AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 5.7.1.1

Crude oil, hydrocarbons and alkanes

Past-paper questions

Tier	**Foundation**
Question groups	**12**
Available paper years	**2018–2025**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

5.7.1.1 Crude oil, hydrocarbons and alkanes

Question 01

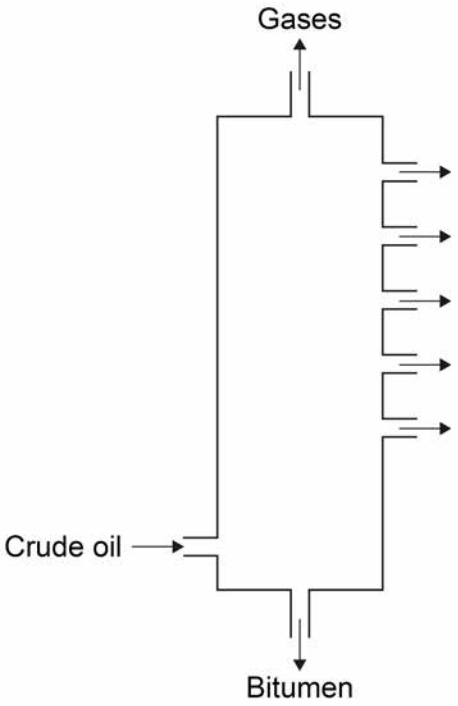
June 2018 | 8464/C/2F | Original Q6

0 6 Crude oil is a mixture of hydrocarbons.

0 6 . 1 The hydrocarbons in crude oil are separated into fractions by fractional distillation.

Figure 13 shows a fractional distillation column.

Figure 13



Crude oil vapour passes up the column.

Complete the sentence.

Choose the answer from the box.

[1 mark]

condenses	**dissolves**	**freezes**	**melts**

Each fraction _____ at a different level.

0 6 . 2 Why do the fractions separate?

[1 mark]

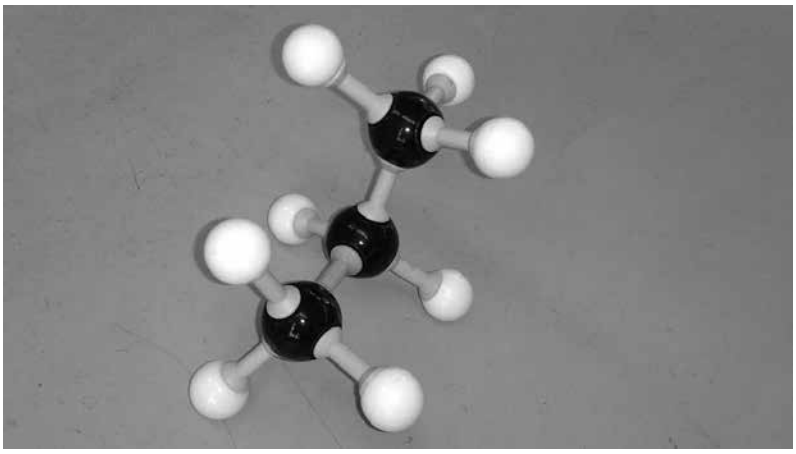
Tick **one** box.

- The fractions have different boiling points. ☐
- The fractions have different flammability. ☐
- The fractions have different melting points. ☐
- The fractions have different viscosity. ☐

Most of the hydrocarbons in crude oil are alkanes.

0 6 . 3 **Figure 14** represents an alkane molecule.

Figure 14



Name the alkane.

[1 mark]

5.7.1.1 Crude oil, hydrocarbons and alkanes

Question 01 · continued

0 6 . 4 Methane (CH_4) is an alkane.

What is the general formula for alkanes?

[1 mark]

Tick **one** box.

- C_nH_n ☐
- C_nH_{2n} ☐
- C_nH_{2n-2} ☐
- C_nH_{2n+2} ☐

0 6 . 5 Alkanes burn in oxygen.

Balance the equation for methane burning.

[1 mark]

$$____ CH_4 + ____ O_2 \rightarrow ____ CO_2 + ____ H_2O$$

0 6 . 6 Ethene is an alkene.

