



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]**



J U N 2 0 8 4 6 4 C 2 H 0 1

**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.

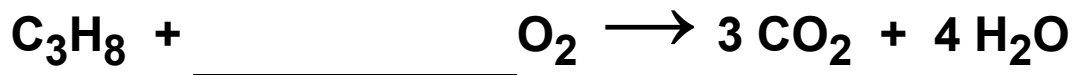


## **INFORMATION**

- **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 Earth's resources.****When most fuels burn, carbon dioxide is produced.****Propane (C<sub>3</sub>H<sub>8</sub>) is a fuel.****0 1 . 1****Balance the equation for the combustion of propane. [1 mark]****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]



**0 1 . 4** Describe the test for hydrogen.

Give the result of the test. [2 marks]

Test \_\_\_\_\_

Result \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

[Turn over]



**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** \_\_\_\_\_

9



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**[Turn over]**



**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<sup>3</sup> 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<sup>3</sup> of hydrochloric acid into the conical flask.**
- 6. Stop the timer when the cross is no longer visible.**

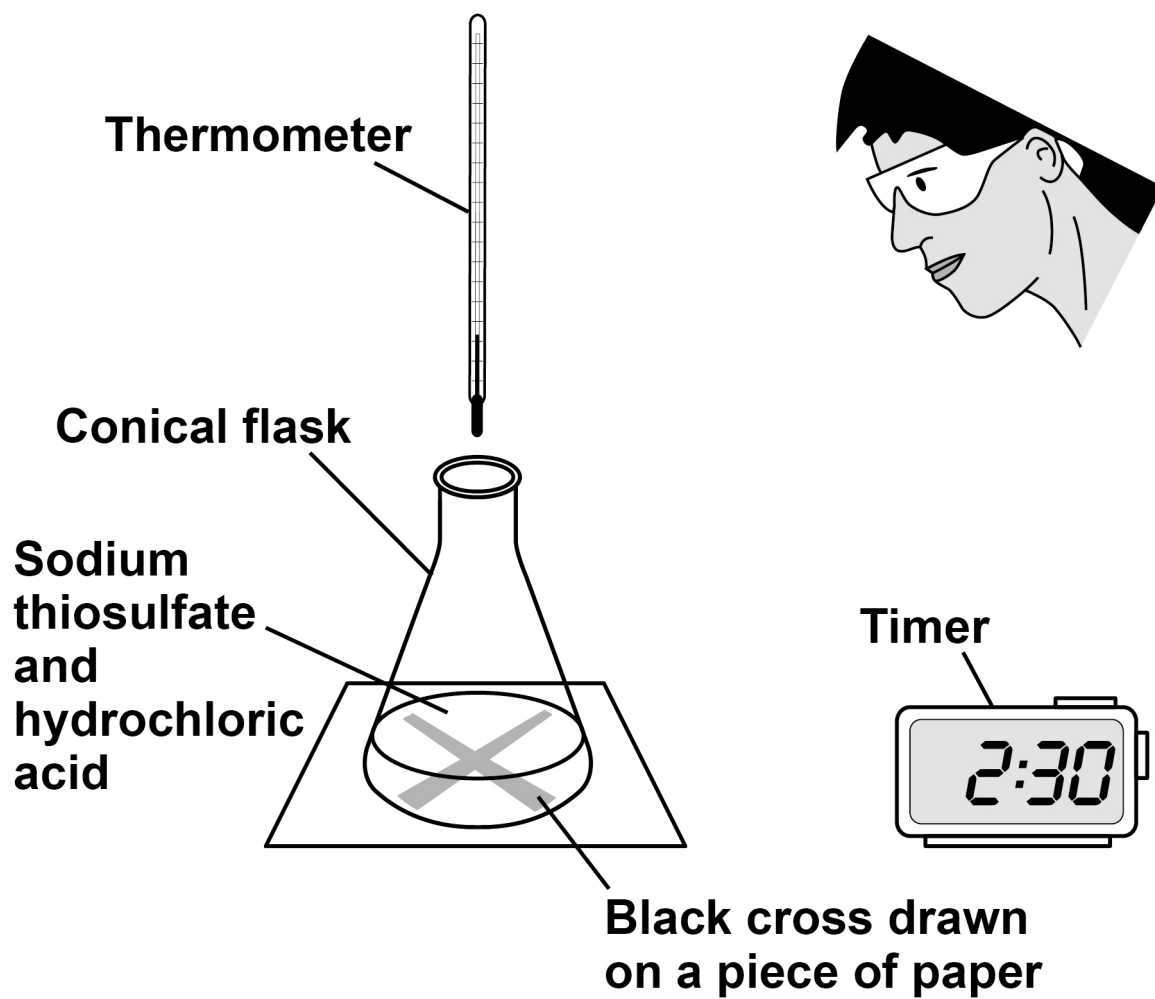
**The students repeated the experiment at a different room temperature.**

**FIGURE 1, on the opposite page, shows the apparatus.**





FIGURE 1



[Turn over]



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**[Turn over]**



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 the opposite page, shows the results.

