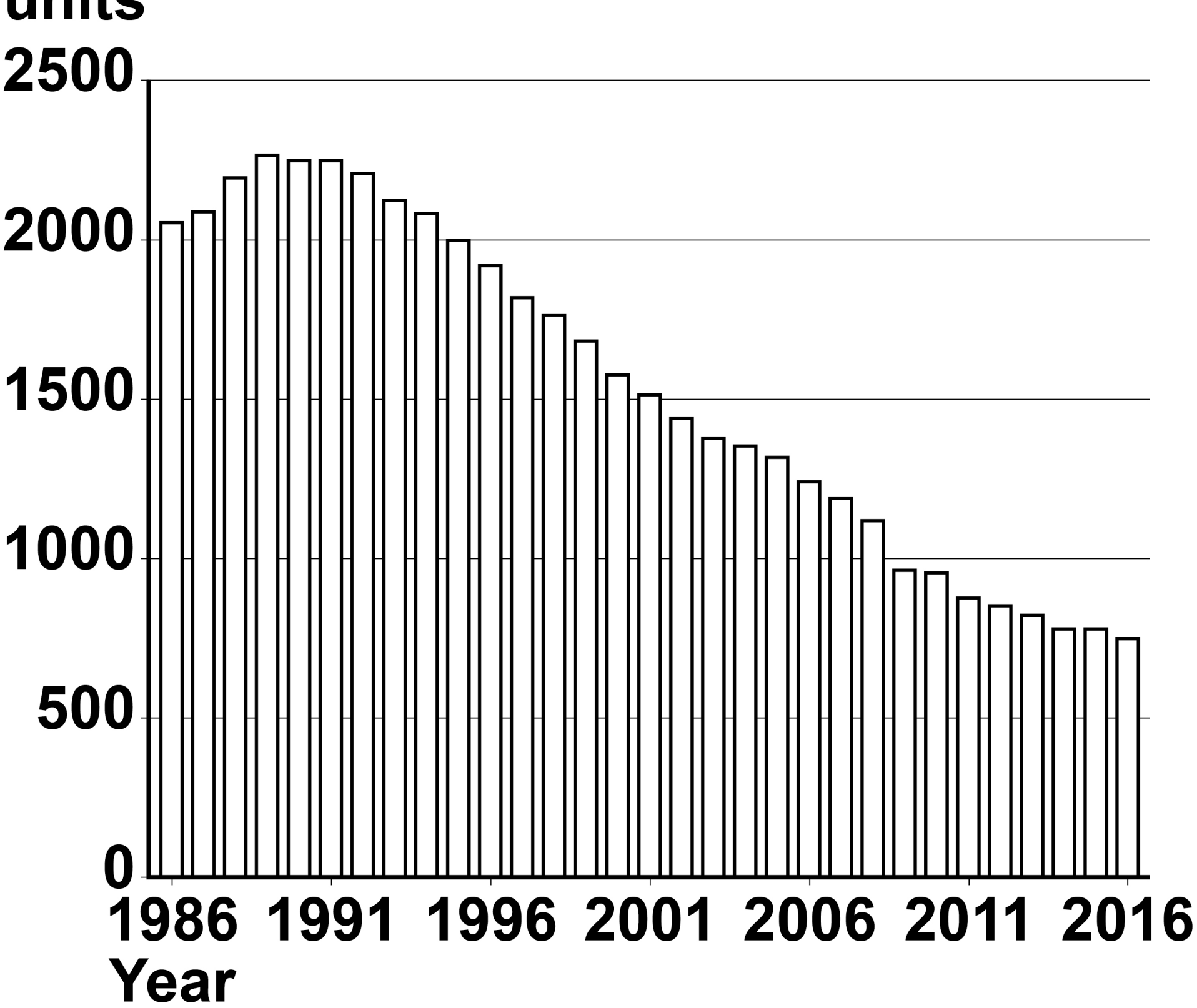
_____

Decreased _____

_____

9

FIGURE 3



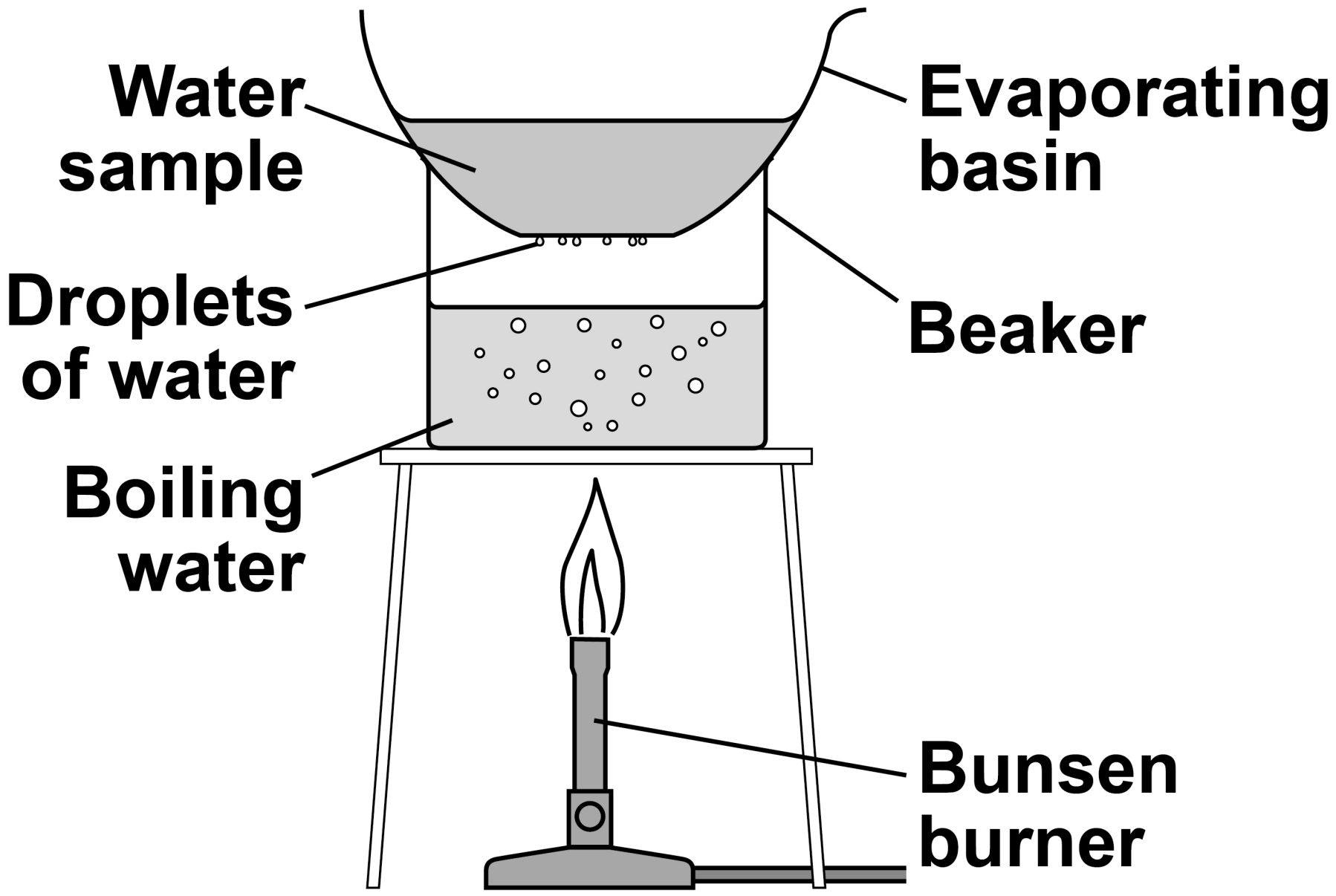
[Turn over]

0 4

A student investigated the mass of dissolved solids in four water samples A, B, C and D.

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 water sample A 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.
5. Repeat steps 1 to 4 with water sample A three more times.
6. Repeat steps 1 to 5 with water samples B, C and D.

[Turn over]

0 4 . 1

What type of variable is the mass of dissolved solids? [1 mark]

Tick (✓) ONE box.

- ☐ **Categoric**
- ☐ **Control**
- ☐ **Dependent**
- ☐ **Independent**

0 4 . 2

The method produced an error in the mass recorded in step 4.

Suggest what caused the error.

How could the error be avoided?
[2 marks]

Error _____

_____

_____

Avoided by _____

_____

Another student carried out the investigation correctly.

TABLE 1 shows the results.

