AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

GCSE
COMBINED SCIENCE: TRILOGY

F

Foundation Tier
Chemistry Paper 2F

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.

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

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 write outside the box

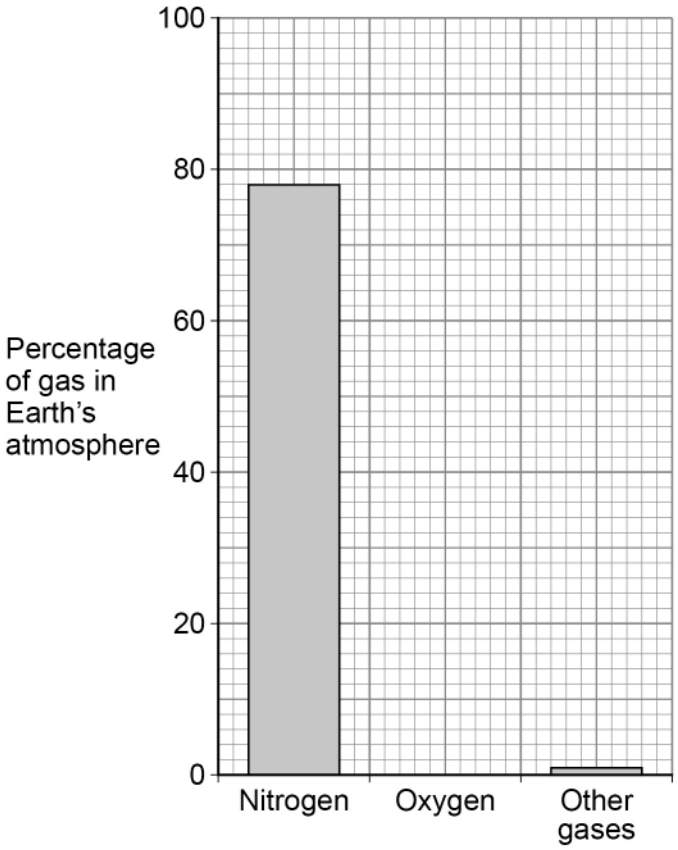
0 1 This question is about the Earth's atmosphere.

0 1 . 1 The Earth's atmosphere contains 21% oxygen.

Draw the bar for oxygen on **Figure 1**.

[1 mark]

Figure 1



0 1 . 2 What is used to test for oxygen gas?

[1 mark]

Tick (✓) **one** box.

A burning splint ☐

A glowing splint ☐

Damp litmus paper ☐

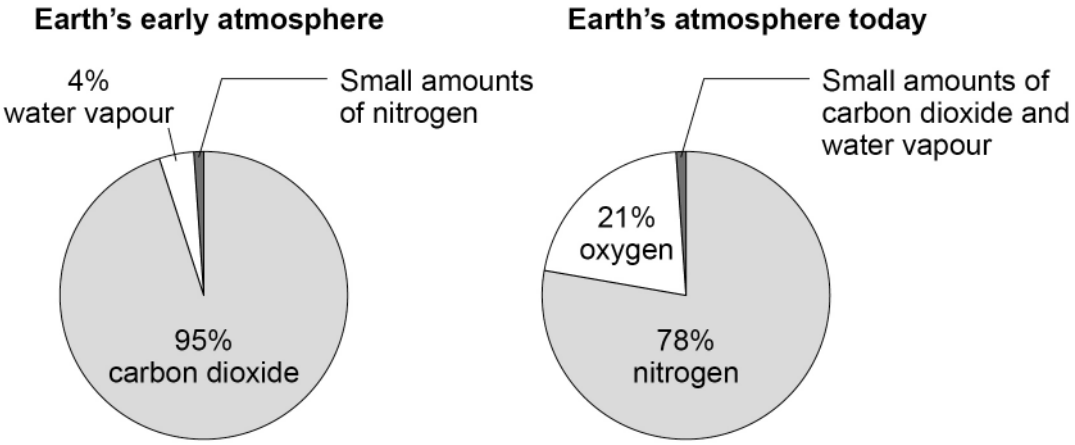
Limewater ☐

Do not write outside the box

The Earth's early atmosphere was very different from the Earth's atmosphere today.

