AQA

Please write clearly in block capitals.

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Forename(s) _____

Candidate signature _____

I declare this is my own work.

GCSE
COMBINED SCIENCE: TRILOGY

F

Foundation Tier
Chemistry Paper 2F

Wednesday 10 June 2020 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	
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.

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0 1 Crude oil is a mixture of hydrocarbons.

0 1 . 1 Complete the sentences.

Choose answers from the box.

[2 marks]

air	**enzymes**	**mud**	**plankton**	**trees**

Crude oil is the remains of _____ .

Millions of years ago biomass was buried under _____ .

0 1 . 2 There are three stages, **A**, **B** and **C**, in separating hydrocarbons from crude oil.

Stage **A** Hydrocarbons evaporate

Stage **B** Crude oil is heated

Stage **C** Vapours condense

Give the correct order for stages **A**, **B** and **C**.

[1 mark]

First stage _____

Second stage _____

Third stage _____

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0 1 . 3 What is the name of the process used in separating hydrocarbons from crude oil?

[1 mark]

Tick (✓) **one** box.

Chromatography ☐

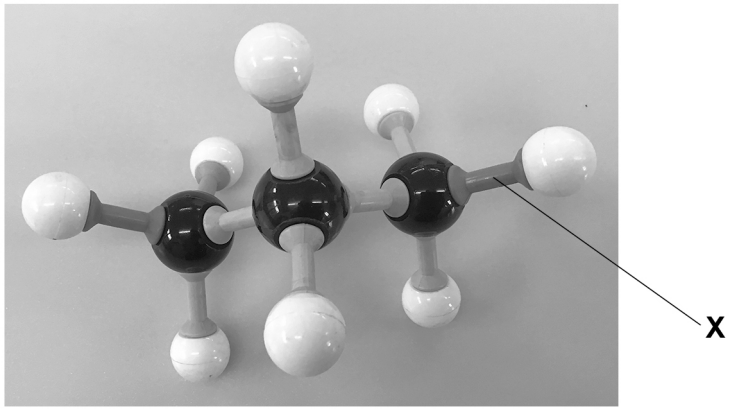
Filtration ☐

Fractional distillation ☐

0 1 . 4 Alkanes are hydrocarbons.

Figure 1 represents an alkane.

Figure 1



What is the formula of the alkane in **Figure 1**?

[1 mark]

C ____ H ____

0 1 . 5 What does **X** represent in **Figure 1**?

[1 mark]

Tick (✓) **one** box.

Covalent bond ☐

Ionic bond ☐

Metallic bond ☐

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0 1 . 6 What is the general formula for alkanes?

[1 mark]

Tick (✓) **one** box.

C_nH_{2n-2} ☐

C_nH_{2n} ☐

C_nH_{2n+2} ☐

0 1 . 7 Hydrocarbons are used to make polymers. Polymers are used to make plastic bags.

In one year 8.0 billion plastic bags were used.

The next year there was a charge for plastic bags and only 1.3 billion plastic bags were used.

Calculate the decrease in the number of plastic bags used.

[1 mark]

