



Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

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.

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.

For Examiner's Use

Question	Mark
1	
2	
3	
4	
5	
6	
7	
TOTAL	



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8464/C/2F

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 plankton.

0 1 . 4

Millions of years ago biomass was buried under mud.

0 1 . 2

There are three stages, **A**, **B** and **C**, in separating hydrocarbons from crude oil.Stage **A** Hydrocarbons evaporateStage **B** Crude oil is heatedStage **C** Vapours condenseGive the correct order for stages **A**, **B** and **C**.

[1 mark]

First stage

B

Second stage

A

Third stage

C

Covalent bond



Ionic bond



Metallic bond



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

Tick (✓) **one** box.

Chromatography

☐

Filtration

☐

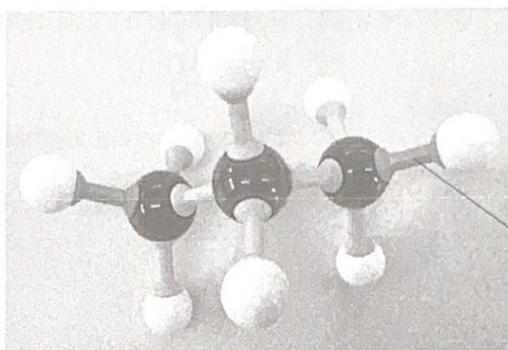
Fractional distillation

☒

0 1 . 4 Alkanes are hydrocarbons.

0 1 . 7 Figure 1 represents an alkane.

Figure 1



What is the formula of the alkane in Figure 1?

[1 mark]

C 3 H 8

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

[1 mark]

Tick (✓) **one** box.

Covalent bond

☒

Ionic bond

☐

Metallic bond

☐

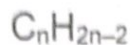
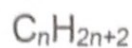
Turn over ►



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

[1 mark]

Tick (✓) one box.

☐☐☒

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]

$$8.0 - 1.3 = 6.7$$

Decrease = 6.7 billion

8

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

Use Figure 2.

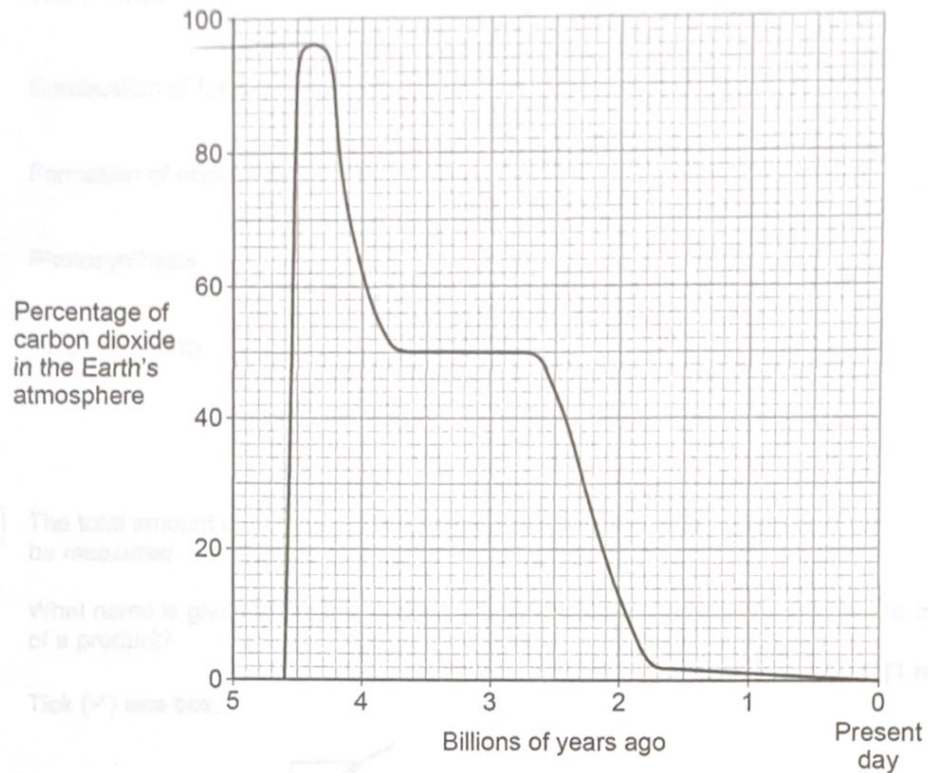
Highest percentage = 96

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.