Figure 2 shows the composition of the Earth's early atmosphere and of the Earth's atmosphere today.

Figure 2



0 1 . 3 The percentages of nitrogen and oxygen in the Earth's atmosphere today are different from the Earth's early atmosphere.

Complete the sentences.

Choose answers from the box.

Use **Figure 2**.

Each answer can be used once, more than once or not at all.

[2 marks]

decreased	**increased**	**stayed the same**

Since the Earth's early atmosphere, the percentage of nitrogen in the Earth's atmosphere has _____ .

Since the Earth's early atmosphere, the percentage of oxygen in the Earth's atmosphere has _____ .

Do not write outside the box

0 1 . 4 The Earth's atmosphere today contains a small amount of carbon dioxide.

Why has the percentage of carbon dioxide decreased since the Earth's early atmosphere?

[2 marks]

Tick (✓) **two** boxes.

Dissolved in oceans ☐

Formation of sedimentary rocks ☐

Industrialisation ☐

Respiration ☐

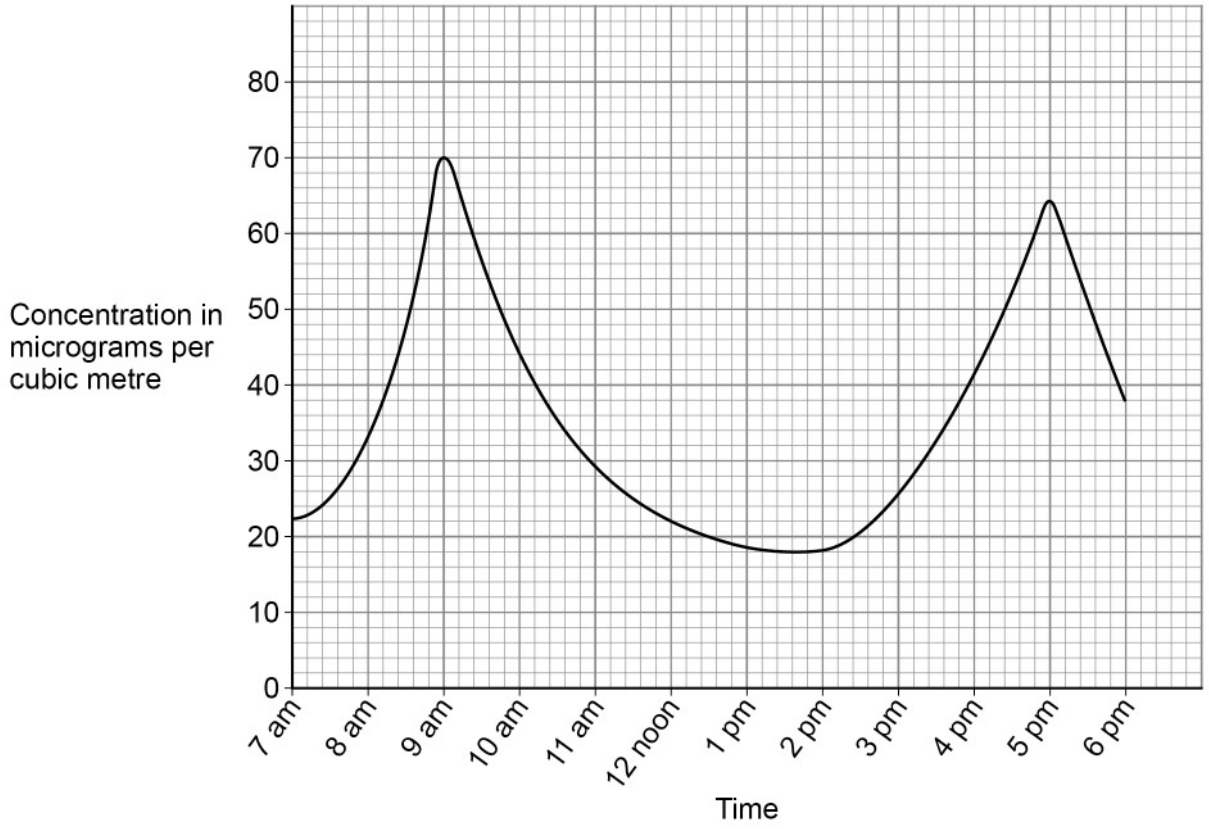
Volcanic activity ☐

Do not write outside the box

Oxides of nitrogen are produced when nitrogen reacts with oxygen in car engines.

