

A



Surname \_\_\_\_\_

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

Centre Number \_\_\_\_\_

Candidate Number \_\_\_\_\_

Candidate Signature \_\_\_\_\_

I declare this is my own work.

**GCSE**

**COMBINED SCIENCE: TRILOGY**

**F**

Foundation Tier

Chemistry Paper 2F

**8464/C/2F**

Tuesday 13 June 2023

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 3 8 4 6 4 C 2 F 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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**Crude oil contains a large number of hydrocarbons.**

0	1	.	1
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**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****0 1 . 3****What type of substance is crude oil? [1 mark]****Tick (✓) ONE box.****Compound****Element****Mixture****[Turn over]**

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

Complete the sentences.

Choose answers from the list. [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 \_\_\_\_\_ .



Hydrocarbons can be cracked to produce more useful molecules.

0 1 . 5

Complete the sentence.

Choose the answer from the list. [1 mark]

- alloys
- fertilisers
- fuels

Some products of cracking are useful as

\_\_\_\_\_.

[Turn over]



01.6

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





0	2
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**The Earth's atmosphere is always changing.**

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

**On the opposite page, draw ONE line from each change to the gas that caused the change. [2 marks]**



**CHANGE****GAS THAT CAUSED  
THE CHANGE****Oceans formed****Ammonia****Carbon dioxide****Sedimentary rocks  
formed****Nitrogen****Oxygen****Water vapour****[Turn over]**

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

**TABLE 1**

<b>GAS</b>	<b>PERCENTAGE OF GAS IN ATMOSPHERE (%)</b>	
	<b>Earth</b>	<b>Mars</b>
<b>Argon</b>	<b>0.90</b>	<b>1.9</b>
<b>Carbon dioxide</b>	<b>0.04</b>	<b>95</b>
<b>Nitrogen</b>	<b>78</b>	<b>2.6</b>
<b>Oxygen</b>	<b>21</b>	<b>0.20</b>

**0 2 . 2**

**Which gas has the highest percentage in the Earth's atmosphere? [1 mark]**

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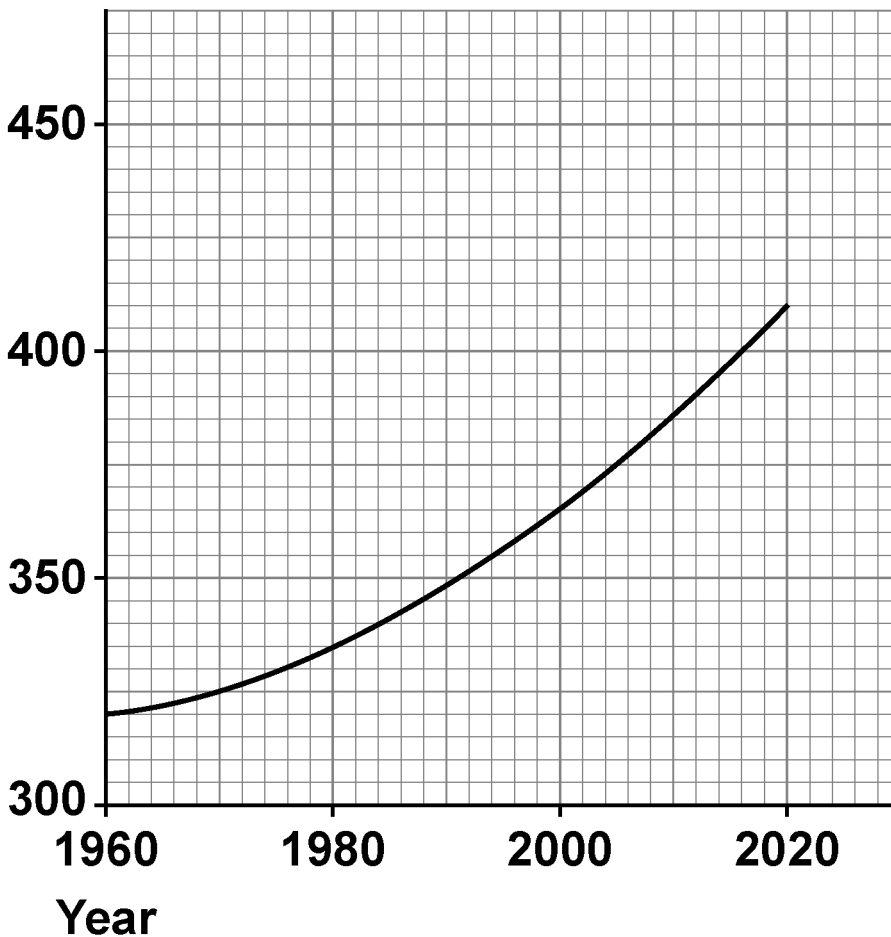
Carbon dioxide is a greenhouse gas.

