AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 5.7.1.3

Properties of hydrocarbons

Past-paper questions

Tier	**Higher**
Question groups	**7**
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.

5.7.1.3 Properties of hydrocarbons

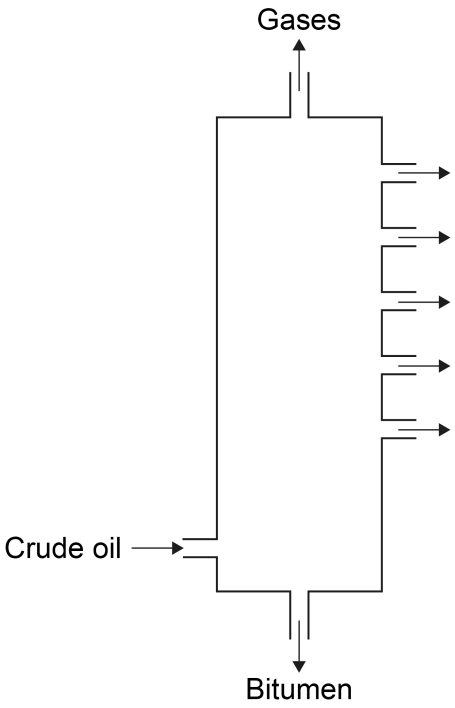
Question 01

0 1 Crude oil is a mixture of hydrocarbons.

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

Figure 1 shows a fractional distillation column.

Figure 1



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.

5.7.1.3 Properties of hydrocarbons

Question 01 · continued

0 1 . 2 Why do the fractions separate?

[1 mark]

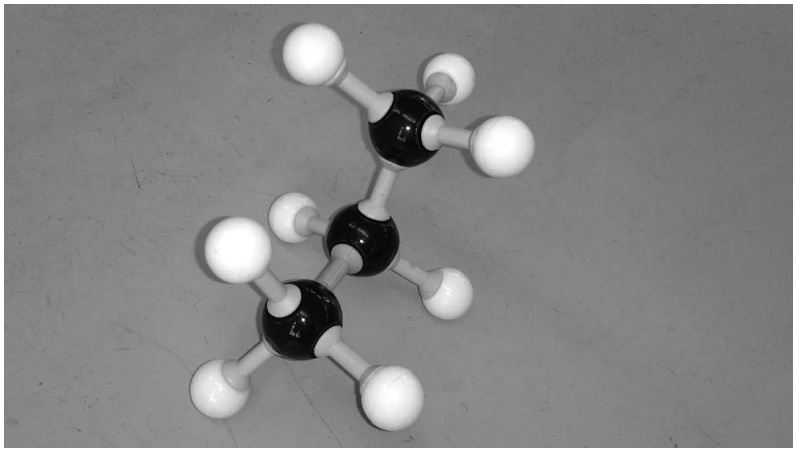
Tick **one** box.

- 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 1 . 3 **Figure 2** represents an alkane molecule.

Figure 2



Name the alkane.

[1 mark]

Question 1 continues on the next page

5.7.1.3 Properties of hydrocarbons

Question 01 · continued

0 1 . 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 1 . 5 Alkanes burn in oxygen.

Balance the equation for methane burning.

[1 mark]

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

0 1 . 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 ☐

5.7.1.3 Properties of hydrocarbons

Question 01 · continued

Table 1 shows data from a life cycle assessment (LCA) for the disposal of 10 000 biodegradable plastic bags.

Table 1

	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 1 . 7 Why are life cycle assessments (LCA) done?

[1 mark]

0 1 . 8 Compare the **two** methods for the disposal of biodegradable plastic bags.

Use information from **Table 1**

[4 marks]

11

5.7.1.3 Properties of hydrocarbons

Question 02

June 2019 | 8464/C/2H | Original Q7

0 7 This question is about hydrocarbons and crude oil.

0 7 . 1 Hydrocarbon fuels are produced from crude oil.

Describe how crude oil is separated into fractions.

[4 marks]

Butane is a hydrocarbon.

0 7 . 2 Two equations for the combustion of butane are:

- $2\,C_4H_{10} + 13\,O_2 \rightarrow 8\,CO_2 + 10\,H_2O$
- $2\,C_4H_{10} + 5\,O_2 \rightarrow 8\,C + 10\,H_2O$

Why are different products formed?

