AQA

GCSE
COMBINED SCIENCE: TRILOGY

H

Higher Tier
Chemistry Paper 2H

Wednesday 10 June 2020   Morning   Time allowed: 1 hour 15 minutes

Materials

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.
- Fill in the boxes at the top of this page.
- 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.

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

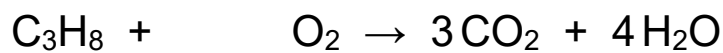**0 1** This question is about the Earth's resources.

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]

$$C_3H_8 \ + \ \underline{\hspace{2cm}} O_2 \ \rightarrow \ 3\,CO_2 \ + \ 4\,H_2O$$

0 1 . 2 Describe the test for carbon dioxide.
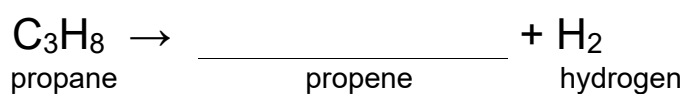
Give the result of the test.

[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]

$$C_3H_8 \ \rightarrow \ \underline{\hspace{3cm}} \ + \ H_2$$
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 _____

9

Turn over for the next question

Turn over ▶

0 2 Some students investigated the effect of temperature on the rate of reaction.
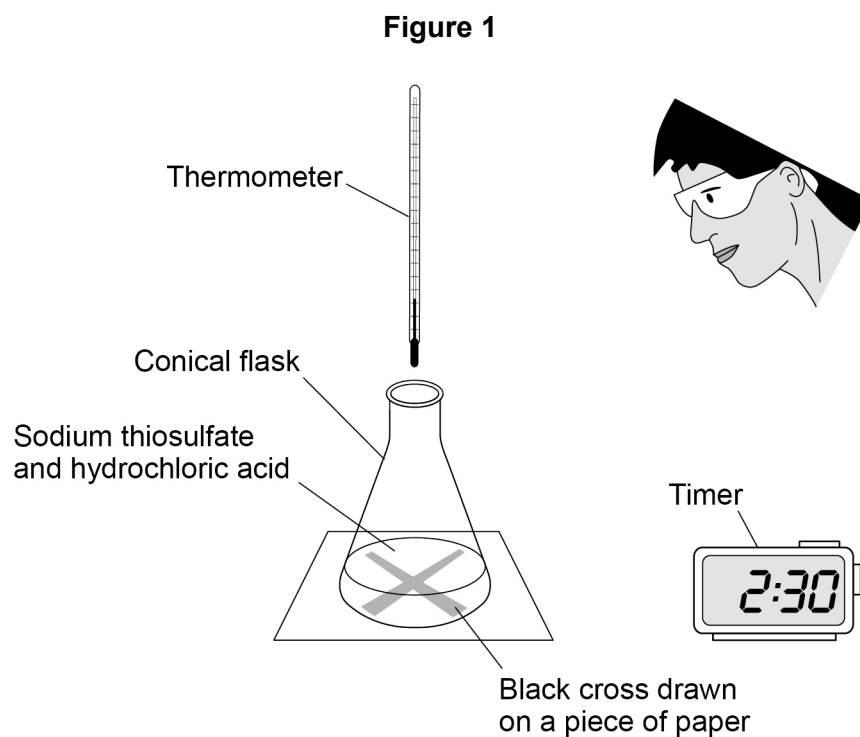
0 2 . 1 The students reacted sodium thiosulfate solution with hydrochloric acid.

This is the method used.

1. Use a beaker to measure 50 cm^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

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]