02.4

FIGURE 1 shows the concentration of carbon dioxide in the Earth's atmosphere from 1960 to 2020.

FIGURE 1

Concentration of  
carbon dioxide in  
parts per million



**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**

**[Turn over]**



**02.5**

**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]**

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**Mass of carbon dioxide = \_\_\_\_\_ kg**



**02.6**

**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]**

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**[Turn over]**

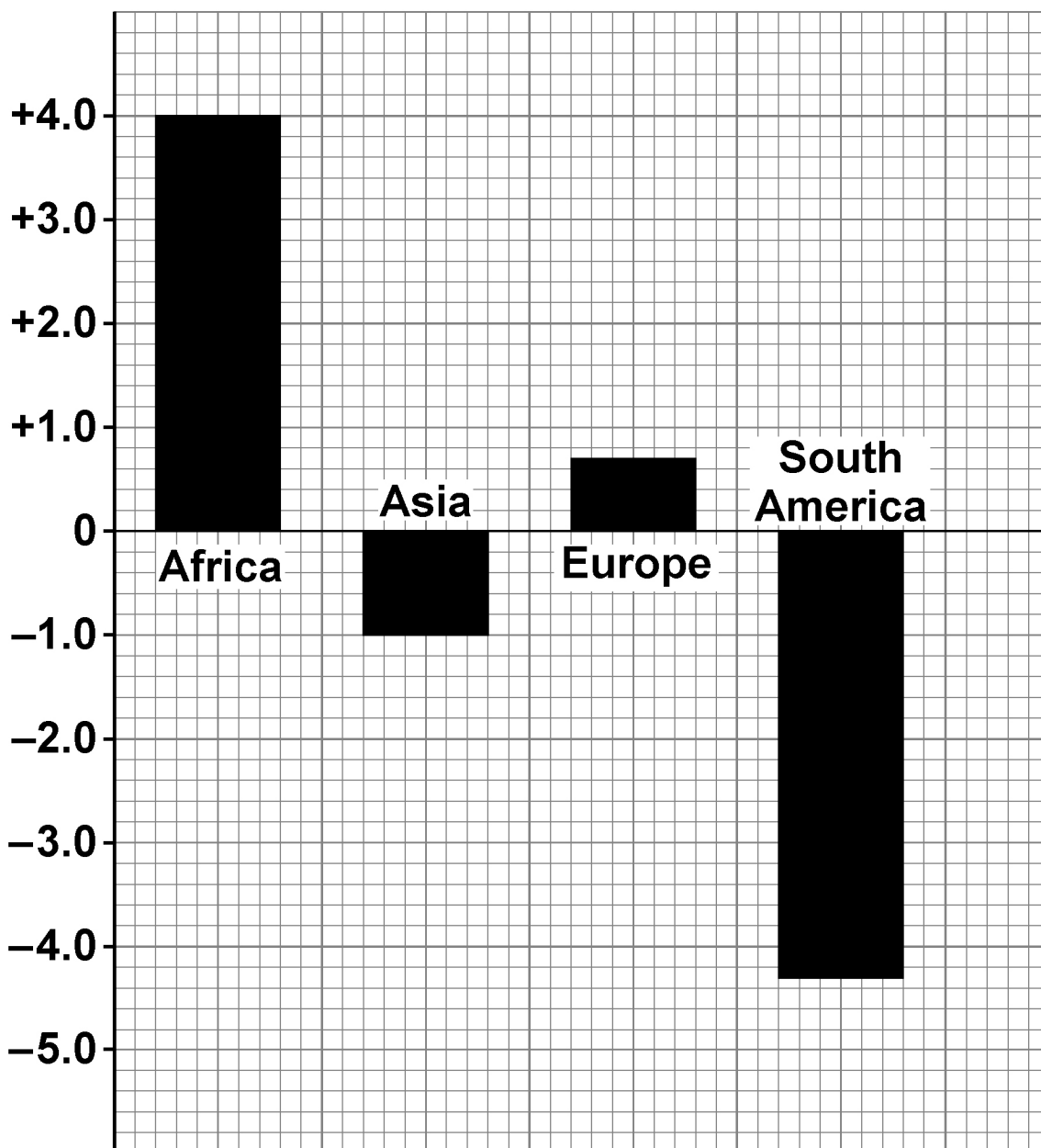


02.7

FIGURE 2 shows the annual change in forest area in four different parts of the world.

