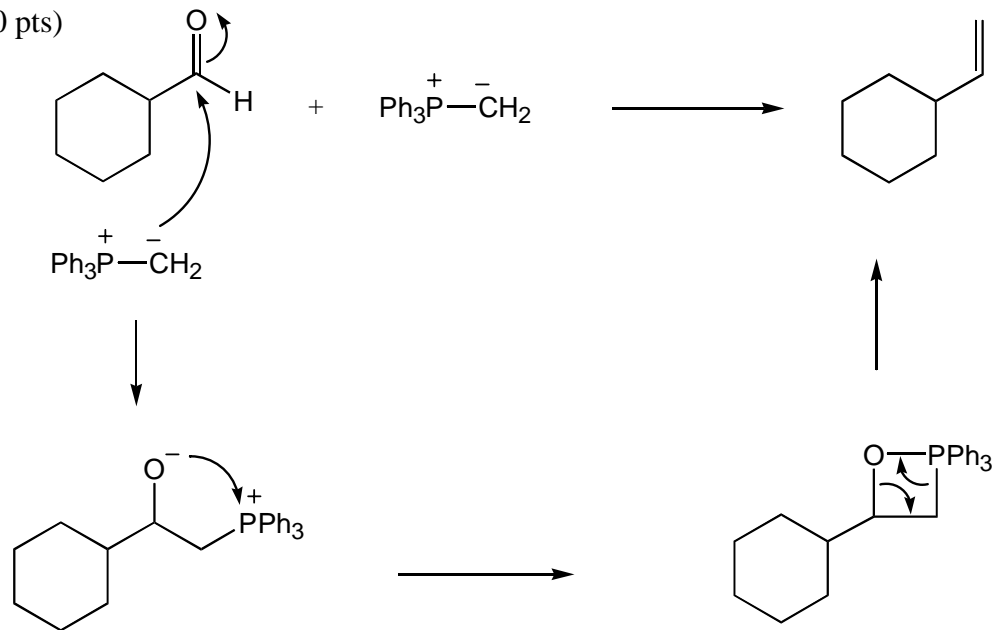


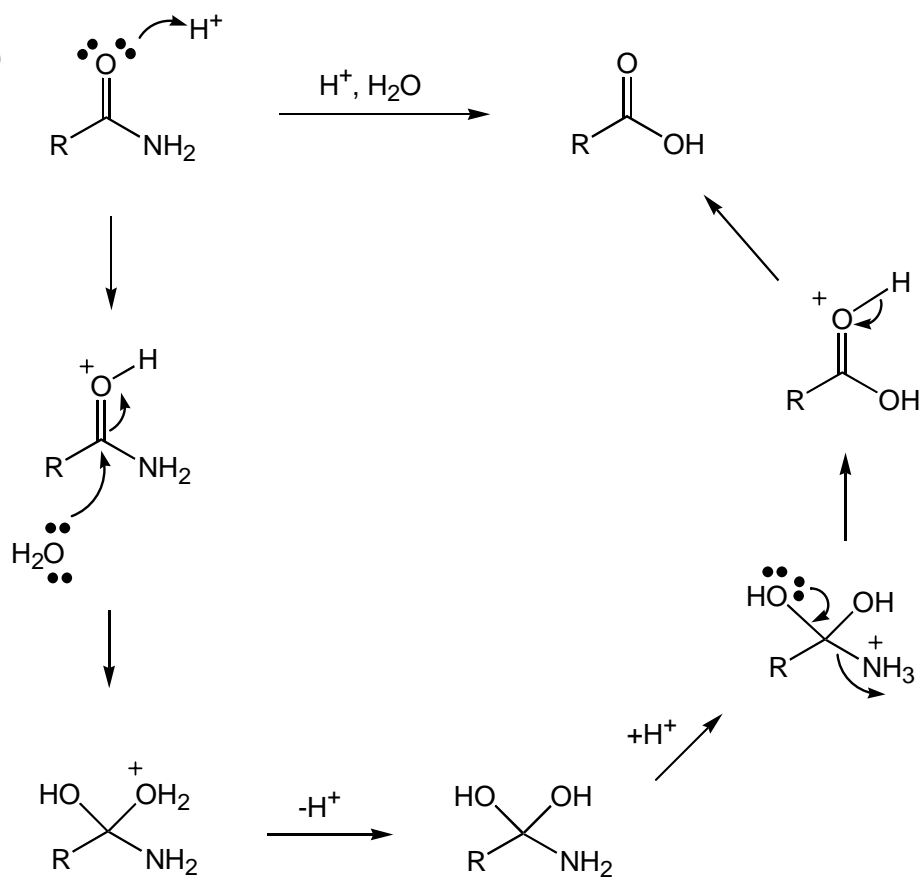
Name: \_\_\_\_\_

1. Provide detailed mechanisms for the following transformations:

a. (10 pts)



