AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

GCSE CHEMISTRY

F

Foundation Tier Paper 2

Friday 13 June 2025 Morning Time allowed: 1 hour 45 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. Do not write outside the box around each page or on blank pages.
- 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.

Information
- The maximum mark for this paper is 100.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- In all calculations, show clearly how you work out your answer.
- 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	
8	
9	
10	
TOTAL	

Do not write outside the box

0 1 This question is about chemical analysis.

Some metal ions can be identified using a flame test.

0 1 . 1 Describe how to do a flame test using a metal wire and a Bunsen burner.

[2 marks]

0 1 . 2 Draw **one** line from each metal ion to the flame colour produced by the metal ion.

[2 marks]

Metal ion	**Flame colour**
	Crimson
	Green
Lithium	
	Lilac
Potassium	
	Orange-red
	Yellow

Do not write outside the box

0 1 . 3 Which gas is produced when carbonates are reacted with dilute acids?

[1 mark]

Tick (✓) **one** box.

Carbon dioxide ☐

Hydrogen ☐

Oxygen ☐

0 1 . 4 Which solution is used to test for sulfate ions?

[1 mark]

Tick (✓) **one** box.

Barium chloride solution ☐

Magnesium chloride solution ☐

Sodium chloride solution ☐

Precipitates are used to identify some ions.

0 1 . 5 Complete the sentence.

Choose the answer from the box.

[1 mark]

gas	**liquid**	**solid**

A precipitate is a _____.

Do not write outside the box

0 1 . 6 Some metal ions in solution can be identified by adding sodium hydroxide solution.

Draw **one** line from each metal ion to the colour of the precipitate produced by the metal ion.

[2 marks]

Metal ion	**Colour of precipitate**
Copper(II)	Blue
Magnesium	Brown
	Green
	White
	Yellow

0 1 . 7 Dilute nitric acid and silver nitrate solution were added to a solution containing iodide ions.

Complete the sentence.

Choose the answer from the box.

[1 mark]

brown	**green**	**yellow**

The colour of the precipitate produced is _____.

10

Do not write outside the box

0 2 Alkanes and alkenes are hydrocarbons.

Hydrocarbon molecules are made up of hydrogen and carbon atoms only.

An alkene has the formula C_3H_6

0 2 . 1 Which alkene has the formula C_3H_6?

[1 mark]

Tick (✓) **one** box.

Butene ☐

Ethene ☐

Propene ☐

0 2 . 2 How many atoms are there in a molecule of C_3H_6?

[1 mark]

Tick (✓) **one** box.

2 ☐ 3 ☐ 6 ☐ 9 ☐

0 2 . 3 Which is a use of C_3H_6?

[1 mark]

Tick (✓) **one** box.

Making a polymer ☐

Making ammonia ☐

Making glass ☐

Do not write outside the box

0 2 . 4 The percentage (%) by mass of each element in a molecule of C_3H_6 is:

- hydrogen 14%
- carbon 86%.

Figure 1 shows the percentage by mass of hydrogen in a molecule of C_3H_6

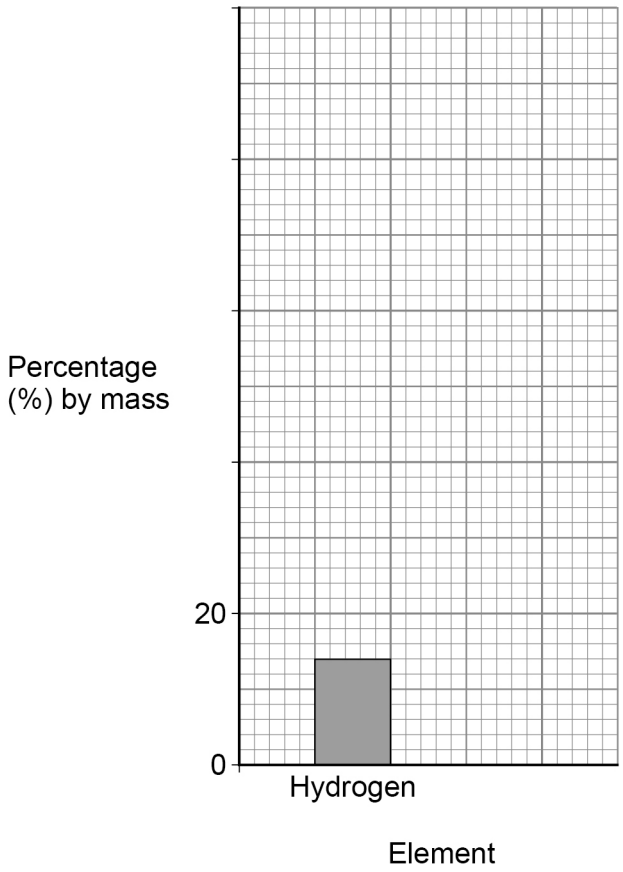
Complete **Figure 1**.