Decrease = _____ billion

8

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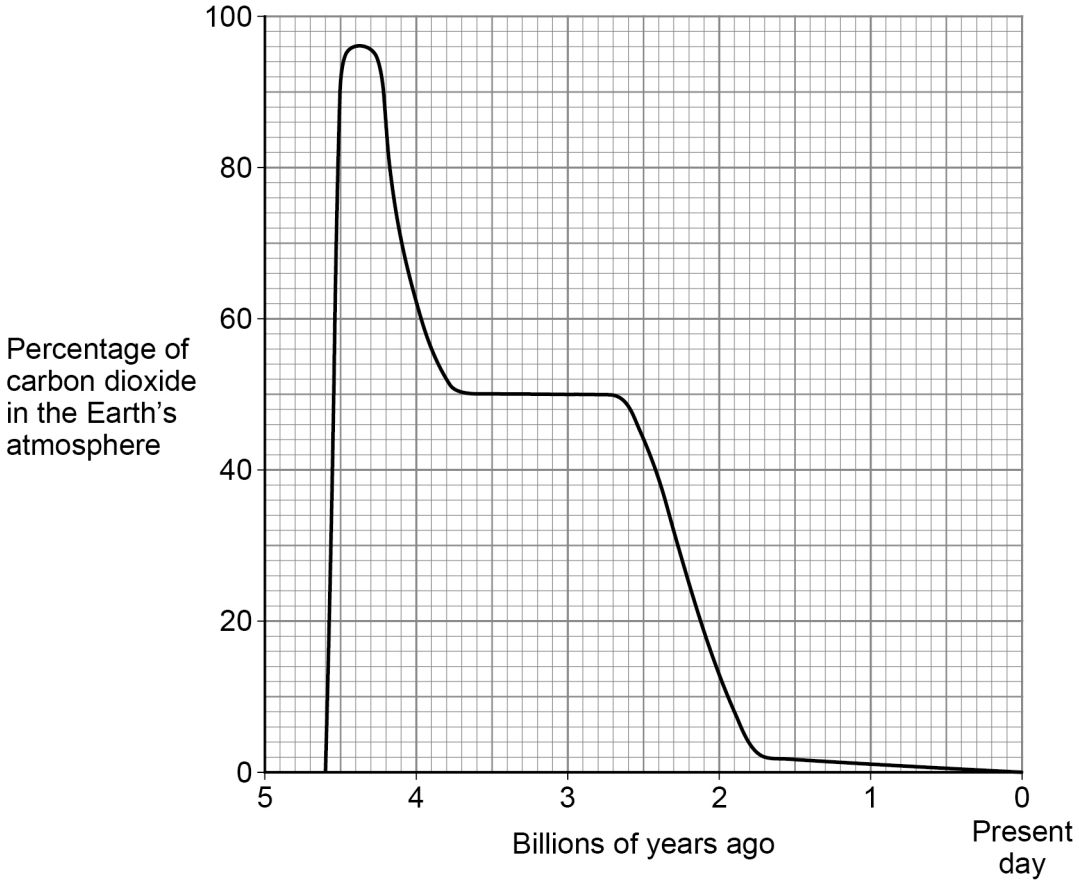
0 2 This question is about carbon dioxide in the Earth's atmosphere.

Figure 2 shows how the percentage of carbon dioxide in the Earth's atmosphere has changed over 4.6 billion years.

Figure 2



0 2 . 1 What was the highest percentage of carbon dioxide in the Earth's atmosphere?

Use **Figure 2**.

[1 mark]

Highest percentage = _____ %

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0 2 . 2 The percentage of carbon dioxide in the atmosphere has decreased since Earth's early atmosphere.

Which **two** processes have decreased the percentage of carbon dioxide in the Earth's atmosphere?

[2 marks]

Tick (✓) **two** boxes.

Combustion of fuels ☐

Formation of sedimentary rocks ☐

Photosynthesis ☐

Volcanic activity ☐

0 2 . 3 The total amount of carbon dioxide emitted over the life cycle of a product can be measured.

What name is given to the total amount of carbon dioxide emitted during the life cycle of a product?

[1 mark]

Tick (✓) **one** box.