Highest percentage = 96 [1 mark]
%



0 5

Turn over ►

- 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

☐

- 0 2 . 5 Calculate the difference in the mass of carbon dioxide dissolved in 1 dm³ of water at 5 °C and at 15 °C.

Use Table 1.

[1 mark]

$$3.3 - 2 = 1.3$$

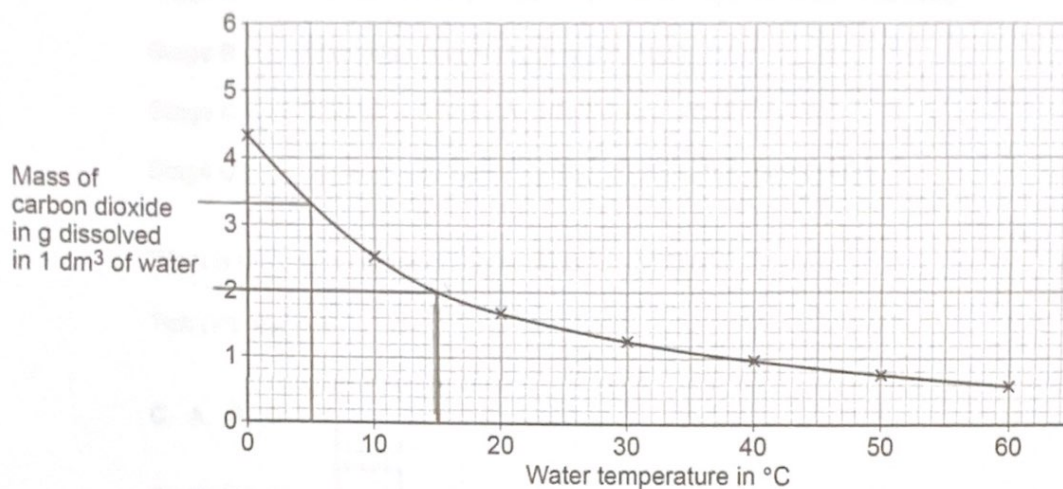
$$\text{Mass} = 1.3$$



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 dm³ of water
5	3.3
15	2

0 2 . 5 Calculate the difference in the mass of carbon dioxide dissolved in 1 dm³ of water at 5 °C and at 15 °C

Use Table 1.

[1 mark]

$$3.3 - 2 = 1.3$$

Mass = 1.3 g

Turn over ►



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 Rising sea levels

2 Extremes of weather

10

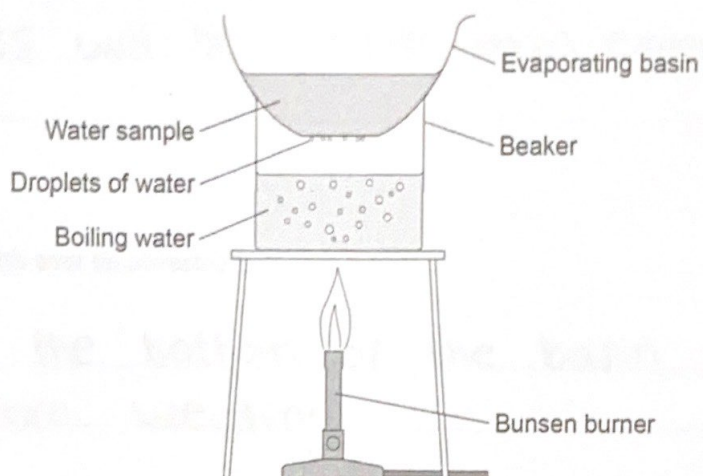


03

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 cm³ 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.

03.1

What is used to find the mass of the evaporating basin?

[1 mark]

Tick (✓) **one** box.

Balance

☒

Beaker

☐

Measuring cylinder

☐

Thermometer

☐


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]

mass will be greater than expected

0 3 . 3

How can this error be corrected?

[1 mark]

dry the bottom of the basin
before weighing.

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

Turn over ►



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

What is the name of this process?

[1 mark]

evaporation

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 ☒



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

Use Table 2.

[2 marks]

$$\frac{0.23 + 0.23 + 0.2}{3} = 0.22$$

$$X = 0.22 \text{ g}$$

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 cm³

Calculate the mass of dissolved solids in 25 cm³ of this sample.

