

UNIVERSITY OF WINDSOR
SCHOOL OF PHYSICAL SCIENCES
CHEMISTRY AND BIOCHEMISTRY

Chemistry 59-331/333
Final Examination

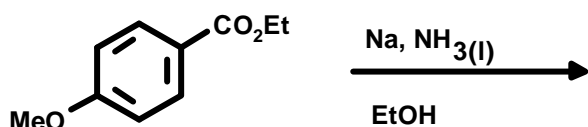
Apr. 19, 1999
Time: 3 hours

Answer all questions in the exam booklet.

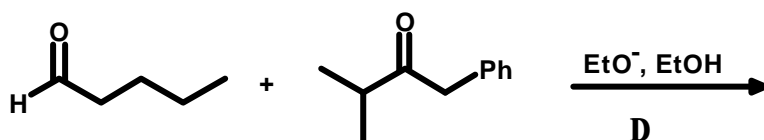
1. Do any eight (8)

Indicate the structure of the expected major product from each of the following reactions. Mechanisms are not necessary, but showing your work is likely to be a help. Indicate product stereochemistry where it applies. (Total 40 marks)

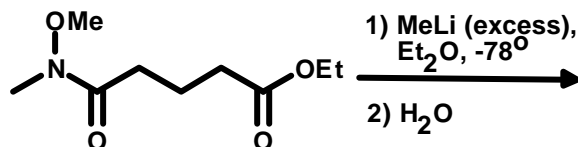
a)



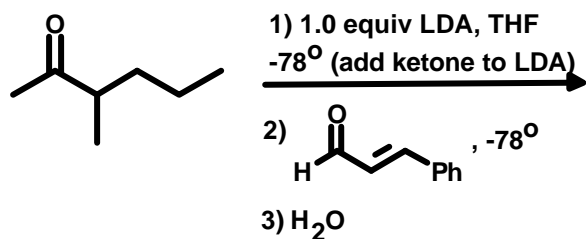
b)



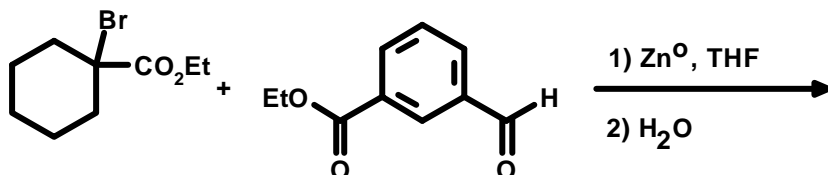
c)



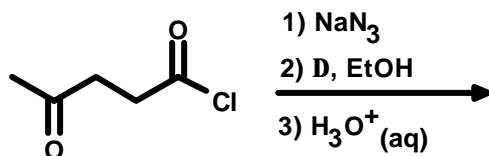
d)



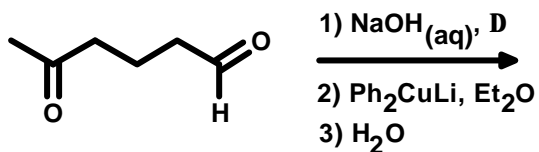
e)



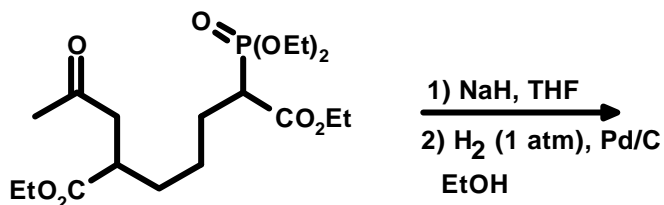
f)



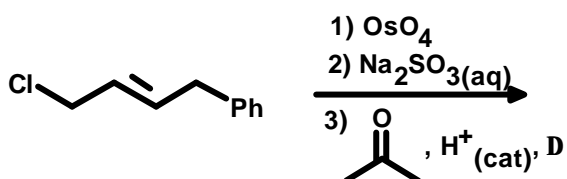
g)



h)

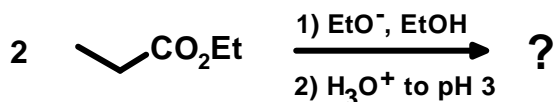


i)

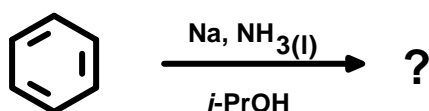


2. (Total 20 marks)

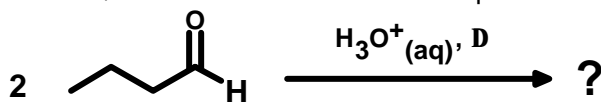
a) Draw the complete mechanism for the Claisen condensation between two molecules of ethyl propanoate. The complete answer will show any small molecules coming off, the reversible/irreversible steps, and indicate the step which drives the reaction to completion (i.e., is essentially irreversible).

b) Do i) or ii), but not both.

i) Show the complete mechanism for the Birch reduction of benzene. Note: I have made no attempt to show the accurate reagent ratio.