FIGURE 2

Annual change in forest area in arbitrary units



**Give TWO conclusions about the annual change in forest area. [2 marks]**

**1** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**2** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**[Turn over]**

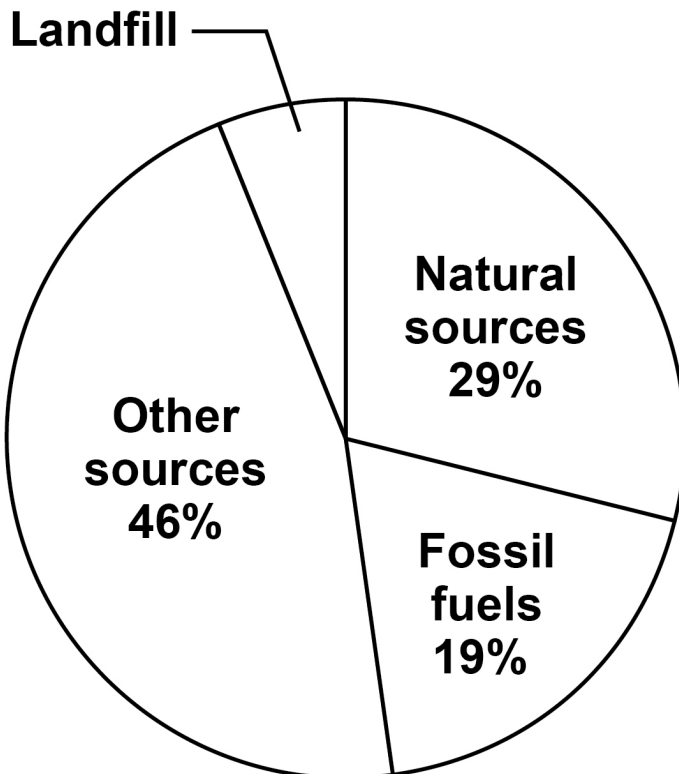


02.8

Methane is a greenhouse gas.

FIGURE 3 shows sources of methane emissions.

FIGURE 3



Determine the percentage (%) of methane emissions from landfill. [1 mark]

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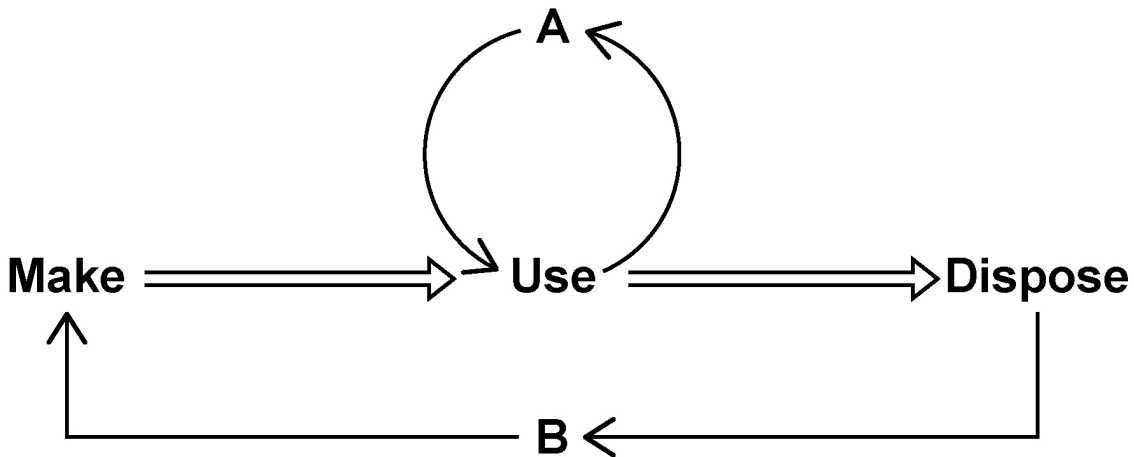
Percentage = \_\_\_\_\_ %