You should:

- complete the *y*-axis scale
- plot the percentage by mass of carbon as a bar
- label the bar plotted for carbon.

[3 marks]

Figure 1



Do not write outside the box

Alkanes can be cracked to produce alkenes and smaller alkane molecules.

0 2 . 5 Describe a test for alkenes.

Give the result of the test.

[2 marks]

Test _____

_____

Result _____

_____

0 2 . 6 $C_{10}H_{22}$ can be cracked to produce C_3H_6 and an alkane.

Complete the equation for the reaction.

[1 mark]

$$C_{10}H_{22} \longrightarrow C_3H_6 + C\_\_\_H_{16}$$

0 2 . 7 Complete the sentence.

Choose the answer from the box.

[1 mark]

ceramics	**fertilisers**	**fuels**

Smaller alkanes from cracking are useful as _____.

Do not write outside the box

High temperatures between 450 °C and 750 °C are used in cracking reactions.

0 2 . 8 Which statement describes the molecules at 750 °C compared with the molecules at 450 °C?

[1 mark]

Tick (✓) **one** box.

The molecules collide more frequently at 750 °C. ☐

The molecules have less energy at 750 °C. ☐

The molecules move more slowly at 750 °C. ☐

0 2 . 9 How does the rate of reaction at 750 °C compare with the rate of reaction at 450 °C?

[1 mark]

_____

_____

12

Do not write outside the box

0 3 Cement, concrete and steel are building materials.

Cement contains calcium oxide.

Calcium oxide reacts with water to produce calcium hydroxide.

The equation for the reaction is:

calcium oxide + water ⇌ calcium hydroxide

0 3 . 1 How does the equation show that this reaction is reversible?

[1 mark]

0 3 . 2 The forward reaction is exothermic.

What type of reaction is the reverse reaction?

[1 mark]

0 3 . 3 When excess water is added to 20 g of calcium oxide, 23 kJ of energy is released.

Calculate the energy released when excess water is added to 4 g of calcium oxide.

[2 marks]

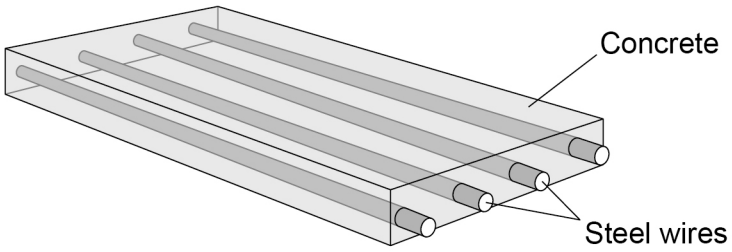
Energy released = _____ kJ

Do not write outside the box

Pre-stressed concrete contains steel wires within the concrete.

Figure 2 shows the structure of a piece of pre-stressed concrete.

Figure 2



0 3 . 4 Pre-stressed concrete is a composite.

Draw **one** line from each component of a composite to a material in pre-stressed concrete.

[2 marks]

Component of composite	**Material in pre-stressed concrete**
Binder	Concrete
Reinforcement	Pre-stressed concrete
	Steel wires

0 3 . 5 Which metal do **all** steels contain?

[1 mark]

_____

Do not write outside the box

0 3 . 6 Bricks are also building materials.

Bricks are ceramics.

Which material is used to make bricks?

[1 mark]

Tick (✓) **one** box.

Aluminium ☐

Clay ☐

Poly(ethene) ☐

8

Turn over for the next question

Do not write outside the box

0 4 Ammonia is produced in the Haber process.

