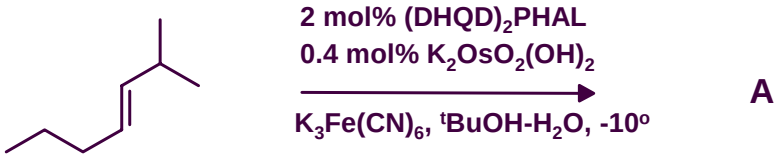
UNIVERSITY OF WINDSOR
CHEMISTRY AND BIOCHEMISTRY

Chemistry 59-531/431 **Apr. 25, 2005**
Final Examination **Time:3 hours**

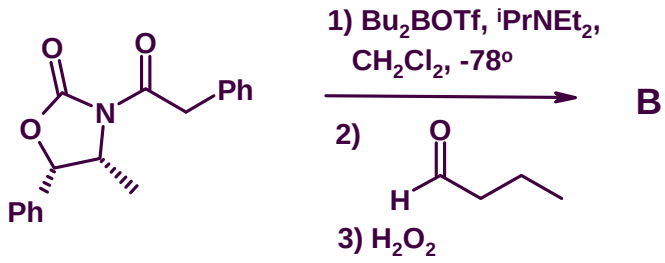
Answer all questions in the exam booklet.

1. Do any nine (9) 'letters', <u>including d</u>. (45 marks) Provide the major reaction product in each of the following transformations. Include stereochemical (relative and or absolute) information where it is relevant. I do wish you to show any intermediates that could be isolated. Mechanisms are not necessary, but showing your work may be a help. A warning, though…if you do the 1st letter of a series, you must do them all (i.e. you can't do **C** but not **D** or **I** but not **J).**

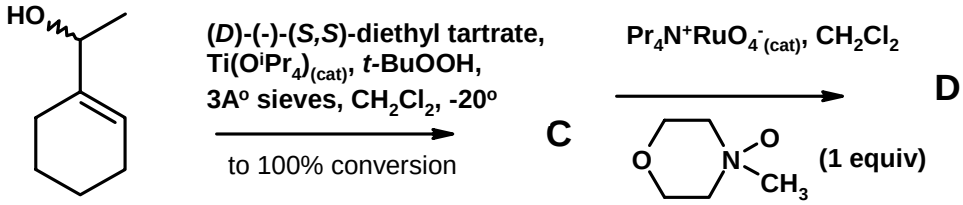
a)



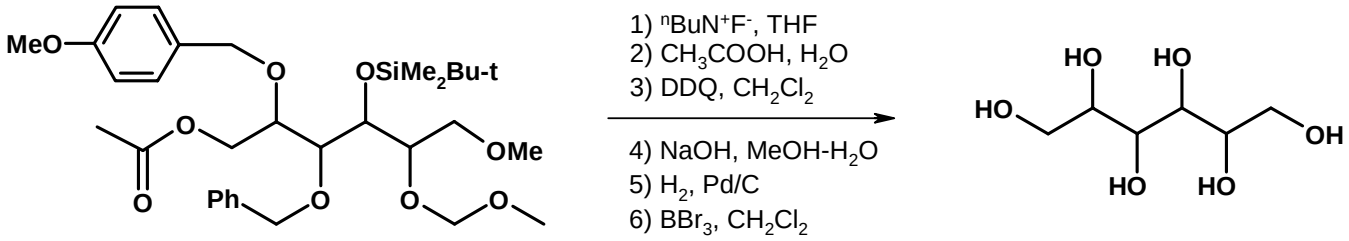
b)



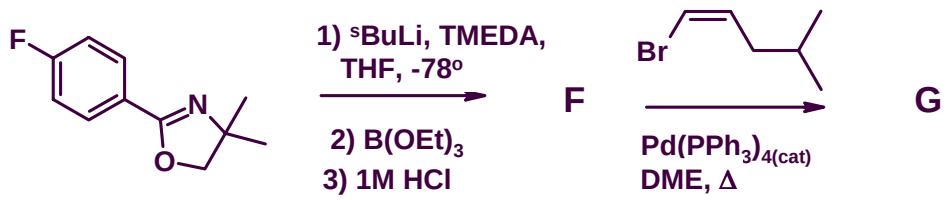
c) In addition…is the reaction to form <u>C</u> stereospecific? Is it stereoselective?