02.9

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 list. [2 marks]

- recycle
- reduce
- release
- reuse
- reverse

A \_\_\_\_\_

B \_\_\_\_\_

[Turn over]



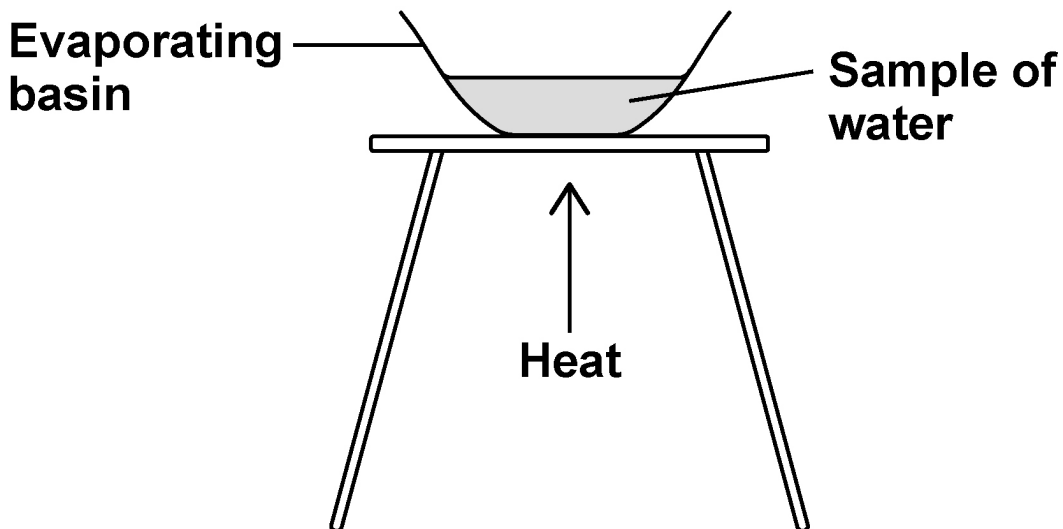
03

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.

03.1

Give ONE safety precaution the student should take.  
[1 mark]

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[Turn over]



**03.2**

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<sup>3</sup> of water for each experiment.

Use a beaker instead of an evaporating basin.



**03.3**

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]

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[Turn over]



Tap water is potable.

One step in producing potable water is sterilisation.

03.4

Why is potable water sterilised? [1 mark]

Tick (✓) ONE box.

To improve the taste

To kill bacteria

To remove dissolved solids



**03.5**

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 \_\_\_\_\_ .

[Turn over]



**03.6**

The test for chlorine uses damp litmus paper.

Complete the sentence.

Choose the answer from the list. [1 mark]

- blue
- green
- white

When damp litmus paper is put into chlorine gas

the litmus paper turns \_\_\_\_\_ .



