

AQA A-Level Chemistry

Alkanes

Questions only

The newest questions, about an hour. All 30 are in the exam generator.

Questions

18

Total marks

46

Time allowed

1 h

Name

Class or teacher

Date

Instructions

- Answer all questions in the spaces provided.
- Use black ink. Show your working for every calculation.
- You may use a scientific calculator and the AQA Data Sheet.
- Print the separate mark scheme when you are ready to mark your answers.

For marking

Q	Source	Marks	Score
1	2023 AS P2 Q2	9	
2	2021 AS P2 Q5	8	
3	2022 A-level P3 Q22	1	
4	2022 AS P2 Q8	1	
5	2022 AS P2 Q6	5	
6	2023 AS P2 Q11	1	
7	2023 AS P2 Q10	1	
8	2024 AS P2 Q14	1	
9	2024 A-level P2 Q3	10	

Q	Source	Marks	Score
10	2024 AS P2 Q16	1	
11	2025 AS P2 Q10	1	
12	2025 AS P2 Q14	1	
13	2025 AS P2 Q15	1	
14	2025 AS P2 Q16	1	
15	2025 AS P2 Q17	1	
16	2025 AS P2 Q21	1	
17	2025 AS P2 Q9	1	
18	2025 A-level P3 Q28	1	

Total _____ / 46 Percentage _____ %

Questions from AQA past papers, 2021–2025, reproduced for revision. Practise these topics online, with instant marking:
whiteboardchemistry.com/revision/aqa-a-level-chemistry/exam-questions?topics=alkanes&len=0

Questions

Alkanes · 18 questions · 46 marks · time allowed 1 h

Q1 · June 2023 · AS Paper 2 · Q2 · [9 marks]

This question also needs Alcohols and Organic analysis.

This question is about fuels.

(a) Crude oil is separated into fractions by fractional distillation.

State the meaning of the term 'fraction' in this context.

[1 mark]

(b) Petrol for cars contains branched and cyclic alkanes produced by catalytic cracking.

Identify the catalyst used in this process.

[1 mark]

(c) 3-Ethyl-4-methylhexane is a branched alkane in petrol.

Draw the skeletal formula of this alkane.

[1 mark]

(d) Give the equation for the complete combustion of 3-ethyl-4-methylhexane.

Use the molecular formula for 3-ethyl-4-methylhexane in your equation.

[2 marks]

(e) Carbon dioxide is a product from the combustion of petrol in cars. Carbon dioxide acts as a greenhouse gas when it absorbs infrared radiation.

Give one reason why carbon dioxide absorbs infrared radiation.

[1 mark]

(f) Nitrogen monoxide (NO) is formed when petrol is burned in cars.

State one environmental problem that NO causes.

State what is used to remove NO from the exhaust gases formed in petrol-fuelled cars.

[2 marks]

Environmental problem

Removal of NO

(g) Petrol sold in the UK contains 10% bioethanol. Bioethanol is ethanol made from crops by fermentation and is considered to be carbon-neutral.

State what is meant by the term 'carbon-neutral'.

[1 mark]

Q2 · November 2021 · AS Paper 2 · Q5 · [8 marks]

This question is about poly(propene).

(a) The three key steps in the manufacture of poly(propene) from crude oil are shown.



Naphtha is a mixture of alkanes with 6 to 12 carbon atoms per molecule.

For each step, name the process and state briefly the purpose of the process that leads to the formation of poly(propene).

[6 marks]

Step 1

Name

Purpose

Step 2

Name

Purpose

Step 3

Name

Purpose

(b) Poly(propene) is not biodegradable because it is unreactive.

Explain why poly(propene) is unreactive.

[1 mark]

(c) Scientists are developing new polymers, including some that are biodegradable.

Suggest why it is beneficial for some polymers to be biodegradable.

[1 mark]

Q3 • June 2022 • Paper 3 • Q22 • [1 mark]

2-Bromopropane reacts with bromine to form 2,2-dibromopropane. What is the name of the mechanism of this reaction?