Carbon footprint ☐

Global dimming ☐

Greenhouse effect ☐

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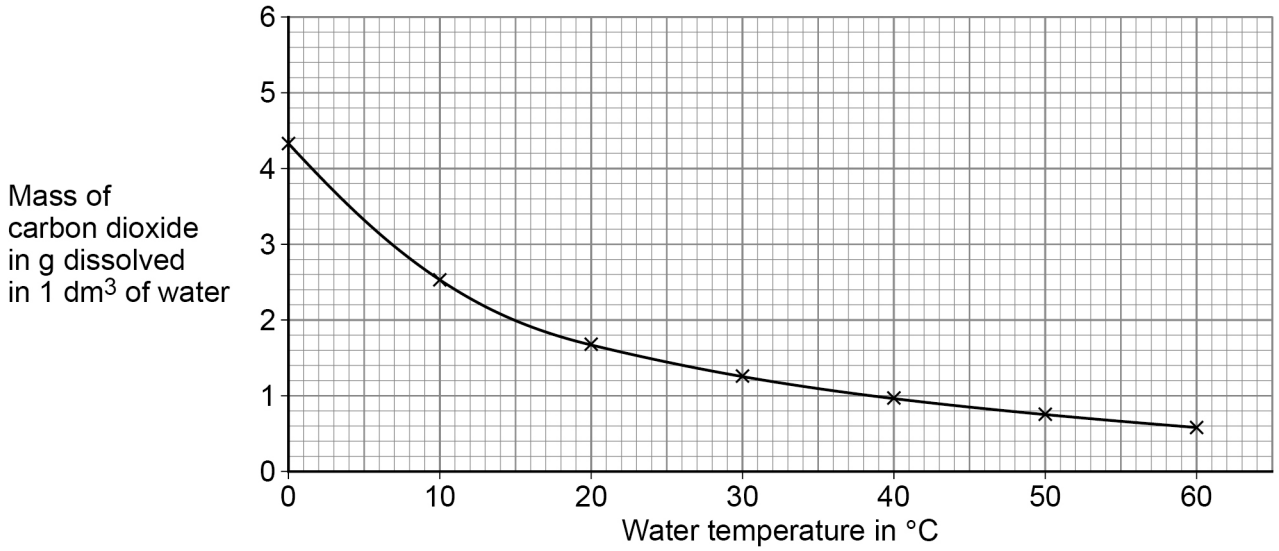
Carbon dioxide dissolves in water.

Figure 3 shows the mass of carbon dioxide dissolved in water at different temperatures.

Figure 3



0 2 . 4 Complete **Table 1**.

Use **Figure 3**.

[2 marks]

Table 1

Water temperature in °C	Mass of carbon dioxide in g dissolved in 1 dm^3 of water
5	
15	

0 2 . 5 Calculate the difference in the mass of carbon dioxide dissolved in 1 dm^3 of water at 5 °C and at 15 °C

Use **Table 1**.

[1 mark]

Mass = _____ g

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0 2 . 6 Carbon dioxide is a greenhouse gas.

The greenhouse effect happens in four stages.

The four stages are:

Stage **A** Carbon dioxide stops longer wavelength radiation escaping

Stage **B** Radiation is absorbed by the Earth

Stage **C** Longer wavelength radiation is emitted

Stage **D** Shorter wavelength radiation enters the atmosphere.

What is the correct order of stages **A**, **B**, **C** and **D**?

[1 mark]

Tick (✓) **one** box.

C, **A**, **B**, **D** ☐

C, **D**, **B**, **A** ☐

D, **B**, **C**, **A** ☐

D, **C**, **B**, **A** ☐

0 2 . 7 Changes in the percentage of carbon dioxide in the Earth's atmosphere cause climate change.

Give **two** effects of climate change.

[2 marks]

1 _____

_____

2 _____

_____

10

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Turn over for the next question

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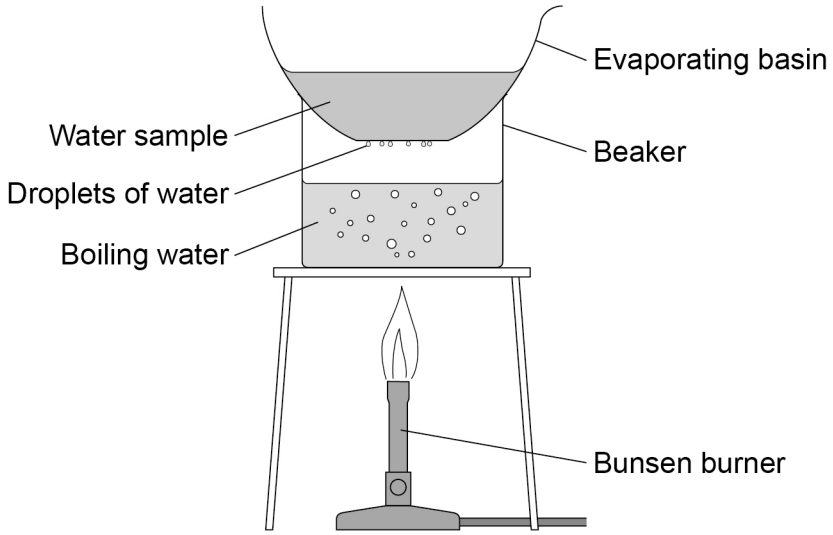
0 3 A student investigated the mass of dissolved solids in water samples.