TABLE 1

Water sample	Mass of dissolved solids in g				
	Test 1	Test 2	Test 3	Test 4	Mean
A	0.22	0.23	0.20	X	0.21
B	0.03	0.08	0.02	0.03	0.04
C	0.45	0.60	0.49	0.58	0.53
D	0.80	0.91	0.79	0.86	0.84

0 4 . 3

Calculate value X in TABLE 1. [2 marks]

X = _____ g

BLANK PAGE

0 4 . 4

Which water sample has the greatest range of masses of dissolved solids?

Give the reason for your answer.
[2 marks]

Water sample _____

Reason _____

_____

_____

_____

[Turn over]

0 4 . 5

Water companies measure the volume of water used by households in cubic metres (m^3).

25 cm^3 of a different water sample contained 0.016 g of dissolved solids.

Calculate the mass of dissolved solid in 1 m^3 of this water sample.

1 m^3 = 1000 dm^3

Give your answer in standard form.
[4 marks]

Mass (in standard form) = _____ g

[Turn over]

11

0 5

This question is about crude oil and alkanes.

0 5 . 1

Describe how crude oil is formed.

[3 marks]

0 5 . 2

Describe how crude oil is separated into fractions by fractional distillation.
[4 marks]

TABLE 2 shows the boiling points of three alkanes.

TABLE 2

Alkanes	Boiling point in °C
C_5H_{12}	36
$C_{10}H_{22}$	174
$C_{15}H_{32}$	271

0 5 . 3

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

0 5 . 4

Explain the trend in the boiling points of the alkanes. [3 marks]

0 5 . 5

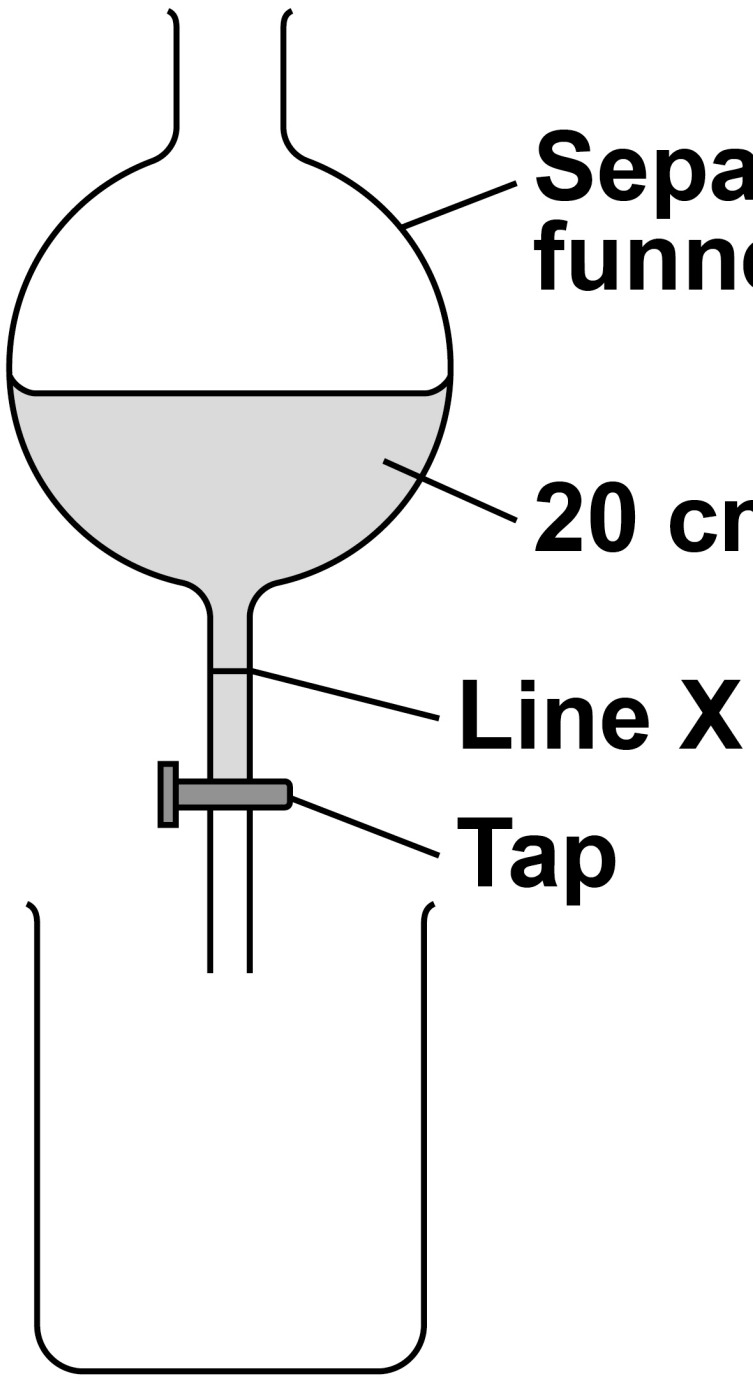
A student investigated one property of the alkanes C_5H_{12}, $C_{10}H_{22}$ and $C_{15}H_{32}$

This is the method used.

