CH310N
Spring 2010

Anslyn

May 12, 2010

Final Exam

Please **PRINT** the first three letters of your last name in the boxes below.

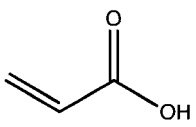
K	E	Y

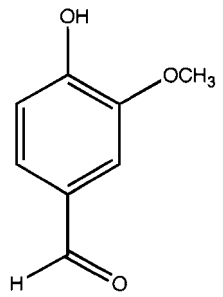
PRINT Full Name _____ **UT-EID**_____

1) _____ (9 pts)
2) _____ (6 pts)
3) _____ (12 pts)
4) _____ (6 pts)
5) _____ (35 pts)
6) _____ (8 pts)
7) _____ (10 pts)
8) _____ (10 pts)
9) _____ (10 pts)
10) _____ (12 pts)
11) _____ (10 pts)
12) _____ (10 pts)
13) _____ (12 pts)
Bonus) _____ (3 pts)

Total Score _____ (150 pts)

1. a) Give either the common names or the IUPAC names for the following molecules. (From notes, 2 points)

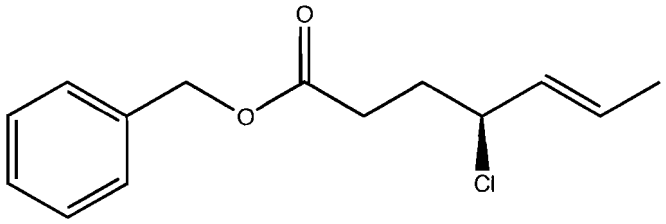




Acrylic acid

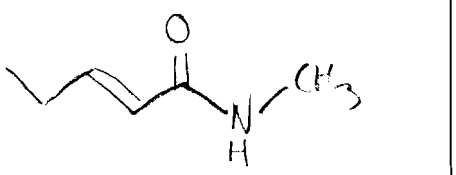
Vanillin

b) Give the IUPAC name for the following molecule. (2 point)

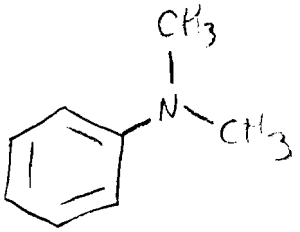


(5E)-Benzyl-(5)-(4)-chloroheptenoate

c) Draw the chemical structures for the following molecules. (From notes and HW, 2 points)



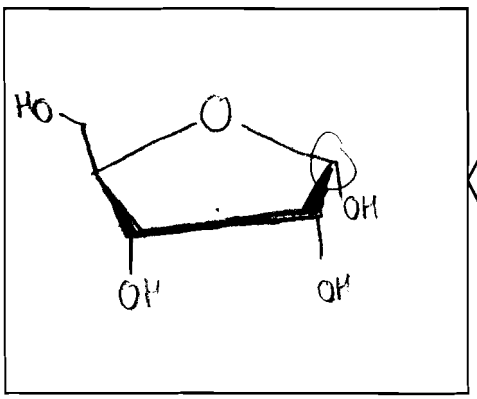
N-methyl-(2*E*)-pentenamide



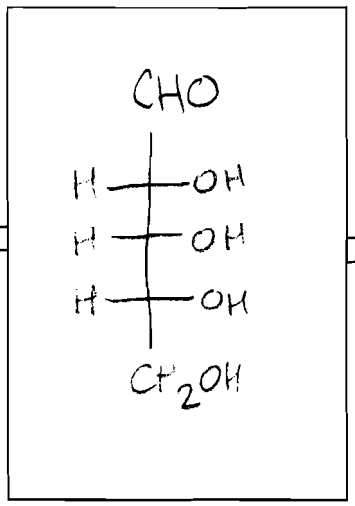
N, N-Dimethylaniline

d) Draw the following projections of D-ribose. For each Haworth projection, **circle** the anomeric carbon. (3 points)

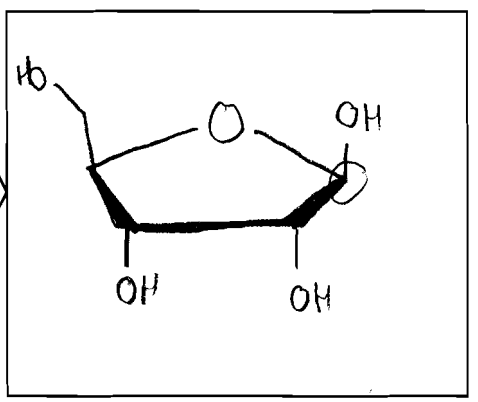
Haworth projection of α- D-furanoribose



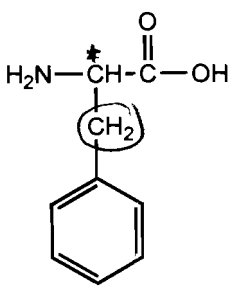
Fischer projection of D-ribose



Haworth projection of β- D-furanoribose



2. Below are the structure and the ^{1}H-NMR of the amino acid, phenylalanine. **Circle** the protons that correspond to the peaks at 3.17 ppm and 3.42 ppm, and explain the splitting pattern observed for these peaks. (6 points)

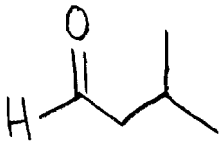


Explanation:

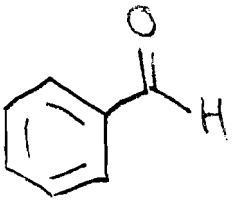
These protons are diastereotopic. Amino acids have a chiral center, meaning that these protons are not in the same chemical environment.

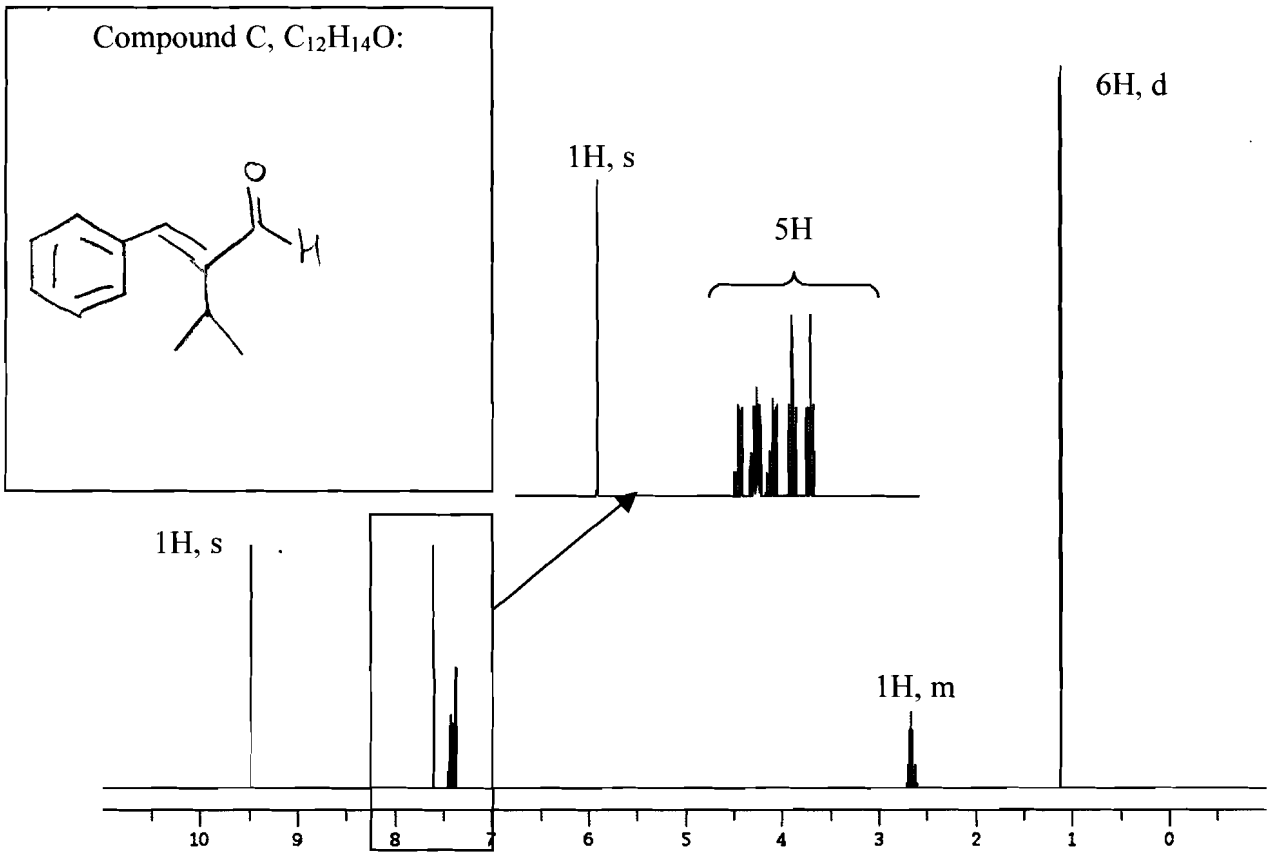
3. a) Provided are the ^{1}H-NMR spectra and chemical formula of three aldehydes (Hint: A and B react to give C, shown in 3b). Please give the structures for all three compounds (12 points)