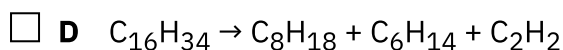
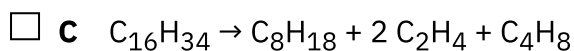
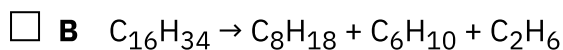
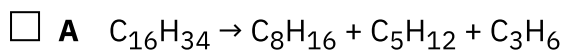
Tick (✓) one box.

- ☐ **A** Electrophilic addition
- ☐ **B** Elimination
- ☐ **C** Free-radical substitution
- ☐ **D** Nucleophilic substitution

Q4 • June 2022 • AS Paper 2 • Q8 • [1 mark]

When hexadecane ($C_{16}H_{34}$) is heated to a high temperature, one molecule of hexadecane decomposes to form an alkane containing eight carbon atoms and two different unsaturated compounds. Which equation could represent this reaction?

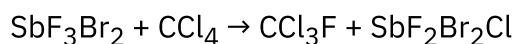
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**Q5 • June 2022 • AS Paper 2 • Q6 • [5 marks]**

This question also needs Amount of substance.

Trichlorofluoromethane (CCl_3F) was developed as a refrigerant. The production and use of CCl_3F is now restricted.

(a) The equation for a process used to manufacture CCl_3F is



Calculate the percentage atom economy for the production of CCl_3F in this reaction. Give your answer to 3 significant figures.

Percentage atom economy

[2 marks]

An alternative synthesis of CCl_3F is the free-radical substitution reaction between fluoromethane (CH_3F) and chlorine.

(b) An intermediate in this alternative synthesis is dichlorofluoromethane (CHCl_2F)

Give equations to represent the two propagation steps in the conversion of CHCl_2F into CCl_3F

[2 marks]

Propagation step 1

Propagation step 2

(c) Analysis of the products of this reaction shows the formation of a compound with the empirical formula CCl_2F

Give an equation to represent a termination step forming this compound. Show the structural formula of the product in the equation.

[1 mark]

Q6 • June 2023 • AS Paper 2 • Q11 • [1 mark]

Which is the overall equation for the reaction of $\text{CCl}_3\text{CH}_2\text{CCl}_3$ with an excess of chlorine in ultraviolet radiation?

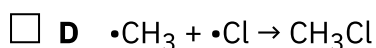
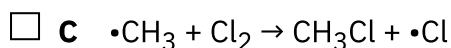
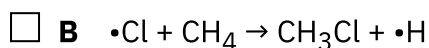
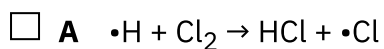
Tick (✓) one box.

- ☐ **A** $\text{CCl}_3\text{CH}_2\text{CCl}_3 + \frac{1}{2}\text{Cl}_2 \rightarrow \text{CCl}_3\text{CHClCCl}_3 + \frac{1}{2}\text{H}_2$
- ☐ **B** $\text{CCl}_3\text{CH}_2\text{CCl}_3 + \text{Cl}_2 \rightarrow \text{CCl}_3\text{CHClCCl}_3 + \text{HCl}$
- ☐ **C** $\text{CCl}_3\text{CH}_2\text{CCl}_3 + 2\text{Cl}_2 \rightarrow \text{CCl}_3\text{CCl}_2\text{CCl}_3 + 2\text{HCl}$
- ☐ **D** $\text{CCl}_3\text{CH}_2\text{CCl}_3 + \text{Cl}_2 \rightarrow \text{CCl}_3\text{CCl}_2\text{CCl}_3 + \text{H}_2$

Q7 • June 2023 • AS Paper 2 • Q10 • [1 mark]

Which equation represents a propagation step in the chlorination of methane?

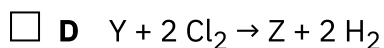
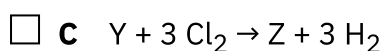
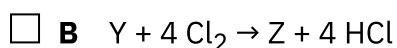
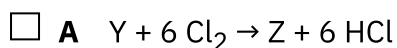
Tick (✓) one box.