**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]

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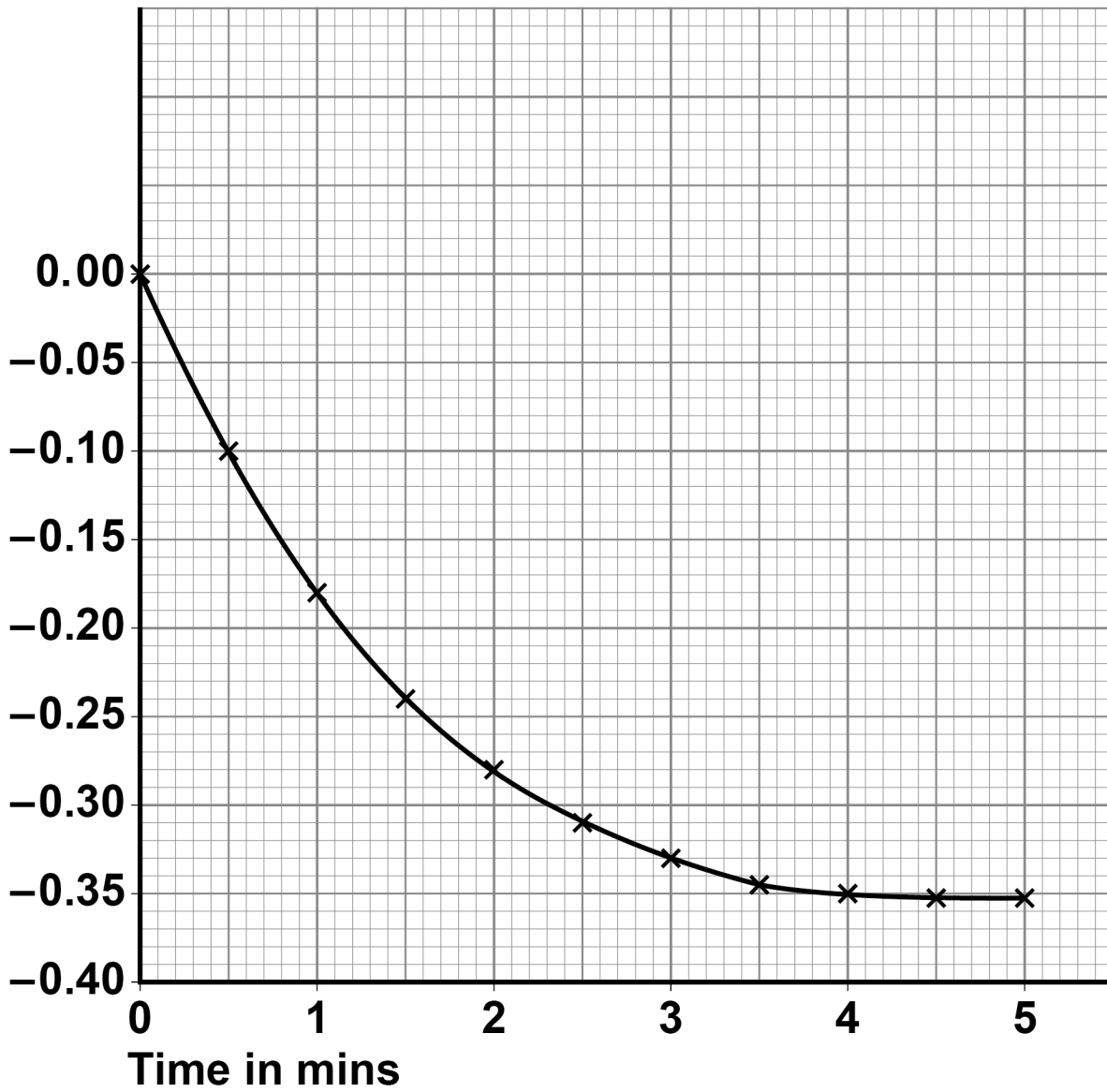
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Mean rate of reaction = \_\_\_\_\_ g/min