Compound A, $C_5H_{10}O$:

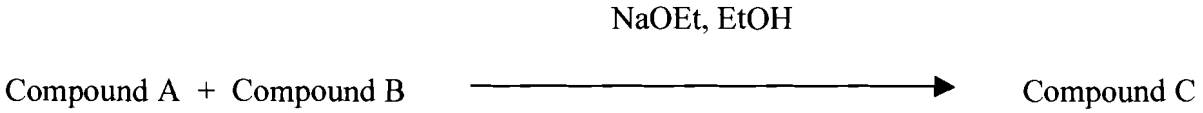


Compound B, C_7H_6O:





b) Given that A and B are the starting materials of a reaction which makes product C, provide the name of the reaction.



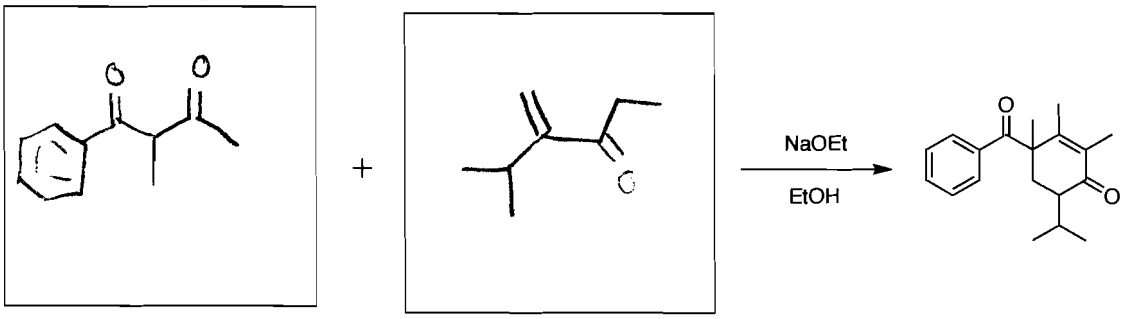
Reaction Name:
Aldol Reaction

4. During the last class day, Dr. Sessler introduced us to the chemical method known as the Edman degradation. Please briefly explain how this process works. What is the name of the reagent used for this process? Where in the molecule does this reagent work? What information is gained from performing this analysis? (6 points)

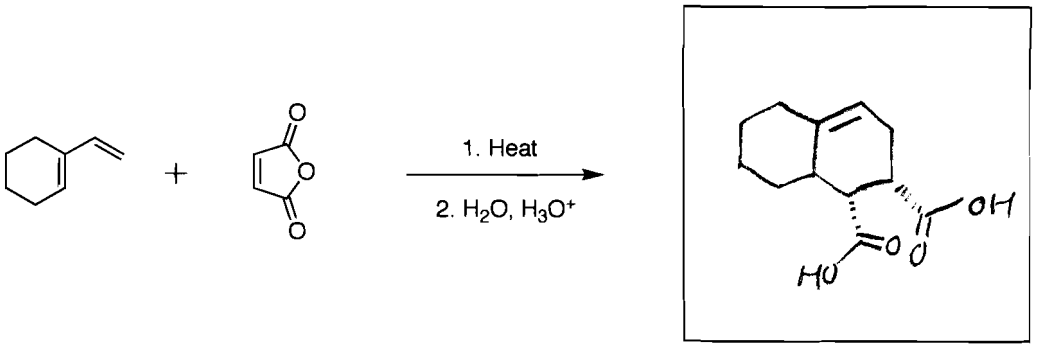
This technique allows scientists to determine the sequence of amino acids of a polypeptide. The polypeptide is reacted with a phenylisothiocyanate (followed by acid), and the amino acid on the N-terminus is removed. The product of this reaction is analyzed to determine the amino acid that was removed. This process is repeated until there are no more amino acids and the whole sequence is obtained.

5. Fill in the box with the appropriate reactant, reagent, or product. Some boxes require more than one step. (35 points)

