Chemistry 232, Spring 2010
Dr. Shaughnessy
Exam #3
March 30th, 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 **9** pages. Make sure you have all 9 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.

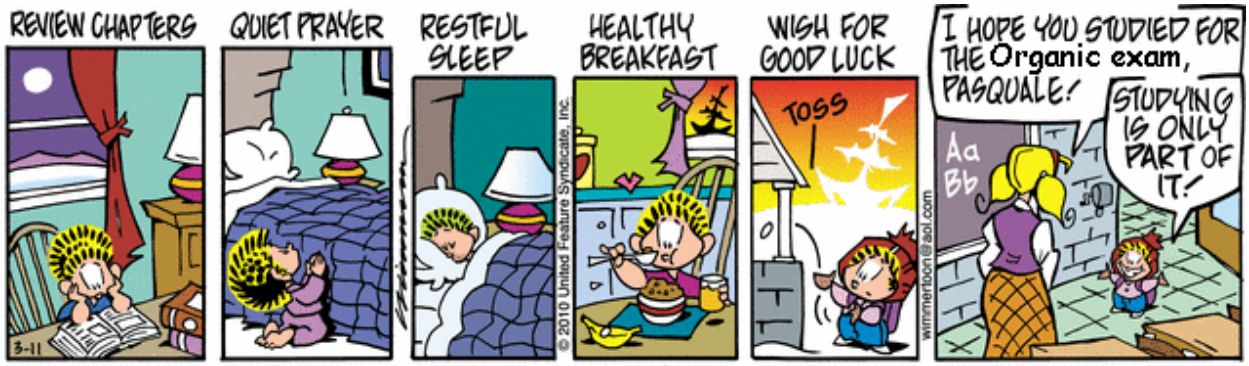
You will not need a calculator or any other electronic device to complete this exam.

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.

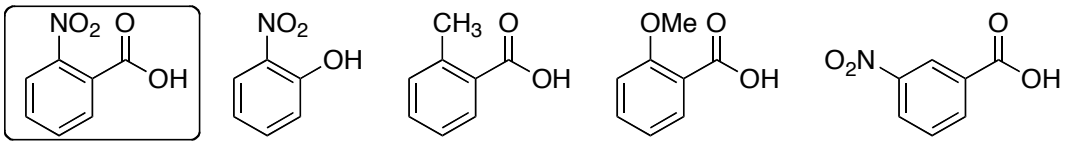
Problem	Score
1	_____ (12)
2	_____ (20)
3	_____ (14)
4	_____ (12)
5	_____ (14)
6	_____ (16)
7	_____ (16)
Total	_____ (104)

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

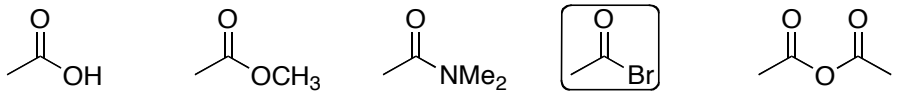


1. For each problem below, circle the **best** answer. In each case, there is only one correct answer (12 points)

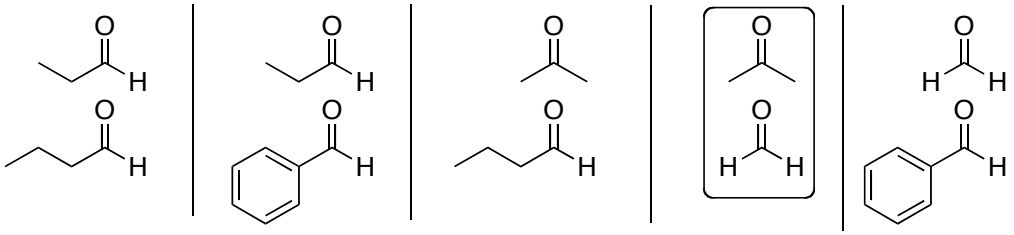
   a. Which of the following would be the **most acidic**?



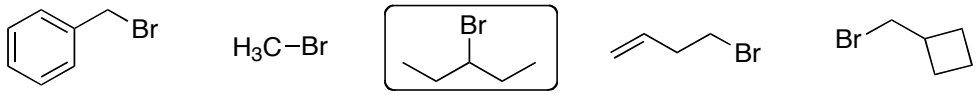
   b. Which compound below would be **most reactive** towards nucleophilic attack?



