



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

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]



For this paper you must have:

- **a ruler**
- **a scientific calculator**
- **the periodic table (enclosed).**

INSTRUCTIONS

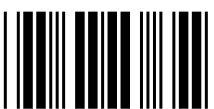
- **Use black ink or black ball-point pen.**
- **Pencil should only be used for drawing.**
- **Answer ALL questions in the spaces provided.**
- **If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).**
- **Do all rough 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



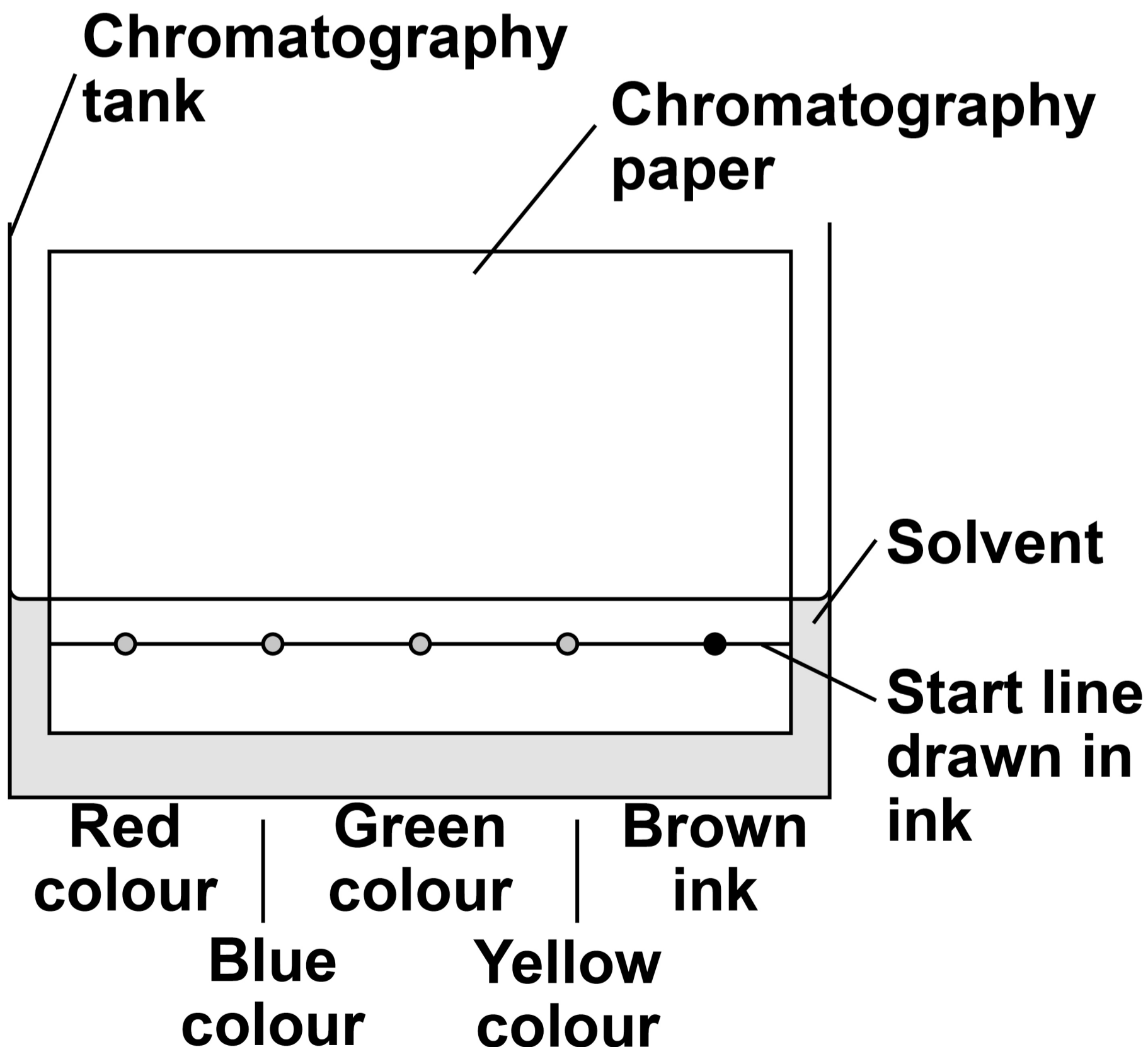
01

A student investigated the colours in a brown ink using chromatography.

