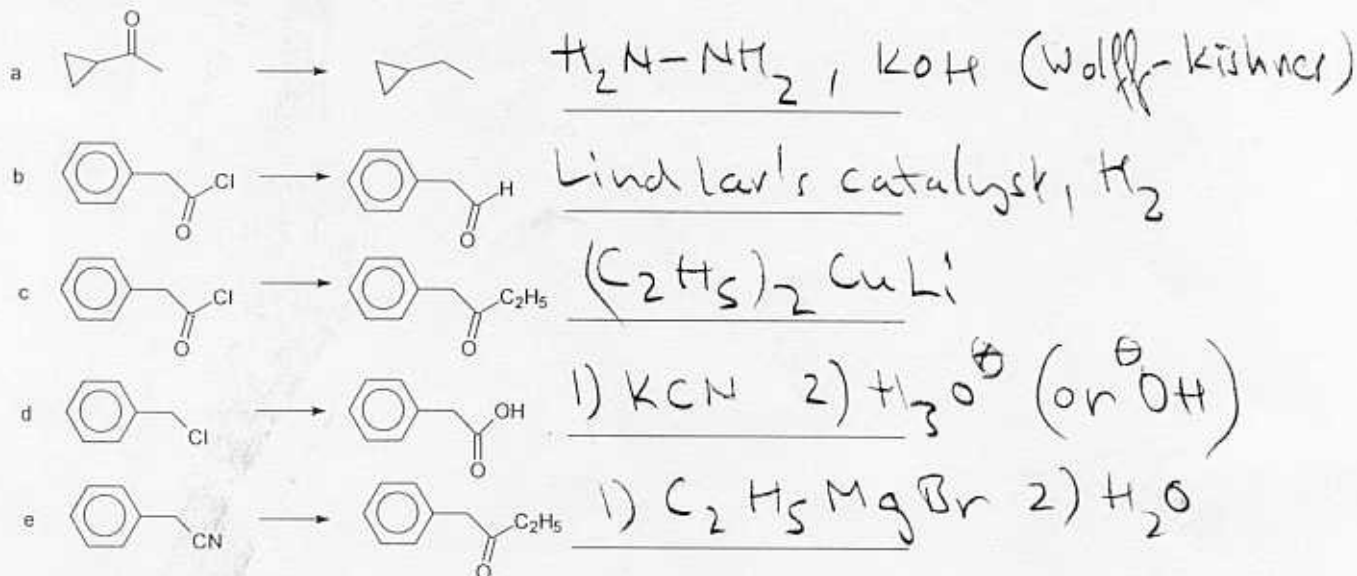
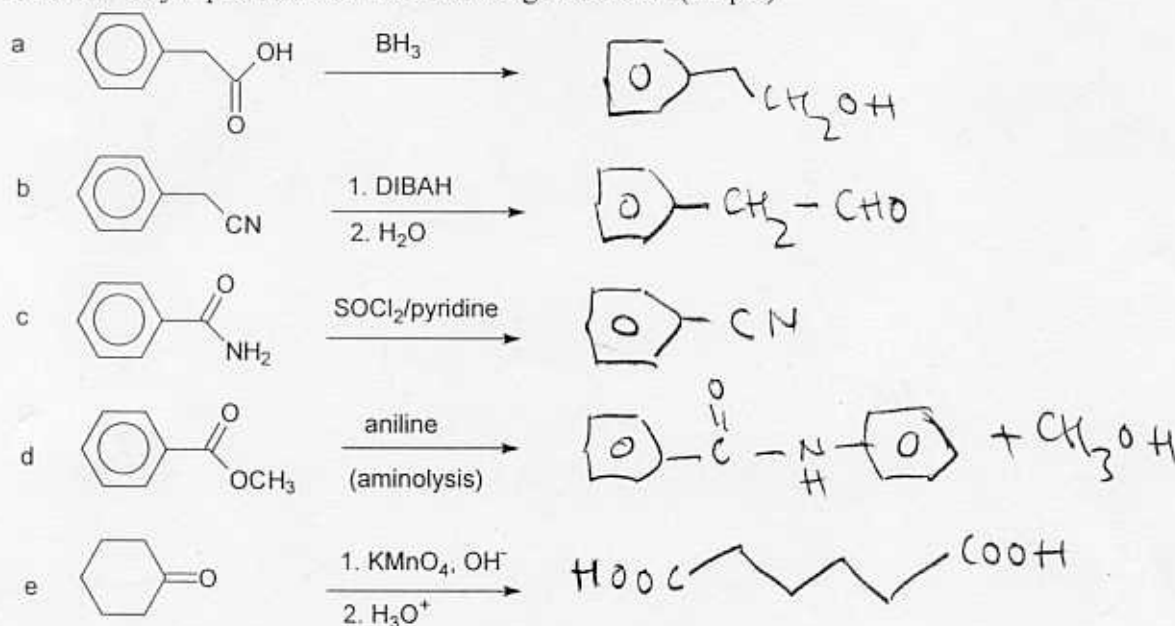


