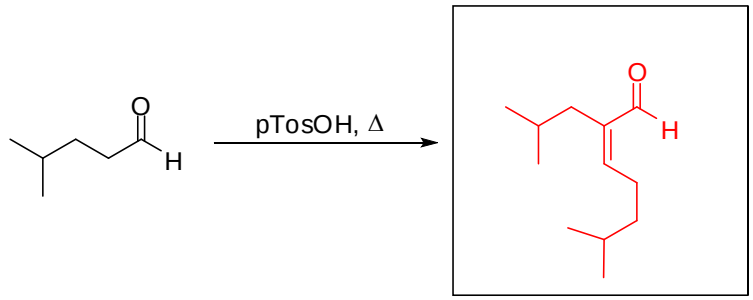
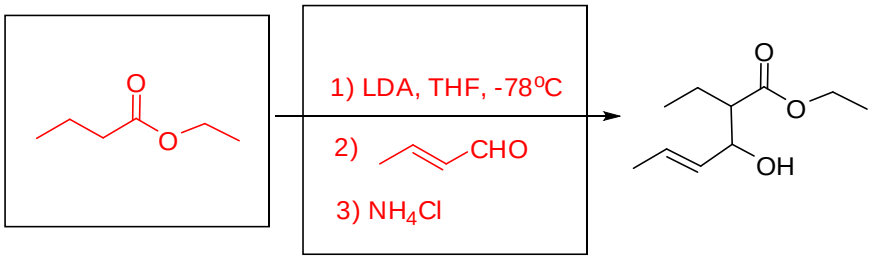
1. Provide the necessary information, product(s), reagents or starting materials, to complete the following reactions.

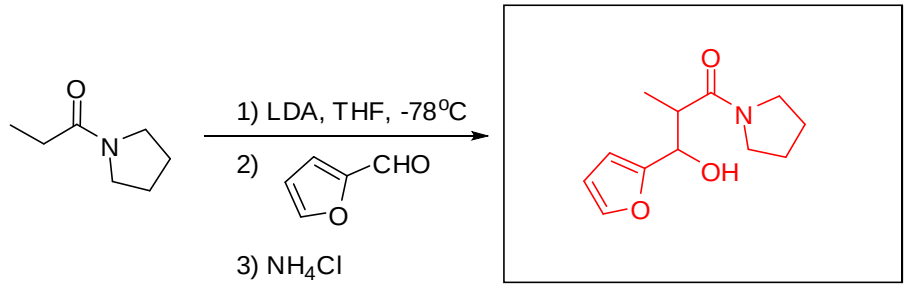
a)



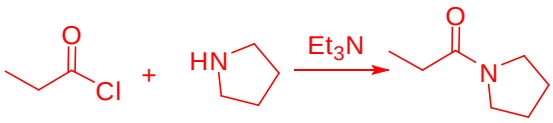
b)



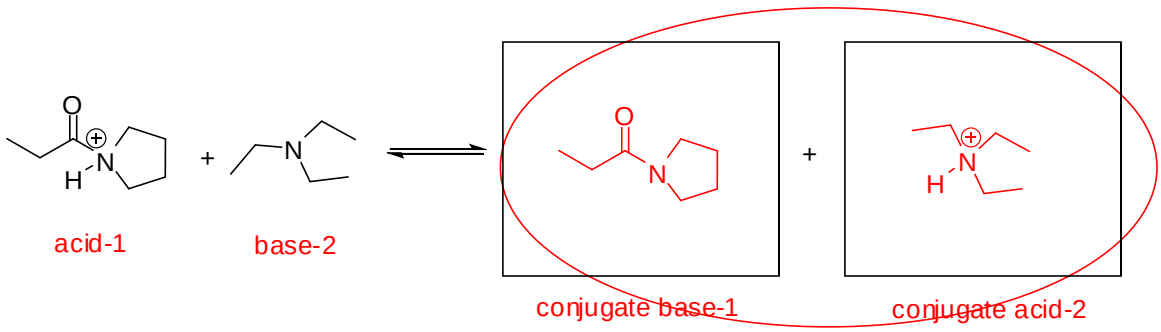
c)



2. Show a reaction to synthesize the amide starting material of question 1 c from any starting materials in one step.



3. a) Complete the acid-base equilibrium below by providing the products. Note that this equilibrium could be a step in the mechanism to form the amide in question 2 and 1 c.



a) Identify the two conjugate acid-base pairs in the equilibrium shown by writing 'acid-1' and 'base-2' under the appropriate groups in the starting materials and then 'conjugate base-1' and 'conjugate acid-2' under the appropriate compounds in the products.

b) Circle the side of the equilibrium that you believe will be favored.

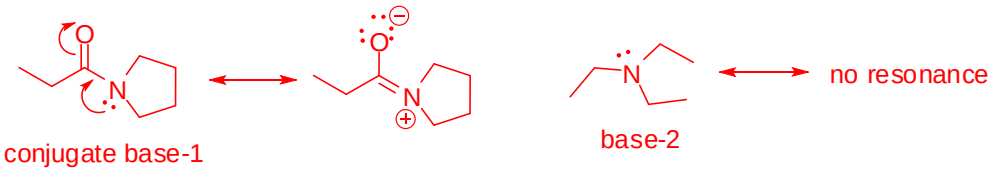
c) Briefly explain why you think the circled side is favored. Your explanation should use fundamental structural principles that we have discussed this semester to explain differences in stability of particular compounds. There are two sound reasons that can be advanced.

Reason 1 focused on stability differences of the acids:

Acid-1 has a carbonyl group bonded to an N with a +1 formal charge. This electron withdrawing group will make the electron deficient N worse. Consequently, acid-1 will be a strong acid looking to donate its proton. Conjugate acid-2 has no carbonyl group and instead has an additional alkyl group which is electron releasing, so it will actually stabilize the positively charged N. Therefore conjugate acid-2 should be a weaker acid.

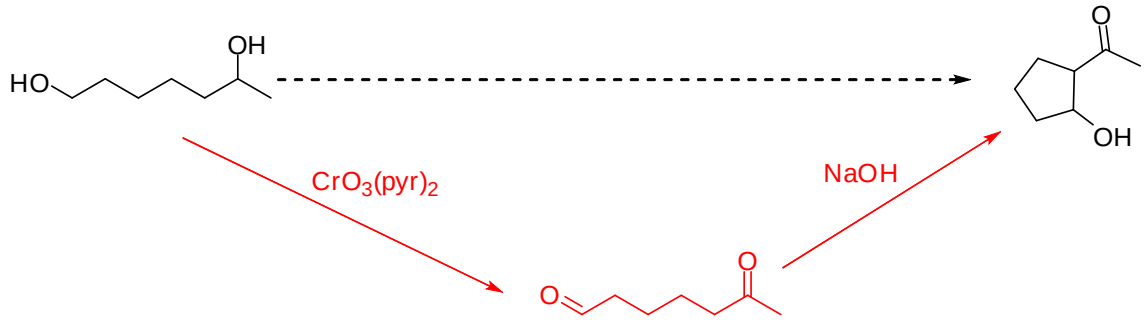
Reason 2 focused on stability differences of the bases:

The electrons of conjugate base-1 will be resonance stabilized by the electron withdrawing carbonyl group and therefore conjugate base-1 will be a weaker base. No such resonance exists for base-2, so it will be a stronger base.



4. Complete the following syntheses by converting the starting material on the left to the product on the right. You may use any organic or inorganic reagent. All transformations can be conducted in three steps or less.

a)



b)