# Organic Chemistry c3444y

## 3rd Hour Exam

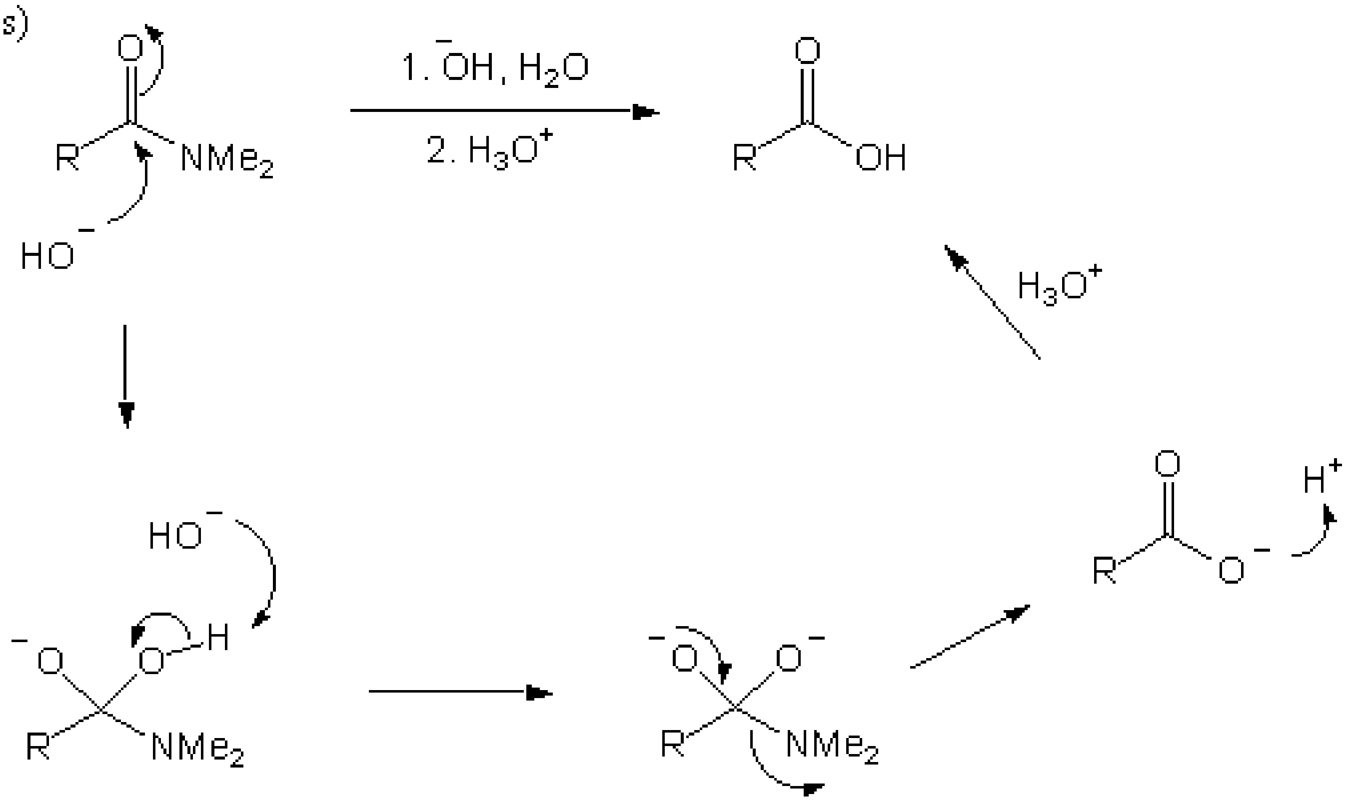
Monday, March 27, 2000
Prof. Leighton

# Answer Key

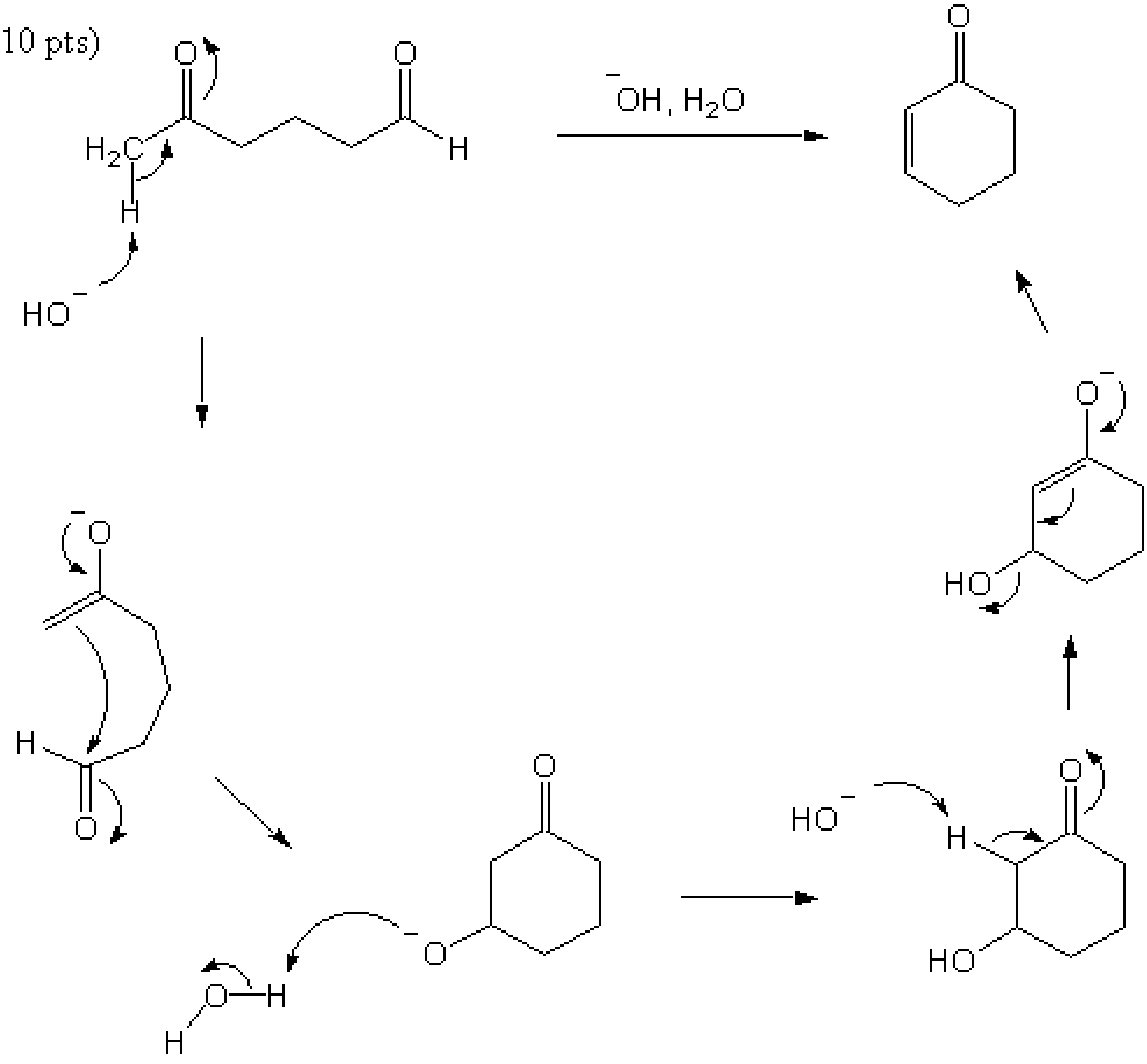
Name: ______________________________

1. Provide detailed mechanisms for the following transformations:

