



Surname \_\_\_\_\_

Forename(s) \_\_\_\_\_

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**

Tuesday 11 June 2024

Morning

Time allowed: 1 hour 15 minutes

At the top of the page, write your surname and forename(s), your centre number, your candidate number and add your signature.

[Turn over]



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

**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.
- 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
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Alkanes and alkenes are hydrocarbons.

0	1	.	1
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Define the term 'hydrocarbon'. [1 mark]

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0	1	.	2
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The general formula for alkanes is  $C_nH_{2n+2}$

Determine the formula of the alkane with 10 carbon atoms. [1 mark]

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Formula = \_\_\_\_\_



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**[Turn over]**

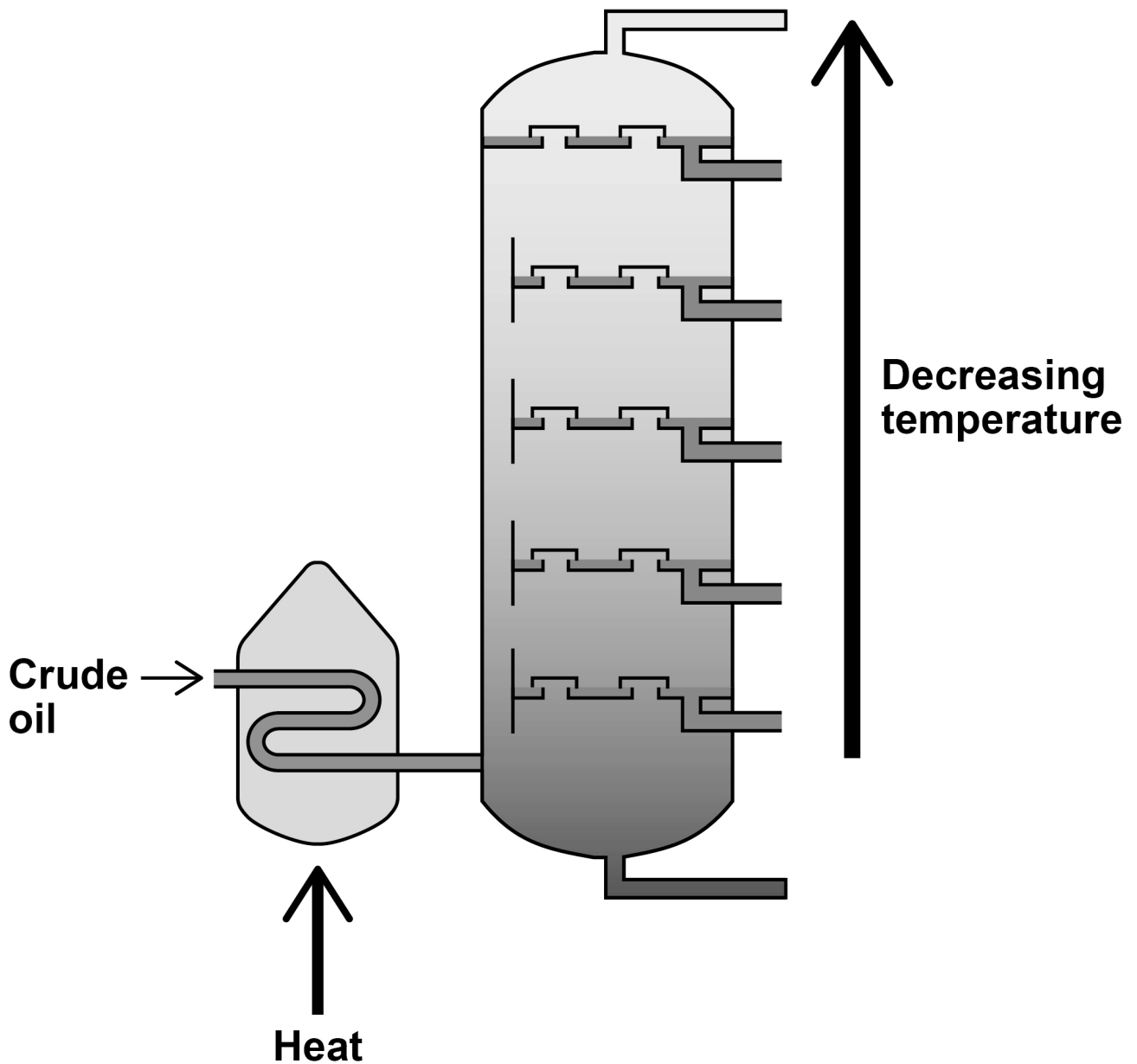


01.3

Crude oil is a mixture of hydrocarbons.

FIGURE 1 represents industrial equipment used to separate crude oil into fractions.

FIGURE 1

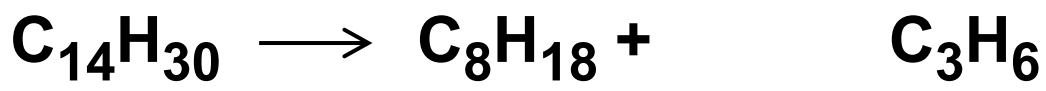




**01.4**

The alkane molecule  $C_{14}H_{30}$  can be cracked to produce smaller molecules.

Balance the equation for the reaction. [1 mark]



Propene ( $C_3H_6$ ) is an alkene.

**01.5**

Describe the test for alkenes.

Give the result. [2 marks]

Test \_\_\_\_\_

\_\_\_\_\_

Result \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

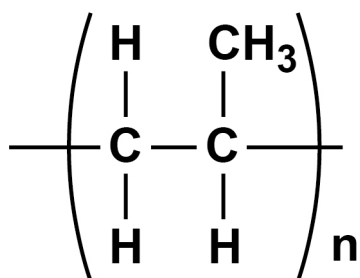


**01.6**

Poly(propene) is made from propene.

FIGURE 2 represents the repeating unit of poly(propene).

FIGURE 2



What type of substance is poly(propene)? [1 mark]

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[Turn over]

10



02

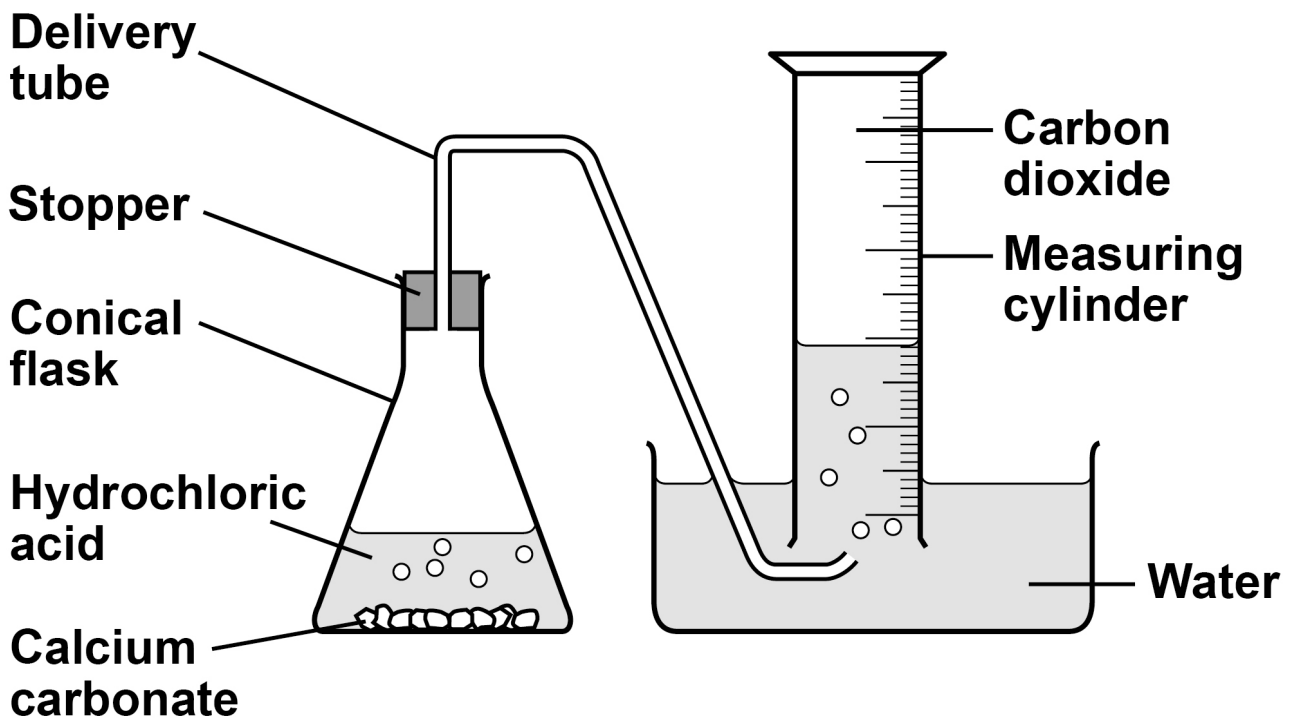
Some factors affect the rates of chemical reactions.

