

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

Forename(s)

Candidate signature

I declare this is my own work.

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 | |
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| 7 | |
| TOTAL | |



0 1

This question is about the Earth's resources.

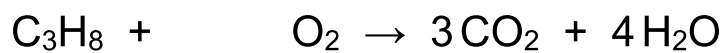
When most fuels burn carbon dioxide is produced.

Propane (C₃H₈) 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]



| | | | |
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| 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 |

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0 2

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

0 2 . 1

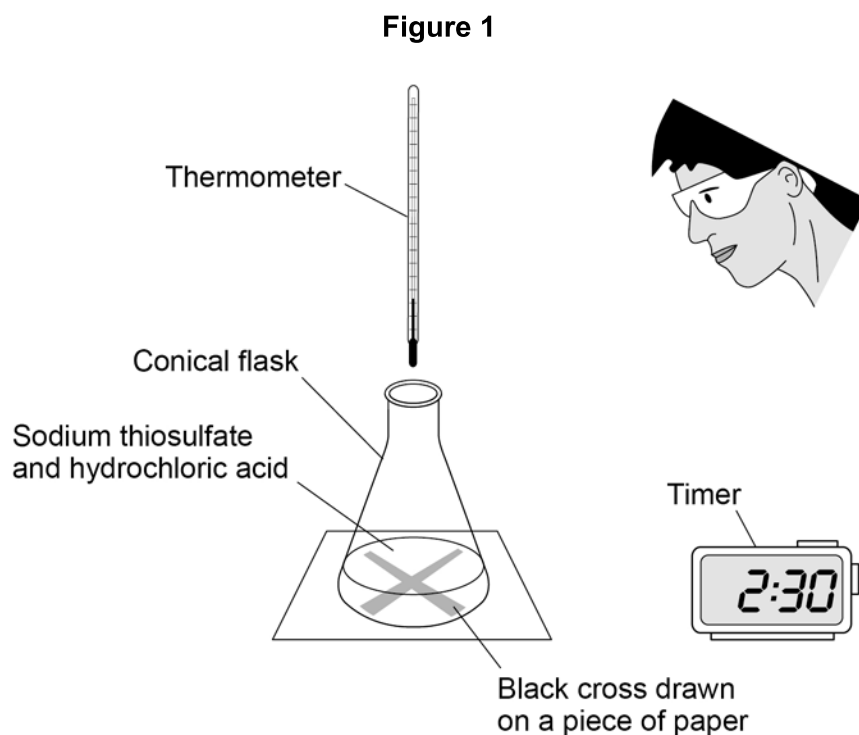
The students reacted sodium thiosulfate solution with hydrochloric acid.

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.