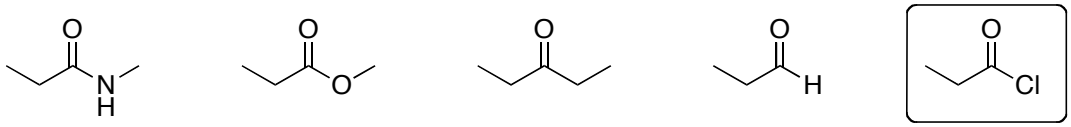
   c. Which combination of compounds below would give a **single aldol condensation product** when treated with NaOH in ethanol?



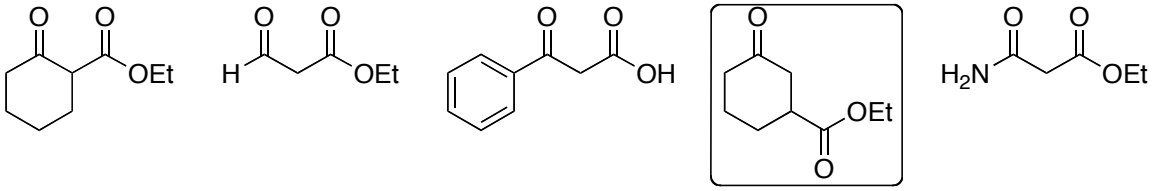
   d. Which alkyl halide **could not** be used to alkylate the enolate derived from 3-pentanone?



   e. Which compound below would have the **highest CO stretching frequency** in its IR spectrum?

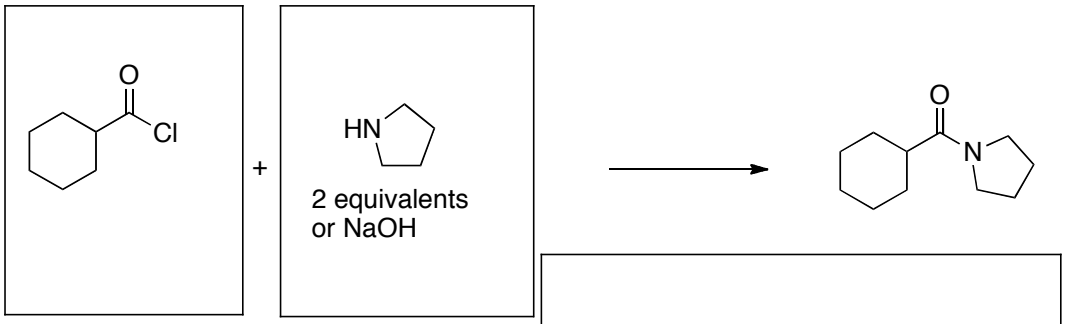


   f. Which of the following **would not undergo decarboxylation** (loss of CO_2) when heated in aqueous acid?

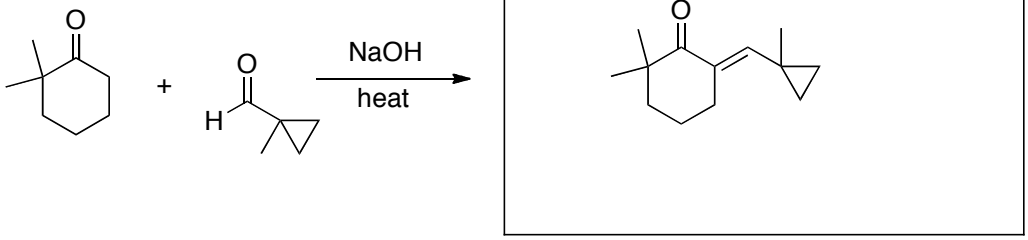


2. For each reaction below, provide the missing starting material(s), reagent(s), or product(s). For reactions in which more than one product can be formed, draw each major product. You should not include products formed as minor products, however. You do not need to indicate side products from the reagents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

