

Solutions

Original marking guidance: M1 method, A1 accuracy, B1 explanation.

2.1 $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2$; $\text{C}_4\text{H}_9\text{NH}_2 + \text{HCl} \rightarrow \text{C}_4\text{H}_9\text{NH}_3^+\text{Cl}^-$.

2.2 Phenylamine lone pair interacts with the ring, reducing availability for H^+ . Alkyl groups increase nitrogen electron density.

2.3 Propan-1-amine, LiAlH_4 /dry ether then aqueous work-up, three carbons because nitrile carbon is retained.

3.1 Sn and concentrated HCl under reflux; add alkali to convert the initially protonated phenylammonium species to free amine.

3.2 $\text{CH}_3\text{COCl} + 2\text{C}_2\text{H}_5\text{NH}_2 \rightarrow \text{CH}_3\text{CONHC}_2\text{H}_5 + \text{C}_2\text{H}_5\text{NH}_3^+\text{Cl}^-$. Correct amide, second amine/coefficient, salt/complete balance.

3.3 Cold nitrous acid, from nitrite/acid, makes diazonium salt; alkaline phenol couples. Cold conditions reduce diazonium decomposition; extended delocalisation gives visible-light absorption.