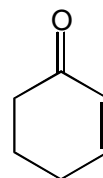
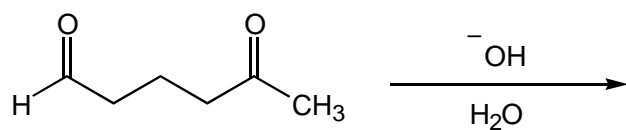
b. (10 pts)



Name: \_\_\_\_\_

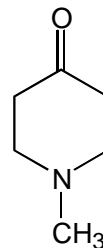
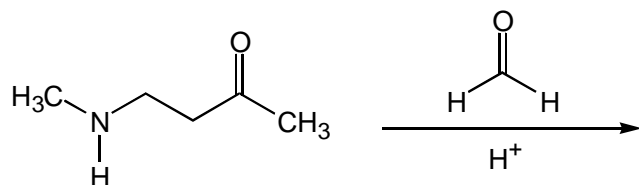
2. Predict the major product of the following reactions:

a. (10 pts)



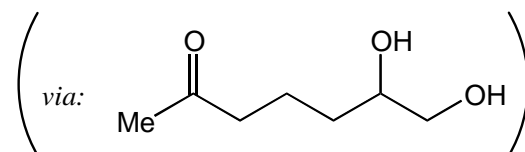
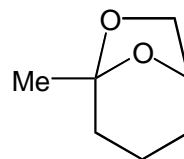
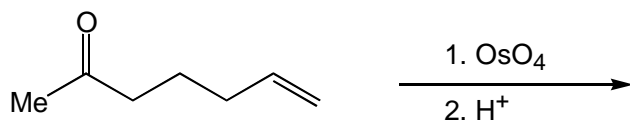
*Intramolecular Aldol Condensation*

b. (10 pts)