Figure 4 shows the apparatus used.

Figure 4



This is the method used.

1. Record the mass of a dry evaporating basin.
2. Pour 25 cm^3 of the water sample into the evaporating basin.
3. Place the evaporating basin on the beaker for 10 minutes.
4. Record the mass of the evaporating basin and contents.

0 3 . 1 What is used to find the mass of the evaporating basin?

[1 mark]

Tick (✓) **one** box.

Balance ☐

Beaker ☐

Measuring cylinder ☐

Thermometer ☐

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One error is that droplets of water collect on the bottom of the evaporating basin.

0 3 . 2 Suggest how this error affects the mass of the evaporating basin and contents.

[1 mark]

0 3 . 3 How can this error be corrected?

[1 mark]

0 3 . 4 Another error in the method is that not all the water was removed from the water sample.

How can this error be corrected?

[1 mark]

Tick (✓) **one** box.

Add more boiling water to the beaker. ☐

Heat until the mass of the evaporating basin and contents is constant. ☐

Stir the water sample in the evaporating basin with a glass rod. ☐

Question 3 continues on the next page

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0 3 . 5 The water in the water sample turns into steam.

What is the name of this process?

[1 mark]

Another student did the experiment correctly with three water samples **A**, **B** and **C**.

Table 2 shows the results.

Table 2

Water sample	Mass of dissolved solids in g			
	Test 1	**Test 2**	**Test 3**	**Mean**
A	0.23	0.23	0.20	**X**
B	0.03	0.07	0.02	0.04
C	1.45	1.60	1.45	1.50

0 3 . 6 The range is the difference between the largest value and the smallest value.

Which water sample has the greatest range of results?

[1 mark]

Tick (✓) **one** box.

A ☐

B ☐

C ☐

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0 3 . 7 Calculate the mean mass **X** for water sample **A**.

Use **Table 2**.

[2 marks]

X = _____ g

0 3 . 8 What is the dependent variable in this experiment?

[1 mark]

Tick (✓) **one** box.

- Mass of dissolved solids ☐
- Time taken for water to heat ☐
- Type of water sample ☐
- Volume of boiling water ☐

0 3 . 9 A different water sample contains 3.6 g of dissolved solids in 150 cm^3

Calculate the mass of dissolved solids in 25 cm^3 of this sample.

[2 marks]

Mass = _____ g

11

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0 4 This question is about hydrogen peroxide.

0 4 . 1 The symbol equation for the decomposition of hydrogen peroxide (H_2O_2) is:

$$2\ H_2O_2 \rightarrow 2\ H_2O + O_2$$

Complete the word equation for the decomposition of hydrogen peroxide.

[2 marks]

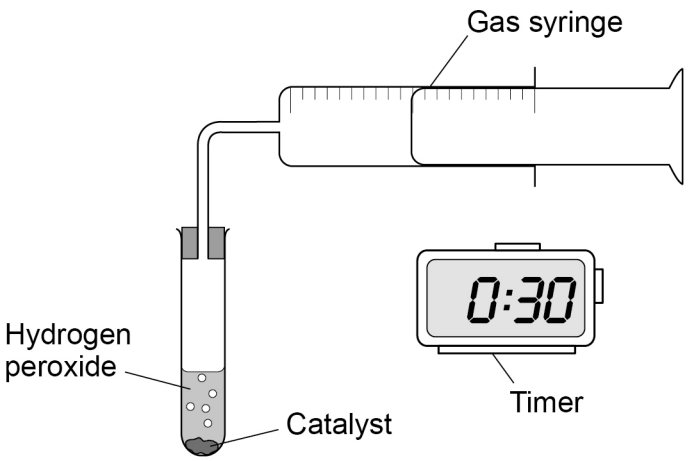
hydrogen peroxide → _____ + _____

A student investigated the effect of different catalysts on the decomposition of hydrogen peroxide.

The student measured the volume of gas collected every 30 seconds for 5 minutes.

Figure 5 shows the apparatus used.

