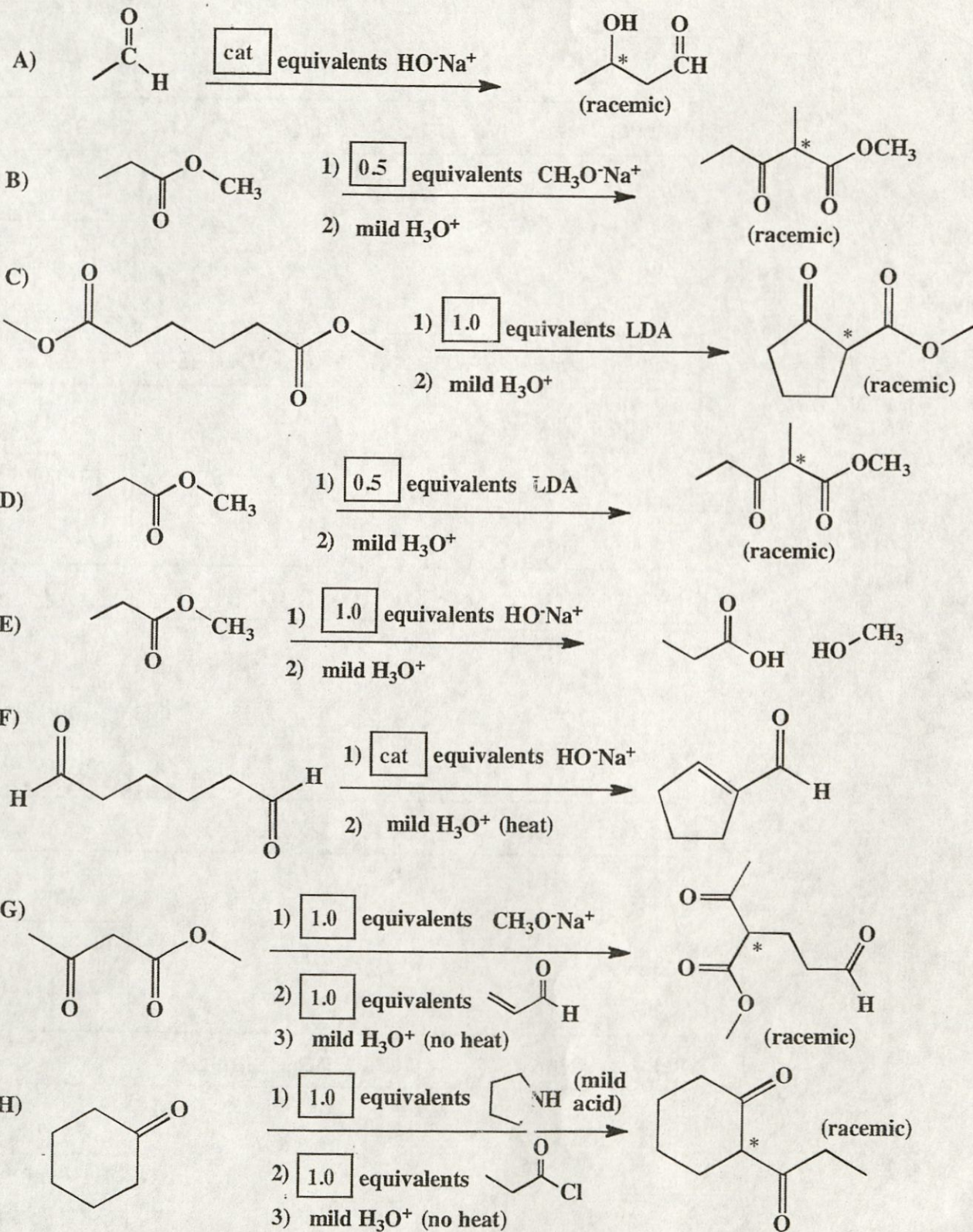
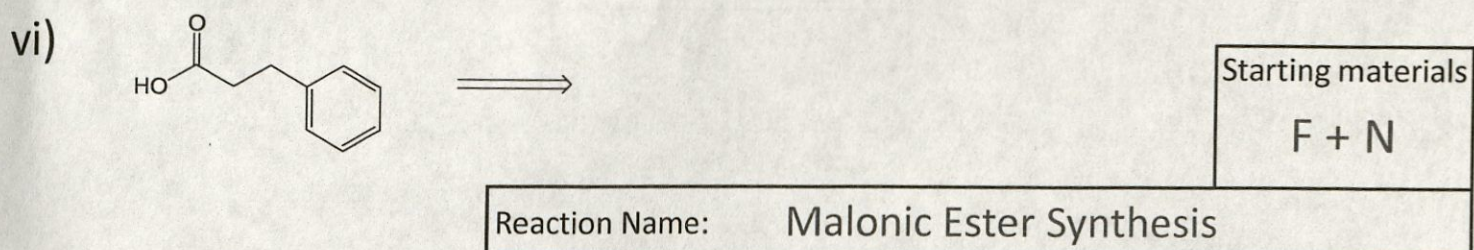
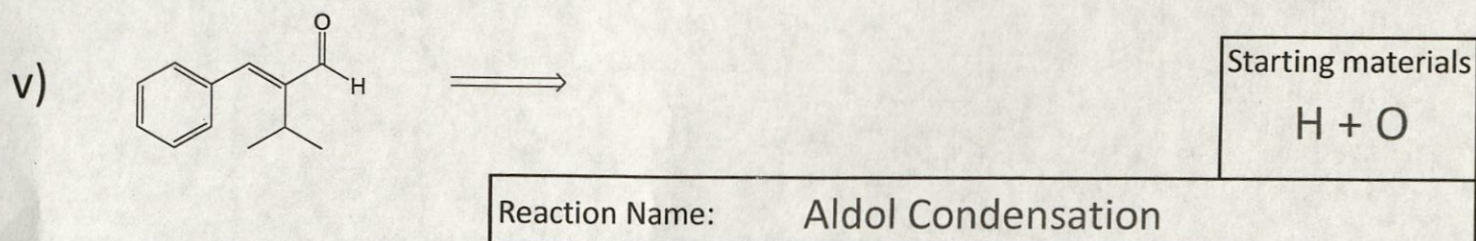
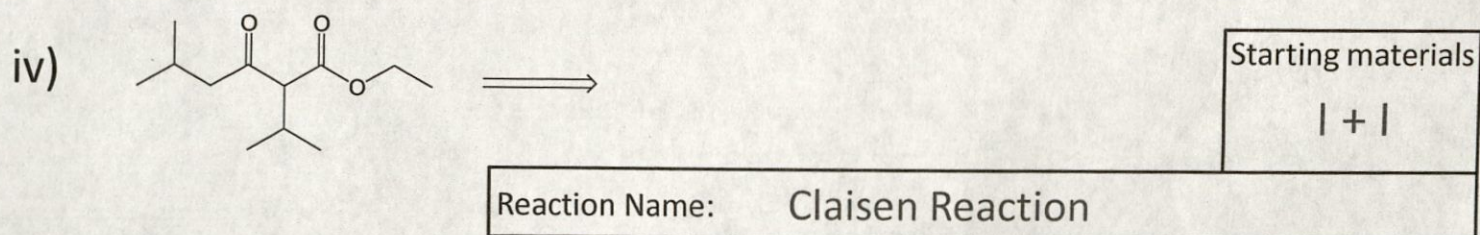