Figure 3 shows the concentration of oxides of nitrogen in the atmosphere during one day in a city.

Figure 3



0 1 . 5 Which **two times** have the highest concentrations of oxides of nitrogen in the atmosphere?

[2 marks]

1 _____

2 _____

0 1 . 6 Suggest why there are the highest concentrations of oxides of nitrogen at these times.

[1 mark]

_____

_____

9

Do not write outside the box

0 2 This question is about fuels.

Coal deposits were formed from the remains of trees.

0 2 . 1 Name the process in the leaves of trees that uses carbon dioxide.

[1 mark]

_____

0 2 . 2 How is coal formed after trees die?

[1 mark]

Tick (✓) **one** box.

The trees are burned. ☐

The trees are compressed. ☐

The trees are melted. ☐

Coal contains small amounts of sulfur.

0 2 . 3 Name the gas produced when sulfur burns in oxygen.

[1 mark]

_____

0 2 . 4 Give **two** problems caused by the gas produced when sulfur burns in oxygen.

[2 marks]

1 _____

_____

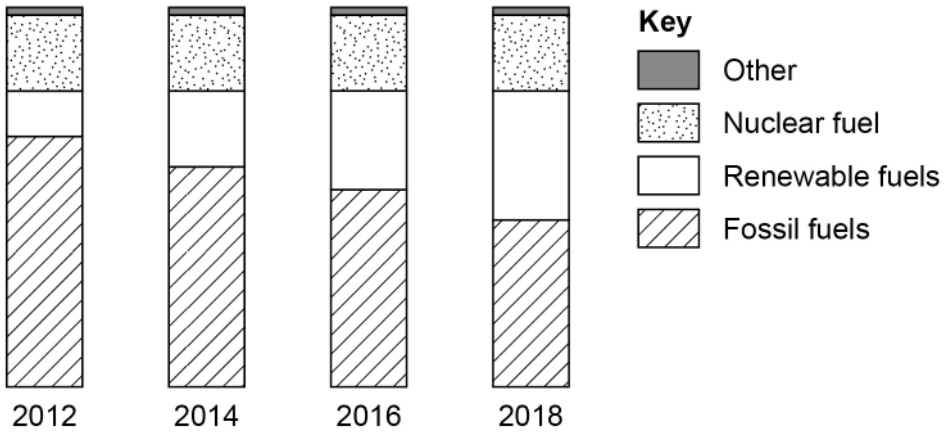
2 _____

_____

Do not write outside the box

0 2 . 5 **Figure 4** shows the relative amount of electricity generated from different fuel sources in the UK from 2012 to 2018.

Figure 4



Describe what happens to the amounts of fuels used to generate electricity in the UK from 2012 to 2018.

[3 marks]

8

Turn over for the next question

Do not write outside the box

0 3 This question is about ammonia and its compounds.

A student heated a sample of ammonium chloride.

The equation for the reaction is:

$$\underset{\text{ammonium chloride}}{NH_4Cl} \rightleftharpoons \underset{\text{ammonia}}{NH_3} + HCl$$

0 3 . 1 One product is ammonia.

What is the name of the product with the formula HCl?

[1 mark]

_____

0 3 . 2 Ammonia is a gas.

What is the state symbol for ammonia?

[1 mark]

Tick (✓) **one** box.

(aq) ☐ (g) ☐ (l) ☐ (s) ☐

0 3 . 3 How does the equation show that the reaction is reversible?

[1 mark]

_____

_____

0 3 . 4 Complete the sentence.

[1 mark]

The forward reaction is endothermic,

so the reverse reaction is _____ .

Do not write outside the box

0 3 . 5 Complete the sentence.

Choose the answer from the box.

[1 mark]

concentration	**rate**	**temperature**

Equilibrium is reached when the forward and reverse reactions happen at exactly the same _____ .