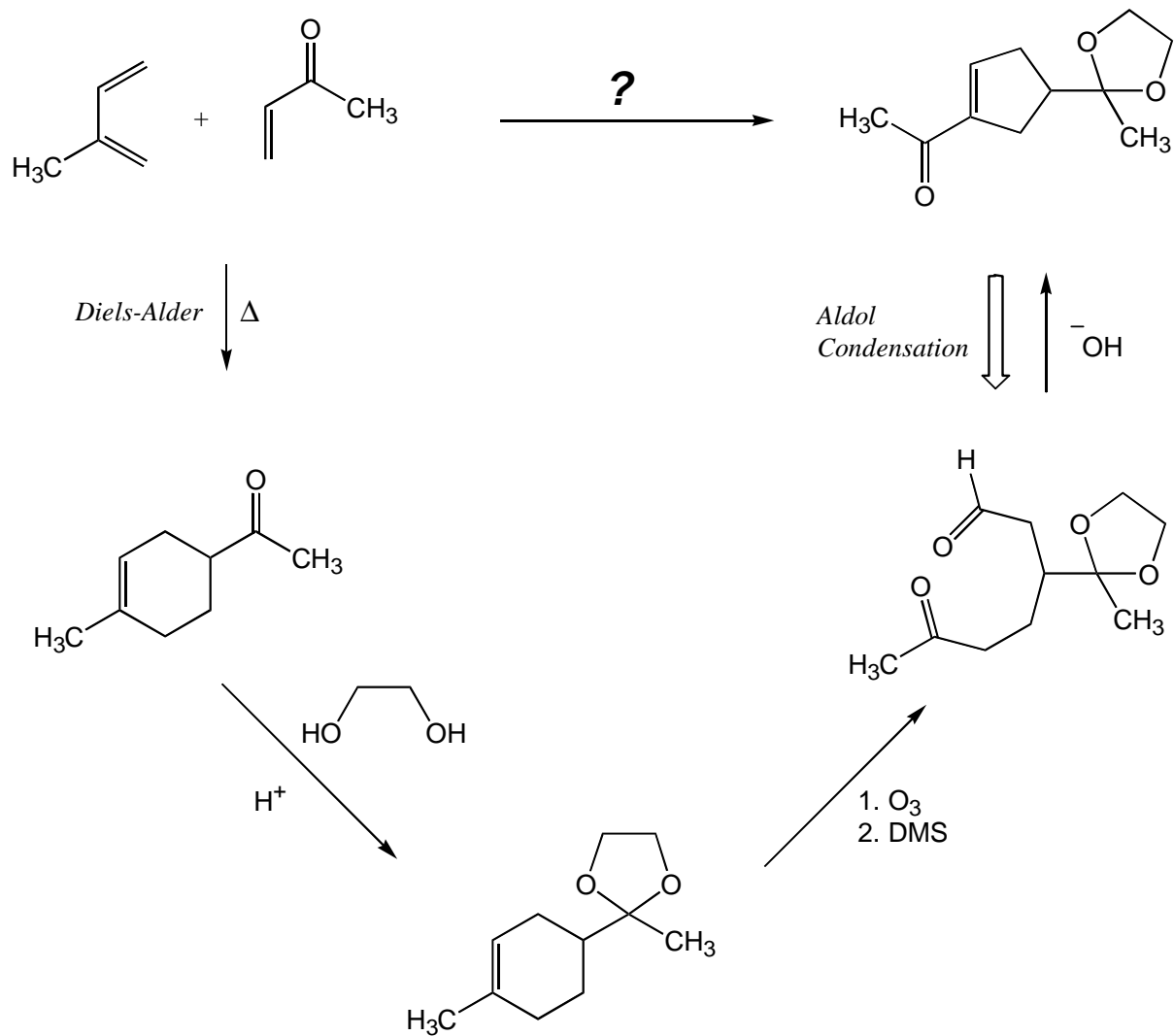
*Mannich Reaction*

c. (10 pts)



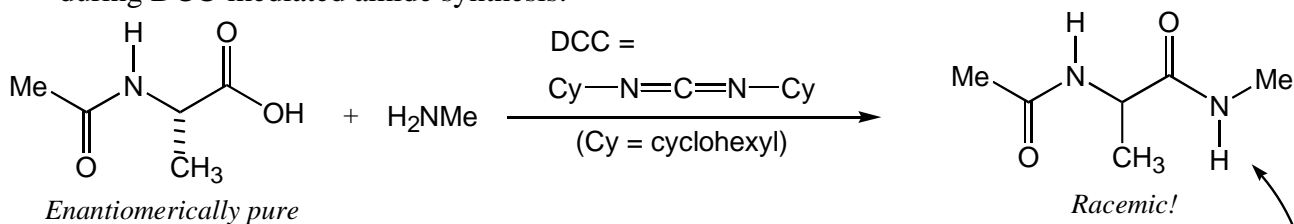
Name: \_\_\_\_\_

3. (20 pts) Propose a synthesis of the illustrated target from the provided starting materials. It will be helpful to work backward from the product one step and forward from the starting materials one step, and then see if you can link them. The reaction conditions are provided for the first step.

