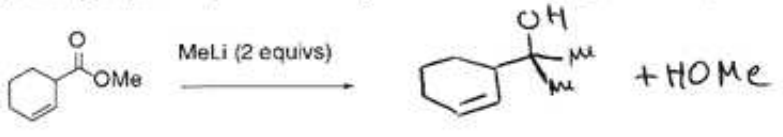
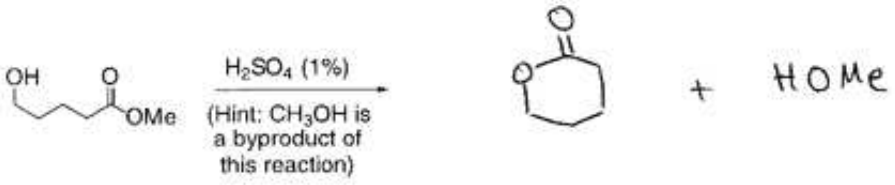
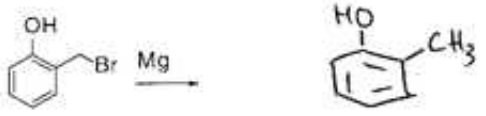
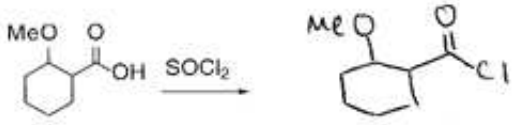
1) Provide the products of the following reactions. If no reaction would occur, write N.R. Where needed, there is an appropriate aqueous work up for each reaction (3 points each).

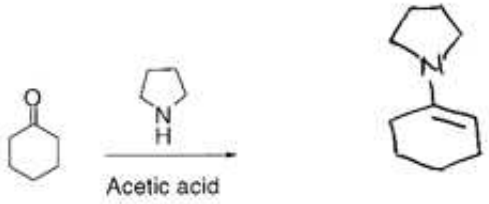
A) 

B) 

C) 

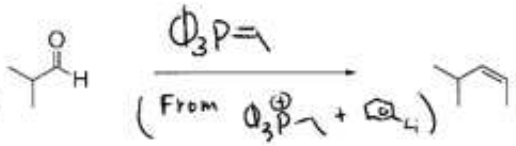
D) 

E) 

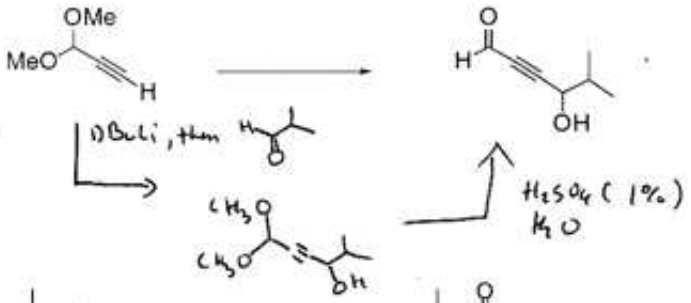
F) 

2) Complete the following syntheses using any organic or inorganic reagents you need. **If your synthesis requires more than one step, you must write the product of each step**. Show the number of equivalents of a reagent whenever more than one equivalent is used. All chiral products are racemic mixtures. (30 points total).

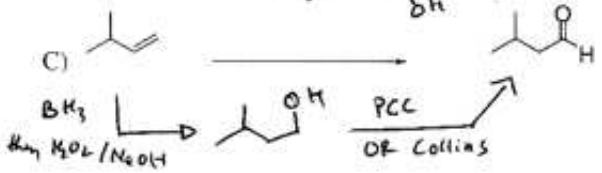
A)



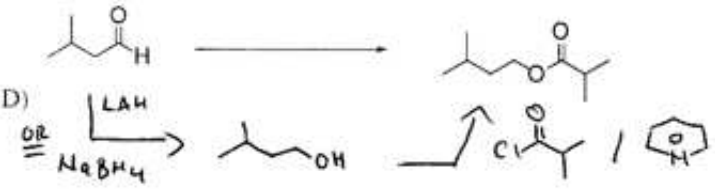
B)