[1 mark]

0 7 . 3 One other product of the combustion of butane is carbon monoxide.

Balance the equation.

[1 mark]

____ C_4H_{10} + ____ O_2 → ____ CO + ____ H_2O

5.7.1.3 Properties of hydrocarbons

Question 02 · continued

0 7 . 4 Carbon dioxide is a greenhouse gas.

Describe the greenhouse effect in terms of the interaction of short and long wavelength radiation with matter.

[4 marks]

10

5.7.1.3 Properties of hydrocarbons

Question 03

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

0 1 This question is about the Earth's resources.

When most fuels burn carbon dioxide is produced.

Propane (C_3H_8) is a fuel.

0 1 . 1 Balance the equation for the combustion of propane.

[1 mark]

$$C_3H_8 + ____ O_2 \rightarrow 3\,CO_2 + 4\,H_2O$$

0 1 . 2 Describe the test for carbon dioxide.

Give the result of the test.

[2 marks]

Test _____

Result _____

_____

0 1 . 3 Propane can be cracked to produce propene and hydrogen.

Complete the symbol equation for the reaction.

[1 mark]

$$\underset{\text{propane}}{C_3H_8} \rightarrow \underset{\text{propene}}{_____} + \underset{\text{hydrogen}}{H_2}$$

5.7.1.3 Properties of hydrocarbons

Question 03 · continued

0 1 . 4 Describe the test for hydrogen.

Give the result of the test.

[2 marks]

Test _____

Result _____

_____

0 1 . 5 Propene is an alkene.

Describe the test for alkenes.

Give the colour change in the test.

[3 marks]

Test _____

Colour change _____ to _____

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5.7.1.3 Properties of hydrocarbons

Question 04

November 2020 | 8464/C/2H | Original Q5

0 5 This question is about crude oil and alkanes.

0 5 . 1 Describe how crude oil is formed.

[3 marks]

0 5 . 2 Describe how crude oil is separated into fractions by fractional distillation.

[4 marks]

5.7.1.3 Properties of hydrocarbons

Question 04 · continued

Table 2 shows the boiling points of three alkanes.

Table 2

Alkanes	Boiling point in °C
C_5H_{12}	36
$C_{10}H_{22}$	174
$C_{15}H_{32}$	271

0 5 . 3 What is the general formula for alkanes?

[1 mark]

0 5 . 4 Explain the trend in the boiling points of the alkanes.

[3 marks]

Question 5 continues on the next page

Question 04 · continued

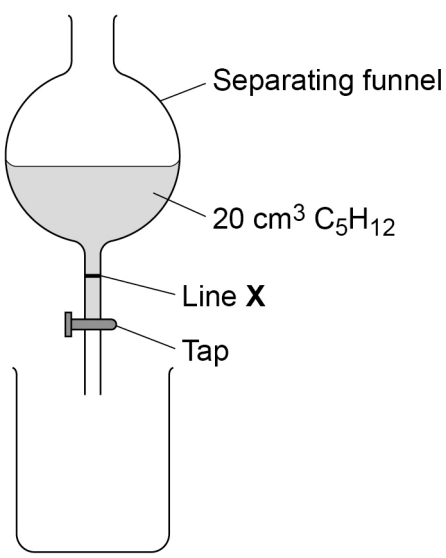
0 5 . 5 A student investigated one property of the alkanes C_5H_{12}, $C_{10}H_{22}$ and $C_{15}H_{32}$

This is the method used.

1. Pour 20 cm^3 of C_5H_{12} into a separating funnel.
2. Open the tap of the separating funnel and start a timer.
3. Stop the timer when the level of C_5H_{12} reaches line **X**.
4. Repeat steps 1 to 3 with $C_{10}H_{22}$ and $C_{15}H_{32}$

Figure 5 shows the apparatus used.

Figure 5



The level of C_5H_{12} takes 6.4 seconds to reach line **X**.

Predict the trend in times for the other two alkanes.

Give **one** reason for your answer.