a. (10 pts)



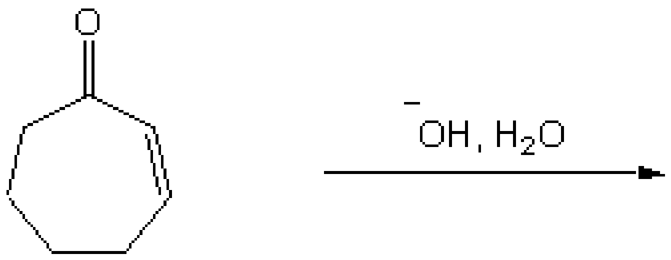
b. (10 pts)

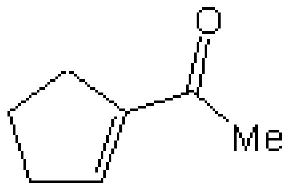


Name: ____________________

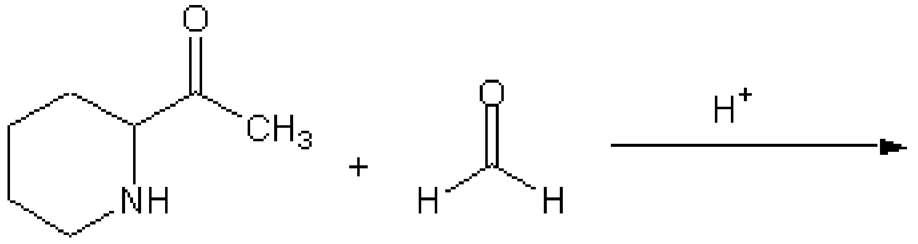
2. Predict the major product of the following reactions:

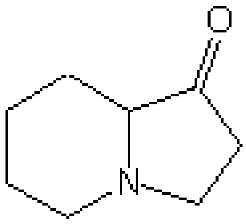
a. (10 pts)



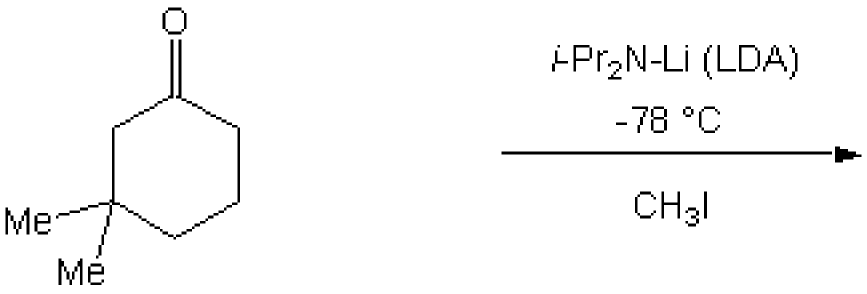


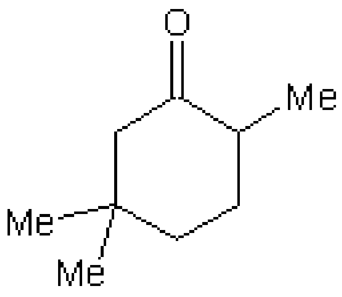
b. (10 pts)



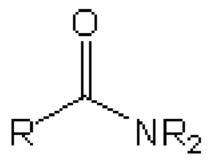


c. (5 pts)

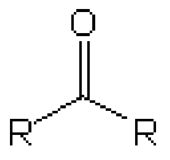




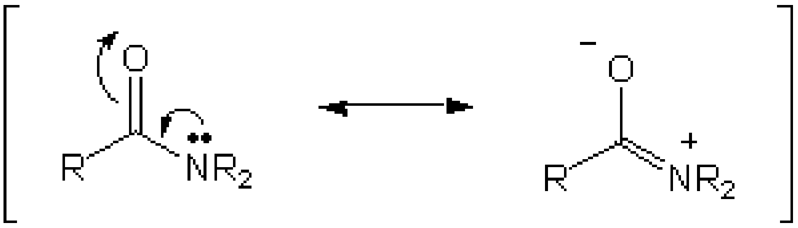
3. a. (5 pts) Using resonance structures, provide a *brief* explanation for the observation that amides typically display a lower C=O stretching frequency in the IR spectra relative to ketones:



~1670 $cm^{-1}$

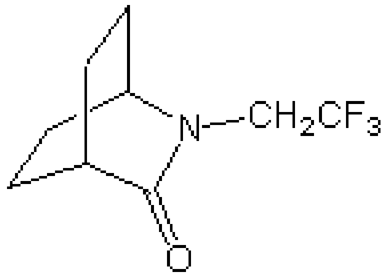


~1720 $cm^{-1}$



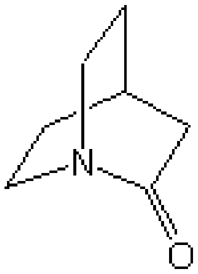
*For amides, this resonance structure is a strong contributor. Thus, amide carbonyls have more single bond character than our reference ketones. The C=O bonds are therefore longer and "looser" leading to a lower frequency stretch in the IR spectra.*

b. (10 pts) Rank the three compounds shown below from lowest frequency to highest frequency for the C=O stretch in the IR spectra. Please clearly write one letter in each box.



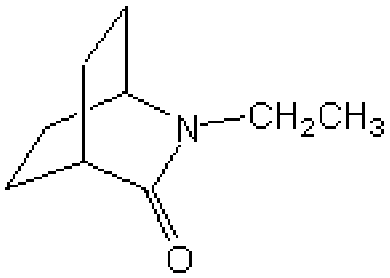
**A**

*Normal amide, however, relative to **C**, N is less strongly donating because of the $CF_3$ group. Thus the effect is weaker than in **C**, and we would expect a higher frequency C=O stretch than **C**.*



**B**

*No Resonance! Just a C=O attached to a Nitrogen. Should have the highest frequency C=O stretch, in that there is no significant resonance structure with a C-O single bond.*



