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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

Friday 13 June 2025

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	
TOTAL	



J U N 2 5 8 4 6 4 C 2 F 0 1

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8464/C/2F

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Crude oil is a resource found in rocks.

0	1	.	1
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What is crude oil produced from?

[1 mark]

Tick (✓) **one** box.

Microbes

☐

Plankton

☐

Water

☐

0	1	.	2
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Most of the compounds in crude oil are made of carbon and hydrogen atoms only.

What name is given to compounds made of carbon and hydrogen atoms only?

[1 mark]

Tick (✓) **one** box.

Fertilisers

☐

Halogens

☐

Hydrocarbons

☐

0 1 3

Crude oil found in different areas has different compositions.

Table 1 shows the percentage (%) composition of crude oil from two different areas.

Table 1

Component	Percentage (%) of component	
	Area A	Area B
Diesel oil	18	13
Heavy fuel oil	32	60
Kerosene	12	10
Petrol	38	17

Give **three** differences between the composition of crude oil from area **A** and crude oil from area **B**.

[3 marks]

- 1 _____

- 2 _____

- 3 _____

Question 1 continues on the next page

Turn over ►



Table 2 shows the percentage (%) composition of crude oil from area **C**.

Table 2

Component	Percentage (%) of component from area C
Diesel oil	15
Heavy fuel oil	42
Kerosene	12
Petrol	31

0 1 . 4 Calculate the volume of **kerosene** in 160 dm³ of crude oil from area **C**.

Give your answer to 2 significant figures.

Use **Table 2**.

[3 marks]

Volume (2 significant figures) = _____ dm³

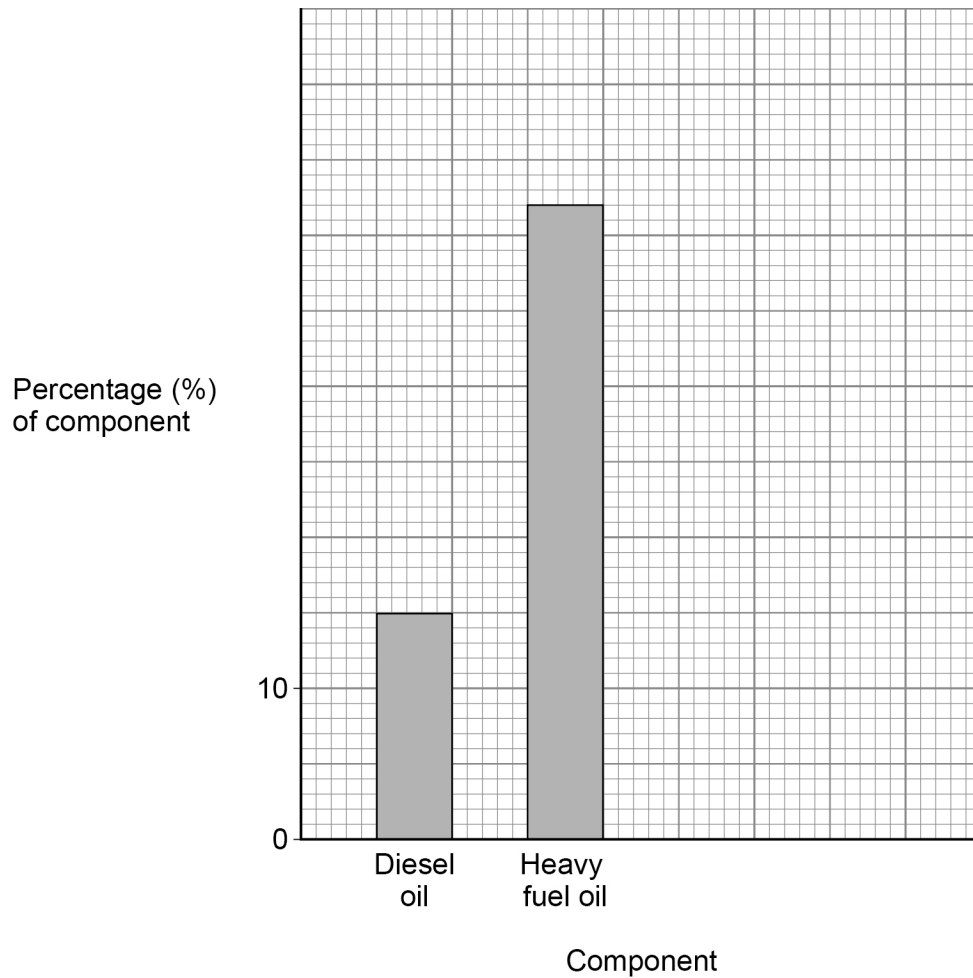


0 1 5

Complete **Figure 1**.