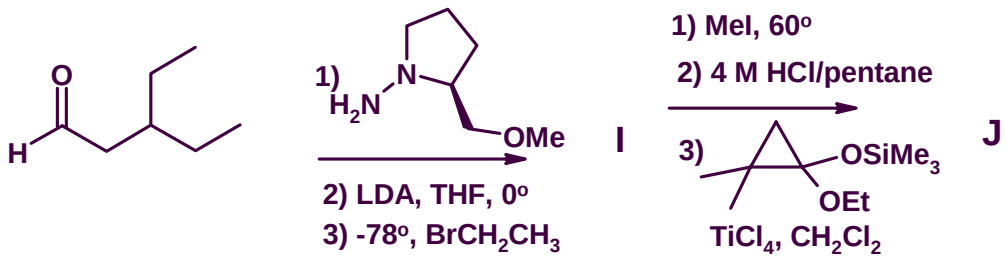
d) This hexa-alcohol can be deprotected by the sequence of reagents below. Show all the interemediates after each step. Markwise, we'll consider this equal to 3 letters (15 marks).



e)



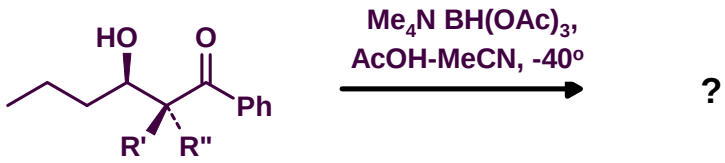
f)



2. (5 marks) Grads: In 1e, the same product **G** could also be obtained by using $BrCH_2CH_2Br$ *instead* of $B(OEt)_3$/HCl in the first step and then using a different reagent in the second step (I will give you a hint on that reagent once you show me compound **F**). Would this likely to be easier (lower T, probably less side products) than the shown procedure above? Why or why not?

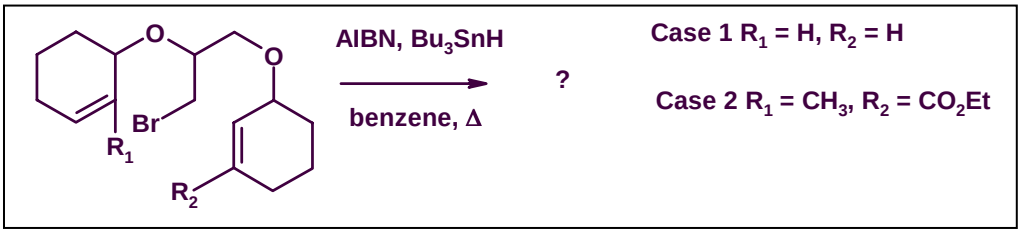
3. (**Total 20 marks**)

a) One of the series reagents for reducing β-hydroxy ketones with excellent diastereoselectivity employs Me_4N^+ $^-BH(OAc)_3$, in acetic acid/acetonitrile workup. Show by way of intermediates and transition state(s) why such selectivity is observed, and of course the final product, including relative stereochemistry (and the stereochemical descriptor used for it). **Grads**: If there is substitution α-to the ketone, this works better (higher de's) if R'=H, R"=substituent (say Me) than if R'=Me, R"=H. Why?

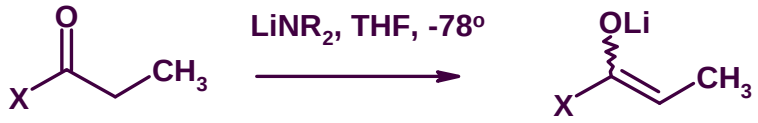


b) **Do i) or ii), but not both.**

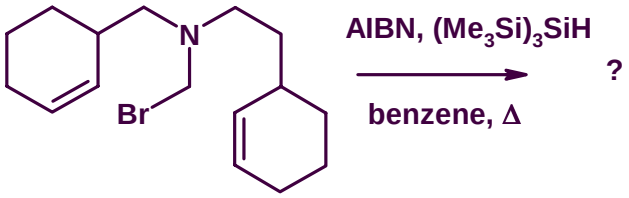
i) The following two precursors, although clearly closely related, give different radical cyclization products; the Case 1 example giving the 5- membered ring compound while the Case 2 example giving the 6-membered ring product. Explain by way of mechanism why this is the case (most of the marks); make sure you include the product structures.



ii) Show by way of transition state how a carbonyl compound, such as the one below, ends up being deprotonated stereoselectively with $LiNR_2$. How does going from a small X (say OCH_3 to a large X (say NMe_2) alters the product you get (the transition state should show this)? How does going from a small R (on the amide) alter the product you get (the transition state should show this)?



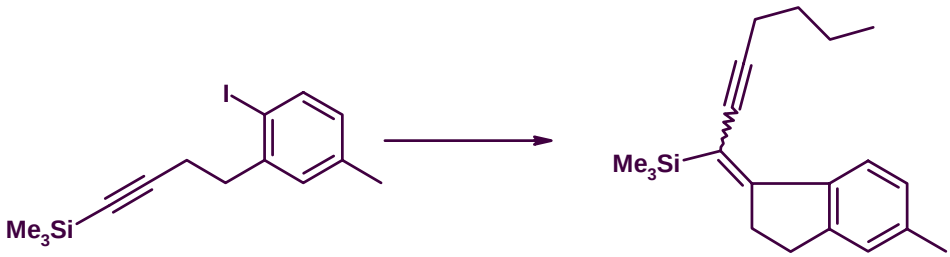
iii) This pertains to i)…Curiously enough, the case below also gives the 6-membered ring product. Can you explain by way of mechanistic considerations why this is the case? Again, include product structures. (**5 marks).**