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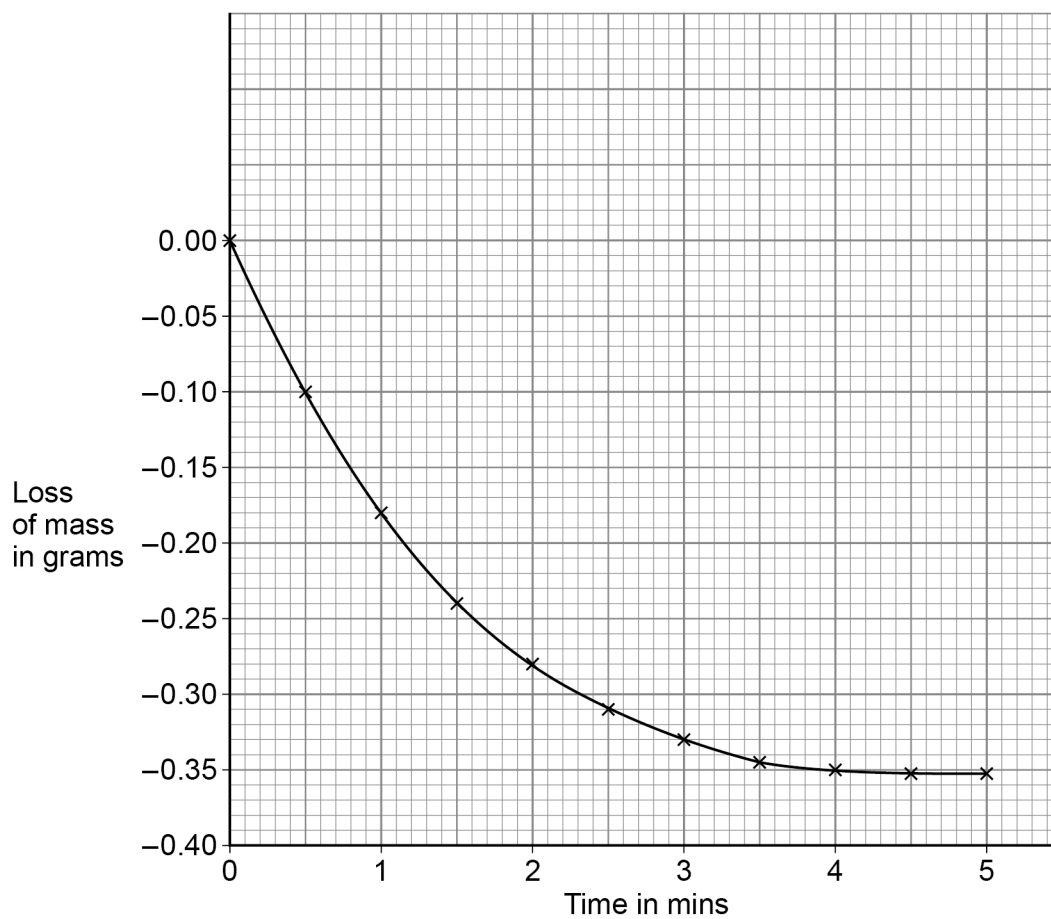
Turn over ▶

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 shows the results.

Figure 2

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

0 2 . 3 Draw a curve on **Figure 2** for the results you would expect at a temperature of 50 °C instead of 40 °C

[2 marks]

11

Turn over for the next question

Turn over ▶

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 ☐

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]

