Solutions

Each answer shows the steps, then the **result**.

2.1

- add a carbonate (e.g. sodium carbonate); fizzing / effervescence of CO_2

2.2

- steam (H_2O gas) with a phosphoric acid (H_3PO_4) catalyst

2.3

- Tollens' reagent, warmed; a silver mirror forms with an aldehyde

2.4

- for example, PCl_5 at room temperature, or HBr (from NaBr and concentrated H_2SO_4) heated under reflux

3.1 A

- decolourising bromine water shows a C=C bond; the orange precipitate with 2,4-DNPH shows a carbonyl group

3.2 B

- KCN adds one carbon (forming a nitrile)

3.3

- react 1-bromopropane with NaOH(aq) and heat
- propan-1-ol (nucleophilic substitution). *(One step suffices; a longer route via the alkene then steam also scores.)*

3.4

- step 1: react bromoethane with KCN in ethanol, heat
- propanenitrile, C_2H_5CN (adds one carbon); step 2: warm the nitrile with dilute acid (hydrolysis)
- propanoic acid

3.5

(a)

- P is **propanone**, CH_3COCH_3, a ketone
- Q is **propan-2-ol**, $CH_3CH(OH)CH_3$

(b)

- **dehydration** (elimination)
- **propene**, $CH_3CH{=}CH_2$

3.6

- step 1: ethanol to bromoethane with HBr (NaBr and concentrated H_2SO_4), heated
- step 2: heat bromoethane with excess concentrated ammonia in ethanol, in a sealed tube (under pressure)