Which reagent is used to test for alkenes?

[1 mark]

Tick **one** box.

- Anhydrous copper sulfate ☐
- Bromine water ☐
- Damp litmus paper ☐
- Limewater ☐

5.7.1.1 Crude oil, hydrocarbons and alkanes

Question 01 · continued

Table 6 shows data from a life cycle assessment (LCA) for the disposal of 10 000 biodegradable plastic bags.

Table 6

	Burning and using the energy to generate electricity	Landfill
Mass of carbon dioxide produced in kg	25	15
Mass of solid residue in kg	0.050	0.070
Mass of sulfur dioxide produced in kg	0.20	0.30

0 6 . 7 Why are life cycle assessments (LCA) done?

[1 mark]

0 6 . 8 Compare the **two** methods for the disposal of biodegradable plastic bags.

Use information from **Table 6**

[4 marks]

11

5.7.1.1 Crude oil, hydrocarbons and alkanes

Question 02

June 2019 | 8464/C/2F | Original Q1

0 1 . 1 This question is about gases.

Draw **one** line from each substance to the description of the substance.

[3 marks]

Substance	Description of substance
	Compound
Air	Element
Carbon dioxide	Hydrocarbon
Oxygen	Metal
	Mixture

5.7.1.1 Crude oil, hydrocarbons and alkanes

Question 02 · continued

0 1 . 2 What is used to test for each of the gases?

Draw **one** line from each gas to the test for the gas.

[2 marks]

Gas	Test
Carbon dioxide	A glowing splint
	A lighted splint
Oxygen	Limewater
	Litmus paper

0 1 . 3 Give **two** reasons why the percentage of carbon dioxide in the air has decreased in the last 2.7 billion years.

[2 marks]

Tick (✓) **two** boxes.

- Combustion ☐
- Dissolved in oceans ☐
- Intense volcanic activity ☐
- Photosynthesis ☐
- Respiration ☐

5.7.1.1 Crude oil, hydrocarbons and alkanes

Question 02 · continued

Oxygen reacts with sulfur dioxide.

The reaction is reversible.

0 1 . 4 What is the symbol for a reversible reaction?

[1 mark]

_____

0 1 . 5 Complete the sentence.

[1 mark]

In a reversible reaction the forward reaction is exothermic, so the

reverse reaction is _____ .

0 1 . 6 A reversible reaction happens in apparatus which stops the escape of reactants and products.

Complete the sentence.

[1 mark]

Equilibrium is reached when the forward and reverse reactions happen at

exactly the same _____ .

10

5.7.1.1 Crude oil, hydrocarbons and alkanes

Question 03

June 2019 | 8464/C/2F | Original Q4

0 4 Large hydrocarbon molecules can be cracked to produce smaller, more useful molecules.

Alkanes and alkenes are produced when hydrocarbons are cracked.

0 4 . 1 Give **two** conditions used for cracking.

[2 marks]

1 _____

2 _____

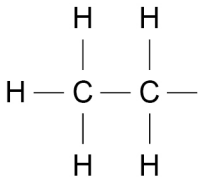
0 4 . 2 Butane (C_4H_{10}) is an alkane.

Figure 5 shows part of the displayed structural formula of butane.

Complete the displayed structural formula of butane in **Figure 5**.

[1 mark]

Figure 5



0 4 . 3 Butane burns in oxygen.

Complete the word equation for the complete combustion of butane.

[2 marks]

butane + oxygen → _____ + _____

Question 4 continues on the next page

5.7.1.1 Crude oil, hydrocarbons and alkanes

Question 03 · continued

0 4 . 4 Ethene is an alkene.

Give a test for alkenes.

Give the result of the test if an alkene is present.

[2 marks]

Test _____

Result _____

_____

0 4 . 5 Each year many tonnes of crude oil are extracted from the Earth.

It took millions of years for the crude oil to be formed.

What do we call development that meets the needs of current generations without compromising the resources for future generations?

[1 mark]

Tick (✓) **one** box.