1. **Pour 20 cm^3 of C_5H_{12} into a separating funnel.**
2. **Open the tap of the separating funnel and start a timer.**
3. **Stop the timer when the level of C_5H_{12} reaches line X.**
4. **Repeat steps 1 to 3 with $C_{10}H_{22}$ and $C_{15}H_{32}$**

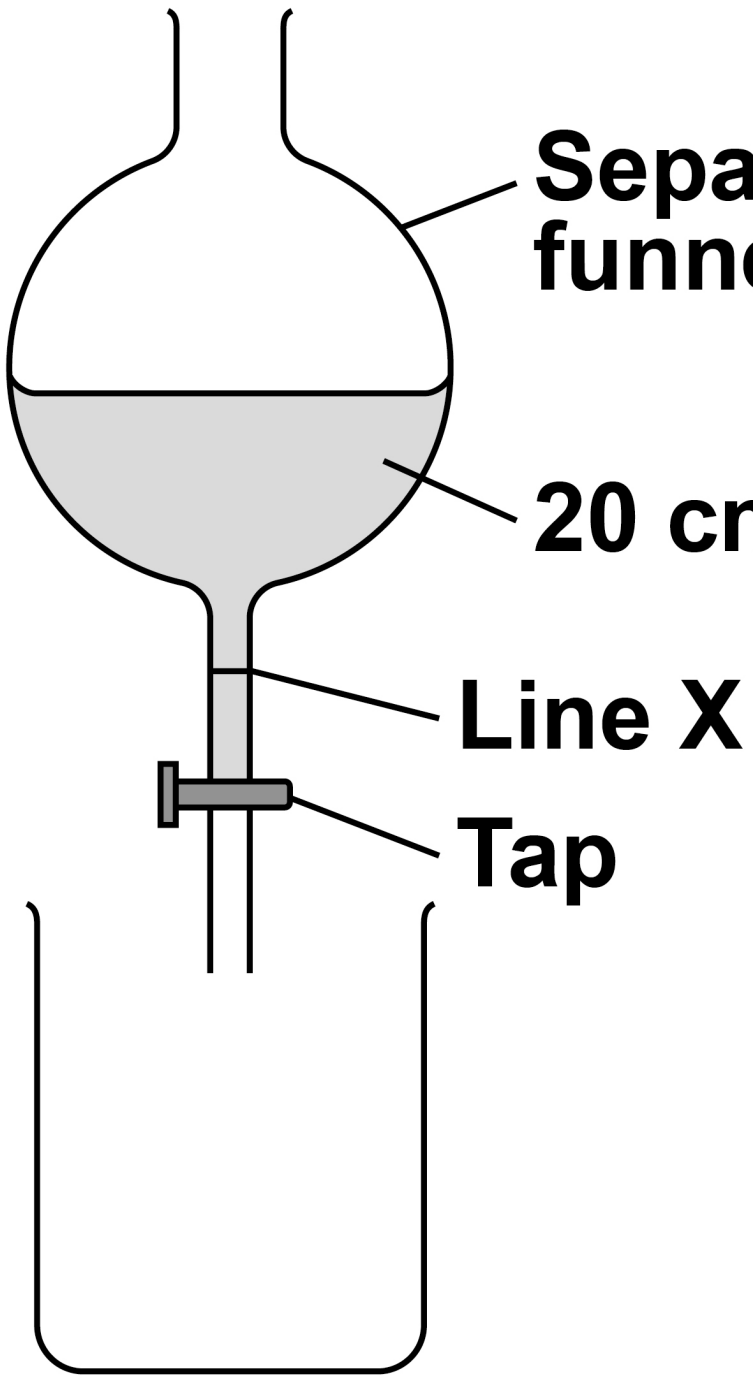
FIGURE 5, on the opposite page, shows the apparatus used.

FIGURE 5



[Turn over]

REPEAT OF FIGURE 5



The level of C_5H_{12} takes 6.4 seconds to reach line X.