[2 marks]

$$\frac{25}{150} \times 3.6 = 0.6$$

$$\text{Mass} = 0.6 \text{ g}$$

11

Turn over ►



0 4

This question is about hydrogen peroxide.

0 4 . 1

The symbol equation for the decomposition of hydrogen peroxide (H_2O_2) is:

Complete the word equation for the decomposition of hydrogen peroxide.

[2 marks]

hydrogen peroxide \rightarrow water + oxygen

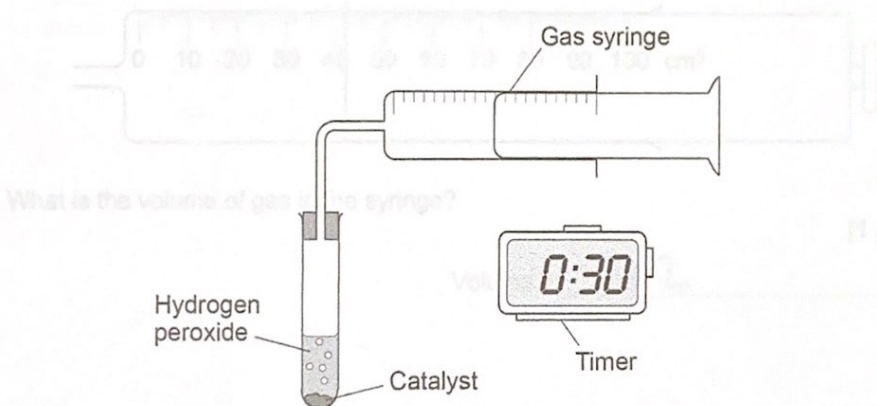
A student investigated the effect of different catalysts on the decomposition of hydrogen peroxide.

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

0 4 . 3

Figure 5 shows the apparatus used.

Figure 5



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

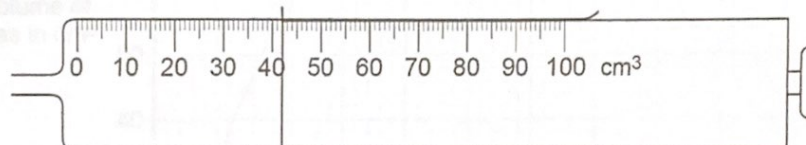
☐

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 = 42 cm³

Question 4 continues on the next page

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]

Turn over ►



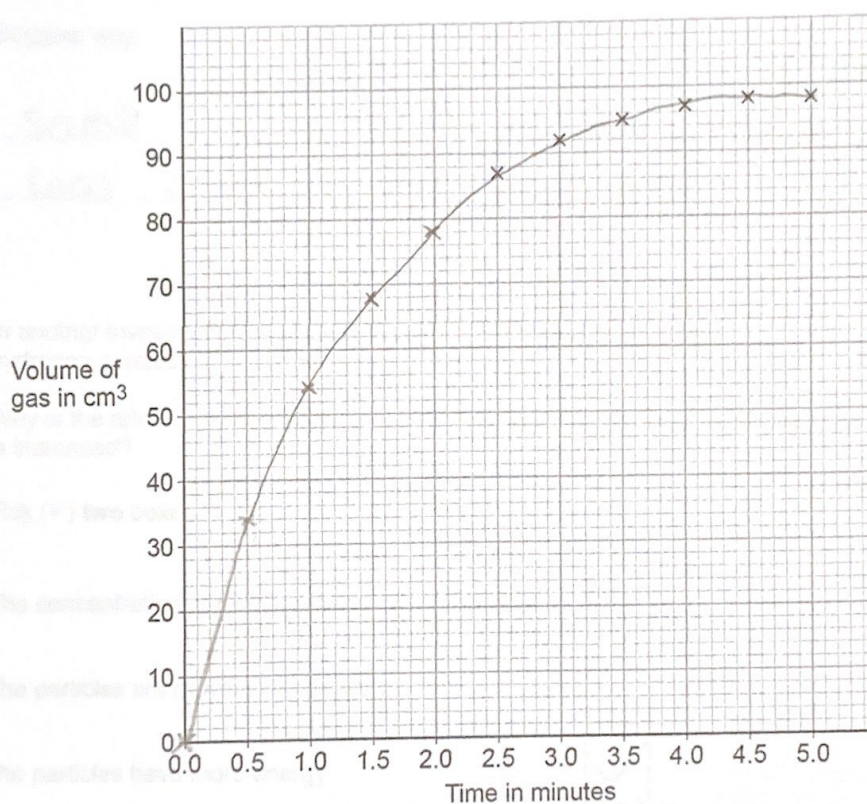
Table 3 shows the student's results for one catalyst.