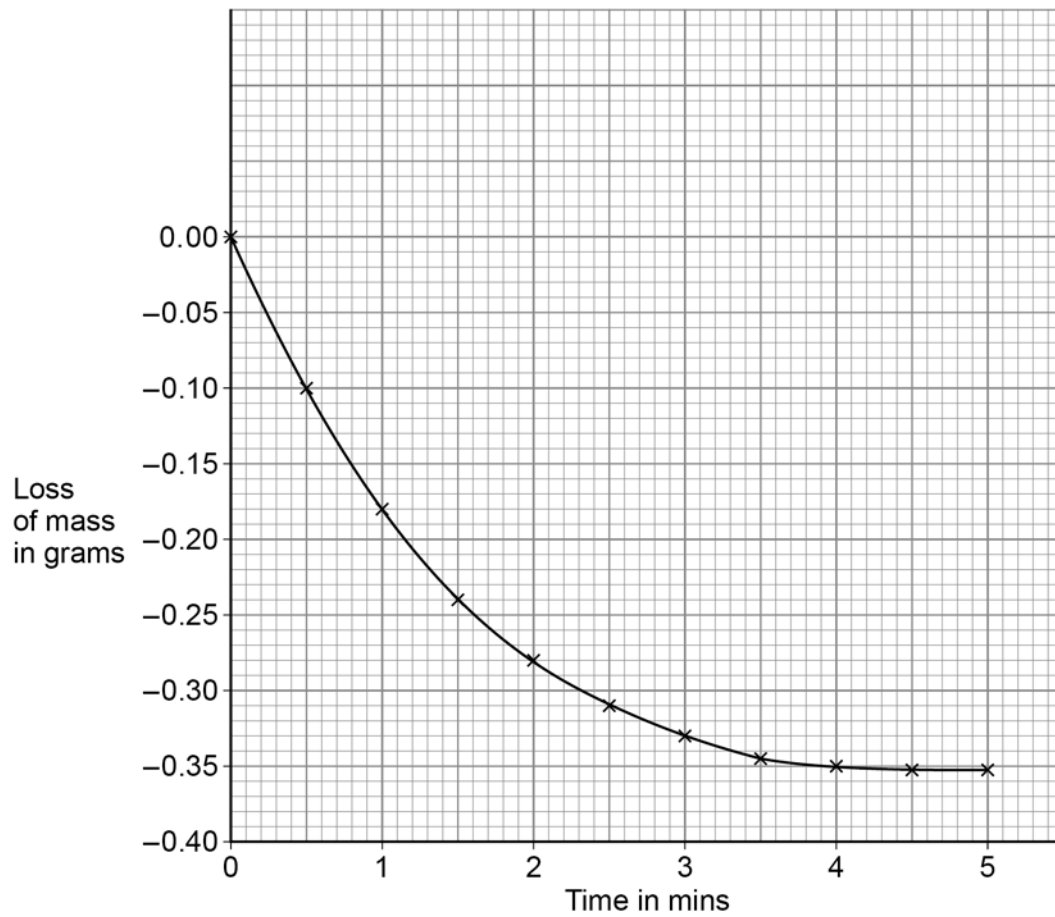


Some students investigated the effect of temperature on the rate of a different reaction.

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

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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

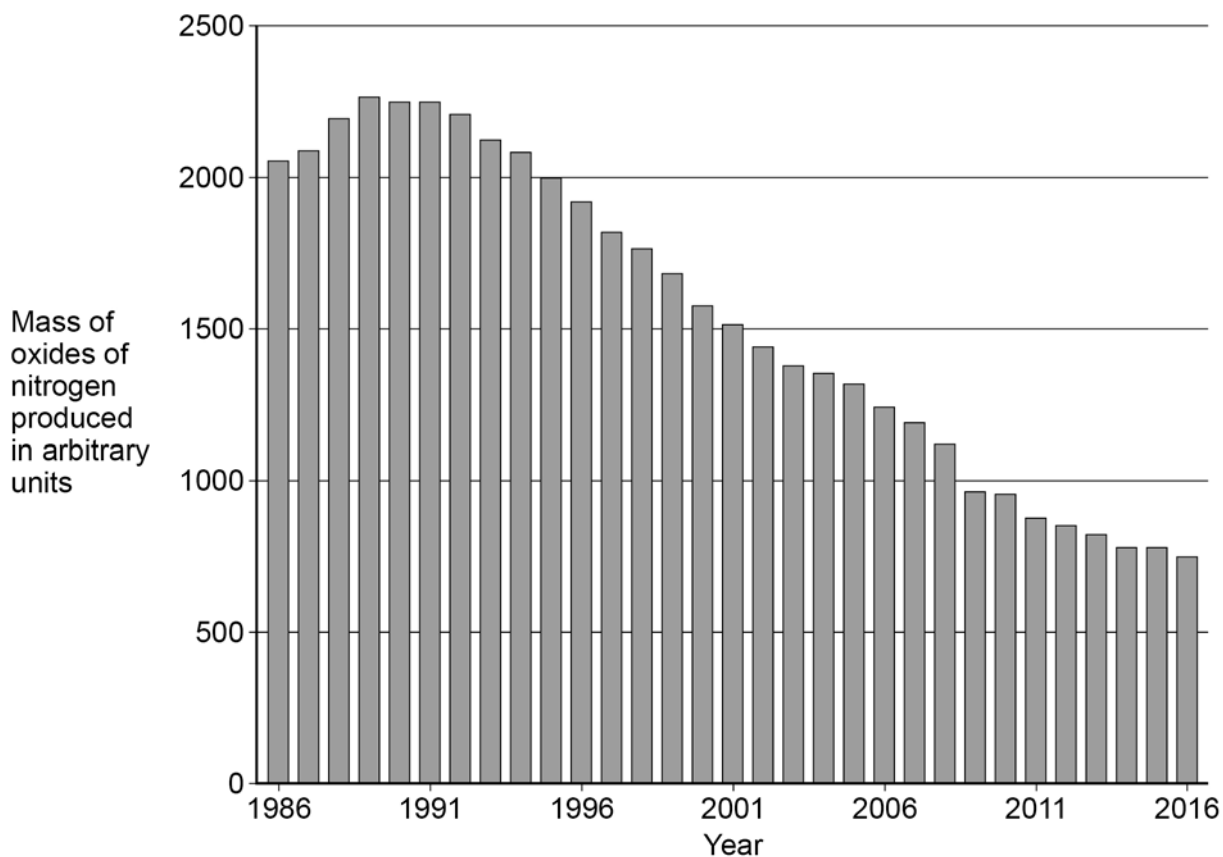
Give **one** problem oxides of nitrogen cause.