You should:

- complete the scale for the y-axis
- plot the data for kerosene and for petrol from **Table 2**
- label the bars for kerosene and for petrol.

[3 marks]**Figure 1**

11

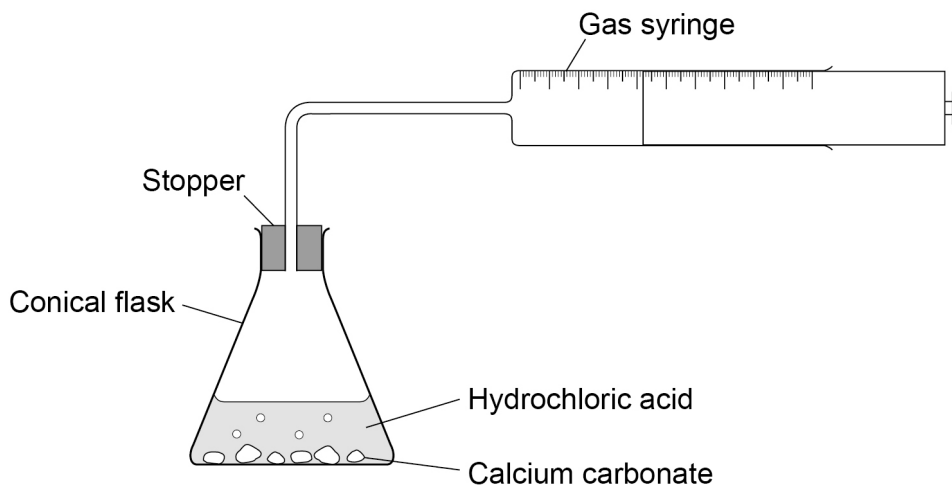
Turn over for the next question**Turn over ►**

0 2

A student investigated the reaction of calcium carbonate with hydrochloric acid.

Figure 2 shows the apparatus.

Figure 2



This is the method used.

1. Measure 50 cm³ of hydrochloric acid into a conical flask.
2. Add 4.0 g of calcium carbonate to the conical flask.
3. Insert the stopper into the conical flask as quickly as possible.
4. Start a timer.
5. Measure the volume of gas collected every 30 seconds for 3 minutes.
6. Repeat steps 1 to 5 using different concentrations of hydrochloric acid.

0 2 . 1

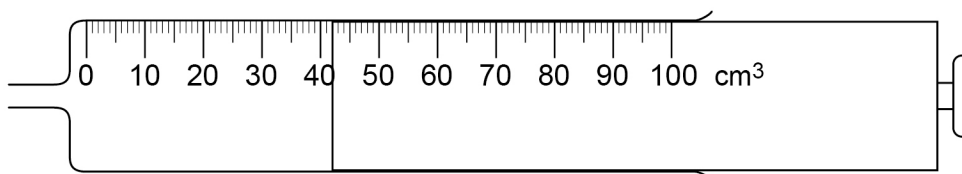
Name a suitable piece of equipment to measure 4.0 g of calcium carbonate.

[1 mark]



0 2 . 2 Figure 3 shows the gas syringe during the investigation.

Figure 3



What is the reading on the gas syringe?

[1 mark]

_____ cm³

0 2 . 3 What is the independent variable in the investigation?

[1 mark]

Tick (✓) **one** box.

Concentration of hydrochloric acid

☐

Mass of calcium carbonate

☐

Temperature of the room

☐

0 2 . 4 Why did the student insert the stopper into the conical flask as quickly as possible in step 3?

[1 mark]

Question 2 continues on the next page

Turn over ►



0 2 . 5 The gas produced during the investigation is carbon dioxide.

The test for carbon dioxide uses limewater.

What is the chemical name for limewater?

[1 mark]

Tick (✓) **one** box.

Calcium hydroxide solution

☐

Potassium carbonate solution

☐

Sodium chloride solution

☐

0 2 . 6

The student measured the volume of gas collected every 30 seconds for 3 minutes.

The volume of gas was zero at the start.

For one concentration of hydrochloric acid, the volumes of gas collected were:

43 cm³66 cm³78 cm³83 cm³84 cm³85 cm³

Complete **Table 3**.

