Solutions

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

2.1

- potassium cyanide (KCN) in ethanol; and heat

2.2

- a carboxylic acid (–COOH)

2.3

- **propanenitrile**

2.4

- $CH_3CH(OH)CN$, 2-hydroxypropanenitrile

3.1 B

- KCN adds one carbon to the chain (forming the nitrile)

3.2 B

- Hydrolysis of a nitrile gives the carboxylic acid (ethanoic acid)

3.3

(a)

- $C_2H_5Br + KCN \rightarrow C_2H_5CN + KBr$

(b)

- warm the nitrile with dilute acid (or dilute alkali then acidify); the –CN group is hydrolysed to –COOH

3.4

- HCN with a KCN catalyst (and heat); nucleophilic addition

3.5

(a)

- HCN is a weak acid, so it gives few CN^- ions; KCN supplies the CN^- nucleophile

(b)

- the cyanide ion, CN^-, acts as a nucleophile
- it attacks the $\delta+$ carbon atom of the C=O group

3.6

- 1-bromopropane (or 1-chloropropane), $CH_3CH_2CH_2Br$, since the CN group adds one carbon
- step 1: heat under reflux with KCN in ethanol, giving butanenitrile
- step 2: heat under reflux with dilute acid (such as HCl), hydrolysing the nitrile to butanoic acid