[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 _____

9



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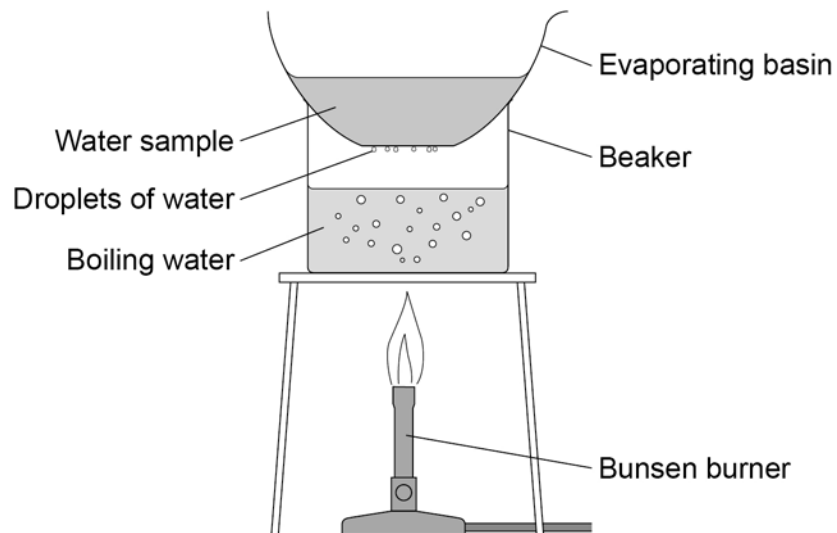


0 4

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.

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

Give your answer in standard form.

[4 marks]

Mass (in standard form) = _____ g

| |
|----|
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| 11 |

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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 ₅ H 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

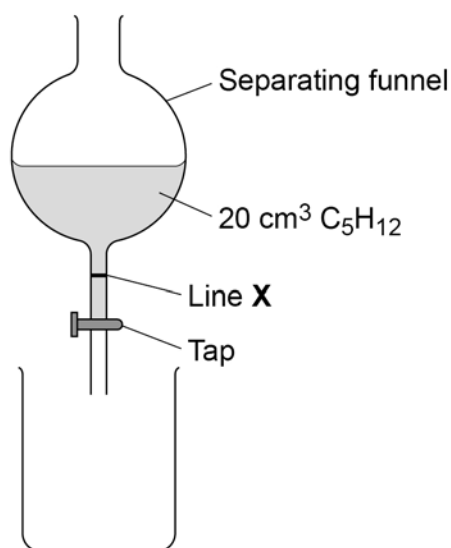
A student investigated one property of the alkanes C_5H_{12} , $C_{10}H_{22}$ and $C_{15}H_{32}$

This is the method used.