Figure 5



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0 4 . 2 Which **two** variables should the student keep the same to make the investigation a fair test?

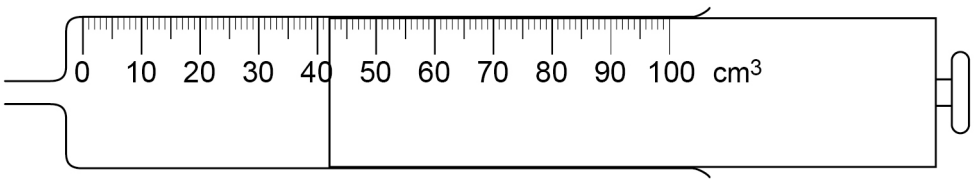
[2 marks]

Tick (✓) **two** boxes.

- Concentration of hydrogen peroxide ☐
- Mass of catalyst ☐
- Size of gas syringe ☐
- Type of catalyst ☐
- Volume of gas collected ☐

0 4 . 3 **Figure 6** shows a gas syringe.

Figure 6



What is the volume of gas in the syringe?

[1 mark]

Volume = _____ cm^3

Question 4 continues on the next page

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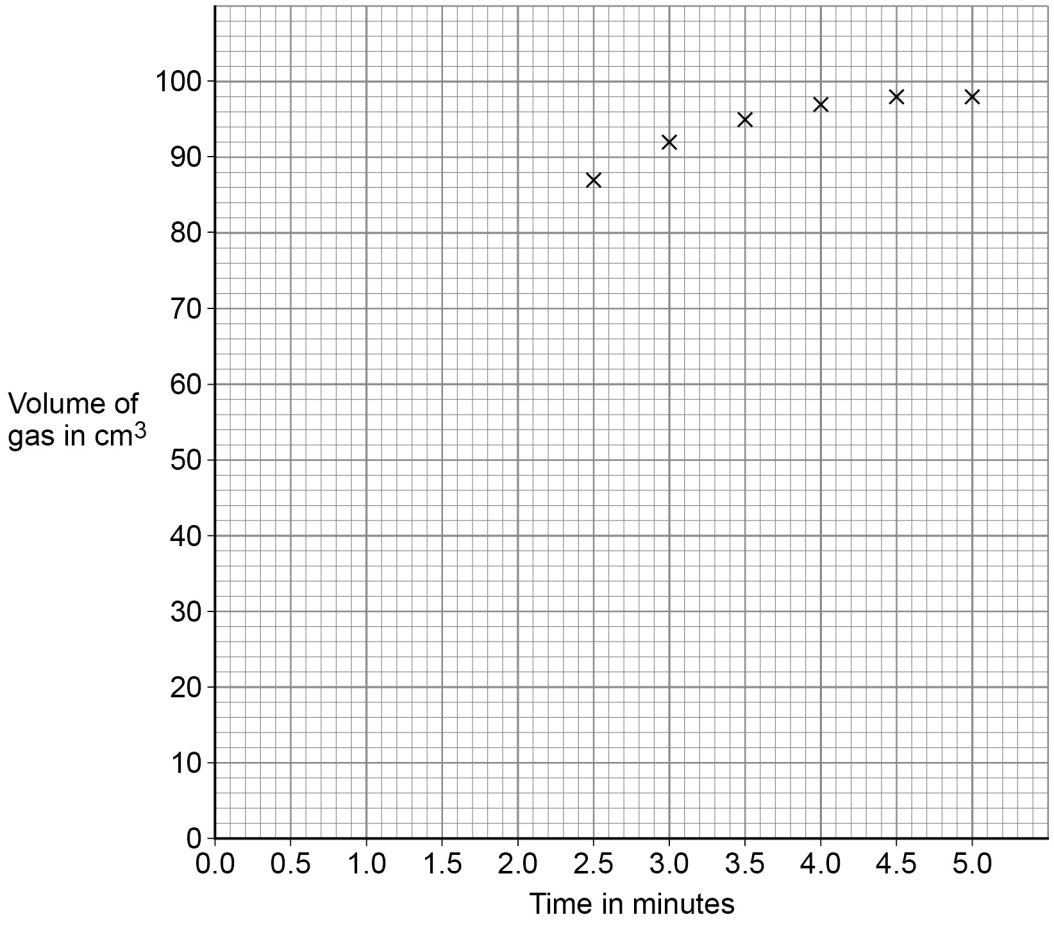
Table 3 shows the student's results for one catalyst.