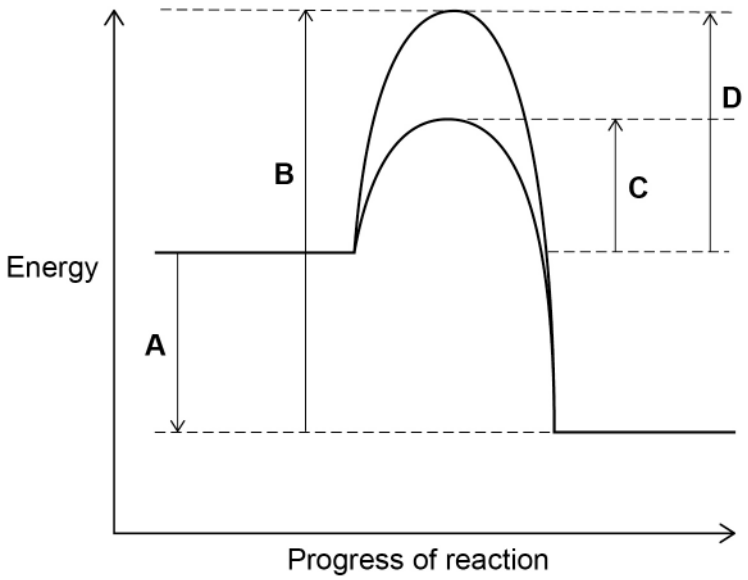
Question 3 continues on the next page

Do not write outside the box

The industrial process to produce ammonia uses a catalyst.

0 3 . 6 **Figure 5** shows the reaction profile for the reaction with and without a catalyst.

Figure 5



Which letter represents the activation energy for the reaction with a catalyst?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

Do not write outside the box

0 3 . 7 Give **one** reason why using a catalyst reduces costs.

Do **not** answer in terms of activation energy.

[1 mark]

0 3 . 8 Ammonia is in a mixture that is used as a household cleaner.

What is a mixture that has been designed as a useful product called?

[1 mark]

8

Turn over for the next question

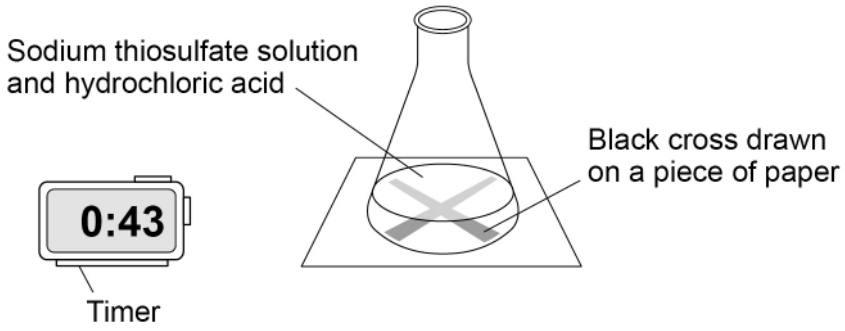
Do not write outside the box

0 4 A student investigates the effect of concentration on the rate of the reaction between sodium thiosulfate solution and hydrochloric acid.

Figure 6 shows the experiment.

The experiment was done in a fume cupboard.

Figure 6



This is the method used.

1. Pour 50 cm^3 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 cm^3 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 with different concentrations of sodium thiosulfate solution.

Do not write outside the box

0 4 . 1 Draw **one** line from each type of variable to the correct example of the variable in this investigation.

[2 marks]

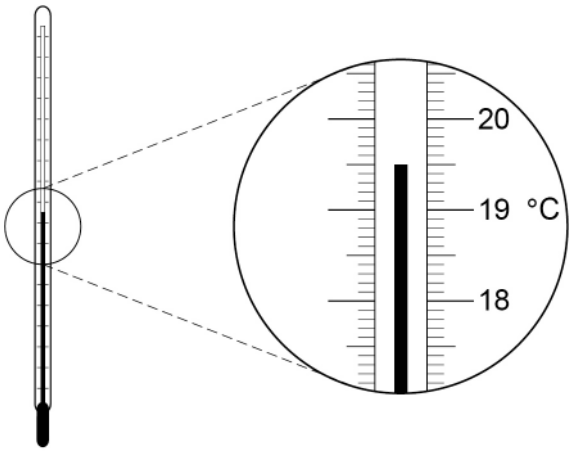
Type of variable	**Example of variable**
	Concentration of sodium thiosulfate solution
Dependent	
	Temperature of reaction mixture
	Time taken for the cross to no longer be seen
Independent	
	Volume of acid
	Volume of the flask

Question 4 continues on the next page

Do not write outside the box

0 4 . 2 The experiment is done at room temperature.