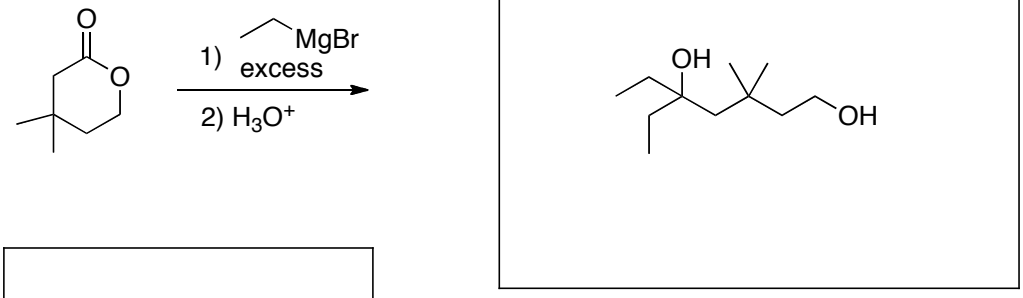
a.



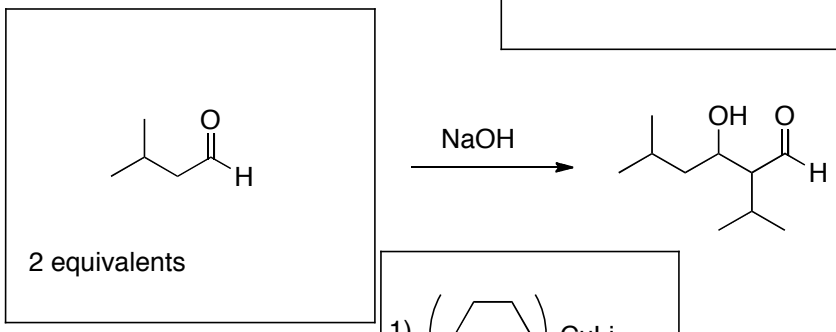
b.



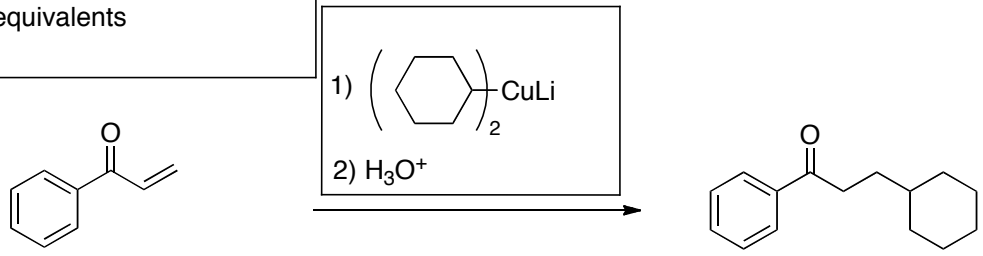
c.



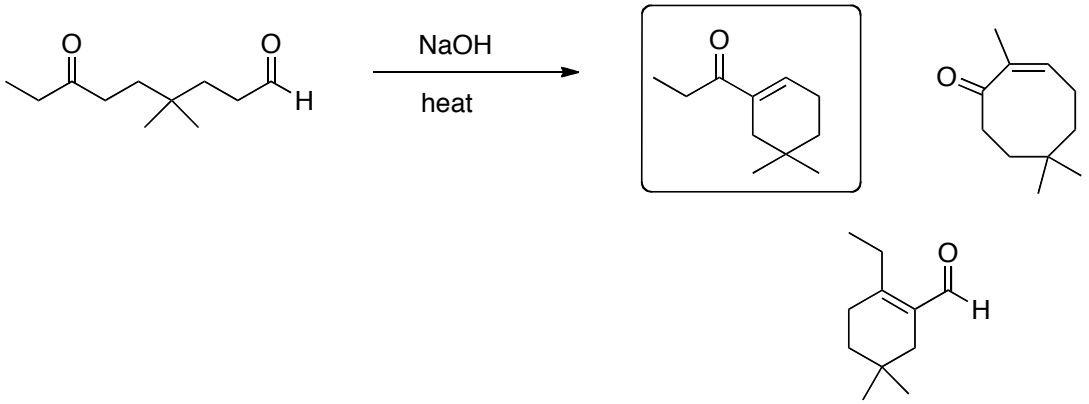
d.



