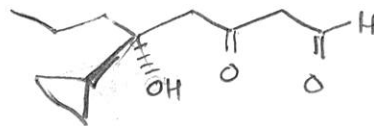
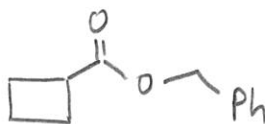


1. Draw the structure of the following compounds (don't forget stereochemistry). (30 points)

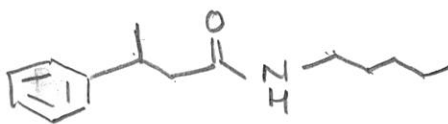
a. (R)-5-cyclopropyl-5-hydroxy-3-oxooctanal



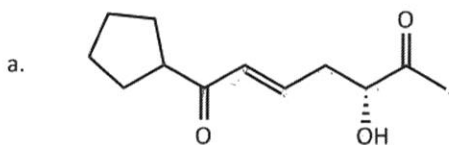
b. benzyl cyclobutanecarboxylate



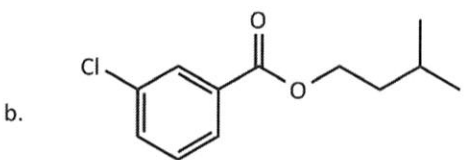
c. N-pentyl-3-phenylbutanamide



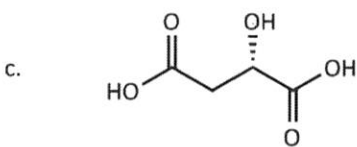
2. Provide IUPAC names for the following compounds (don't forget stereochemistry where appropriate). (30 points)