Finite development ☐

Global development ☐

Natural development ☐

Sustainable development ☐

8

5.7.1.1 Crude oil, hydrocarbons and alkanes

Question 04

November 2020 | 8464/C/2F | Original Q1

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 _____

5.7.1.1 Crude oil, hydrocarbons and alkanes

Question 04 · continued

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

[1 mark]

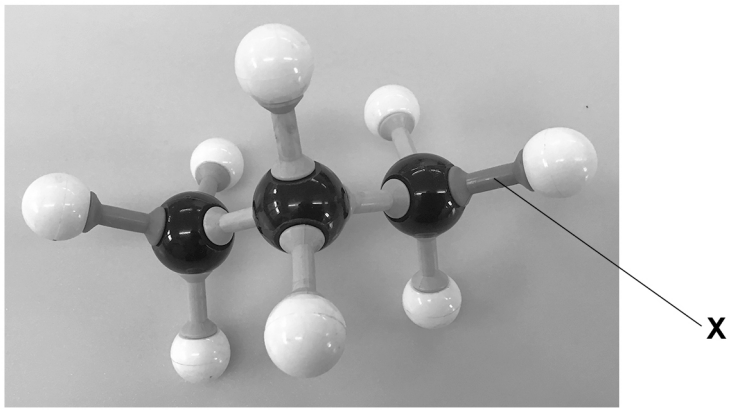
Tick (✓) **one** box.

- 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 ☐

Question 04 · continued

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

5.7.1.1 Crude oil, hydrocarbons and alkanes

Question 05

November 2021 | 8464/C/2F | Original Q1

0 1 Fresh water contains low levels of dissolved salts.

Water reacts with anhydrous copper sulfate in a reversible reaction.

The word equation for the reaction is:

water + anhydrous copper sulfate ⇌ hydrated copper sulfate

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

[1 mark]

_____

_____

0 1 . 2 Complete the sentences.

Choose answers from the box.

[2 marks]

blue	**green**	**orange**	**white**	**yellow**

The colour of anhydrous copper sulfate is _____ .

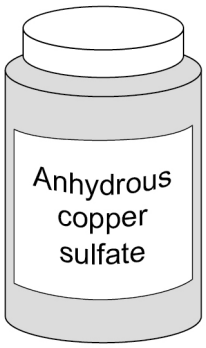
The colour of hydrated copper sulfate is _____ .

5.7.1.1 Crude oil, hydrocarbons and alkanes

Question 05 · continued

0 1 . 3 **Figure 1** shows anhydrous copper sulfate in a sealed container.

Figure 1



Suggest **one** reason why anhydrous copper sulfate is kept in a sealed container.

[1 mark]

Question 1 continues on the next page

5.7.1.1 Crude oil, hydrocarbons and alkanes

Question 05 · continued

Sodium chloride dissolves in water to form sodium chloride solution.

0 1 . 4 Draw **one** line from each substance to the description of the substance.

[2 marks]

Substance	Description of substance
Sodium chloride solution	Compound
Water	Element
	Hydrocarbon
	Mixture

0 1 . 5 Name the process used to obtain solid sodium chloride from sodium chloride solution.

[1 mark]

_____

5.7.1.1 Crude oil, hydrocarbons and alkanes

Question 05 · continued

0 1 . 6 Two processes used to obtain potable water from fresh water are:

- filtering
- sterilising.

Give **one** reason why each process is used.

[2 marks]

Filtering _____

_____

Sterilising _____

_____

0 1 . 7 Which type of water is the easiest to obtain potable water from?

[1 mark]

Tick (✓) **one** box.

Ground water ☐

Salt water ☐

Waste water ☐

0 1 . 8 Which of the following is the first stage of waste water treatment?

[1 mark]

Tick (✓) **one** box.

Aerobic biological treatment of effluent ☐

Anaerobic digestion of sewage sludge ☐

Screening and removal of grit ☐

11

5.7.1.1 Crude oil, hydrocarbons and alkanes

Question 06

November 2021 | 8464/C/2F | Original Q7

0 7 Crude oil is a resource found in rocks.

Most of the compounds in crude oil are hydrocarbons.