01.1

FIGURE 1 shows the apparatus used.

FIGURE 1



Give TWO errors made by the student.

Describe the problem each error would cause. [4 marks]

Error 1 _____

Problem 1 _____

Error 2 _____

Problem 2 _____

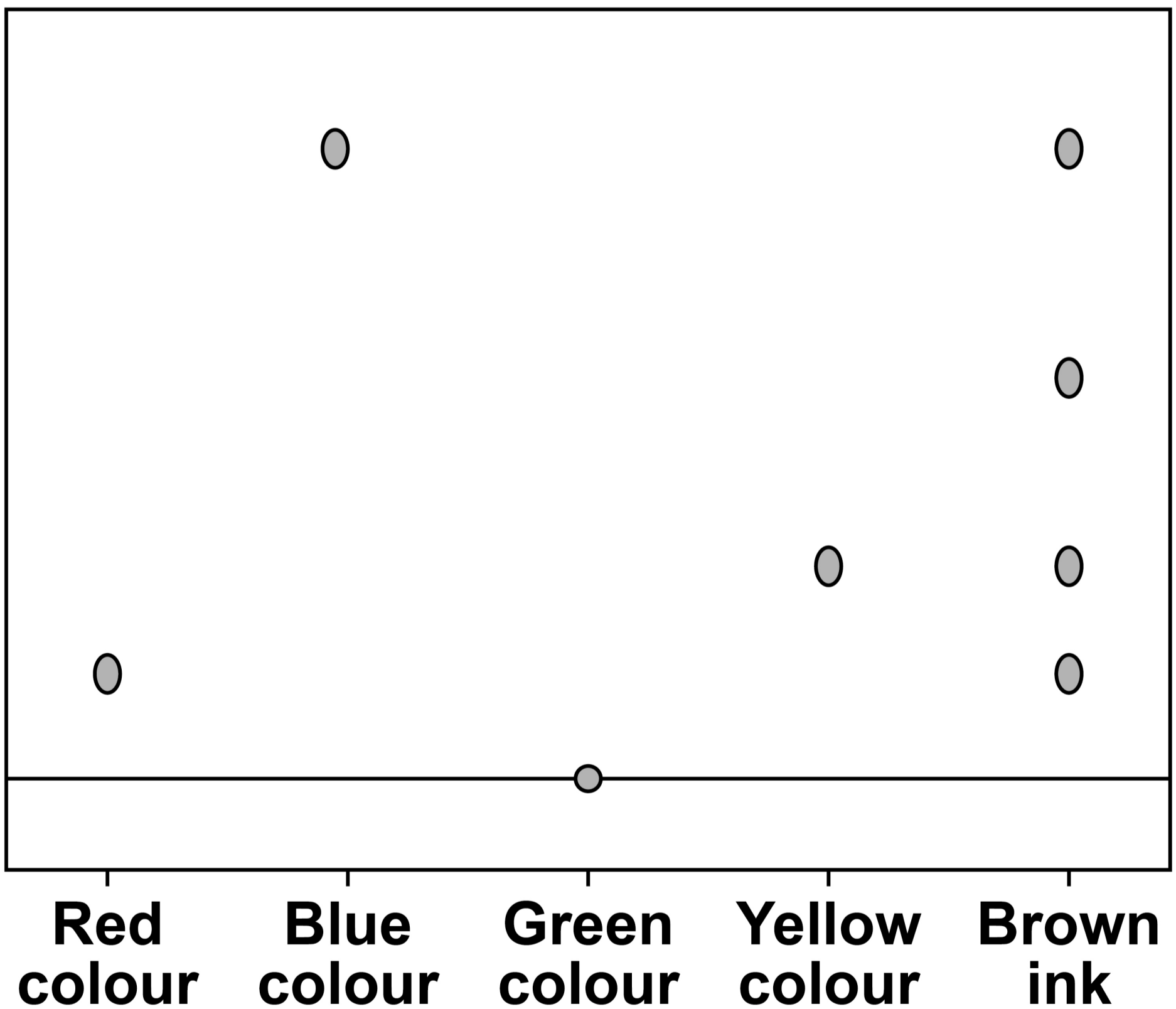
[Turn over]



A different student set up the apparatus correctly.