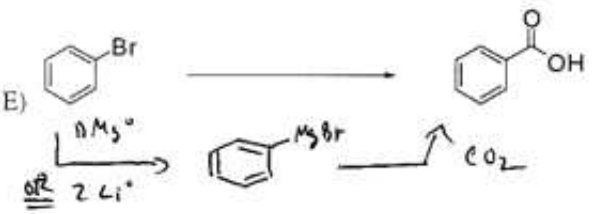
C)



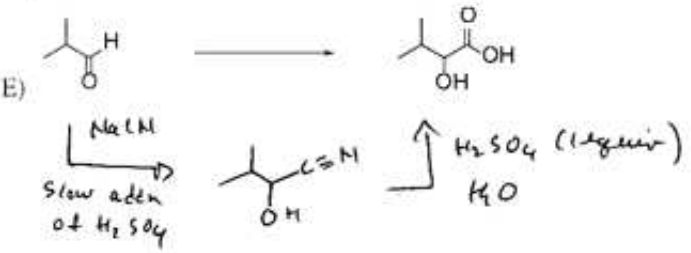
D)



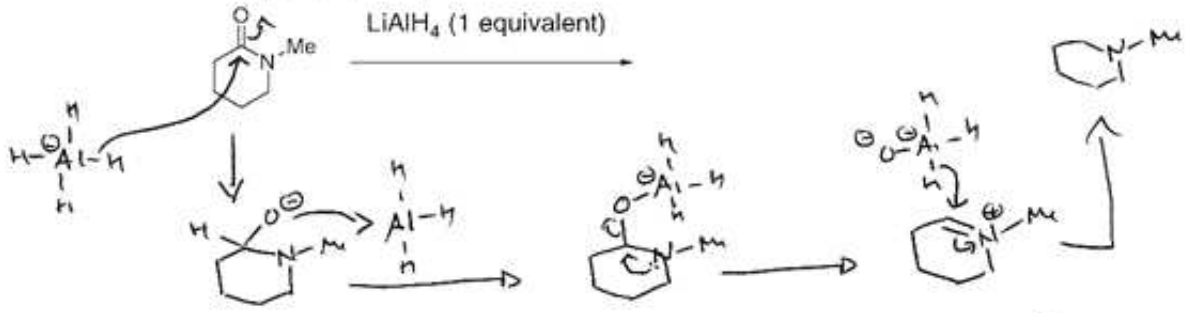
E)



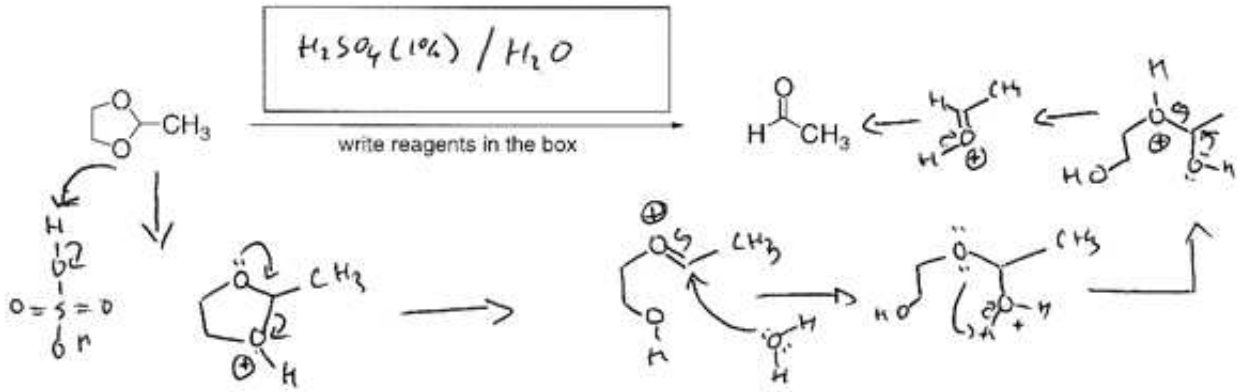
E)