Predict the trend in times for the other two alkanes.

Give ONE reason for your answer.
[2 marks]

Trend _____

_____

_____

Reason _____

_____

0 6

This question is about the Earth's atmosphere.

0 6 . 1

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]

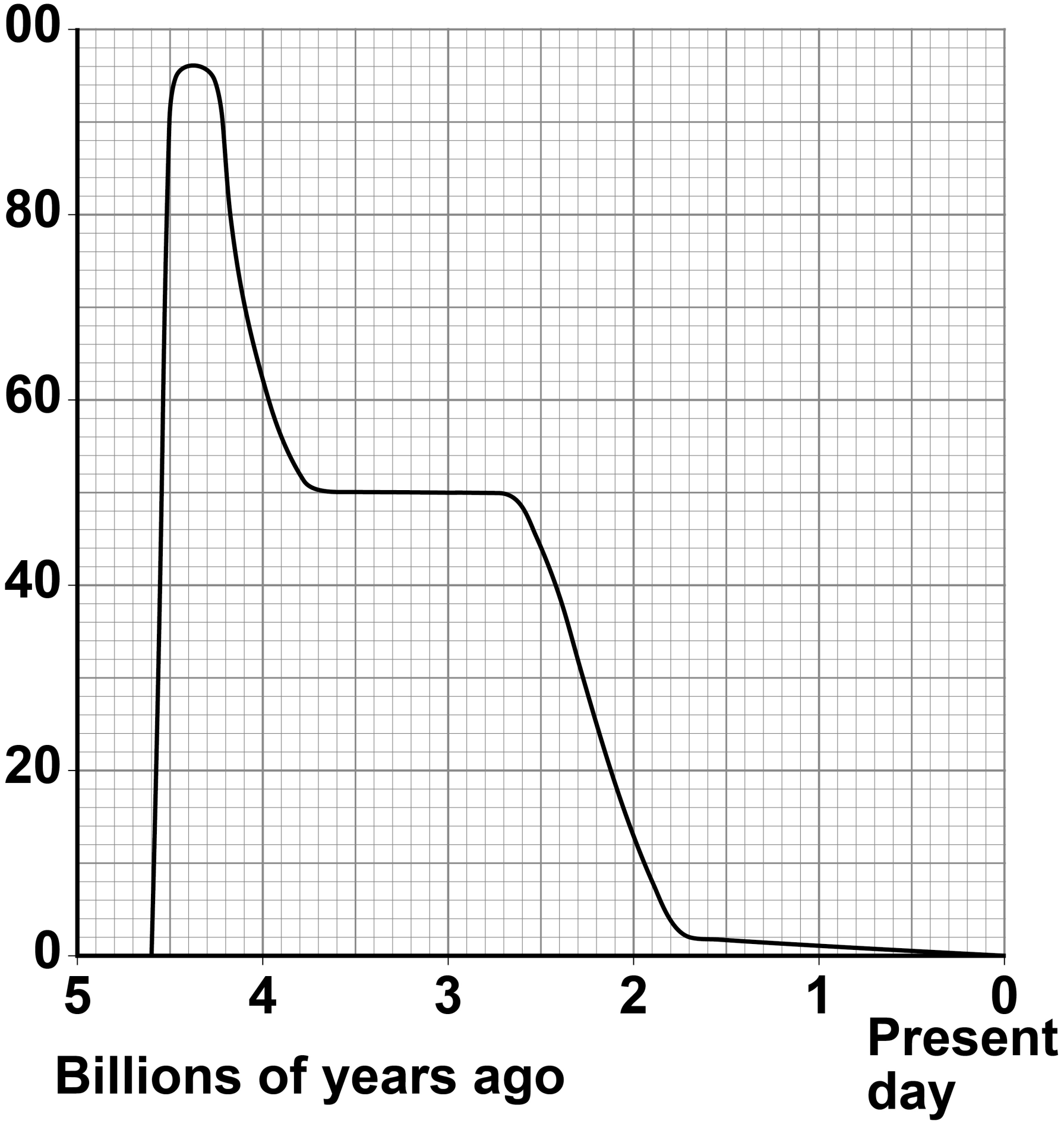
Tick (✓) ONE box.

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

FIGURE 6, on the opposite page, shows how the percentage of carbon dioxide in the Earth's atmosphere has changed over 4.6 billion years.