Q8 • June 2024 • AS Paper 2 • Q14 • [1 mark]

1,1-Dichloroethane (Y) reacts with chlorine to form hexachloroethane (Z). Which is the correct equation for this reaction?

Tick (✓) one box.



Q9 · June 2024 · Paper 2 · Q3 · [10 marks]

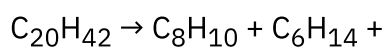
This question also needs Amount of substance and NMR.

This question is about hydrocarbons.

(a) Eicosane ($C_{20}H_{42}$) can be cracked by heating to 700 K in the presence of a catalyst.

The products are

- an aromatic hydrocarbon C_8H_{10}
- an alkane C_6H_{14}
- another alkane.



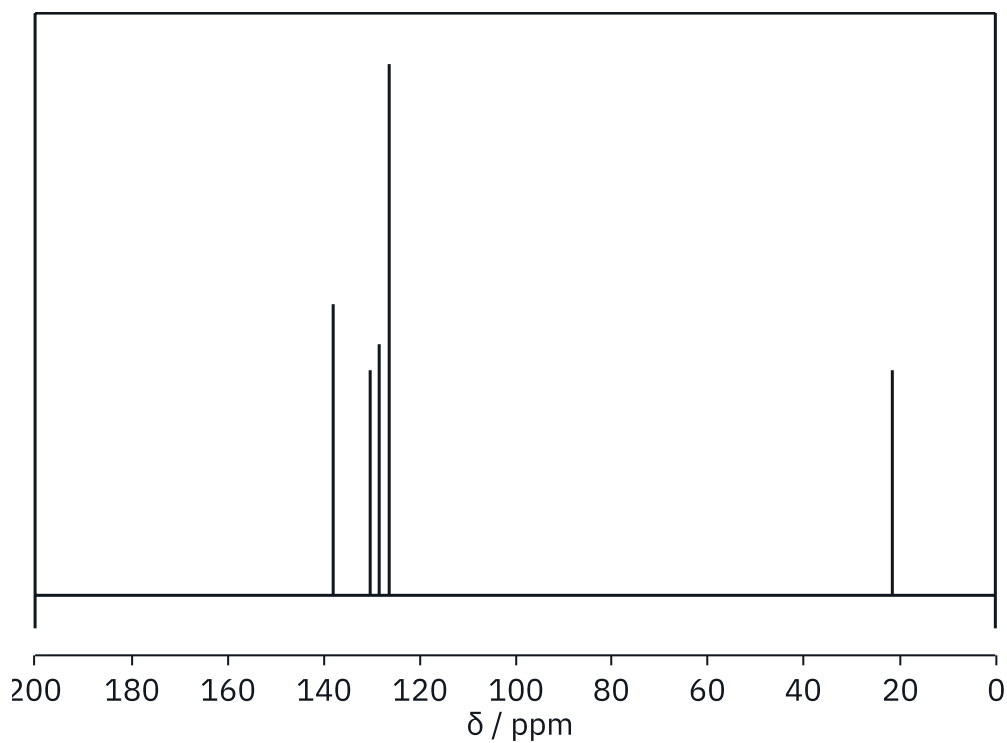
Complete the equation for this reaction.

Give a suitable catalyst for this reaction.

