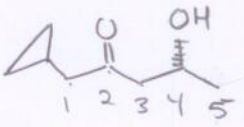
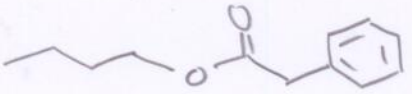
Key

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

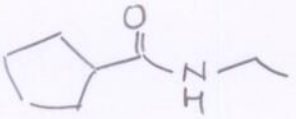
a. (*R*)-1-cyclopropyl-4-hydroxy-2-pentanone



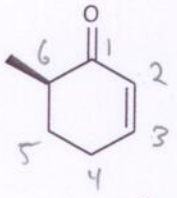
b. butyl phenylacetate



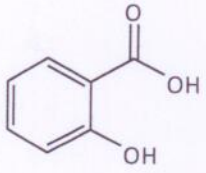
c. *N*-propylcyclopentanecarboxamide



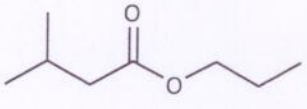
2. Provide IUPAC (not common) names for the following compounds (don't forget stereochemistry where appropriate). (30 points)

a. 

(R)-6-methyl cyclohex-2-enone

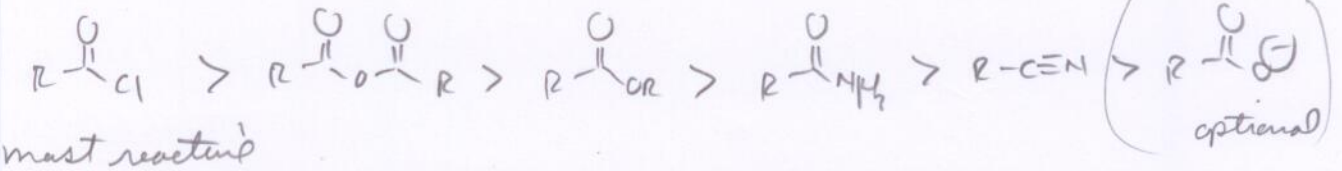
b. 

2-hydroxy benzoic acid

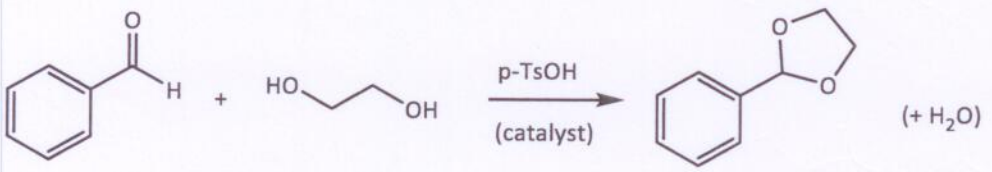
c. 

