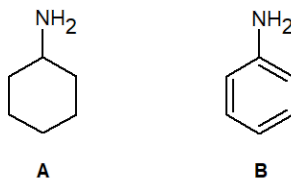


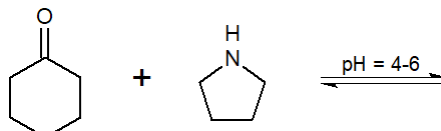
## 20.11: ADDITIONAL EXERCISES

### General Review

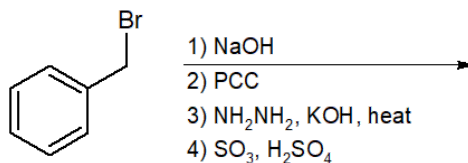
**20-1** Predict which amine is more basic and provide a reason for your answer.



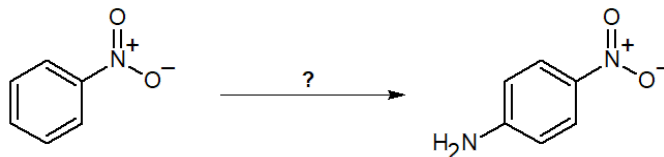
**20-2** Give the product of the following reaction.



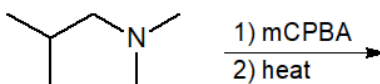
**20-3** Predict the final product of the following reaction chain and give its IUPAC name.



**20-4** Propose a route of synthesis from nitrobenzene to the given product. Assume the given molecule is the major product, and for the purposes of this problem, ignore its isomers.

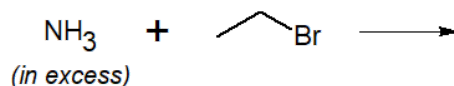


**20-5** Choose the correct answer that describes the product of the following Cope elimination reaction.



- a) N,N,2-trimethylpropan-1-iminium
- b) N,N,2-trimethylpropan-1-amine
- c) 2-methylprop-1-ene and N-hydroxy-N-methylmethanamine
- d) N-hydroxy-N,2-dimethylpropan-1-amine

**20-6** Explain why the following reaction might not be the best way to synthesize ethanamine.

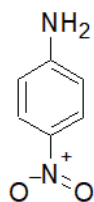


### Basicity and Effects of Amines

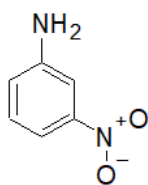
**20-7** Draw all possible resonance structures for aniline and cyclohexanamine.



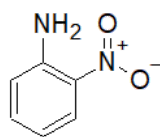
**20-8** Identify which of the following nitroaniline isomers is the most basic and give a reason for your answer.



**p-nitroaniline**



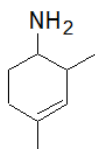
**m-nitroaniline**



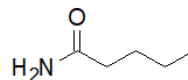
**o-nitroaniline**

**20-9** For the following compounds, identify which substituents are pi-acceptors of the electrons from the amine group (if applicable) and if they are, draw their resonance structure to show the movement of electrons.

a)



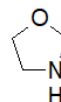
b)



c)

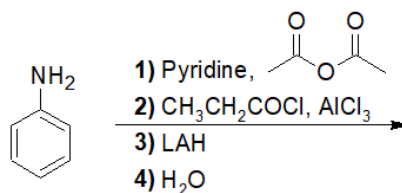


d)



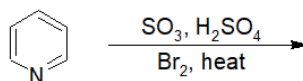
### Aromatic Substitution of Arylamines and Pyridin

**20-10** Explain why the following arylamine needs to be turned into an amide before a Friedel-Crafts acylation and then predict the final product of the reaction.

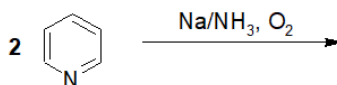


**20-11** Predict the products of the following reactions.

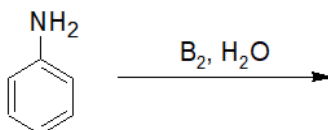
a)



b)

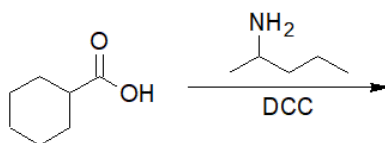


**20-12** Predict the product of the following reaction and provide the correct IUPAC nomenclature.

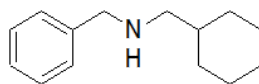


### Alkylation and Acylation of Amines

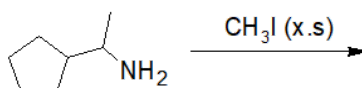
**20-13** Predict the product of the following acylation reaction.



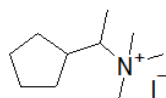
20-14 Suggest a route of synthesis for the following compound, starting with benzoyl chloride.



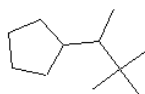
20-15 Choose the correct product of the following reaction.



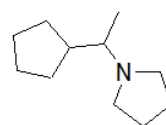
a)



b)

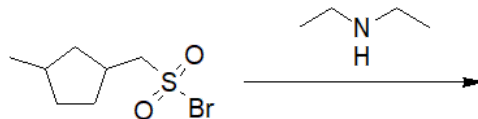


c)

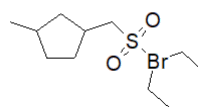


### Formation of Sulfonamides

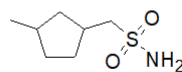
20-16 Choose the correct structure of the product of the following reaction.



