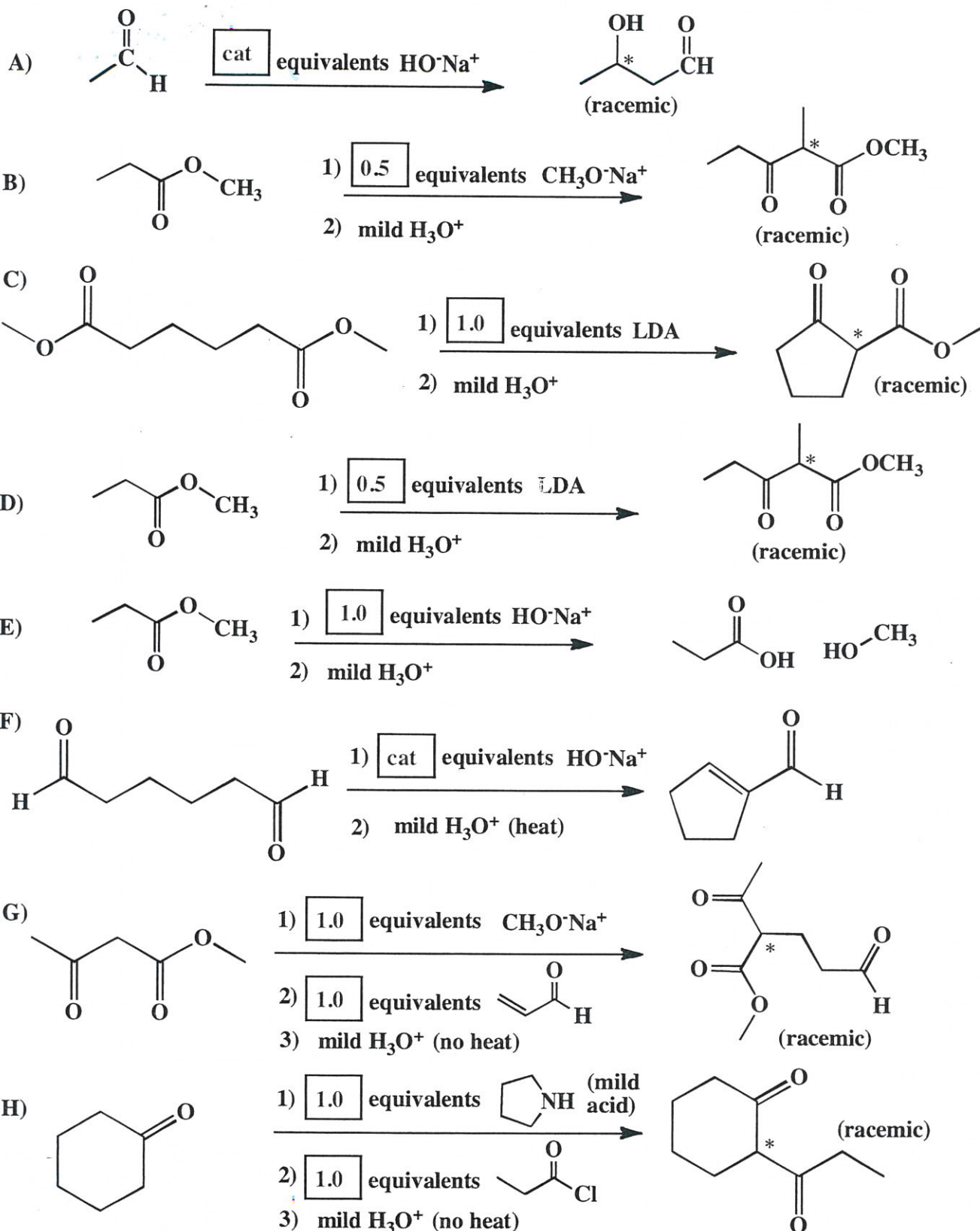
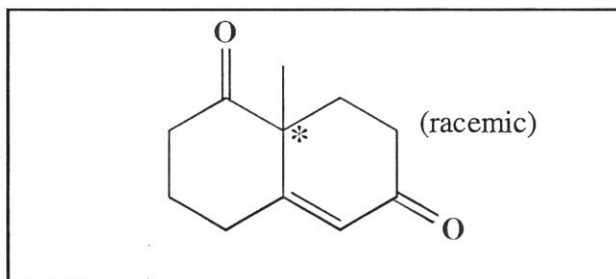
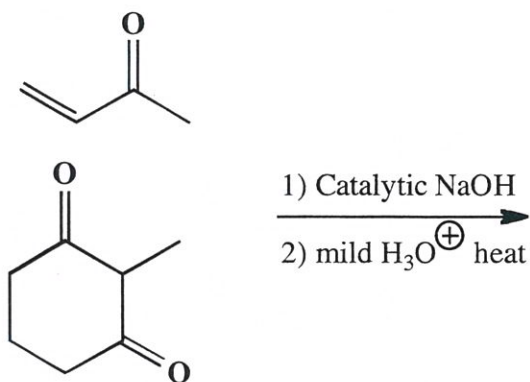
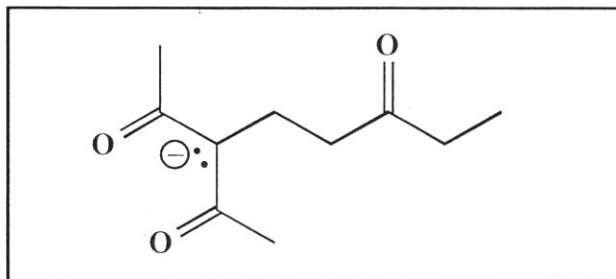
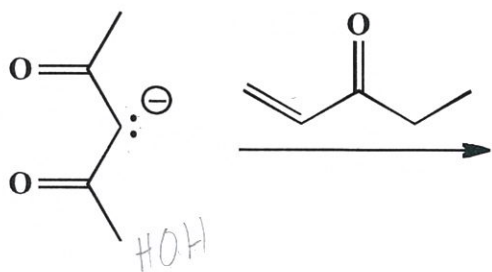