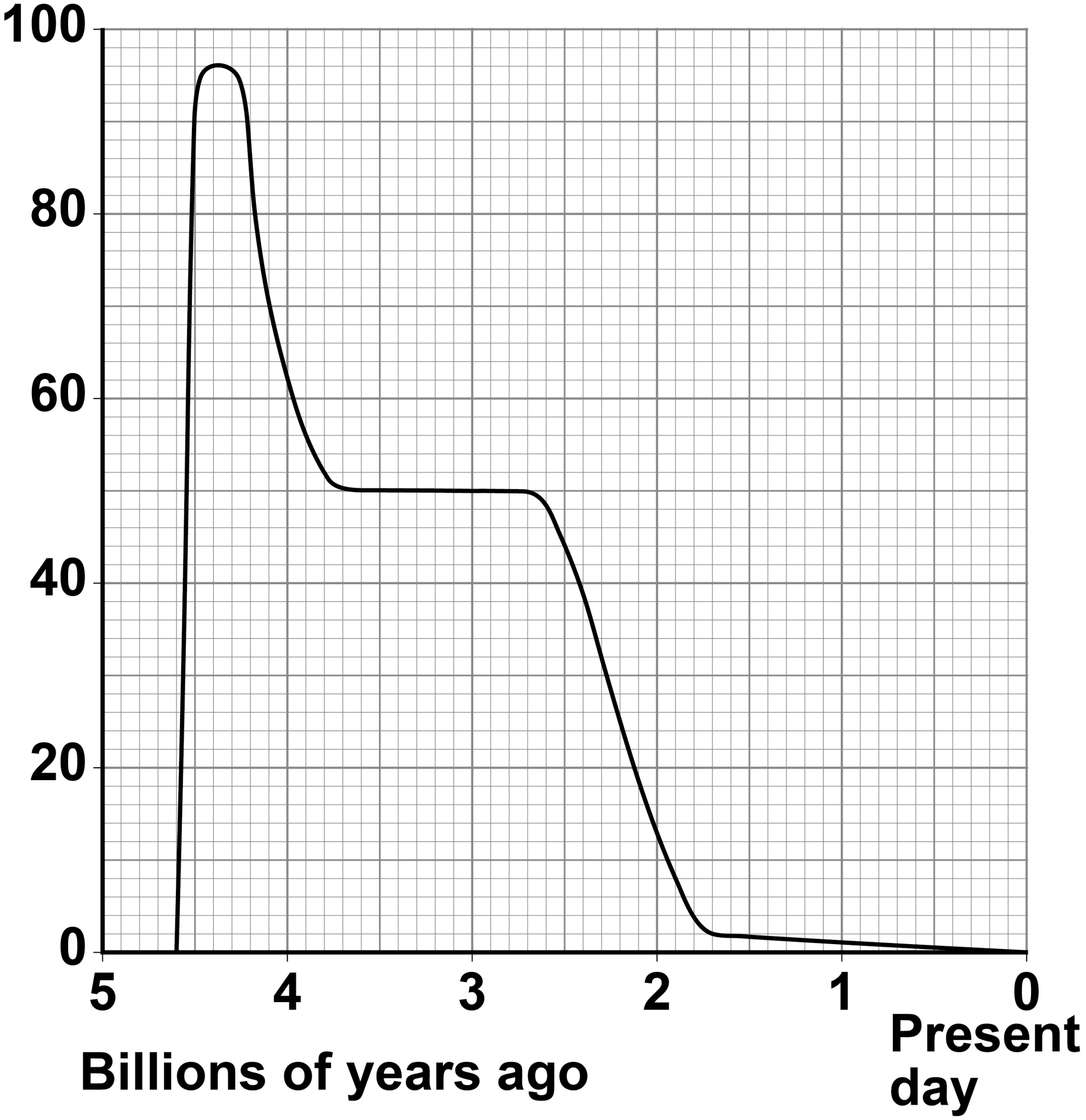
FIGURE 6

Percentage of carbon dioxide in the Earth's atmosphere



[Turn over]