Table 3

Time in minutes	0.0	0.5	1.0	1.5	2.0
Volume of gas in cm^3	0	34	54	68	78

0 4 . 4 Six of the other results have been plotted on **Figure 7**.

Figure 7



Complete the graph in **Figure 7**.

You should:

- plot the results from **Table 3**
- draw a line of best fit for all of the results.

[3 marks]

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The student repeated the experiment with other catalysts and plotted a graph for each of the catalysts used.

0 4 . 5 Suggest how the student could use these graphs to identify the best catalyst.

[1 mark]

0 4 . 6 All the graphs level off at the same volume of gas.

Suggest why.

[1 mark]

0 4 . 7 In another investigation, a student increased the temperature of the hydrogen peroxide.

Why is the rate of reaction faster when the temperature of the hydrogen peroxide is increased?

[2 marks]

Tick (✓) **two** boxes.

- The concentration of hydrogen peroxide decreases. ☐
- The particles are moving more slowly. ☐
- The particles have more energy. ☐
- There are more particle collisions per second. ☐
- There are more particles per unit volume. ☐

12

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0 5 This question is about mixtures.

0 5 . 1 Which substance is a mixture?

[1 mark]

Tick (✓) **one** box.

Air ☐ Gold ☐ Methane ☐ Nitrogen ☐

0 5 . 2 Food colourings are often mixtures of dyes.

What name is given to mixtures that are designed as useful products?

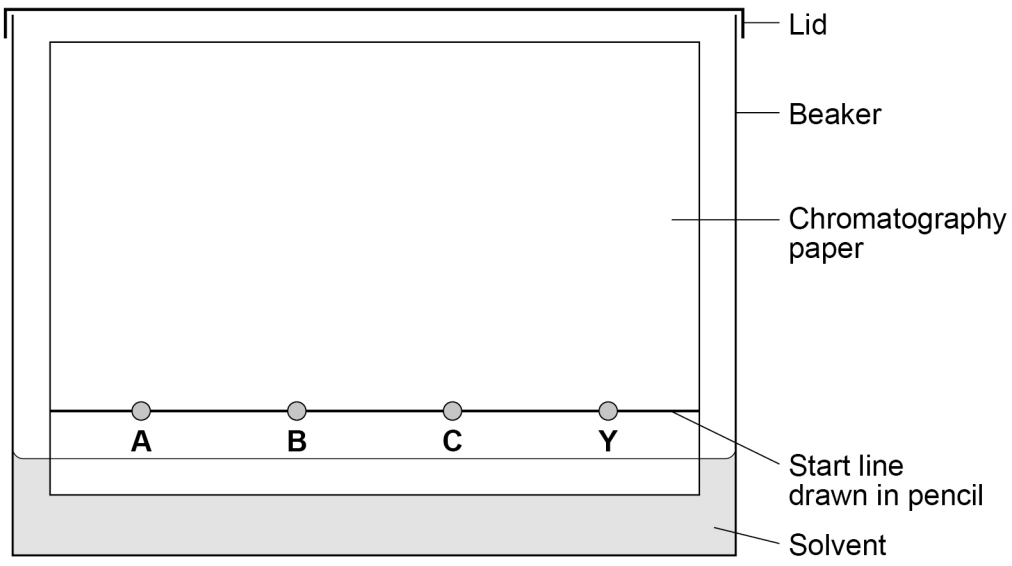
[1 mark]

A student investigated a purple food colouring, **Y**, using chromatography.

The student compares **Y** with dyes **A**, **B** and **C**.

0 5 . 3 **Figure 8** shows the apparatus used.

Figure 8



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Chromatography involves a stationary phase and a mobile phase.

Draw **one** line from each phase to what is used for that phase.

Use **Figure 8**.

[2 marks]

Phase	**What is used**
	Beaker
Mobile phase	Chromatography paper
	Food colouring
Stationary phase	Pencil line
	Solvent

Question 5 continues on the next page

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Figure 9 shows the student's results.

