GCSE Chemistry Topic 7 AQA: Organic Chemistry
Mark Scheme

Q1. Crude oil

(a) **Type of mixture:**

- **Mixture of hydrocarbons** OR **a mixture** (1 mark)

(b) **Main group of hydrocarbons:**

- **Alkanes** (1 mark)

Total: 2 marks

Q2. Alkanes

(a) **General formula of alkanes:**

- **C□H₂□₊₂** (1 mark)

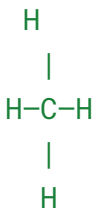
(b) **Molecular formula of propane:**

- **C₃H₈** (1 mark)

Total: 2 marks

Q3. Structure of methane

- Displayed formula:



- Correct bonds and four hydrogens attached (2 marks)

Total: 2 marks

Q4. Fractional distillation

(a) **Why different fractions collected at different levels:**

- Different hydrocarbons have different **boiling points** (1 mark)
- Fractions condense at different heights because column is **hotter at bottom, cooler at top** (1 mark)

(b) **Fraction at top of column:**

- **Refinery gases / petrol / LPG** (1 mark)

Total: 3 marks

Q5. Properties of hydrocarbons

(a) **Viscosity as chain length increases:**

- **Viscosity increases / becomes thicker** (1 mark)

(b) **Flammability as chain length increases:**

- **Flammability decreases / harder to ignite** (1 mark)

Total: 2 marks

Q6. Combustion

(a) **Word equation – complete combustion of methane:**

- **Methane + oxygen → carbon dioxide + water** (2 marks)

(b) **Product of incomplete combustion:**

- **Carbon monoxide** OR **carbon / soot** (1 mark)

Total: 3 marks

Q7. Cracking

(a) **Conditions:**

- **High temperature** (around 600–700 °C) (1 mark)
- **Catalyst (aluminium oxide / silica)** (1 mark)

(b) **Why useful:**

- Produces **more useful smaller hydrocarbons / alkenes for polymers** (1 mark)
- Converts **long-chain alkanes into shorter-chain alkanes** (1 mark)

Total: 4 marks

Q8. Bromine water test

(a) **Alkene:**

- **Bromine water turns colourless** (1 mark)

(b) **Alkane:**

- **No change / remains orange-brown** (1 mark)

Total: 2 marks

Q9. Alkenes

(a) **General formula:**

- **C□H₂□** (1 mark)

(b) **Displayed formula of ethene:**

```
H   H
 \ /
  C=C
 / \
H   H
```

(2 marks)

Total: 3 marks

Q10. Polymers

(a) **Type of reaction:**

- **Addition polymerisation** (1 mark)

(b) **Displayed formula of poly(ethene):**

$-[CH_2-CH_2]-$

- Correct repeating unit (2 marks)

Total: 3 marks

Q11. Alcohols

(a) **Functional group:**

- **–OH** (1 mark)

(b) **C_2H_5OH:**

- **Ethanol** (1 mark)

Total: 2 marks

Q12. Uses of ethanol

- **Fuel / alcoholic drinks / solvent** (1 mark)

Total: 1 mark

Q13. Carboxylic acids

(a) **Functional group:**

- **–COOH** (1 mark)

(b) **CH_3COOH:**

- **Ethanoic acid / vinegar** (1 mark)

Total: 2 marks

Q14. Esters

(a) **Ester from ethanol + ethanoic acid:**

- **Ethyl ethanoate** (1 mark)

(b) **One use:**

- **Perfume / flavouring / solvent** (1 mark)

Total: 2 marks

Q15. Differences alkanes vs alkenes

- **Alkanes:** single bonds only (1 mark)

- **Alkenes:** contain a C=C double bond (1 mark)
- Alternative valid differences: saturated vs unsaturated, general formula, reactivity

Total: 2 marks

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Q16. Hydrocarbons

(a) General formula for alkanes:

- **C□H₂□₊₂ (1 mark)**

(b) Molecular formula for butane:

