Chemistry 232, Spring 2010
Dr. Shaughnessy
Exam #4
April 20th, 2010

Name: **ANSWER KEY** (print) **CWID:**_____

Honor Pledge: I promise or affirm that I will not at any time be involved with cheating, plagiarism, fabrication, or misrepresentation while enrolled as a student at The University of Alabama. I have read the Academic Honor Code, which explains disciplinary procedures that will result from the aforementioned. I understand that violation of this code will result in penalties as severe as indefinite suspension from the University.

_____(*signature*)

You will have **1 hour and 30 minutes** to complete this exam. When time is called please stop all work and turn in your exam.

Show all work. Partial credit will be given where appropriate.

This exam has **10** pages. Make sure you have all 10 pages, and that they are correctly copied, before starting the exam. The last page is a periodic table

You may use molecular models to help you answer questions on this exam.

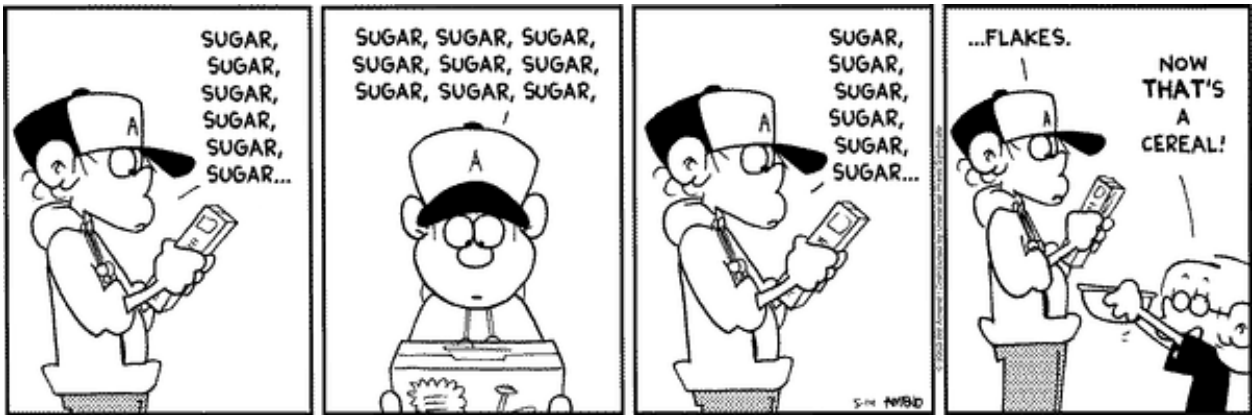
You will not need a calculator or any other electronic device to complete this exam.

Please put all cell phones (turn off or to silent), ipods, calculators, or other electronic devices away in a book bag.

Your book and all notes should be placed out of sight of yourself and your neighbors before the exam begins.

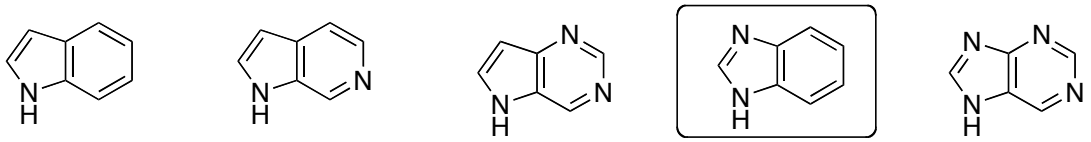
Problem	Score
1	_____ (12)
2	_____ (20)
3	_____ (10)
4	_____ (10)
5	_____ (21)
6	_____ (15)
7	_____ (16)
Total	_____ (104)

