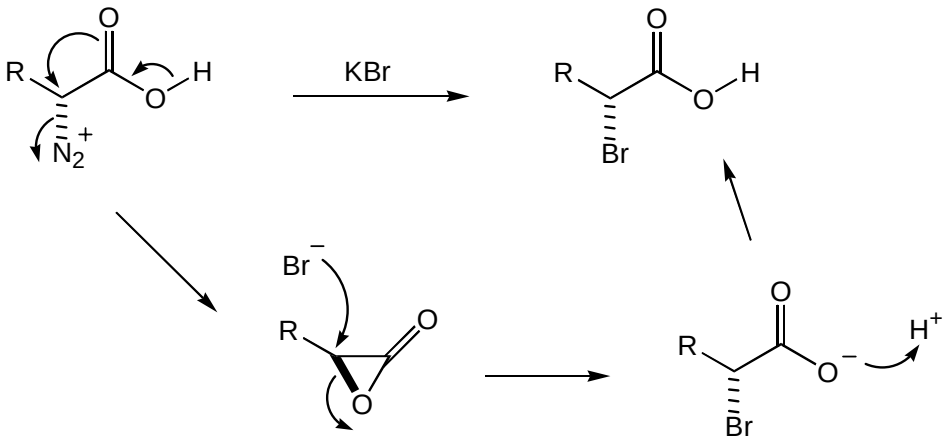
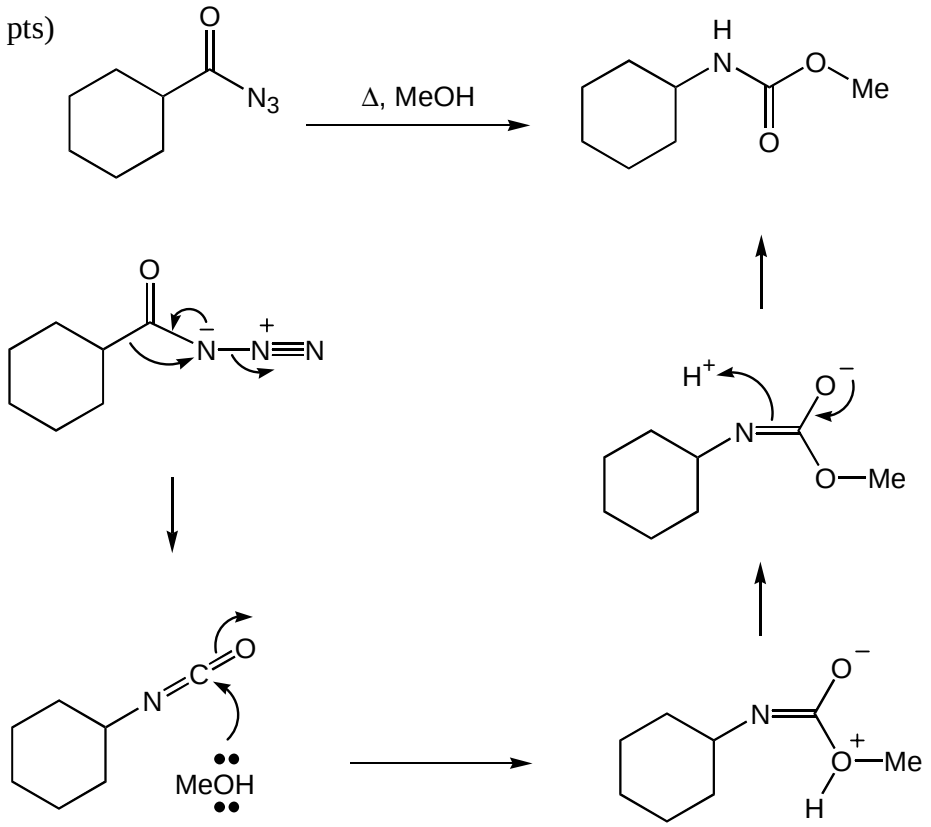
Name:_____

1. Provide detailed mechanisms for the following transformations:

a. (10 pts)