(2R,5S)-
1-cyclopentyl-
5-hydroxyhept-2-ene-1,6-dione

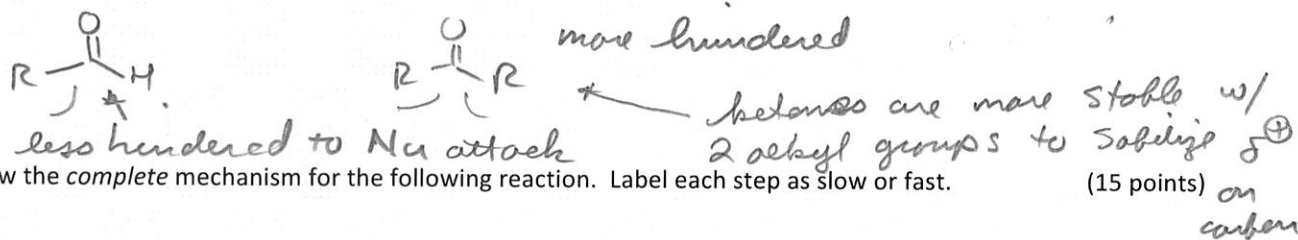


3-methylbutyl 3-chlorobenzoate

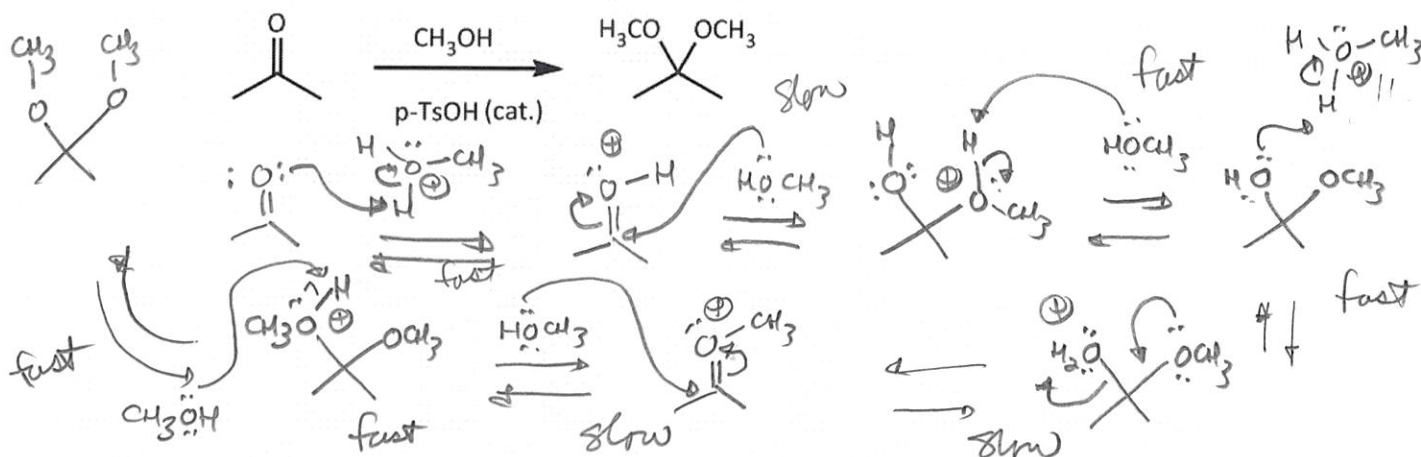


(S)-2-hydroxybutanedioic acid
(S)-malic acid
from apples!

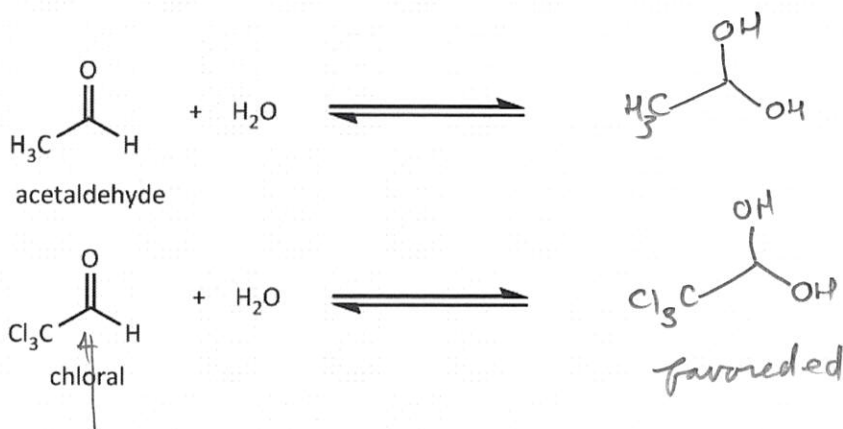
3. Which carbonyl group is more reactive toward nucleophilic attack, aldehydes or ketones? Explain. (10 points)



4. Show the complete mechanism for the following reaction. Label each step as slow or fast. (15 points)

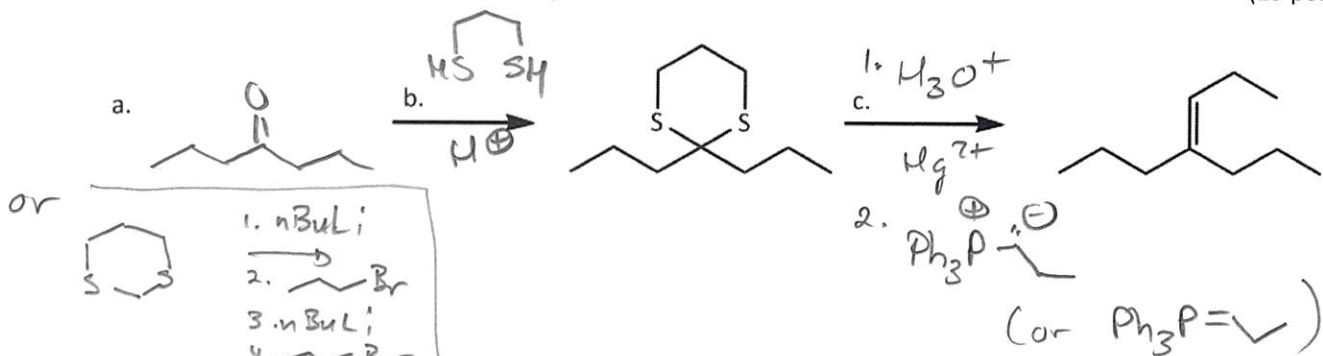


5. Show the hydrates from each aldehyde. Which equilibrium reaction is expected to favor the product more. Explain. (10 points)

