



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 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	



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

IB/G/Jun25/G4007/E12

8462/2F

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**

Lithium

Potassium

Crimson

Green

Lilac

Orange-red

Yellow



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 _____.

Turn over ►



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
	Blue
	Brown
Copper(II)	Green
	White
Magnesium	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



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

☐

Turn over ►



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

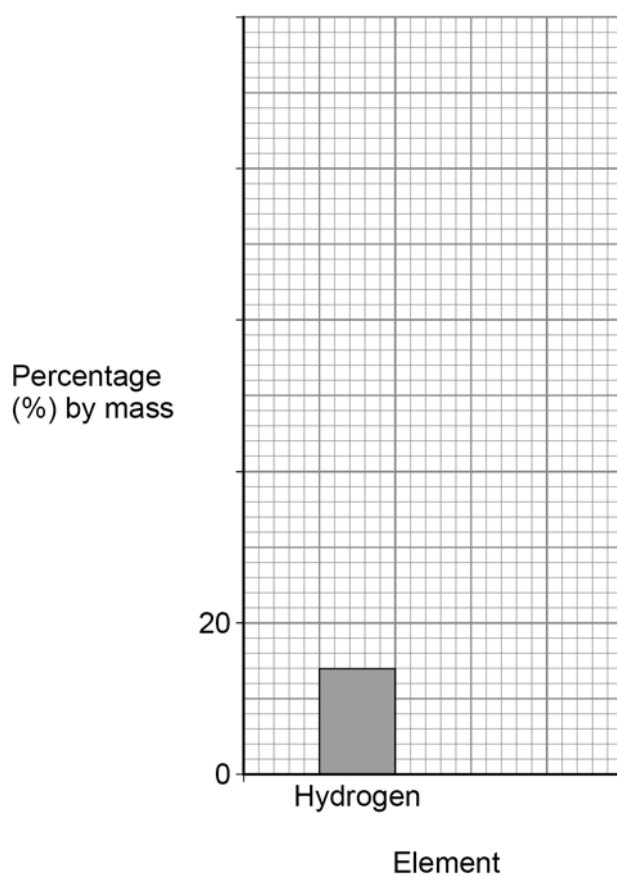
Complete **Figure 1**.

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



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]

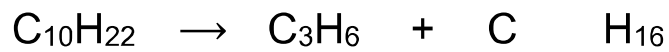
Test _____

Result _____

0 2 . 6 C₁₀H₂₂ can be cracked to produce C₃H₆ and an alkane.

Complete the equation for the reaction.

[1 mark]



0 2 . 7 Complete the sentence.

Choose the answer from the box.

[1 mark]

ceramics

fertilisers

fuels

Smaller alkanes from cracking are useful as _____.

Turn over ►



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



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:

**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]

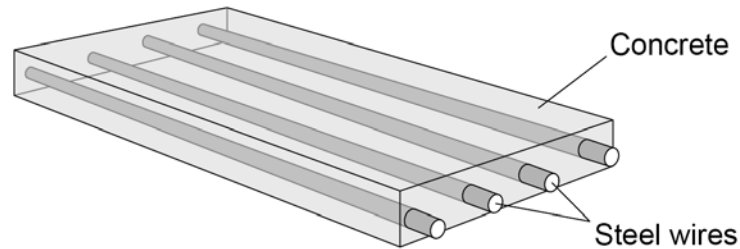
Energy released = _____ kJ

Turn over ►

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]



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

Turn over ►



0	4
---	---

Ammonia is produced in the Haber process.

The word equation for the reaction to produce ammonia is:



0	4	.	1
---	---	---	---

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

[2 marks]

Element

Source of element

Nitrogen

Hydrogen

Air

Clay

Limestone

Natural gas

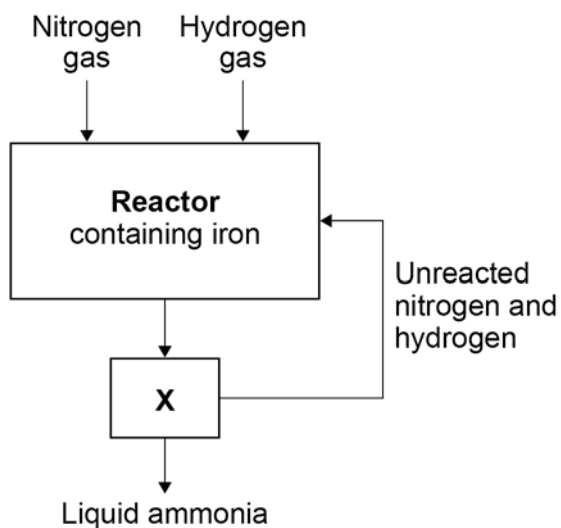
Sand



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 ►



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



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.