Catalyst

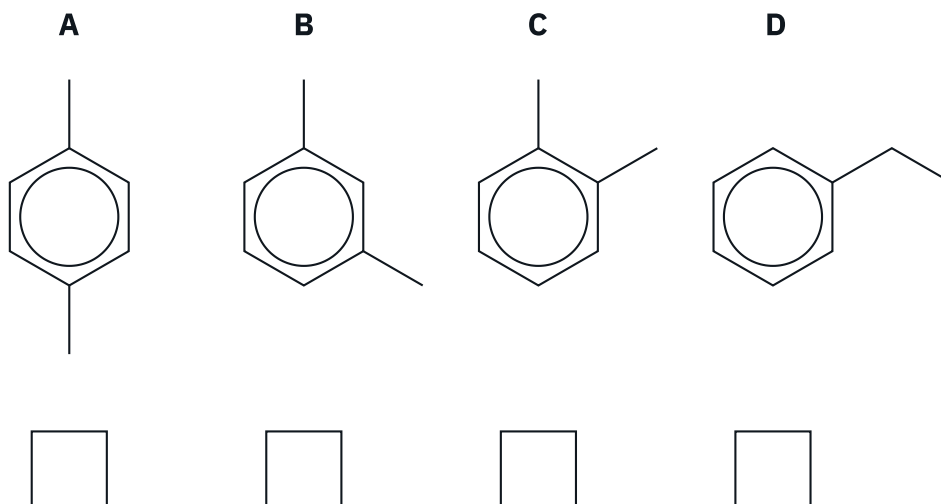
[2 marks]

(b) The figure below shows the ^{13}C NMR spectrum for the aromatic hydrocarbon C_8H_{10}



Which of these is the structure of C_8H_{10} ?

Tick (✓) one box.



[1 mark]

(c) Cracking can also be done without a catalyst, using a temperature of 1200 K and a pressure of 7000 kPa

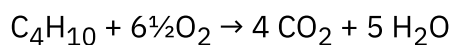
State the type of product that is formed in high percentage in this type of cracking.

[1 mark]

(d) A sample of butane has a volume of 20 cm³ at room temperature and pressure.

The sample is burned completely in 1350 cm³ of air.

The final mixture is cooled to room temperature and pressure.



Calculate the total volume of gas in the final mixture.

Assume that air contains 21% by volume of oxygen.

Total volume of gas remaining cm³

[4 marks]

(e) Natural gas is used in power stations to produce electricity.

Natural gas contains sulfur impurities. Sulfur dioxide forms when these impurities are burned.

State an environmental problem caused by sulfur dioxide.

Give the formula of a compound that is used to help remove sulfur dioxide from the combustion products.

[2 marks]

Environmental problem

Formula of compound

Q10 • June 2024 • AS Paper 2 • Q16 • [1 mark]

Octadecane is a straight-chain alkane containing 18 carbon atoms per molecule. It is cracked to produce oct-1-ene and two other compounds. Which equation represents this reaction?

Tick (✓) one box.

- ☐ **A** $\text{C}_{18}\text{H}_{36} \rightarrow \text{C}_8\text{H}_{16} + \text{C}_6\text{H}_{12} + 2 \text{C}_2\text{H}_4$
- ☐ **B** $\text{C}_{18}\text{H}_{38} \rightarrow \text{C}_8\text{H}_{16} + \text{C}_4\text{H}_{10} + 2 \text{C}_3\text{H}_6$
- ☐ **C** $\text{C}_{18}\text{H}_{38} \rightarrow \text{C}_8\text{H}_{18} + \text{C}_2\text{H}_4 + 2 \text{C}_4\text{H}_8$
- ☐ **D** $\text{C}_{18}\text{H}_{38} \rightarrow \text{C}_8\text{H}_{18} + \text{C}_4\text{H}_8 + 2 \text{C}_3\text{H}_6$

Q11 • June 2025 • AS Paper 2 • Q10 • [1 mark]

Which statement about catalytic cracking is correct?

Tick (✓) one box.

- ☐ **A** A high percentage of alkenes is formed.
- ☐ **B** A pressure of about 70 MPa is used.
- ☐ **C** C–C bonds are broken.
- ☐ **D** A nickel catalyst is used.

Q12 · June 2025 · AS Paper 2 · Q14 · [1 mark]

Sulfur dioxide can be found in the flue gases from the combustion of some fuels.

Which statement about sulfur dioxide is correct?

Tick (✓) one box.