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]



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]

The best catalyst will have the
steepest initial gradient

- 0 4 . 6 All the graphs level off at the same volume of gas. Suggest why. [1 mark]

Same volume of hydrogen peroxide
was used in all experiments

- 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.

☐

Turn over ►



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?

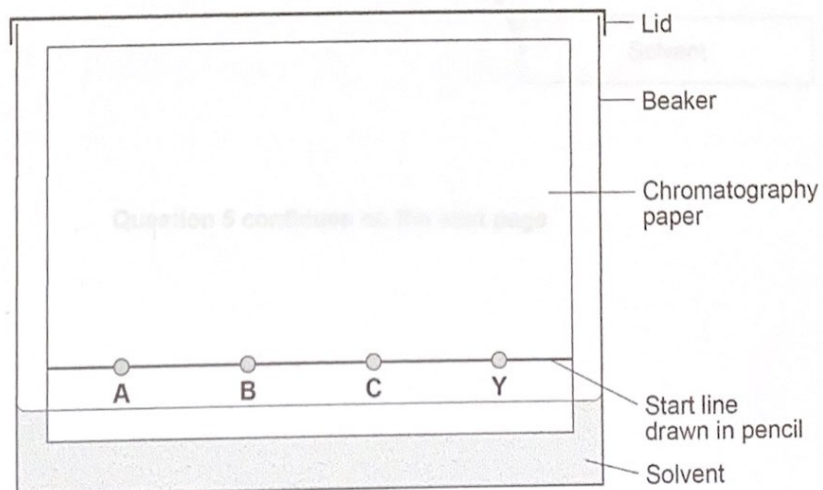
[1 mark]

formulationA 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



Chromatography involves a stationary phase and a mobile phase.

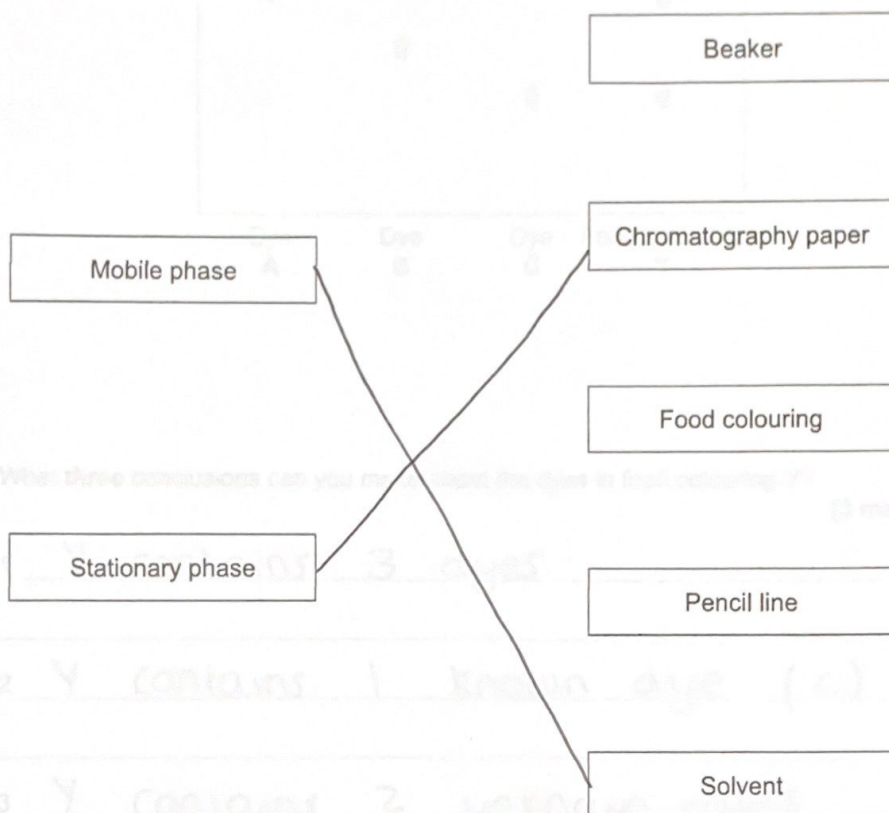
Draw **one** line from each phase to what is used for that phase.

Use Figure 8.