0 7 . 1 Complete the sentence.

[1 mark]

Crude oil is formed by the decomposition of _____.

0 7 . 2 Alkanes are hydrocarbons.

Give the name of the alkane molecule that has three carbon atoms.

[1 mark]

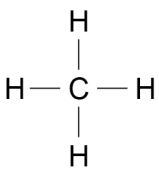
_____

Question 7 continues on the next page

0 7 . 3 **Figure 7** shows two alkane molecules.

Figure 7

Methane



Hexane

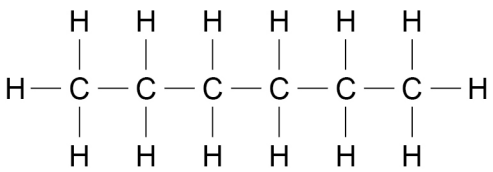


Table 4 shows the melting points and boiling points of methane and hexane.

Table 4

	Melting point in °C	Boiling point in °C
Methane	−183	−162
Hexane	−95	69

Compare the structure and properties of methane and hexane.

[6 marks]

5.7.1.1 Crude oil, hydrocarbons and alkanes

Question 06 · continued

Hydrocarbons are cracked to produce more useful alkanes and alkenes.

0 7 . 4 Decane ($C_{10}H_{22}$) is cracked to produce **two** products.

Complete the equation for the reaction.

[1 mark]

$$C_{10}H_{22} \rightarrow _____ + C_2H_4$$

0 7 . 5 C_2H_4 is an alkene.

What is the test for alkenes?

Give the result of the test if an alkene is present.

[2 marks]

Test _____

_____

Result _____

_____

11

5.7.1.1 Crude oil, hydrocarbons and alkanes

Question 07

June 2023 | 8464/C/2F | Original Q1

0 1 Crude oil contains a large number of hydrocarbons.

0 1 . 1 Crude oil is a finite resource.

What is a finite resource?

[1 mark]

Tick (✓) **one** box.

- A limited resource ☐
- A renewable resource ☐
- A sustainable resource ☐

0 1 . 2 What is crude oil formed from?

[1 mark]

Tick (✓) **one** box.

- Plankton ☐
- Volcanoes ☐
- Water ☐

5.7.1.1 Crude oil, hydrocarbons and alkanes

Question 07 · continued

0 1 . 3 What type of substance is crude oil?

[1 mark]

Tick (✓) **one** box.

Compound ☐

Element ☐

Mixture ☐

0 1 . 4 The hydrocarbons in crude oil are separated into fractions using fractional distillation.

Complete the sentences.

Choose answers from the box.

[2 marks]

condense	**evaporate**	**freeze**	**melt**

In fractional distillation the crude oil is heated so

the hydrocarbons _____ .

The fractions collect as the hydrocarbons cool and _____ .

Question 1 continues on the next page

5.7.1.1 Crude oil, hydrocarbons and alkanes

Question 07 · continued

Hydrocarbons can be cracked to produce more useful molecules.

0 1 . 5 Complete the sentence.

Choose the answer from the box.

[1 mark]

alloys	**fertilisers**	**fuels**

Some products of cracking are useful as _____ .

0 1 . 6 Hydrogen gas is a product of cracking.

What is used in the test for hydrogen gas?

[1 mark]

Tick (✓) **one** box.

Burning splint ☐

Glowing splint ☐

Limewater ☐

5.7.1.1 Crude oil, hydrocarbons and alkanes

Question 07 · continued

0 1 . 7 5.20 kg of crude oil contains 1.53 kg of LPG (Liquefied Petroleum Gas).

Calculate the percentage (%) of LPG in 5.20 kg of crude oil.

Give your answer to 3 significant figures.

[3 marks]

Percentage (3 significant figures) = _____ %

10

Turn over for the next question

5.7.1.1 Crude oil, hydrocarbons and alkanes

Question 08

June 2023 | 8464/C/2F | Original Q5

0 5 The combustion of fuels is a source of atmospheric pollutants.

0 5 . 1 Methane is a fuel.

Balance the equation for the combustion of methane.

