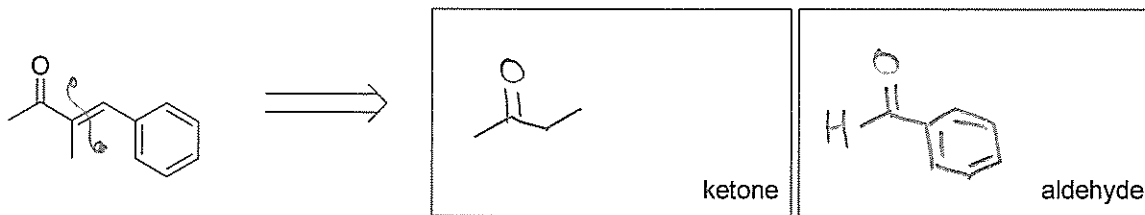
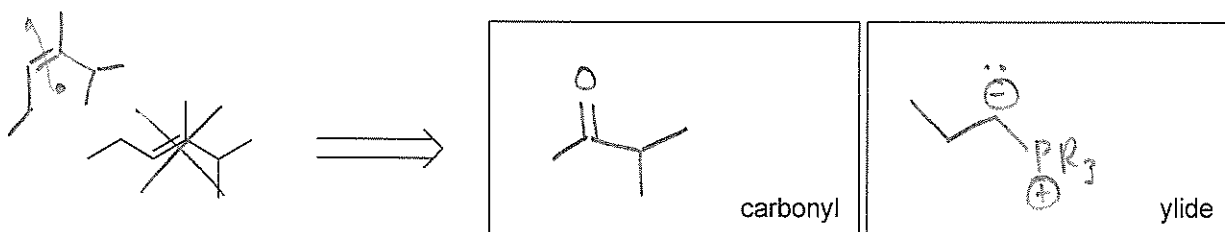


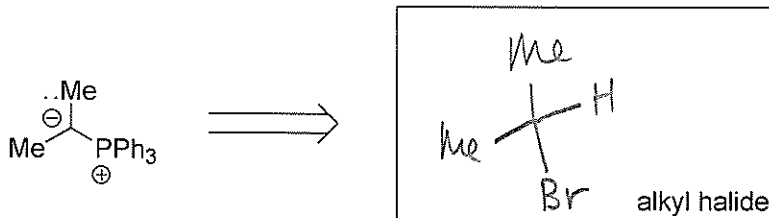
1a. Draw the structures of the ketone and aldehyde that would have formed the aldol condensation product shown (4 pts).



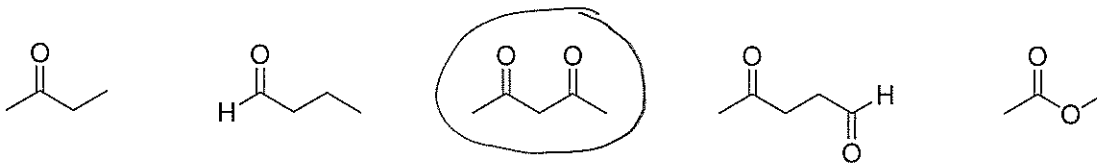
1b. Draw the structures of the carbonyl compound and the phosphorous ylide that would be combined to form the alkene product shown (4 pts).



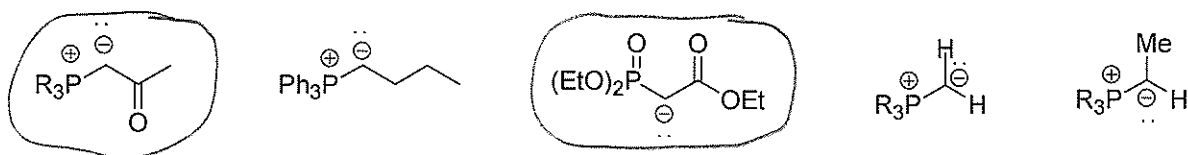
1c. Draw the structure of the alkyl halide that was used to make the ylide shown (2 pts)



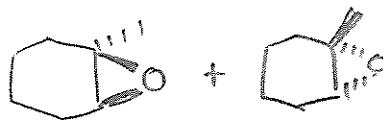
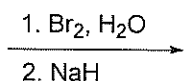
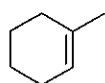
1d. Circle the most acidic carbonyl compound in the series shown (5 pts).