The exam is worth 100 points. There are 4 bonus points built in

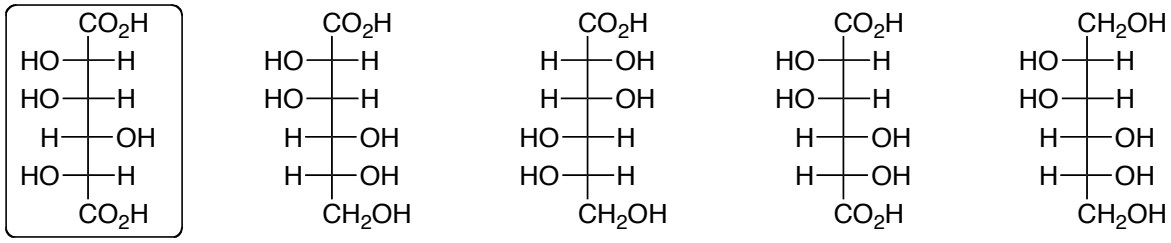


1. For each problem below, circle the **best** answer. In each case, there is only one correct answer (12 points)

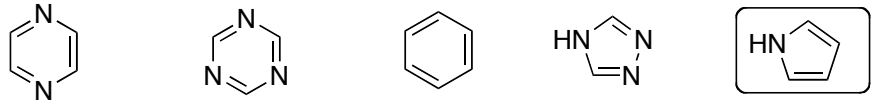
   a. Which compound below would be **most basic**?



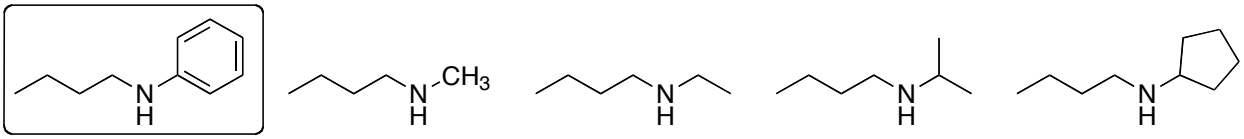
   b. Which of the following is an **L-aldaric acid**?



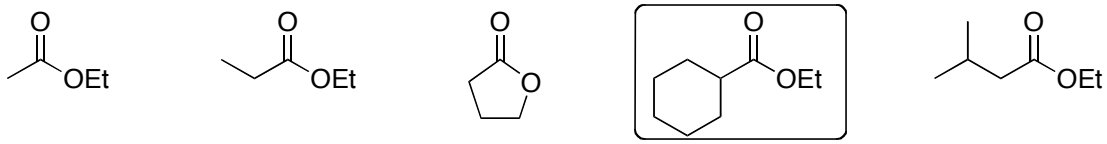
   c. Which compound would be **most reactive** towards reaction with Br_2 in an electrophilic aromatic substitution reaction.



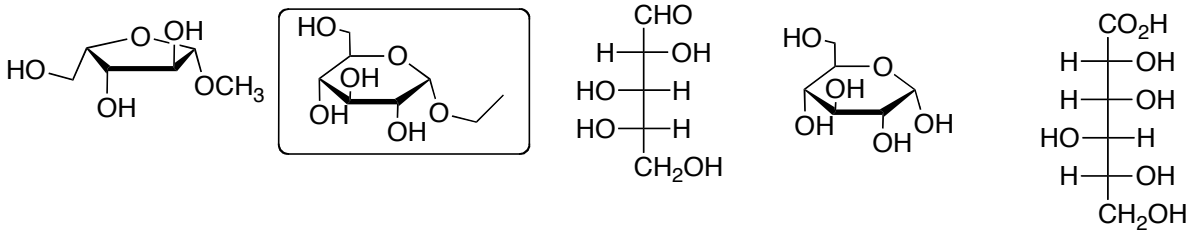
   d. Which of the following **could not** be made by reductive amination using butanamine as the nitrogen source?



   e. Which compound would be **least reactive** in a Claisen self-condensation reaction when treated with NaOEt?

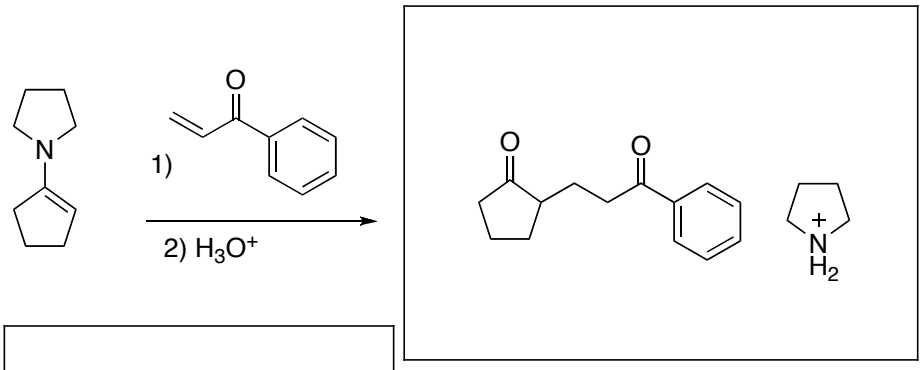


   f. Which of the following is an **α-glycoside**?

