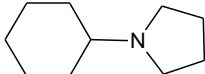


1) The two most general synthesis of amines are reductions of amides and reductive amination. How can the following transformations can be carried out using these reductions

a) Benzoic acid \longrightarrow benzylamine

b) Benzaldehyde \longrightarrow benzylamine

c) Cyclohexanone \longrightarrow N-cyclohexylpyrrolidene 

d) $\text{HOOC}(\text{CH}_2)_3\text{COOH}$ \longrightarrow 1,5-pentanediamine (cadaverine)

e) $\text{PhCH}_2\text{CH}_2\text{CONH}_2$ \longrightarrow 2-phenylethanamine

2) Several syntheses are used to make primary amines, namely, reduction of azides and nitro compounds and the Gabriel synthesis. All these leave the carbon skeleton unchanged. Reduction of nitrile adds one carbon and Hoffman rearrangement eliminates one carbon. Show how you can use any of the above mentioned synthesis in the following conversions.

a) Allyl bromide \longrightarrow allylamine

b) Ethylamine \longrightarrow p-ethylaniline

c) 3-phenylheptanoic acid \longrightarrow 2-phenyl-1-hexanamine

d) 1-bromo-3-phenylheptane \longrightarrow 3-phenyl-1-heptanamine

e) 1-bromo-3-phenylheptane \longrightarrow 4-phenyl-1-octanamine

3) Using benzene or toluene and or alcohols containing no more than four carbon atoms as your starting material, show how you can synthesize the following compounds.

a) 1-pentanamine

b) N-methyl-1-butanamine

c) N-ethyl-N-propyl-2-butanamine

d) Benzyl-n-propylamine

e) Para n-butylaniline