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**[Turn over]**

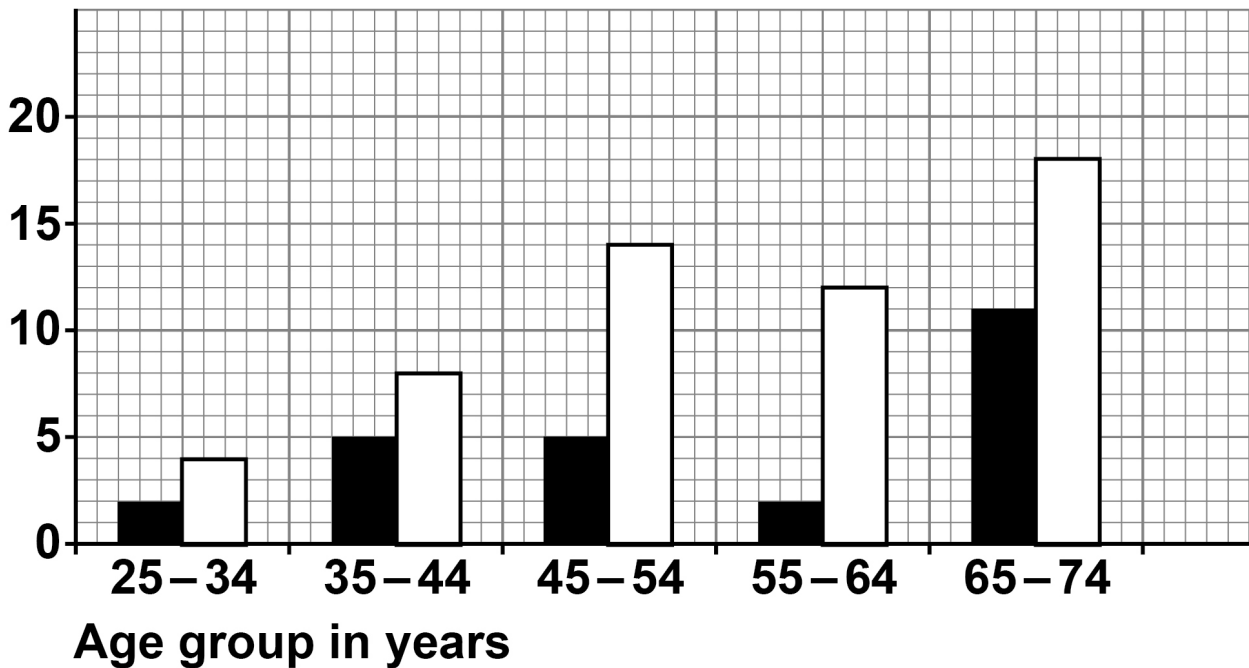


There is evidence that adding fluoride ions to drinking water reduces tooth decay.

FIGURE 6 shows the percentage of people showing tooth decay.

FIGURE 6

Percentage (%) of people showing tooth decay



KEY

■ Water with fluoride ions

□ Water without fluoride ions





**03.8**

**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]**

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12



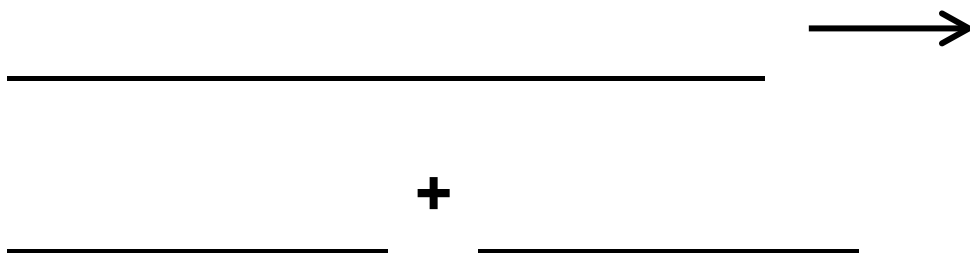
0	4
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A catalyst is used to increase the rate of decomposition of hydrogen peroxide.

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

Write a word equation for the reaction. [1 mark]



[Turn over]