1. Pour 20 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 _____

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

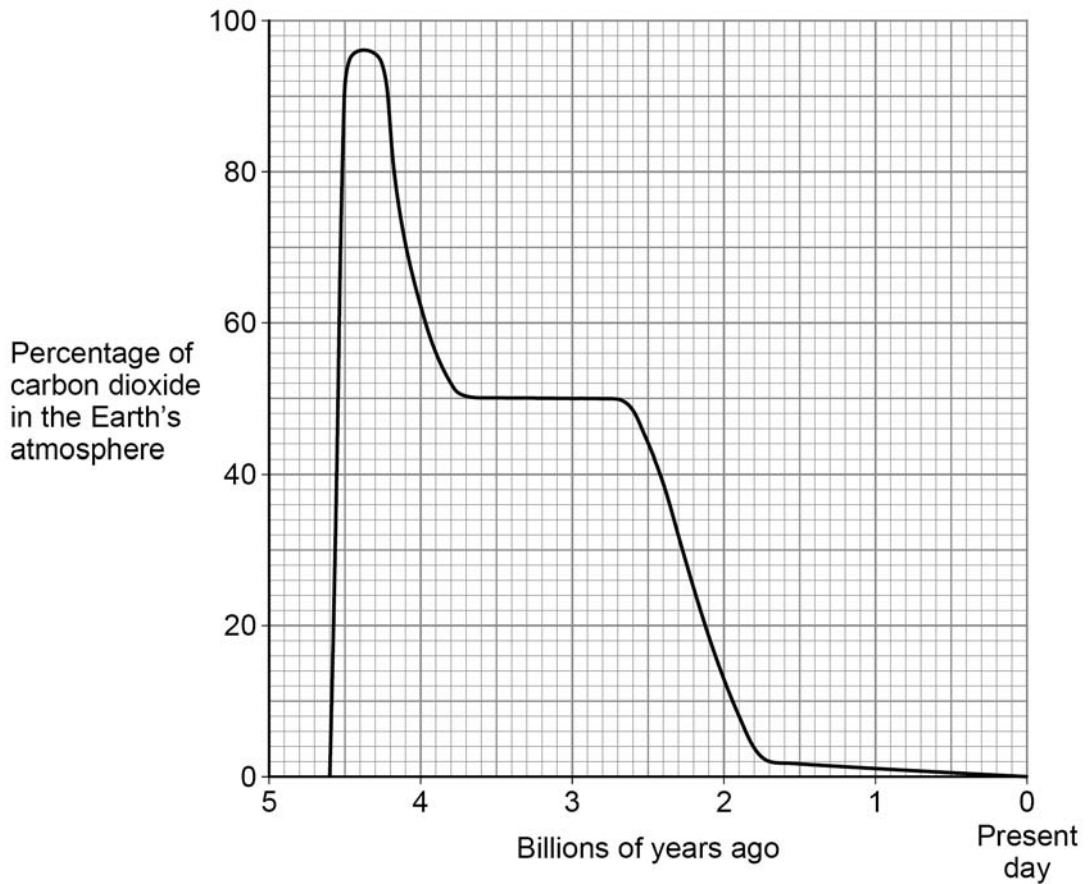
Question 6 continues on the next page

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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]

Mass of carbon dioxide = _____ kg



0 7

This question is about equilibrium.

0 7 . 1

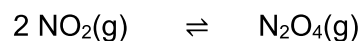
Describe how a reaction reaches equilibrium.

[2 marks]

Nitrogen dioxide gas reacts to form dinitrogen tetraoxide gas.

The reaction is reversible.

The equation for the reaction is:



0 7 . 2

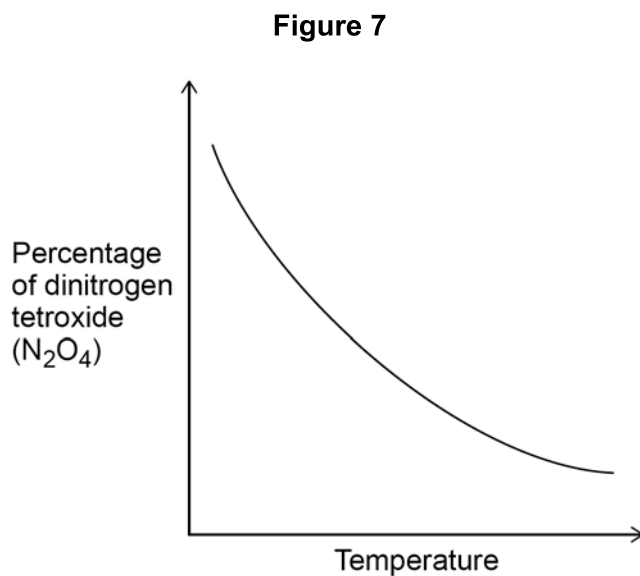
Explain the effect on the equilibrium position of increasing the pressure.

[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.



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

Use **Figure 7**.

[3 marks]

7

END OF QUESTIONS



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2 8



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