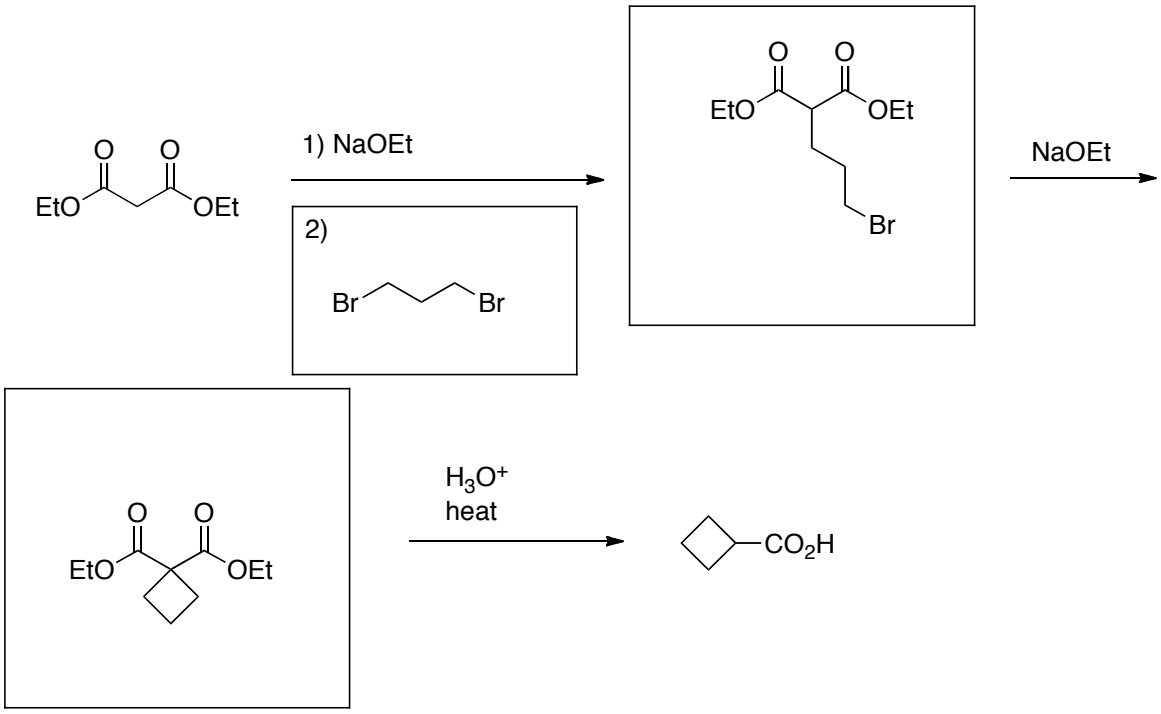
e.



3. Draw all of the products that could be formed in the intramolecular aldol reaction of the ketoaldehyde below. Circle the major product that would be formed (14 points).

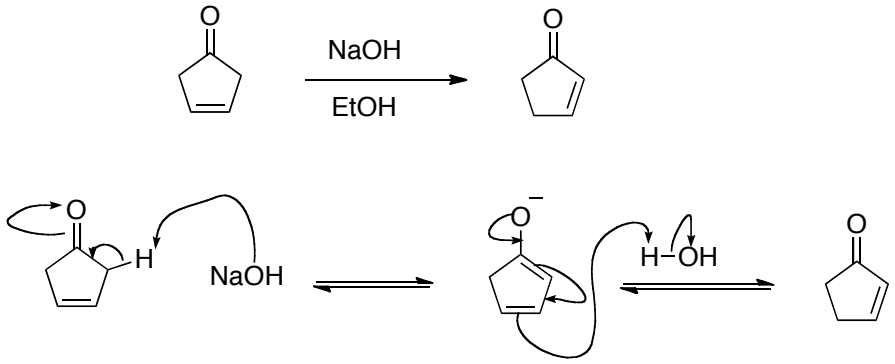


4. The malonic ester synthesis has been used as a way to prepare a variety of cyclic compounds, including those with small rings. Provide the missing reagents and intermediates in the synthesis of cyclobutane carboxylic acid in the reaction scheme below (12 point).

