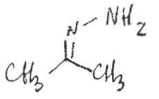
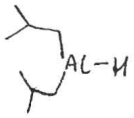
Practice Exam #3

I. General Knowledge (38 pts)

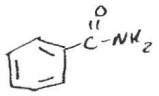
1. (9 pts) Give the structures of the molecules written below and provide the names of any structures shown.



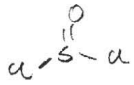
hydrazone of acetone



DIBAL-H

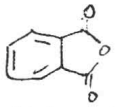


benzamide

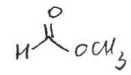


thionyl chloride

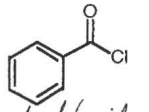
ethylene glycol



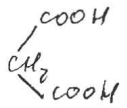
phthalic anhydride



methyl formate



benzoyl chloride

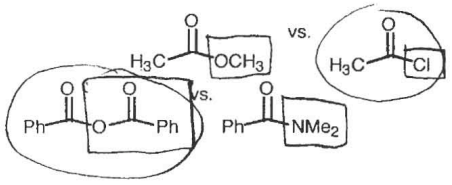


malonic acid

2. (6 pts) Circle the π electron donating groups and underline the π electron withdrawing groups listed below.

CF_3 -Cl $-NO_2$ $-NH_2$ $-CH_2CO_2H$ $-OC(O)CH_3$ -

3. (4 pts) For each pair of molecules, circle the structure which is most reactive toward *nucleophilic acyl substitution*. Box-in the leaving group in each of the four compounds.



4. (3 pts) Circle the strongest and box-in the weakest acid.

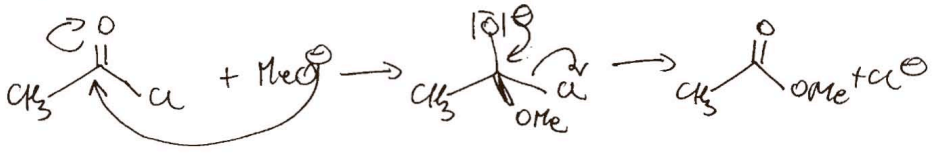
CH_3CH_2COOH FCH_2COOH CH_3COOH

5. (4 pts) True or False. **Read the questions carefully**. (Circle **T** or **F**)

i. Protonation of a carbonyl group increases its reactivity toward nucleophiles. (T) F

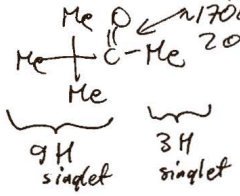
ii. $NaBH_4$ is a more potent reducing reagent than $LiAlH_4$. T (F)

6. (6 pts) One of the most common reactions of carboxylic acid derivatives is nucleophilic acyl substitution at the carbonyl group. Please write this reaction below for methoxide anion reaction with acetyl chloride and use e-pushing arrows for the nucleophilic addition step and the elimination step, showing also the intermediate formed.



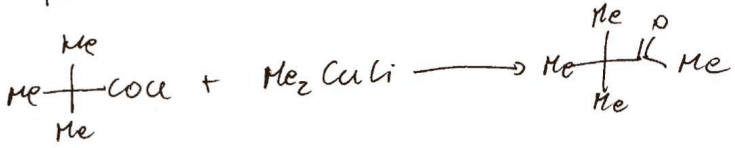
7. (6 pts) Reaction of an acid chloride (C_5H_9ClO) with lithium dimethylcuprate gives a product with the following spectroscopic properties: **IR** strong peak in 1710 - 1740 cm^{-1} range; **^{13}C NMR** (fully decoupled): δ (ppm) 206, 45, 29, 24; **^{1}H NMR**: δ (ppm) 2.1 (s, 3H), 1.1 (s, 9H) [s=singlet]
Write the structures of the acid chloride and the reaction product.

product :



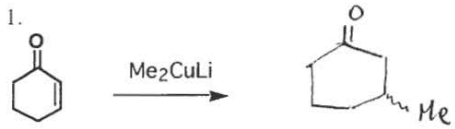
3 distinct aliphatic carbons.

RXN :

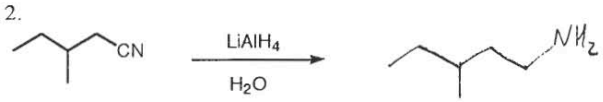


II. Reactions (32 pts total) Draw structures (including stereochemistry) of the expected organic products formed under the following reaction conditions and provide the names of the reactions where requested.

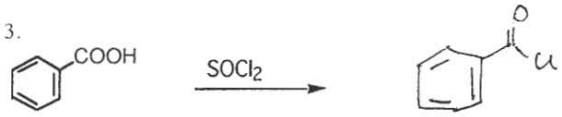
1.



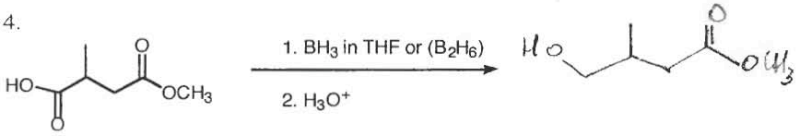
2.



