AQA A-Level Chemistry

Alkanes mark scheme · goes with “Alkanes” · whiteboardchemistry.com/revision/aqa-a-level-chemistry/exam-questions

Mark schemes

Alkanes · 18 questions

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

(a) (mixture of) compounds/substances with similar boiling points

Allow similar number of carbon atoms / chain length / M_r / size

Ignore same boiling point / number of C atoms / chain length / M_r / size

Ignore reference to similar melting points

Ignore reference to similar chemical properties

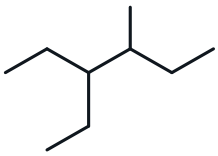
[1 mark]

(b) zeolites / aluminosilicates

Ignore aluminium oxide

[1 mark]

(c)



Must be skeletal formula

Ignore working, including other forms of structure of this compound.

[1 mark]

(d) M1 C_9H_{20}

M2 $C_9H_{20} + 14O_2 \rightarrow 9CO_2 + 10H_2O$

For M2 allow ECF from their molecular formula, providing it is an attempt at the molecular formula of a hydrocarbon

Penalise M1 only for not using molecular formula

Allow multiples and fractions

[2 marks]

(e) (C=O) bonds vibrate (at IR frequency) / (IR/it makes) bonds vibrate or

net change in dipole moment of molecule during (asymmetric) vibration or

(C=O) bonds are polar

Do not allow that CO_2 is a polar molecule / has a dipole

[1 mark]

(f) M1 acid rain / respiratory problems

M1 Allow direct consequences of acid rain; allow smog; allow production of ground level ozone

M2 catalytic converters

M2 allow description of process that occurs in catalytic converter but must include reference to a (named) catalyst

[2 marks]

(g) no net emissions of carbon dioxide/CO_2 to the atmosphere

Allow explanation showing that same amount of CO_2 taken in and released to the atmosphere

Answer needs to refer to carbon dioxide (not just carbon)

[1 mark]

Q2 · June 2022 · AS Paper 2 · Q8 · [1 mark]

Answer: **C**

$C_{16}H_{34} \rightarrow C_8H_{18} + 2C_2H_4 + C_4H_8$

Q3 · June 2022 · AS Paper 2 · Q6 · [5 marks]

(a) M1 $\dfrac{137.5}{492.6}$

or $\dfrac{(12.0 + 3(35.5) + 19.0)}{(121.8 + 3(19.0) + 2(79.9) + 12.0 + 4(35.5))}$

or $\dfrac{137.5}{(338.6 + 154.0)}$

or $\dfrac{(12.0 + 3(35.5) + 19.0)}{(12.0 + 3(35.5) + 19.0 + 121.8 + 2(19.0) + 2(79.9) + 35.5)}$

or $\dfrac{137.5}{(355.1 + 137.5)}$

[1 mark]

M2 (× 100) = 27.9 (%)

[1 mark]

M2 must be 3 sig figs

Correct answer scores 2 marks

Can score 1 mark for 137.5 (or working that gives this) or 492.6 (or working that gives this) in working if no other marks scored

(b) M1 $CHCl_2F + \bullet Cl \rightarrow \bullet CCl_2F + HCl$

[1 mark]

M2 $\bullet CCl_2F + Cl_2 \rightarrow CCl_3F + \bullet Cl$

[1 mark]

Allow equations in either order

Allow dot anywhere on the correct radical

Ignore extra initiation and termination steps

Penalise absence of dots once only

(c) $2 \bullet CCl_2F \rightarrow CCl_2FCCl_2F$

Allow dot anywhere on the radical

Structural formula of product must be shown in answer (ignore additional correct molecular formula)

[1 mark]

Q4 · June 2023 · AS Paper 2 · Q11 · [1 mark]

Answer: **C**

$CCl_3CH_2CCl_3 + 2Cl_2 \rightarrow CCl_3CCl_2CCl_3 + 2HCl$

Q5 · June 2023 · AS Paper 2 · Q10 · [1 mark]

