

Solutions

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

2.1

- concentrated HNO_3 and concentrated H_2SO_4 ; warm, 25–60 °C

2.2

- LiAlH_4 (or H_2/Ni)

3.1 B

- KCN adds a $-\text{CN}$ group, lengthening the chain by one carbon

3.2 B

- Work backwards from the target molecule

3.3

- nitrate benzene with conc. HNO_3 + conc. H_2SO_4
- nitrobenzene; reduce with Sn and conc. HCl ; add NaOH(aq) to free phenylamine

3.4

(a)

- KCN (in ethanol) to give propanenitrile; then LiAlH_4 (or H_2/Ni) to reduce it to propylamine

(b)

- the direct halogenoalkane + ammonia route also makes secondary/tertiary amines (over-substitution), lowering the yield of the primary amine