The word equation for the reaction to produce ammonia is:

nitrogen + hydrogen ⇌ ammonia

0 4 . 1 Draw **one** line from each element to a source of that element.

[2 marks]

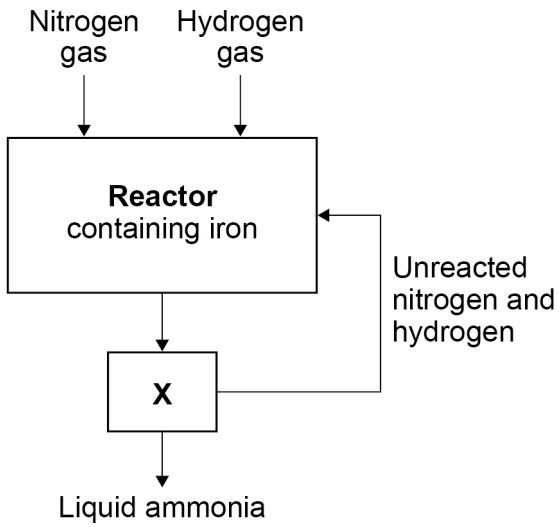
Element	**Source of element**
Nitrogen	Air
Hydrogen	Clay
	Limestone
	Natural gas
	Sand

Do not write outside the box

Ammonia is a gas at room temperature.

Figure 3 shows how ammonia is produced from nitrogen and hydrogen.

Figure 3



0 4 . 2 Which process takes place at **X** in **Figure 3**?

[1 mark]

Tick (✓) **one** box.

Cooling ☐

Filtering ☐

Melting ☐

0 4 . 3 Complete the sentence.

Use **Figure 3**.

[1 mark]

The iron in the reactor is used as a _____.

Turn over ►

Do not write outside the box

Table 1 shows the world production of ammonia between 1990 and 2020.

Table 1

Year	World production of ammonia in arbitrary units
1990	120
2000	130
2010	155
2020	165

0 4 . 4 How did the world production of ammonia change between 1990 and 2020?

Use **Table 1**.

[1 mark]

0 4 . 5 Determine the mean change in mass of ammonia produced per year between 2000 and 2020.

Use **Table 1** and the equation:

$$\text{mean change in mass produced per year} = \frac{\text{change in mass produced between 2000 and 2020}}{\text{number of years}}$$

[4 marks]

Change in mass = _____ arbitrary units

Number of years = _____

Mean change = _____ arbitrary units per year

Do not write outside the box

Most of the ammonia produced in the Haber process is used to make fertilisers.

0 4 . 6 Which is a reason for the change in the world production of ammonia shown in **Table 1**?

[1 mark]

Tick (✓) **one** box.

Change in amount of acid rain ☐

Change in global temperatures ☐

Change in world population ☐

0 4 . 7 Fertilisers produced using ammonia contain nitrogen.

Which **two** compounds used in fertilisers contain nitrogen?

Use the periodic table.

[2 marks]

Tick (✓) **two** boxes.

$Ca(NO_3)_2$ ☐

$Ca_3(PO_4)_2$ ☐

KCl ☐

K_2SO_4 ☐

$(NH_4)_2SO_4$ ☐

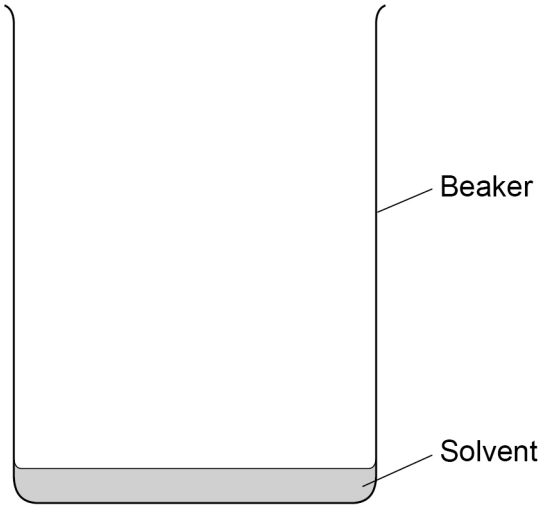
12

Do not write outside the box

0 5 This question is about chromatography.

