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

Tuesday 13 June 2023 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.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
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 Crude oil contains a large number of hydrocarbons.

0 1 . 1 Crude oil is a finite resource.

What is a finite resource?

[1 mark]

Tick (✓) **one** box.

A limited resource ☐

A renewable resource ☐

A sustainable resource ☐

0 1 . 2 What is crude oil formed from?

[1 mark]

Tick (✓) **one** box.

Plankton ☐

Volcanoes ☐

Water ☐

Do not write outside the box

0 1 . 3 What type of substance is crude oil?

[1 mark]

Tick (✓) **one** box.

Compound ☐

Element ☐

Mixture ☐

0 1 . 4 The hydrocarbons in crude oil are separated into fractions using fractional distillation.

Complete the sentences.

Choose answers from the box.

[2 marks]

condense	**evaporate**	**freeze**	**melt**

In fractional distillation the crude oil is heated so

the hydrocarbons _____ .

The fractions collect as the hydrocarbons cool and _____ .

Question 1 continues on the next page

Do not write outside the box

Hydrocarbons can be cracked to produce more useful molecules.

0 1 . 5 Complete the sentence.

Choose the answer from the box.

[1 mark]

alloys	**fertilisers**	**fuels**

Some products of cracking are useful as _____ .

0 1 . 6 Hydrogen gas is a product of cracking.

What is used in the test for hydrogen gas?

[1 mark]

Tick (✓) **one** box.

Burning splint ☐

Glowing splint ☐

Limewater ☐

Do not write outside the box

0 1 . 7 5.20 kg of crude oil contains 1.53 kg of LPG (Liquefied Petroleum Gas).

Calculate the percentage (%) of LPG in 5.20 kg of crude oil.

Give your answer to 3 significant figures.

[3 marks]

Percentage (3 significant figures) = _____ %

10

Turn over for the next question

Do not write outside the box

0 2 The Earth's atmosphere is always changing.

0 2 . 1 Gases in the Earth's early atmosphere caused changes on the Earth.

Draw **one** line from each change to the gas that caused the change.

[2 marks]

Change	**Gas that caused the change**
	Ammonia
Oceans formed	Carbon dioxide
	Nitrogen
Sedimentary rocks formed	
	Oxygen
	Water vapour

Do not write outside the box

Table 1 shows the percentage of some gases in the atmospheres of Earth and Mars today.

Table 1

Gas	Percentage of gas in atmosphere (%)	
	Earth	Mars
Argon	0.90	1.9
Carbon dioxide	0.04	95
Nitrogen	78	2.6
Oxygen	21	0.20

0 2 . 2 Which gas has the highest percentage in the Earth's atmosphere?

[1 mark]

0 2 . 3 Calculate how many times more carbon dioxide there is in the atmosphere of Mars than in the atmosphere of Earth.

Use **Table 1**.

Give your answer in standard form.

[3 marks]

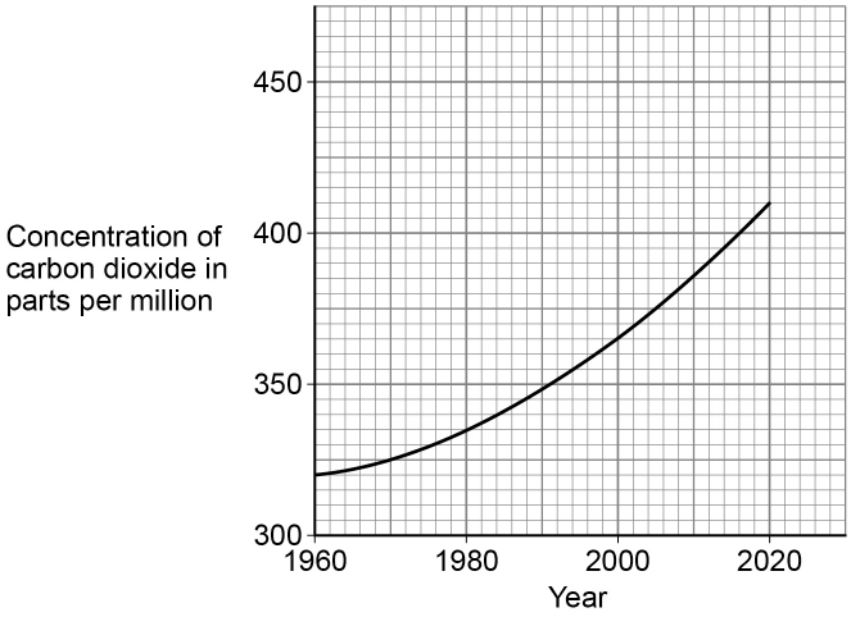
Number of times more carbon dioxide (in standard form) = _____

Do not write outside the box

Carbon dioxide is a greenhouse gas.