02.1

A student investigated the effect of changing the particle size of calcium carbonate on the rate of reaction with hydrochloric acid.

FIGURE 3 shows the apparatus.

FIGURE 3





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0 2 . 2

**The student investigated the effect of increasing the temperature on the rate of a reaction.**

**Explain the effect of increasing the temperature on the rate of a reaction.**

**Refer to particles and collisions in your answer.  
[3 marks]**

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**[Turn over]**



**Catalysts affect the rate of reactions.**

**0 2 . 3**

**What is meant by a 'catalyst'? [2 marks]**

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**0 2 . 4**

**What are catalysts in biological systems called?  
[1 mark]**

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**12**



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**[Turn over]**





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**Transport is a source of atmospheric pollutants.**

**0 3 . 2**

**Suggest how sulfur dioxide can be produced by transport. [2 marks]**

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**[Turn over]**



03.3

**Give TWO problems caused by sulfur dioxide as an atmospheric pollutant. [2 marks]**

1 \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

2 \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

03.4

**Describe how carbon monoxide can be produced by transport. [2 marks]**

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



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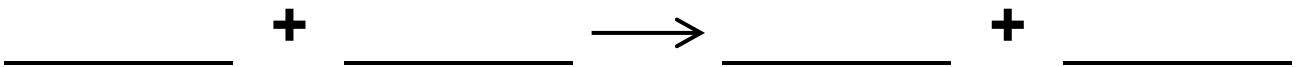
03.5

Catalytic converters are fitted to car exhausts to reduce the amount of pollution from cars.

Carbon monoxide and nitrogen dioxide (NO<sub>2</sub>) react in a catalytic converter.

Nitrogen and carbon dioxide are produced.

Write a balanced equation for the reaction. [2 marks]



[Turn over]

12



0	4
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Printer ink is a mixture of chemicals.

A student used chromatography to investigate the colours in a printer ink.

The student put a spot of the printer ink on the start line.

FIGURE 4, on the opposite page, shows the results.

0	4	.	1
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Explain why the red colour did NOT move from the start line. [2 marks]