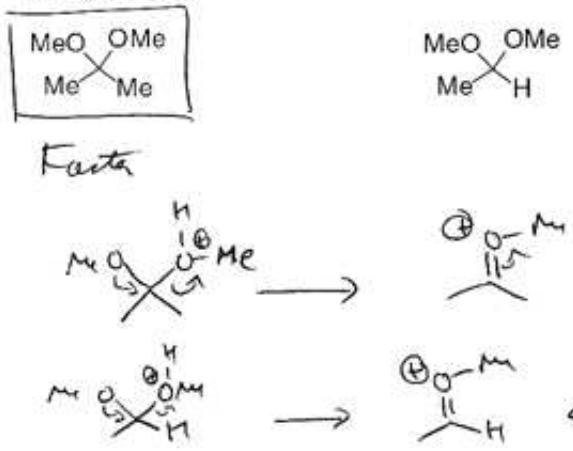
3) Provide the product and mechanism for the reaction shown below. Be sure to show all intermediates, arrows and charges (15 points).



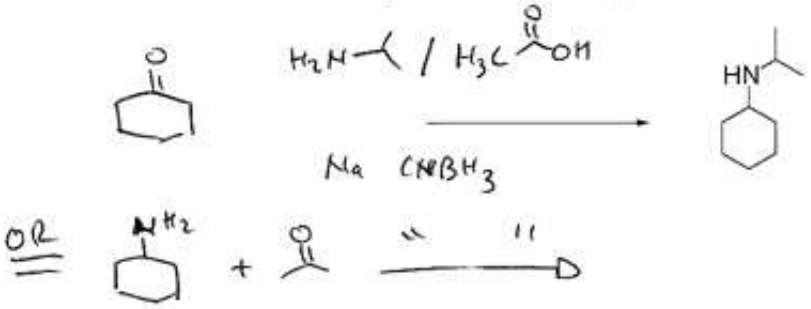
4) Acetals have two C-O bonds to one carbon, and these groups can be converted to aldehydes by treatment with certain reagents.
a) provide the regents needed for the conversion of the acetal shown below to the aldehyde (3 pts) AND.
b) draw the mechanism for this reaction showing all intermediates, arrows and charges (12 pts).



c) The rate limiting step for this conversion is the cleavage of the first C-O bond. Based on this and the mechanism you drew above, predict which of the two compounds shown below will undergo conversion to the aldehyde more rapidly and explain your prediction in two sentences or less (hint, this is problem 12.9 in the book, 6 pts).



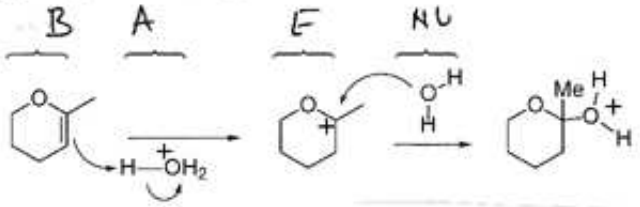
5) Prepare the molecule shown below by reductive amination (4 pts). You may use any starting materials of six carbons or less and common organic or inorganic reagents.



6) Describe each reactant in each step of the reaction shown below as either a nucleophile or an electrophile or an acid or a base (pick one for each reactant in each step). Also, in each step of the reaction, a filled orbital initiates the reaction by attacking an empty orbital. For each step, indicate the filled orbital that initiates the attacking, and the empty orbital that is undergoing attack. You may chose from the following orbitals:

σ C-C; σ* C-C; σ C-O; σ* C-O; π C-C; π* C-C; σ O-H; σ* O-H; O lone pair; C lone pair; empty C p orbital; empty C sp^3 orbital; empty C sp^2 orbital. (12 pts total).

Label each reactant beneath the brackets as either a: **nucleohpile / electropile / acid / base** (1 pt each)



(2 pts each)

The orbital that is doing the attacking is the: C-C π ; O lone Pair

The orbital that is being attacked is the: H-O σ* ; C empty P orbital