FIGURE 2

Loss  
of mass  
in grams

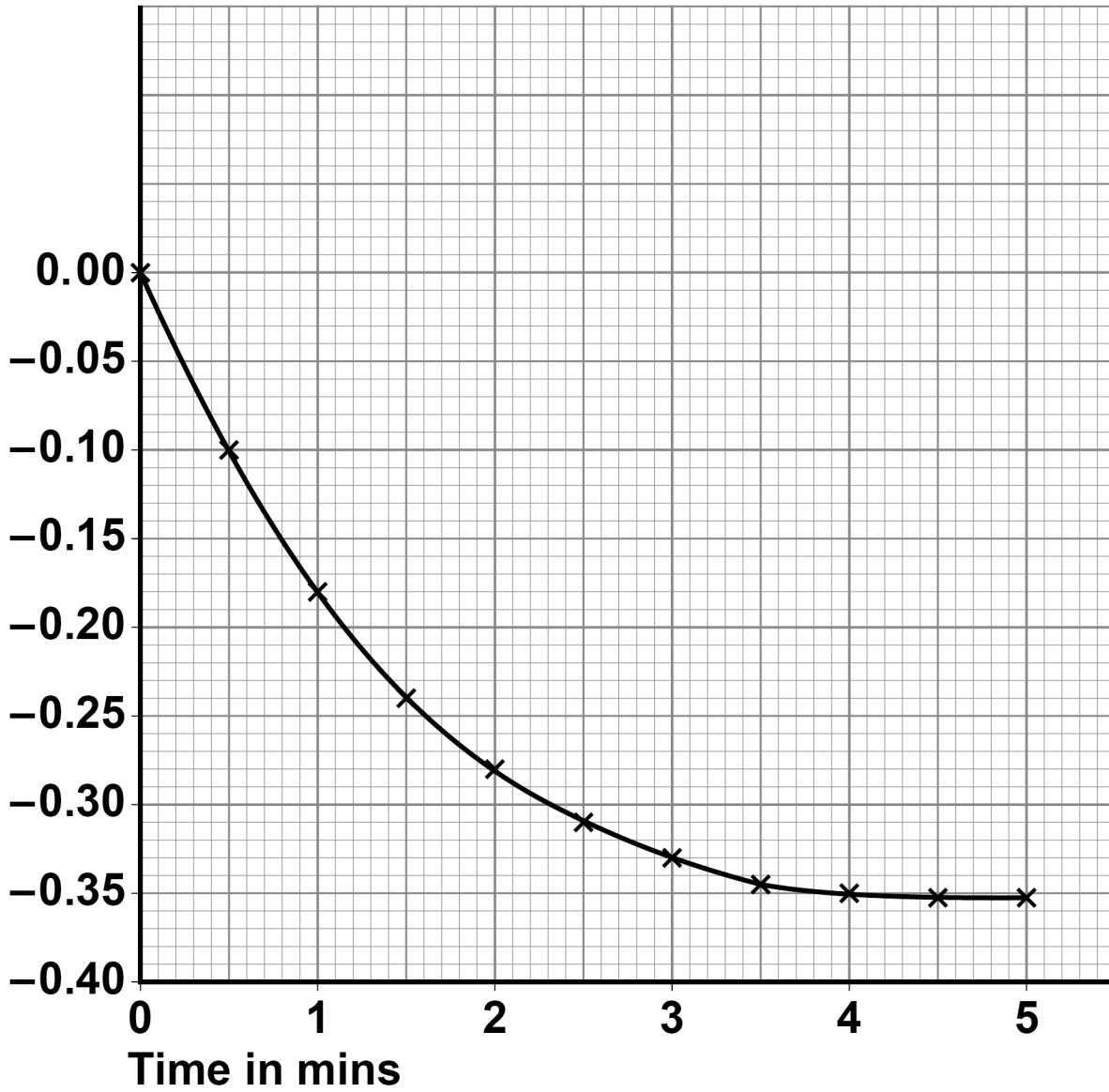


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## REPEAT OF FIGURE 2

Loss  
of mass  
in grams





**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]**

**[Turn over]**

<b>11</b>



**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 \_\_\_\_\_ .**



**03.2** 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]**





Oxides of nitrogen are pollutants formed in car engines.