Figure 9

0 5 . 4 What **three** conclusions can you make about the dyes in food colouring **Y**?

[3 marks]

1 _____

_____

2 _____

_____

3 _____

_____

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0 5 . 5 In a different experiment a student recorded these results:

Distance moved by dye **G** = 60 mm

Distance moved by solvent = 80 mm

Calculate the R_f value of dye **G**.

$$R_f = \frac{\text{distance moved by dye } \mathbf{G}}{\text{distance moved by solvent}}$$

[2 marks]

R_f = _____

9

Turn over for the next question

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0 6 This question is about the Earth's resources.

When most fuels burn carbon dioxide is produced.

Propane (C_3H_8) is a fuel.

0 6 . 1 Balance the equation for the combustion of propane.

[1 mark]

$$C_3H_8 + \_\_\_\_ O_2 \rightarrow 3\,CO_2 + 4\,H_2O$$

0 6 . 2 Describe the test for carbon dioxide.

Give the result of the test.

[2 marks]

Test _____

Result _____

_____

0 6 . 3 Propane can be cracked to produce propene and hydrogen.

Complete the symbol equation for the reaction.

[1 mark]

$$\underset{\text{propane}}{C_3H_8} \rightarrow \underset{\text{propene}}{\_\_\_\_\_} + \underset{\text{hydrogen}}{H_2}$$

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0 6 . 4 Describe the test for hydrogen.

Give the result of the test.

[2 marks]

Test _____

Result _____

_____

0 6 . 5 Propene is an alkene.

Describe the test for alkenes.

Give the colour change in the test.

[3 marks]

Test _____

Colour change _____ to _____

9

Turn over for the next question

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0 7 Some students investigated the effect of temperature on the rate of reaction.

0 7 . 1 The students reacted sodium thiosulfate solution with hydrochloric acid.

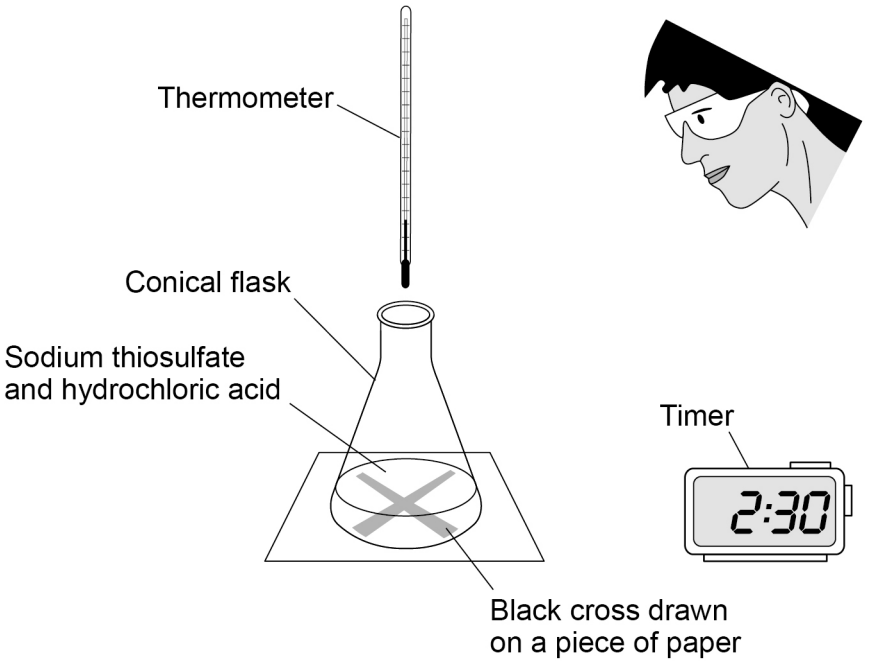
This is the method used.

1. Use a beaker to measure 50 cm^3 of heated sodium thiosulfate solution into a conical flask.
2. Measure the temperature of the room.
3. Put the conical flask on a black cross drawn on a piece of paper.
4. Start a timer.
5. Use the same beaker to measure 10 cm^3 of hydrochloric acid into the conical flask.
6. Stop the timer when the cross is no longer visible.