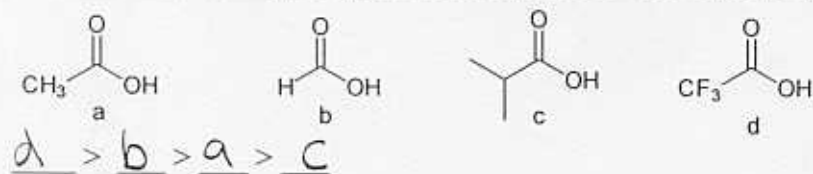
1. Suggest conditions/reagents for the following transformations. More than one step may be necessary in some cases. (10 pts)



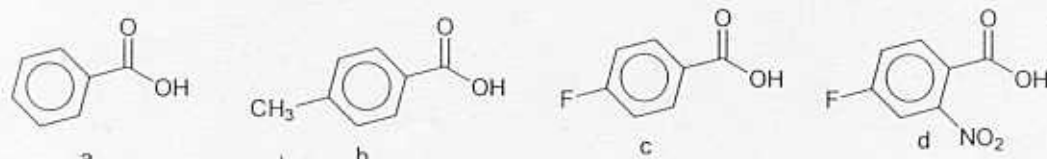
2. Show major products for the following reactions! (10 pts)



3. Rank the following compounds in order of DECREASING acidities, e.g. a > b > d > c. (4 pts)



4. Rank the following compounds in order of DECREASING acidities, e.g. $a > b > d > c$. (4 pts)



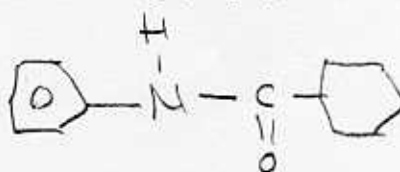
$d > c > a > b$

5. Rank the following carboxylic acid derivatives in order of DECREASING reactivity: acid amides, acid chlorides, esters, acid anhydrides, carboxylic acids (5 pts)

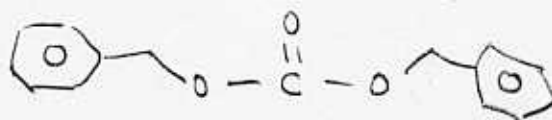
chlorides > anhydrides > acids > esters > amides

6. Draw valid structural representations of the following: (10 pts)

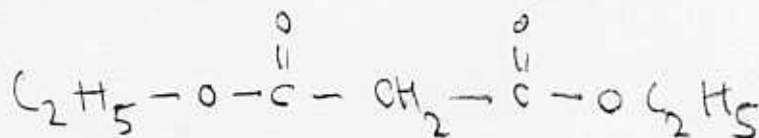
a. N-phenylcyclohexanecarboxamide



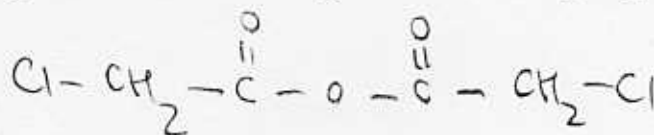
b. dibenzylcarbonate



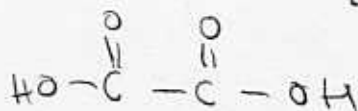
c. diethylmalonate



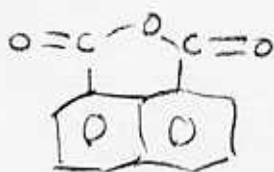
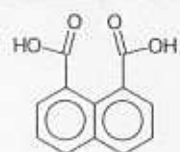
d. bis(chloroacetic) anhydride