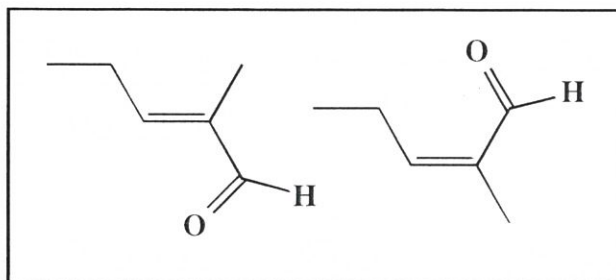
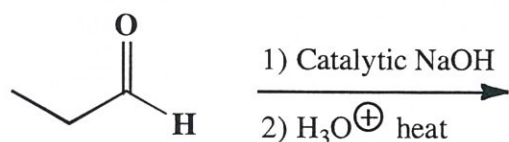
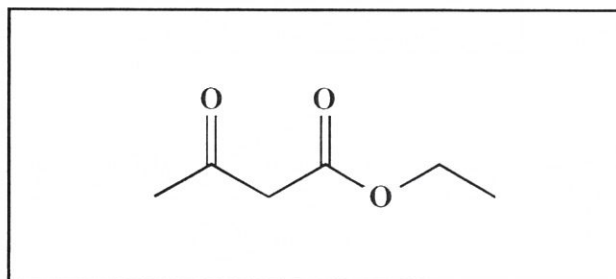
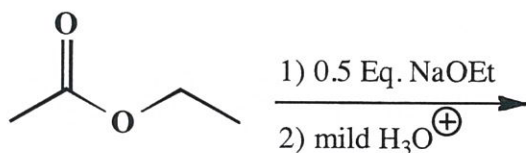