0 2 . 4 **Figure 1** shows the concentration of carbon dioxide in the Earth's atmosphere from 1960 to 2020.

Figure 1



How has the concentration of carbon dioxide in the Earth's atmosphere changed from 1960 to 2020?

[1 mark]

Tick (✓) **one** box.

Decreased ☐

Stayed the same ☐

Increased ☐

Do not write outside the box

0 2 . 5 Cars emit carbon dioxide.

A car emits 17.2 kg of carbon dioxide on a journey.

There are four people in the car.

Calculate the mass of carbon dioxide emitted per person.

[2 marks]

Mass of carbon dioxide = _____ kg

0 2 . 6 Planting trees helps to reduce climate change, because trees use carbon dioxide from the Earth's atmosphere.

Name the process in trees which uses carbon dioxide.

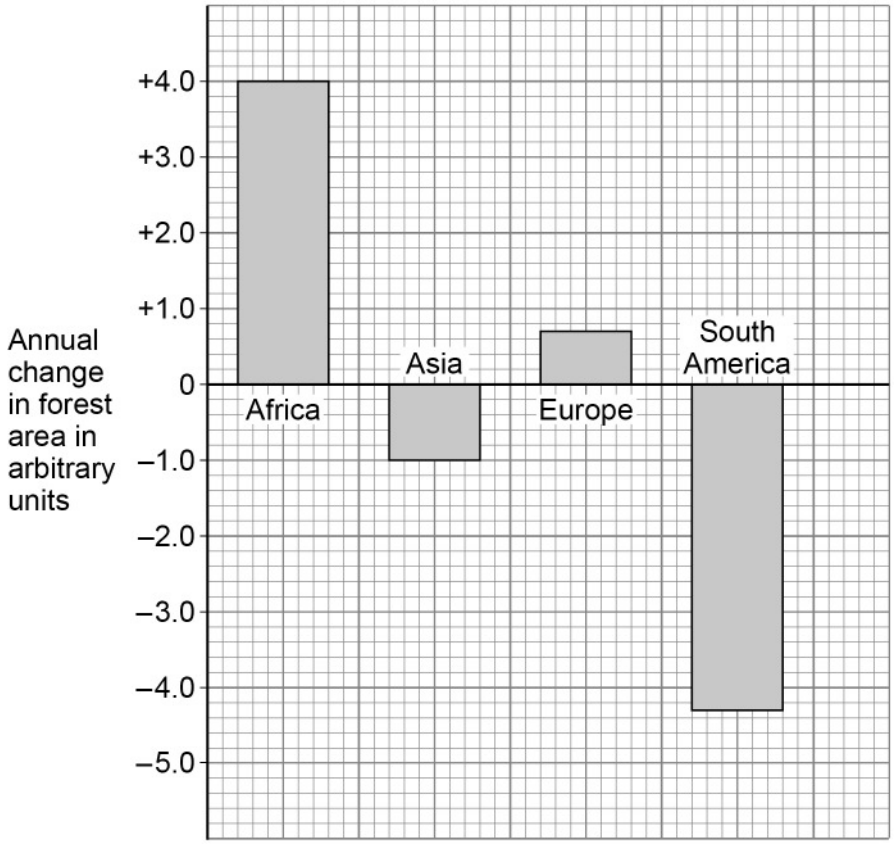
[1 mark]

Question 2 continues on the next page

Do not write outside the box

0 2 . 7 **Figure 2** shows the annual change in forest area in four different parts of the world.

Figure 2



Give **two** conclusions about the annual change in forest area.

[2 marks]

1 _____

_____

2 _____

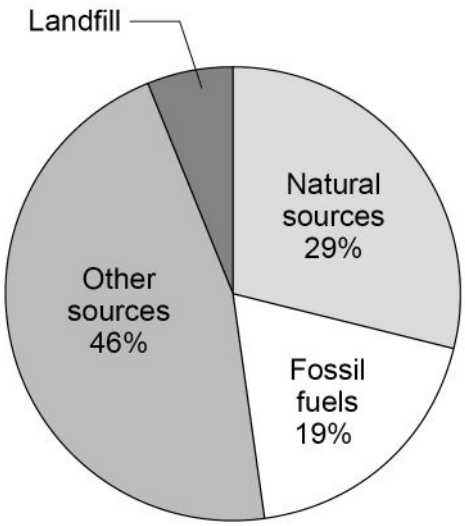
_____

Do not write outside the box

0 2 . 8 Methane is a greenhouse gas.