- **C_4H_{10} (1 mark)**

Total: 2 marks

Q17. Properties of hydrocarbons

(a) Viscosity:

- **Viscosity increases as chain length increases (1 mark)**
- **Longer chains have stronger intermolecular forces / more entanglement (1 mark)**

(b) Flammability:

- **Flammability decreases as chain length increases (1 mark)**
- **Longer chains require more energy to ignite (1 mark)**

Total: 4 marks

Q18. Fractional distillation

(a) Why fractions collected at different levels:

- **Different hydrocarbons have different boiling points (1 mark)**
- **Temperature gradient in column (hot bottom, cool top) (1 mark)**
- **Hydrocarbons condense at the level matching their boiling point (1 mark)**

(b) Fraction at top:

- **Gases / refinery gases / LPG (1 mark)**

Total: 4 marks

Q19. Combustion

(a) Balanced symbol equation – ethane:

- **$2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$ (2 marks)**

(b) Products of incomplete combustion:

- **Carbon monoxide (CO) (1 mark)**
- **Carbon / soot (1 mark)**

Total: 4 marks

Q20. Cracking

(a) Balanced equation for decane → octane + ethene:

- **$C_{10}H_{22} \rightarrow C_8H_{18} + C_2H_4$ (2 marks)**

(b) Importance of cracking:

- **Produces smaller, more useful hydrocarbons for fuels (1 mark)**
- **Produces alkenes for polymers / chemicals (1 mark)**

Total: 4 marks

Q21. Bromine water test

(a) Result with alkene:

- **Bromine water decolourises (1 mark)**

(b) Reason:

- **C=C double bond undergoes electrophilic addition with bromine (1 mark)**
- **Forms a colourless dibromoalkane (1 mark)**

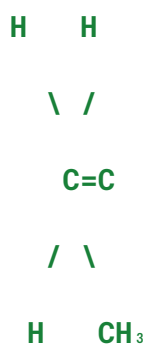
Total: 4 marks

Q22. Alkenes

(a) General formula:

- **C□H₂□ (1 mark)**

(b) Displayed formula of propene:



(2 marks)

Total: 3 marks

Q23. Addition polymerisation

(a) Type of monomer:

- **Unsaturated (contains C=C) (1 mark)**

(b) Poly(propene) displayed formula:

$-[CH_2-CH(CH_3)]-$

(2 marks)

Total: 3 marks

Q24. Alcohols

(a) Functional group:

- **–OH (1 mark)**

(b) Molecular formula of propanol:

- **C_3H_7OH (1 mark)**

(c) Use:

- **Solvent / fuel / in alcoholic drinks / chemical feedstock (1 mark)**

Total: 3 marks

Q25. Combustion of alcohols

(a) Word equation – complete combustion:

- **Ethanol + oxygen → carbon dioxide + water (2 marks)**

(b) Fuel use:

- **Biofuel / spirit burners / ethanol fuel (1 mark)**

Total: 3 marks

Q26. Fermentation

(a) Word equation:

- **Glucose → ethanol + carbon dioxide (2 marks)**

(b) Conditions:

- **Anaerobic (no oxygen) (1 mark)**
- **Warm (30–40 °C) (1 mark)**

Total: 4 marks

Q27. Carboxylic acids

(a) Functional group:

- **–COOH (1 mark)**

(b) C_2H_5COOH:

- **Propanoic acid (1 mark)**

Total: 2 marks

Q28. Carboxylic acid + metal carbonate

(a) General word equation:

- **Carboxylic acid + metal carbonate → salt + water + carbon dioxide (2 marks)**

(b) Observation:

- **Fizzing / effervescence (1 mark)**

Total: 3 marks

Q29. Esters

(a) Ester from ethanol + propanoic acid:

- **Ethyl propanoate (1 mark)**

(b) Use:

- **Perfume / flavouring / solvent (1 mark)**

Total: 2 marks

Q30. Alkanes vs alkenes

- **Alkanes are saturated, alkenes are unsaturated (1 mark)**
- **Alkenes undergo addition reactions, alkanes generally do not (1 mark)**