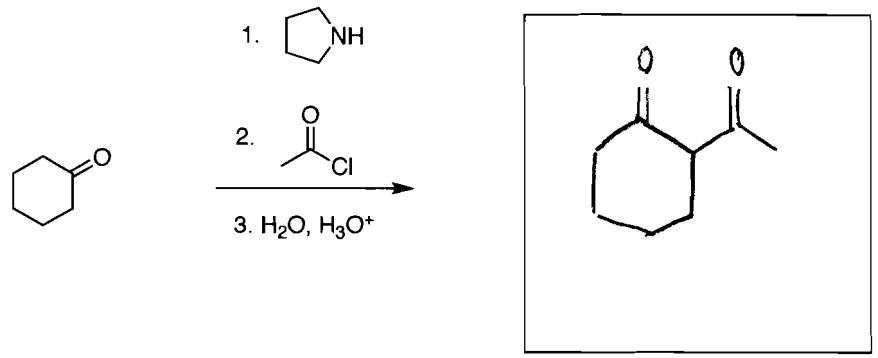
a) From homework, problem 19.53d



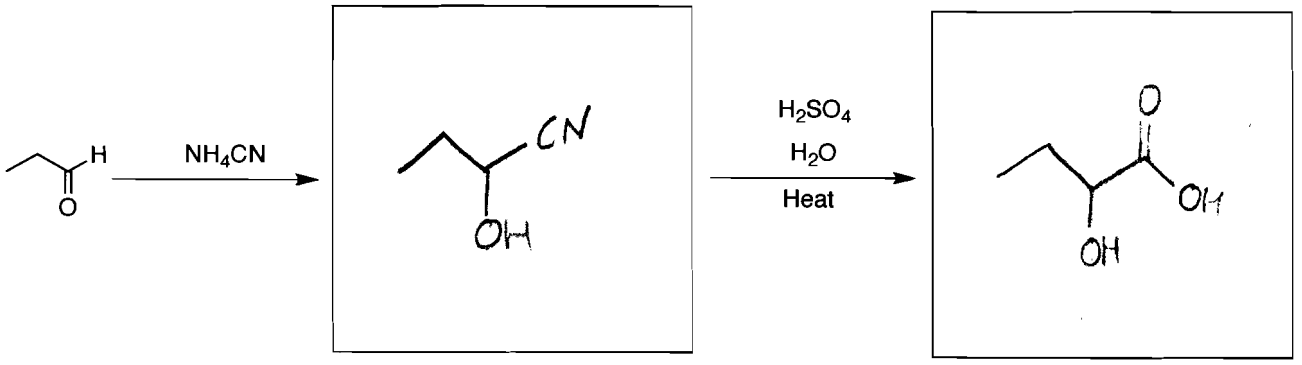
b) From homework, problem 24.33



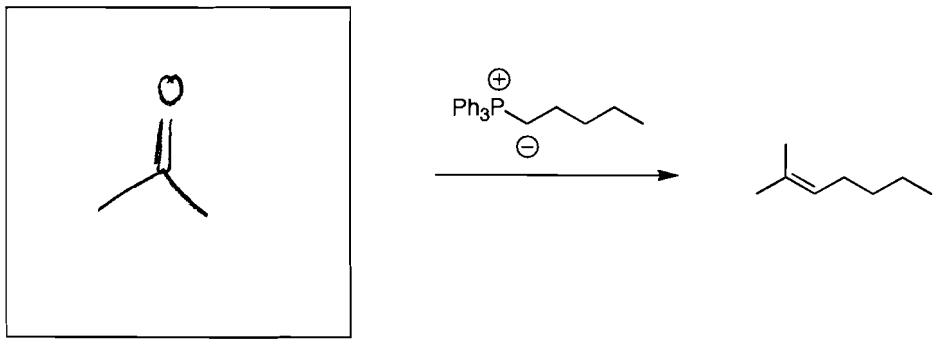
c) From class notes



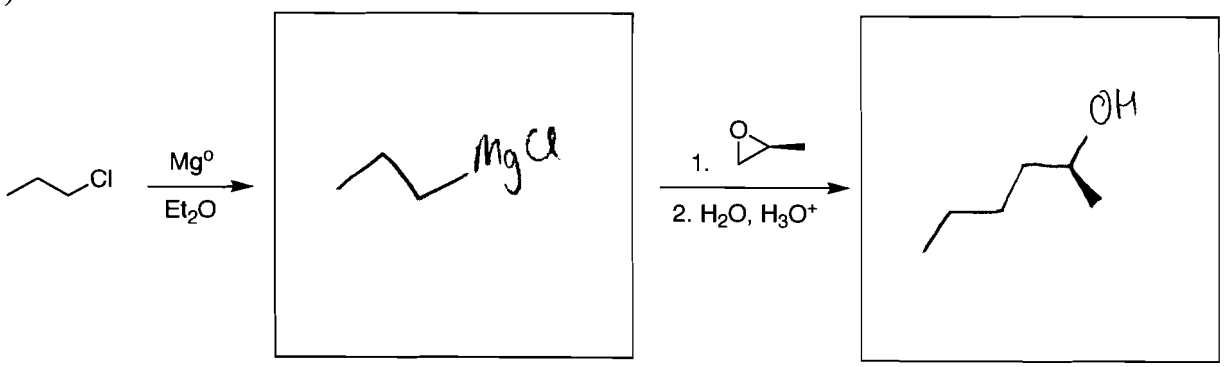
d)



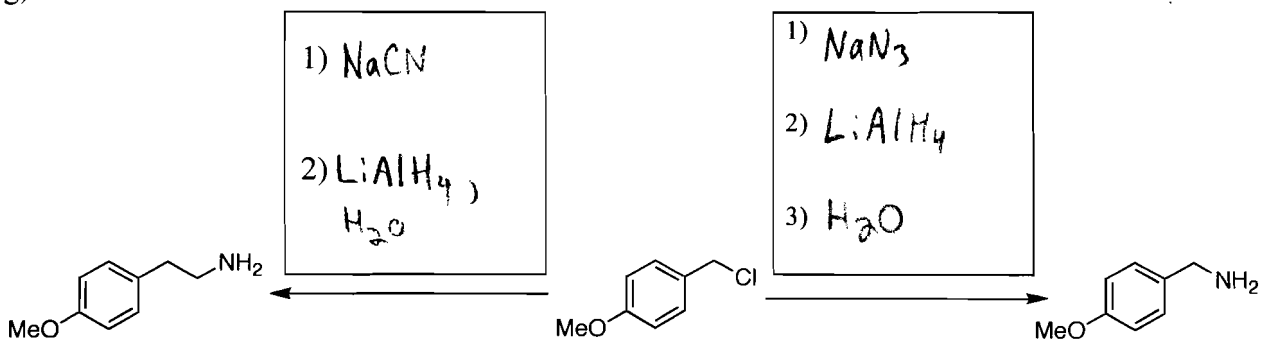
e) From homework, problem 16.24a



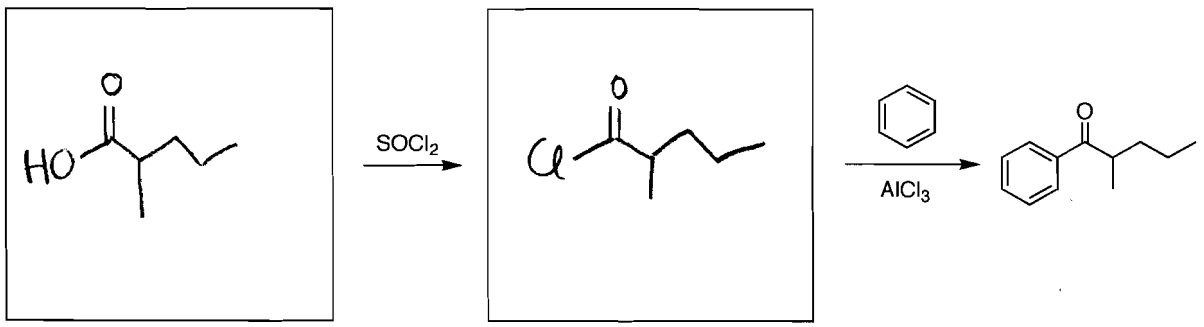
f)



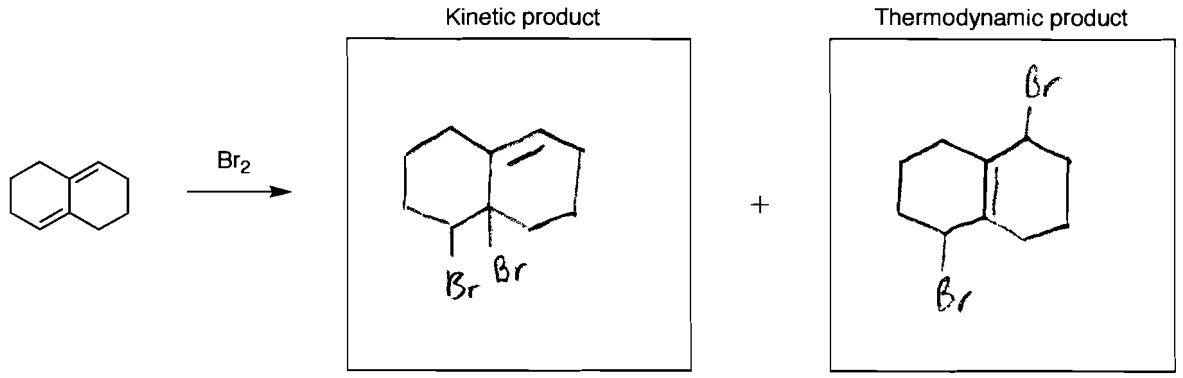
g)



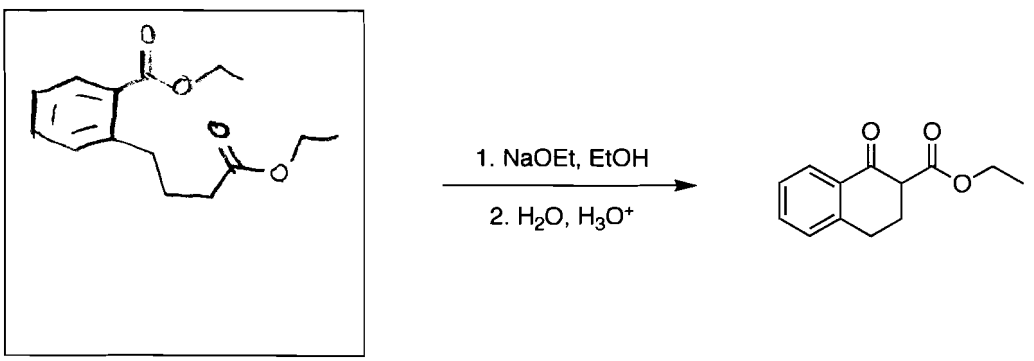
h)