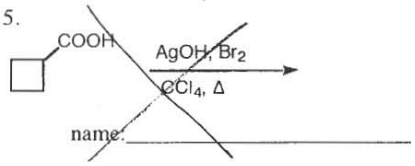
3.



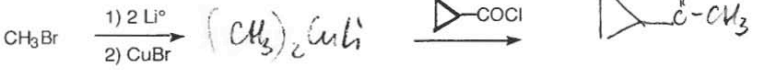
4.



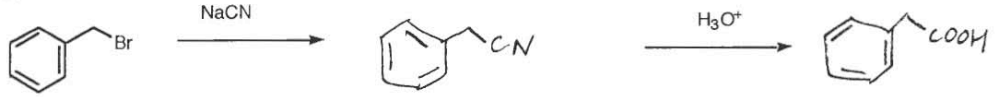
5.



6.

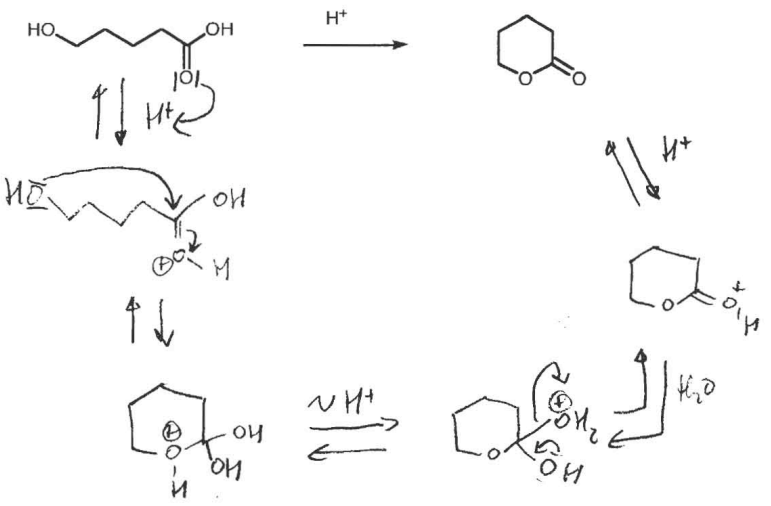


7.

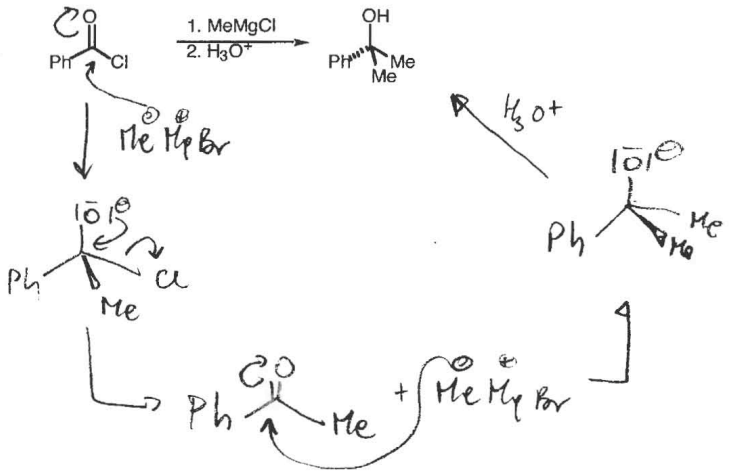


III. Mechanism (20 pts) Provide detailed mechanisms for the transfrmations given below, showing every step in the process clearly. Use electron pushing arrows whenever you wish (they are not required but may be helpful to you).

(a) (10 pts)

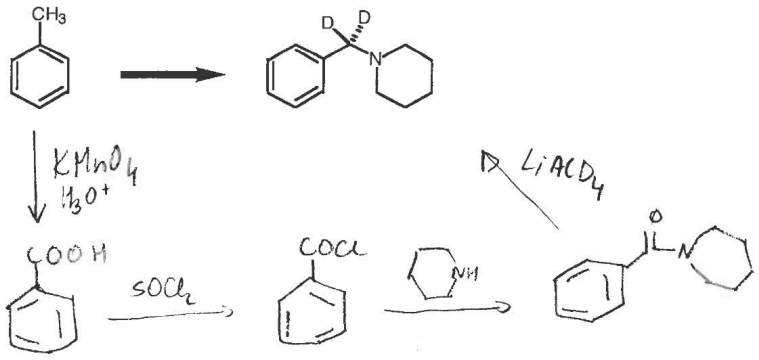


(b) (10 pts)



IV. Synthesis (15 pts) Provide a reaction sequence to accomplish ***one of the two*** following conversions (left to right) using any reagents needed to convert the carbons of the starting material into the product structure. Show reactants, products, and necessary reagents for each step in the sequence, but do not show mechanisms here. Partially correct answers will receive partial credit.

(1)



(2)