[1 mark]

$$CH_4 + ____ O_2 \rightarrow CO_2 + ____ H_2O$$

0 5 . 2 Many fuels are mixtures.

Petrol and diesel are mixtures of hydrocarbons.

Table 4 shows properties of petrol and of diesel.

Table 4

	Petrol	**Diesel**
Range of number of carbon atoms in a hydrocarbon molecule	4 to 12	12 to 20
Range of boiling points in °C	40 to 205	250 to 350

Compare the properties of petrol and diesel.

Use **Table 4**.

[2 marks]

Question 08 · continued

0 5 . 3 The gases released when a fuel is burned in car engines may include:

- oxides of nitrogen
- carbon monoxide
- water vapour.

Which chemical element do all these gases contain?

[1 mark]

Tick (✓) **one** box.

Carbon ☐

Hydrogen ☐

Nitrogen ☐

Oxygen ☐

0 5 . 4 When diesel burns in car engines, oxides of nitrogen are produced.

Where does the nitrogen come from?

[1 mark]

0 5 . 5 When diesel burns, particulates may be produced.

What environmental effect do particulates from burning diesel cause?

[1 mark]

5.7.1.1 Crude oil, hydrocarbons and alkanes

Question 08 · continued

0 5 . 6 Carbon monoxide may be produced when diesel burns.

Give **one** reason why carbon monoxide is difficult to detect.

[1 mark]

0 5 . 7 Explain why water vapour and **not** liquid water is produced when diesel burns.

[2 marks]

0 5 . 8 Sulfur is a common impurity in diesel.

Explain why this causes an environmental problem.

[3 marks]

12

5.7.1.1 Crude oil, hydrocarbons and alkanes

Question 09

June 2024 | 8464/C/2F | Original Q6

0 6 Alkanes and alkenes are hydrocarbons.

0 6 . 1 Define the term 'hydrocarbon'.

[1 mark]

0 6 . 2 The general formula for alkanes is C_nH_{2n+2}

Determine the formula of the alkane with 10 carbon atoms.

[1 mark]

Formula = _____

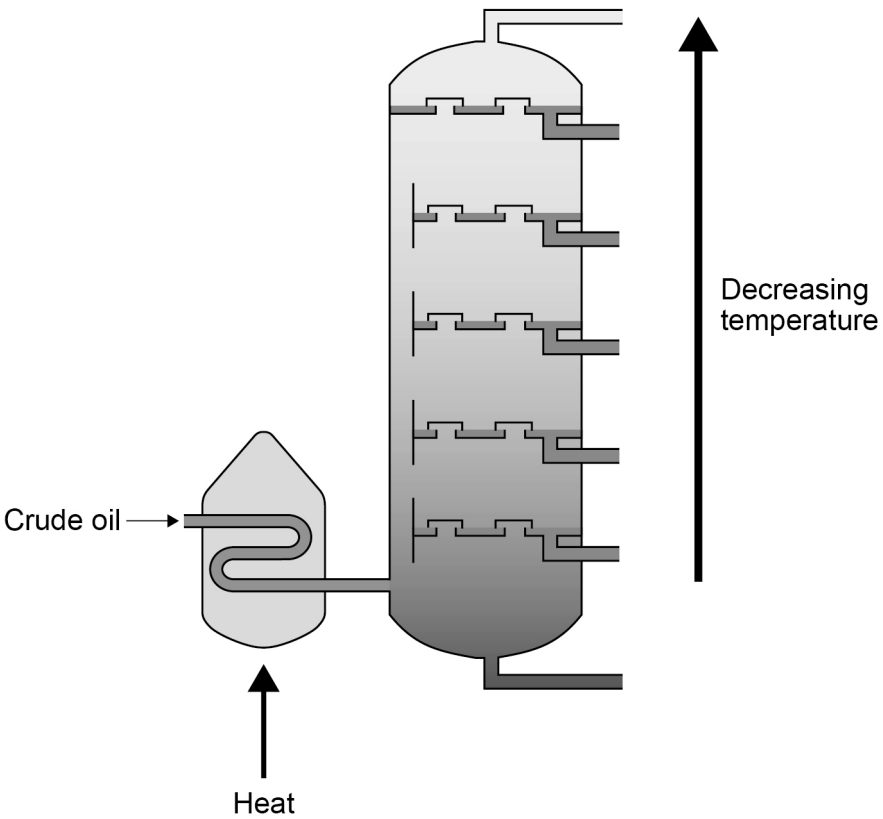
Question 6 continues on the next page

Question 09 · continued

0 6 . 3 Crude oil is a mixture of hydrocarbons.