Figure 7



What is the temperature shown on the thermometer in **Figure 7**?

[1 mark]

Temperature = _____ °C

Table 1 shows the student's results.

Table 1

Concentration of sodium thiosulfate solution in mol/dm^3	Time in seconds
0.1	82
0.2	40
0.3	20
0.4	13
0.5	10
0.6	8

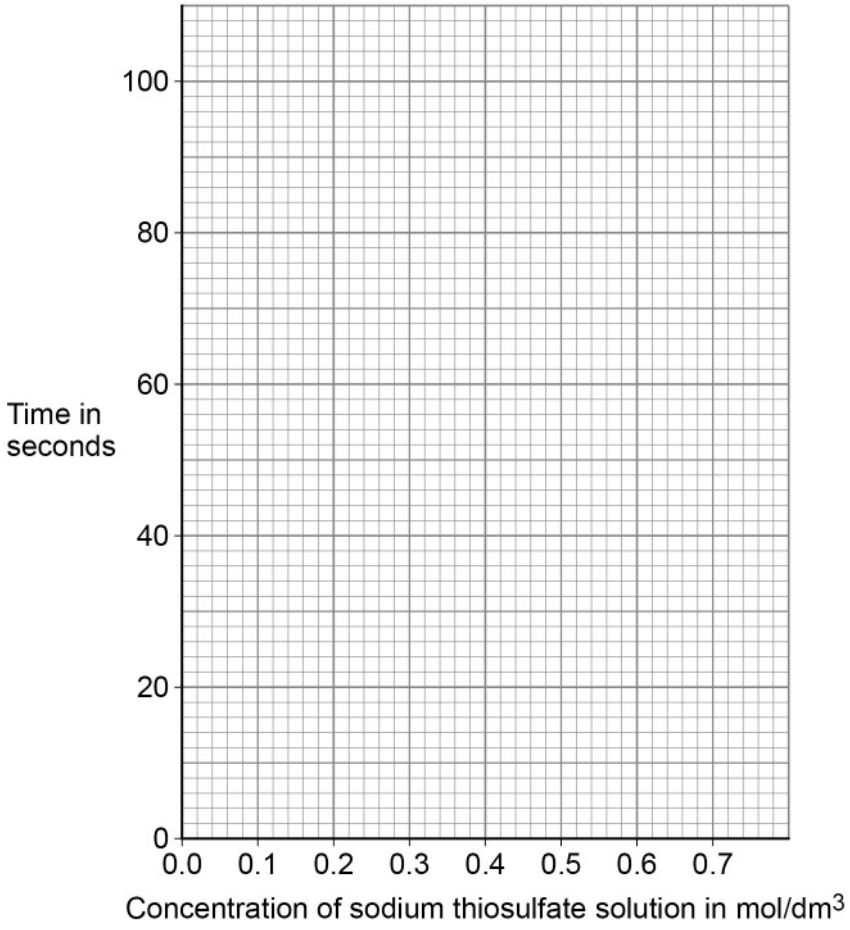
Do not write outside the box

0 4 . 3 Plot the data from **Table 1** on **Figure 8**.

Draw a line of best fit.

[3 marks]

Figure 8



0 4 . 4 Predict the time taken for the cross to no longer be seen at a concentration of 0.7 mol/dm^3

Use your graph in **Figure 8**.

[1 mark]

Time = _____ s

0 4 . 5 Complete the sentence.

[1 mark]

As the concentration of sodium thiosulfate solution increases, the time taken for the cross to no longer be seen _____ .

Turn over ►

Do not write outside the box

0 4 . 6 In one experiment 0.725 g of sulfur is produced in 20 seconds.

Calculate the mean rate of the reaction from 0 to 20 seconds.