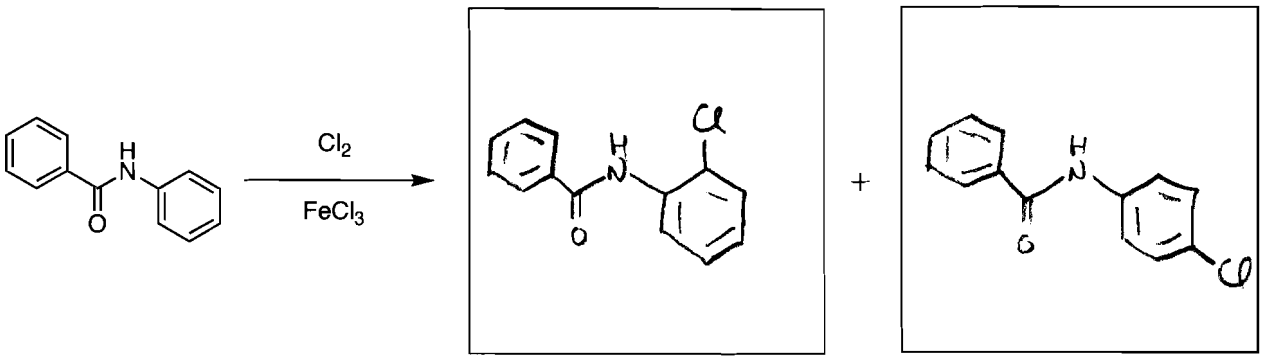
i) From homework, problem 20.14b



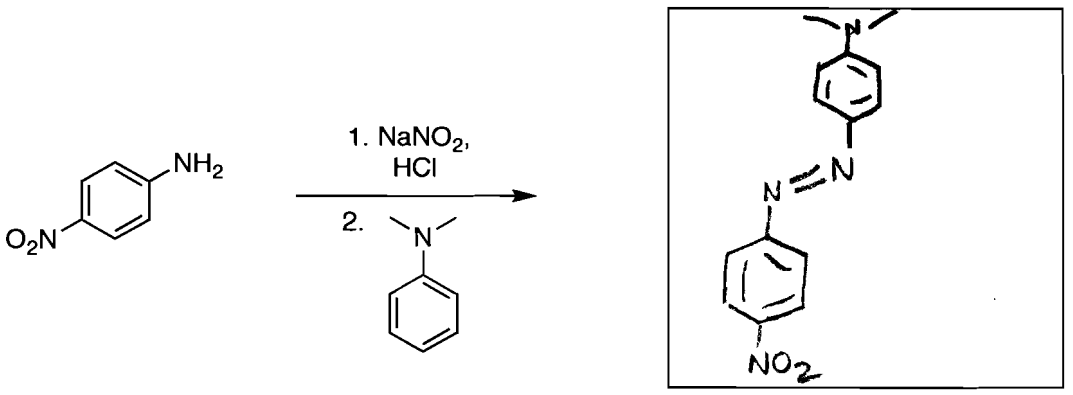
j)



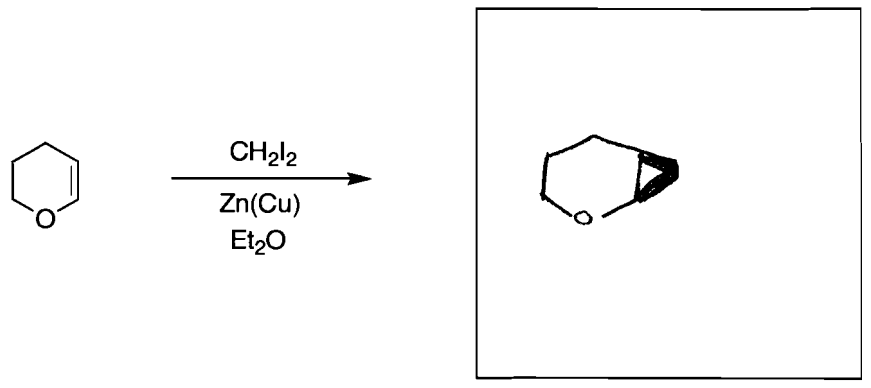
k)