Figure 4 represents industrial equipment used to separate crude oil into fractions.

Figure 4



Explain how crude oil is separated into fractions.

Use **Figure 4**.

[4 marks]

5.7.1.1 Crude oil, hydrocarbons and alkanes

Question 09 · continued

0 6 . 4 The alkane molecule $C_{14}H_{30}$ can be cracked to produce smaller molecules.

Balance the equation for the reaction.

[1 mark]

$$C_{14}H_{30} \rightarrow C_8H_{18} + ____ C_3H_6$$

Question 6 continues on the next page

Question 09 · continued

Propene (C_3H_6) is an alkene.

0 6 . 5 Describe the test for alkenes.

Give the result.

[2 marks]

Test _____

_____

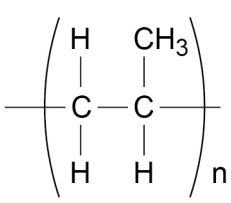
Result _____

_____

0 6 . 6 Poly(propene) is made from propene.

Figure 5 represents the repeating unit of poly(propene).

Figure 5



What type of substance is poly(propene)?

[1 mark]

_____

10

5.7.1.1 Crude oil, hydrocarbons and alkanes

Question 10

June 2025 | 8464/C/2F | Original Q1

0 1 Crude oil is a resource found in rocks.

0 1 . 1 What is crude oil produced from?

[1 mark]

Tick (✓) **one** box.

- Microbes ☐
- Plankton ☐
- Water ☐

0 1 . 2 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 ☐

5.7.1.1 Crude oil, hydrocarbons and alkanes

Question 10 · continued

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

	Percentage (%) of component	
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

5.7.1.1 Crude oil, hydrocarbons and alkanes

Question 10 · continued

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 dm^3 of crude oil from area **C**.

Give your answer to 2 significant figures.

Use **Table 2**.

[3 marks]