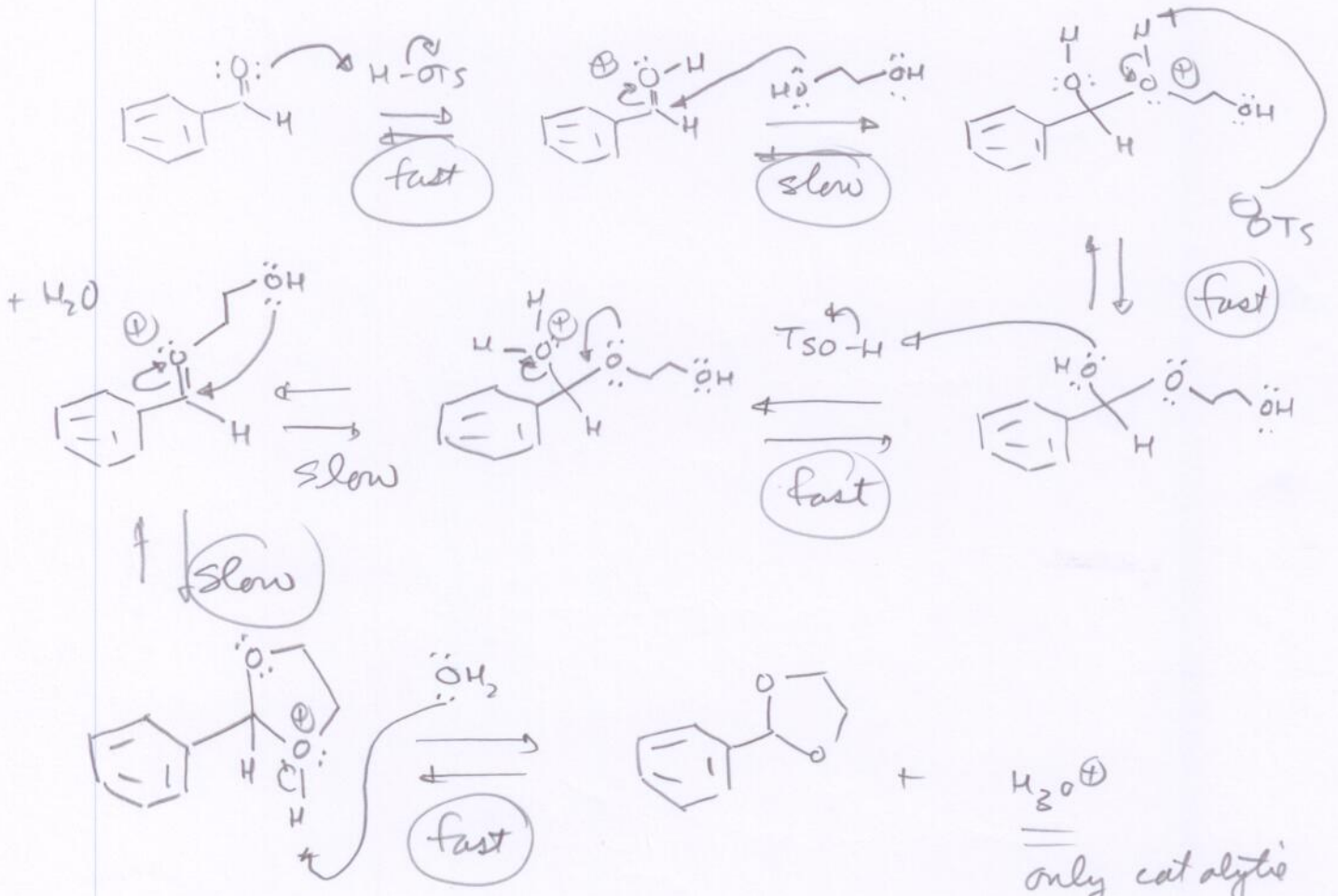
propyl 3-methyl butanoate

3. Show the order or reactivity of the carboxylic acid derivative from most reactive to least reactive toward nucleophilic attack. (10 points)