REPEAT OF FIGURE 6



0 6 . 2

The mass of gas in Earth's atmosphere remains constant at 5.15×10^{18} kg

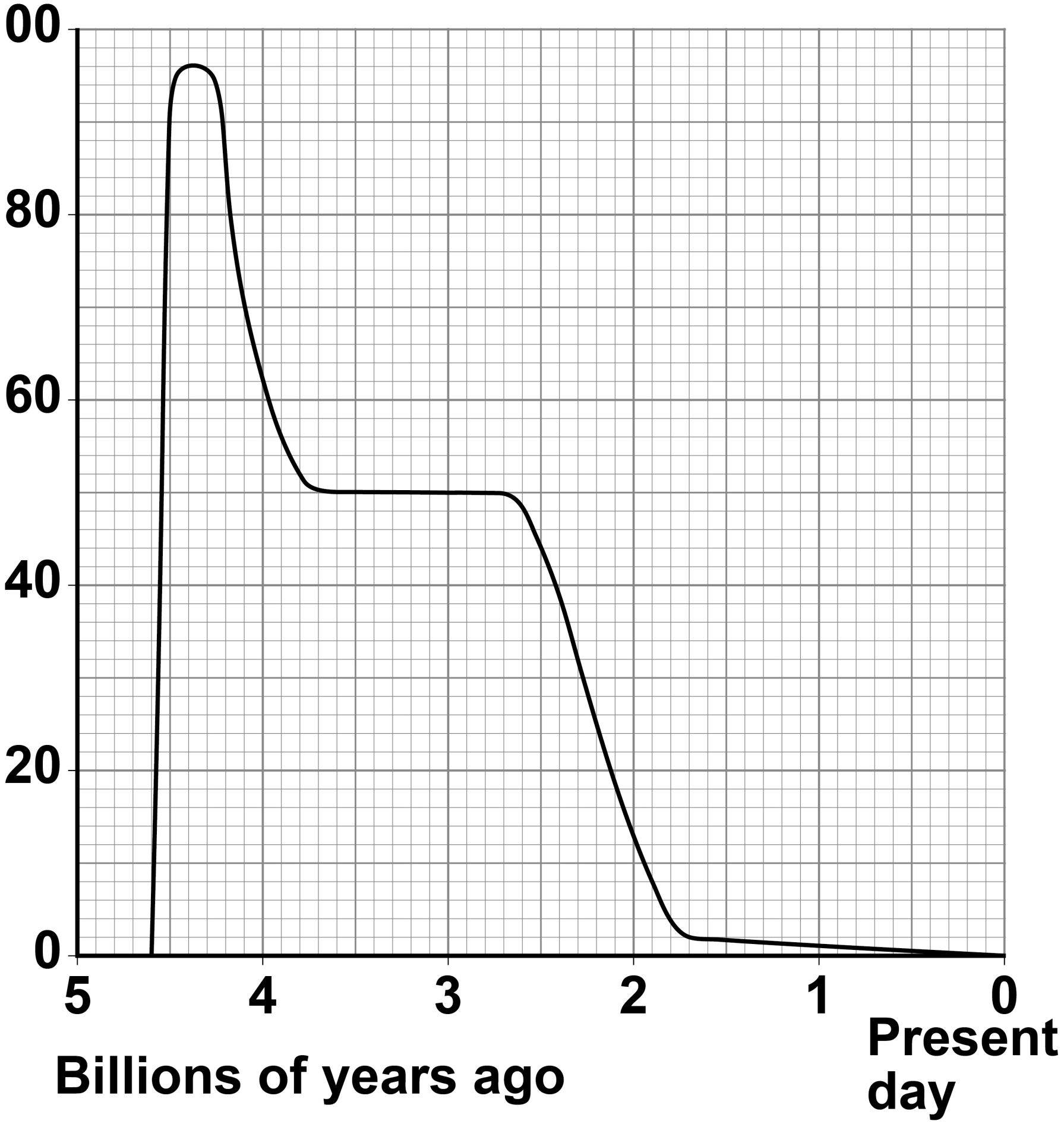
Determine the maximum mass of carbon dioxide that was in the Earth's atmosphere.

Use FIGURE 6, on the opposite page
[3 marks]

Mass of carbon dioxide = _____ kg

[Turn over]

REPEAT OF FIGURE 6



0 6 . 3

Describe the processes that have caused the main CHANGES in the percentage of carbon dioxide in the Earth's atmosphere over the last 4.6 billion years.

Use FIGURE 6. [6 marks]

50

[Turn over]

10

0 7

This question is about equilibrium.

0 7 . 1

Describe how a reaction reaches equilibrium. [2 marks]

Nitrogen dioxide gas reacts to form dinitrogen tetraoxide gas.

The reaction is reversible.