Figure 3 shows sources of methane emissions.

Figure 3



Determine the percentage (%) of methane emissions from landfill.

[1 mark]

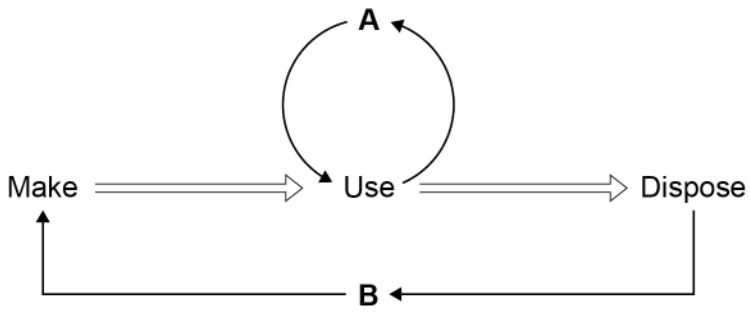
Percentage = _____ %

Question 2 continues on the next page

Do not write outside the box

0 2 . 9 **Figure 4** shows two ways (**A** and **B**) of preventing used items going to landfill.

Figure 4



Name **A** and **B**.

Choose answers from the box.

[2 marks]

recycle	**reduce**	**release**	**reuse**	**reverse**

A _____

B _____

15

Do not write outside the box

Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

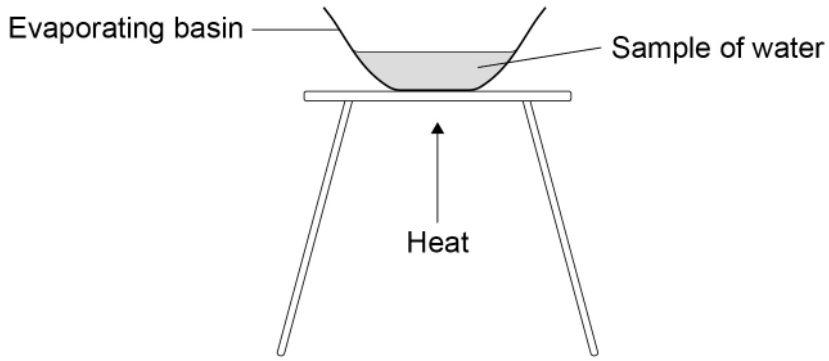
Do not write outside the box

0 3 Some types of water contain dissolved substances.

A student investigated the mass of dissolved solids in distilled water and in sea water.

Figure 5 shows the apparatus.

Figure 5



This is the method used.

1. Weigh an evaporating basin.
2. Add a sample of distilled water to the evaporating basin.
3. Weigh the evaporating basin and the water sample.
4. Heat the water sample.
5. Weigh the evaporating basin and contents.
6. Repeat steps 1 to 5 two more times.
7. Repeat steps 1 to 6 with sea water.

0 3 . 1 Give **one** safety precaution the student should take.

[1 mark]

Do not write outside the box

0 3 . 2 The method used did **not** give valid results.

Which **two** improvements could the student make to give valid results?

[2 marks]

Tick (✓) **two** boxes.

Heat until the mass of the evaporating basin and contents does not change. ☐

Leave some water in the evaporating basin after heating. ☐

Record the results in a table and plot a bar graph. ☐

Use 25 cm^3 of water for each experiment. ☐

Use a beaker instead of an evaporating basin. ☐

0 3 . 3 A different student used a method which gave valid results.

Table 2 shows the results.

Table 2

	Mass of dissolved solids in grams		
Type of water	**Test 1**	**Test 2**	**Test 3**
Distilled water	0.00	0.00	0.00
Sea water	0.31	0.32	0.27

The student concludes that distilled water is pure.

Suggest **one** reason why.

[1 mark]

_____

_____

Do not write outside the box

Tap water is potable.

One step in producing potable water is sterilisation.

0 3 . 4 Why is potable water sterilised?

[1 mark]

Tick (✓) **one** box.

To improve the taste ☐

To kill bacteria ☐

To remove dissolved solids ☐

0 3 . 5 Chlorine is used to sterilise water.