FIGURE 2 shows the results.

FIGURE 2



01.2

Give TWO conclusions the student can make from FIGURE 2 about the four colours in the brown ink. [2 marks]

1 _____

2 _____

[Turn over]



0	1	.	3
---	---	---	---

**Why was the green colour still on the start line at the end of the experiment?
[1 mark]**

Tick (✓) ONE box.

The experiment was left for too long.

The green colour was insoluble in the solvent.

The green spot contained too many colours.

The green spot was too small.



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[Turn over]



0 1 . 4

A student calculated the R_f value of a colour to be 0.24

The colour moved 1.8 cm from the start line.

Calculate the distance the solvent moved.

Use the equation:

$$R_f = \frac{\text{distance moved by colour}}{\text{distance moved by solvent}}$$

[3 marks]



Distance moved by solvent = _____ cm

[Turn over]

<hr/>
10



02.1

Water that is safe to drink is called potable water.

Compare how easily potable water can be obtained from:

- waste water (sewage)**
- ground water (fresh water).**

[6 marks]



[Turn over]



A scientist produced potable water from 150 cm³ of salty water.

0 2 . 2

Which process can be used to produce potable water from salty water? [1 mark]

Tick (✓) ONE box.

Distillation

Electrolysis

Filtration

Sterilisation



0 2 . 3

The salty water contains sodium chloride.

The scientist collected 2.40 g of sodium chloride from 150 cm³ of salty water.

**Calculate the concentration of sodium chloride in grams per dm³
[3 marks]**

[Turn over]



Concentration of sodium chloride =
_____ g/dm³

10



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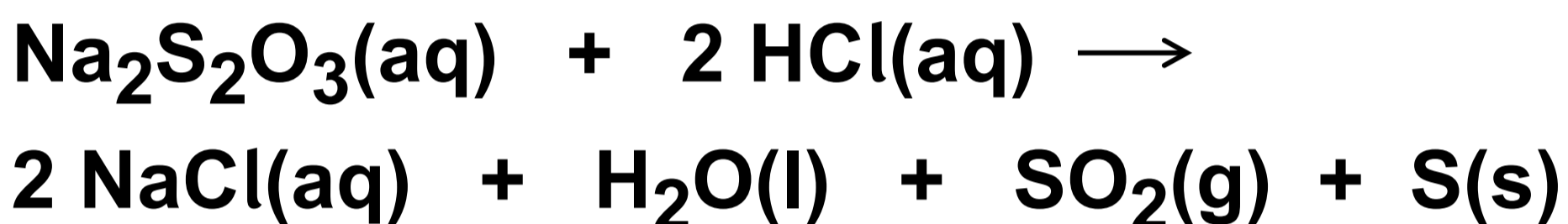
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0	3
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This question is about the reaction between sodium thiosulfate solution and hydrochloric acid.

The equation for the reaction is:



0	3	.	1
---	---	---	---

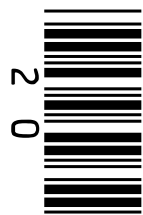
The mass of the conical flask and contents was greater at the start of the reaction than at the end.