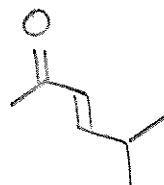
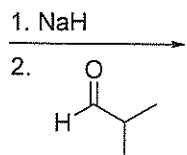
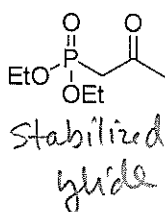
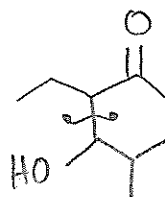
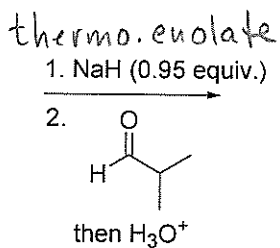
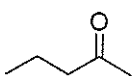
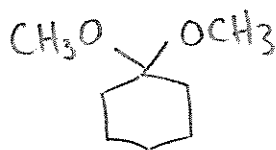
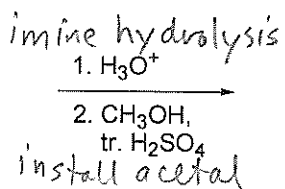
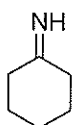
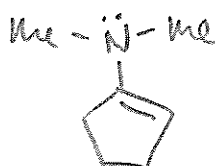
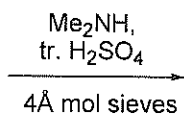
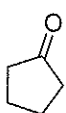
1e. Circle any and all of the following that are *stabilized ylides* (5 pts).



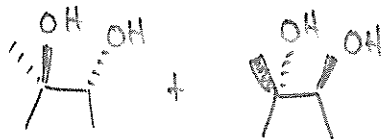
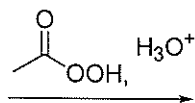
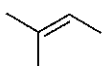
2) Predict the major organic product of each of the following reactions. Assume aqueous workup for all reactions. If a racemic mixture forms, draw only one enantiomer, and show correct stereochemistry using wedge and dash notation (30 pts).



