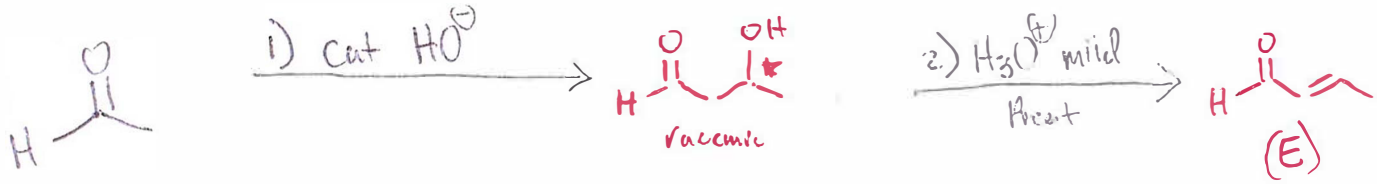
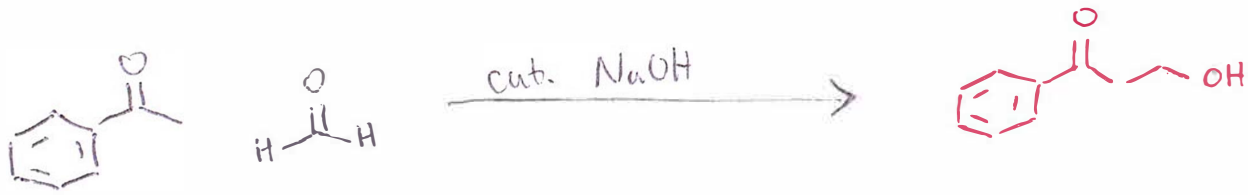
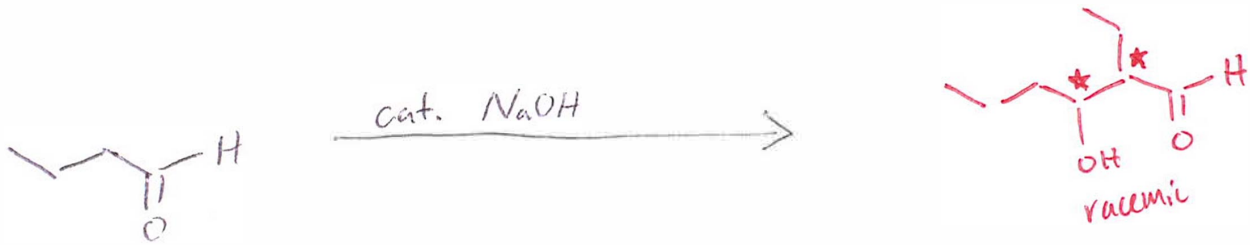
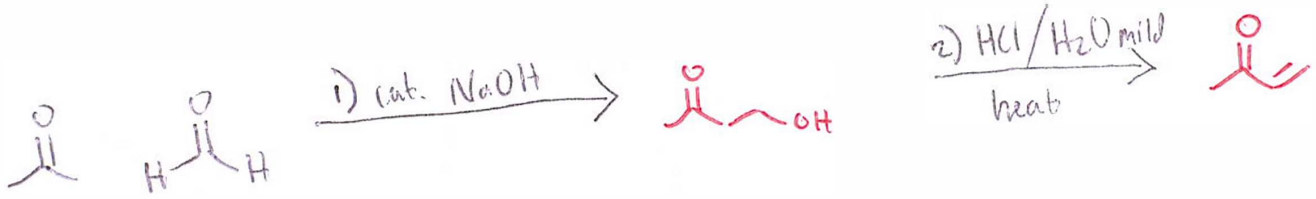
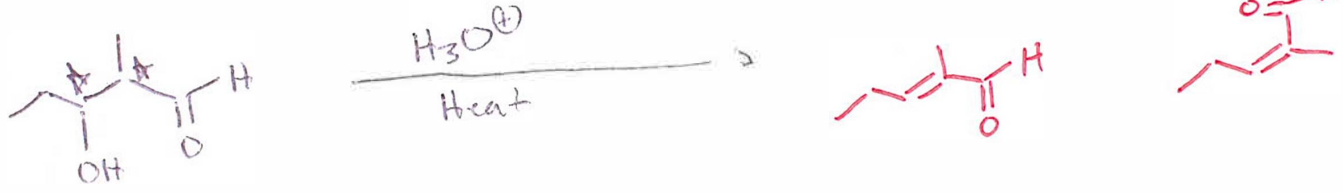
(1) Practice Problem Session