Total: 2 marks

Q31. Environmental issues – addition polymers

- **Non-biodegradable / persist in environment (1 mark)**
- **Difficult to recycle (1 mark)**
- **Incineration produces toxic gases / CO_2 (1 mark)**
- **Made from non-renewable resources / fossil fuels (1 mark)**

Total: 4 marks

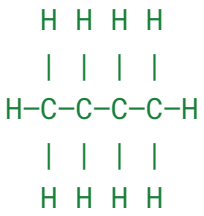
Q32. Ethanol production – fermentation vs hydration

- **Fermentation advantages: renewable raw materials (1 mark)**
- **Fermentation disadvantages: slow, produces dilute ethanol, requires separation (1 mark)**
- **Hydration advantages: fast, continuous, produces pure ethanol (1 mark)**
- **Hydration disadvantages: requires high T and P, uses non-renewable ethene (1 mark)**
- **Evaluation / comparison: cost, yield, purity, sustainability (2 marks)**

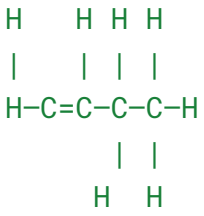
Total: 6 marks

Q33. Displayed formulae

- **Butane:**



- **But-1-ene:**



Total: 2 marks

Q34. Incomplete combustion dangers

- **Carbon monoxide is toxic (1 mark)**
- **Soot / carbon causes air pollution (1 mark)**

Total: 2 marks

Q35. Crude oil products + uses

- **Petrol → fuel for cars (1 mark)**
- **Diesel → fuel for vehicles / generators (1 mark)**
- **Kerosene → jet fuel / heating (1 mark)**

Total: 3 marks

Q36. Alkene reactions other than combustion

- **Hydrogenation (addition of H_2) (1 mark)**
- **Addition of halogens (e.g., bromine water) (1 mark)**

Total: 2 marks

Q37. Comparing energy from alcohols

- **Measure mass of alcohol and temperature change of water (1 mark)**
- **Calculate energy released per gram (1 mark)**
- **Repeat for accuracy / control variables (1 mark)**
- **Compare energy of different alcohols (1 mark)**

Total: 4 marks

Q38. Carboxylic acids – weak acids

- **Partially ionise in water (1 mark)**
- **Do not release all H^+ ions (1 mark)**

Total: 2 marks

Q39. Homologous series

(a) Definition:

- **Compounds with the same functional group and similar chemical properties (1 mark)**
- **Each differs by CH_2 unit (1 mark)**

(b) Shared property:

- **Trend in physical properties (e.g., boiling point) (1 mark)**

Total: 3 marks

Q40. Valid/accurate combustion experiment

- **Control hydrocarbon mass / volume (1 mark)**
- **Use same apparatus / insulating calorimeter (1 mark)**
- **Repeat and calculate mean (1 mark)**
- **Measure temperature accurately / reduce heat loss (1 mark)**

Total: 4 marks

Q41. Cracking

(a) **Why cracking is thermal decomposition:**

- **Cracking involves breaking long-chain hydrocarbons into smaller molecules using heat** (1 mark)

- **Bonds are broken by thermal energy** (1 mark)

(b) **Two products and uses:**

- **Alkanes → fuels (e.g., petrol, diesel)** (1 mark)

- **Alkenes → feedstock for polymers / chemicals** (1 mark)

Total: 4 marks

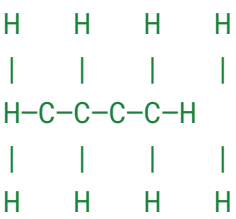
Q42. Structural isomers

(a) **Definition:**

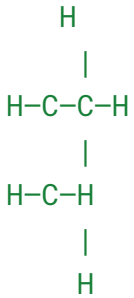
- **Compounds with the same molecular formula but different structural arrangements of atoms** (2 marks)