Volume (2 significant figures) = _____ dm^3

5.7.1.1 Crude oil, hydrocarbons and alkanes

Question 10 · continued

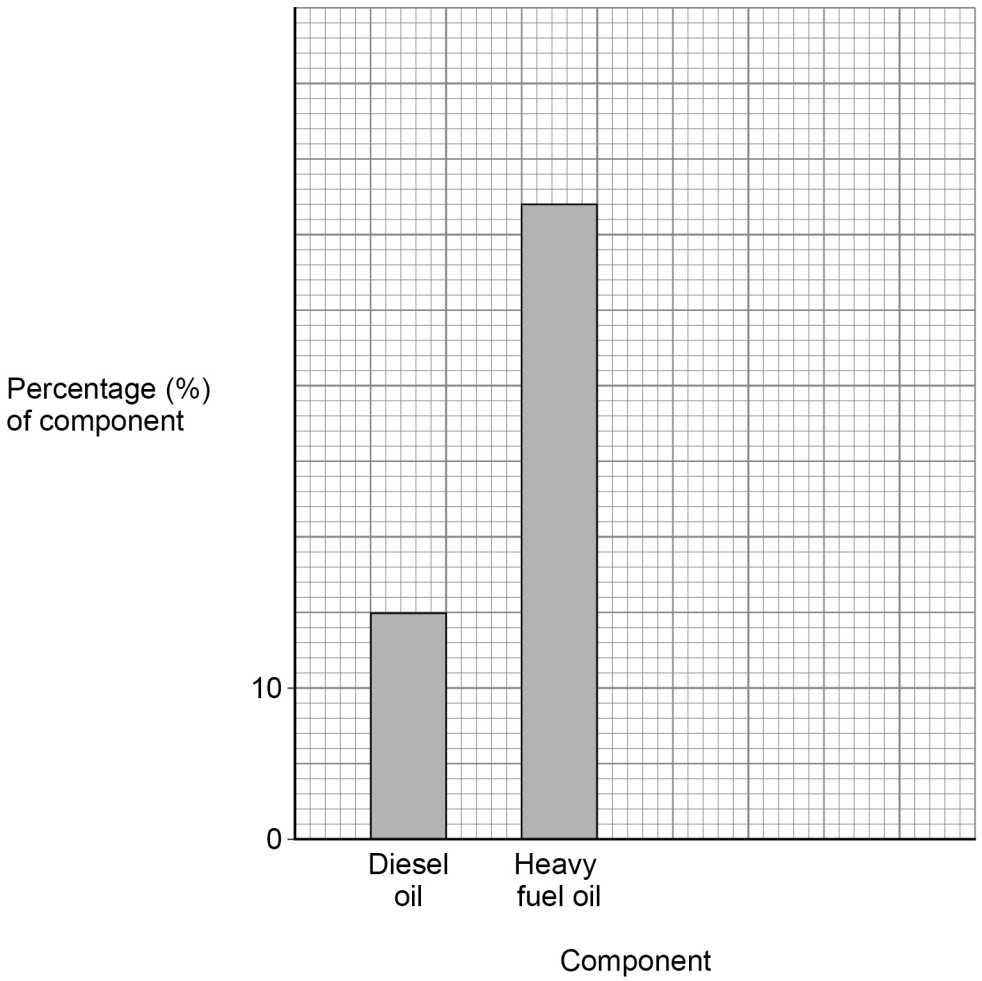
0 1 . 5 Complete **Figure 1**.

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

5.7.1.1 Crude oil, hydrocarbons and alkanes

Question 11

June 2025 | 8464/C/2F | Original Q4

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 ☐

5.7.1.1 Crude oil, hydrocarbons and alkanes

Question 11 · continued

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 = _____

5.7.1.1 Crude oil, hydrocarbons and alkanes

Question 11 · continued

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

5.7.1.1 Crude oil, hydrocarbons and alkanes

Question 11 · continued

0 4 . 5 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 _____.

5.7.1.1 Crude oil, hydrocarbons and alkanes

Question 11 · continued

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 ☐

14

5.7.1.1 Crude oil, hydrocarbons and alkanes

Question 12

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.

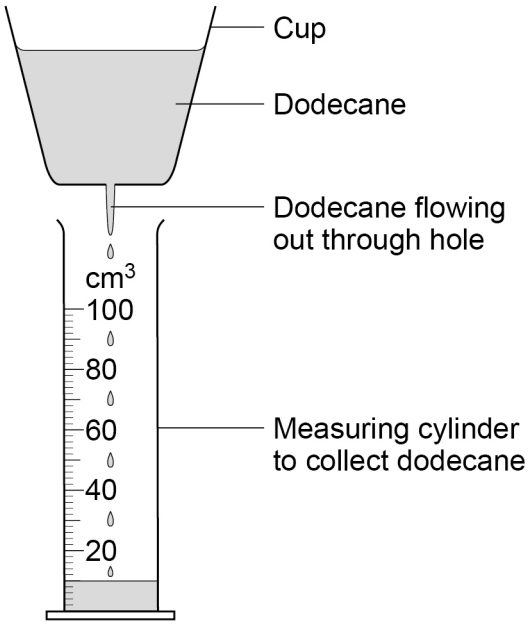
[1 mark]

C ____ H ____

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

Figure 4 shows the apparatus.

Figure 4



Question 12 · continued

This is the method used.