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

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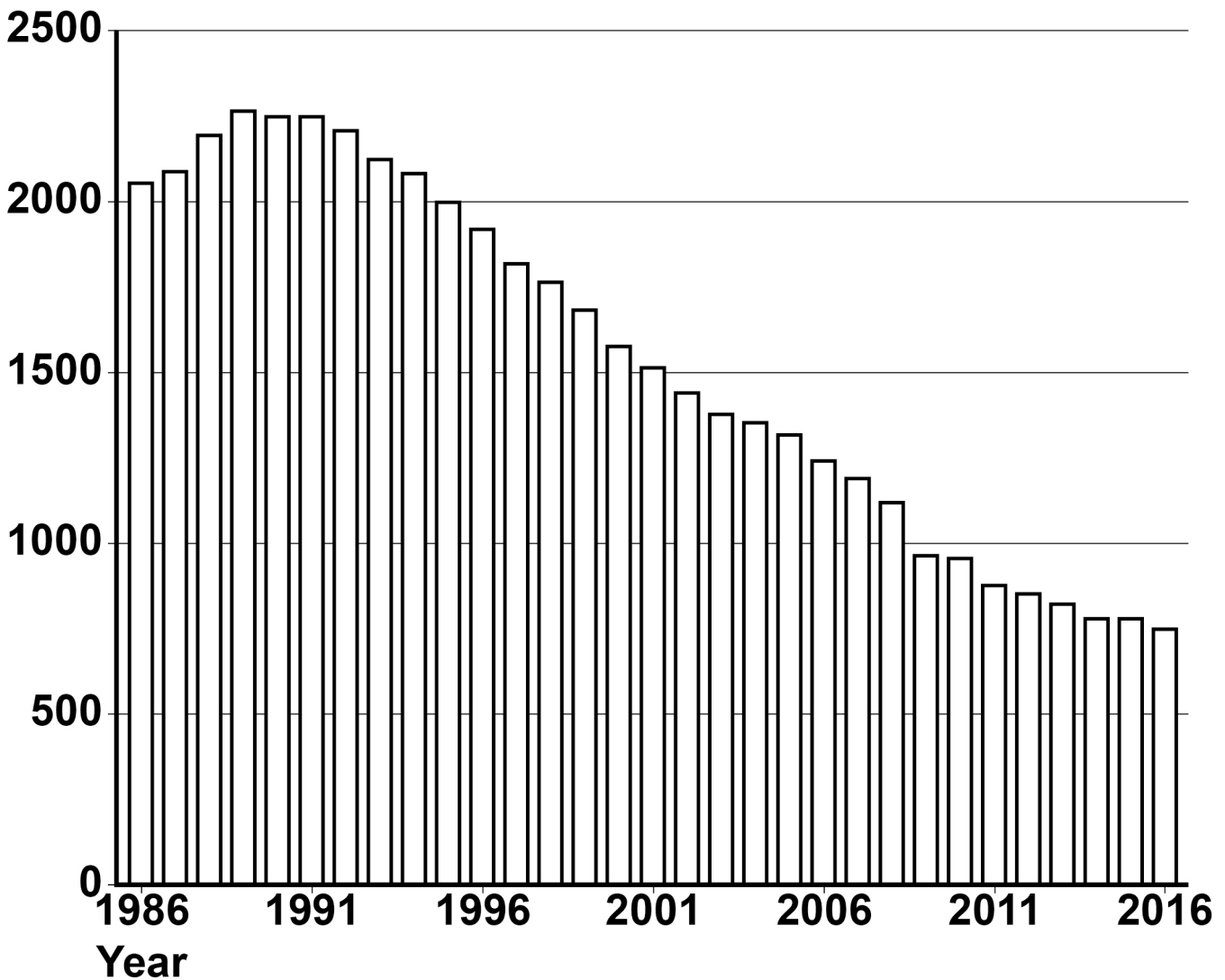
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**03.5** FIGURE 3 shows the mass of oxides of nitrogen produced from car engines from 1986 to 2016.