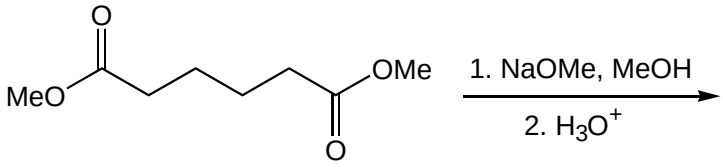
b. (10 pts)

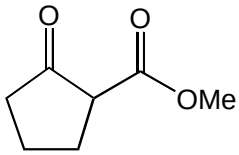


Name:_____

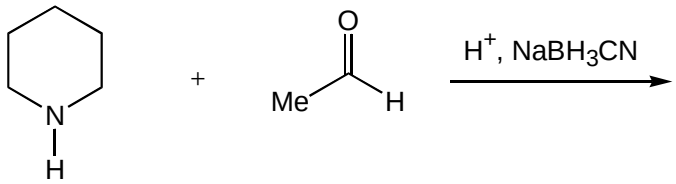
2. Predict the major product of the following reactions:

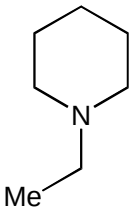
a. (10 pts)



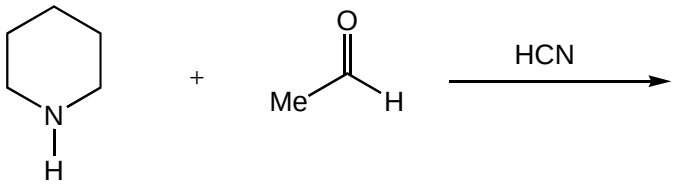


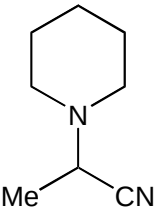
b. (5 pts)





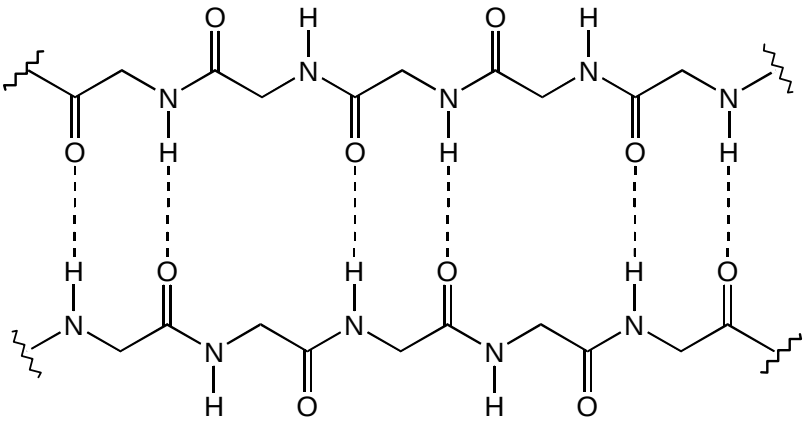
c. (5 pts)