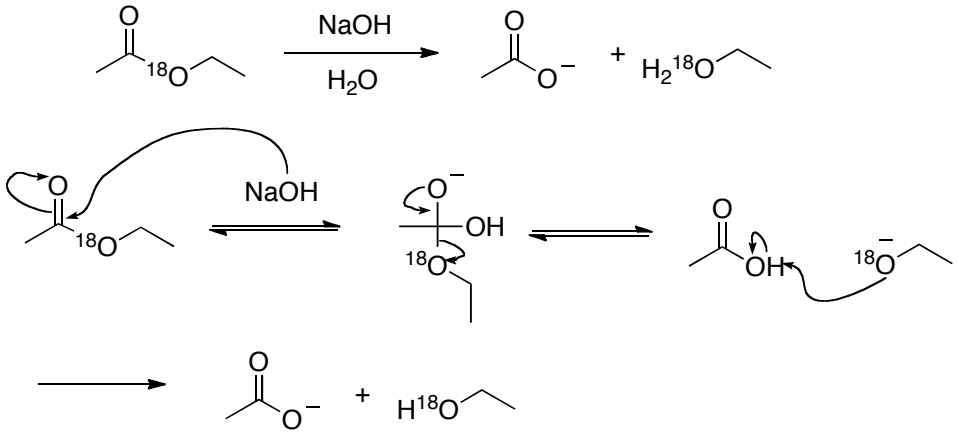


5. Provide an answer to each question below (14 points)

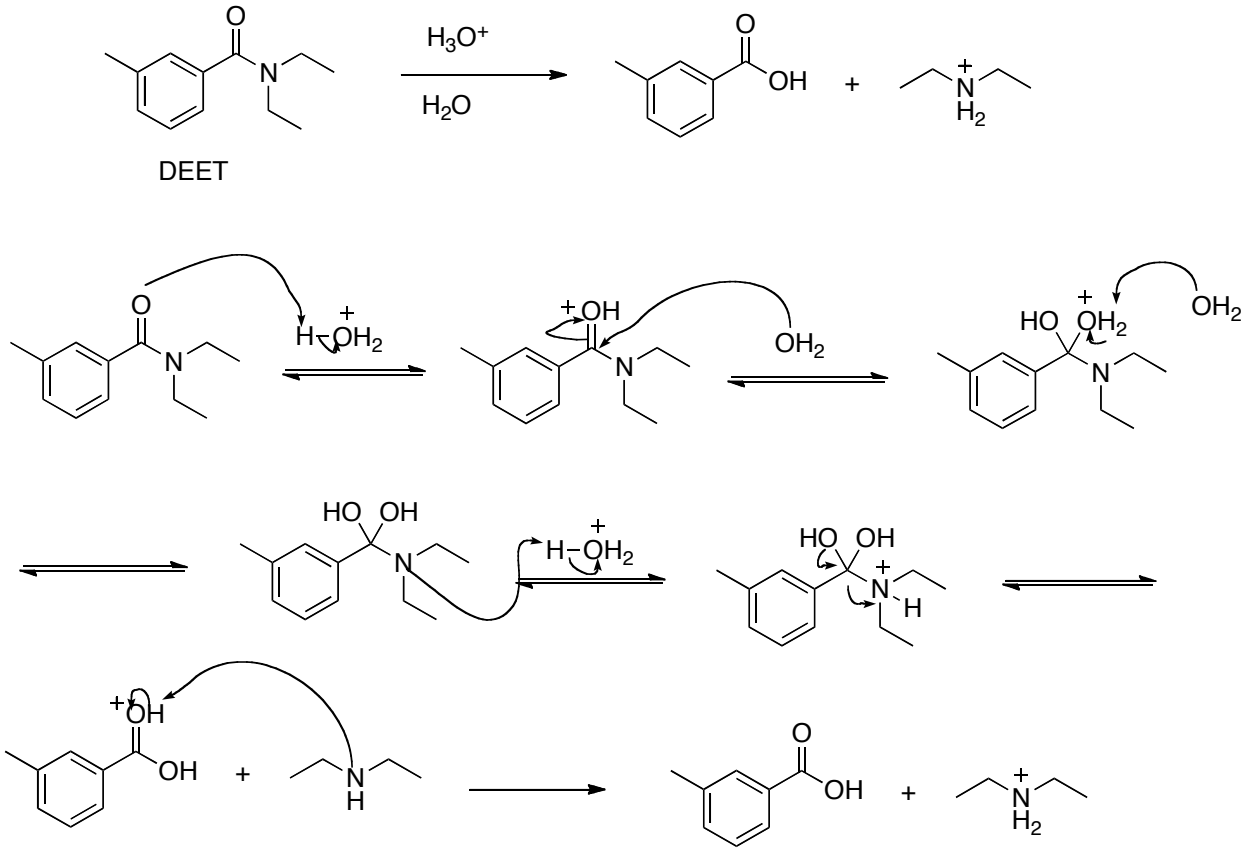
   a. Treatment of 3-cyclopentenone with base results in a rearrangement to 2-cyclopentenone. Draw an electron-pushing mechanism to show how this occurs.