**FIGURE 3**

**Mass of  
oxides of  
nitrogen  
produced  
in arbitrary  
units**



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

**Increased** \_\_\_\_\_

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**Decreased** \_\_\_\_\_

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**[Turn over]**

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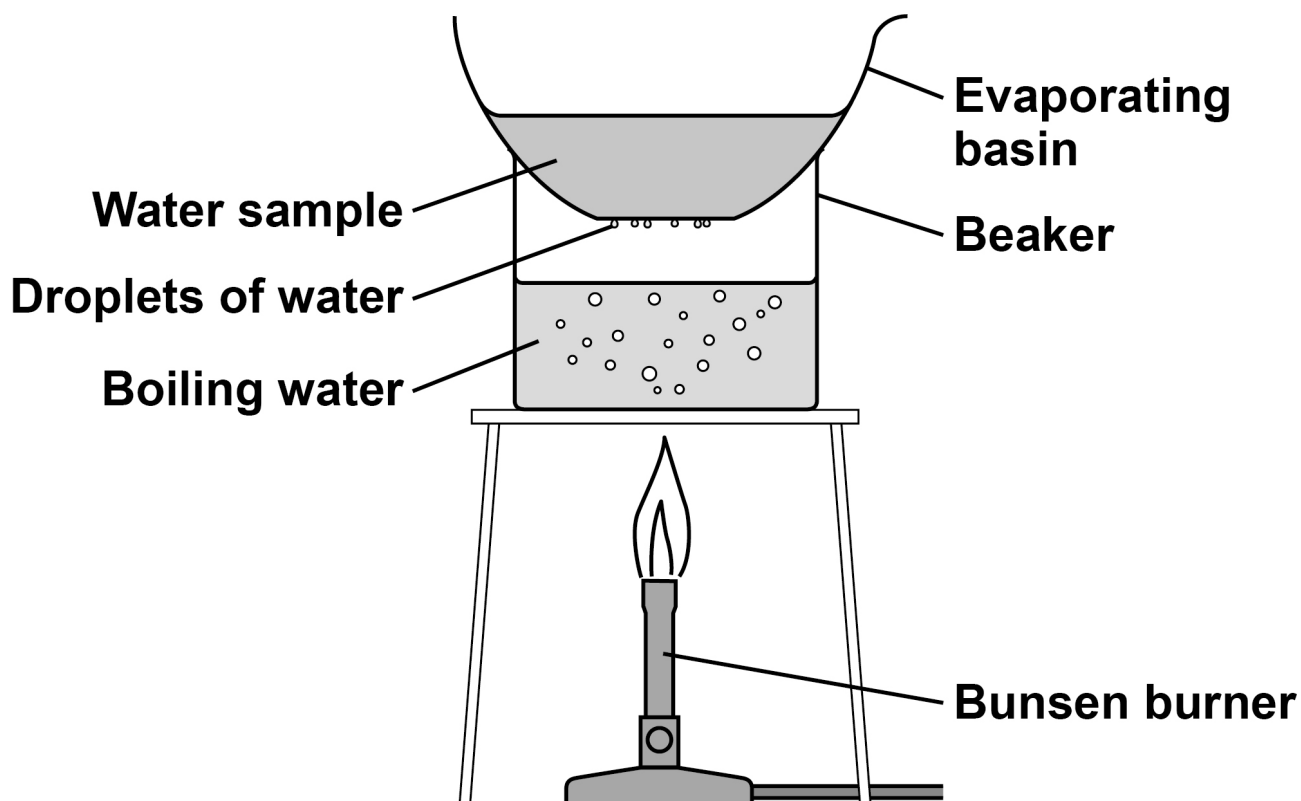


04

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  $25 \text{ cm}^3$  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.

**0 4 . 1** What type of variable is the mass of dissolved solids? [1 mark]

Tick (✓) ONE box.

**Categoric**

**Control**

**Dependent**

**Independent**

**[Turn over]**



**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, on the opposite page, 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]

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X = \_\_\_\_\_ g

[Turn over]



**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 \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**0 4 . 5** Water companies measure the volume of water used by households in cubic metres ( $\text{m}^3$ ).

25  $\text{cm}^3$  of a different water sample contained 0.016 g of dissolved solids.

Calculate the mass of dissolved solid in 1  $\text{m}^3$  of this water sample.

$$1 \text{ m}^3 = 1000 \text{ dm}^3$$

Give your answer in standard form. [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

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

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**0 5 . 4** Explain the trend in the boiling points of the alkanes. [3 marks]