The reaction between chlorine and water is reversible.

Complete the sentence.

[1 mark]

Equilibrium is reached when the forward and reverse reactions

occur at the same _____ .

0 3 . 6 The test for chlorine uses damp litmus paper.

Complete the sentence.

Choose the answer from the box.

[1 mark]

blue	**green**	**white**

When damp litmus paper is put into chlorine gas

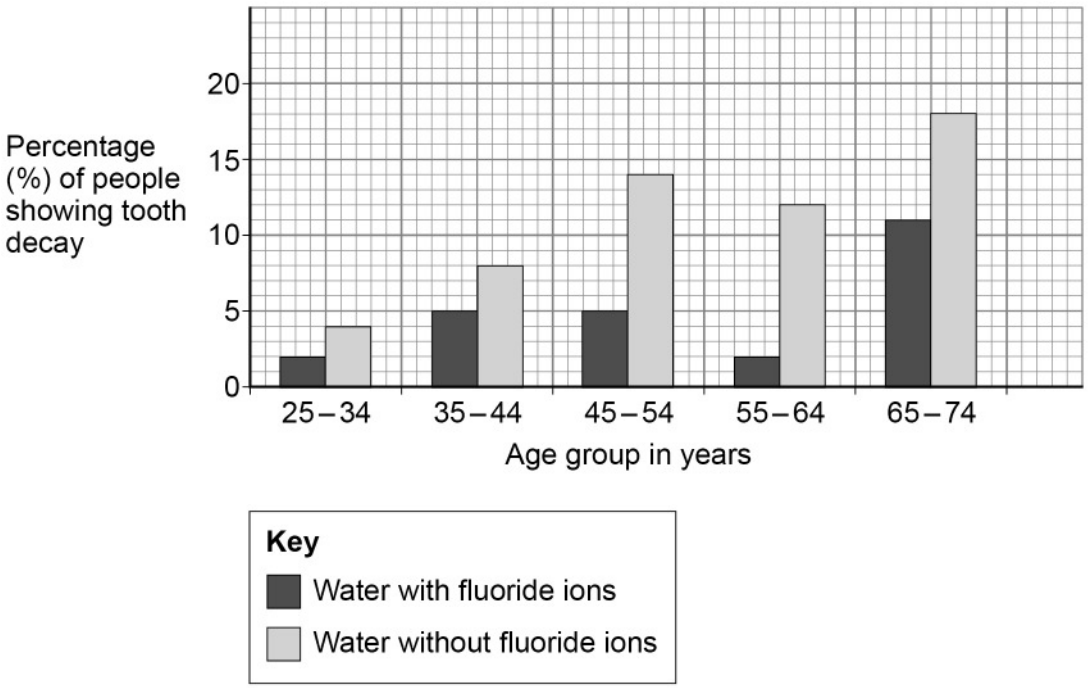
the litmus paper turns _____ .

Do not write outside the box

There is evidence that adding fluoride ions to drinking water reduces tooth decay.

Figure 6 shows the percentage of people showing tooth decay.

Figure 6



0 3 . 7 Compare the effects of adding fluoride ions to drinking water on tooth decay in people between the ages of 25 and 74.

Use data from **Figure 6**.

[4 marks]

Do not write outside the box

0 3 . 8 Student **A** says that water companies should add fluoride ions to all drinking water.

Student **B** disagrees.

Suggest **one** reason why Student **B** may think that fluoride ions should **not** be added to all drinking water.

[1 mark]

12

Do not write outside the box

Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Do not write outside the box

0 4 A catalyst is used to increase the rate of decomposition of hydrogen peroxide.

0 4 . 1 Hydrogen peroxide decomposes to produce water and oxygen.

Write a word equation for the reaction.

[1 mark]