**C**

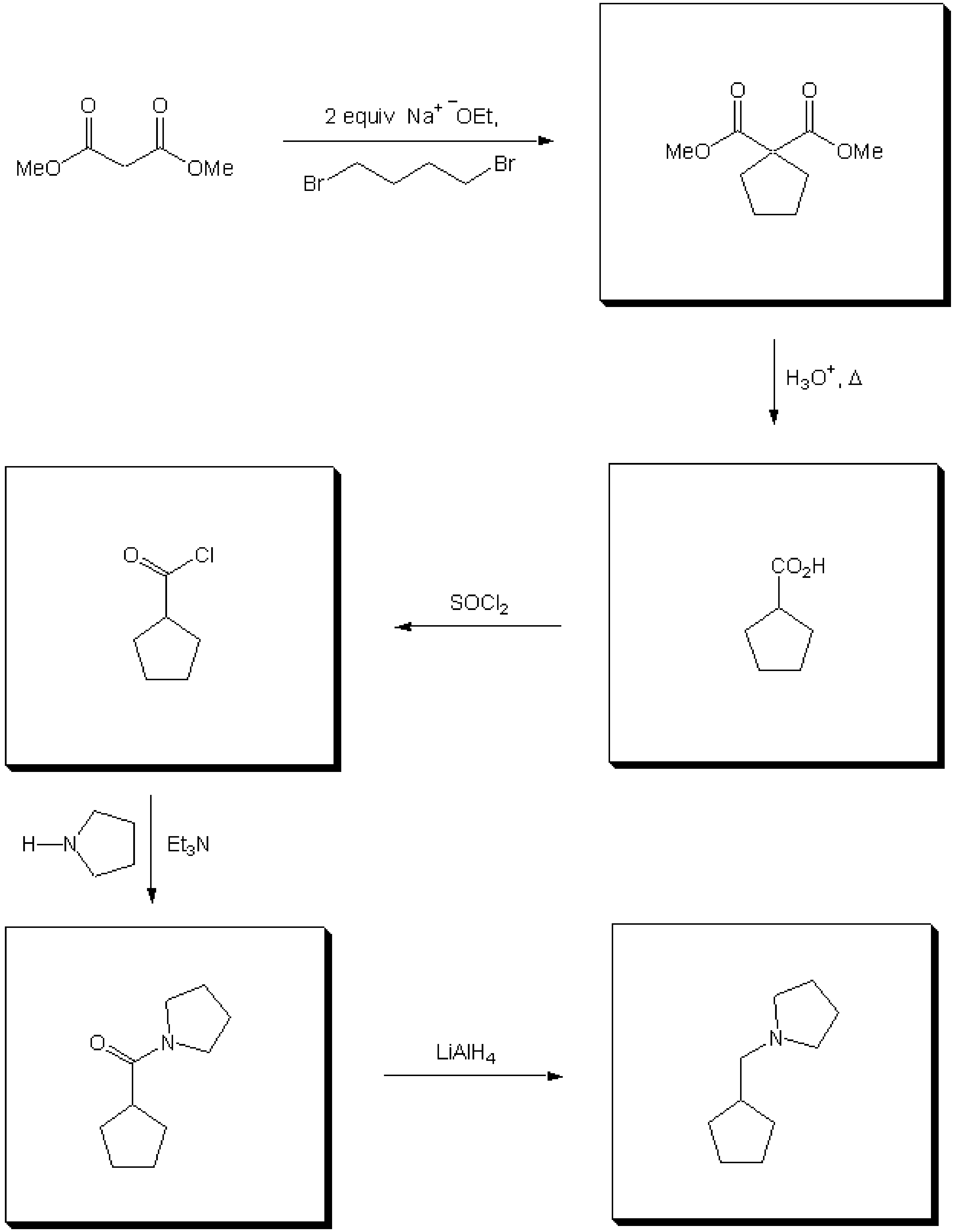
*Normal Amide.*

| | | |
|---|---|---|
| **C** | **A** | **B** |

*Lowest Frequency* → *Highest Frequency*

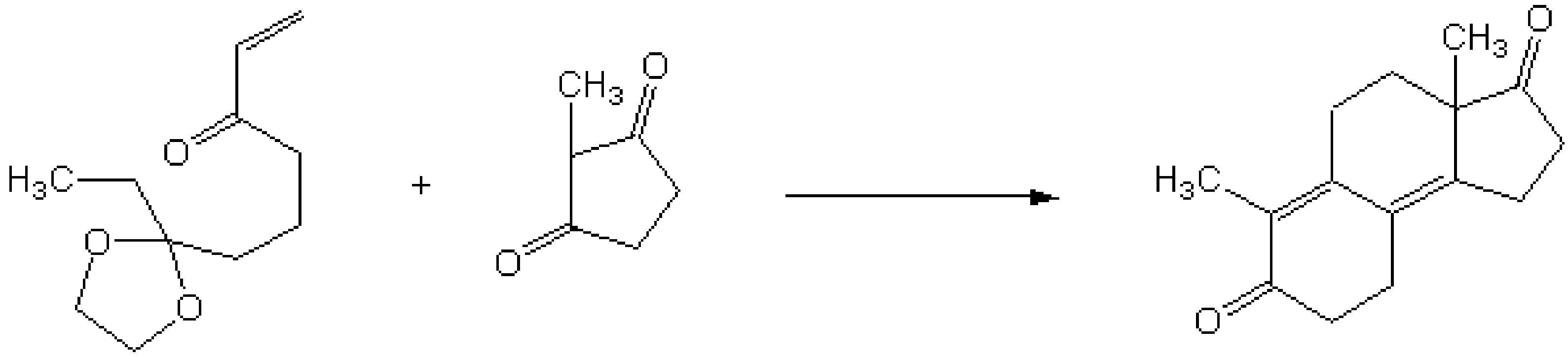
Name: ____________________

4. (20pts) Provide the missing products of the following sequence of reactions:

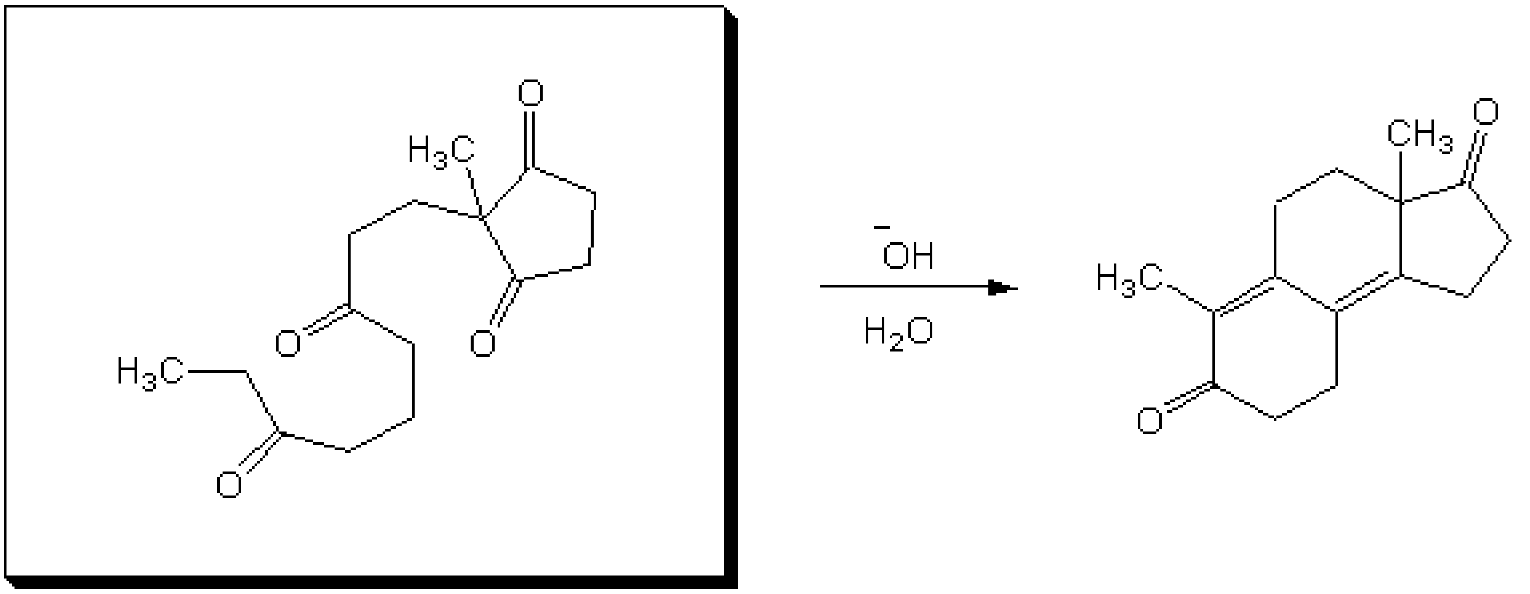


Name: ______________________________

5. The illustrated tricyclic compound may be synthesized in only a few steps from the illustrated starting materials. If you understand the Robinson Annulation, then you can understand this modified version of it.



a. (10 pts) The last step involves *two* aldol condensations, one after the other. The starting material for this double aldol condensation is a tetraketone. Thinking "backwards" from the product, provide the structure of this tetraketone:



b. (10 pts) Show how you might synthesize the tetraketone you have just identified in two steps from the starting materials provided above.