4. Do any five (5) 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 50 marks**)

a)



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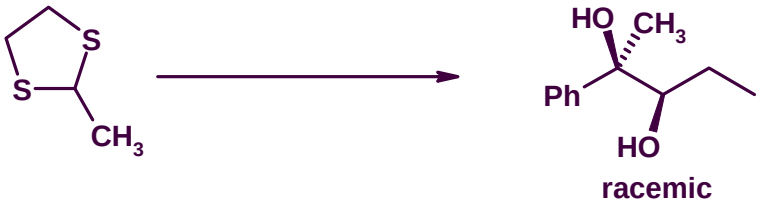
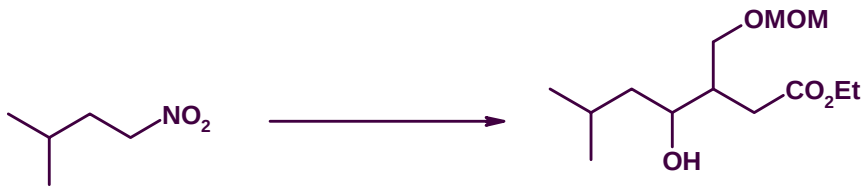
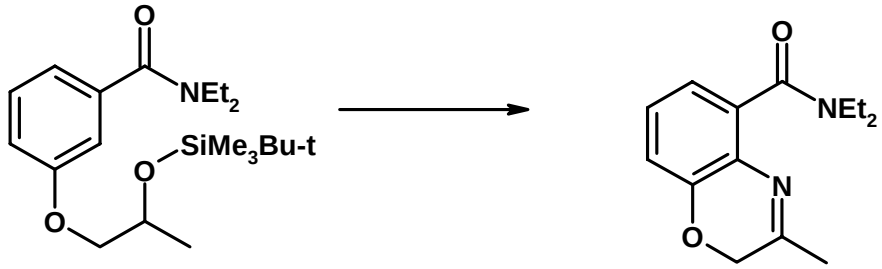


c)



Note: I expect to see the *structure* of OMOM in the answer

d)



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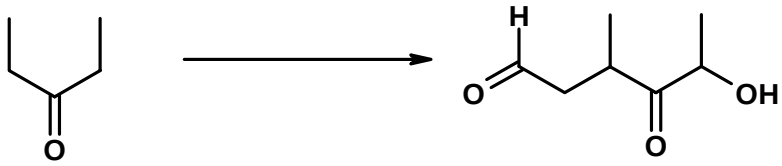
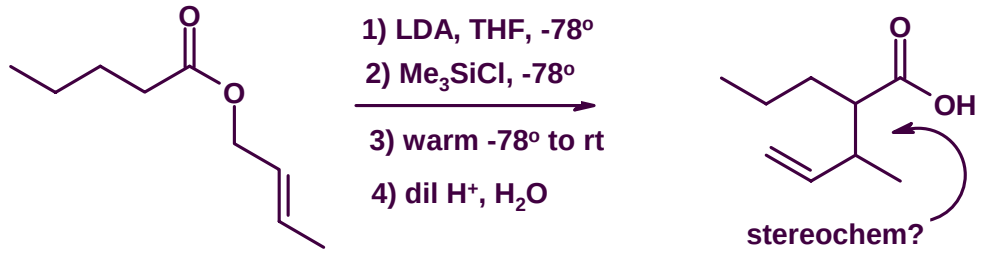


f)

5. (**5 marks**) Classify *any and all* cyclization reactions you do in **4a-f** according to Baldwin's Rules.

Bonus: An important reaction not studied in this course is the Claisen rearrangement; the most well known is the ester enolate Claisen rearrangement (or Ireland version) which employs an O-allyl ester and a silyl enol ether (silyl ketene acetal). Can you predict the (very reliable) stereochemical outcome of this process based on transition state considerations? I've given you the 'gross' structure.



Assorted Cheat-sheet info

Baldwin's Rules for Ring Closure

For tetrahedral substrates:

a) 3- to 7- exo-tet favoured
b) 5- to 6- endo-tet disfavoured

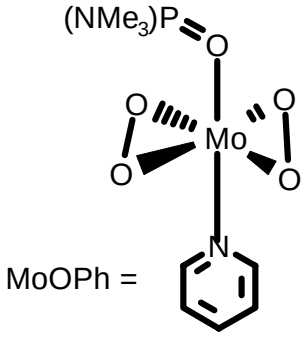
For trigonal substrates

a) 3- to 7- exo-trig favoured
b) 3- to 5- endo-trig disfavoured
c) 6- to 7- endo-trig favoured

For digonal substrates

a) 3- to 4- exo-dig disfavoured
b) 5- to 7- exo-dig favoured
c) 3- to 7- endo-dig favoured

The structure of MoOPh is:



The structure of DDQ is