Solutions

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

2.1

- ethanoyl chloride; ammonia, NH_3

2.2

- ethylamine

3.1 B

- Acid hydrolysis gives ethanoic acid and an ammonium salt

3.2 B

- The N lone pair is delocalised onto the neighbouring C=O group

3.3

(a)

- sodium ethanoate and ammonia

(b)

- $CH_3CONH_2 + NaOH \rightarrow CH_3COONa + NH_3$

3.4

- in ethanamide the nitrogen lone pair is delocalised onto the C=O group; so it is not available to accept an H^+, whereas in ethylamine the lone pair is fully available

3.5

(a)

- Ethanoyl chloride and methylamine; the acyl chloride reaction is fast and goes to completion, whereas the carboxylic acid would simply form an ammonium salt in an acid–base reaction

(b)

(i)

- With acid: **ethanoic acid** and the salt **methylammonium chloride**

(ii)

- With alkali: **sodium ethanoate** and **methylamine** — the base deprotonates the acid and frees the amine

(c)

- $CH_3CONHCH_3 + 4[H] \rightarrow CH_3CH_2NHCH_3 + H_2O$; the product is the secondary amine *N*-methylethylamine

(d)

- In an amide the nitrogen lone pair is **delocalised** onto the adjacent carbonyl oxygen; it is therefore not available to accept a proton; in an amine the lone pair sits on the nitrogen alone, with no electron-withdrawing carbonyl beside it, so it is readily donated