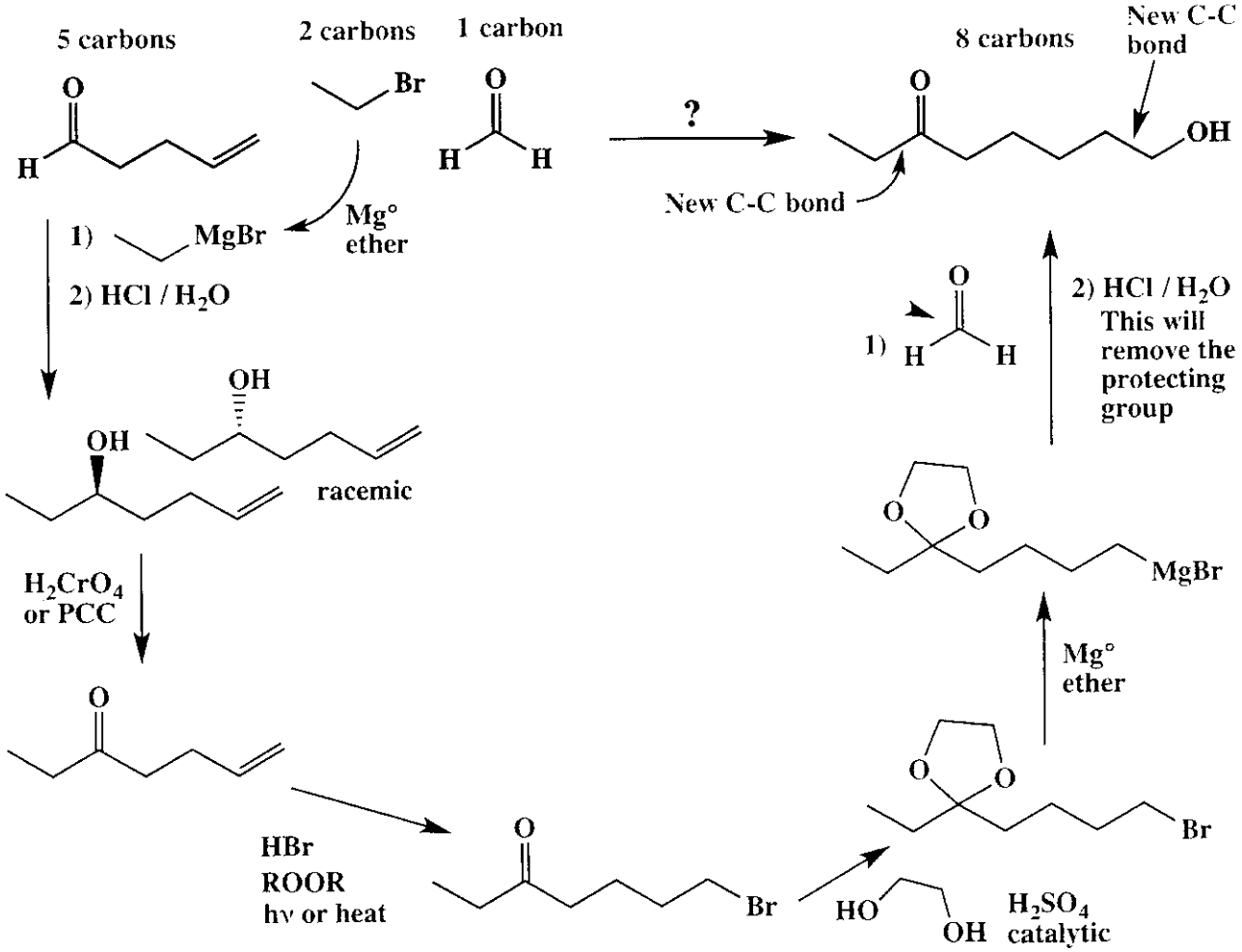
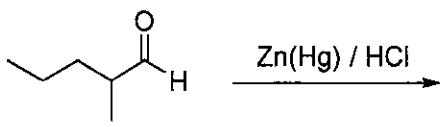
23. These are synthesis questions. You need to show how the starting material can be converted into the product(s) shown. You may use any reactions we have learned. Show all the reagents you need. Show each molecule synthesized along the way and be sure to pay attention to the regiochemistry and stereochemistry preferences for each reaction. If you make a racemic mixture, you can either draw both enantiomers or simply draw one structure and label all chiral centers with an asterisk (*). Either way, you must write racemic if appropriate.