[2 marks]

Phase

What is used



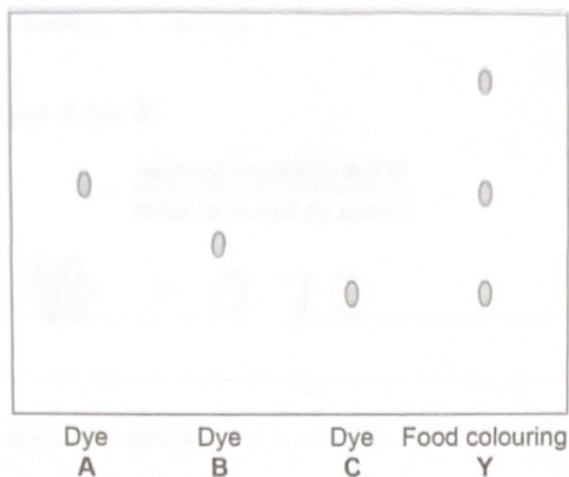
Question 5 continues on the next page

Turn over ►



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 Y contains 3 dyes

2 Y contains 1 known dye (c)

3 Y contains 2 unknown dyes



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.

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

[2 marks]

$$R_f = \frac{60}{80} = 0.75$$

$$R_f = 0.75$$

9

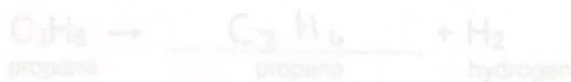
Turn over for the next question

0 6 5

Propene can be cracked to produce propane and hydrogen.

Complete the symbol equation for the reaction.

[1 mark]



Turn over ►



2 1

0 6

This question is about the Earth's resources.

When most fuels burn carbon dioxide is produced.

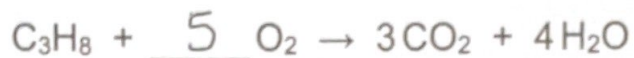
Propane (C_3H_8) is a fuel.

0 6

1

Balance the equation for the combustion of propane.

[1 mark]



0 6

2

Describe the test for carbon dioxide.

Give the result of the test.

[2 marks]

Test bubble gas through limewaterResult turns cloudy

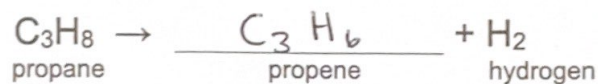
0 6

3

Propane can be cracked to produce propene and hydrogen.

Complete the symbol equation for the reaction.

[1 mark]



0 6 . 4 Describe the test for hydrogen.

Give the result of the test.

[2 marks]

Test Hold lit splint to test tube

Result A squeaky pop will be heard if hydrogen is present

0 6 . 5 Propene is an alkene.

Describe the test for alkenes.

Give the colour change in the test.

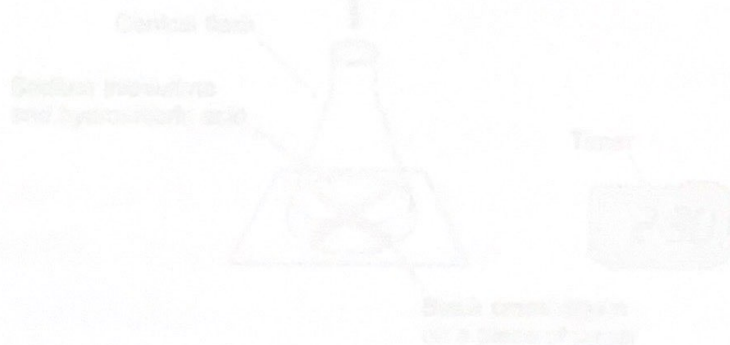
[3 marks]

Test add bromine water

Colour change Orange to colourless

9

Turn over for the next question



Turn over ►



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.