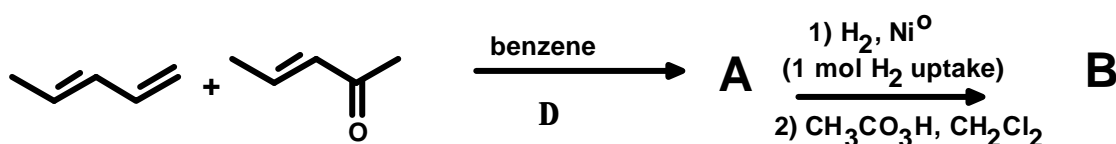


ii) Draw the complete mechanism for the acid catalyzed condensation of two molecules of butanal. The mechanism for the formation of the nucleophilic species involved should be included, as well as whether each step is reversible/irreversible.

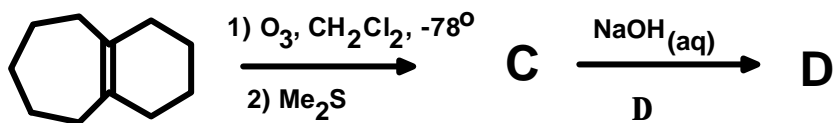


3. Do any 5 of the question parts, accounting for 10 compound letters. Give the expected compounds corresponding to the letters below. Indicate stereochemistry where it applies. Mechanisms are not necessary. (Total 50 marks)

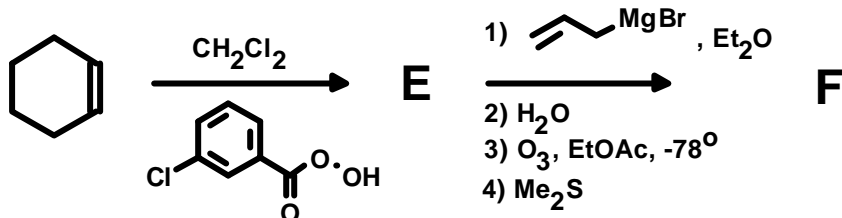
a)



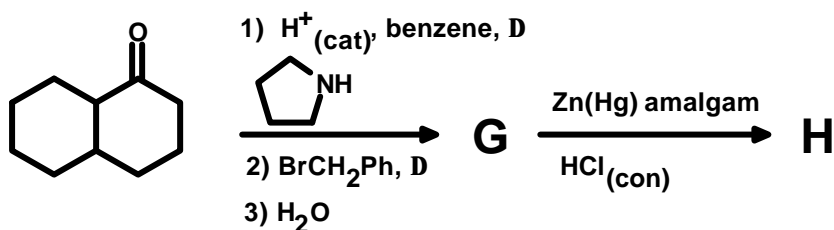
b)



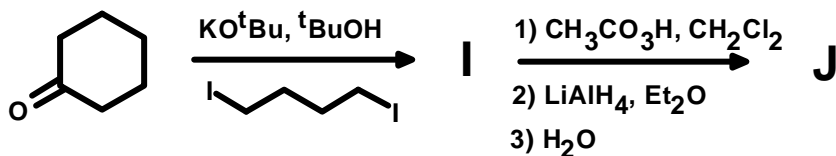
c)



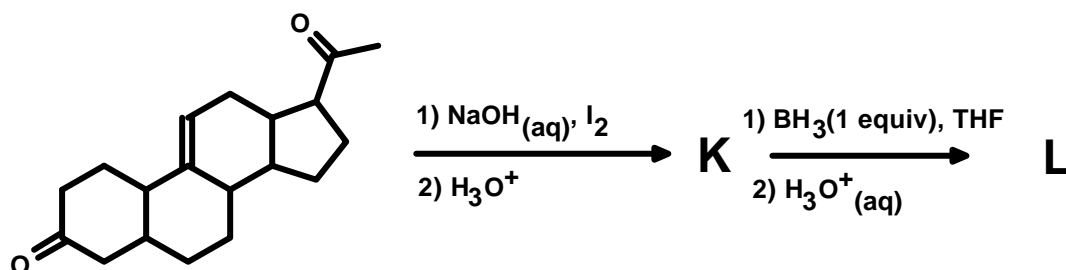
d)



e)



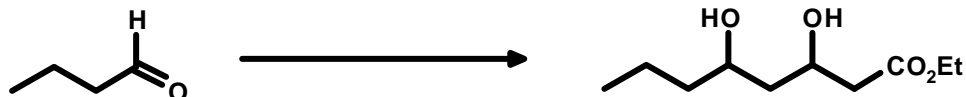
f)



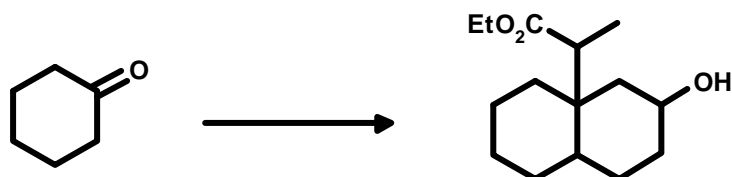
4. Do any seven (7) of the following

Show by equation how you would prepare the illustrated below from the given starting material. You may use any other reagents which you deem fit. Show all reagents, conditions, and isolable intermediates. Mechanisms are not necessary, but may be a help. (Total 70 marks)