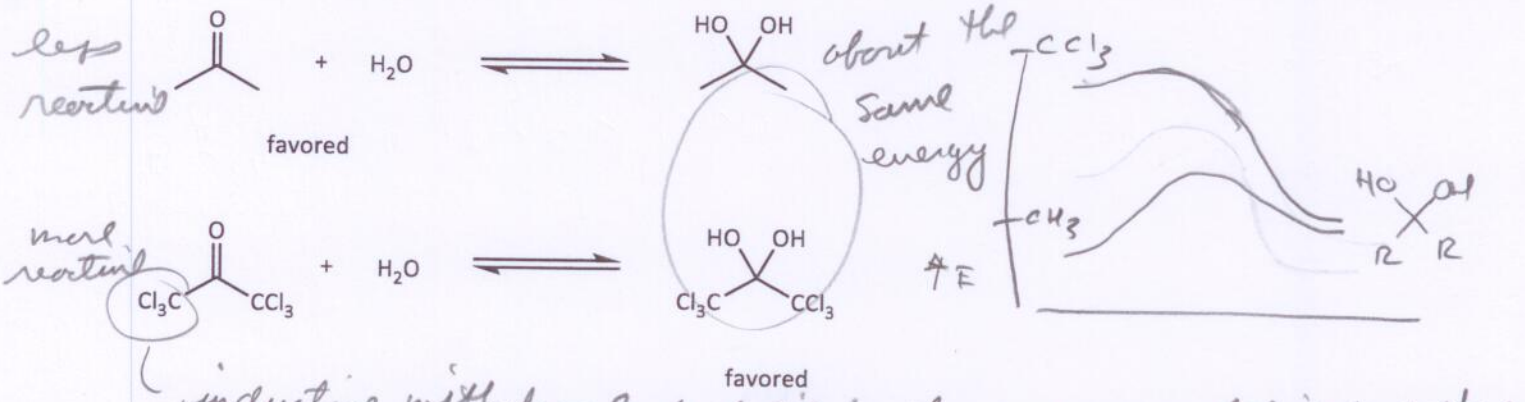


4. Show the *complete* mechanism for the following reaction. Label each step as slow or fast. (15 points)

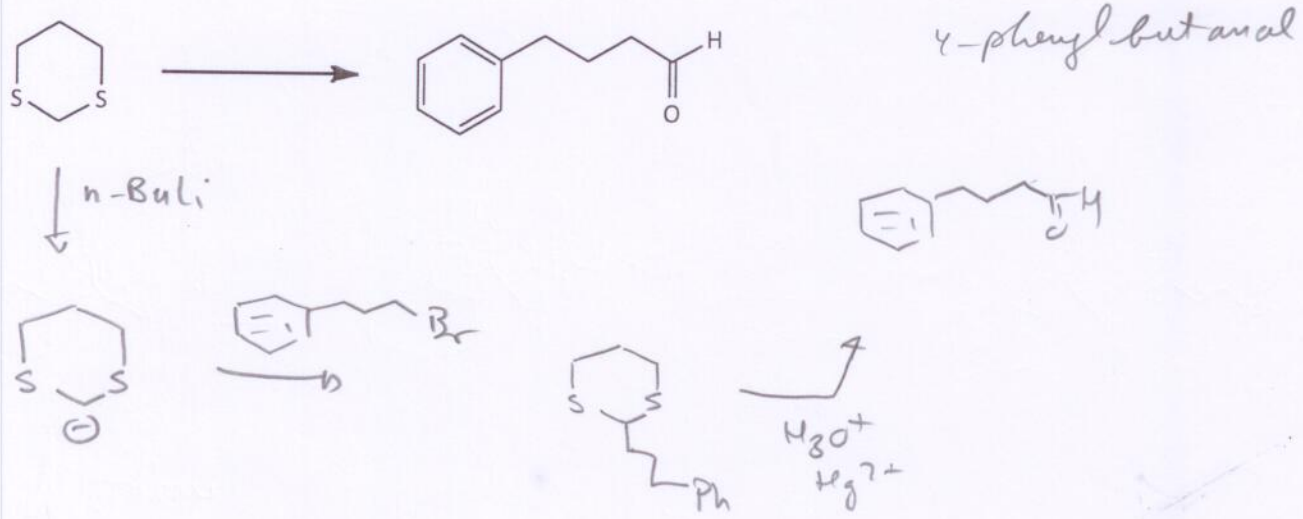




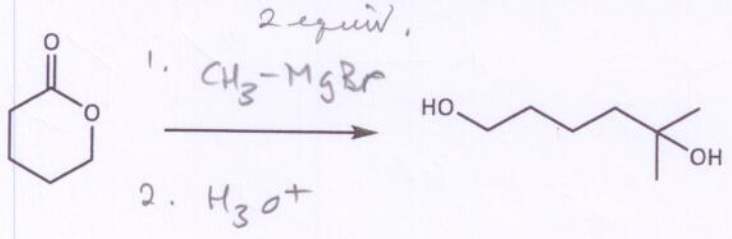
5. Explain why the top equilibrium favors the reactants and the bottom one favors the product. (In fact the product from the bottom equilibrium is a solid and can be purchased from Aldrich). (10 points)



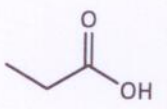
6. Show how to convert 1,3-dithiane to the product shown – show all intermediates. Also, provide an IUPAC name for the product. (15 points)



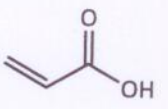
7. Suggest reagents to accomplish the following transformation. (10 points)



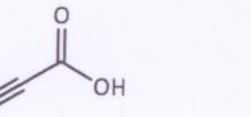
8. Explain the trend in acidity for the carboxylic acids shown below. (10 points)