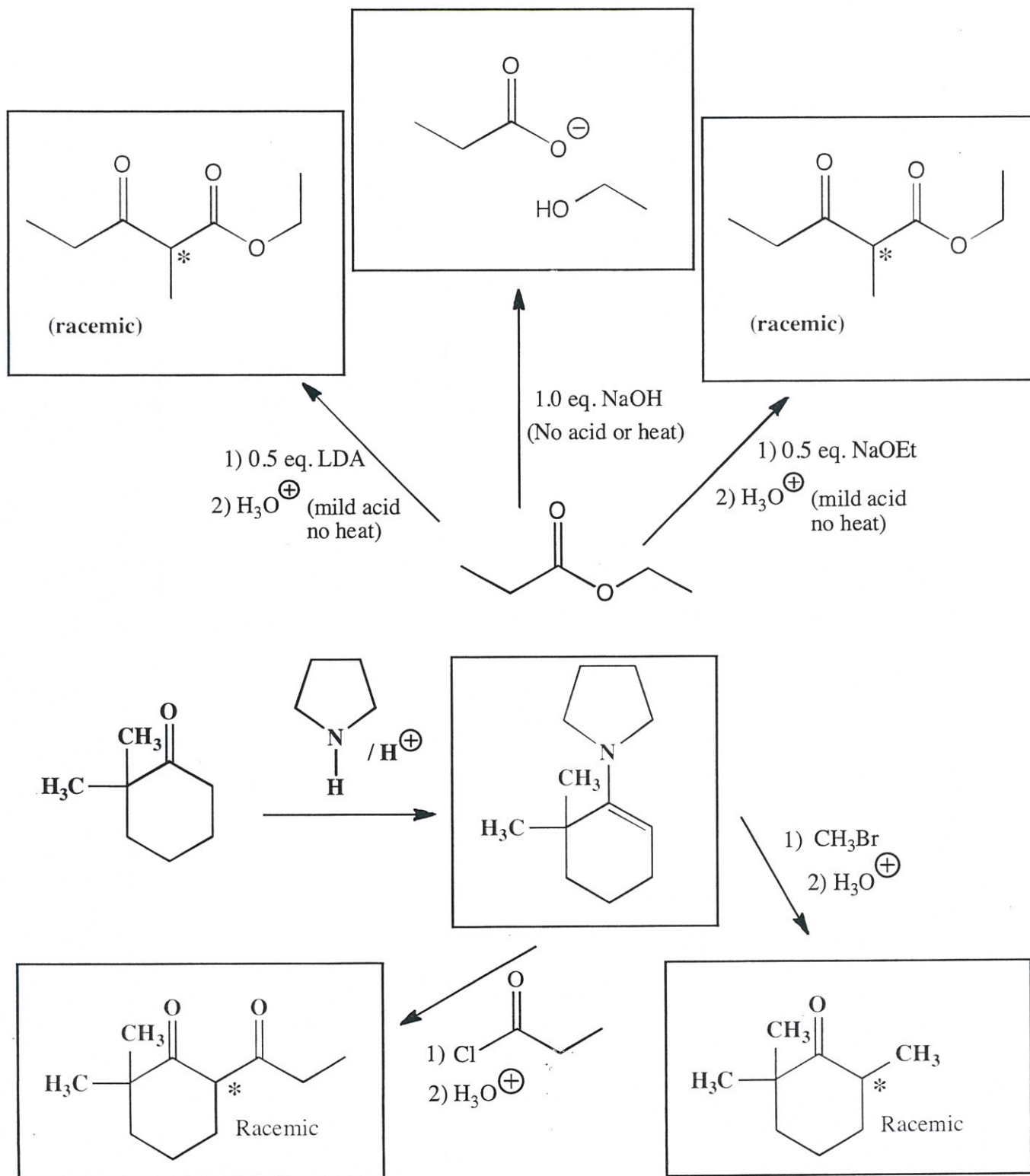
11. (2 pts each) In each of the boxes over an arrow, write the **minimum number of equivalents** of the specified reagent required to carry out the reaction shown **to completion**. If only a catalytic amount is needed, write "CAT". Note: **You must assume the carbonyl compound starting material is initially present in an amount of 1.0 equivalent.**