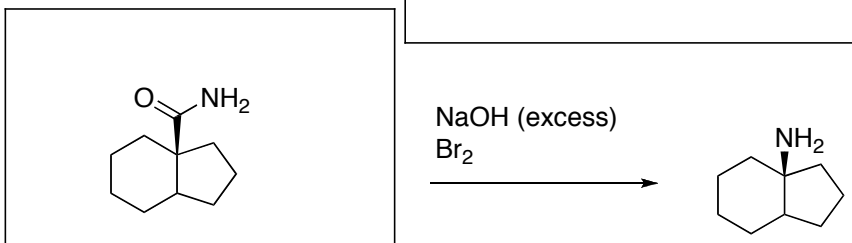


2. For each reaction below, provide the missing starting material(s), reagent(s), or product(s). For reactions in which more than one product can be formed, draw each major product. You should not include products formed as minor products, however. You do not need to indicate side products from the reagents used. Note that some boxes may require more than one starting material or reaction step (20 points)

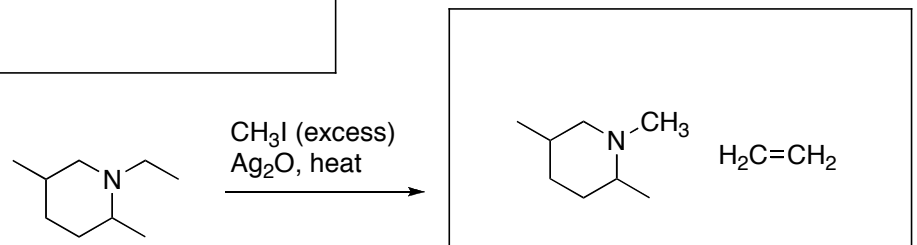
a.



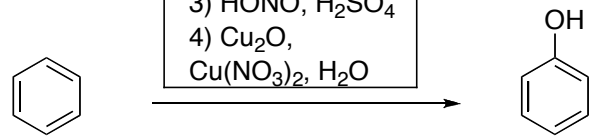
b.



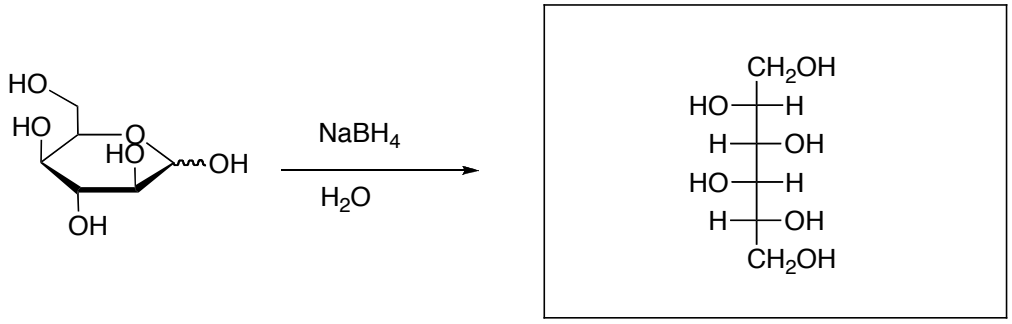
c.



d.

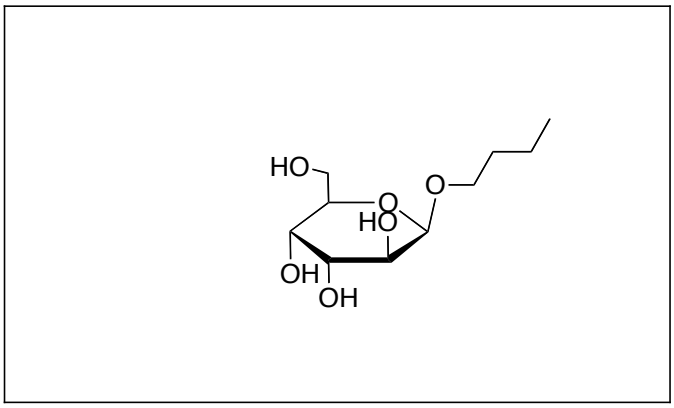


e.