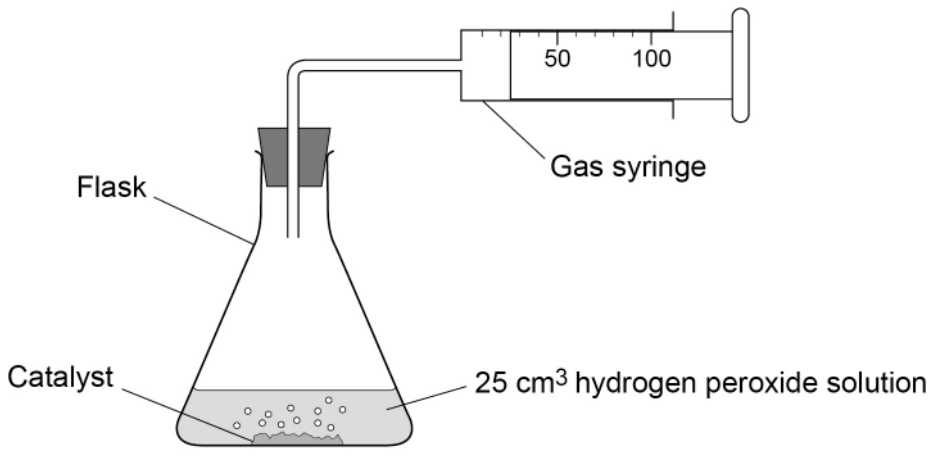
_____ → _____ + _____

A student investigated the rate of decomposition of hydrogen peroxide using three different catalysts:

- manganese dioxide
- copper oxide
- zinc oxide.

Figure 7 shows the apparatus.

Figure 7



Do not write outside the box

This is the method used.

1. Measure 25 cm^3 of hydrogen peroxide solution into a flask.

2. Add 0.5 g of manganese dioxide catalyst to the flask.

3. Attach a gas syringe to the flask.

4. Measure the volume of oxygen produced every 20 seconds for 120 seconds.

5. Repeat steps 1 to 4 two more times.

6. Repeat steps 1 to 5 using copper oxide catalyst.

7. Repeat steps 1 to 5 using zinc oxide catalyst.

0 4 . 2 Which **two** control variables are used in the investigation?

[2 marks]

Tick (✓) **two** boxes.

- Mass of catalyst ☐
- Shape of flask ☐
- Time of taking readings ☐
- Volume of hydrogen peroxide solution ☐
- Volume of oxygen produced ☐

Question 4 continues on the next page

Do not write outside the box

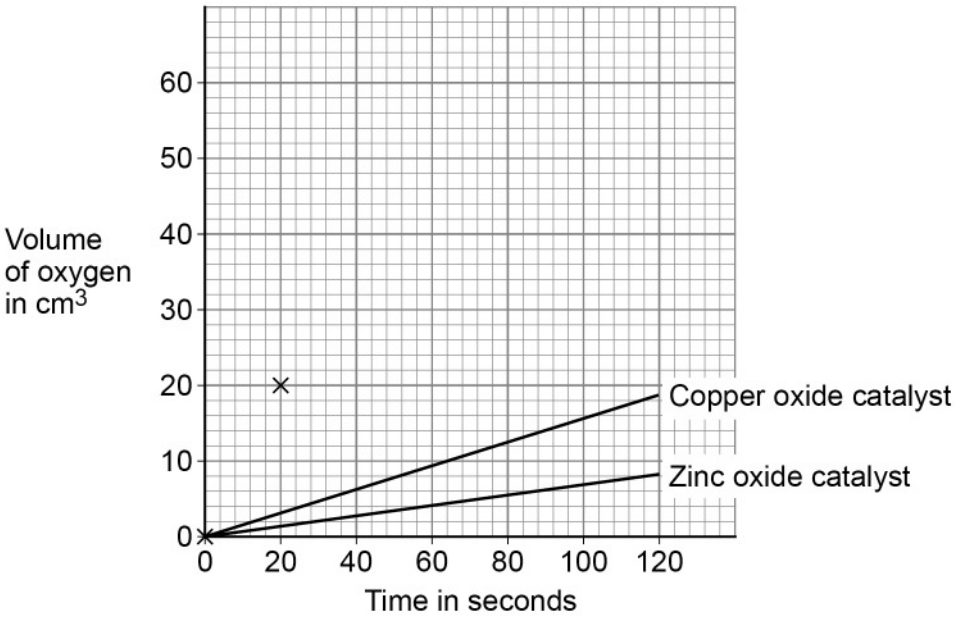
Table 3 shows the results with manganese dioxide catalyst.

Table 3

Time in seconds	0	20	40	60	80	100	120
Volume of oxygen in cm^3	0	20	32	40	45	49	50

Figure 8 shows a graph of the results with copper oxide catalyst and with zinc oxide catalyst.

Figure 8



0 4 . 3 Complete **Figure 8**.

You should:

- plot the data for the manganese dioxide catalyst from **Table 3**
- draw a line of best fit.

The first two points have been plotted for you.

[3 marks]

Do not write outside the box

0 4 . 4 Which is the best catalyst?

Give **one** reason for your answer.

Use the completed **Figure 8**.