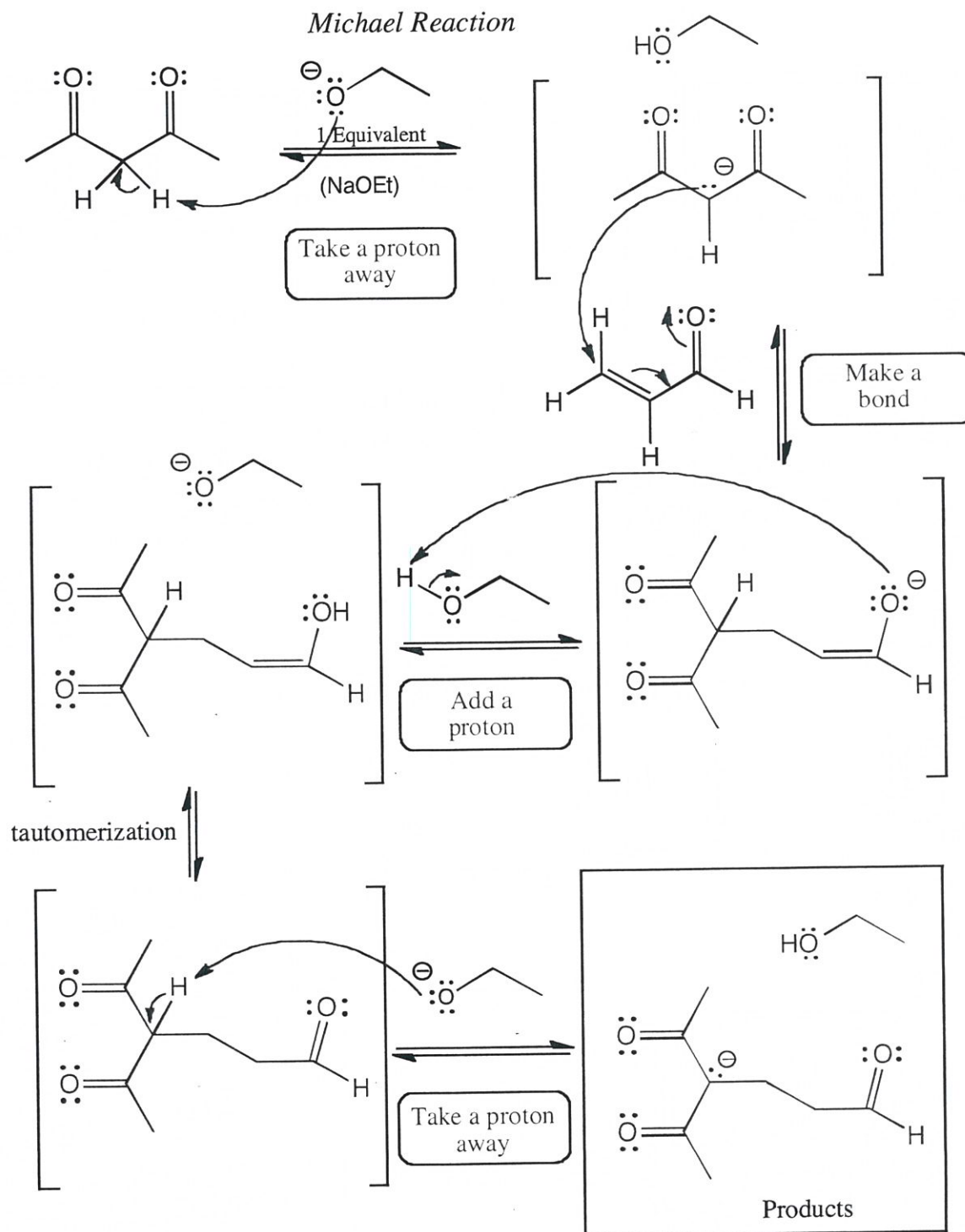
13. (3, 4 or 5 pts each) For the following reactions, draw the predominant product or products. When a new chiral center is created, mark it with an asterisk (*) and if a racemic mixture is produced, you must write "racemic" under your structure. For an aldol reaction YOU NEED TO DEHYDRATE!!! If an E,Z mixture is produced as the result of the aldol dehydration step you have to draw both structures. These directions are different than you may have seen before. You should read them again so you know what we want.