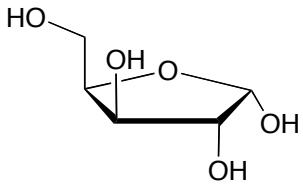
3. Provide the missing structure or sugar name below. Be sure that you name fully describes the stereochemistry displayed and that your structure clearly shows the stereochemistry of the indicated sugar. (10 points)

a.



O-butyl β-D-altropyranoside

b.



α-D-xylofuranose

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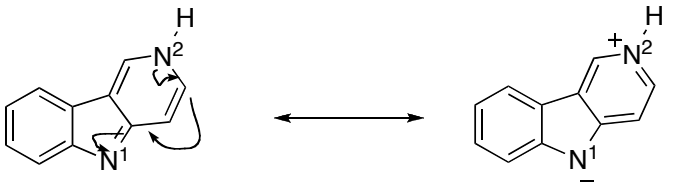
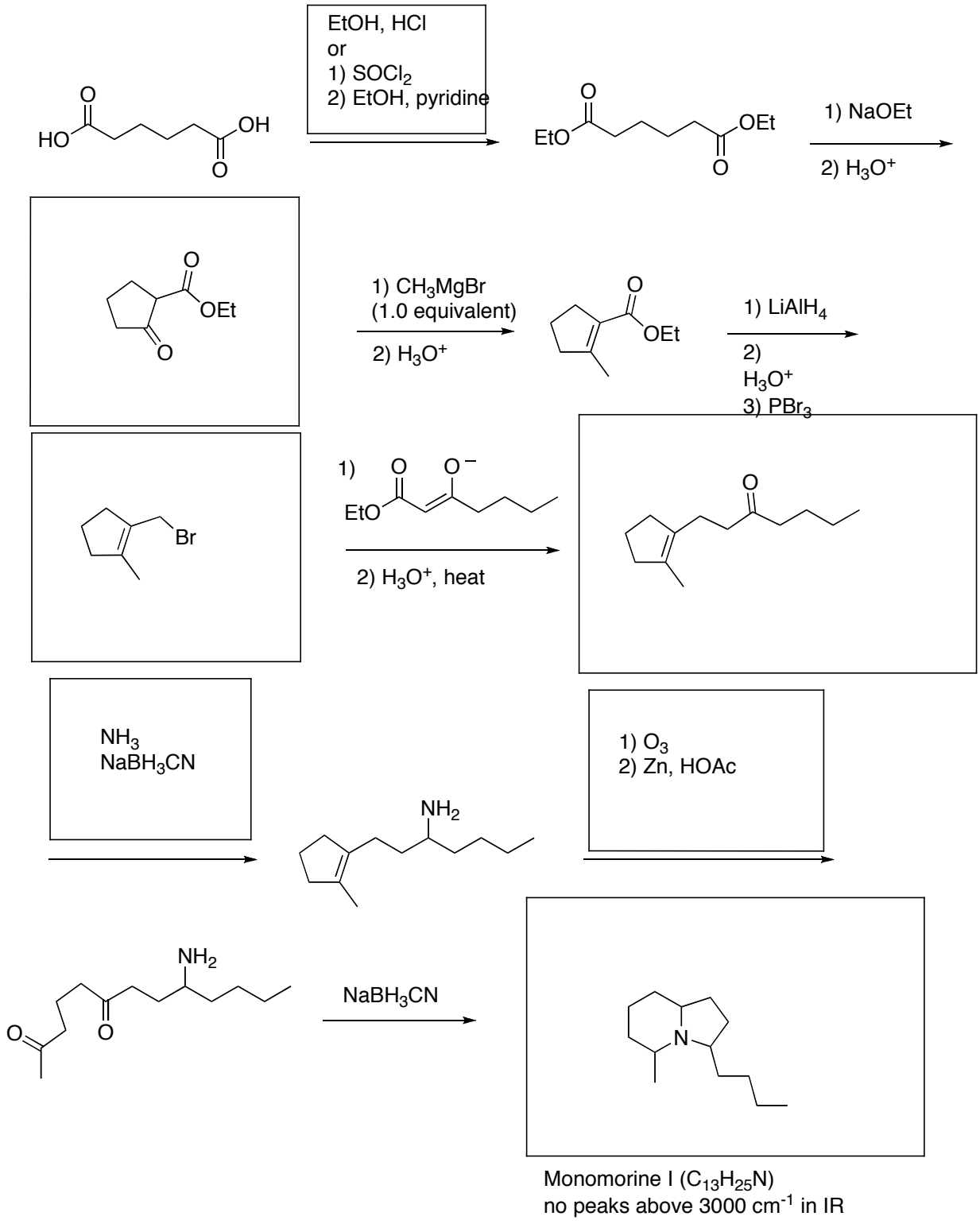
4. The heterocyclic compound is nearly as basic as ammonia (pK_a conjugate acid = 10). Which nitrogen is the most basic in this compound? Draw one or more additional resonance structures of the compound to support your answer. (10 points)