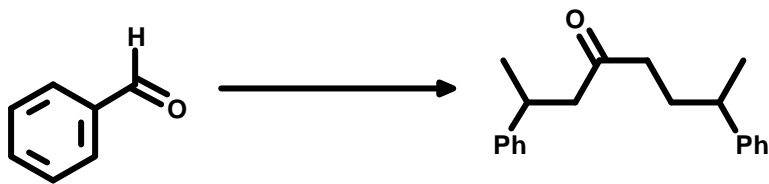
a)



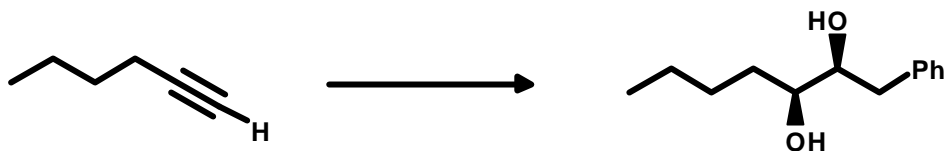
b)



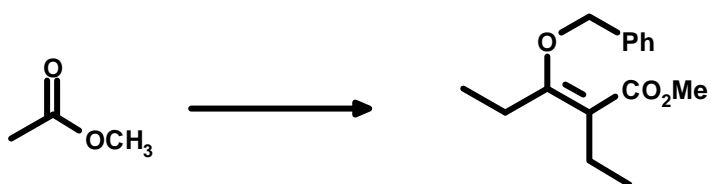
c)



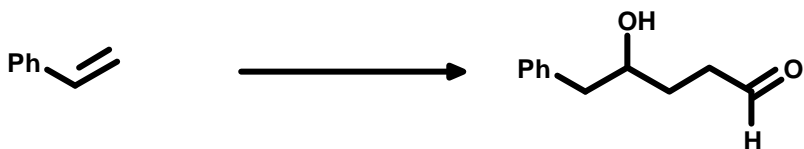
d)



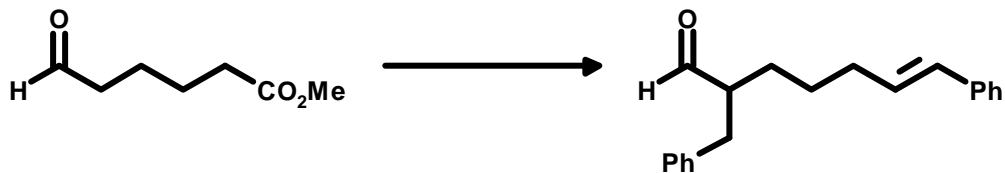
e)



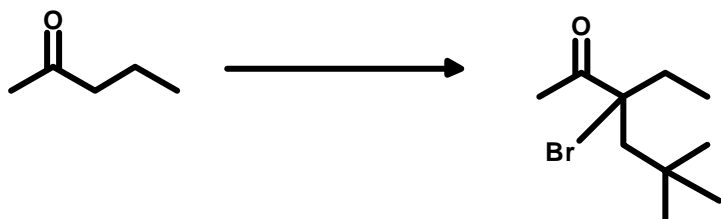
f)



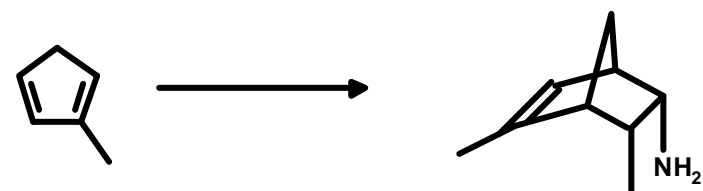
g)



h)

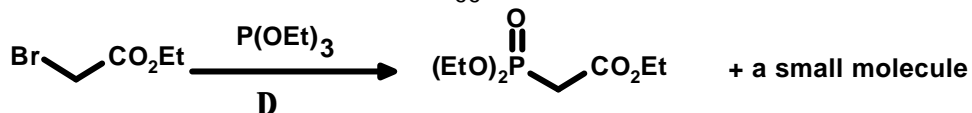


i)

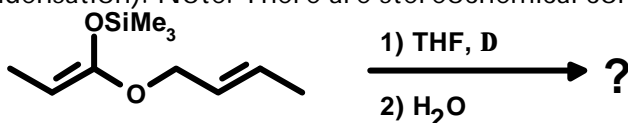


Bonus: (up to 10 marks):

a) The Wadsworth-Horner-Emmons reaction uses phosphonate esters as opposed to phosphonium salts as starting reagents. These phosphonate esters are almost always made by the Arbuzov reaction, shown below. Suggest a reasonable mechanism for the Arbuzov reaction.



b) As you've seen recently, concerted reactions with a 6 π -electron cyclic transition state tend to go rather well. Using that piece of information, predict the outcome of the following transformation; it's called the Claisen rearrangement (not to be confused with the Claisen condensation). Note: There are stereochemical considerations here, too.



note: made by
O-silylation of the
ester enolate