

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

3.1 A

- Bromine water
- $\text{C}=\text{C}$; 2,4-DNPH
- a carbonyl group

3.2 B

- KCN adds one carbon (forming a nitrile)

3.3

- react 1-bromopropane with $\text{NaOH}(\text{aq})$ 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, $\text{C}_2\text{H}_5\text{CN}$ (adds one carbon); step 2: warm the nitrile with dilute acid (hydrolysis)
- propanoic acid