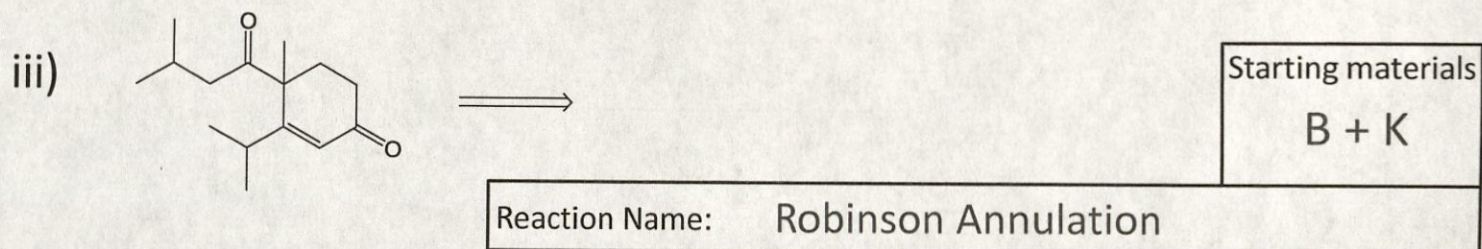
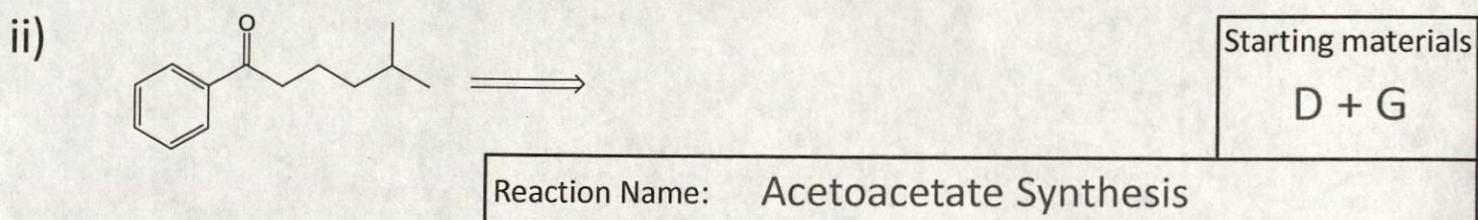
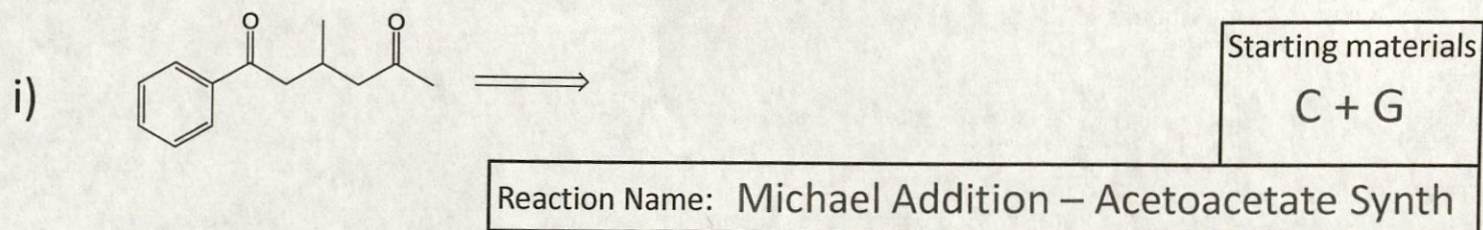