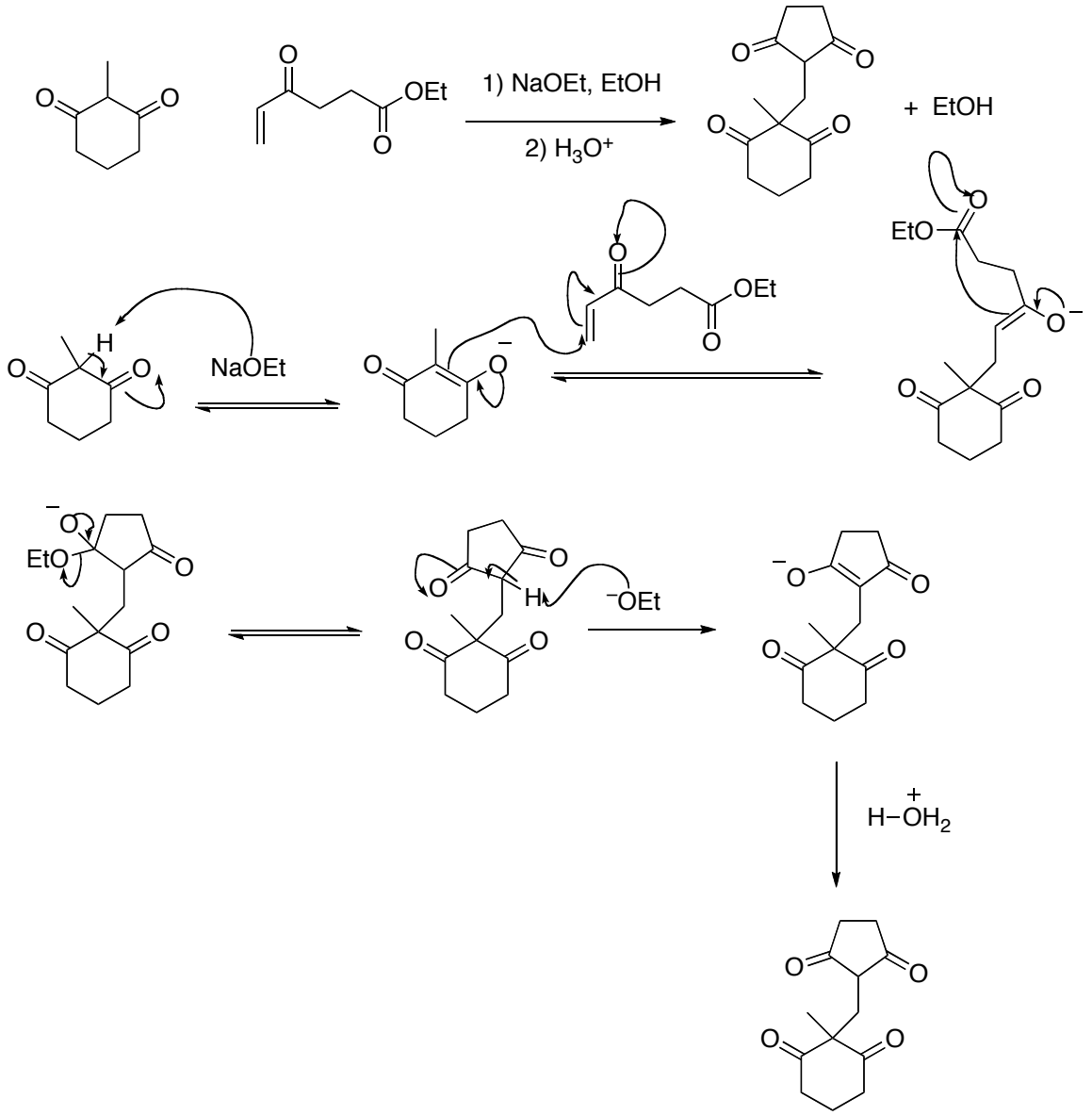
N^1 is most basic. N^2's lone pair is delocalized in the aromatic system. It acts as a electron donor making N^1 more electron-rich and thus more basic.