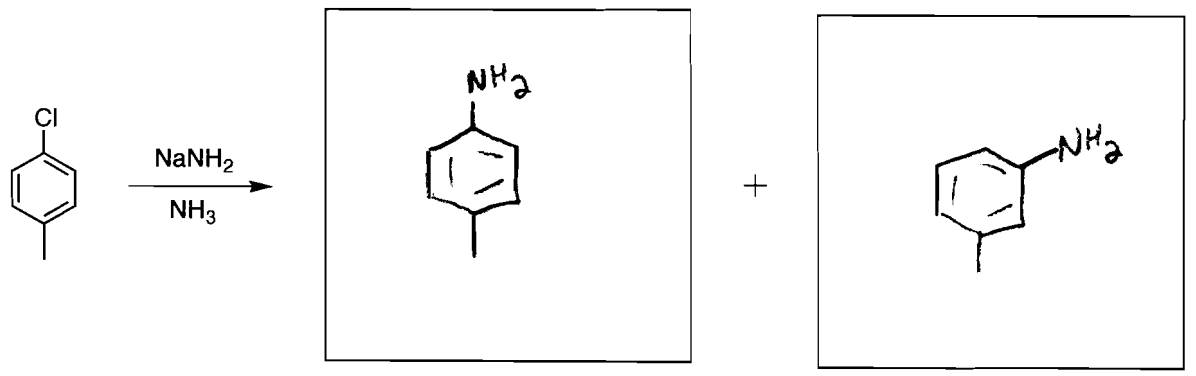
l) From class notes



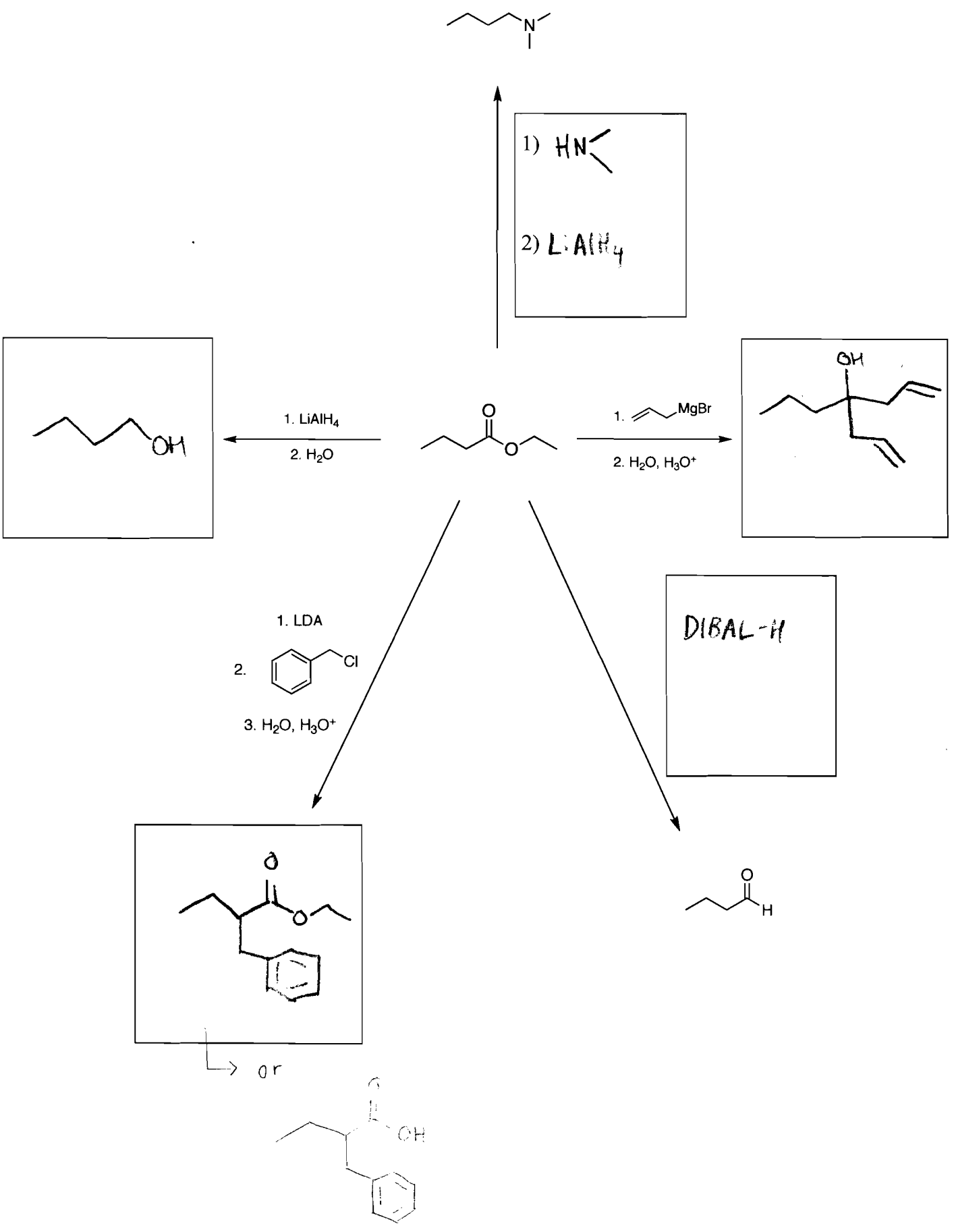
m) From homework, 15.12d



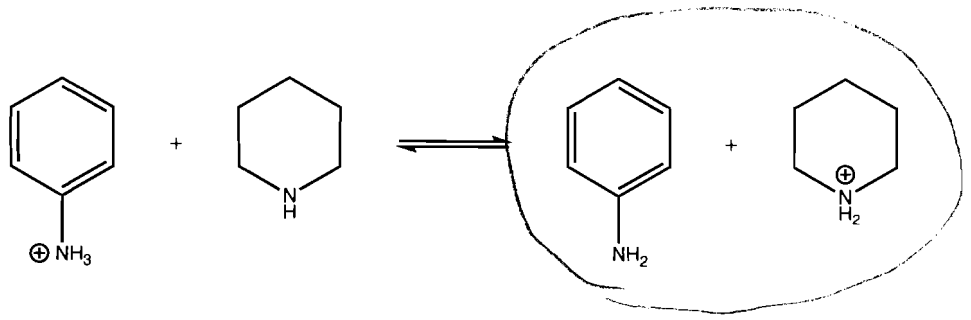
n) From class notes



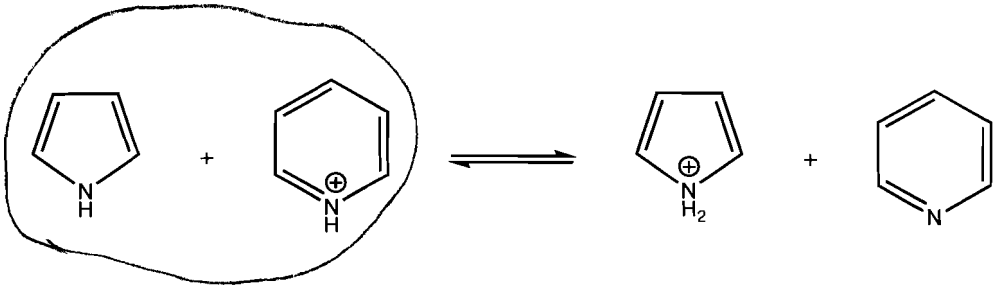
o)


1) HN
2) LiAlH4
1. LiAlH4
2. H2O
1. MgBr
2. H2O, H3O+
1. LDA
2.
Cl
3. H2O, H3O+
DIBAL-H
or

6. For each of the following cases, circle the side of the equilibrium which will be favored and provide a brief explanation. (8 points)

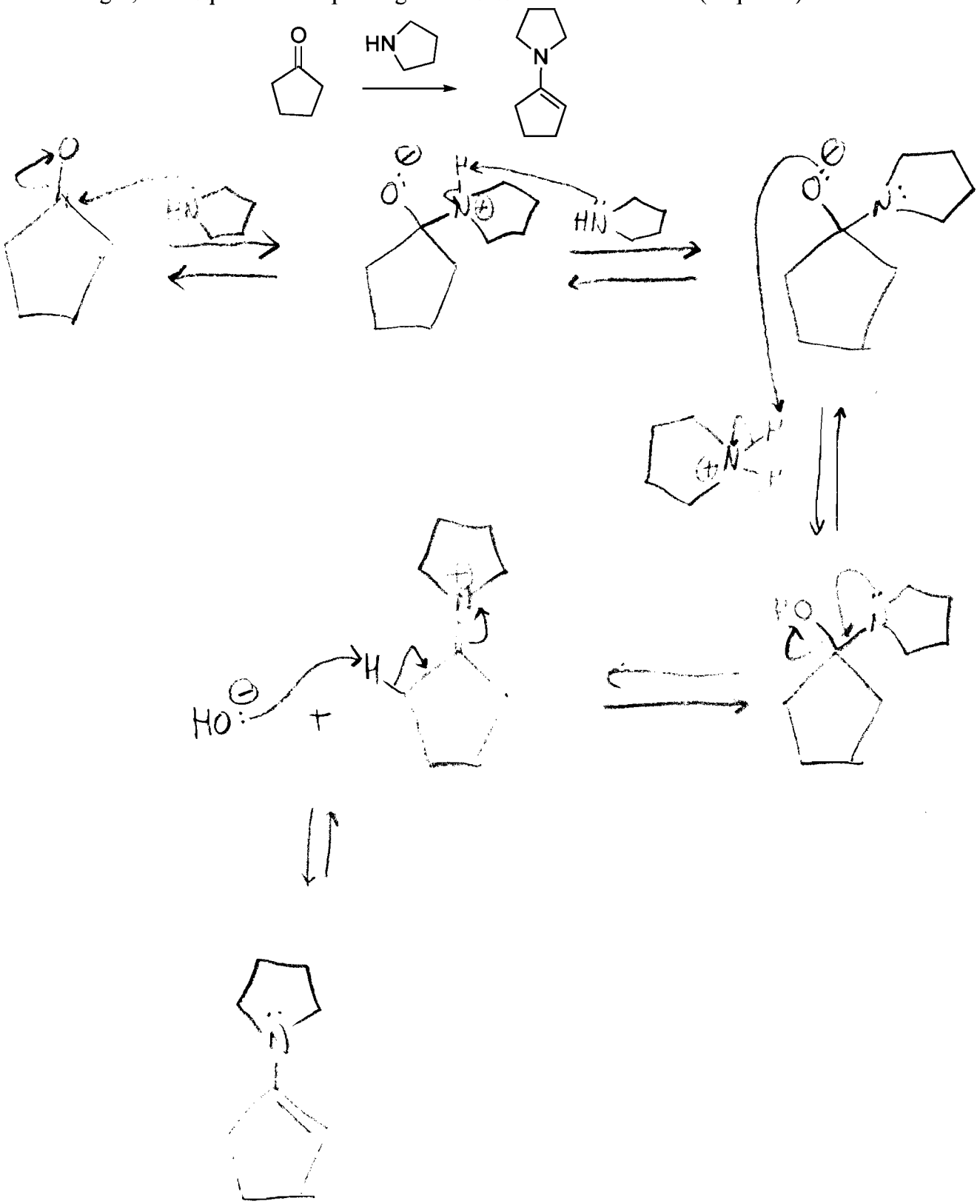


Protonation of aniline takes away the ability of that lone pair to be conjugated with the ring. This species is sp^2 hybridized, with the lone pair in a p orbital (so as to participate in conjugation). Pyridine does not have this conjugation, and thus may be protonated with little destabilization. The right side is favored.