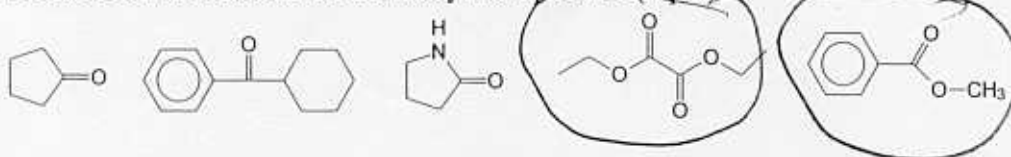
e. oxalic acid



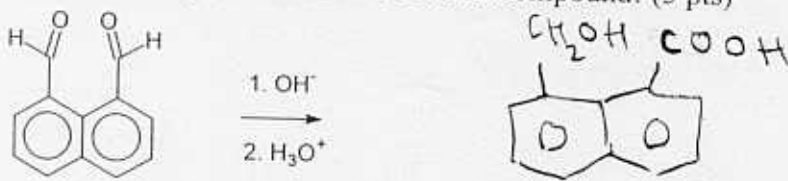
7. 1,8-Naphthalenedicarboxylic acid readily dehydrates to form an anhydride, $C_{12}H_6O_3$. Propose a structure for this compound! (5 pts)



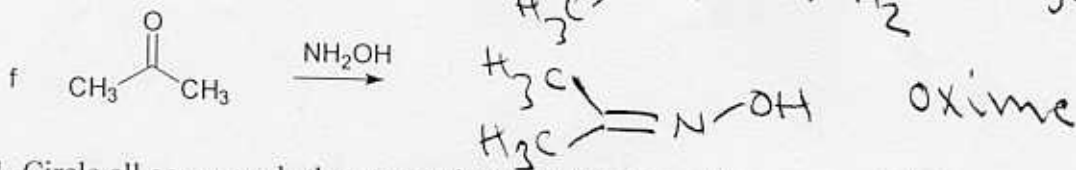
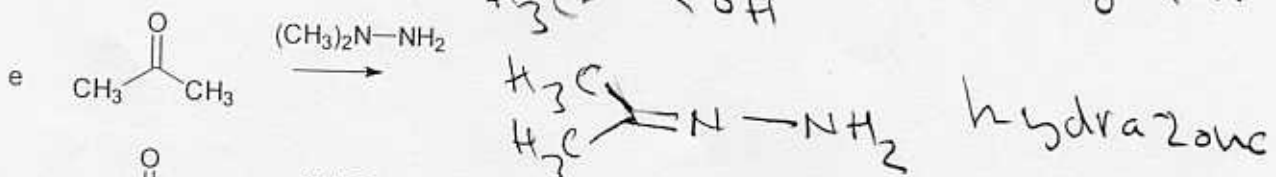
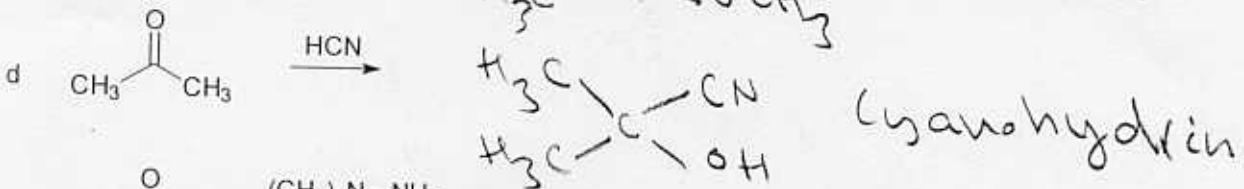
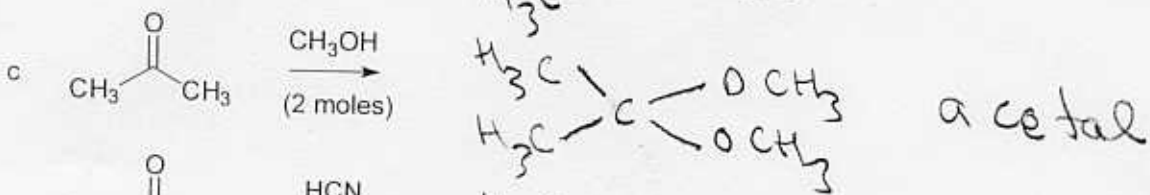
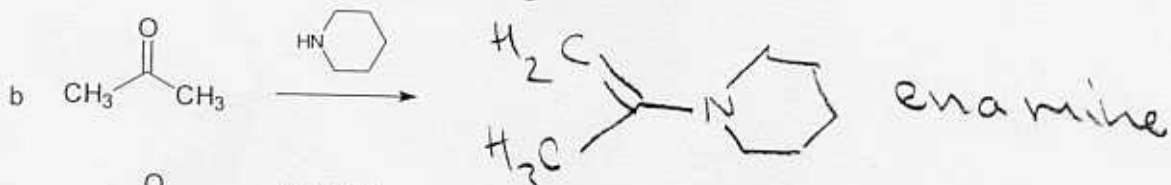
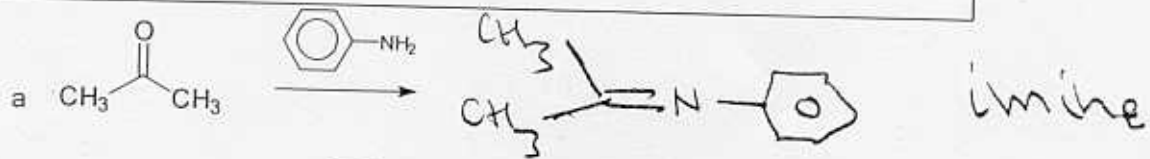
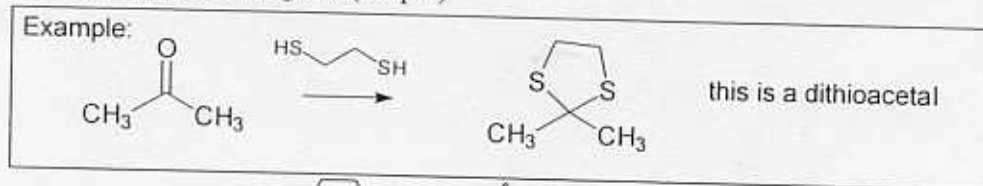
8. Circle all non-enolizable carbonyl compounds (5 pts)