[2 marks]

Tick (✓) **one** box.

Copper oxide ☐

Manganese dioxide ☐

Zinc oxide ☐

Reason _____

_____

0 4 . 5 The student repeated the investigation with manganese dioxide catalyst.

The results were all close to the true value.

Complete the sentence.

Choose the answer from the box.

[1 mark]

accurate	**approximate**	**random**

Results that are close to the true value are _____.

Question 4 continues on the next page

Do not write outside the box

0 4 . 6 The student repeated the investigation using manganese dioxide catalyst at a higher temperature.

Complete the sentence.

Choose the answer from the box.

[1 mark]

decrease	**stay the same**	**increase**

At a higher temperature, the rate of reaction will _____.

10

Do not write outside the box

0 5 The combustion of fuels is a source of atmospheric pollutants.

0 5 . 1 Methane is a fuel.

Balance the equation for the combustion of methane.

[1 mark]

$$CH_4 + ____ O_2 \rightarrow CO_2 + ____ H_2O$$

0 5 . 2 Many fuels are mixtures.

Petrol and diesel are mixtures of hydrocarbons.

Table 4 shows properties of petrol and of diesel.

Table 4

	Petrol	**Diesel**
Range of number of carbon atoms in a hydrocarbon molecule	4 to 12	12 to 20
Range of boiling points in °C	40 to 205	250 to 350

Compare the properties of petrol and diesel.

Use **Table 4**.

[2 marks]

Do not write outside the box

0 5 . 3 The gases released when a fuel is burned in car engines may include:

- oxides of nitrogen
- carbon monoxide
- water vapour.

Which chemical element do all these gases contain?

[1 mark]

Tick (✓) **one** box.

Carbon ☐

Hydrogen ☐

Nitrogen ☐

Oxygen ☐

0 5 . 4 When diesel burns in car engines, oxides of nitrogen are produced.

Where does the nitrogen come from?

[1 mark]

0 5 . 5 When diesel burns, particulates may be produced.

What environmental effect do particulates from burning diesel cause?

[1 mark]

Do not write outside the box

0 5 . 6 Carbon monoxide may be produced when diesel burns.

Give **one** reason why carbon monoxide is difficult to detect.

[1 mark]

0 5 . 7 Explain why water vapour and **not** liquid water is produced when diesel burns.

[2 marks]

0 5 . 8 Sulfur is a common impurity in diesel.

Explain why this causes an environmental problem.

[3 marks]

12

Turn over for the next question

Do not write outside the box

0 6 Chromatography is used to separate mixtures.

Chromatography involves a mobile phase and one other phase.

0 6 . 1 What is the other phase in chromatography?

[1 mark]

Tick (✓) **one** box.

Moving phase ☐

Recycled phase ☐

Stationary phase ☐

Viscous phase ☐

0 6 . 2 Why do the substances in the mixture separate in the mobile phase?

[1 mark]

_____

_____

0 6 . 3 How many spots will be produced on the chromatogram of a pure compound?

[1 mark]

Number of spots = _____

Do not write outside the box

0 6 . 4 In a chromatography experiment, a blue colour moved 4.77 cm.

The solvent moved 5.30 cm.

Calculate the R_f value for the blue colour.

[2 marks]

R_f value = _____

Question 6 continues on the next page

Turn over ►

Do not write outside the box

0 6 . 5 Black ink is a mixture of several colours.

Plan an experiment using paper chromatography to:

- separate the colours in black ink
- identify the colours from their R_f values.

[6 marks]

11

END OF QUESTIONS

Do not write outside the box

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Do not write outside the box

Question number	**Additional page, if required.** **Write the question numbers in the left-hand margin.**

Do not write outside the box

Question number	**Additional page, if required.** **Write the question numbers in the left-hand margin.**

Do not write outside the box

Question number	**Additional page, if required.** **Write the question numbers in the left-hand margin.**

Do not write outside the box

Question number	**Additional page, if required.** **Write the question numbers in the left-hand margin.**

Do not write outside the box

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Copyright information

For confidentiality purposes, all acknowledgements of third-party copyright material are published in a separate booklet. This booklet is published after each live examination series and is available for free download from www.aqa.org.uk.

Permission to reproduce all copyright material has been applied for. In some cases, efforts to contact copyright-holders may have been unsuccessful and AQA will be happy to rectify any omissions of acknowledgements. If you have any queries please contact the Copyright Team.

Copyright © 2023 AQA and its licensors. All rights reserved.