either is fine

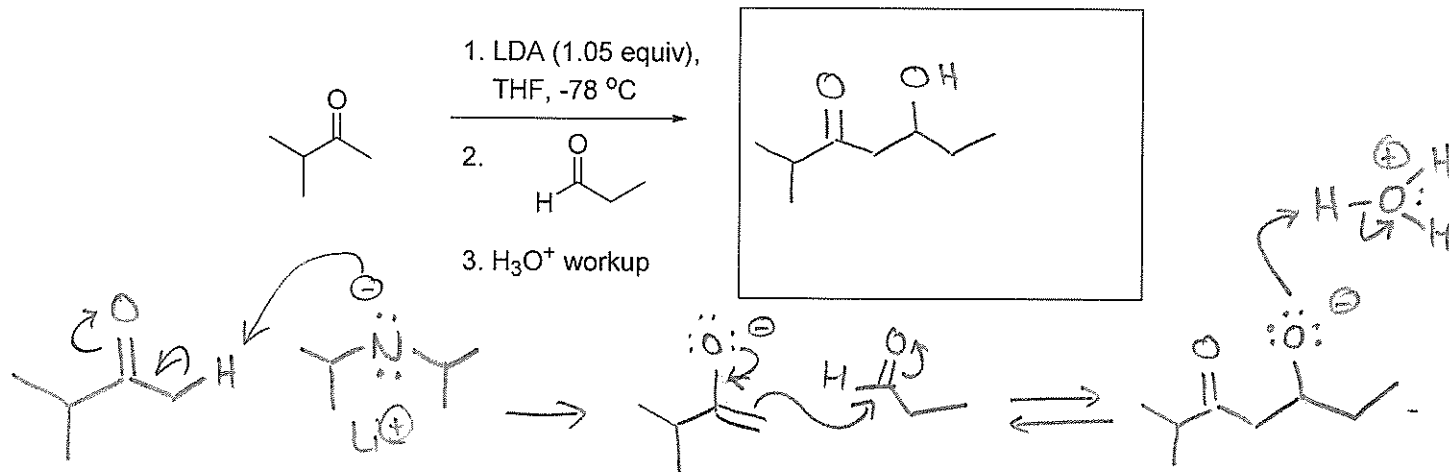


E alkene

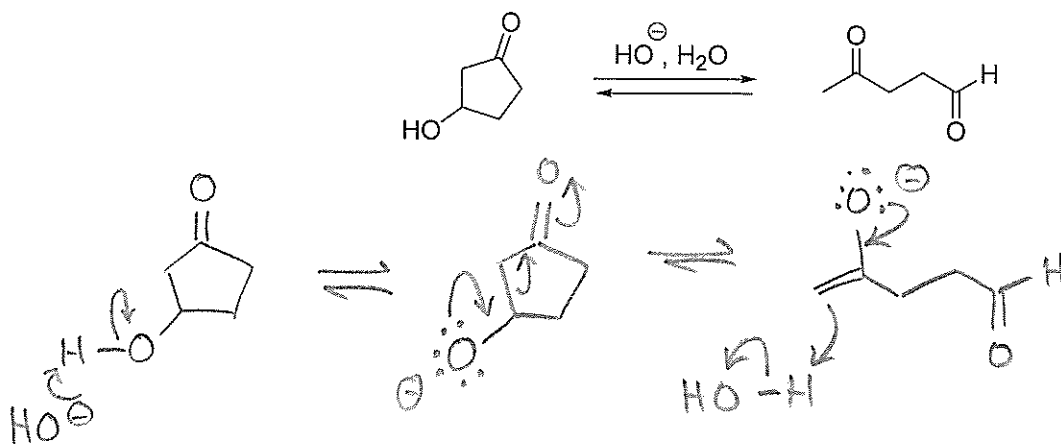


either is fine

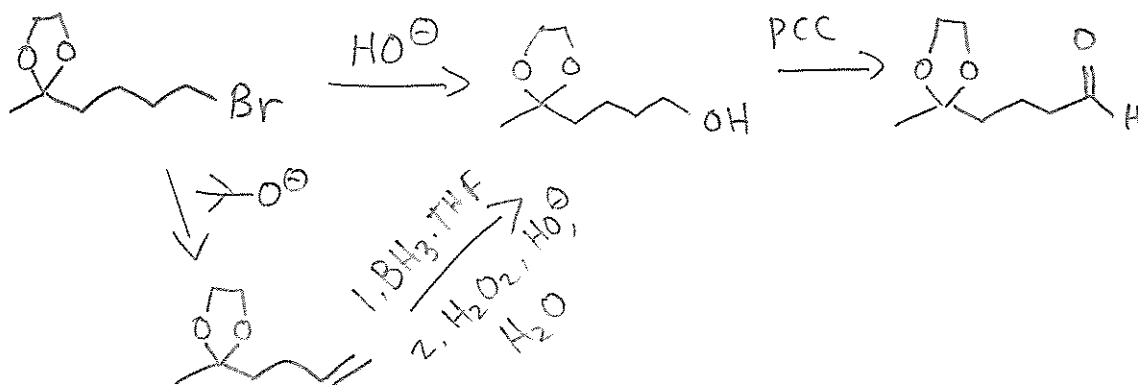
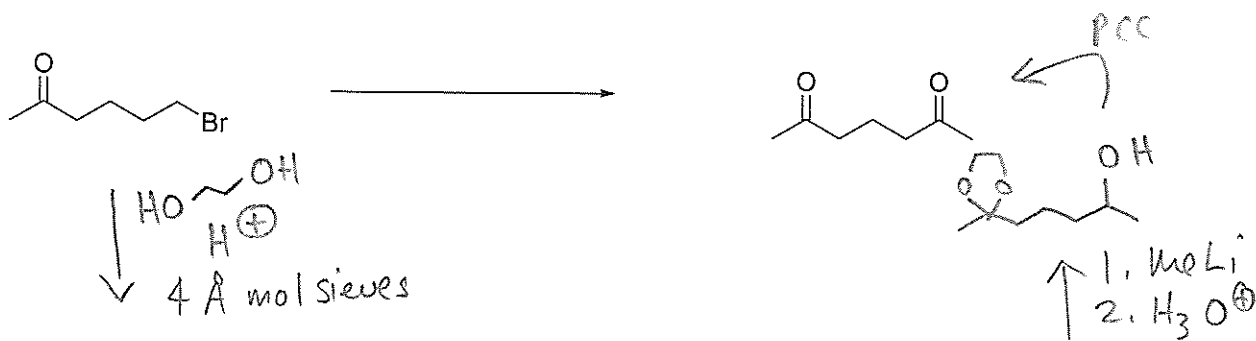
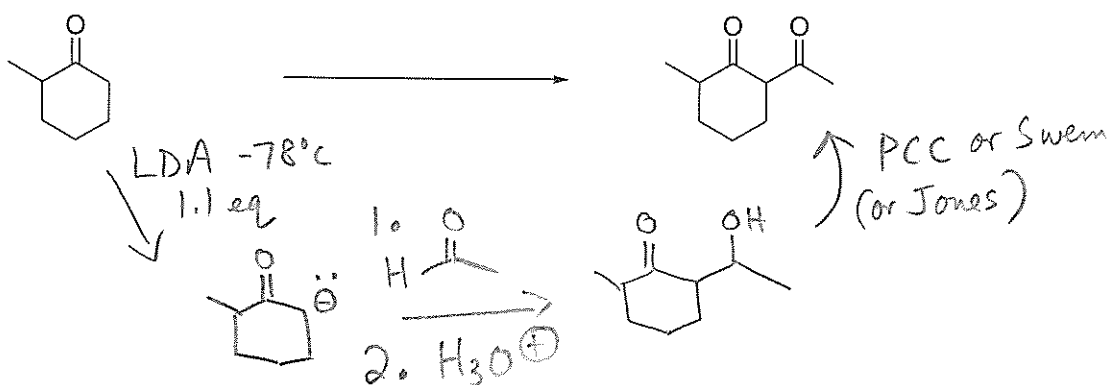
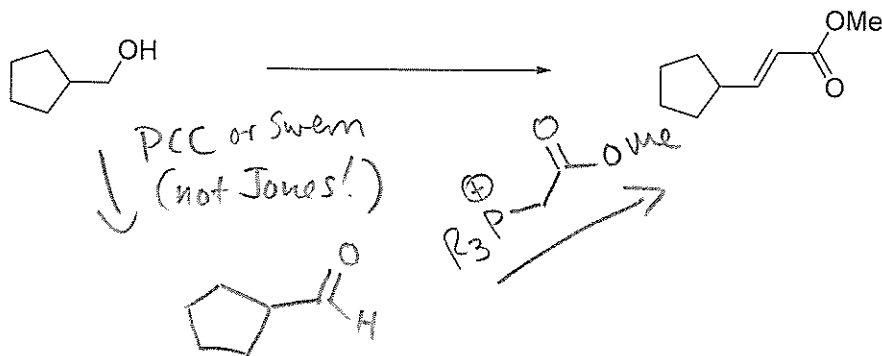
3a. Predict the major organic product of the following reaction sequence and draw it in the box provided. Then draw an arrow-pushing mechanism to show its formation. For full credit, include all curved arrows, necessary lone pairs and bonds, and non-zero formal charges. You may buy the structure of LDA from a T.A. for 2 points (10 pts).