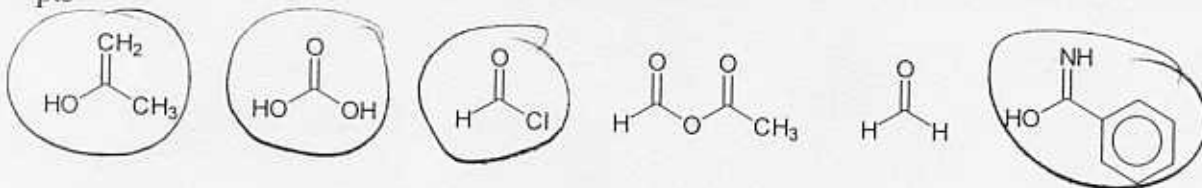
9. 1,8-Naphthalenedicarbaldehyde readily undergoes Cannizzaro disproportionation to form $C_{12}H_{10}O_3$. Propose a structure for this compound! (5 pts)



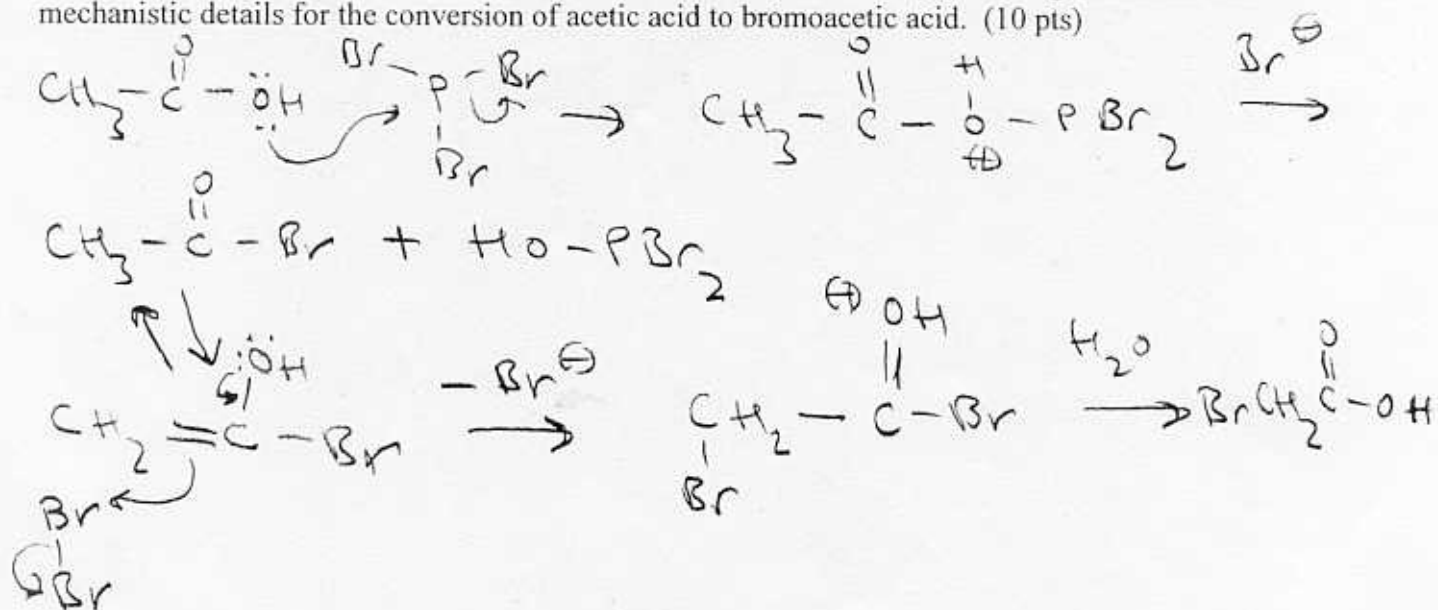
10. Acetone reacts with various nucleophiles. For each reaction, show a product and state the class of compound it belongs to (10 pts)



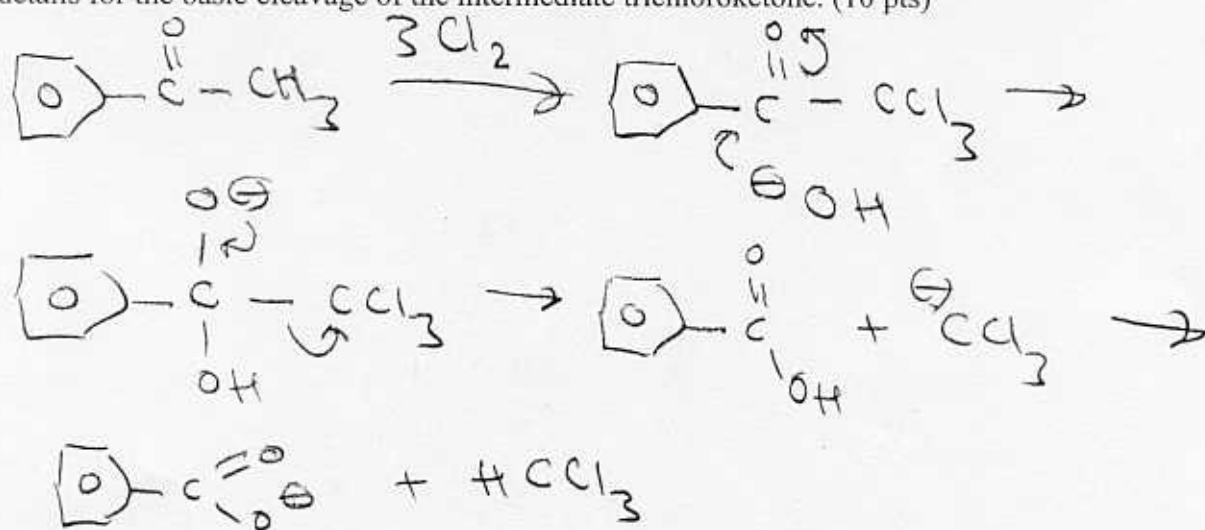
11. Circle all compounds that cannot be isolated because they are unstable (rearrange/decompose) 6 pts



12. Illustrate the mechanism of the Hell-Vollard- Zelinsky reaction by providing conditions and mechanistic details for the conversion of acetic acid to bromoacetic acid. (10 pts)



13. The treatment of acetophenone with chlorine and sodium hydroxide generates chloroform and sodium benzoate. Outline this synthesis by showing conditions/intermediates and mechanistic details for the basic cleavage of the intermediate trichloroketone. (10 pts)



14. Prolonged heating of the ester below generates methanol and a second product. Propose a structure for this product! (6 pts)