$\text{Ca}(\text{NO}_3)_2$

☐

$\text{Ca}_3(\text{PO}_4)_2$

☐

KCl

☐

K_2SO_4

☐

$(\text{NH}_4)_2\text{SO}_4$

☐

12

Turn over ►

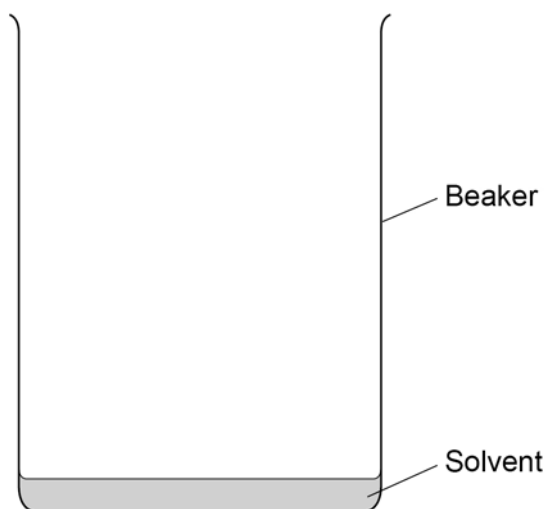


0 5

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]



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

Turn over ►



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

Turn over for the next question

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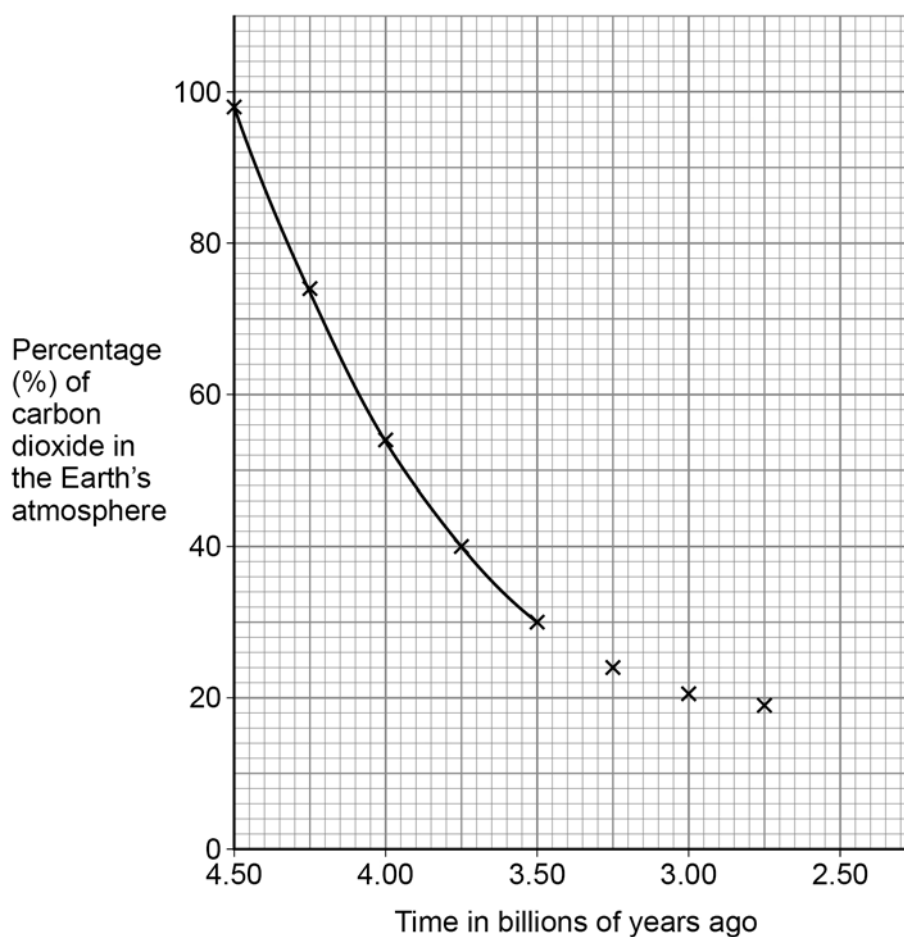


0 6

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]



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

Turn over ►



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.

☐


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]



07

This question is about gold.

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

07.1

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

[2 marks]

Mass = _____ g

07.2

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 ☐

07.3

What other **two** metals may also be present in 18 carat gold?

[2 marks]

Tick (✓) **two** boxes.