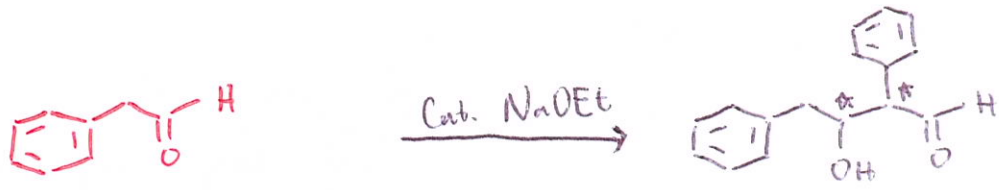


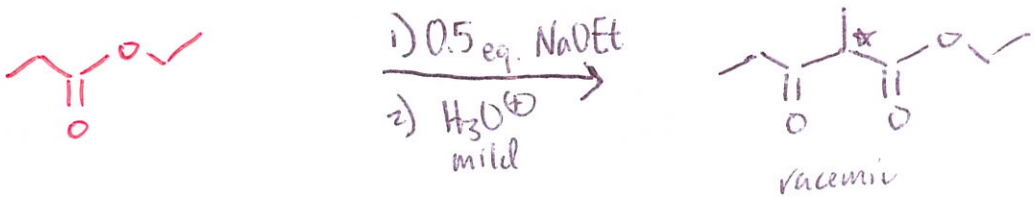


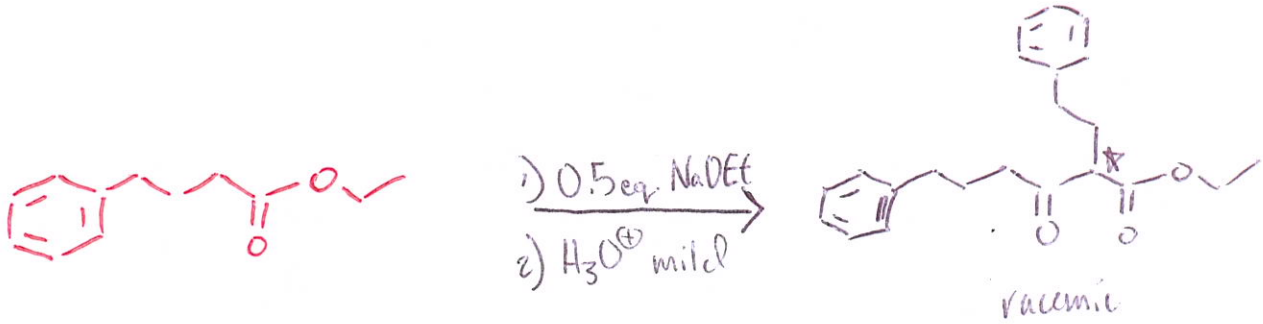


(2)

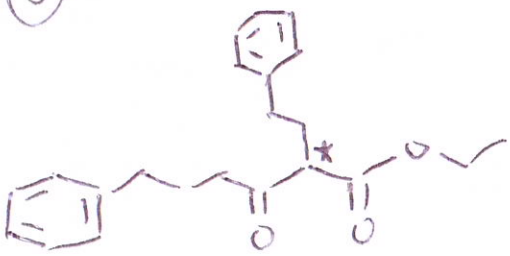

Heat
+ CO_2


Cat. NaOEt
racemic


1) 0.5 eq. NaOEt
2) $H_3O^{\oplus}$
mild
racemic

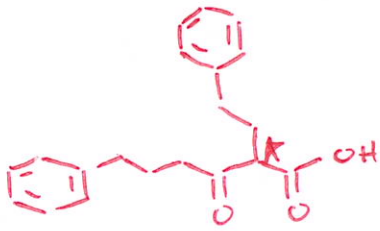

1) 0.5 eq. NaOEt
2) $H_3O^{\oplus}$ mild
racemic

(3)