Explain why. [2 marks]



[Turn over]



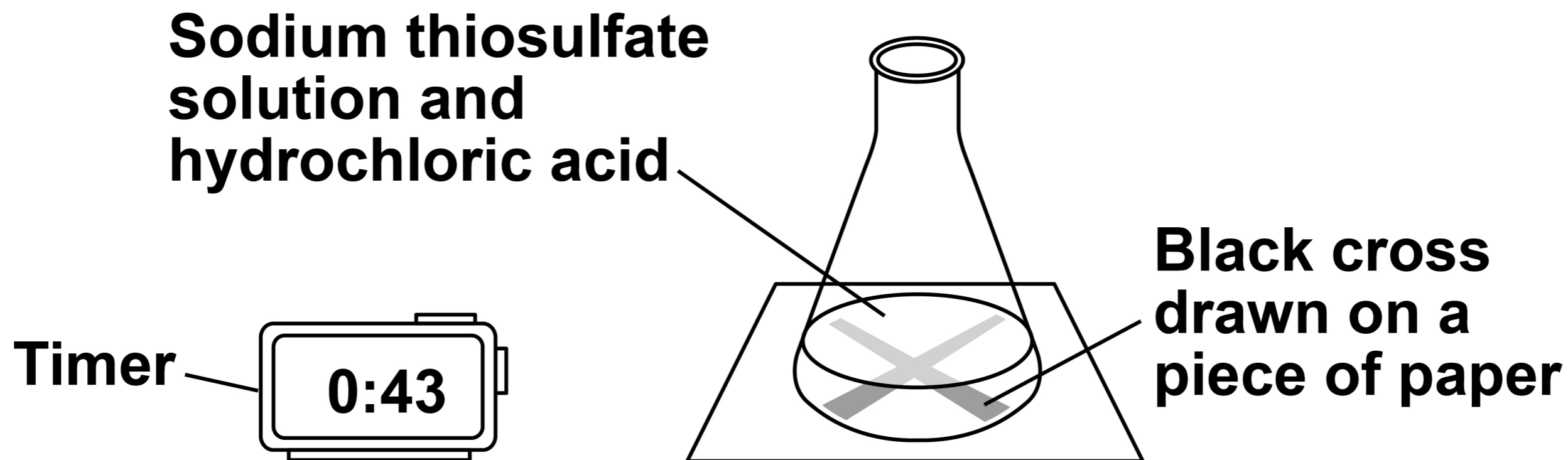


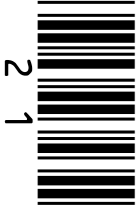
A teacher demonstrated the reaction between sodium thiosulfate solution and hydrochloric acid.

FIGURE 3 shows the experiment.

The experiment was done in a fume cupboard.

FIGURE 3

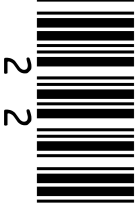




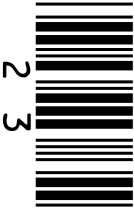
This is the method the teacher used.

- 1. Pour 50 cm³ of sodium thiosulfate solution into a conical flask.**
- 2. Put the conical flask on a black cross drawn on a piece of paper.**
- 3. Pour 10 cm³ of hydrochloric acid into the conical flask and start a timer.**
- 4. Stop the timer when the cross can no longer be seen.**
- 5. Repeat the experiment at different temperatures.**

[Turn over]



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0 3 . 2

What type of variable is time in this reaction? [1 mark]

Tick (✓) ONE box.

Control

Dependent

Independent

[Turn over]

0 3 . 3**TABLE 1 shows the results.****TABLE 1**

Temperature in °C	Time in seconds
19	82
32	48
45	43
52	15
63	7
73	3

Complete FIGURE 4, on the opposite page.

You should:

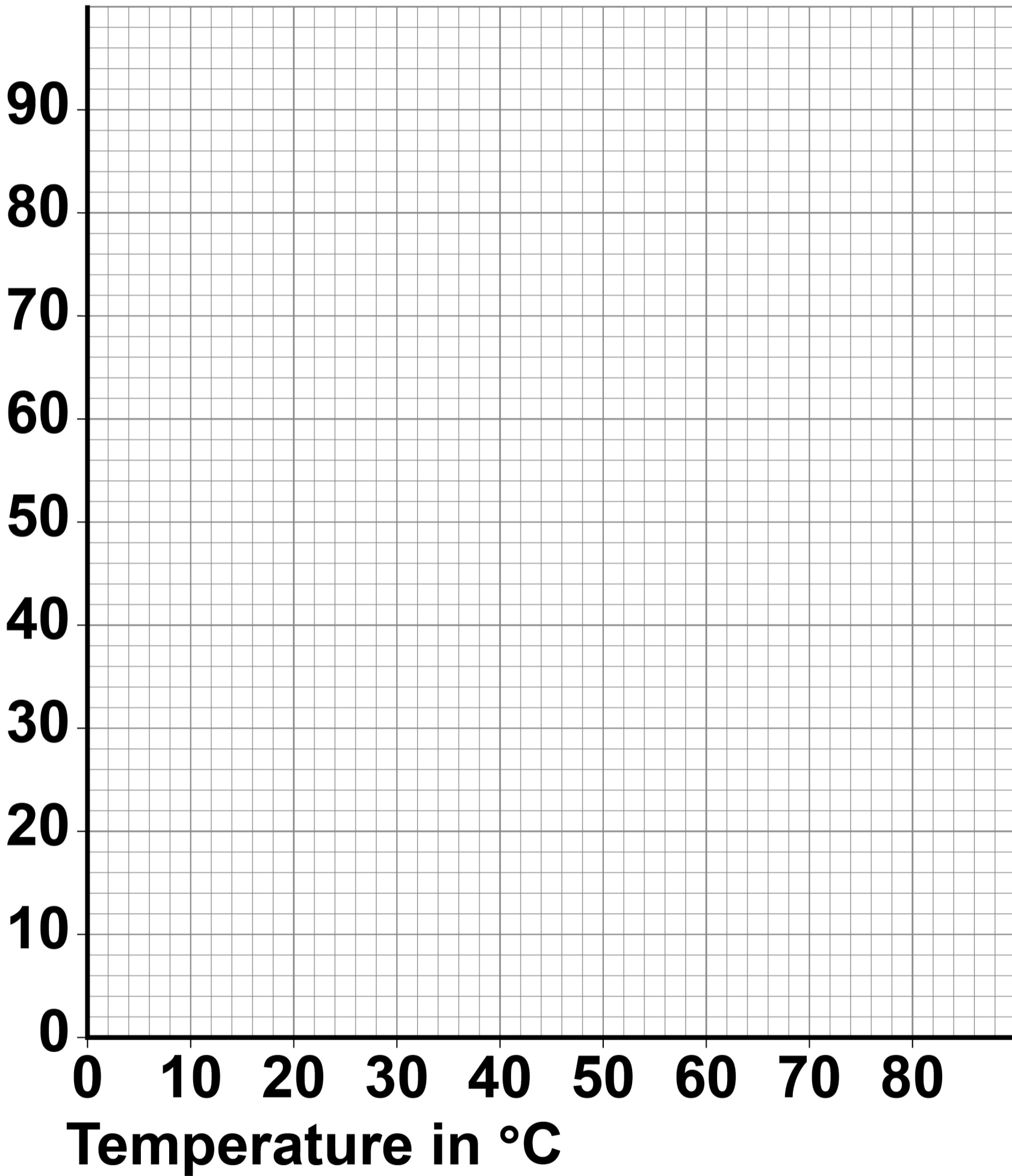
- plot the data from TABLE 1 on FIGURE 4**
- draw a line of best fit.**

[3 marks]



FIGURE 4

**Time in
seconds**



[Turn over]



03.4

A student investigated the effect of concentration of sodium thiosulfate on the time taken for the reaction at room temperature.