The students repeated the experiment at a different room temperature.

Figure 10 shows the apparatus.

Figure 10



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The method contains errors and does **not** produce accurate results.

Describe a method the students should use to produce accurate results.

You do **not** need to write about safety precautions.

[6 marks]

Question 7 continues on the next page

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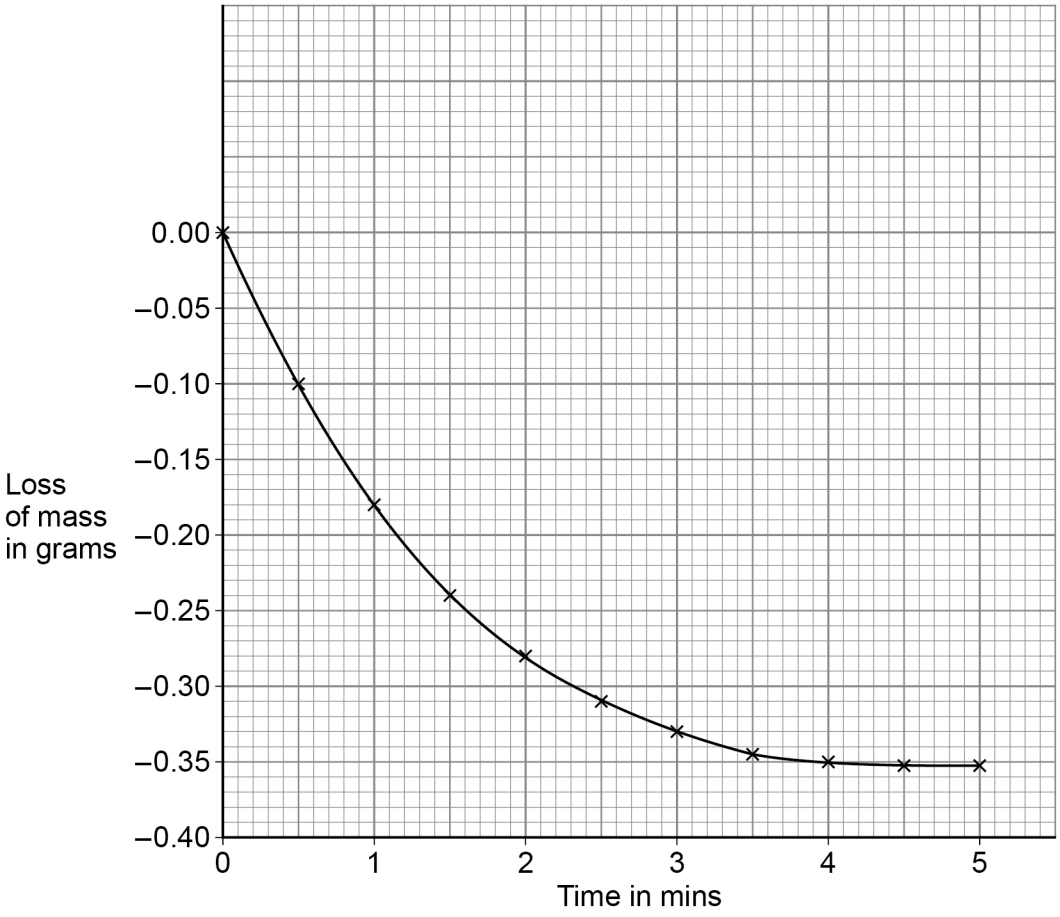
Some students investigated the effect of temperature on the rate of a different reaction.

They recorded the loss of mass from their apparatus at 40 °C

Figure 11 shows the results.

Figure 11



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0 7 . 2 Calculate the mean rate of reaction between 1 minute and 3 minutes at 40 °C

Use **Figure 11** and the equation:

$$\text{Mean rate of reaction} = \frac{\text{change in mass of gas in g}}{\text{time in mins}}$$

[3 marks]

Mean rate of reaction = _____ g/min

0 7 . 3 Draw a curve on **Figure 11** for the results you would expect at a temperature of 50 °C instead of 40 °C

[2 marks]

END OF QUESTIONS

11

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