H_2O

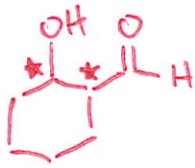
Cat. H_2SO_4



racemic

Heat

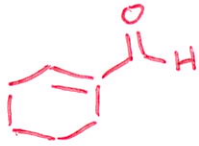
Cat. NaOH

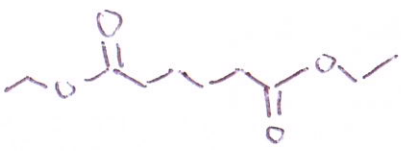


racemic

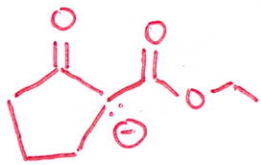
$H_3O^{\oplus}$

Heat

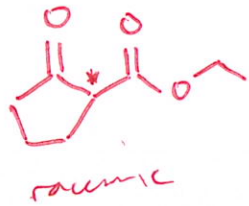




1) 1.0 NaOEt



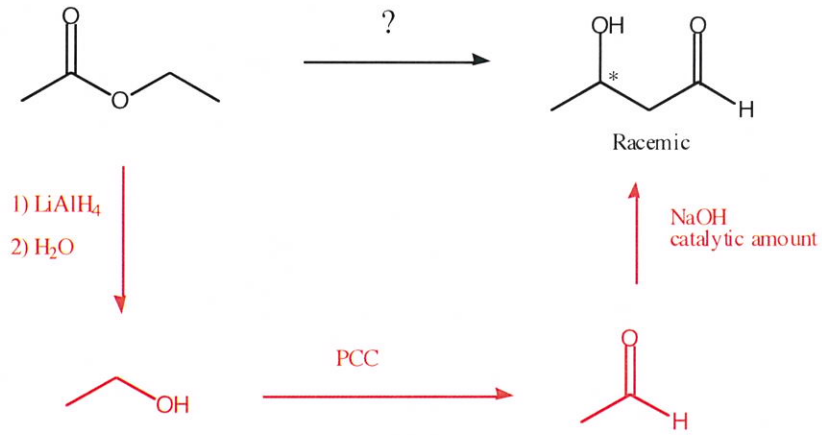
2) Mild Acid



racemic

21. For the following synthesis questions, show how the starting material can be converted into the product. Show ALL intermediate molecules synthesized along the way, and show the reagents needed for each step. To get full credit, you must use the predominant product expected for each step. All of the carbon atoms of the product must come from the starting material(s).

(7 pts)



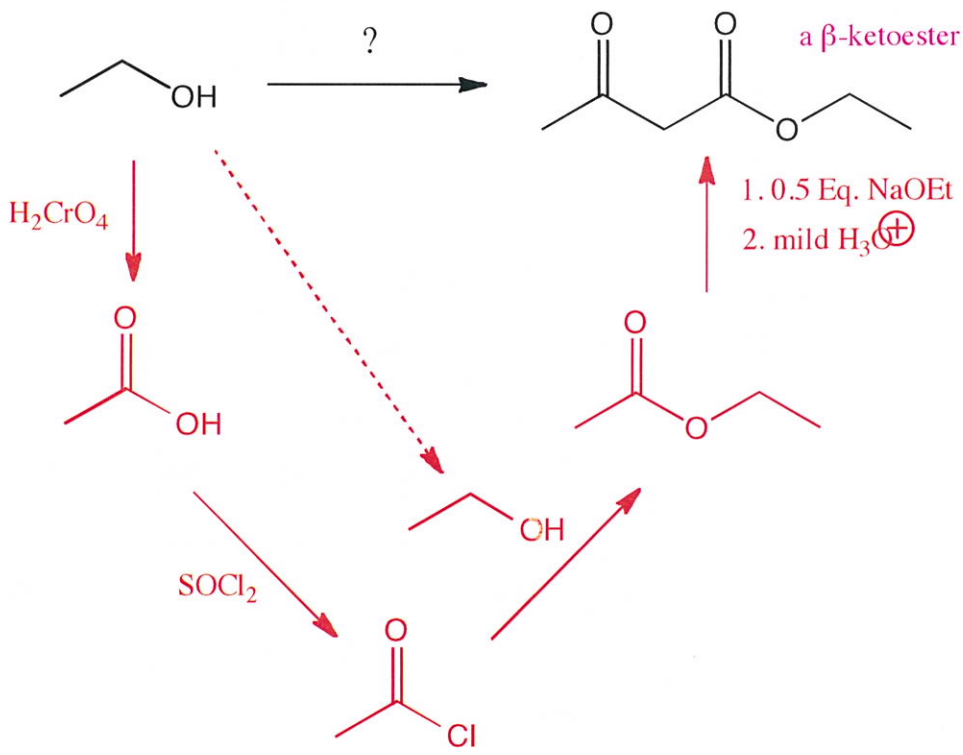
Recognize the product as a β–hydroxy aldehyde, which is the product of an aldol reac tion before dehydration. This aldc requires acetaldehyde, which is made conveniently from reduction of the ethyl acetate starting material using $LiAlH_4$, followed by oxidation using PCC. Note there are several acceptable alternative ways to make the acetaldhyde from ethyl acetate including DIBAL-H reduction or hydrolysis followed by oxidation/reduction.