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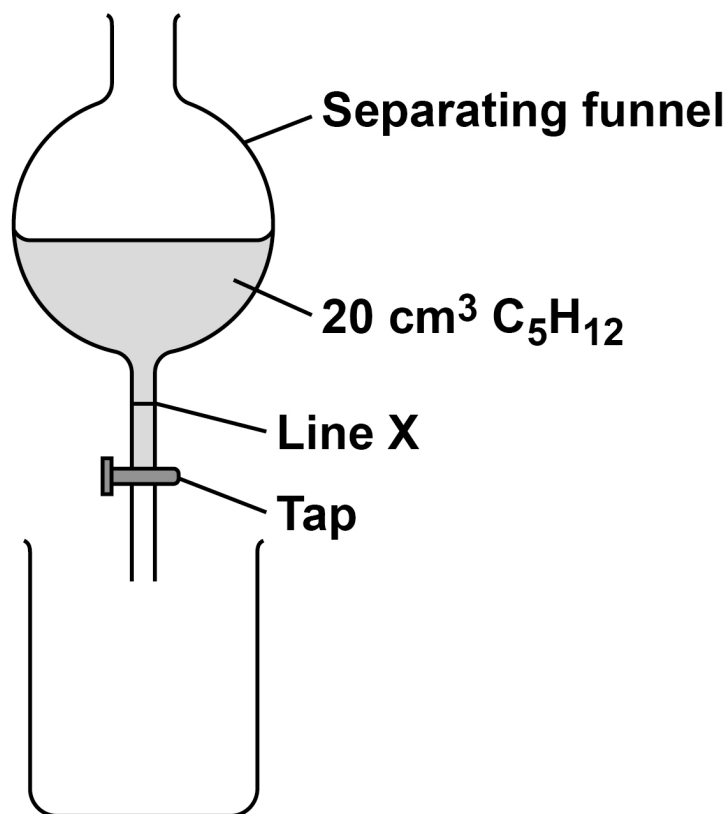
**05.5** A student investigated one property of the alkanes  $C_5H_{12}$ ,  $C_{10}H_{22}$  and  $C_{15}H_{32}$

This is the method used.

1. Pour  $20\text{ cm}^3$  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 shows the apparatus used.

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 \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

[Turn over]

13



**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**

**[Turn over]**



**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.**

**06.2** The mass of gas in Earth's atmosphere remains constant at  $5.15 \times 10^{18}$  kg

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

**Use FIGURE 6. [3 marks]**

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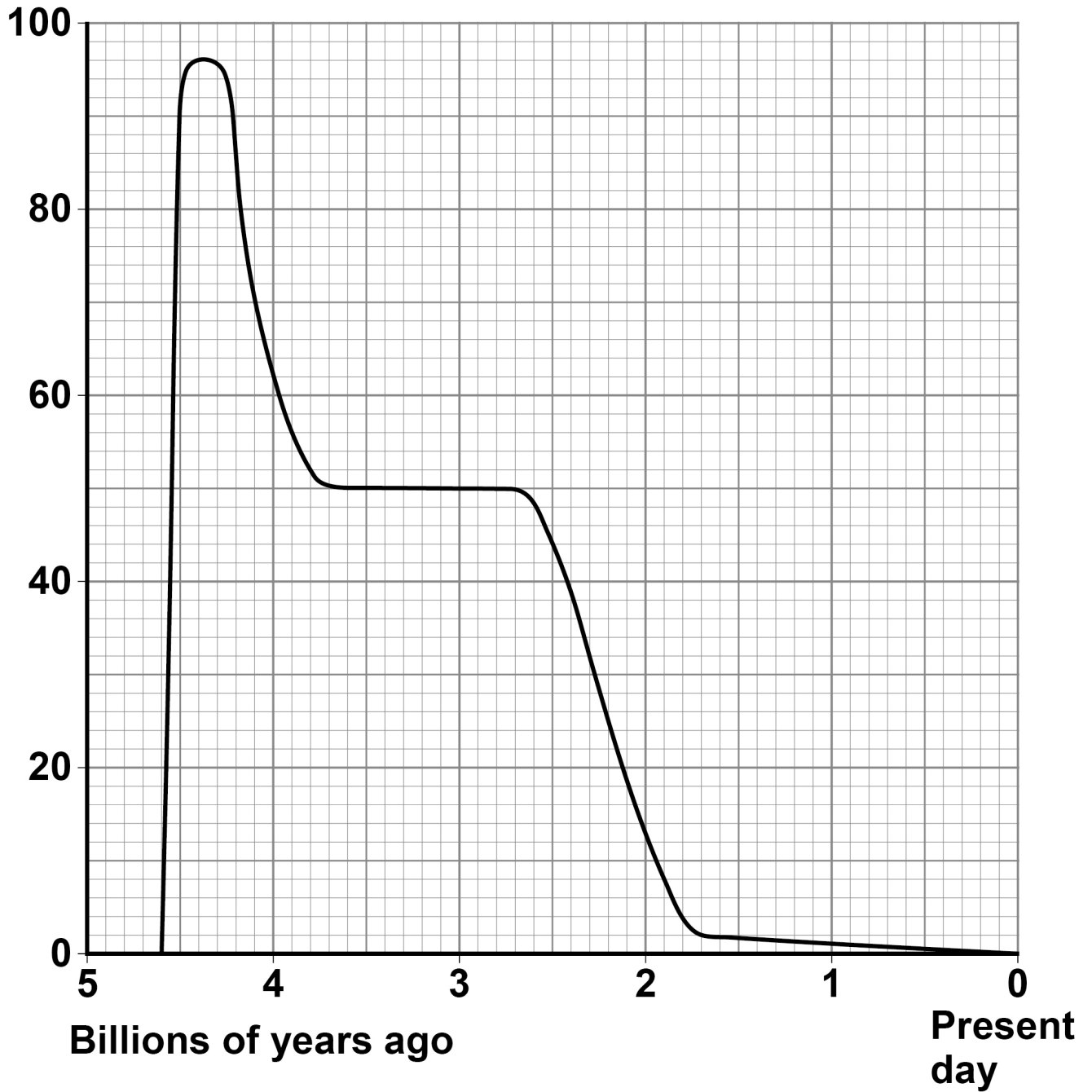
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**Mass of carbon dioxide = \_\_\_\_\_ kg**