The equation for the reaction is:

$$2\ NO_2(g) \rightleftharpoons N_2O_4(g)$$

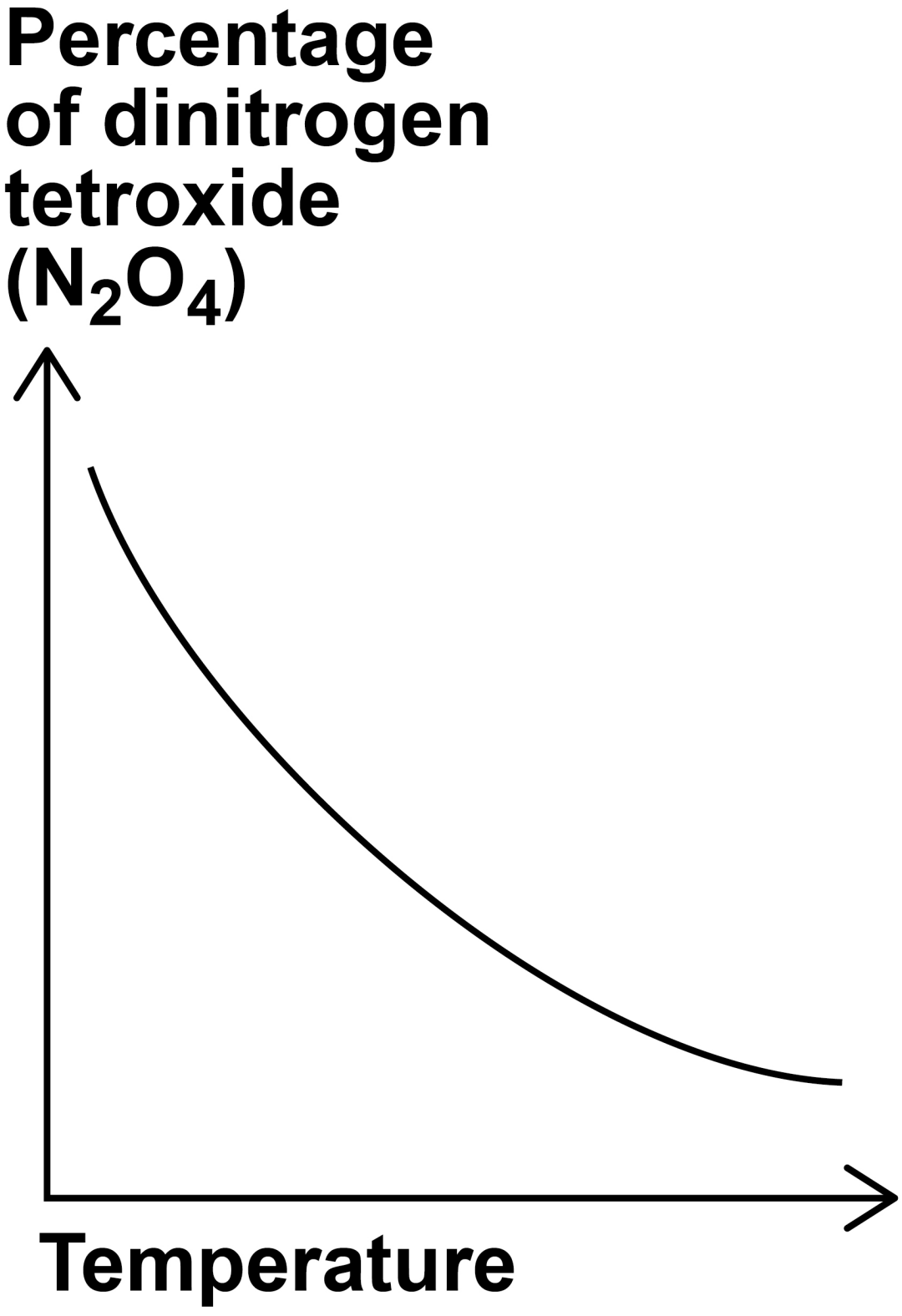
0 7 . 2

Explain the effect on the equilibrium position of increasing the pressure.
[2 marks]

0 7 . 3

FIGURE 7 shows the change in the percentage of dinitrogen tetroxide (N_2O_4) in the equilibrium mixture as the temperature of the equilibrium mixture is changed.

FIGURE 7



Explain the effect on the equilibrium position of increasing the temperature.

Use FIGURE 7. [3 marks]

END OF QUESTIONS

7

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.

BLANK PAGE

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