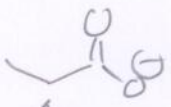
$pK_a = 4.8$



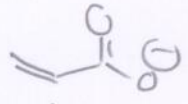
$pK_a = 4.1$



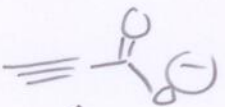
$pK_a = 2.1$



sp^3



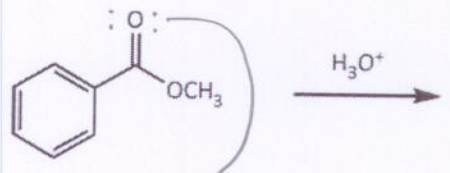
sp^2

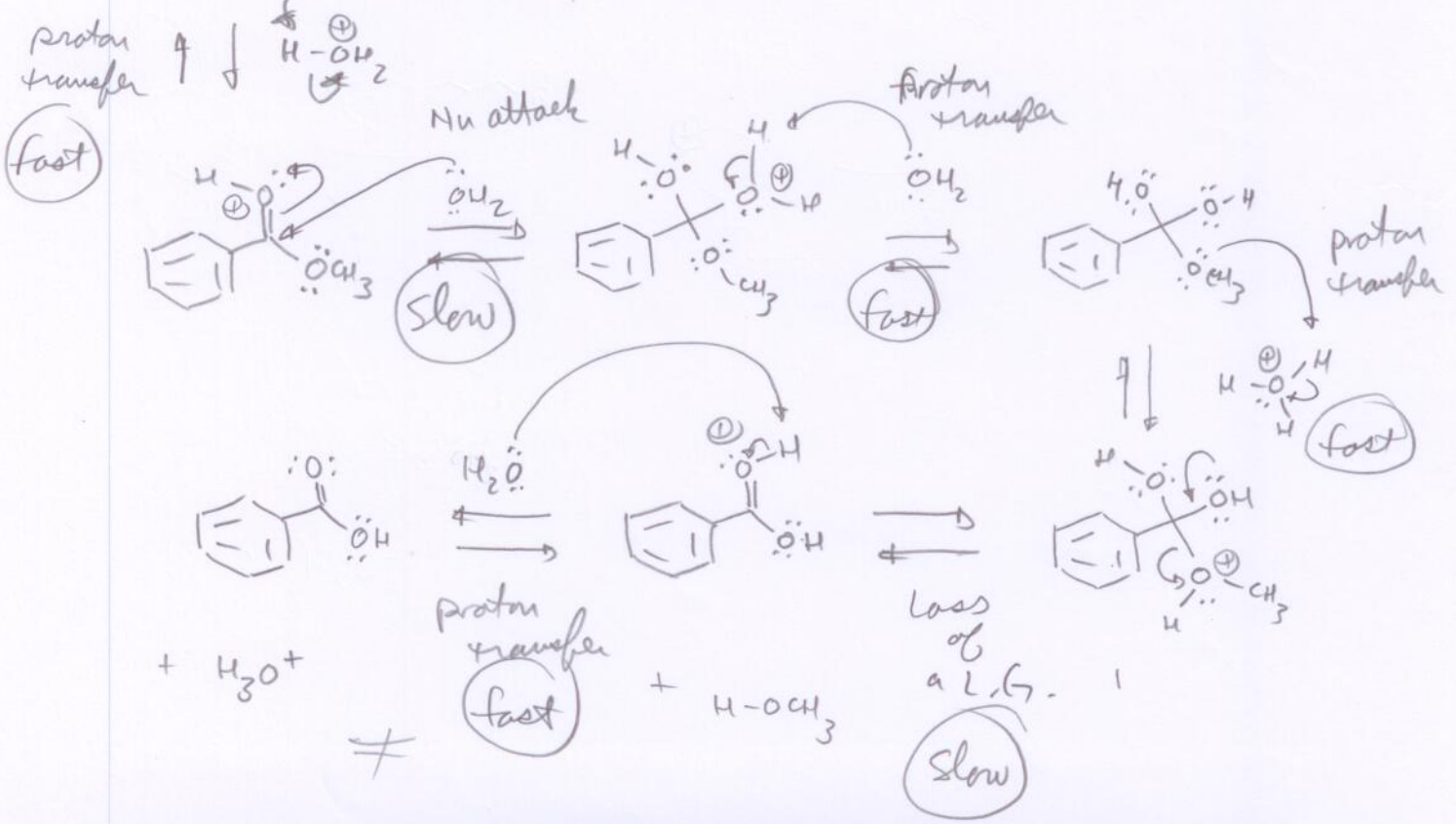


sp

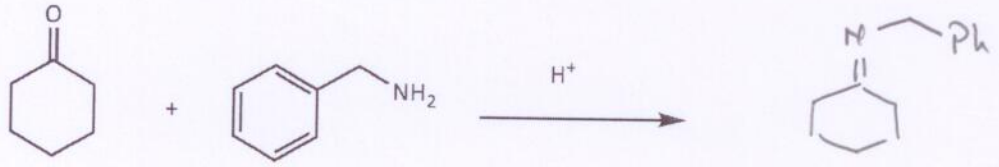
Hybridization change is toward more s-character which in turn stabilizes the carboxylate + conjugation w/ π system also stabilizes carboxylate

9. Show the *complete* mechanism of the acid-catalyzed hydrolysis of methyl benzoate, shown below. 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*. (40 points)