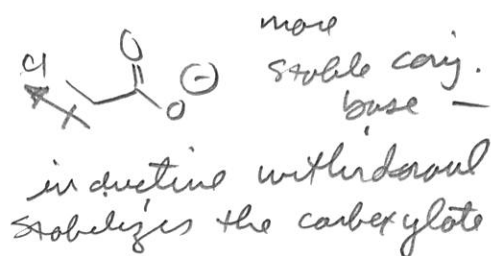
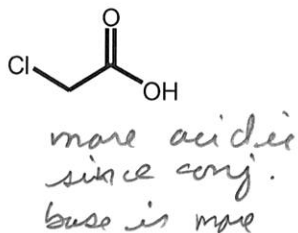
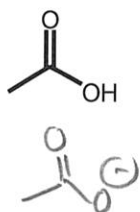


this carbonyl is more reactive than in acetaldehyde - due to inductive withdrawal by the CCl_3 group - destabilizes δ^+ of carbon

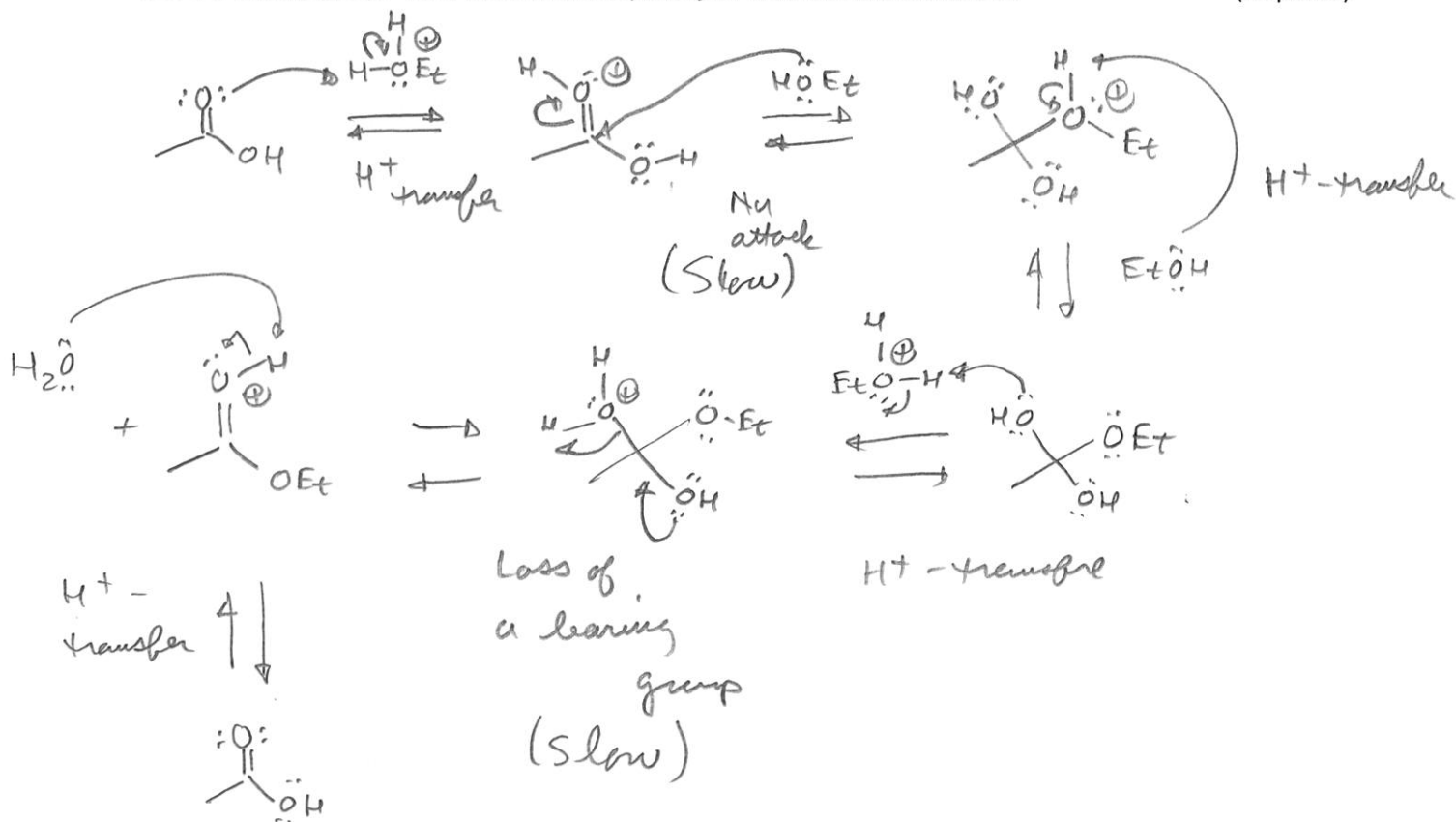
6. Suggest starting materials in a. and reagents and conditions for b. and c. (15 points)