[2 marks]

Trend _____

_____

Reason _____

_____

13

5.7.1.3 Properties of hydrocarbons

Question 05

0 2 Crude oil is a resource found in rocks.

Most of the compounds in crude oil are hydrocarbons.

0 2 . 1 Complete the sentence.

[1 mark]

Crude oil is formed by the decomposition of _____.

0 2 . 2 Alkanes are hydrocarbons.

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

[1 mark]

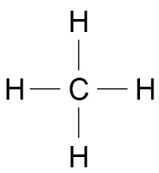
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Question 2 continues on the next page

0 2 . 3 **Figure 3** shows two alkane molecules.

Figure 3

Methane



Hexane

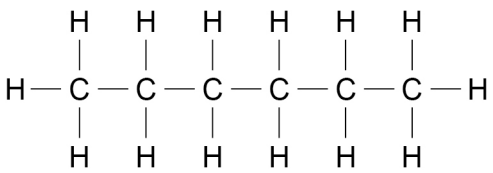


Table 2 shows the melting points and boiling points of methane and hexane.

Table 2

	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]

5.7.1.3 Properties of hydrocarbons

Question 05 · continued

Hydrocarbons are cracked to produce more useful alkanes and alkenes.

0 2 . 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 2 . 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

5.7.1.3 Properties of hydrocarbons

Question 06

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

0 1 The combustion of fuels is a source of atmospheric pollutants.

0 1 . 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 1 . 2 Many fuels are mixtures.

Petrol and diesel are mixtures of hydrocarbons.

Table 1 shows properties of petrol and of diesel.

Table 1

	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 1**.

[2 marks]

5.7.1.3 Properties of hydrocarbons

Question 06 · continued

0 1 . 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 1 . 4 When diesel burns in car engines, oxides of nitrogen are produced.

Where does the nitrogen come from?

[1 mark]

0 1 . 5 When diesel burns, particulates may be produced.

What environmental effect do particulates from burning diesel cause?

[1 mark]

5.7.1.3 Properties of hydrocarbons

Question 06 · continued

0 1 . 6 Carbon monoxide may be produced when diesel burns.

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

[1 mark]

0 1 . 7 Explain why water vapour and **not** liquid water is produced when diesel burns.

[2 marks]

0 1 . 8 Sulfur is a common impurity in diesel.

Explain why this causes an environmental problem.

[3 marks]

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5.7.1.3 Properties of hydrocarbons

Question 07

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

0 1 Dodecane is an alkane.

0 1 . 1 The general formula for alkanes is C_nH_{2n+2}

A molecule of dodecane has 12 carbon atoms.

Complete the formula of dodecane.

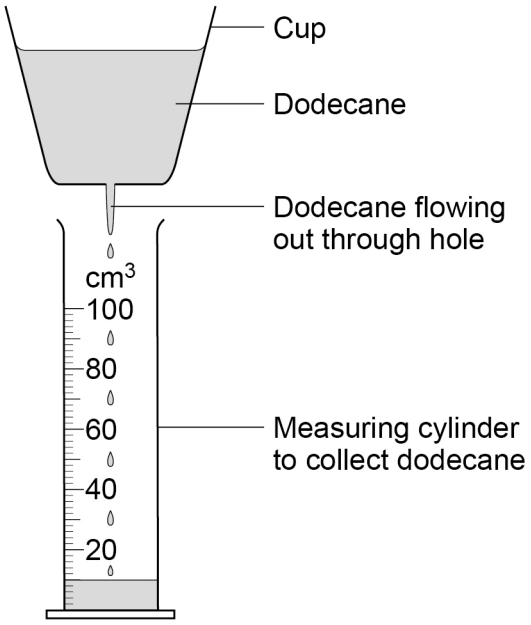
[1 mark]

C ____ H ____

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

Figure 1 shows the apparatus.

Figure 1



5.7.1.3 Properties of hydrocarbons

Question 07 · 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 1 . 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 1 . 3 Give **one** control variable used in the investigation.