Use the equation:

$$\text{mean rate of reaction} = \frac{\text{mass of sulfur produced in grams}}{\text{time in seconds}}$$

[2 marks]

Mean rate of reaction = _____

0 4 . 7 What is the unit for the mean rate of reaction calculated in Question **04.6**?

[1 mark]

Tick (✓) **one** box.

g ☐ g/s ☐ s ☐ s/g ☐

Do not write outside the box

0 4 . 8 The student did the experiment with 0.15 mol/dm^3 sodium thiosulfate solution and repeated the experiment three more times.

Table 2 shows the results.

Table 2

	Test 1	**Test 2**	**Test 3**	**Test 4**
Time in seconds for the cross to no longer be seen	60.5	63.2	82.3	65.7

Calculate the mean time for this reaction.

Do **not** include the anomalous result in your calculation.

Give your answer to 3 significant figures.

[3 marks]

Mean time for the reaction (3 significant figures) = _____ s

14

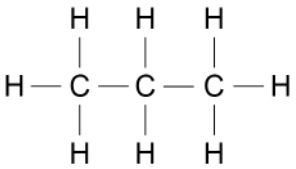
Turn over for the next question

Do not write outside the box

0 5 This question is about hydrocarbons.

Figure 9 shows a hydrocarbon.

Figure 9



0 5 . 1 Complete the formula for the hydrocarbon shown in **Figure 9**.

[1 mark]

C____H____

0 5 . 2 What is the name of the hydrocarbon in **Figure 9**?

[1 mark]

_____

0 5 . 3 Which homologous series does the hydrocarbon in **Figure 9** belong to?

[1 mark]

_____

Do not write outside the box

0 5 . 4 30 g of another hydrocarbon contains 24 g of carbon.

Which calculation gives the percentage of carbon in the hydrocarbon?

[1 mark]

Tick (✓) **one** box.

$\frac{24 \times 30}{100}$ ☐

$\frac{100 \times 30}{24}$ ☐

$\frac{24 \times 100}{30}$ ☐

$\frac{24}{30 \times 100}$ ☐

0 5 . 5 **Table 3** shows boiling points of some hydrocarbons.

Table 3

Formula of hydrocarbon	Boiling point in °C
C_2H_6	–89
C_4H_{10}	0
C_6H_{14}	69
C_8H_{18}	125
$C_{10}H_{22}$	174

Describe how the boiling points change as the number of carbon atoms in the hydrocarbon increases.

[1 mark]

Do not write outside the box

Hydrocarbons can be cracked.

0 5 . 6 Give **one** condition used to crack hydrocarbons.

[1 mark]

0 5 . 7 Balance the equation for the cracking of C_6H_{14}

[1 mark]

$$C_6H_{14} \rightarrow C_2H_6 + ____ C_2H_4$$

0 5 . 8 Give **one** reason why hydrocarbons are cracked.

[1 mark]

Do not write outside the box

0 5 . 9 Window frames can be manufactured from wood or plastic.

Table 4 shows the results of a life cycle assessment (LCA) for making one wooden and one plastic window frame.

Both window frames are the same size.

Table 4

Table 4 not reproduced here due to third-party copyright restrictions

Give **three** advantages of using wood instead of plastic in the manufacture of window frames.

[3 marks]