Figure 4 shows some equipment used for paper chromatography.

Figure 4



0 5 . 1 Complete **Figure 4** to show how the equipment can be used to separate the dyes in an ink.

You should draw and **label**:

- a piece of chromatography paper **in the beaker**
- a start line on the chromatography paper
- a spot of the ink on the chromatography paper at the **start** of the experiment.

[3 marks]

0 5 . 2 Why should a pencil be used to draw the start line on the chromatography paper?

[1 mark]

Do not write outside the box

The R_f value of a dye was 0.80

A spot of the dye moved a distance of 5.2 cm.

0 5 . 3 Calculate the distance moved by the solvent.

Use the equation:

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

[3 marks]

Distance moved by solvent = _____ cm

0 5 . 4 How is the distance moved by the spot of the dye measured?

[1 mark]

Tick (✓) **one** box.

From the start line to the bottom of the spot ☐

From the start line to the centre of the spot ☐

From the start line to the top of the spot ☐

Question 5 continues on the next page

Do not write outside the box

0 5 . 5 Which **two** changes could produce a different R_f value for this dye?

[2 marks]

Tick (✓) **two** boxes.

Use a different beaker. ☐

Use a different length of time. ☐

Use a different sized spot of dye. ☐

Use a different solvent. ☐

Use a different type of chromatography paper. ☐

0 5 . 6 A different dye is a pure substance.

How many spots will this dye produce during chromatography?

[1 mark]

_____

0 5 . 7 Which is an advantage of using gas chromatography instead of paper chromatography?

Choose the answer from the box.

[1 mark]

less sensitive	**more accurate**	**slower**

Gas chromatography is _____.

12

Do not write outside the box

Turn over for the next question

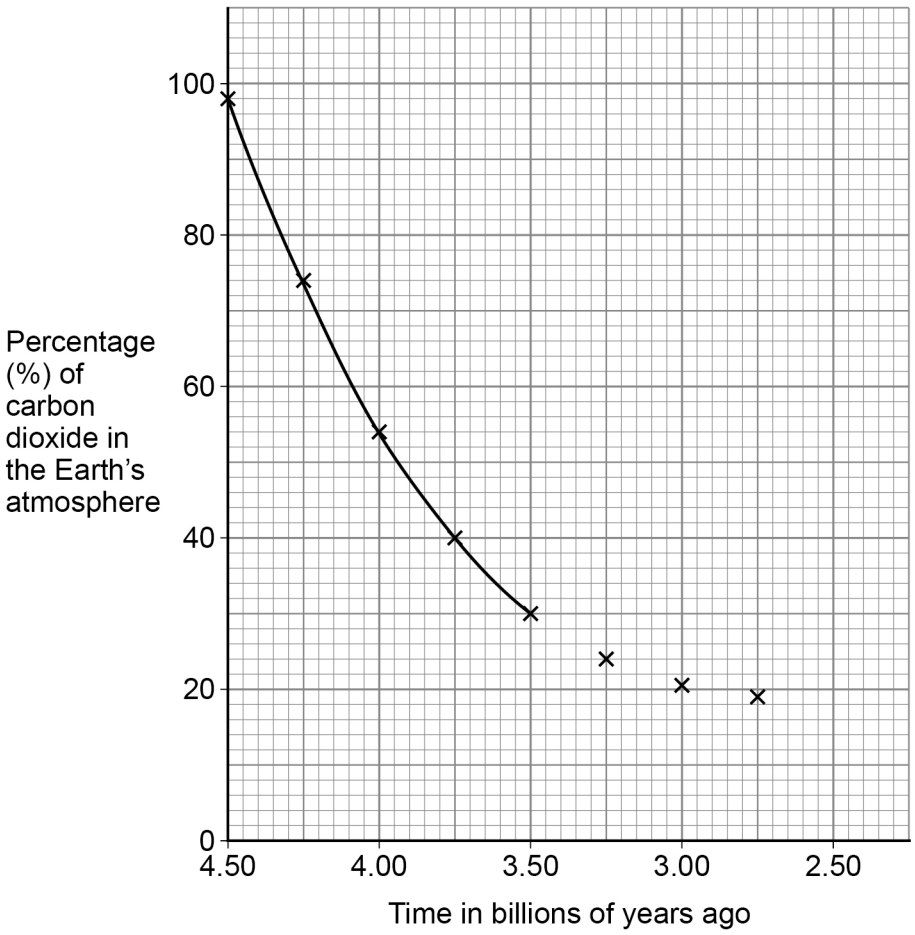
DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Do not write outside the box

0 6 The Earth's atmosphere has changed over time.