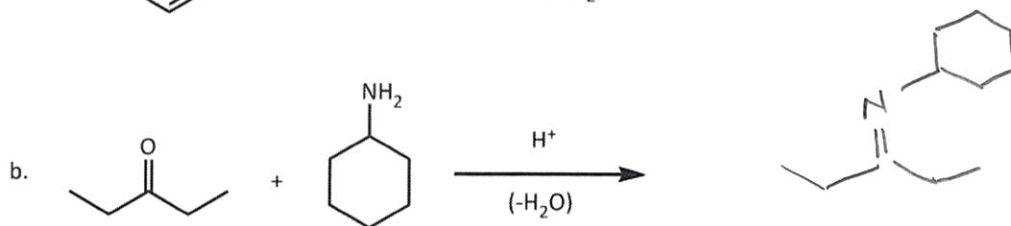
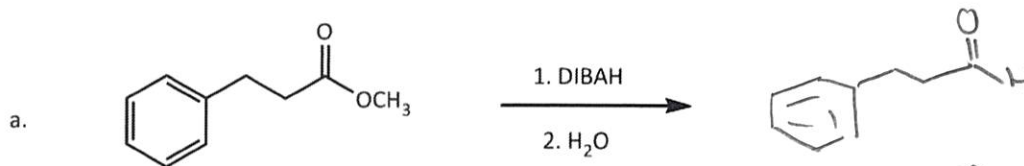
7. Which carboxylic acid shown below is more acidic? Clearly explain why. (10 points)



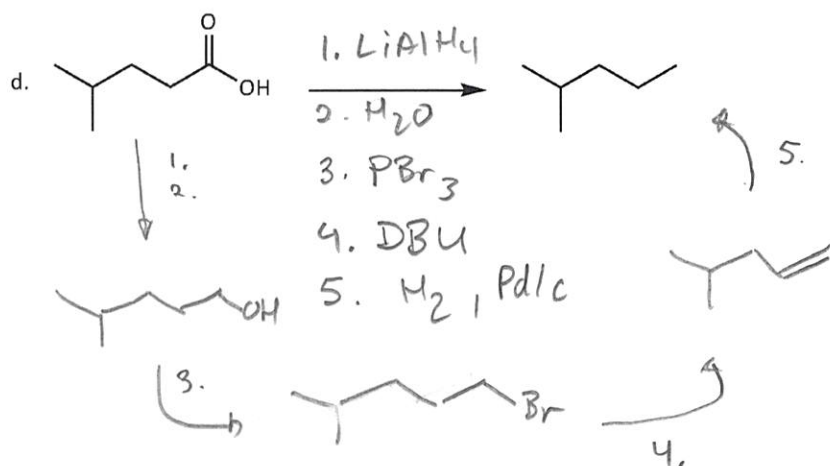
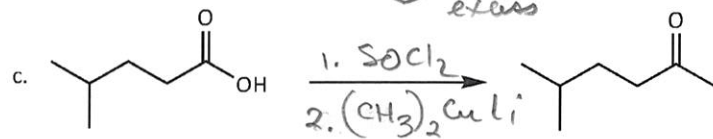
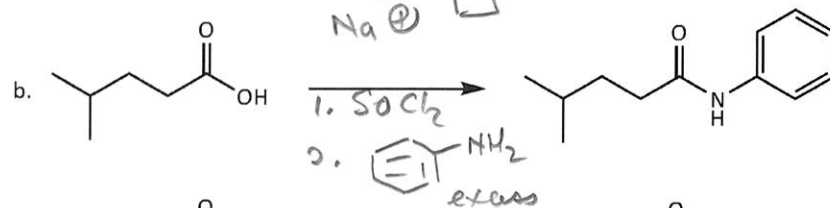
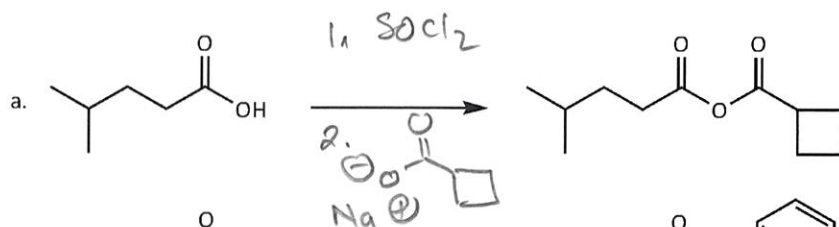
8. Show the complete mechanism of the Fischer esterification of acetic acid with ethanol (using a catalytic amount of H_2SO_4). For each step of the reaction, indicate whether the step is a proton transfer, nucleophilic attack, or loss of a leaving group. Also, show which steps are fast and which ones are slow. (20 points)