Advantage of wood 1 _____

_____

_____

Advantage of wood 2 _____

_____

_____

Advantage of wood 3 _____

_____

_____

11

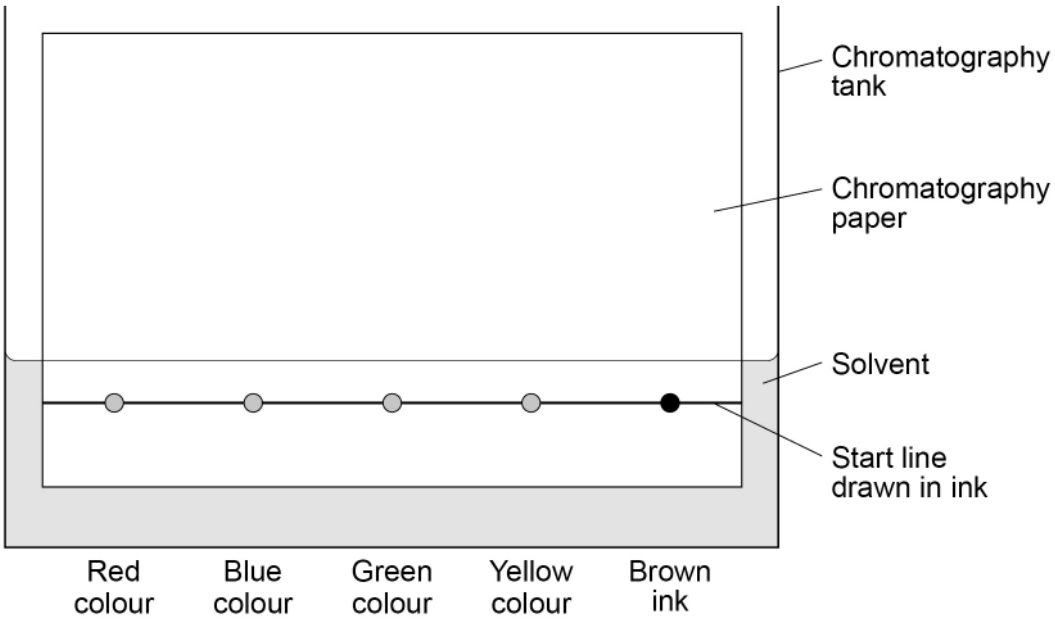
Turn over for the next question

Do not write outside the box

0 6 A student investigated the colours in a brown ink using chromatography.

0 6 . 1 **Figure 10** shows the apparatus used.

Figure 10



Give **two** errors made by the student.

Describe the problem each error would cause.

[4 marks]

Error 1 _____

_____

Problem 1 _____

_____

Error 2 _____

_____

Problem 2 _____

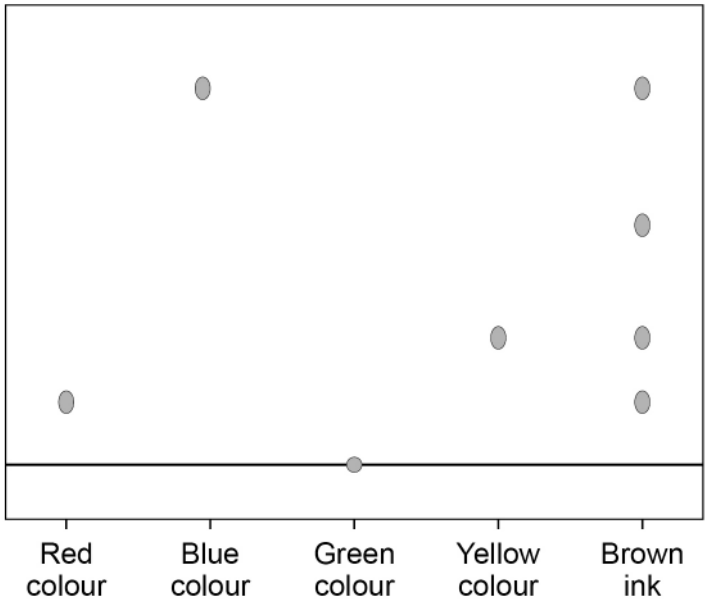
_____

Do not write outside the box

A different student set up the apparatus correctly.

Figure 11 shows the results.

Figure 11



0 6 . 2 Give **two** conclusions the student can make from **Figure 11** about the four colours in the brown ink.

[2 marks]

1 _____

_____

2 _____

_____

Question 6 continues on the next page

Do not write outside the box

0 6 . 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. ☐

0 6 . 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

10

Do not write outside the box

0 7 . 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]

Question 7 continues on the next page

Do not write outside the box

A scientist produced potable water from 150 cm^3 of salty water.

0 7 . 2 Which process can be used to produce potable water from salty water?

[1 mark]

Tick (✓) **one** box.

Distillation ☐

Electrolysis ☐

Filtration ☐

Sterilisation ☐

0 7 . 3 The salty water contains sodium chloride.

The scientist collected 2.40 g of sodium chloride from 150 cm^3 of salty water.

Calculate the concentration of sodium chloride in grams per dm^3

[3 marks]

Concentration of sodium chloride = _____ g/dm^3

10

END OF QUESTIONS

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