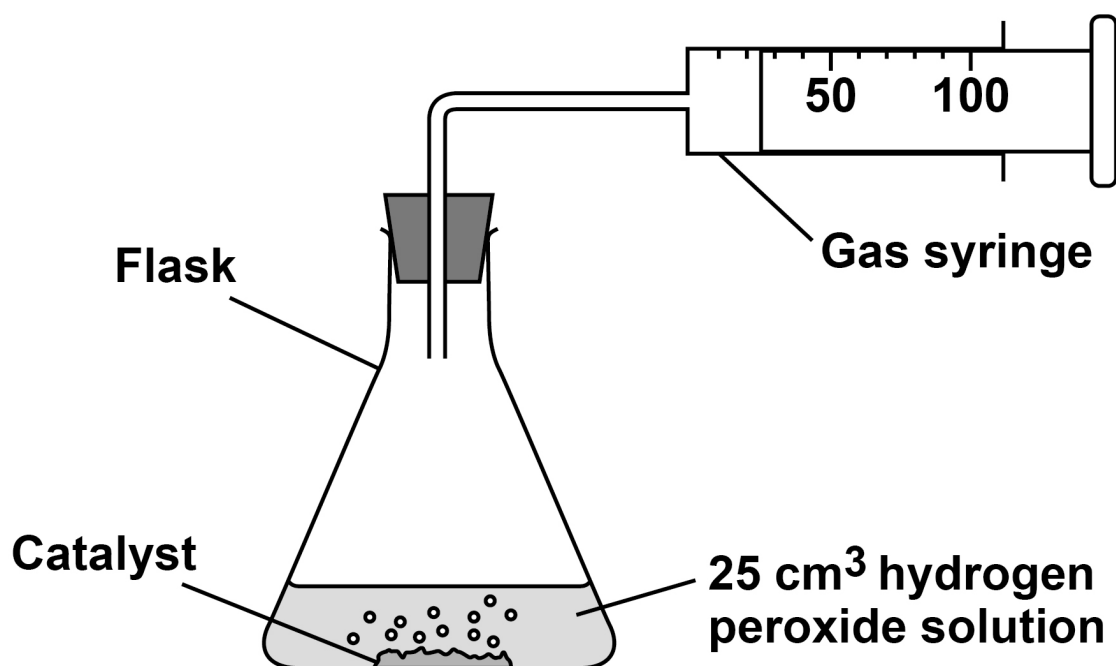


A student investigated the rate of decomposition of hydrogen peroxide using three different catalysts:

- manganese dioxide
- copper oxide
- zinc oxide.

FIGURE 7 shows the apparatus.

FIGURE 7



This is the method used.

1. Measure 25 cm<sup>3</sup> 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.

04.2

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

[Turn over]



**TABLE 3** shows the results with manganese dioxide catalyst.

**TABLE 3**

<b>Time in seconds</b>	<b>0</b>	<b>20</b>	<b>40</b>	<b>60</b>	<b>80</b>	<b>100</b>	<b>120</b>
<b>Volume of oxygen in cm<sup>3</sup></b>	<b>0</b>	<b>20</b>	<b>32</b>	<b>40</b>	<b>45</b>	<b>49</b>	<b>50</b>

**FIGURE 8**, on the opposite page, shows a graph of the results with copper oxide catalyst and with zinc oxide catalyst.

**0 4 . 3**

**Complete FIGURE 8, on the opposite page.**

**You should:**

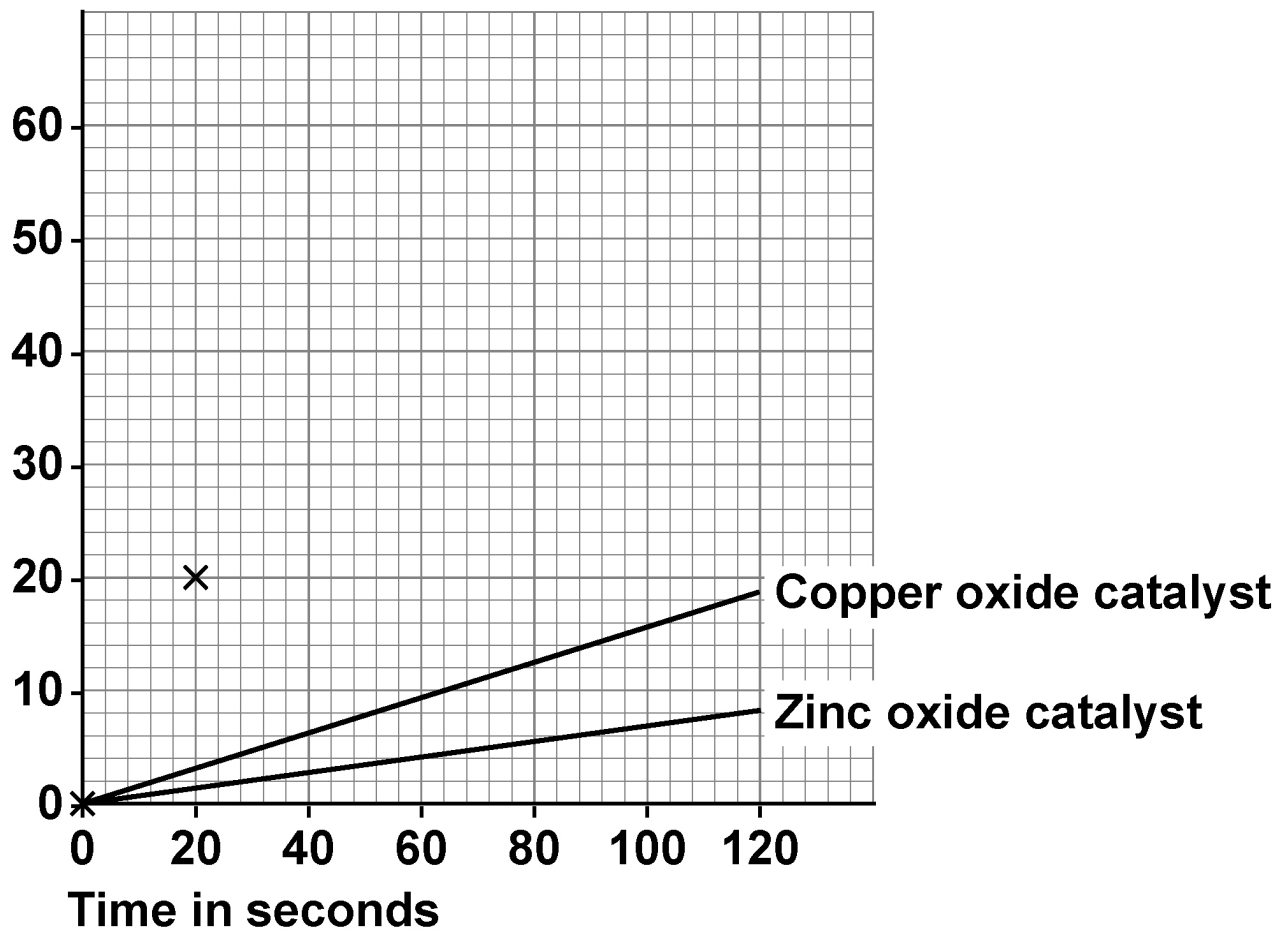
- **plot the data for the manganese dioxide catalyst from TABLE 3**
- **draw a line of best fit.**