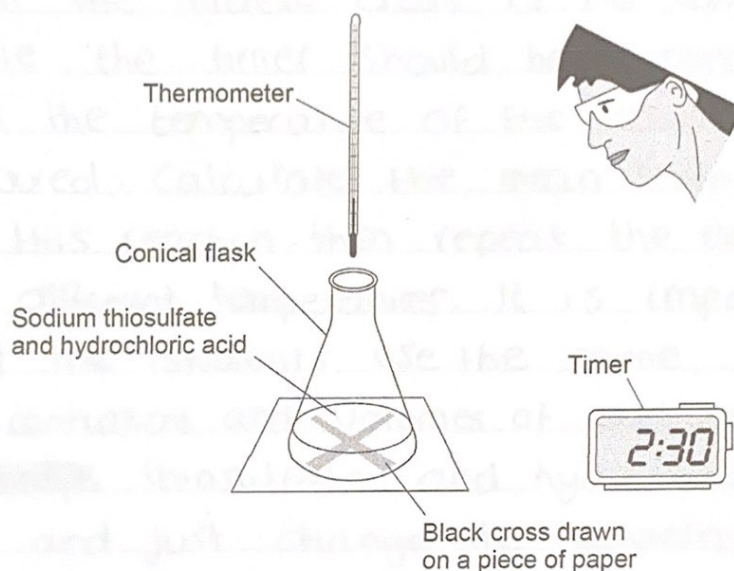
This is the method used.

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



Question 7 continues on the next page



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]

Use a measuring cylinder to measure 50 cm^3 of sodium thiosulfate and use a different measuring cylinder to measure 10 cm^3 of hydrochloric acid. Add them together in a conical flask and immediately start the timer and measure the temperature of the solution. The flask should be placed on the piece of paper with the black cross. When the black cross is no longer visible the timer should be stopped and the temperature of the solution is measured. Calculate the mean temperature for this reaction. then repeat the experiment at different temperatures. It is important that the students use the same concentrations and volumes of sodium ~~thiosulfate~~ thiosulfate and hydrochloric acid and just change the temperature by heating the different solutions.

Question 7 continues on the next page

Turn over ►

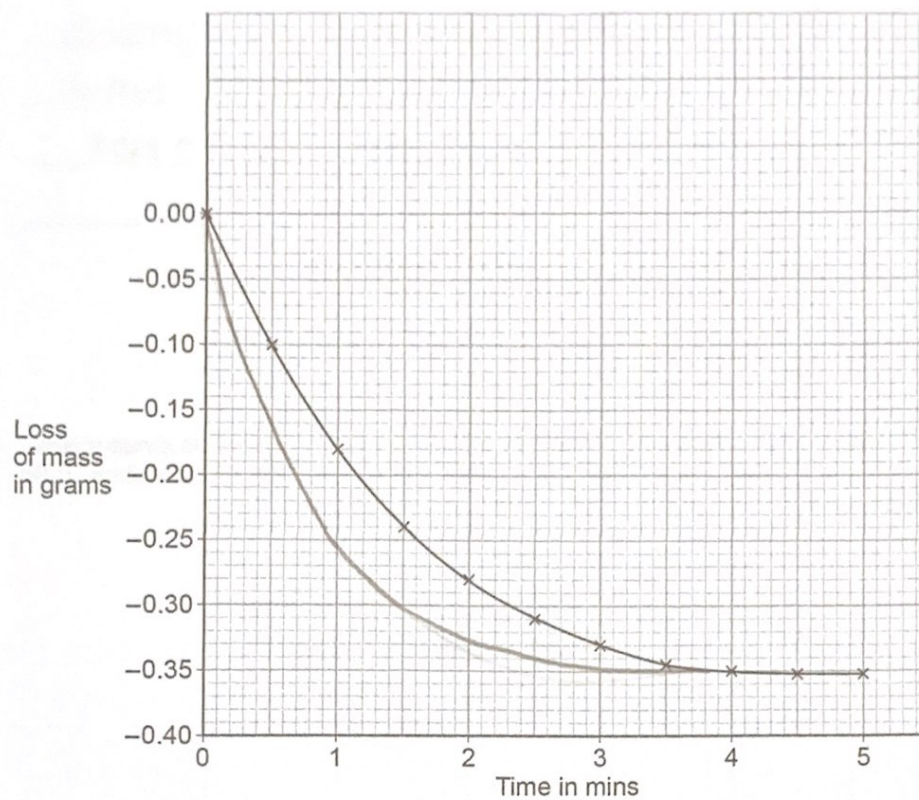


Some students investigated the effect of temperature on the rate of a different reaction.

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

Figure 11 shows the results.

Figure 11



07.2

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]

$$\begin{aligned} \text{change in mass of gas} &= 0.15 \\ \text{time} &= 2 \\ \text{rate of reaction} &= \frac{0.15}{2} = 0.075 \end{aligned}$$

$$\text{Mean rate of reaction} = 0.075 \text{ g/min}$$

07.3

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

[2 marks]

11

END OF QUESTIONS