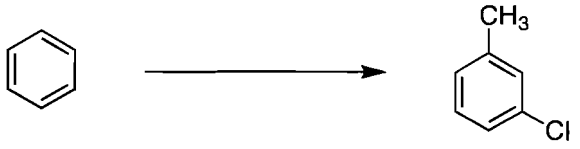


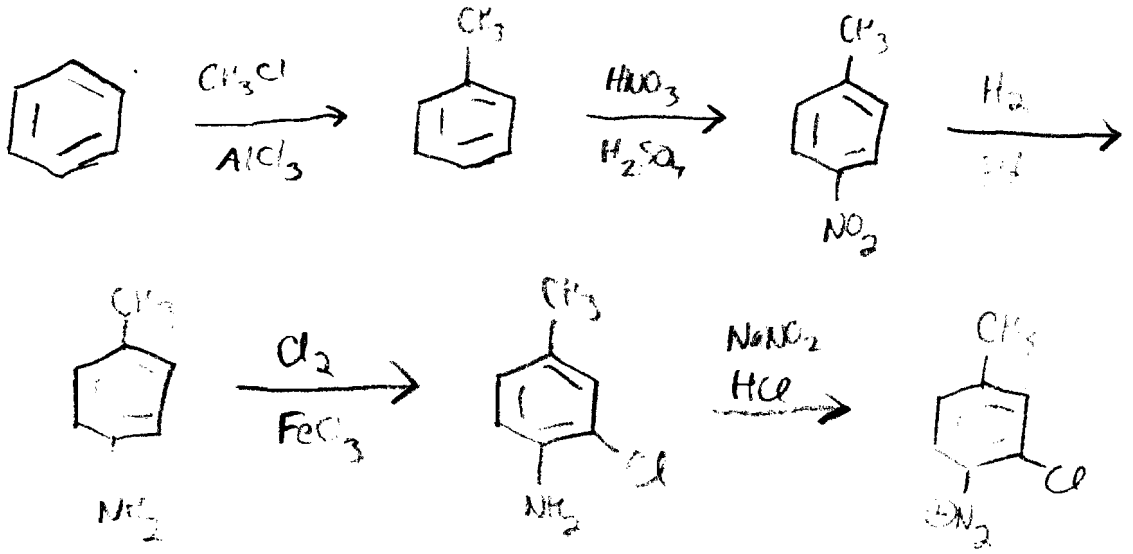
Protonation of the pyrrole ( ) causes that species to lose aromaticity. Pyridine's lone pair is in an sp^2 hybrid, which has no affect on aromaticity. There is no loss of stability by protonating it, thus the left side is favored.

7. Please draw the mechanism for the formation of an enamine from the ketone and 2° amine, as shown below. This mechanism is neither acid nor base catalyzed, and proceeds with only the reagents shown. Your mechanism should include all participating lone pairs, applicable formal charges, and required arrow pushing to indicate flow of electrons. (10 points)

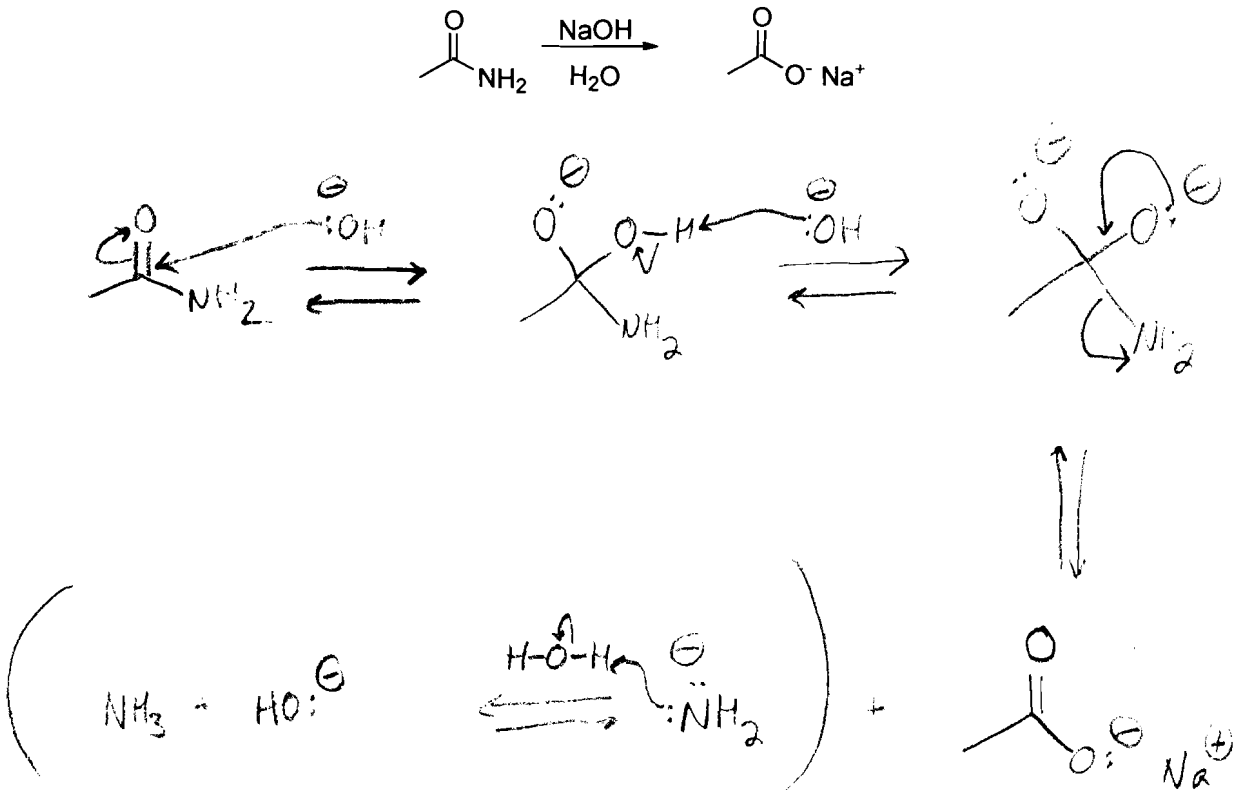


8. Using only benzene as a source of carbon, show how you would synthesize the following compound. You may use any reagent, as long as it contributes no carbon atoms to the final product. Note: you do not need to provide a mechanism for the transformations. (10 points)