Figure 5 shows the percentage of carbon dioxide in the Earth's atmosphere between 4.5 billion and 2.75 billion years ago.

Figure 5



0 6 . 1 Complete **Figure 5**.

You should extend the line of best fit to the plotted point at 2.75 billions of years ago.

[1 mark]

Do not write outside the box

0 6 . 2 What was the percentage (%) of carbon dioxide in the Earth's atmosphere 3.75 billions of years ago?

Use **Figure 5**.

[1 mark]

_____ %

0 6 . 3 The percentage of carbon dioxide changed between 4.5 and 3.0 billion years ago.

Which was a cause of this change?

Use **Figure 5**.

[1 mark]

Tick (✓) **one** box.

Carbon dioxide was dissolved in oceans. ☐

Carbon dioxide was produced during combustion of fossil fuels. ☐

Carbon dioxide was released during volcanic activity. ☐

Question 6 continues on the next page

Do not write outside the box

Table 2 shows information about the percentage of nitrogen present in the Earth's atmosphere.

Table 2

Time in billions of years ago	Percentage (%) of nitrogen
4.5	4
4.0	34
3.5	62
3.0	75
2.5	78

0 6 . 4 The percentage of nitrogen changed between 4.5 and 2.5 billion years ago.

Which was a cause of this change?

Use **Table 2**.

[1 mark]

Tick (✓) **one** box.

Nitrogen was dissolved in oceans. ☐

Nitrogen was produced during combustion of fossil fuels. ☐

Nitrogen was released during volcanic activity. ☐

Do not write outside the box

0 6 . 5 When did the percentage of nitrogen in the Earth's atmosphere become similar to the percentage of nitrogen in the Earth's atmosphere today?

Use **Table 2**.

[1 mark]

Tick (✓) **one** box.

2.5 billion years ago ☐

3.0 billion years ago ☐

3.5 billion years ago ☐

4.0 billion years ago ☐

4.5 billion years ago ☐

0 6 . 6 Which **two** gases may also have been present in the Earth's early atmosphere?

[2 marks]

Tick (✓) **two** boxes.

Ammonia ☐

Chlorine ☐

Helium ☐

Hydrogen ☐

Methane ☐

0 6 . 7 Name the process that started to produce oxygen in the Earth's atmosphere 2.7 billion years ago.

[1 mark]

_____

8

Do not write outside the box

0 7 This question is about gold.

18 carat gold is an alloy containing 75% by mass of gold.

0 7 . 1 Calculate the mass of gold in a 4 g jewellery ring made from 18 carat gold.

[2 marks]

Mass = _____ g

0 7 . 2 What is the simplest whole-number ratio of the mass of gold : mass of other metals in 18 carat gold?

[1 mark]

Tick (✓) **one** box.

1 : 3 ☐ 3 : 1 ☐ 6 : 18 ☐ 18 : 6 ☐

0 7 . 3 What other **two** metals may also be present in 18 carat gold?

[2 marks]

Tick (✓) **two** boxes.

Copper ☐

Magnesium ☐

Potassium ☐

Silver ☐

Sodium ☐

Do not write outside the box

0 7 . 4 **Figure 6** represents the structure of 18 carat gold and of 24 carat gold.

Figure 6

18 carat gold

24 carat gold

Key:

Gold atom

Atom of a different metal

Explain why 18 carat gold is harder than 24 carat gold.

[3 marks]

0 7 . 5 Gold is used to make jewellery.

Give **one** reason why iron is **not** used to make jewellery.

[1 mark]

9

Do not write outside the box

0 8 A student investigated the mass of dissolved solids in sea water.

This is the method used.