13. (3 or 5 pts each) For the following reactions, draw the predominant product or products. **When a new chiral center is created, mark it with an asterisk (*) and if a racemic mixture is produced, you must write "racemic" under your structure. If an E,Z mixture is produced as the result of a dehydration step, write "E,Z mixture", but you only have to draw one isomer, not both.** These directions are different than you may have seen before, and are intended to make it easier for you. You should read them again so you know what we want.

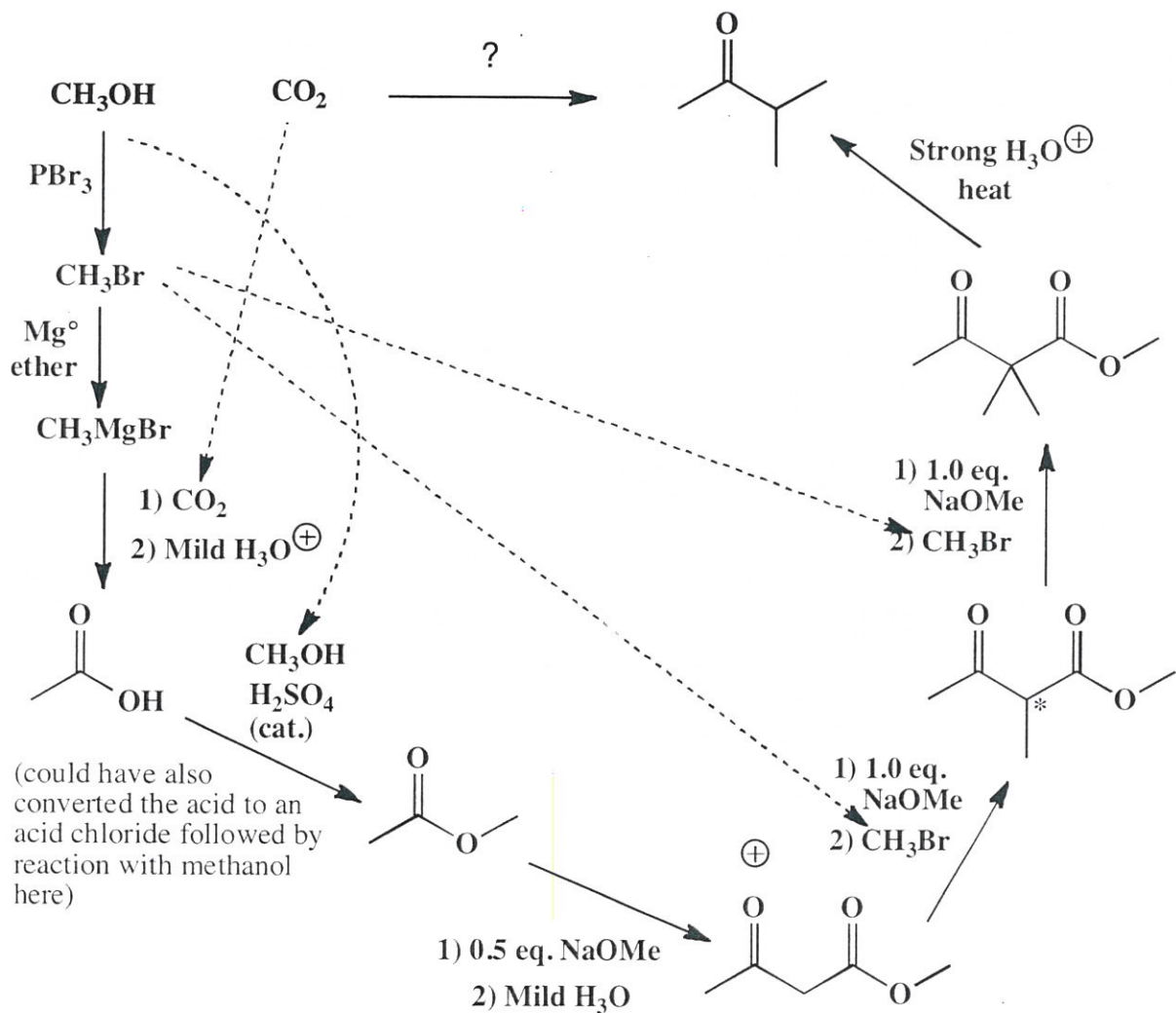


11. (26 pts) Complete the mechanism for the following Michael reaction. Be sure to show arrows to indicate movement of all electrons, write all lone pairs, all formal charges, and all the products for each step. Remember, I said all the products for each step. IF A NEW CHIRAL CENTER IS CREATED IN AN INTERMEDIATE OR THE PRODUCTS, MARK IT WITH AN ASTERISK AND LABEL AS "RACEMIC" IF RELEVANT. IN THE BOX BY EACH SET OF ARROWS, WRITE WHICH OF THE 4 MECHANISTIC ELEMENTS IS INDICATED IN EACH STEP OF YOUR MECHANISM (For example, "Add a proton").



14. (cont. 22 pts) Using any reagents turn the starting material into the indicated product. All carbon atoms must come from the starting material. Draw all molecules synthesized along the way. When in doubt, draw the molecule! Label all chiral centers with an asterisk (*) and make sure to right "Racemic" where appropriate.