[1 mark]

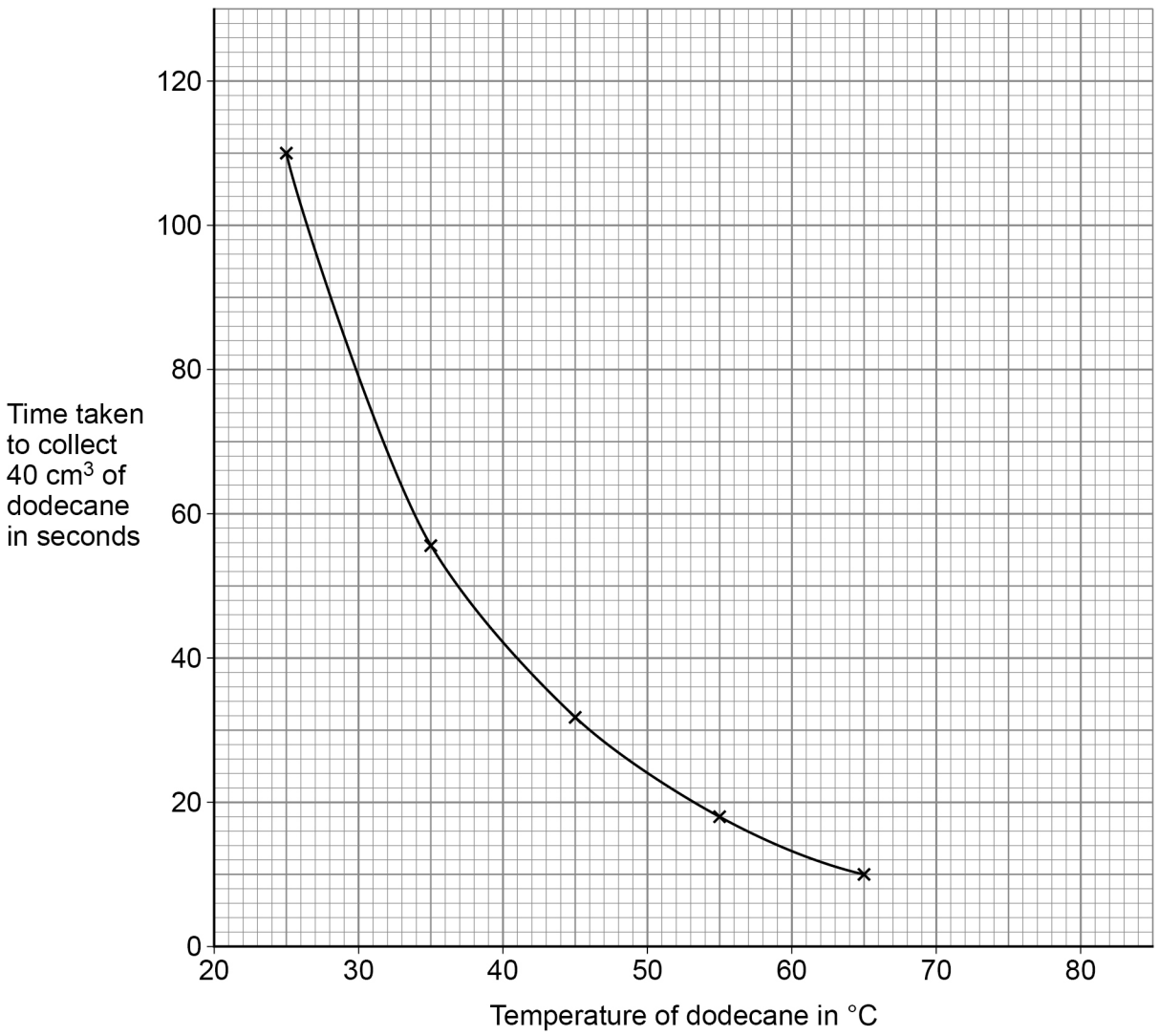
Question 1 continues on the next page

5.7.1.3 Properties of hydrocarbons

Question 07 · continued

Figure 2 shows the results.

Figure 2



0 1 . 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 2**.

[2 marks]

Time taken = _____ s

5.7.1.3 Properties of hydrocarbons

Question 07 · continued

0 1 . 5 The higher the viscosity, the slower dodecane flows.

Explain how the trend in **Figure 2** shows the effect of an increase in temperature on the **viscosity** of dodecane.

[2 marks]

7

Turn over for the next question