FIGURE 6

Percentage of  
carbon dioxide  
in the Earth's  
atmosphere

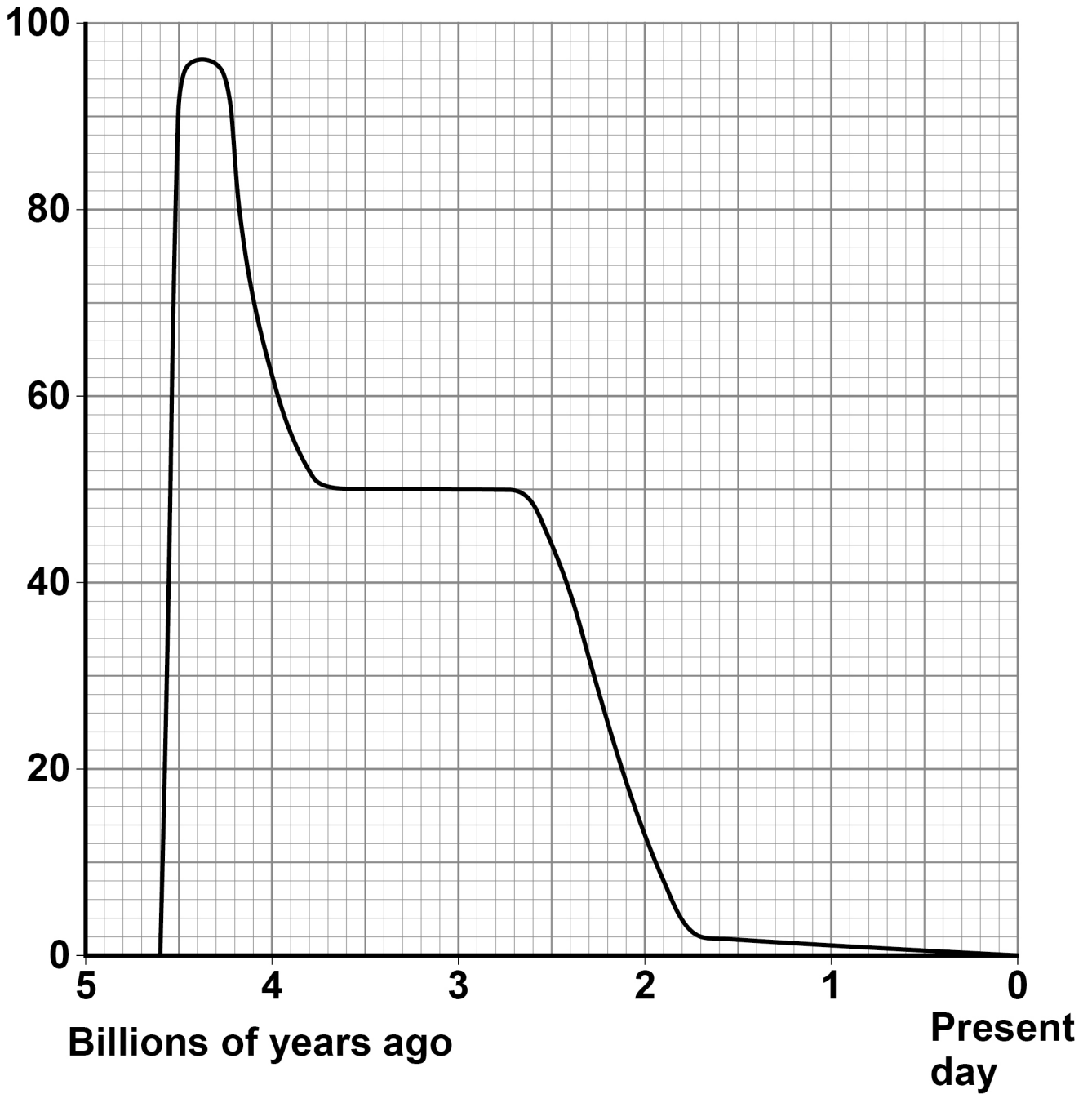


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## REPEAT OF FIGURE 6

Percentage of  
carbon dioxide  
in the Earth's  
atmosphere









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[Turn over]

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**07****This question is about equilibrium.****07.1****Describe how a reaction reaches equilibrium.  
[2 marks]**

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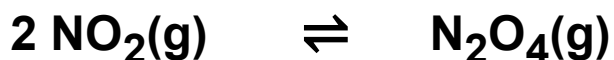
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Nitrogen dioxide gas reacts to form dinitrogen tetraoxide gas.

The reaction is reversible.

The equation for the reaction is:



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

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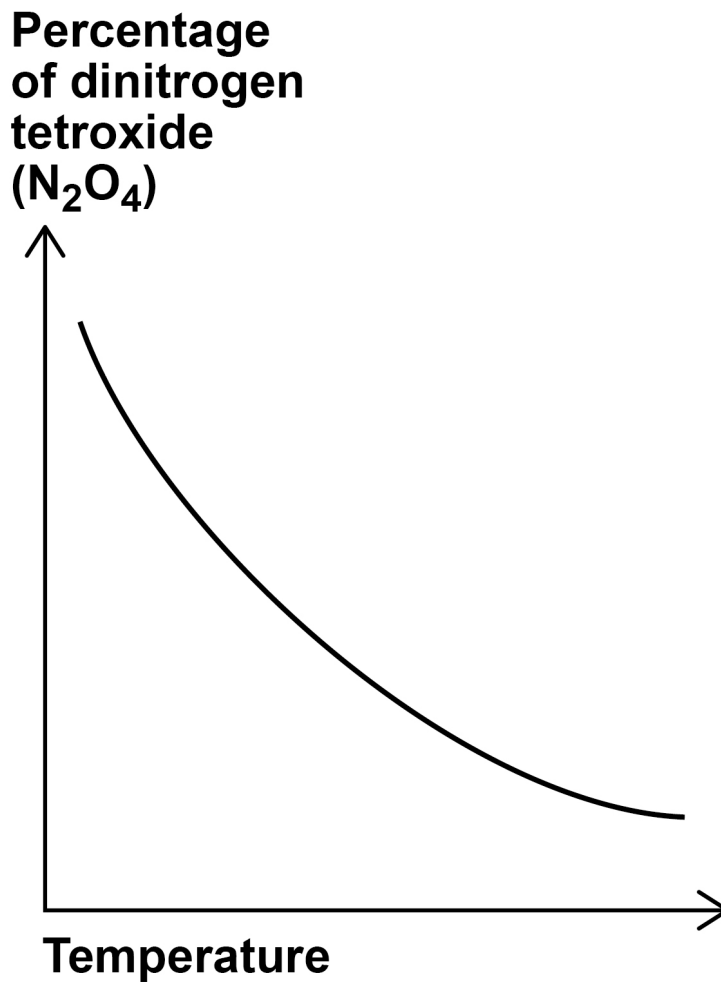
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**07.3** FIGURE 7 shows the change in the percentage of dinitrogen tetroxide ( $\text{N}_2\text{O}_4$ ) in the equilibrium mixture as the temperature of the equilibrium mixture is changed.

**FIGURE 7**



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

**Use FIGURE 7. [3 marks]**

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**END OF QUESTIONS**

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7



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Question	Mark
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<b>TOTAL</b>	

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