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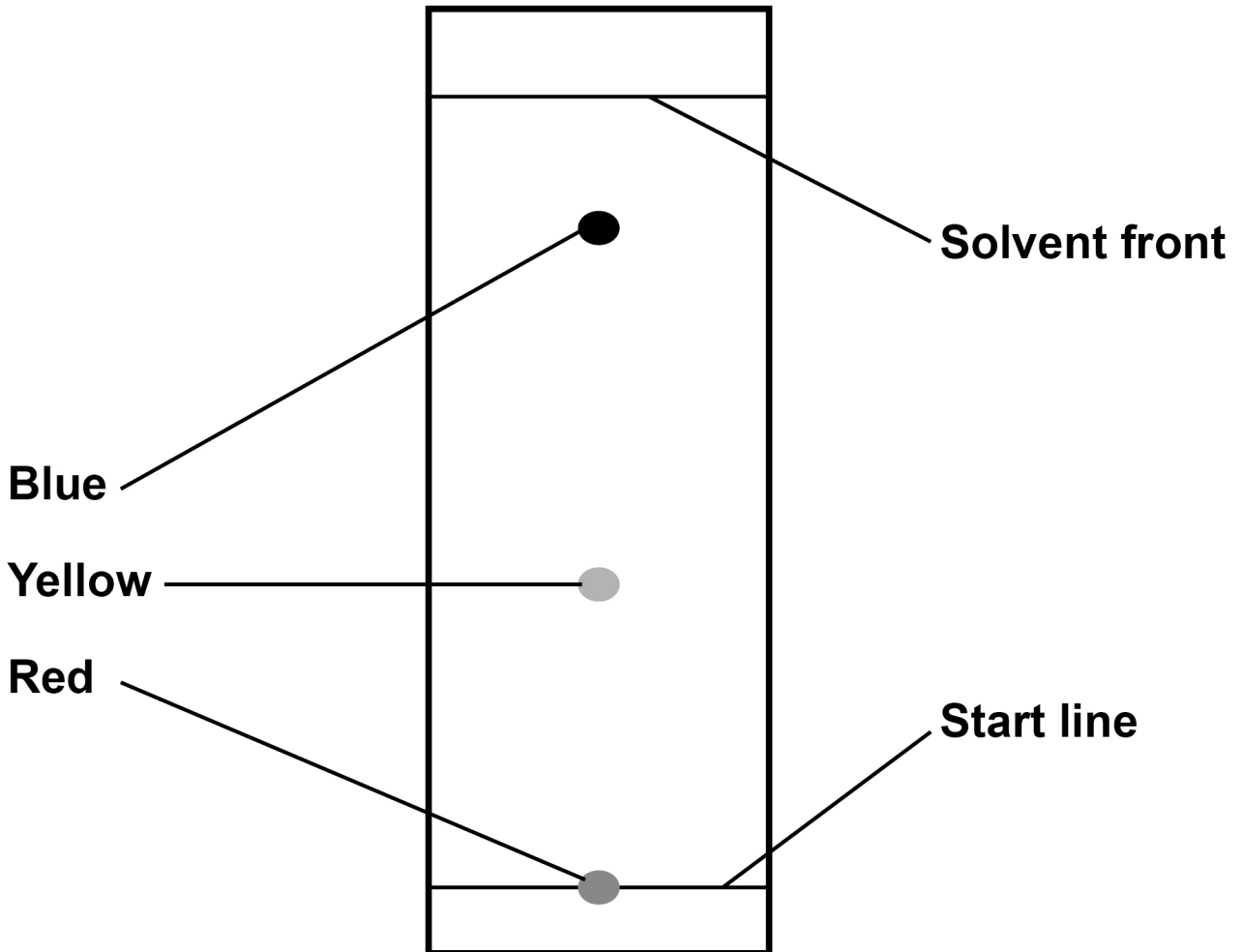
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**FIGURE 4**

**This figure is NOT drawn to scale.**



**[Turn over]**





There were four colours in the printer ink.

0 4 . 3

Suggest ONE reason why only three colours were visible on the chromatogram. [1 mark]

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0 4 . 4

Suggest how the student could use chromatography to show there were four colours in the printer ink. [1 mark]

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[Turn over]

8

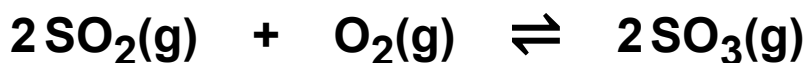


0	5
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Sulfuric acid is produced by an industrial process.