1. Add 100 cm^3 of dodecane at 25 °C to the cup.
2. Immediately start a timer.
3. Stop the timer when 40 cm^3 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]

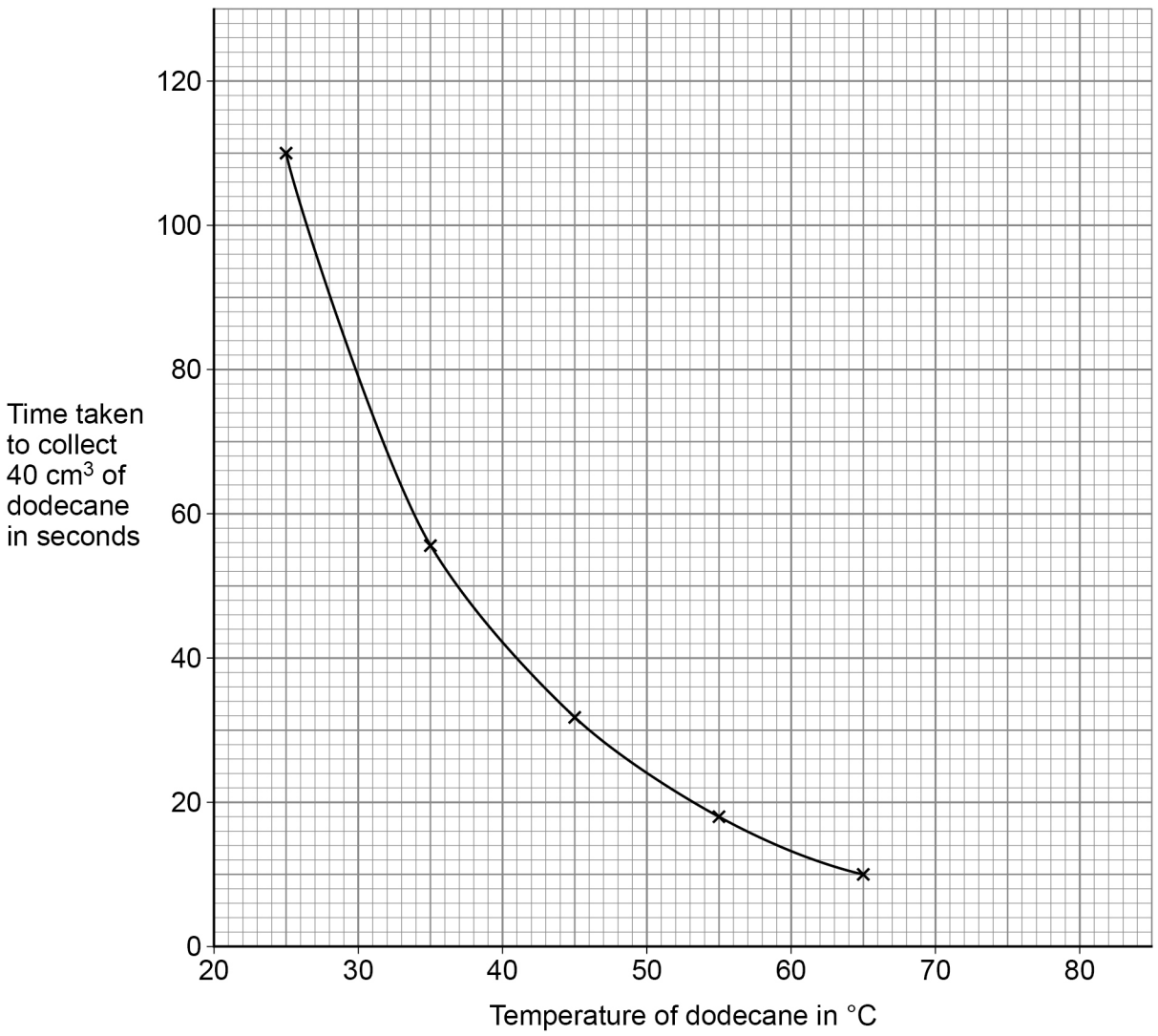
Question 5 continues on the next page

5.7.1.1 Crude oil, hydrocarbons and alkanes

Question 12 · continued

Figure 5 shows the results.

Figure 5



0 5 . 4 Predict the time taken to collect 40 cm^3 of dodecane at 75 °C.

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

[2 marks]

Time taken = _____ s

5.7.1.1 Crude oil, hydrocarbons and alkanes

Question 12 · continued

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