11. (2 pts each) In each of the boxes over an arrow, write the minimum number of equivalents of the specified reagent required to carry out the reaction shown to completion. If only a catalytic amount is needed, write "CAT". Note: You must assume the carbonyl compound starting material is initially present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



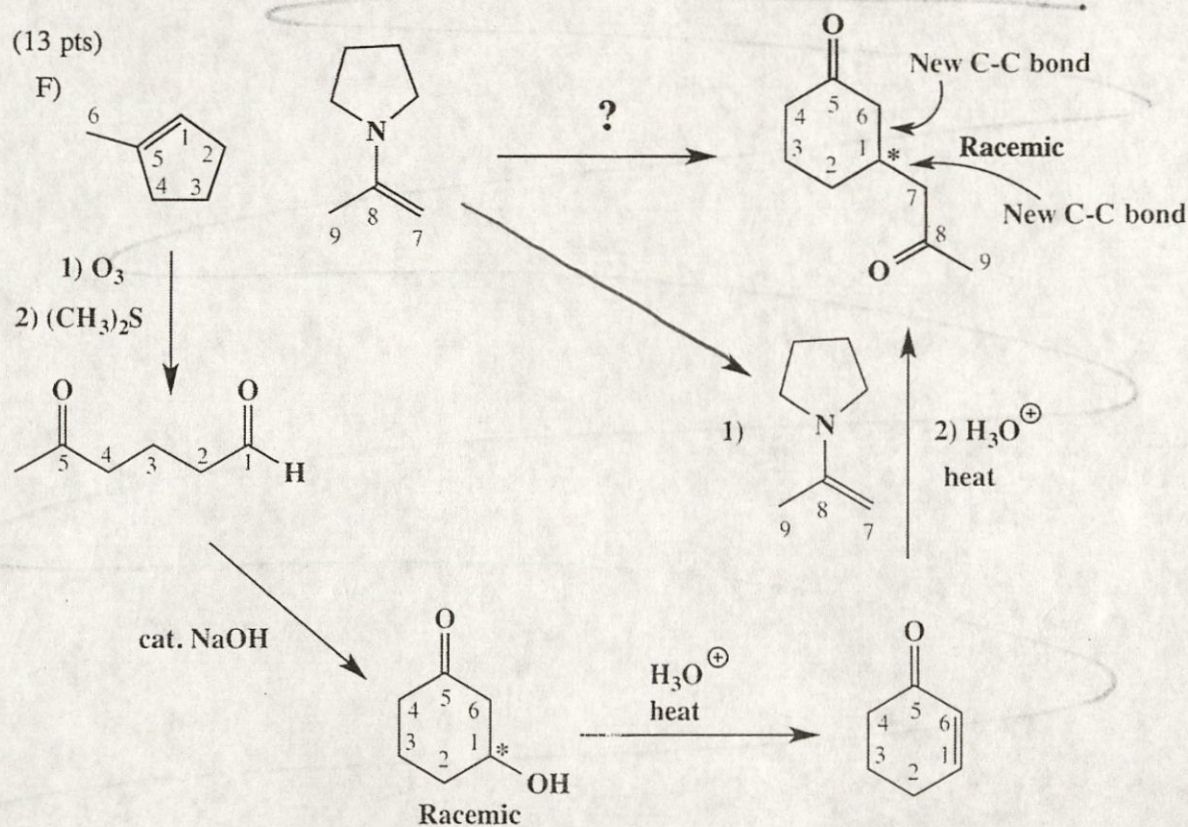
Use retrosynthesis to provide the starting materials and name of reaction for each product. Each letter (A-P) can be used any number of times or not at all.