In the process, sulfur dioxide (SO<sub>2</sub>) reacts with oxygen (O<sub>2</sub>) to produce sulfur trioxide (SO<sub>3</sub>).

The equation for the reversible reaction is:



The forward reaction releases 198 kJ/mol of energy.

0	5	.	1
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What is the amount of energy transferred during the reverse reaction? [1 mark]

Tick (✓) ONE box.

< 198 kJ/mol

= 198 kJ/mol

> 198 kJ/mol



05.2

The concentration of oxygen is increased.

What is the effect on the position of the equilibrium?  
[1 mark]

Tick (✓) ONE box.

Equilibrium position shifts to the left

Equilibrium position does not change

Equilibrium position shifts to the right

[Turn over]



**05.3**

The pressure is decreased.

What is the effect on the position of the equilibrium?  
[1 mark]

Tick (✓) ONE box.

Equilibrium position shifts to the left

Equilibrium position does not change

Equilibrium position shifts to the right



0	5	.	4
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The temperature is increased.

What is the effect on the position of the equilibrium?  
[1 mark]

Tick (✓) ONE box.

Equilibrium position shifts to the left

Equilibrium position does not change

Equilibrium position shifts to the right

[Turn over]



0	5	.	5
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A catalyst is used in the reaction.

Suggest what effect the catalyst has on the position of the equilibrium.

Give ONE reason for your answer. [2 marks]

Effect \_\_\_\_\_

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Reason \_\_\_\_\_

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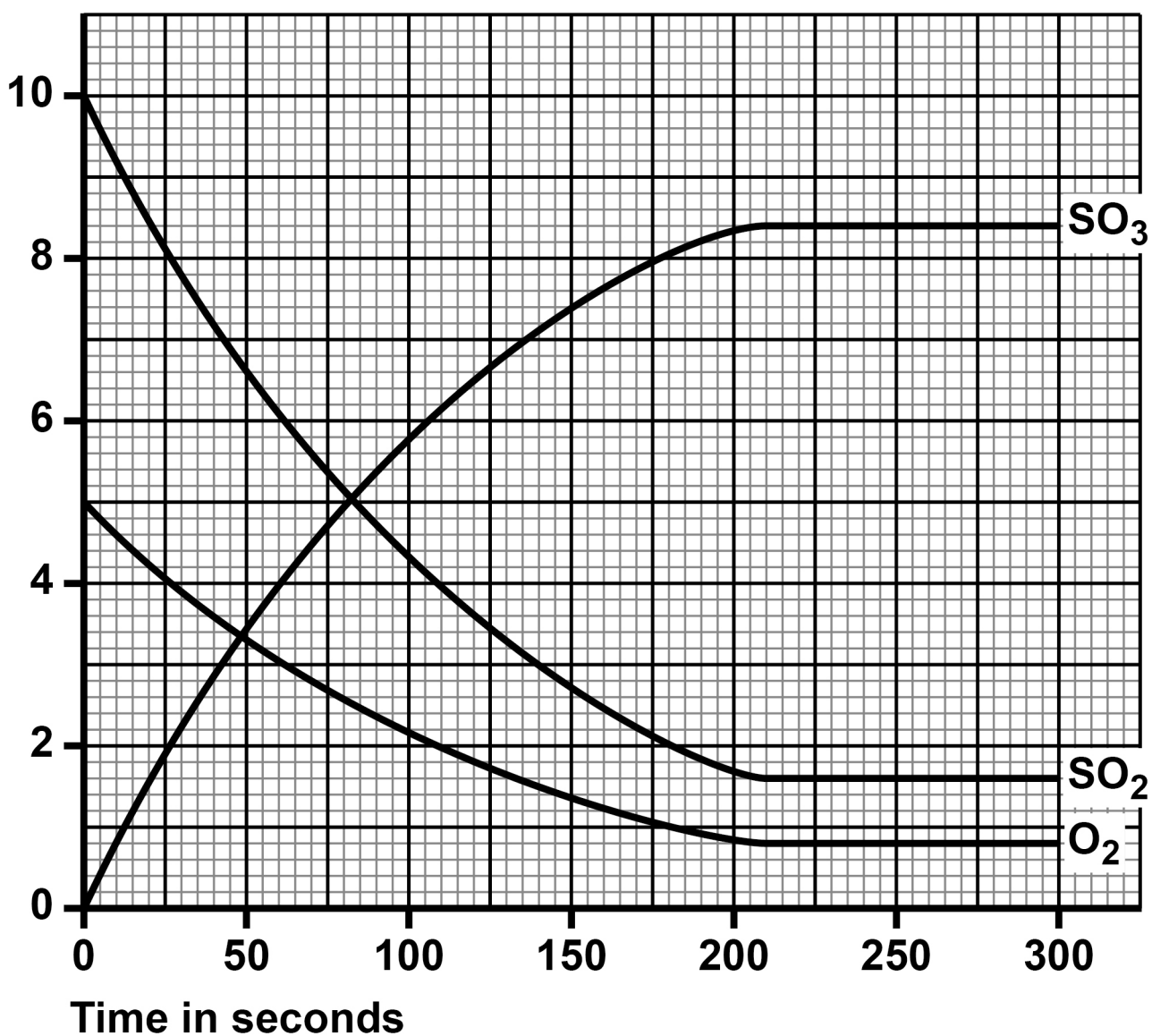