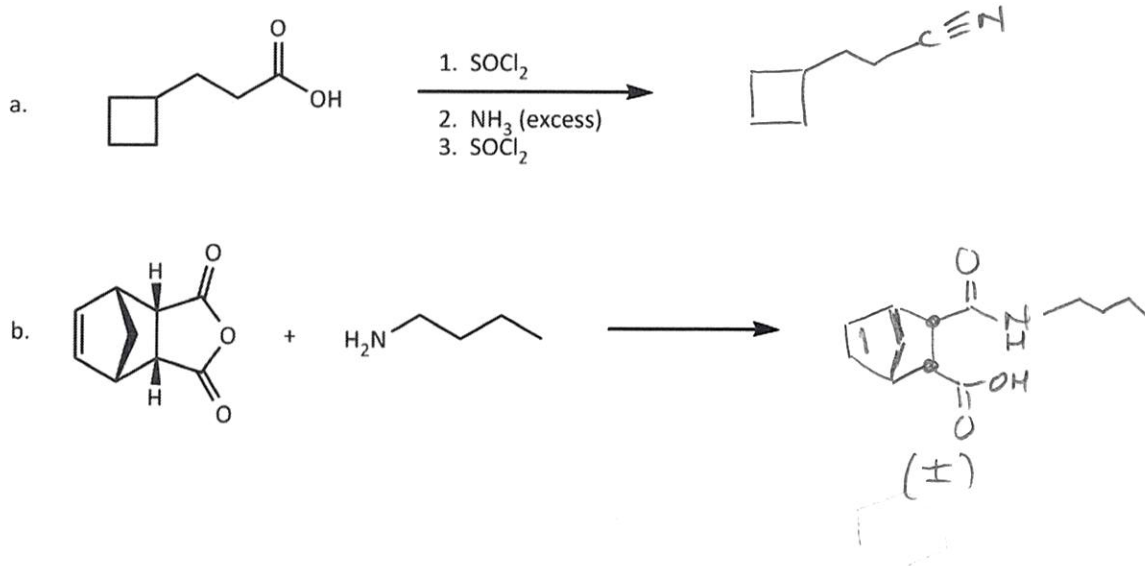
9. Show the product (or products) produced from the following synthetic transformations. (20 points)



10. Show the reagents required to accomplish the following conversions. More than one step may be required. (40 points)



11. Show the product (or products) from each reaction shown below. (20 points)



12. Each of the following products comes from a ketone or aldehyde. Show the starting ketone or aldehyde and any other compounds or reagents needed to complete the transformation. (30 points)