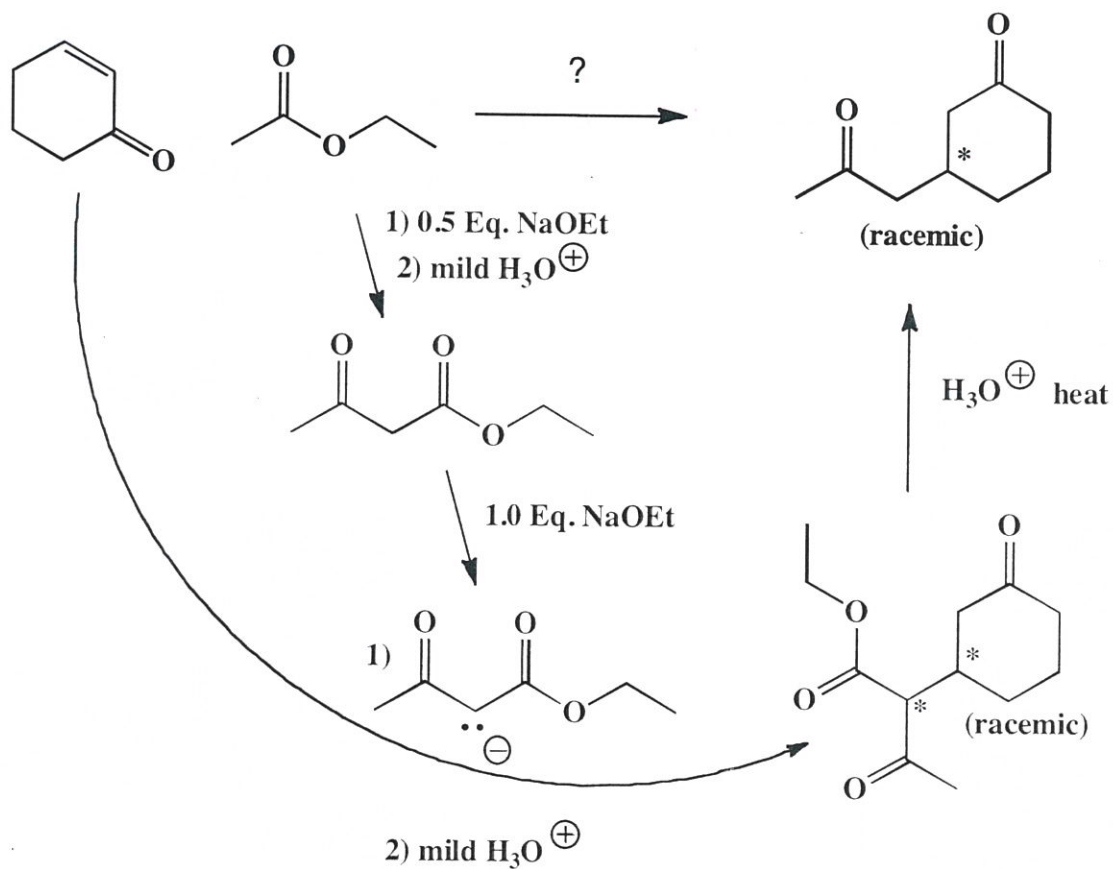
Remember, all of the carbons of the product must come from the given starting material.



I consider this to be a difficult problem because of how many pieces from one carbon units (starting materials) need to be assembled to get to the product. Recognize the product as a methyl ketone derivative, the KRE for the acetoester synthesis. The required β -ketoacid derivative is acetoester that has been alkylated twice using methyl bromide, which is available from the starting methanol following reaction with PBr_3 . Recognize that acetoester comes from the Claisen reaction of methyl acetate. Recognize further that methyl acetate comes from esterification of acetic acid. The required acetic acid can be made from the Grignard reagent derived from methyl bromide added to CO_2 .

14. (9 pts) Using any reagents turn the starting material into the indicated product. All carbon atoms must come from the starting material. Draw all molecules synthesized along the way. When in doubt, draw the molecule! Label all chiral centers with an asterisk (*) and make sure to right "Racemic" where appropriate.

Remember, all of the carbons of the product must come from the given starting material.



This one is EXTRA CREDIT. It DOES NOT COUNT IN THE POINT TOTAL for the exam but it is a chance to add points to your score.

22. Using any reagents turn the starting material into the indicated product. All carbon atoms in the product must come from the starting material. Draw all molecules synthesized along the way. When in doubt, draw the molecule! Label all chiral centers with an asterisk (*) and make sure to right "Racemic" where appropriate.

Remember, all of the carbons of the product must come from the given starting material.