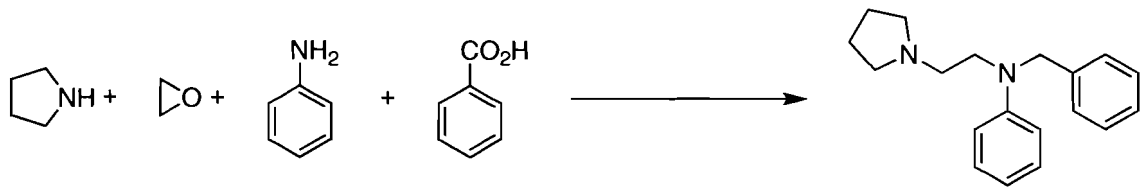




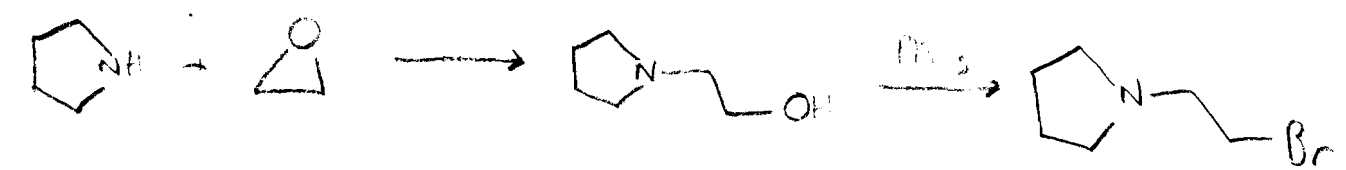
9. Please draw the mechanism for the hydrolysis of an amide in basic conditions, as shown below. Your mechanism should include all participating lone pairs, applicable formal charges, and required arrow pushing to indicate flow of electrons. (10 points)

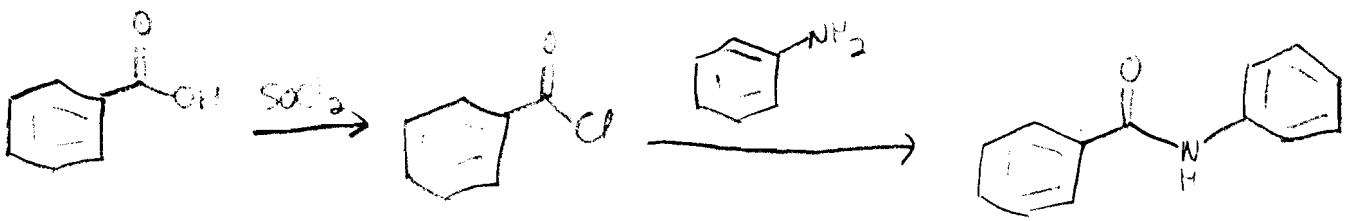


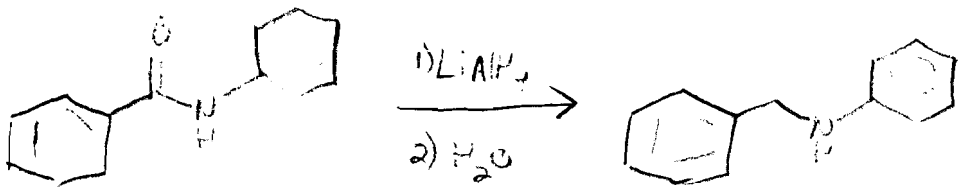
10. (From homework, problem 23.57) Show how you would synthesize the product, an antihistimine Histapyrrodine, using only the given starting materials as sources of carbon. You may use any reagent, as long as it contributes no carbon atoms to the final product. Note: you do not need to provide a mechanism for the transformations. (12 points)