   b. One way that the mechanism for ester hydrolysis under basic conditions has been confirmed is by carrying out the reaction using an ester that has been specifically labeled with ^{18}O in the ester oxygen. Draw the products for this reaction showing the position of the ^{18}O in the final product. Draw an electron pushing mechanism for this hydrolysis. Be sure to label the position of the ^{18}O throughout your mechanism.

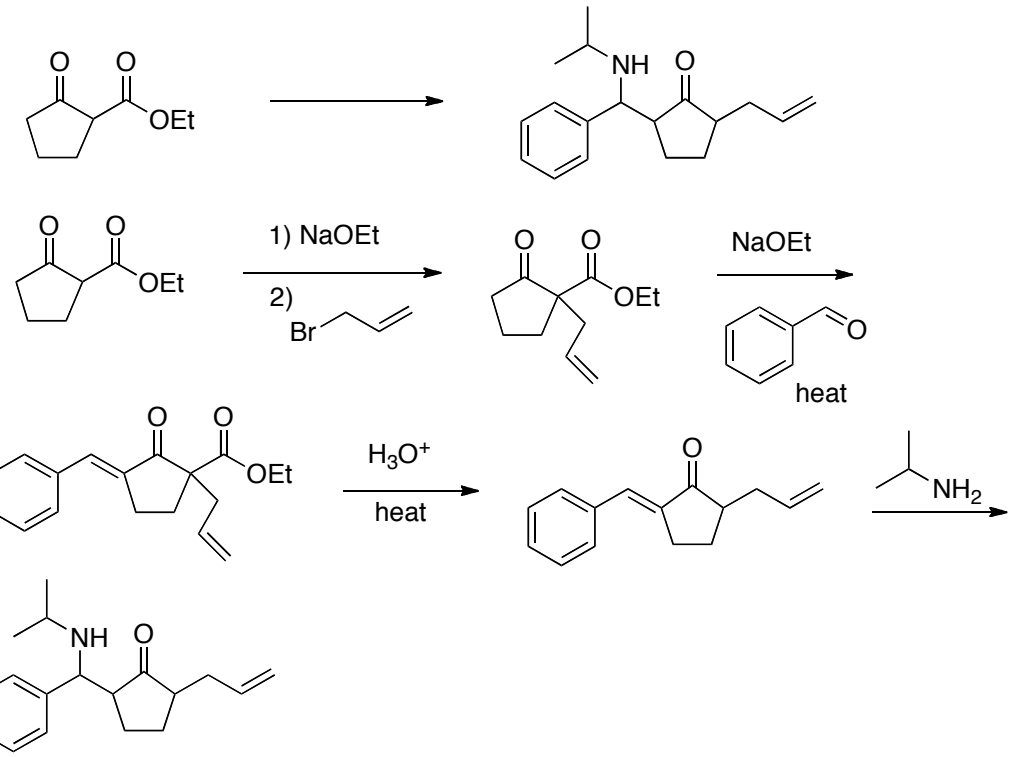


6. *N,N*-Diethyl toluamide (DEET) is commonly used as an insect repellant. Provide a detailed electron-pushing mechanism for the hydrolysis of DEET under acidic conditions. Show each step using arrows to show the movement of electrons. Clearly indicate all formal charges. (16 points)



7. Starting from the indicated molecule(s), provide an efficient synthesis of the desired product. An efficient synthesis should give the desired product as the major product in each step. In addition to the indicated starting material(s), you may use any **organic compound with ≤ 7 carbons** (counting only carbons that will end up in the product) plus any other inorganic reagents. (16 points)

a.



b.