FIGURE 5, on page 28, shows the results with a tangent drawn at 0.4 mol/dm^3



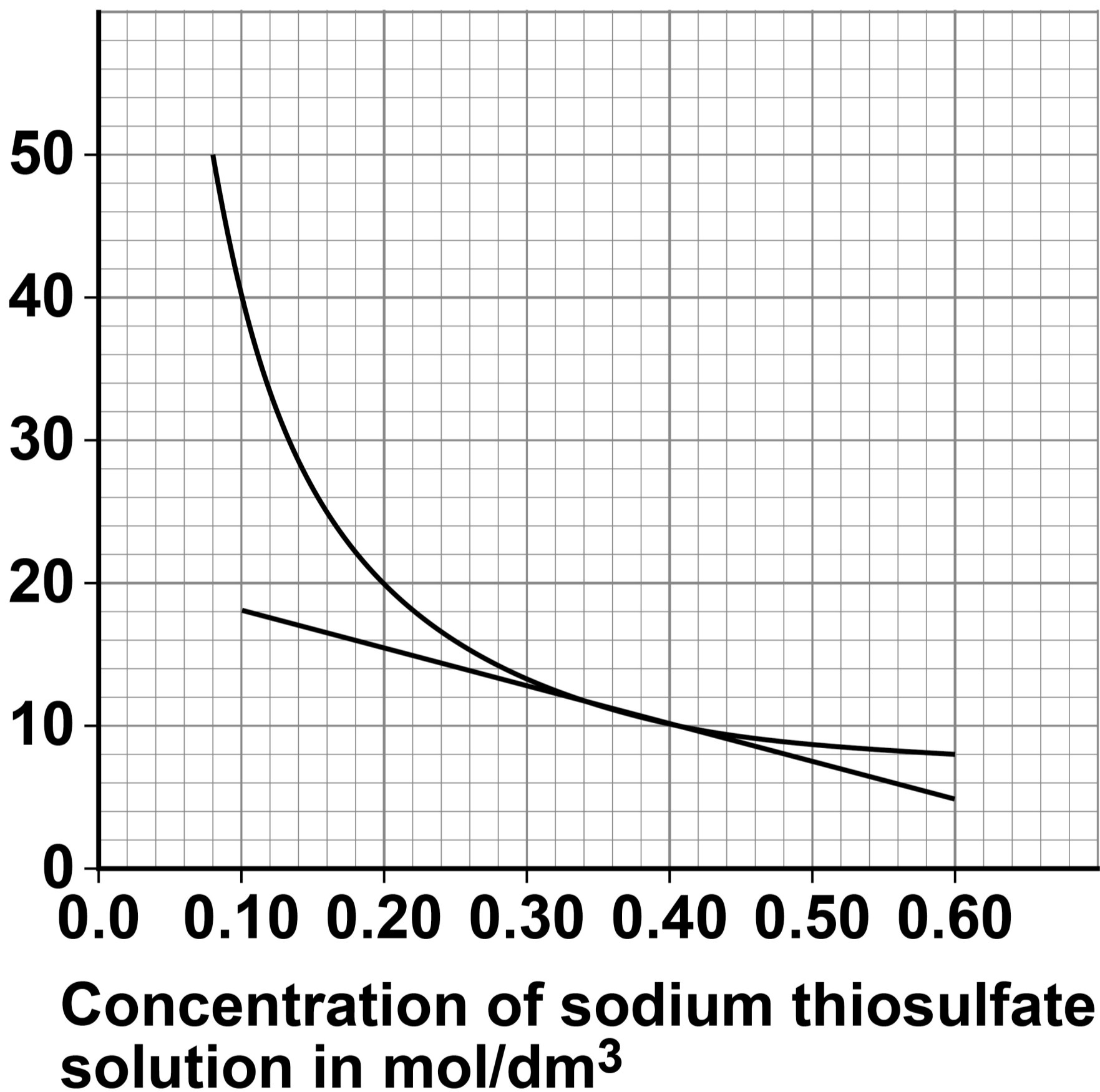
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[Turn over]



FIGURE 5

**Time in
seconds**



Calculate the gradient (slope) of the tangent at 0.4 mol/dm^3

Give the unit. [4 marks]

Gradient = _____

Unit = _____

[Turn over]

0 3 . 5

The student determined the RATE of the reaction at regular time intervals during an experiment.

Explain why the RATE decreased during the reaction.