1. Weigh an empty evaporating basin.
2. Measure 10.0 cm^3 of sea water sample **A** into the evaporating basin using a burette.
3. Heat the evaporating basin until all the water seems to have evaporated.
4. Weigh the evaporating basin and contents.
5. Calculate the mass of dissolved solids in the sample.
6. Repeat steps 1 to 5 with sea water samples **B**, **C** and **D**.

0 8 . 1 Why did the student use a burette rather than a measuring cylinder to measure 10.0 cm^3 of each sample?

[1 mark]

0 8 . 2 What was the dependent variable in this investigation?

[1 mark]

0 8 . 3 Describe how the student could make sure **all** of the water had evaporated in **step 3**.

[2 marks]

0 8 . 4 How did the student calculate the mass of dissolved solids in each sea water sample?

[1 mark]

Do not write outside the box

Table 3 shows the results.

Table 3

Sea water sample	**A**	**B**	**C**	**D**
Mass of dissolved solids in grams	0.35	0.37	0.33	0.34

0 8 . 5 Calculate the mean concentration of dissolved solids in 10.0 cm^3 samples of sea water **A**, **B**, **C** and **D**.

Use **Table 3** and the equation:

$$\text{mean concentration of dissolved solids } (g/dm^3) = \frac{\text{mean mass of dissolved solids (g)}}{\text{volume of sample } (dm^3)}$$

Give your answer in g/dm^3.

[5 marks]

Mean concentration = _____ g/dm^3

0 8 . 6 Suggest why sea water samples **A**, **B**, **C** and **D** contain different masses of dissolved solids.

[1 mark]

11

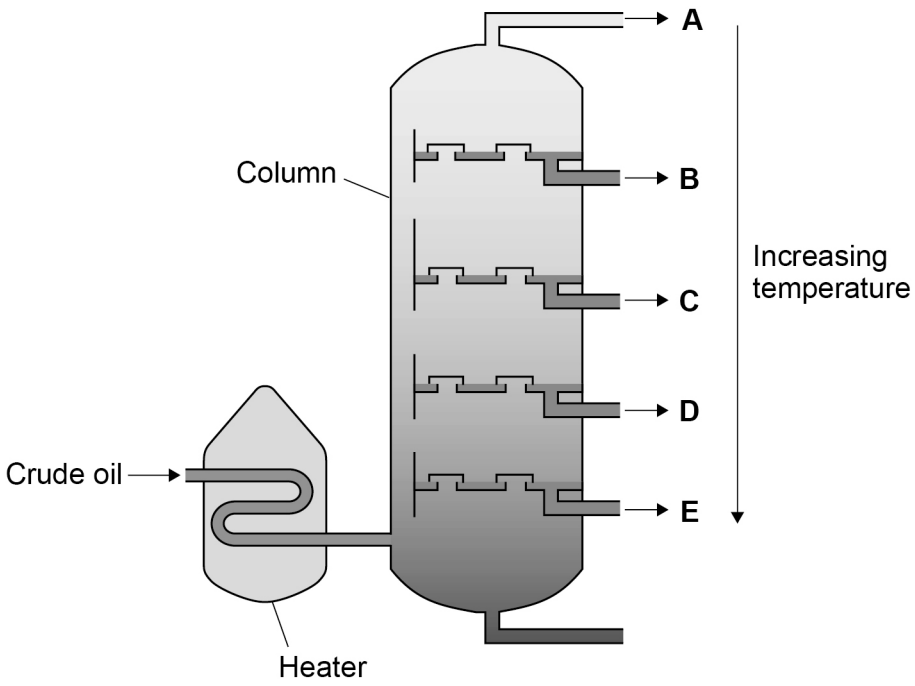
Turn over ►

Do not write outside the box

0 9 This question is about hydrocarbon fuels.

Figure 7 represents the process used to separate hydrocarbon fuels from crude oil.

Figure 7



0 9 . 1 Name the process represented by **Figure 7**.

[1 mark]

0 9 . 2 Changes of state take place during the process in **Figure 7**.

Name the change of state taking place in:

- the heater
- the column.

[2 marks]

Heater _____

Column _____

Do not write outside the box

Different fuels are obtained from crude oil at the points on **Figure 7** labelled **A** to **E**.