(19 pts) **All of the carbon atoms of the products must come from the starting materials.**

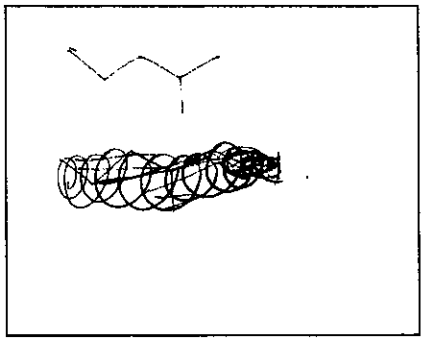


Recognize that the product has 8 carbons, and the starting materials have 5, 2 and 1. Therefore there must be *two* new C-C bonds. The most logical places for these are adjacent to the carbonyl and OH groups as shown. The most logical KRE is for a new C-C bond on a carbon with an OH group, the KRE for a Grignard reaction. Propose a Grignard reaction between formaldehyde (given starting material) and a protected Grignard as shown. **Recognize** the protected Grignard as coming from 7-bromo-3-heptanone. This may be the hardest part of the synthesis, noticing that the required 7-bromo-3-heptanone can be derived from 6-heptene-3-one through non-Markovnikov hydrobromination. The 6-heptene-3-one comes from oxidation of the corresponding alcohol 6-hepten-3-ol. The 6-hepten-3-ol is the product of a Grignard reaction between the 4-pentenal starting material and a two-carbon Grignard reagent derived from the bromoethane starting material.

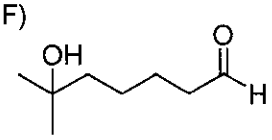
E)



Zn(Hg) / HCl

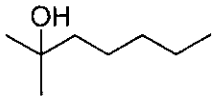


F)

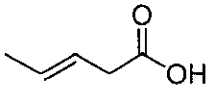


N_2H_4, KOH

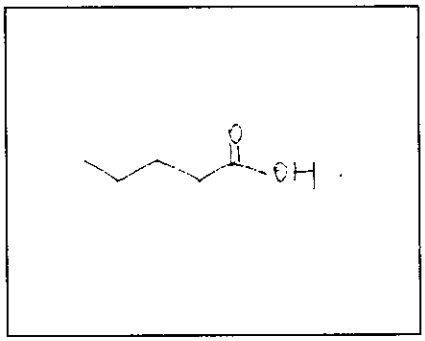
diethylene glycol (reflux)



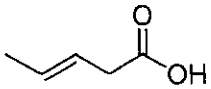
G)



H_2/ Pd



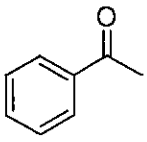
H)



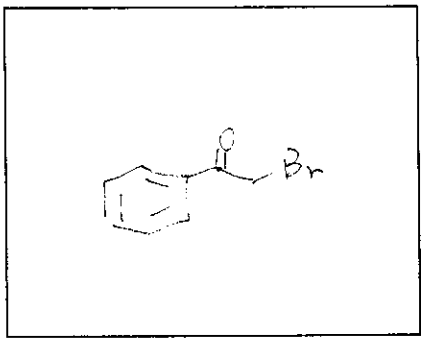
1) $LiAlH_4$, ether

2) H_2O

I)



Br_2/ CH_3COOH



All of the carbon atoms of the products must come from the starting materials for this question!