4. Shown below is the synthesis of Monomorine I, a naturally occurring alkaloid. Provide the missing reagents or intermediates in the synthesis. In some cases there may be more than one reagent required in each box. (21 points)



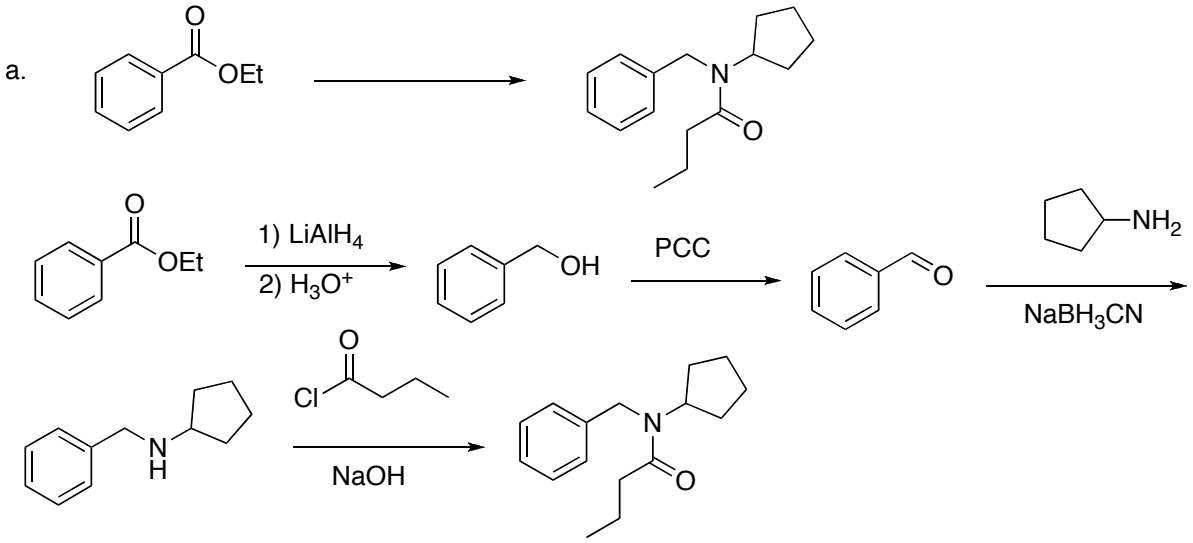
Monomorine I ($C_{13}H_{25}N$)
no peaks above 3000 cm^{-1} in IR

6. The reaction below involves a sequence of two of the reactions we have discussed recently. Provide an electron-pushing mechanism to show how the product is formed from the starting material under basic conditions. Hint: The acid is added at the end of the reaction to protonate the enolate of the diketone in the final product. (15 points)



7. Starting from the indicated molecule, provide an efficient synthesis of the desired products below**.** An efficient synthesis should give the desired product as the major product in each step and use a minimal number of steps. Where necessary, assume that you can separate ortho and para isomers. In addition to the indicated starting material, you may use any organic reactant with **≤6 carbons (only carbons in the final product are counted)**. You may also use other necessary inorganic reagents. (16 points)

a.



There are many other ways to make this compound.

b.