You should:

- add headings to each column
- add units
- add all of the results to the table.

[4 marks]

Table 3

0	0

Turn over ►



0 2 . 7

The student used a different concentration of hydrochloric acid.

18 cm³ of gas was collected in the first 30 seconds.

Calculate the mean rate of reaction for the first 30 seconds.

Use the equation:

$$\text{mean rate of reaction} = \frac{\text{volume of gas collected in cm}^3}{\text{time taken in seconds}}$$

Choose the unit from the box.

[3 marks]

cm ³	cm ³ /s	s	s/cm ³
-----------------	--------------------	---	-------------------

Mean rate of reaction = _____ Unit _____

0 2 . 8

Increasing the concentration of hydrochloric acid increases the rate of the reaction.

What are **two** reasons why?

[2 marks]

Tick (✓) **two** boxes.

The particles are closer together.

☐

The particles collide more frequently.

☐

The particles have a lower surface area.

☐

The particles have less energy.

☐

The particles move faster.

☐


0 3

Screenwash is a mixture designed to keep car windscreens clean.

The components in screenwash include glycerol, methanol and water.

0 3 . 1

Screenwash is made by mixing the components in carefully measured quantities so that the product has the required properties.

What name is given to this type of mixture?

[1 mark]

Tick (✓) **one** box.

Catalyst

☐

Formulation

☐

Polymer

☐**0 3 . 2**

Glycerol has the formula $C_3H_8O_3$

How many atoms are there in one molecule of glycerol?

[1 mark]

Tick (✓) **one** box.

3

☐

8

☐

11

☐

14

☐

Question 3 continues on the next page

Turn over ►

0 3 . 3

Incomplete combustion happens when glycerol burns in limited oxygen.

Incomplete combustion produces carbon monoxide gas.

Why can the production of carbon monoxide gas be a problem?

[1 mark]

Tick (✓) **one** box.

Carbon monoxide is a greenhouse gas.

☐

Carbon monoxide is a toxic gas.

☐

Carbon monoxide is an acidic gas.

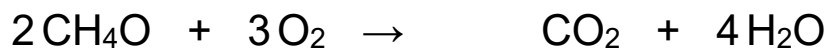
☐

0 3 . 4

Complete combustion happens when methanol (CH_4O) burns in excess oxygen.

Balance the equation for the reaction.

[1 mark]



Methanol can be produced by the reaction of carbon dioxide with hydrogen.

0 3 . 5

Describe the test for hydrogen gas.

Give the result of the test.

[2 marks]

Test _____

Result _____

0 3 . 6

Carbon dioxide is a greenhouse gas.

An increase in greenhouse gases in the atmosphere has led to an increase in average global temperature.

The increase in average global temperature has caused global climate change.

Give **two** effects of global climate change.

[2 marks]

1 _____

2 _____

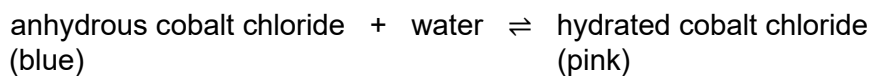
Question 3 continues on the next page

Turn over ►



Anhydrous cobalt chloride can be used to test for water.

The word equation for the reaction is:



0 3 . 7

Suggest **one** observation that could be made when water is added to anhydrous cobalt chloride.

[1 mark]

0 3 . 8

The reaction between anhydrous cobalt chloride and water is exothermic.

What type of reaction is the reverse reaction?

[1 mark]

10



0 4

Humans use many different resources.

Water is an important natural resource.

0 4 . 1

What is meant by 'potable water'?

[1 mark]Tick (✓) **one** box.

Water from the ground

☐

Water that is pure

☐

Water that is safe to drink

☐**0 4 . 2**

Waste water needs treatment before the water is put back into rivers and the sea.

The first stage of waste water treatment is to pass the waste water through metal grids.

Why is the waste water passed through metal grids?

[1 mark]Tick (✓) **one** box.

To remove dissolved salts

☐

To remove large solid objects

☐

To remove microbes

☐

To remove oxygen gas

☐**Turn over ►**

Clothes can be made from different materials.

Some clothes are made from wool and some clothes are made from poly(propene).

0 4 . 3 One sheep produces 4.5 kg of wool.

50 g of wool is needed to make a hat.

Calculate the number of hats that can be made from the wool of one sheep.

1 kg = 1000 g

[3 marks]

Number of hats = _____



0 4 . 4 Table 4 gives information about poly(propene) and wool.