A scientist measured how the number of moles of sulfur dioxide, oxygen and sulfur trioxide varied with time during the reaction.

FIGURE 5 shows the results.

FIGURE 5

Number  
of moles



0	5	.	6
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Determine the time taken for the reaction to reach equilibrium.

Explain your answer.

Use FIGURE 5. [3 marks]

Time \_\_\_\_\_ s

Explanation \_\_\_\_\_

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[Turn over]

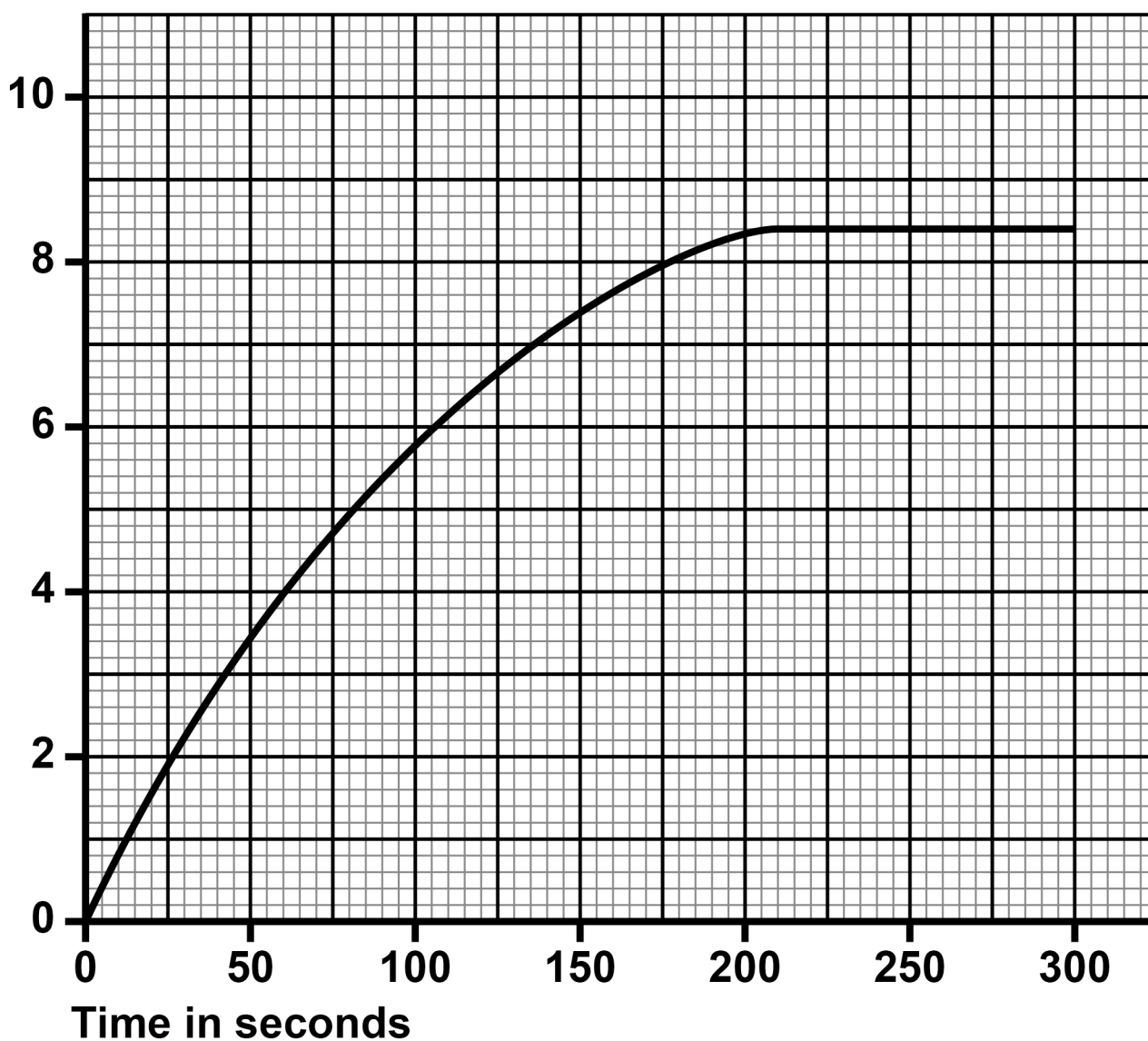


05.7

FIGURE 6 shows the results for sulfur trioxide.

FIGURE 6

Number  
of moles  
of sulfur  
trioxide





0	6
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The Earth's natural resources are used to manufacture useful products.

One useful product is potable water.

Potable water can be produced from sea water by distillation.

0	6	.	1
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Give **ONE DISADVANTAGE** of using distillation to produce potable water. [1 mark]

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06.2

**Describe ONE other method to produce potable water from sea water. [2 marks]**

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**[Turn over]**



A student investigated the mass of dissolved solids in a  $100 \text{ cm}^3$  sample of sea water.

This is the method used.

1. Weigh an evaporating basin.
2. Measure  $100 \text{ cm}^3$  of sea water.
3. Pour the sea water into the evaporating basin.
4. Heat the evaporating basin.
5. Weigh the evaporating basin and contents.
6. Calculate the mass of dissolved solids in the sea water.

0 6 . 3

Explain how repeating steps 4 and 5 would improve this method. [2 marks]

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0 6 . 4

The total mass of dissolved solids in a  $100 \text{ cm}^3$  sample of sea water is 3.50 g.

The percentage of sodium chloride in the dissolved solids is 77.8%.

Calculate the mass of sodium chloride dissolved in the  $100 \text{ cm}^3$  sample of sea water. [2 marks]

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Mass of sodium chloride = \_\_\_\_\_ g

[Turn over]



**Biological methods are used to extract metal compounds from metal ores.**

**06.5**

**One method of producing copper from low-grade copper ores is by using bacteria.**

**The bacteria produce leachate solutions that contain copper compounds.**

**Give TWO methods that can be used to extract copper from these leachate solutions. [2 marks]**

**1**

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**2**

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0	6	.	7
---	---	---	---

Nickel is produced by phytomining.

One hectare of plants produces 215 kg of nickel.

Determine the area required to produce 750 kg of nickel.

Give your answer in m<sup>2</sup>.

One hectare = 10 000 m<sup>2</sup>

[3 marks]

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Area required = \_\_\_\_\_ m<sup>2</sup>

END OF QUESTIONS

15









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For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
<b>TOTAL</b>	

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