(b) **Two isomers of C_4H_{10}:**

Butane:



2-methylpropane:



(2 marks)

Total: 4 marks

Q43. Addition polymerisation

(a) **Why repeating unit has no double bond:**

- **The C=C double bond in the monomer is broken during polymerisation** (1 mark)
- **Single bonds form to link monomers into the polymer chain** (1 mark)

(b) **Poly(propene) repeating unit:**

$-[CH_2-CH(CH_3)]-$

(2 marks)

Total: 4 marks

Q44. Addition vs condensation polymers

- **Addition polymers:** formed from monomers with C=C bonds, no small molecule is released (1 mark)
- **Condensation polymers:** formed from monomers with two functional groups, water or another small molecule is released (1 mark)

Total: 2 marks

Q45. Alcohol reactions

(a) **Combustion of ethanol:**

- $\mathbf{C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O}$ (2 marks)

(b) **Reaction with sodium:**

- **Ethanol + sodium → sodium ethoxide + hydrogen**
- **Fizzing / bubbles of hydrogen observed** (2 marks)

Total: 4 marks

Q46. Fermentation temperature control

- **Too low: yeast inactive → slow reaction** (1 mark)
- **Too high: yeast denatured → stops reaction** (1 mark)

Total: 2 marks

Q47. Hydration of alkenes

(a) **Conditions:**

- **High temperature (~300 °C)**
- **High pressure (~60–70 atm)**
- **Acid catalyst (phosphoric acid, H_3PO_4)** (2 marks)

(b) **Balanced equation:**

- **$C_2H_4 + H_2O \rightarrow C_2H_5OH$** (2 marks)

Total: 4 marks

Q48. Carboxylic acids + alcohols

(a) **Product of ethanoic acid + ethanol:**

- **Ethyl ethanoate** (1 mark)

(b) **Property:**

- **Sweet smell / fruity smell** (1 mark)

Total: 2 marks

Q49. Esters as solvents – evaluation

- **Advantages:**
    - Volatile → evaporates easily → useful in paints / perfumes (1 mark)
    - Dissolves many organic substances (1 mark)
- **Disadvantages:**
    - Flammable → fire hazard (1 mark)
    - Can be toxic / expensive (1 mark)

Total: 4 marks

Q50. Homologous series physical trends

- **Members differ by CH_2 units** (1 mark)
- **Increase in chain length → trend in melting/boiling points / viscosity / density** (1 mark)

Total: 2 marks

Q51. Alkanes vs alkenes

- **Alkanes: only single bonds; alkenes: contains C=C double bond** (1 mark)
- **Alkanes: mainly substitution reactions; alkenes: addition reactions** (1 mark)

Total: 2 marks

Q52. Functional groups

(a) Alcohols: **–OH** (1 mark)
(b) Esters: **–COO–** (1 mark)
(c) Carboxylic acids: **–COOH** (1 mark)

Total: 3 marks

Q53. Disposal problems – addition polymers

- **Non-biodegradable → persist in environment** (1 mark)
- **Incineration produces CO_2 / toxic gases** (1 mark)
- **Difficult to recycle** (1 mark)

Total: 3 marks

Q54. Biofuels vs fossil fuels

Advantages:

- Renewable → sustainable (1 mark)
- Carbon-neutral → less net CO_2 (1 mark)

Disadvantages:

- Large land area needed → food vs fuel conflict (1 mark)
- Expensive / less energy dense than fossil fuels (1 mark)

Total: 4 marks

Q55. Practical: burning alcohols

Apparatus:

- Spirit burner, thermometer, calorimeter / beaker of water, balance, measuring cylinder (1 mark)

Method:

- Measure initial water temperature
- Burn known mass of alcohol to heat water
- Record final temperature (1 mark)

Measurements:

- Temperature change of water
- Mass of alcohol burned (1 mark)

Improving accuracy:

- Insulate calorimeter to reduce heat loss
- Repeat and take mean
- Use lid / draught shield (3 marks)

Total: 6 marks