Table 4

	Poly(propene)	Wool
Source of material	Crude oil	Sheep
Level of insulation	High	Medium
Cost	Low	High
Durability	High	Medium

Explain the advantages of using poly(propene) and of using wool for clothing.

[4 marks]

Extra space

Question 4 continues on the next page

Turn over ►



0	4	.	5
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After being used, clothes can be:

- given to other people to wear
- used to make insulation blocks for buildings.

Complete the sentences.

Choose answers from the box.

[2 marks]

recycled

reduced

released

reused

reversed

When clothes are given to other people to wear,

the clothes are _____.

When clothes are used to make insulation blocks for buildings,

the clothes are _____.



Poly(propene) is made from an alkene.

Alkenes are produced by cracking alkanes.

0 4 . 6 A high temperature is used for cracking alkanes.

Which **two** of the following can also be used to crack alkanes?

[2 marks]

Tick (✓) **two** boxes.

A catalyst

☐

A solvent

☐

Carbon dioxide

☐

Steam

☐

Sulfuric acid

☐

0 4 . 7 Which chemical is used to test for alkenes?

[1 mark]

Tick (✓) **one** box.

Ammonia

☐

Bromine water

☐

Copper sulfate

☐

Nitrogen

☐

Turn over ►



0 5

Dodecane is an alkane.

0 5 . 1

The general formula for alkanes is C_nH_{2n+2}

A molecule of dodecane has 12 carbon atoms.

Complete the formula of dodecane.

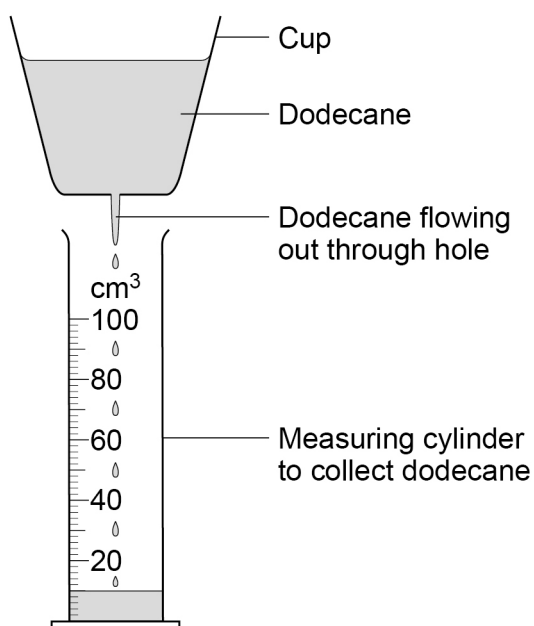
[1 mark]

C ____ H ____

A student investigated the effect of changing the temperature on the viscosity of dodecane.

Figure 4 shows the apparatus.

Figure 4



This is the method used.

1. Add 100 cm³ of dodecane at 25 °C to the cup.
2. Immediately start a timer.
3. Stop the timer when 40 cm³ of dodecane has been collected in the measuring cylinder.
4. Record the time taken.
5. Repeat steps 1 to 4 using dodecane at different temperatures.

0 5 . 2 The student used a water bath to heat the dodecane.

Suggest **one** reason why the student used a water bath instead of a Bunsen burner to heat the dodecane.

[1 mark]

0 5 . 3 Give **one** control variable used in the investigation.

[1 mark]