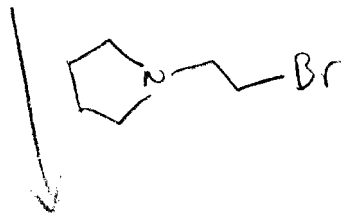


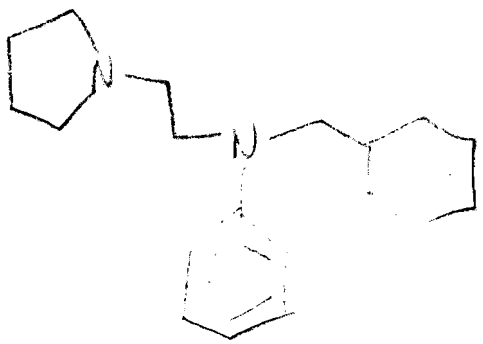
Histapyrrodine



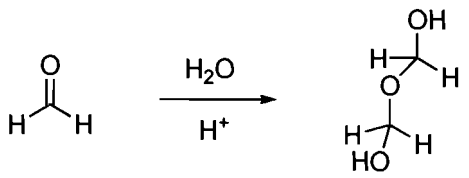


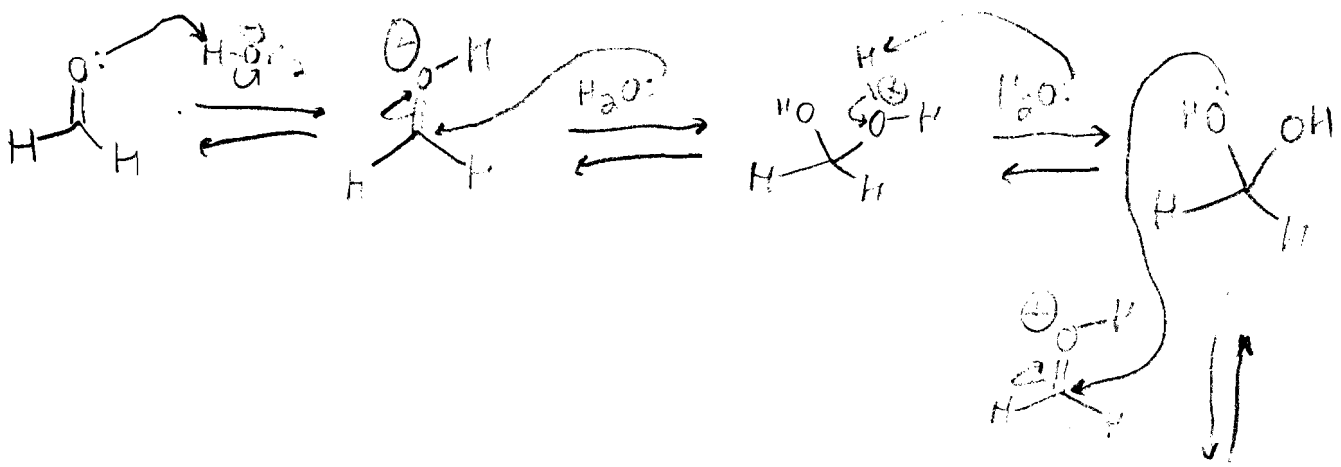


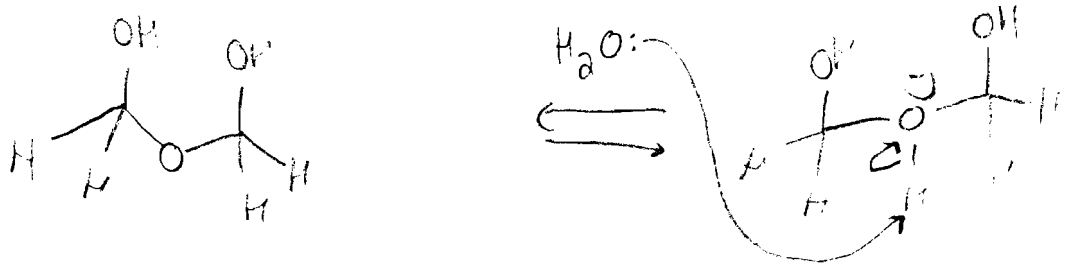




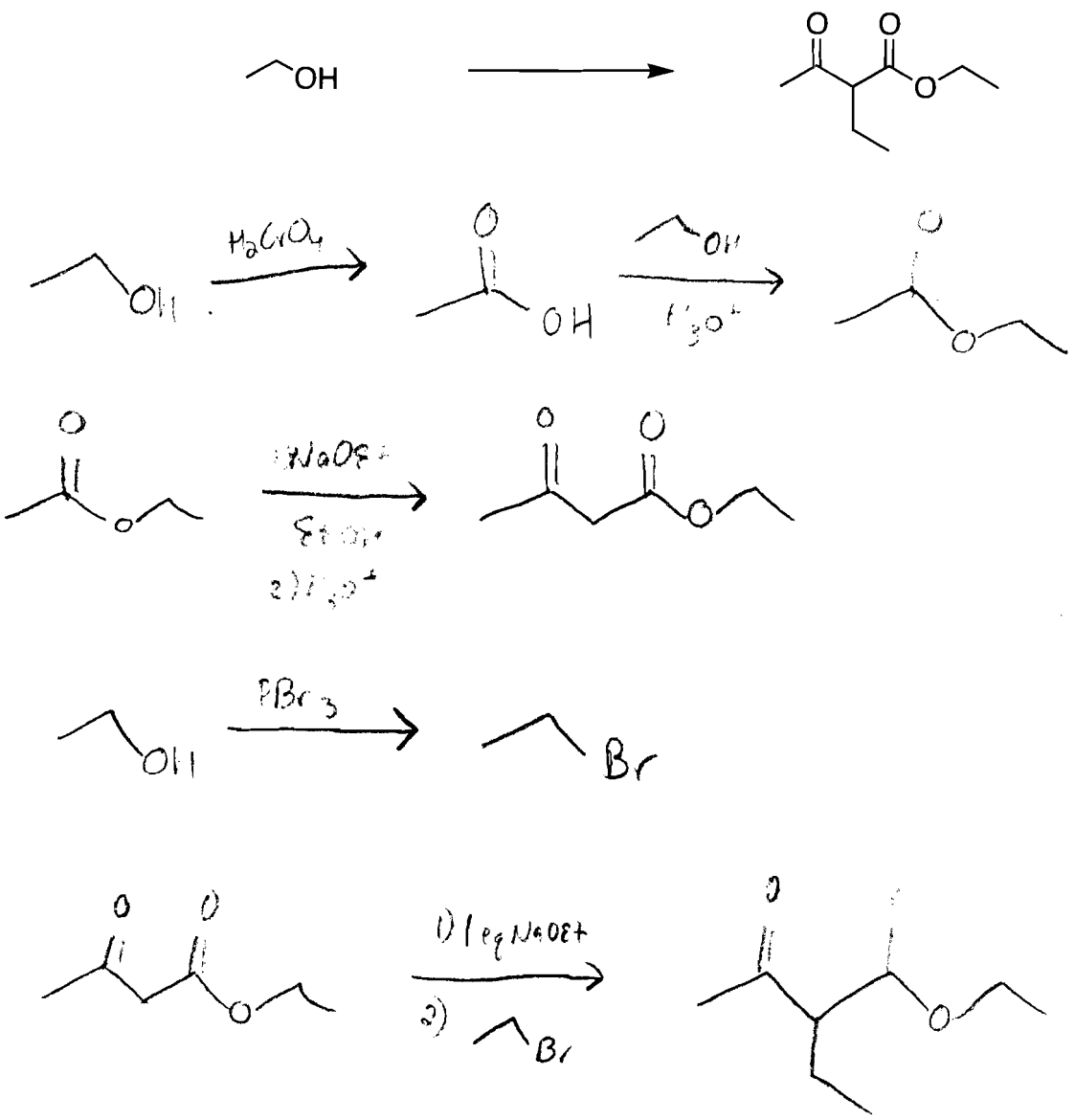
11. When formaldehyde is left in acidic water, it forms the dimerized product that is shown below. Please draw the mechanism for this transformation. Your mechanism should include all participating lone pairs, applicable formal charges, and required arrow pushing to indicate flow of electrons. (10 points)



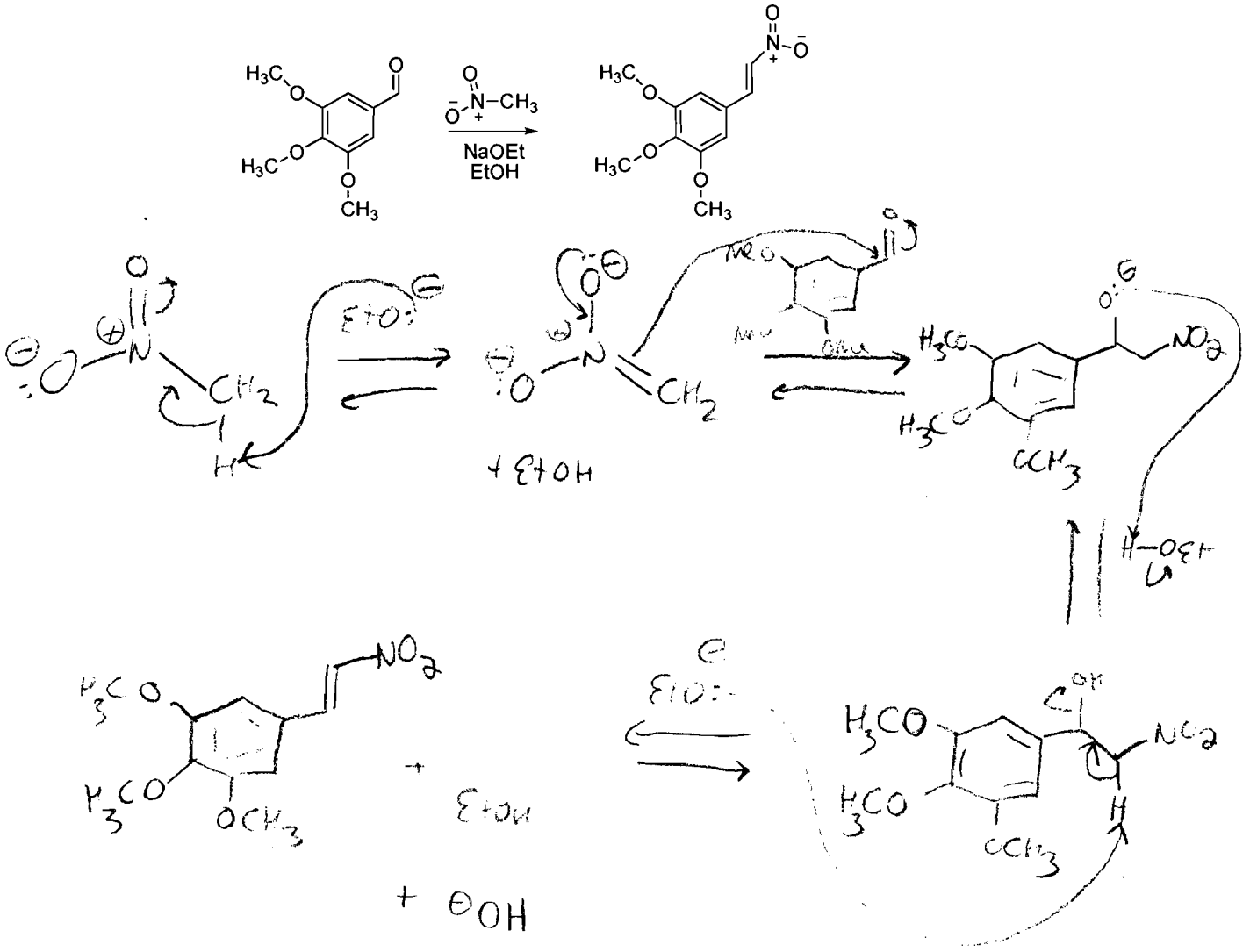




12. Show the steps needed to convert ethanol into the following product. You must only use ethanol as your sources of carbon atoms. You may use any other reagent needed as long as it contributes no carbon atoms to the final product. Note: you do not need to provide a mechanism for the transformations. (10 points)



13. The Henry reaction, shown below, is one that we have did not explicitly cover in class. However, the mechanistic steps are similar to the ones we have seen previously for carbonyl addition. Given this information, please draw the mechanism for this reaction. Your mechanism should include all participating lone pairs, applicable formal charges, and required arrow pushing to indicate flow of electrons. (12 points)



BONUS: While gardening this last weekend, Dr. Anslyn was bitten by ants. What is the chemical compound that causes ant bites to hurt?

Formic Acid