Copper

☐

Magnesium

☐

Potassium

☐

Silver

☐

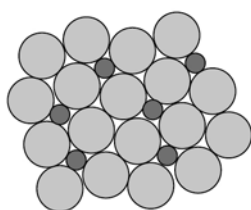
Sodium

☐

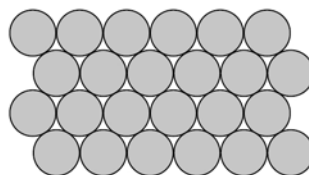
0 7 . 4

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

Turn over ►



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]



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 cm³ samples of sea water **A**, **B**, **C** and **D**.

Use **Table 3** and the equation:

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

Give your answer in g/dm³.

[5 marks]

Mean concentration = _____ g/dm³

0 8 . 6

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

[1 mark]

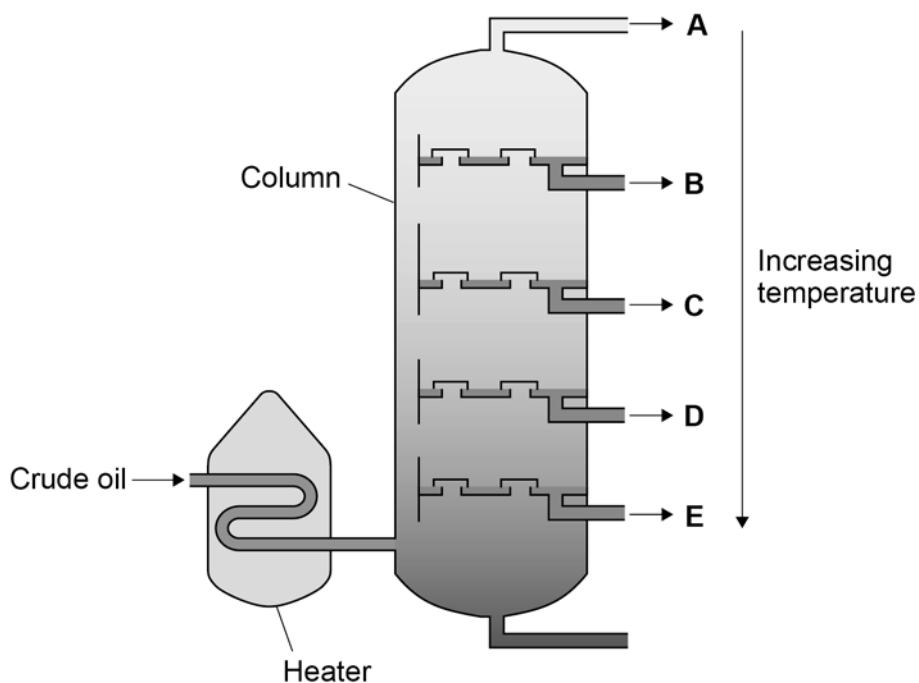


0 9

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 _____



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

☐

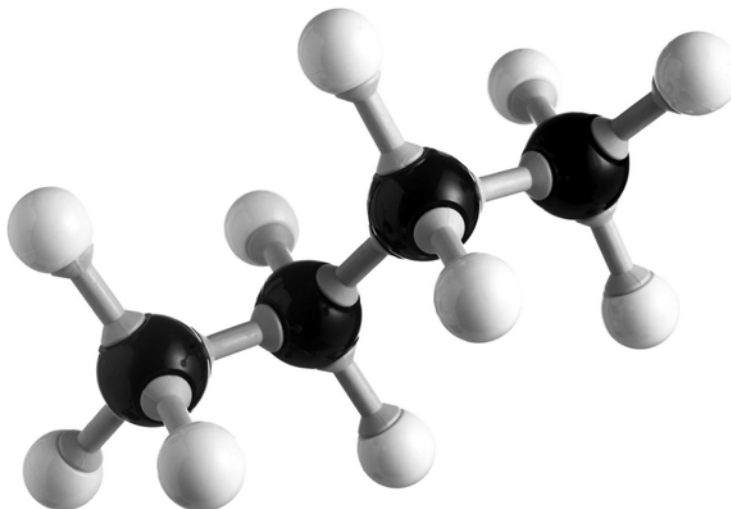
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Liquified petroleum gases are a mixture of several different hydrocarbons.

Figure 8 shows a model of one of these hydrocarbons.

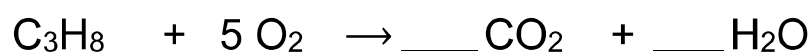
Figure 8



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]



9



Turn over for the next question

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Table 5 gives information about aluminium and wood.

	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

[6 marks]

[illegible]

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



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[illegible]