17. (10 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. Hint: this should look familiar as a homework problem.

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

(10 pts)

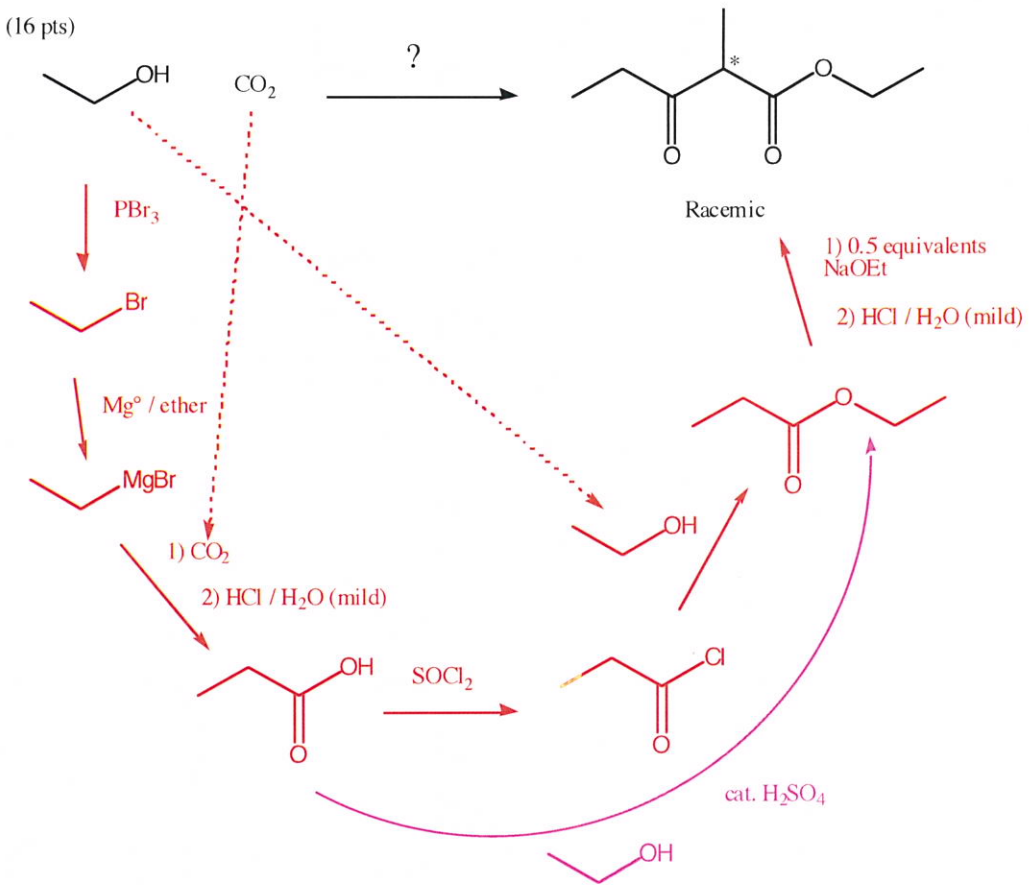
A)



Notice that the product has 6 carbon atoms, and the staring material has 2. Therefore, assume 3 molecules are reacted to make one product molecule. **Recognize** the product as a β-ketoester, the KRE for a Claisen condensation. **Recognize** that the required ester is derived from acetyl chloride reacting with ethanol. The aeetyl chloride is made from aetic acid with $SOCl_2$, which, in turn, comes from reaction of the starting ethanol with chromic acid.

21. For the following synthesis questions, show how the starting material can be converted into the product. Show ALL intermediate molecules synthesized along the way, and show the reagents needed for each step. To get full credit, you must use the predominant product expected for each step. All of the carbon atoms of the product must come from the starting material(s).