You should give your answer in terms of particles. [2 marks]

12



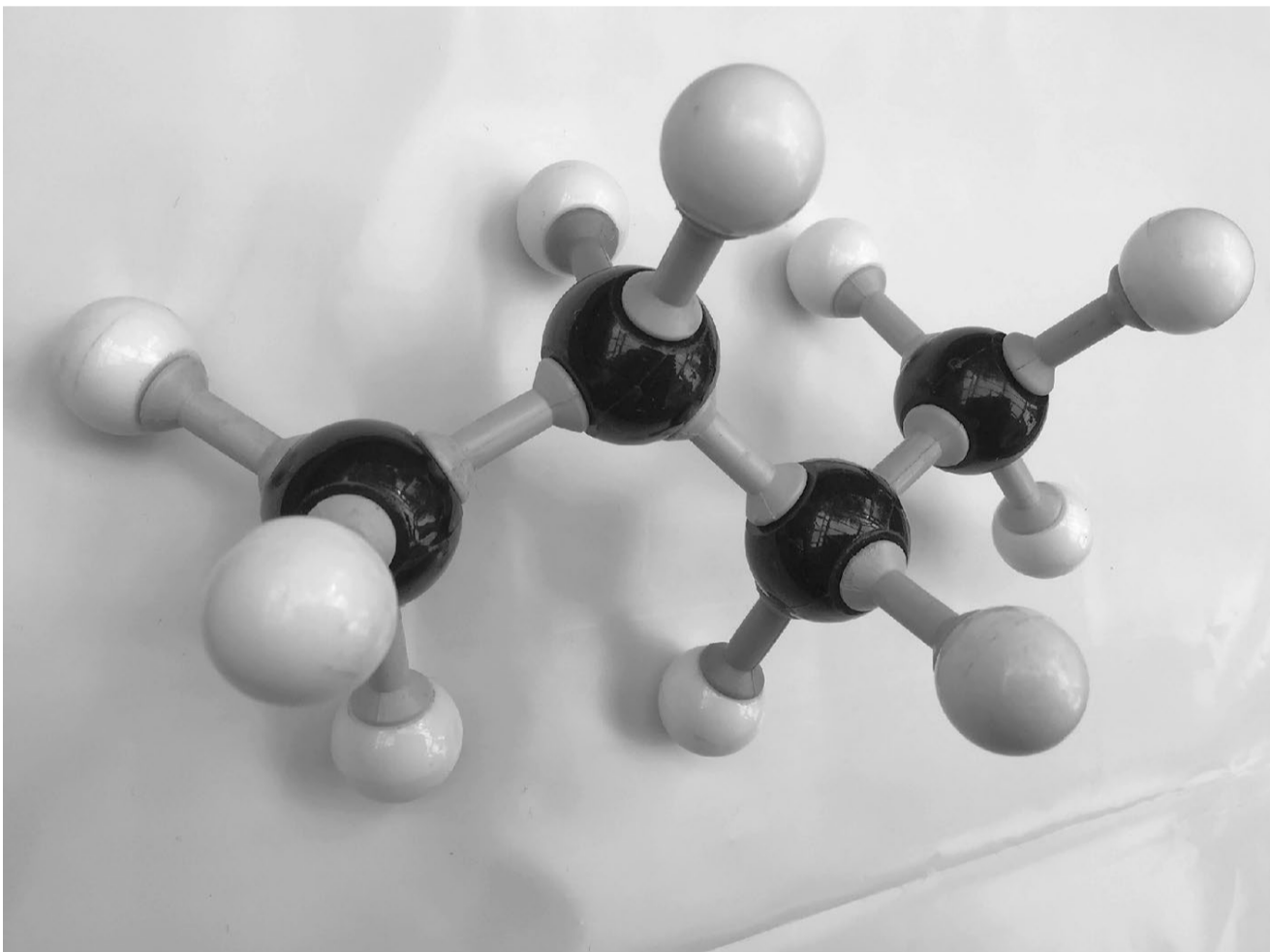
0	4
---	---

This question is about hydrocarbons and the uses of hydrocarbons.

0	4	.	1
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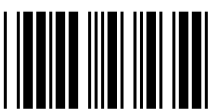
FIGURE 6 shows a model of an alkane.

FIGURE 6



What is the name of the alkane in FIGURE 6? [1 mark]

[Turn over]



0	4	.	2
---	---	---	---

What is a hydrocarbon? [1 mark]

Large hydrocarbon molecules are cracked.