- ☐ **A** Sulfur dioxide molecules have a linear shape.
- ☐ **B** Sulfur dioxide is a basic oxide.
- ☐ **C** Sulfur dioxide reacts with calcium oxide to form CaSO_4 as the main product.
- ☐ **D** Sulfur dioxide molecules contain polar bonds.
-

Q13 · June 2025 · AS Paper 2 · Q15 · [1 mark]

Which equation shows a step in the decomposition of ozone by free radicals formed from CFCs in the upper atmosphere?

Tick (✓) one box.

- ☐ **A** $\text{Cl}\cdot + \text{O}_3 \rightarrow \text{O}_2 + \text{ClO}\cdot$
- ☐ **B** $\text{Cl}\cdot + \text{O}_3 \rightarrow \text{ClO}_2 + \text{O}\cdot$
- ☐ **C** $\text{Cl}\cdot + \text{O}_2 \rightarrow \text{ClO}\cdot + \text{O}\cdot$
- ☐ **D** $\text{ClO}\cdot + \text{O}_3 \rightarrow \text{ClO}_2 + \text{O}_2$
-

Q14 · June 2025 · AS Paper 2 · Q16 · [1 mark]

Crude oil is separated into fractions in a fractionating column at an oil refinery.

Which statement about the fractions collected higher up in the column, compared with those collected lower down, is correct?

Tick (✓) one box.

- ☐ **A** They are collected at a higher temperature.
- ☐ **B** They have stronger intermolecular forces.
- ☐ **C** They are more volatile.
- ☐ **D** They are more viscous.

Q15 · June 2025 · AS Paper 2 · Q17 · [1 mark]

Which of these gases is not linked to global warming caused by the absorption of infrared radiation?

Tick (✓) one box.

- ☐ **A** CO₂
- ☐ **B** C₃H₈
- ☐ **C** H₂O
- ☐ **D** N₂

Q16 · June 2025 · AS Paper 2 · Q21 · [1 mark]

Which equation for the reaction of chlorine with excess ethane in the presence of ultraviolet light is correct?

Tick (✓) one box.

- ☐ **A** $\text{C}_2\text{H}_6 + (1)/(2)\text{Cl}_2 \rightarrow \text{C}_2\text{H}_5\text{Cl} + (1)/(2)\text{H}_2$
- ☐ **B** $\text{C}_2\text{H}_6 + \text{Cl}_2 \rightarrow \text{C}_2\text{H}_5\text{Cl} + \text{HCl}$
- ☐ **C** $\text{C}_2\text{H}_6 + 3\text{Cl}_2 \rightarrow \text{C}_2\text{Cl}_6 + 3\text{H}_2$
- ☐ **D** $\text{C}_2\text{H}_6 + 6\text{Cl}_2 \rightarrow \text{C}_2\text{Cl}_6 + 6\text{HCl}$

Q17 · June 2025 · AS Paper 2 · Q9 · [1 mark]

Which statement about the combustion of petrol in vehicles is correct?

Tick (✓) one box.

- ☐ **A** Exhaust gases can contain a mixture of unburned hydrocarbon molecules.
- ☐ **B** In the catalytic converter, carbon dioxide is converted into carbon monoxide.
- ☐ **C** More nitrogen gas is emitted from the catalytic converter than enters the internal combustion engine.
- ☐ **D** Combustion in a plentiful supply of oxygen often causes an increased amount of black solid to be emitted from the exhaust.

Q18 · June 2025 · Paper 3 · Q28 · [1 mark]

Alkanes are obtained from crude oil by fractional distillation.

Which statement is correct?

Tick (✓) one box.

- ☐ **A** Alkanes obtained are converted to alkenes by thermal cracking.
- ☐ **B** Alkanes with longer chains rise to the top of the fractionating column.
- ☐ **C** The diesel fraction contains sulfur compounds that react to form SO_3 in car exhausts.
- ☐ **D** The boiling points of alkane isomers increase as the carbon chains become more branched.

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Mark scheme:

whiteboardchemistry.com/revision/aqa-a-level-chemistry/exam-questions/pdf/alkanes-mark-scheme.pdf