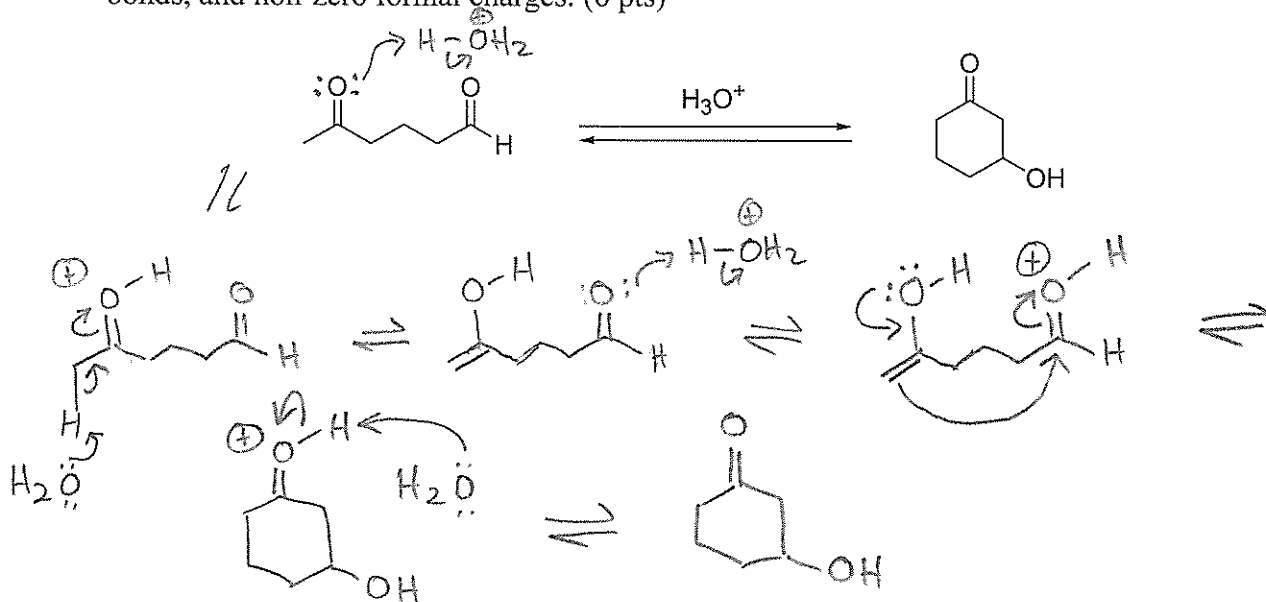
3b. Provide an arrow-pushing mechanism for the following transformation. For full credit, include all curved arrows, necessary lone pairs and bonds, and non-zero formal charges. (10 pts).



4. For each of the following, outline a synthesis of the target molecule from the indicated starting material and any organic or inorganic reagents. For full credit, show the reagents and the product of each step. Do not draw any mechanisms. (18 pts)



5a. We have seen aldol reactions performed under basic conditions, but they also may be carried out in aqueous acid where the pH of the solution is less than 5. Under these conditions, enolate ions do not form. Propose a mechanism for the acid-catalyzed aldol reaction shown below. For full credit, include all curved arrows, necessary lone pairs and bonds, and non-zero formal charges. (6 pts)



5b. Condensation reactions can take place with anions besides enolates. For example, cyclopentadiene is acidic enough to be deprotonated by an alkoxide base and then act as a nucleophile with a carbonyl compound to generate interesting and colorful compounds called *fulvenes*. Propose a mechanism for the condensation reaction shown below. For full credit, include all curved arrows, necessary lone pairs and bonds, and non-zero formal charges. (6 pts)