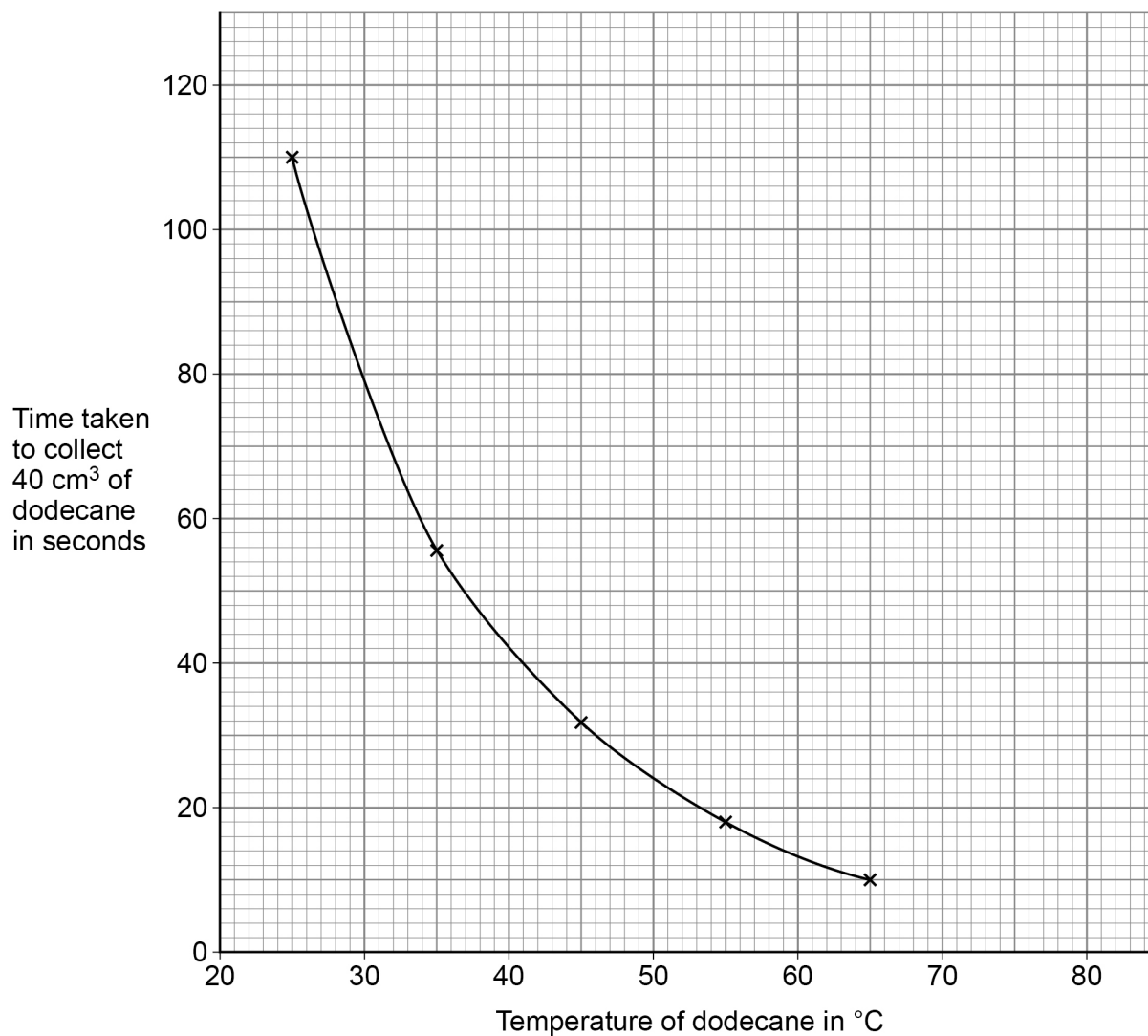
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Figure 5 shows the results.

Figure 5



0 5 . 4 Predict the time taken to collect 40 cm³ of dodecane at 75 °C.

You should extend the line of best fit on **Figure 5**.

[2 marks]

Time taken = _____ s



0	5	.	5
---	---	---	---

The higher the viscosity, the slower dodecane flows.

Explain how the trend in **Figure 5** shows the effect of an increase in temperature on the **viscosity** of dodecane.

[2 marks]

7

Turn over for the next question

Turn over ►



0 6

The proportions of most gases in the Earth's atmosphere have not changed much for the past 200 million years.

0 6**1**

About one-fifth of the atmosphere is oxygen.

Describe the test for oxygen gas.

Give the result of the test.

[2 marks]

Test _____

Result _____

0 6**2**

Table 5 shows the percentages of some gases in the Earth's early atmosphere and in the Earth's atmosphere today.

Table 5

Gas	Percentage (%) of gas in the atmosphere	
	Earth's early atmosphere	Earth's atmosphere today
Carbon dioxide	95	0.04
Nitrogen	3	78.0
Oxygen	Less than 1	21.0



You should refer to all three gases in **Table 5**.

[illegible]

Give **two** ways to reduce methane emissions into the atmosphere.

- 1 _____
- 2 _____

The percentage of sulfur dioxide in the Earth's atmosphere increased between 1850 and 1980.

0 6 . 4

Describe how sulfur dioxide emissions are produced.

[2 marks]

0 6 . 5

Give **one** harmful effect of sulfur dioxide emissions.

[1 mark]

0 6 . 6

Suggest **one** reason why the percentage of sulfur dioxide in the Earth's atmosphere has decreased since 1980.

[1 mark]

14

END OF QUESTIONS



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