Answer: **C**

$\bullet CH_3 + Cl_2 \rightarrow CH_3Cl + \bullet Cl$

Q6 · June 2024 · AS Paper 2 · Q14 · [1 mark]

Answer: **B**

$Y + 4Cl_2 \rightarrow Z + 4HCl$

Q7 · June 2024 · Paper 2 · Q3 · [10 marks]

(a) M1 + 3 C_2H_6

M2 Zeolite/Aluminosilicate/Aluminium oxide

[2 marks]

(b) Option B

[1 mark]

(c) Alkenes

[1 mark]

(d) M1 Initial volume $O_2 = 0.21 \times 1350 = 283.5$ (cm^3)

M2 Volume of O_2 remaining = M1 - $(6.5 \times 20) = 153.5$ cm^3

M3 Volume of CO_2 formed = 20 × 4 = 80 cm^3

M4 Total volume of gas left = M2 + M3 + (0.79 × 1350) = 1300 cm^3

Alternative route:

M1 Vol Air decreases by 6.5 × 20 = 130 cm^3

M2 = 1220 cm^3

M3 Vol CO_2 produced = 4 × 20 = 80 cm^3

M4 Total Vol Air + CO_2 = 1220 + 80 = 1300 cm^3

[4 marks]

(e) M1 Acid rain

M1 Allow damages (limestone) buildings or statues/death of aquatic organisms/air pollution

M2 CaO or $CaCO_3$

[2 marks]

Q8 · June 2024 · AS Paper 2 · Q16 · [1 mark]

Answer: **B**

$C_{18}H_{38} \rightarrow C_8H_{16} + C_4H_{10} + 2C_3H_6$

Q9 · June 2022 · AS Paper 2 · Q9 · [1 mark]

Answer: **D**

Kerosene is a mixture of compounds

Q10 · June 2019 · AS Paper 2 · Q4 · [4 marks]

04.1

$C_8H_{18} + 12.5O_2 \rightarrow 8CO_2 + 9H_2O$

Allow multiples

Ignore state symbols

[1 mark]

04.2

$2NO + 2CO \rightarrow N_2 + 2CO_2$ or

$25NO + C_8H_{18} \rightarrow 12.5N_2 + 9H_2O + 8CO_2$

Allow multiples

Ignore state symbols

Allow $2NO \rightarrow N_2 + O_2$ (or multiples)

[1 mark]

04.3

M1 moles SO_2 = $\frac{(6\ 490\ 000 \times 10^6)}{(64.1)}$ (= $\frac{(6.49 \times 10^{12})}{(64.1)}$ = 1.012×10^{11})

M2 mass CaO = ($\frac{(1.012 \times 10^{11} \times 56.1)}{(1000)}$) = 5.68×10^9 (kg)

M2 must be in standard form

Correct answer in standard form scores 2 marks (allow 5.6 – 5.7 x 10^9). Answer to at least 2sf.

Correct answer in non-standard form scores 1 mark

Answers that are 5.6 – 5.7 x 10^n score 1 mark

For other answers, allow ECF from M1 to M2 (but answer must be in standard form for M2 to score)

Alternative

M1 mass CaO = $\frac{(6\ 490\ 000 \times 10^6)}{(64.1)}$ x 56.1

= 5.68 million tonnes

M2 5.68×10^9 (kg)

(7.4.. x 10^9 would score 1 mark due to use of $\frac{(64.1)}{(56.1)}$)

[2 marks]

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

Answer: **C**

C–C bonds are broken.

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

Answer: **D**

Sulfur dioxide molecules contain polar bonds.

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

Answer: **A**

$Cl\bullet + O_3 \rightarrow O_2 + ClO\bullet$

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

Answer: **C**

They are more volatile.

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

Answer: **D**

N_2

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

Answer: **B**

$C_2H_6 + Cl_2 \rightarrow C_2H_5Cl + HCl$

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

Answer: **A**

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

Answer: **A**

Alkanes obtained are converted to alkenes by thermal cracking.

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