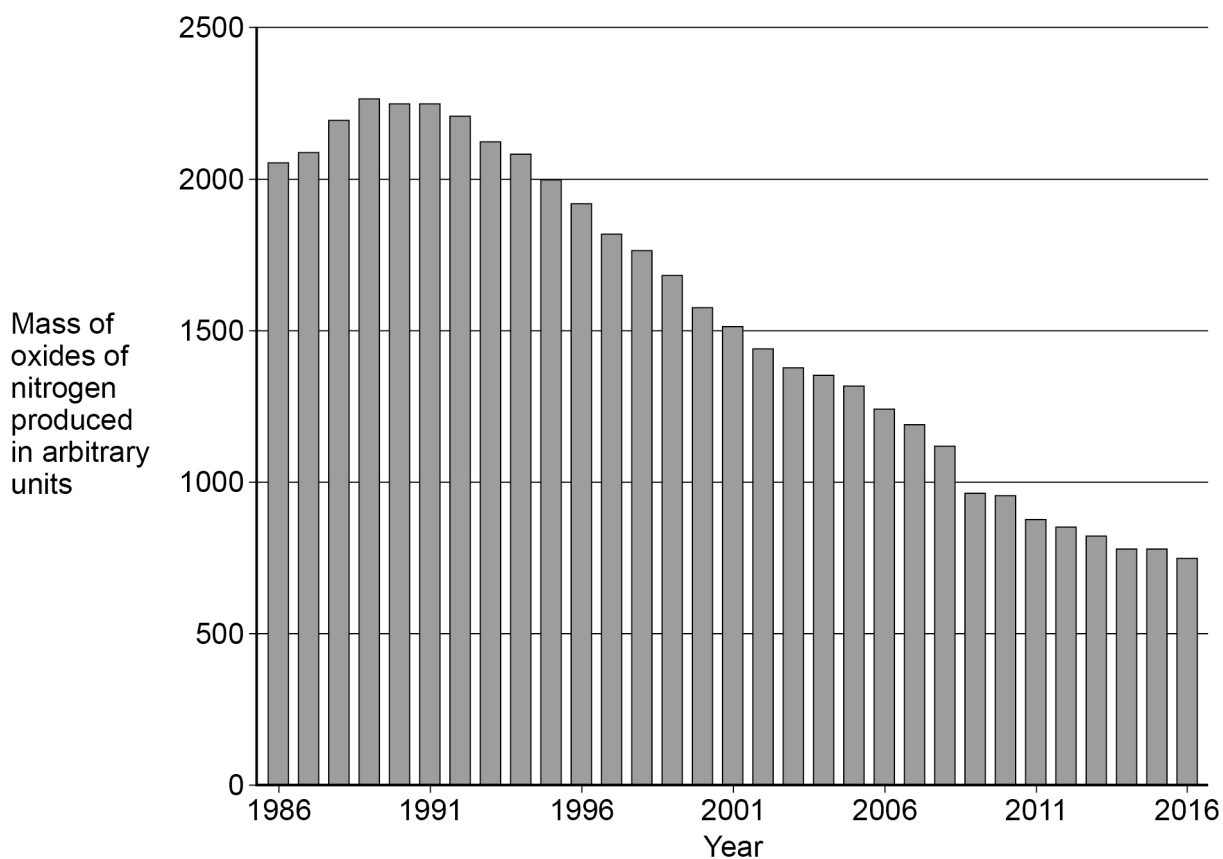Percentage decrease = _____ %

Question 3 continues on the next page

Turn over ▶

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

Figure 3

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

[2 marks]

Increased _____

_____

Decreased _____

_____

Turn over for the next question

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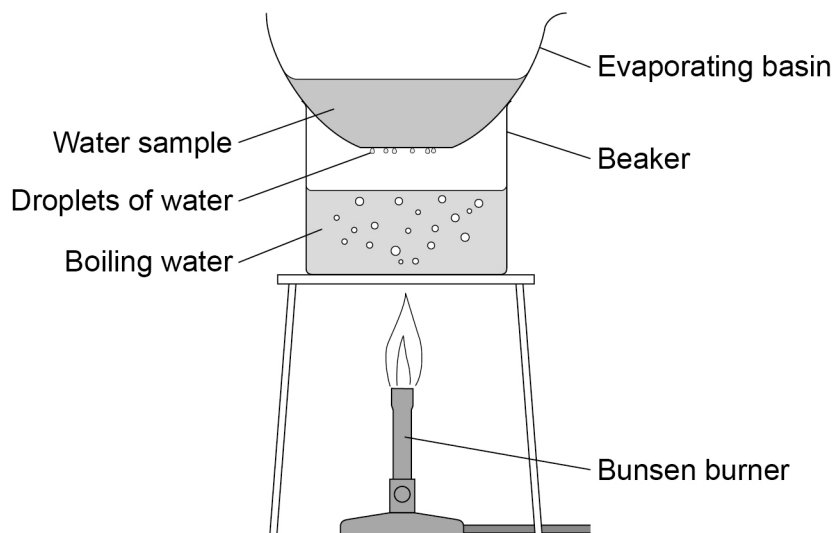ANSWER IN THE SPACES PROVIDED

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 cm³ 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 ☐

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 _____

_____

Question 4 continues on the next page

Turn over ▶

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

| 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 (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]

_____

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Mass (in standard form) = _____ g

11

Turn over for the next question

Turn over ▶

0 5 This question is about crude oil and alkanes.

0 5 . 1 Describe how crude oil is formed.

[3 marks]

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0 5 . 2 Describe how crude oil is separated into fractions by fractional distillation.

[4 marks]

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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]

Question 5 continues on the next page
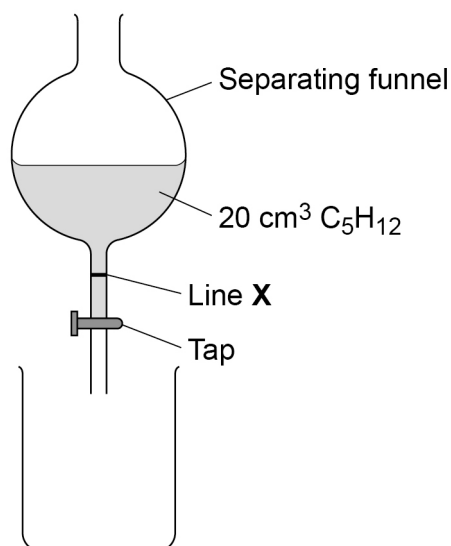
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| 0 5 | . | 5 | A student investigated one property of the alkanes C_5H_{12}, $C_{10}H_{22}$ and $C_{15}H_{32}$

This is the method used.

1. Pour 20 cm³ 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 _____

_____

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 ☐

Question 6 continues on the next page

Turn over ▶

Figure 6 shows how the percentage of carbon dioxide in the Earth's atmosphere has changed over 4.6 billion years.