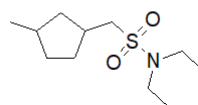
a)



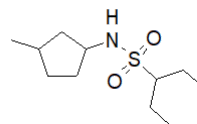
b)



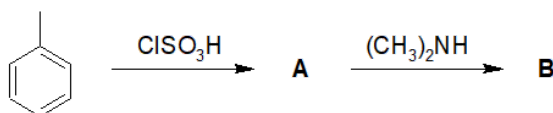
c)



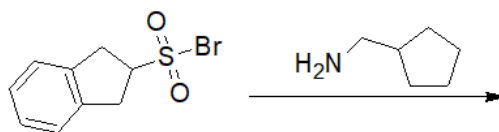
d)



20-17 Provide the structure of the intermediate compound and final product of the following reaction.

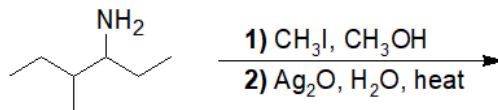


20-18 Predict the product of the following reaction.

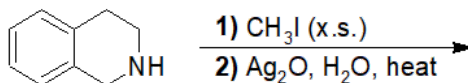


### Amines as Leaving Groups: The Hofmann Elimination

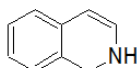
20-19 Predict the major alkene product of the following Hofmann elimination reaction and give the proper IUPAC nomenclature.



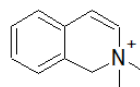
20-20 Choose the correct product of the following reaction.



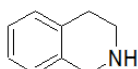
a)



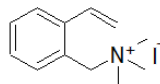
b)



c)



d)

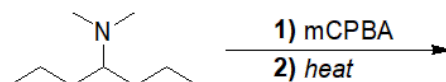


20-21 Propose a route of synthesis from pentan-1-amine to pentanal (include a Hofmann elimination reaction).

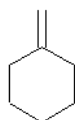


### Oxidation of Amines: The Cope Elimination

20-22 Predict the structure and give the proper IUPAC nomenclature of the product of the following reaction.

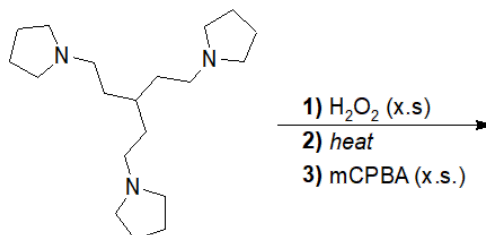


20-23 Propose a route of synthesis for the following compound, starting with cyclohexanecarboxylic acid and include a Cope elimination reaction.



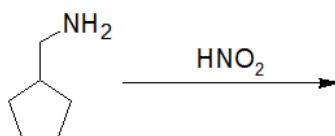
methylenecyclohexane

20-24 Predict the structure of the product of the following reaction.



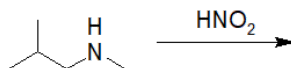
### Reactions of Amines with Nitrous Acid

20-25 Predict the product of the following reaction and provide the correct IUPAC nomenclature.

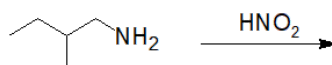


20-26 Predict the products of the following reactions.

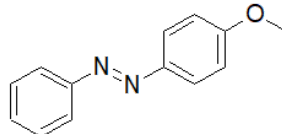
a)



b)



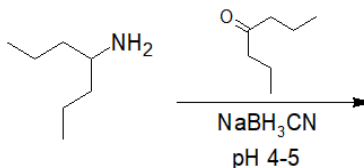
20-27 Suggest a route of synthesis for the following product, starting with aniline.



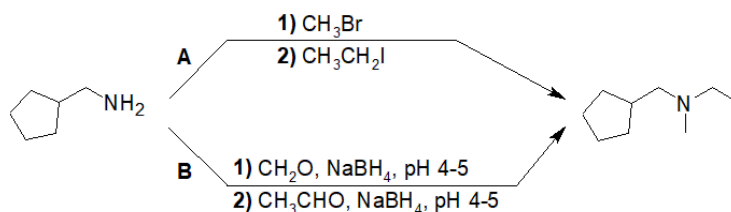
(E)-1-(4-methoxyphenyl)-2-phenyldiazene

### Synthesis of Amines by Reductive Amination and Acylation-Reduction

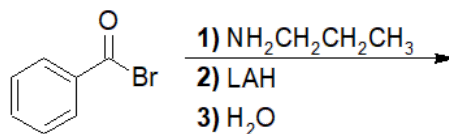
20-28 Predict the product of the following reaction and provide its IUPAC nomenclature.



20-29 Identify which route of synthesis is the better way to make N-(cyclopentylmethyl)-N-methylethanamine and then show the intermediate molecules for the correct path.



20-30 Choose the correct IUPAC nomenclature of the product of the following reaction.



- a) N-propylbenzamide
- b) phenyl(propylamino)methanol
- c) N-benzylpropan-1-amine
- d) benzamide

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