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.

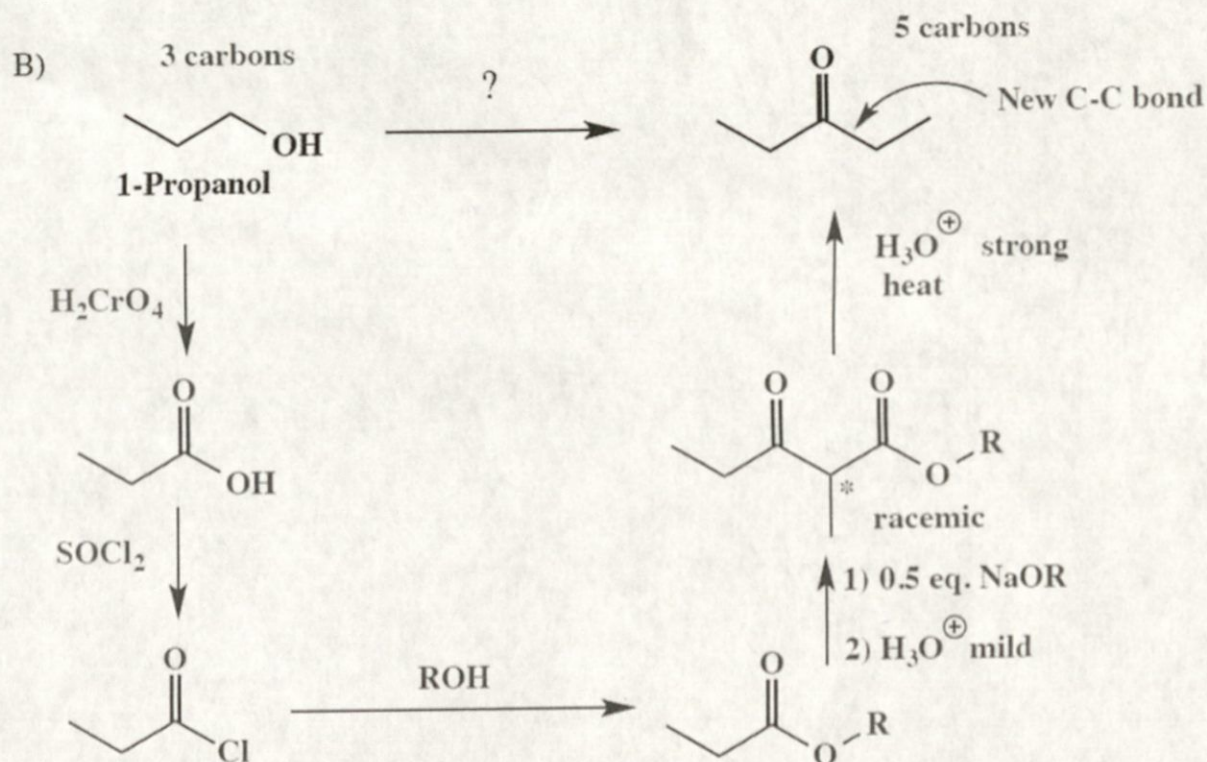
Remember, all of the carbons of the product must come from the given starting material.