**The first two points have been plotted for you.**  
**[3 marks]**



FIGURE 8

Volume of oxygen  
in  $\text{cm}^3$



[Turn over]



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04.4

Which is the best catalyst?

Give ONE reason for your answer.

Use the completed FIGURE 8, on page 37. [2 marks]

Tick (✓) ONE box.

Copper oxide

Manganese dioxide

Zinc oxide

Reason

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[Turn over]



**04.5**

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 list. [1 mark]

- accurate
- approximate
- random

Results that are close to the true value are

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**04.6**

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

Complete the sentence.

Choose the answer from the list. [1 mark]

- decrease
- stay the same
- increase

At a higher temperature, the rate of reaction will

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[Turn over]

10



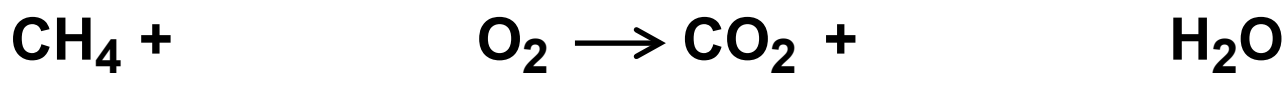
**0 5**

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]

**0 5 . 2**

Many fuels are mixtures.

Petrol and diesel are mixtures of hydrocarbons.

TABLE 4, on the opposite page, 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]

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[Turn over]



**05.3**

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



**05.4**

**When diesel burns in car engines, oxides of nitrogen are produced.**

**Where does the nitrogen come from? [1 mark]**

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**05.5**

**When diesel burns, particulates may be produced.**

**What environmental effect do particulates from burning diesel cause? [1 mark]**

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**[Turn over]**



**05.6**

**Carbon monoxide may be produced when diesel burns.**

**Give ONE reason why carbon monoxide is difficult to detect. [1 mark]**

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**05.7**

**Explain why water vapour and NOT liquid water is produced when diesel burns. [2 marks]**

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0	6
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**Chromatography is used to separate mixtures.**

**Chromatography involves a mobile phase and one other phase.**

0	6	.	1
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**What is the other phase in chromatography? [1 mark]**

**Tick (✓) ONE box.**

**Moving phase**

**Recycled phase**

**Stationary phase**

**Viscous phase**



**06.2**

**Why do the substances in the mixture separate in the mobile phase? [1 mark]**

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**06.3**

**How many spots will be produced on the chromatogram of a pure compound? [1 mark]**

**Number of spots = \_\_\_\_\_**

**[Turn over]**



0	6	.	4
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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]

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$R_f$  value = \_\_\_\_\_













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

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