0	4	.	3
---	---	---	---

When $C_{11}H_{24}$ is cracked, three products are formed.

**Complete the equation for the reaction.
[2 marks]**



0 4 . 4

Explain why ONE of the products of cracking is in high demand. [2 marks]

[Turn over]



04.5

Window frames can be manufactured from wood or from plastic.

TABLE 2, on the opposite page, shows data from a life cycle assessment (LCA) for a wooden window frame and a plastic window frame.

Both window frames are the same size.

TABLE 2

	Wood	Plastic
Sources of hydrocarbons used for production in kg	5.37	18.23
Greenhouse gases released during production, use and disposal in kg equivalent of CO₂	457	487
Oxides of nitrogen and sulfur dioxide produced in arbitrary units	29.6	37.7
Waste materials in kg	16.5	28.8
Total energy consumption in production, use and disposal in MJ	9150	9713
Lifetime cost to customer to buy and maintain in £	147	102

[Turn over]



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Evaluate the sustainability of wooden and plastic window frames.

You should include environmental and economic factors. [6 marks]

[Turn over]



12



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[Turn over]



05

This question is about the Earth's atmosphere and the Earth's resources.

05.1

After the formation of the Earth's early atmosphere, the amounts of nitrogen and oxygen in the atmosphere changed.

Explain the main changes in the amounts of nitrogen and oxygen in the Earth's atmosphere. [4 marks]

Nitrogen _____

Oxygen _____

[Turn over]



0	5	.	2
---	---	---	---

Describe how coal was formed from the carbon dioxide present in the Earth's early atmosphere. [4 marks]



0	5	.	3
---	---	---	---

The combustion of 1.0 kg of coal produces more carbon dioxide than the combustion of 1.0 kg of natural gas.

Suggest why. [1 mark]

[Turn over]



Metals are extracted from metal ores found in the Earth.

0 5 . 4

Describe how bioleaching is used to extract copper from low grade ores.

[3 marks]

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[Turn over]



0 5 . 5

Phytomining uses plants to extract nickel from low grade ores.

The plants contain 0.792% nickel by mass.

The plants are burned to produce ash.

The ash from these plants contains 4.80% nickel by mass.

Calculate the mass of ash produced from burning 1000 kg of plants.

Give your answer in grams in standard form. [4 marks]



Mass of ash (in standard form) =
_____ **g**

[Turn over]

16



0	6
---	---

This question is about catalysts and equilibrium.

0	6	.	1
---	---	---	---

What type of substance is a catalyst in biological systems? [1 mark]

Tick (✓) ONE box.

Algae

Alkene

Enzyme

Formulation

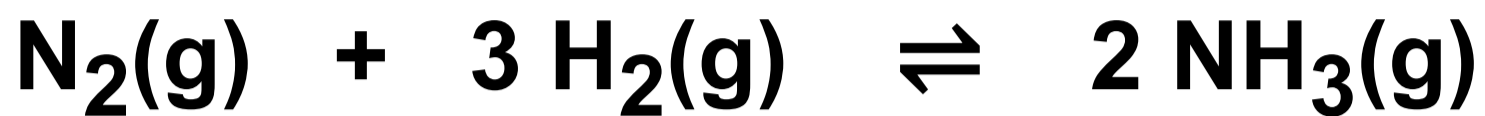


06.2

Explain how a catalyst increases the rate of a reaction. [2 marks]

[Turn over]

The reversible reaction for the production of ammonia is:



0 6 . 3

What can scientists predict using Le Chatelier's Principle? [1 mark]



0	6	.	4
---	---	---	---

**Describe how a reversible chemical reaction is able to reach equilibrium.
[2 marks]**

[Turn over]



0	6	.	5
---	---	---	---

**Explain the effect of increasing the pressure on the yield of ammonia.
[2 marks]**



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

The forward reaction to produce ammonia is exothermic.

**Explain the effect of increasing the temperature on the yield of ammonia.
[2 marks]**

END OF QUESTIONS

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10



**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.**

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

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5 6



2 2 6 G 8 4 6 4 / C / 2 H