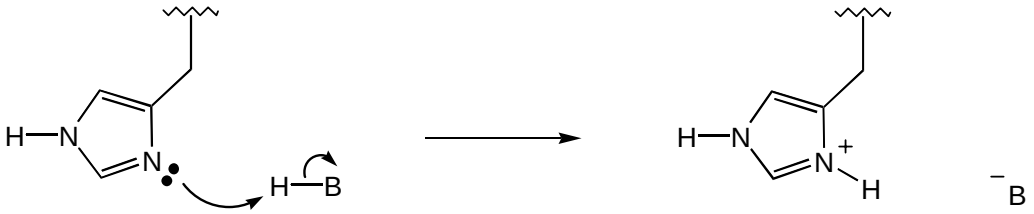


Name: _____

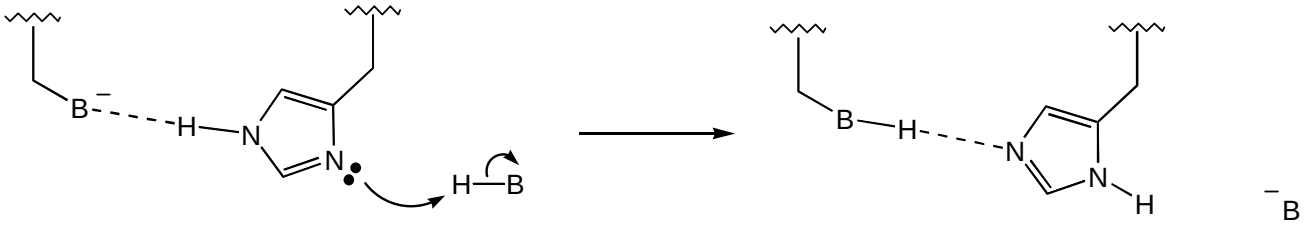
3. a. (10 pts) Shown below is a section of a peptide chain. Draw a second peptide chain underneath it such that you form an antiparallel β-sheet. Be sure to indicate the hydrogen bonds.



b. (10 pts) The imidazole of histidine is often used by proteins as a base at the active site.



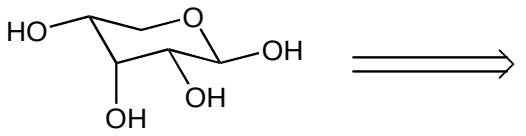
Although imidazole is a reasonably competent base (pK_a of protonated imidazole = 7), proteins often use a "trick" to increase its basicity. Show with structures how the basicity of imidazole may be increased. You may use any other reasonable chemical entity likely to be found in a protein that you desire.

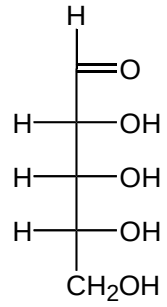


The protein can employ a base to deprotonate the imidazole during the reaction. In this way, the electron density of the imidazole is increased and it is thus a stronger base. Another way to lookat this is that in the first reaction above we have created a positive charge on the imidazole. By using the other base, we avoid the creation of this charge.

Name:_____

4. a. (10 pts) Provide a classification (*e.g.* D-ketotriose) and a Fischer projection for the following carbohydrate:



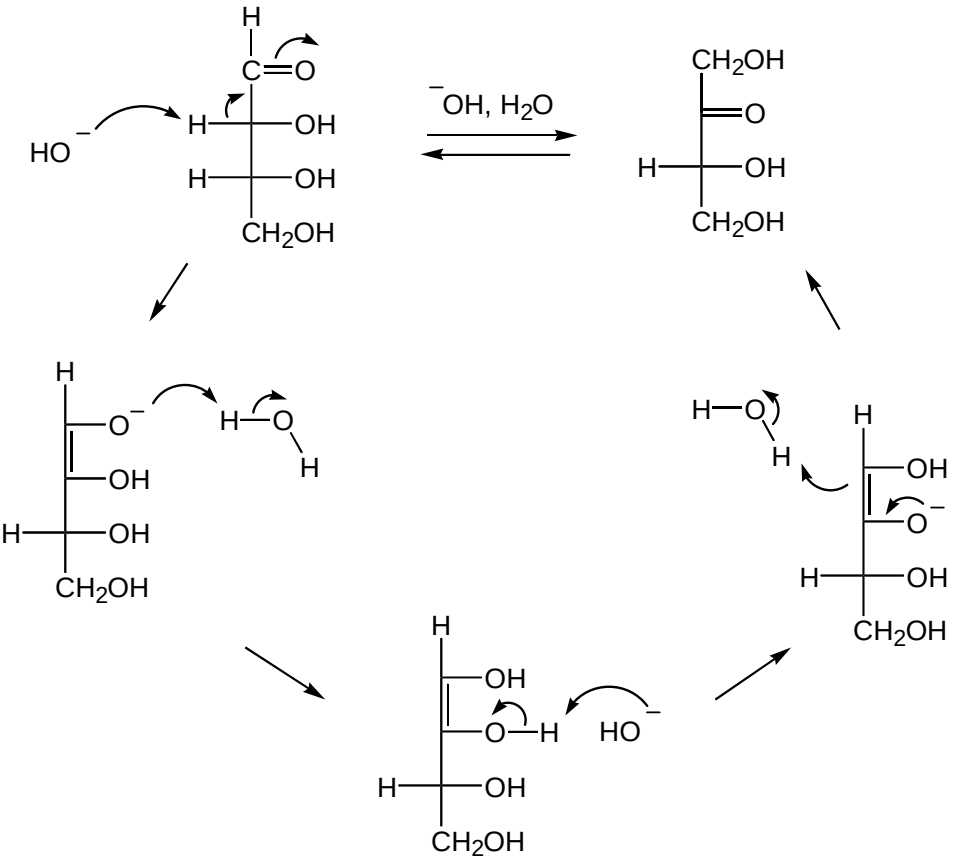


Fischer Projection

D-Aldopentose

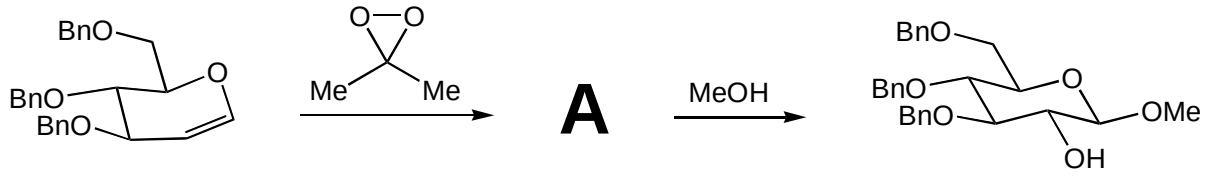
Classification

b. (10 pts) Provide a mechanism for the following transformation:

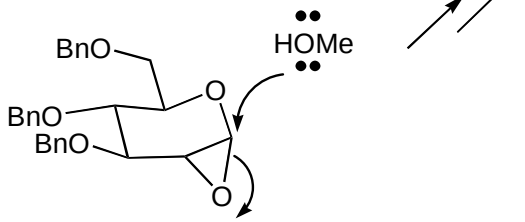


Name: _____

5. a. (10 pts) Provide the structure of intermediate **A**, and provide a *brief, concise* explanation for why this two step process leads to the indicated stereochemistry in the product.

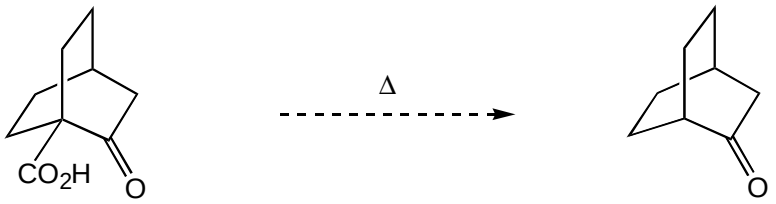


A =

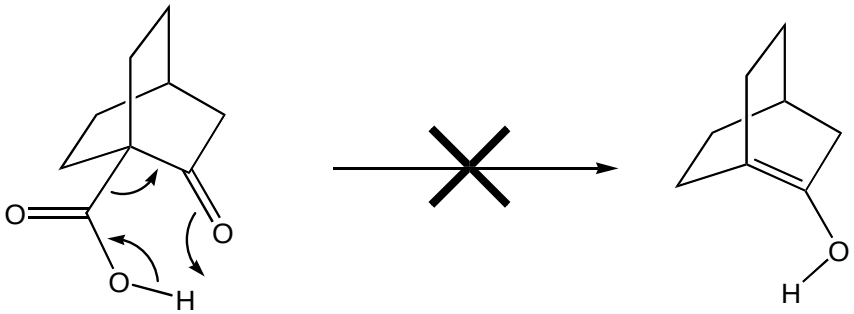


The epoxide forms on the bottom face of the alkene because the nearest BnO group is blocking the top face. A direct S_N2-like displacement then gives inversion leading to the observed stereochemical result.

b. (10 pts) Because most β-ketoacids readily decarboxylate, your lab partner is planning to attempt the following dercarboxylation:



Even though your lab partner routinely steals your food, you decide to explain why you believe this reaction might not work based on a careful mechanistic analysis:



This enol cannot form, it's a bridgehead double bond!