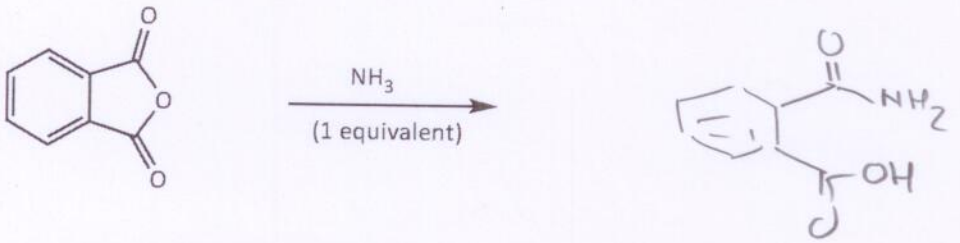


10. Show the product (or products) produced from the following synthetic transformations. (20 points)

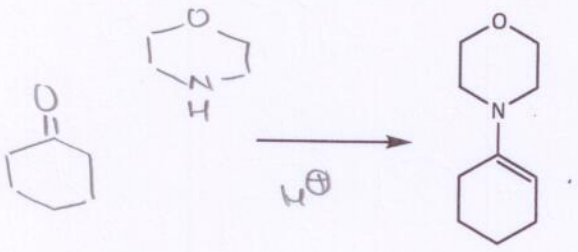
a. 

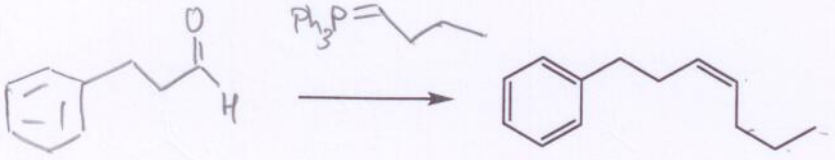
b. 

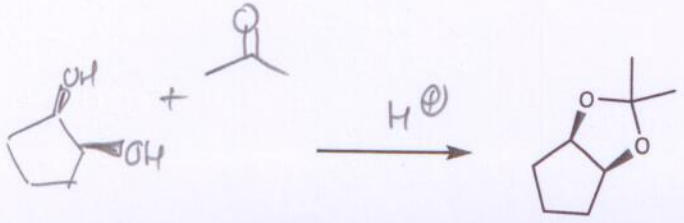
c. 

d. 

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

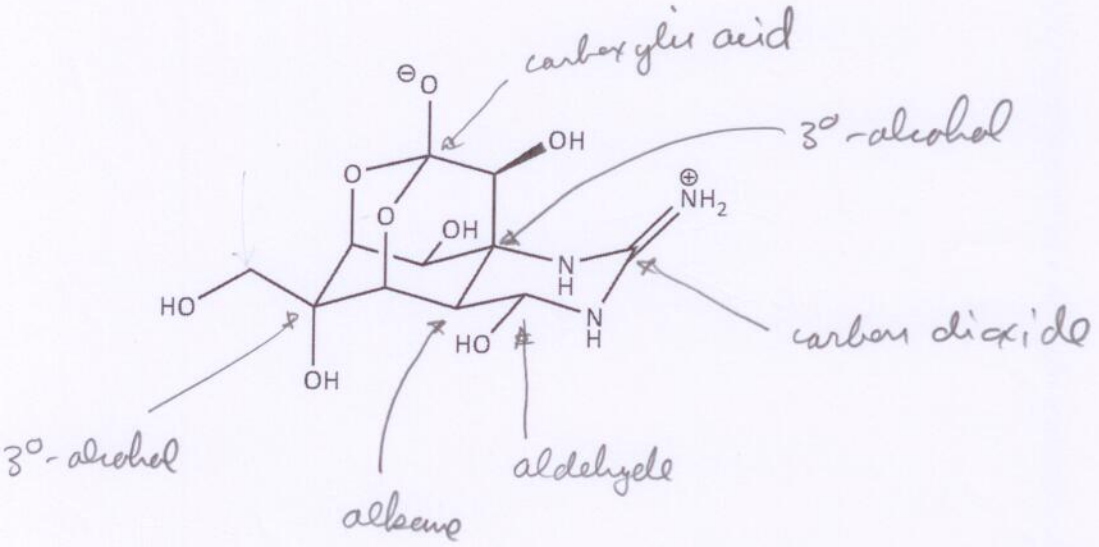
a. 

b. 

c. 

12. Tetrodotoxin (shown below) is one of the most toxic substances known to man. It is found in a variety of bacteria, and a diverse array of animals, which include the pufferfish, flatworms, certain crabs, and even the red-bellied newt, *Taricha rivularis* (found in Northern California). The molecule's dense structure happens to contain every possible oxidation state for carbon. Although they may be in "disguise," locate and identify the carbons that are in the following oxidation states: (20 points)

alkane
tertiary alcohol
aldehyde
carboxylic acid
carbon dioxide (carbonic acid)



(Plenty of other carbons, but are either 1° or 2° alcohol variety)