

21.1 Organic synthesis

Name: _____ Class: _____ Date: _____

Total: 11 marks

KEY WORDS synthetic route 合成路线 • multi-step 多步 • functional group 官能团
 • reagent 试剂 • carboxylic acid 羧酸

Objective

Build the skills to answer exam questions on **organic synthesis** 有机合成 — identifying **functional groups** 官能团 by their test reactions, and devising **multi-step** 多步 synthetic routes.

You must be able to:

- identify functional groups in a molecule from the standard tests
- devise multi-step synthetic routes using the reactions in the syllabus
- analyse a route in terms of reaction type and reagents

1 Worked examples

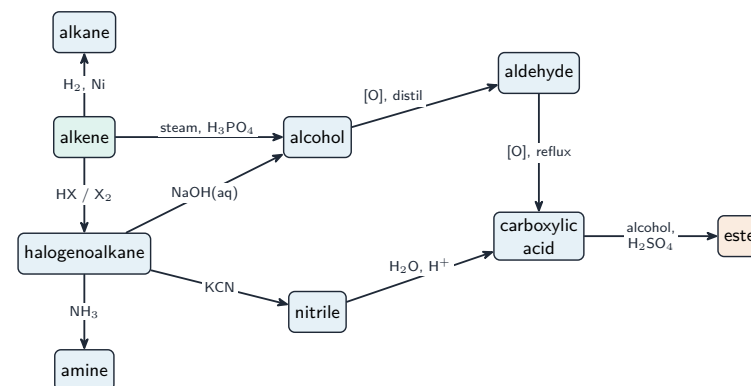
■ Identifying functional groups

add this	you see	functional group
bromine water	orange → colourless	C=C (alkene)
silver nitrate	a precipitate forms	halogenoalkane
acidified K ₂ Cr ₂ O ₇	orange → green	1°/2° alcohol
2,4-DNPH	orange precipitate	aldehyde / ketone
a carbonate	fizzes (CO ₂ given off)	carboxylic acid

Each test points to one functional group

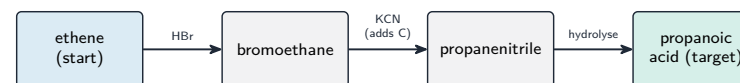
- decolourises bromine water → alkene (C=C); precipitate with AgNO₃ → halogenoalkane; K₂Cr₂O₇ orange→green → primary/secondary alcohol; orange ppt with 2,4-DNPH → carbonyl; fizzes with a carbonate → carboxylic acid.

■ The reaction map and planning backwards



Learn the AS reactions as a map you can travel around to plan a synthesis

plan backwards from the target



To plan: work backwards from the target, choosing a known reaction for each step (watch the carbon count — KCN/HCN add one carbon)

2 Practice

2.1 State the test and result that identifies a carboxylic acid. [2]

2.2 State the reagent and condition to convert an alkene into an alcohol. [2]

3 Exam-style questions

3.1 A compound decolourises bromine water and gives an orange precipitate with 2,4-DNPH. It contains: [1]

- | | |
|---|---|
| A | B |
| C | D |
- A** a C=C bond and a carbonyl group
B an alcohol only
C a carboxylic acid only
D a halogenoalkane only

3.2 Which reagent adds **one** carbon to a chain? [1]

- | | |
|---|---|
| A | B |
| C | D |
- A** NaOH(aq)
B KCN in ethanol
C H₂ / Ni
D concentrated H₂SO₄

3.3 Devise a two-step synthesis of propan-1-ol from 1-bromopropane that adds **no** carbons. Give the reagents and conditions for each step. [2]

3.4 Devise a synthesis of propanoic acid (CH₃CH₂COOH) from bromoethane (C₂H₅Br), giving the reagents for each step. (*Hint: you need to add one carbon.*) [3]