Table 4 shows the boiling point ranges of different fuels obtained from the process in **Figure 7**.

Table 4

Fuel	**Boiling point range in °C**
Diesel oil	260 – 320
Heavy fuel oil	320 – 400
Kerosene	180 – 260
Petrol	40 – 110
Petroleum gases	Below 30

0 9 . 3 Which fuel is obtained at **B** in the column?

Use **Figure 7** and **Table 4**.

[1 mark]

0 9 . 4 Fuels with higher boiling point ranges contain larger molecules.

What is the order of increasing flammability of the fuels?

Use **Table 4**.

[1 mark]

Tick (✓) **one** box.

Heavy fuel oil ⟶ diesel oil ⟶ kerosene ☐

Heavy fuel oil ⟶ kerosene ⟶ diesel oil ☐

Kerosene ⟶ diesel oil ⟶ heavy fuel oil ☐

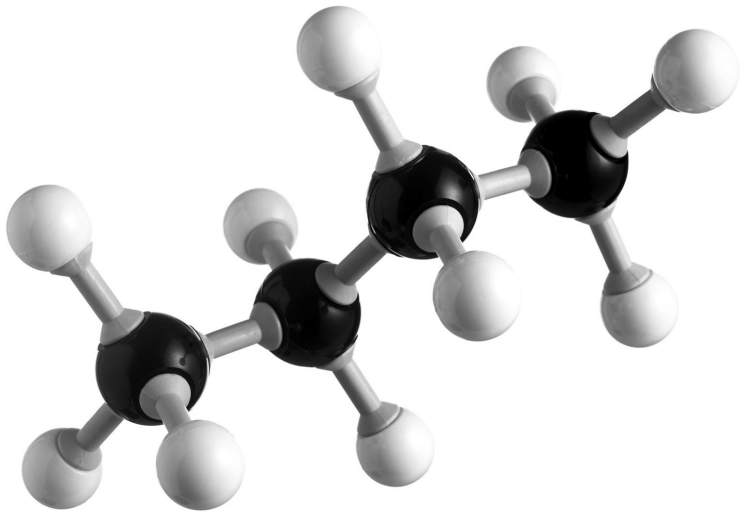
Kerosene ⟶ heavy fuel oil ⟶ diesel oil ☐

Do not write outside the box

Liquified petroleum gases are a mixture of several different hydrocarbons.

Figure 8 shows a model of one of these hydrocarbons.

Figure 8



0 9 . 5 Write the molecular formula of the hydrocarbon represented by the model in **Figure 8**.

[1 mark]

0 9 . 6 Name the hydrocarbon represented by the model in **Figure 8**.

[1 mark]

0 9 . 7 Petroleum gases also contain a hydrocarbon with the formula C_3H_8

Balance the equation for the complete combustion of C_3H_8

[2 marks]

$$C_3H_8 \quad + \quad 5\ O_2 \quad \longrightarrow \_\_\_\_\ CO_2 \quad + \quad \_\_\_\_\ H_2O$$

9

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

1 0 Doors can be made from aluminium or wood.

1 0 . 1 **Table 5** gives information about aluminium and wood.

Table 5

	Aluminium	**Wood**
Raw material	Metal ore from rock	Trees
Relative cost of 1 kilogram of material	87	1
Relative strength	1.3	1.0
Protection	No protection needed to prevent corrosion	Painted to prevent rotting
Disposal	Melted to form new products	Shredded into wood chips for fuel

Evaluate the use of aluminium and of wood for making doors.

[6 marks]

Extra space

Do not write outside the box

1 0 . 2 Aluminium has an oxide coating that protects the metal from corrosion.

Explain how the oxide coating protects aluminium from corrosion.

[2 marks]

1 0 . 3 Doors made from wood need painting to prevent rotting.

Paints are **formulations** made by mixing a solid pigment and a liquid.

Which statement describes the composition of a paint?

[1 mark]

Tick (✓) **one** box.

A fixed mass of pigment and a fixed mass of liquid ☐

A fixed mass of pigment and a variable mass of liquid ☐

A variable mass of pigment and a fixed mass of liquid ☐

A variable mass of pigment and a variable mass of liquid ☐

9

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.**