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. You will notice a theme in these problems in that you will be starting with very simple structures and making more complex products.

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

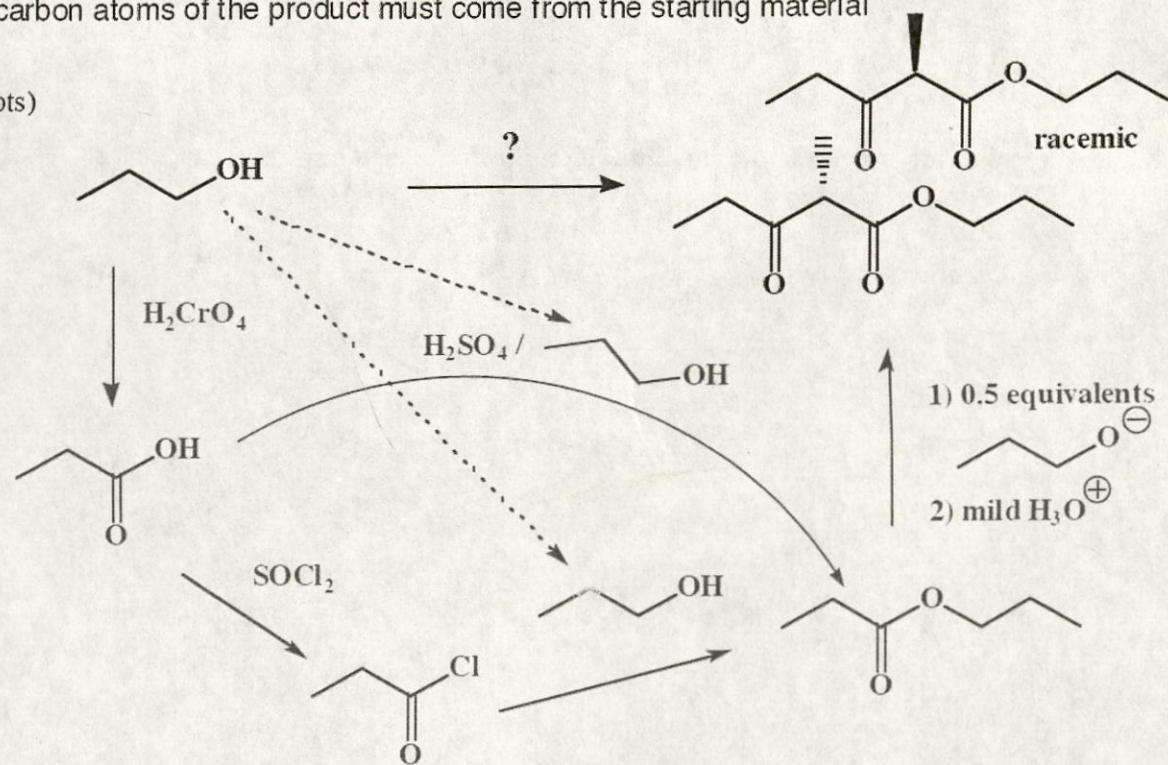
(13 pts)



Recognize there are 5 carbons in the product, but 3 carbons in the starting material so, 2 molecules of starting material must be assembled into the product (minus 1 carbon) with the location of the new C-C bond as shown. Losing 1 carbon indicates a decarboxylation. **Recognize** further the final product as a symmetrical ketone, the KRE of a Claisen reaction followed by ester hydrolysis/decarboxylation. **Recognize** that the Claisen product can be derived from a three carbon ester, that can be made from the three carbon alcohol starting material using chromic acid followed by SOCl_2 and reaction with an alcohol. Because the alcohol does not show up in the product, any alcohol can be used and I indicated that by designating the alcohol as ROH.

All the carbon atoms of the product must come from the starting material

(10 pts)



(7 pts)