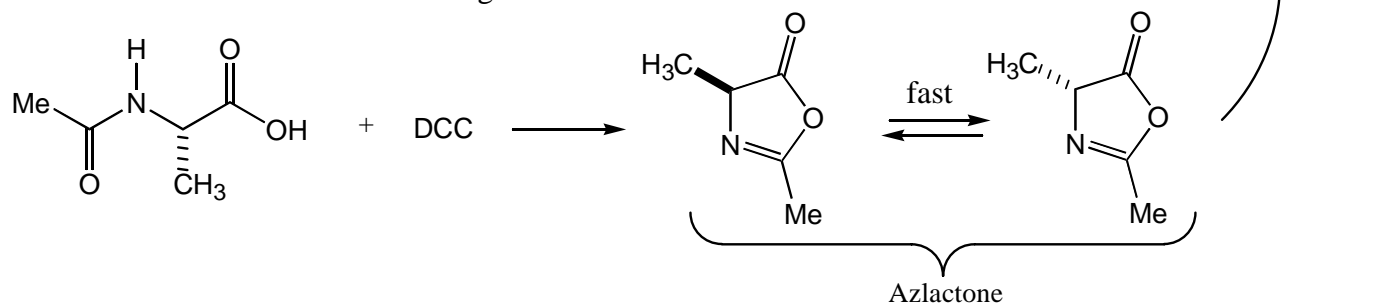


Name: \_\_\_\_\_

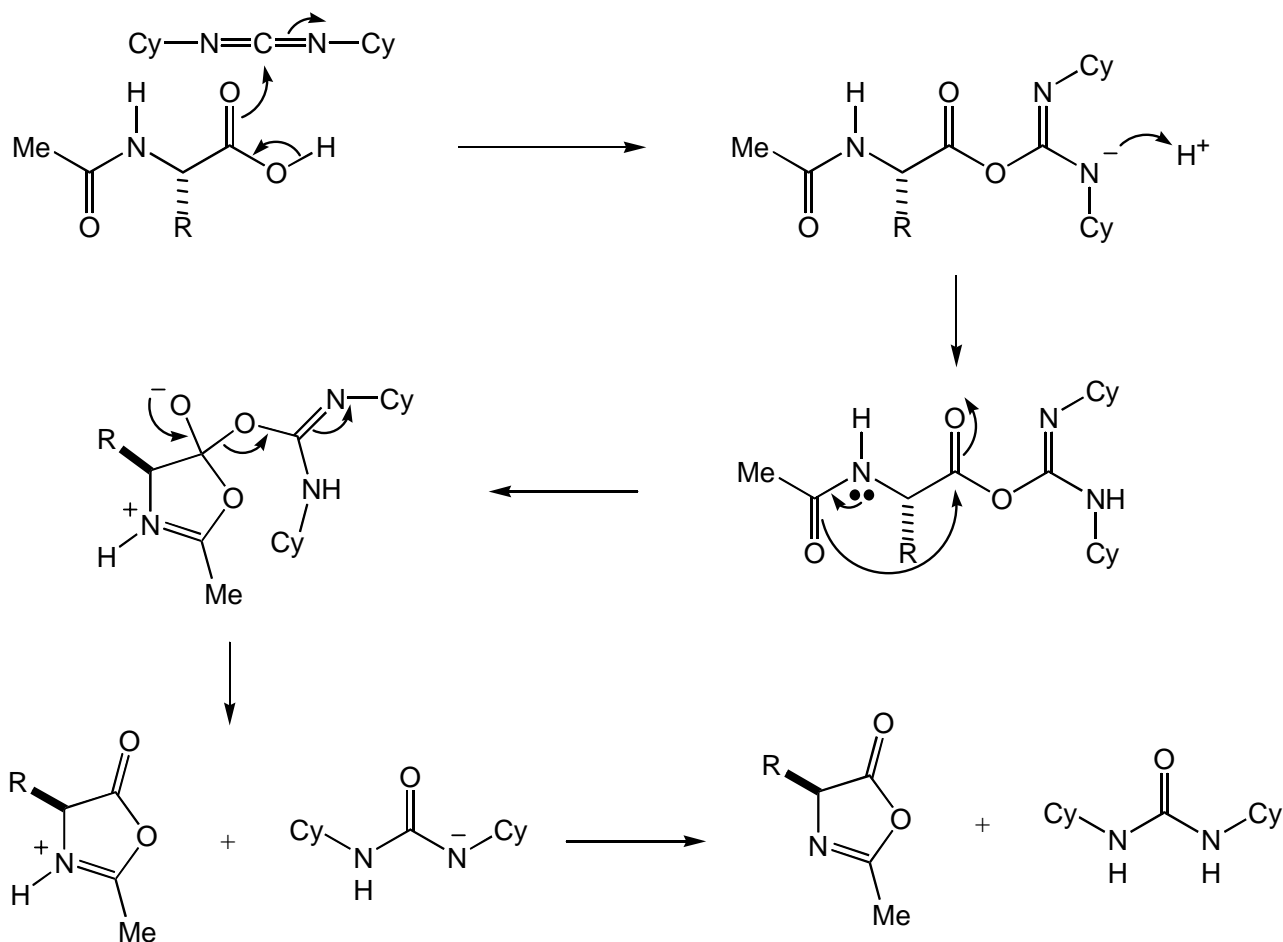
4. It has been observed that the illustrated carboxylic acid can undergo racemization during DCC-mediated amide synthesis:



It has been established that the carboxylic acid and the DCC react to form an azlactone, and that it is the azlactone which undergoes racemization:

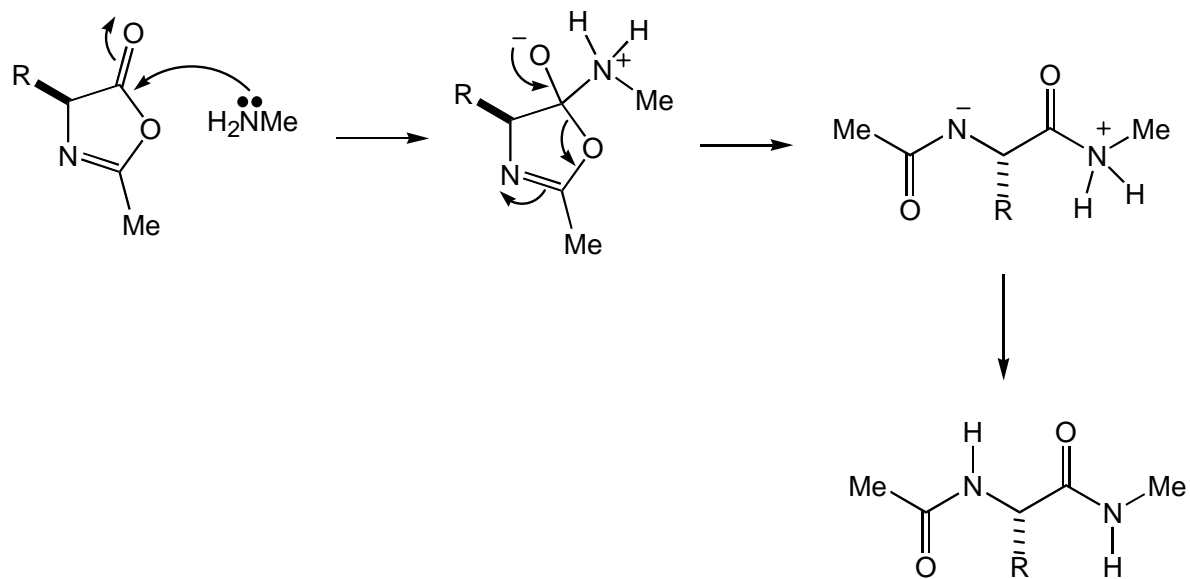


(15 pts) Provide a mechanism for the formation of the azlactone, and then for the reaction of the azlactone with the methylamine to give the final amide product. Do not worry about stereochemistry here. CONTINUE YOUR ANSWER ONTO THE NEXT PAGE IF YOU NEED MORE SPACE.

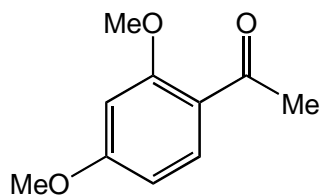


Name: \_\_\_\_\_

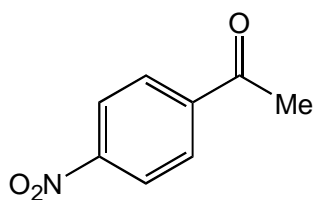
4. cont'd:



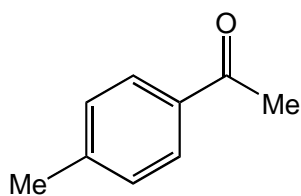
5. (15 pts) Rank the four ketones shown below in order of increasing  $\text{C}=\text{O}$  stretching frequency in the IR spectra.



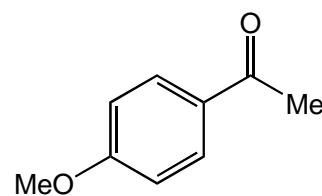
**A**



**B**



**C**



**D**

**A**

**D**

**C**

**B**

*Lowest frequency*  
*C=O stretch*



*Highest frequency*  
*C=O stretch*