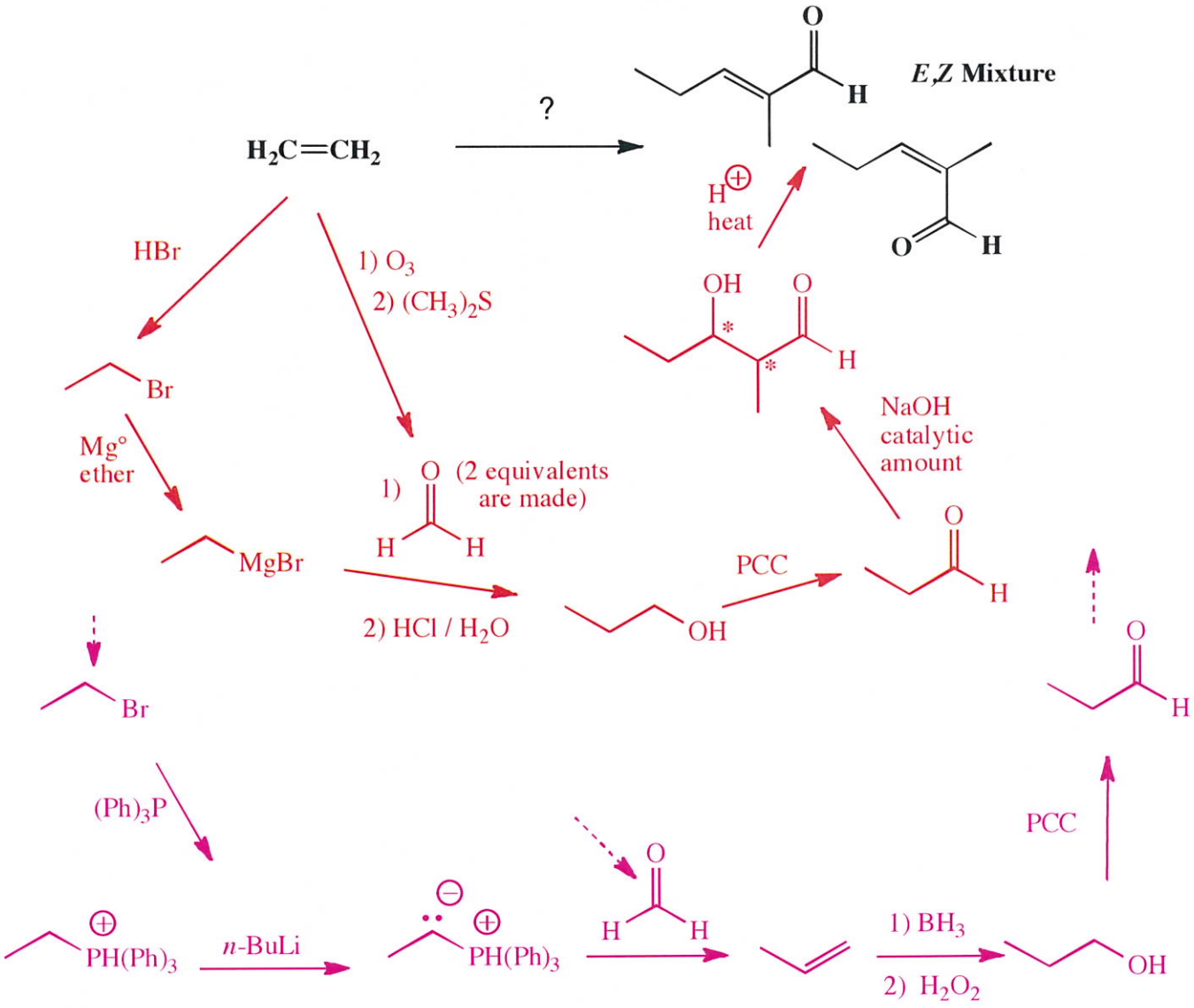
(16 pts)



Recognize the product as that of a Claisen reaction using ethyl propanoate. To make the three carbon acid, you need to add one carbon to ethanol , the easiest way to do this is via the Grignard and CO2. The resulting propanoic acid is then converted to the ethyl ester using either $SOCl_2$ then ethanol, or just ethanol and acid catalysis (Fischer esterification)

17. (cont. 19 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.



Recognize that the product has the α,β-unsaturated aldehyde functional group, the KRE of an aldol reaction followed by dehydration. Further, it has 6 carbons so predict it is the result of an aldol using propanal. **Recognize** you need to add one carbon to the starting material to get propanal from ethylene, You can do this a couple of ways, but in either case, you need to carry out ozonlysis to create the one carbon fragment in the form of formaldehyde. One approach to propanal uses ethyl bromide, created from ethylene plus HBr, to make a Grignard that reacts with formaldehyde to give propanol, followed by PCC oxidation to give propanal. Another approach (below) uses the formaldehyde in a Wittig reaction that uses the Wittig reagent created from ethyl bromide. Following the Wittig reaction, the propene undergoes hydroboration to give propanol, followed by PCC oxidation to give propanal.