Figure 6
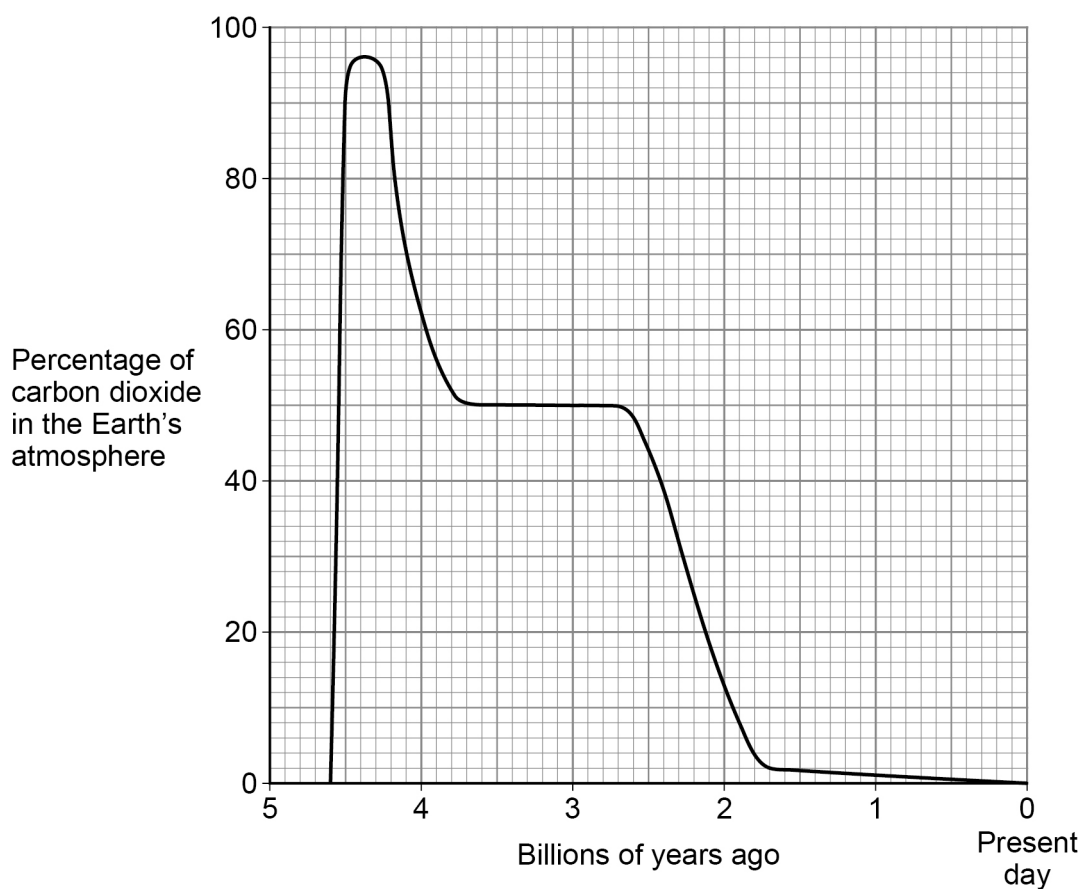
0 6 . 2 The mass of gas in Earth's atmosphere remains constant at 5.15×10^{18} kg

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

Use **Figure 6**.

[3 marks]

_____

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Mass of carbon dioxide = _____ kg

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]

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10

Turn over for the next question

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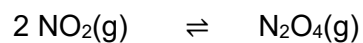**0 7** This question is about equilibrium.

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:

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

0 7 . 2 Explain the effect on the equilibrium position of increasing the pressure.
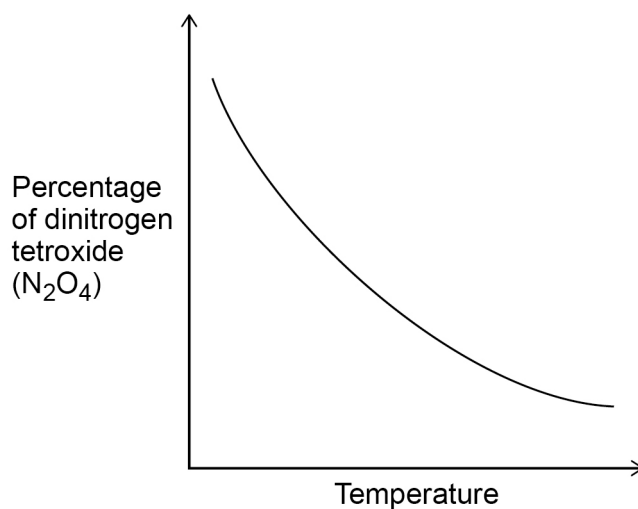
[2 marks]

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

Percentage of dinitrogen tetroxide (N_2O_4)

Temperature

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

Use **Figure 7**.

[3 marks]

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END OF QUESTIONS

7

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