CHEM 330

Final Exam
December 8, 2010

Your name: _____

This a closed-notes, closed-book exam

The use of molecular models is allowed

This exam contains 10 pages

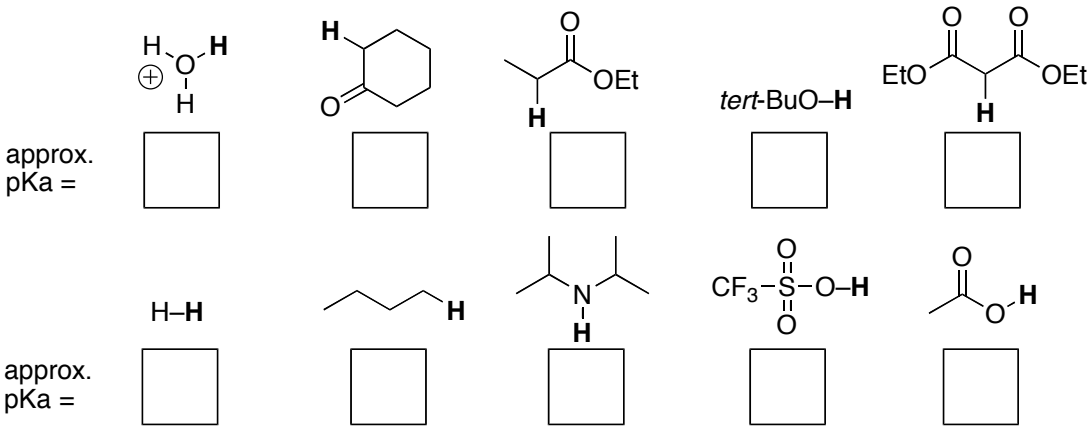
Time: 2h 30 min

1. _____ / 20
2. _____ / 20
3. _____ / 20
4. _____ / 30
5. _____ / 40
6. _____ / 40
7. _____ / 40
8. _____ / 40

TOTAL _____ / 250 = _____ / 100

This exam counts for 45% of your CHEM 330 final grade

1. (20 pts.) Indicate the approximate pKa for the dissociation of the H in boldface in the substances listed below



2. (20 pts.) Write a chemical equation to show an example of (**do not** write mechanisms – just the reactions):

   a. A cross-Claisen reaction that will work well under conditions of reversible enolate formation:

   b. An Evans aldol reaction that occurs between stereochemically matched reactants:

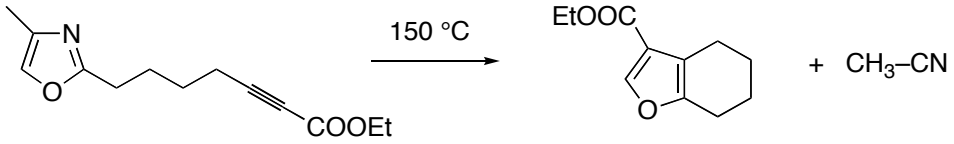
   c. A nucleophilic addition to a chiral aldehyde that occurs in accord with the Felkin-Ahn reactivity model:

   d. A nucleophilic addition to a chiral aldehyde that occurs in accord with the Cram-Felkin reactivity model:

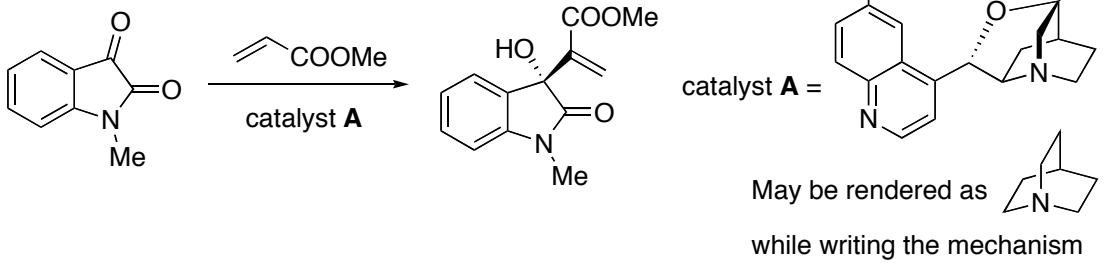
e. An Evans aldol reaction that occurs between stereochemically mismatched reactants:

3. (20 pts.) Write accurate mechanisms for the following known reactions:

a.

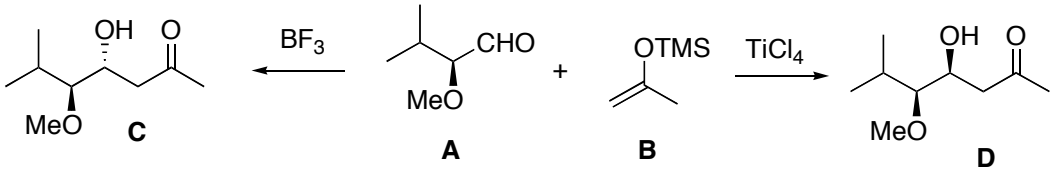


b.

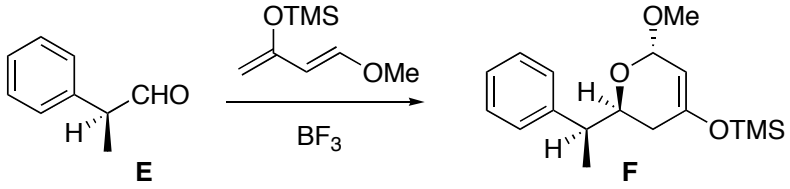


4. (30 pts.) Briefly rationalize the stereochemical outcome of the following reactions and write clear diagrams to illustrate your arguments:

   a. The major product of the Mukaiyama aldol reaction of **A** with **B** is compound **C** if BF_3 is used as the promoter, but compound **D** if $TiCl_4$ is used instead:

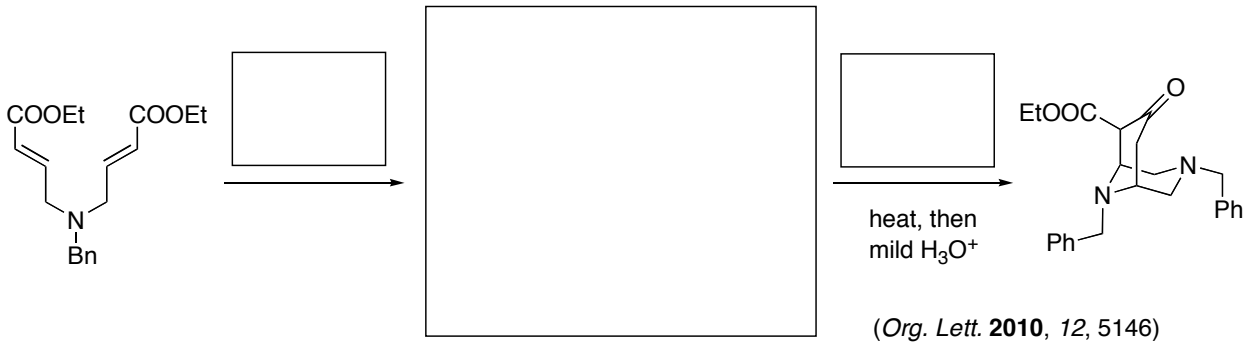


   b. In the presence of BF_3, the Danishefsky diene undergoes a Diels-Alder-like reaction with aldehyde **E**, acting now as a dienophile, to give **F** as the major product:



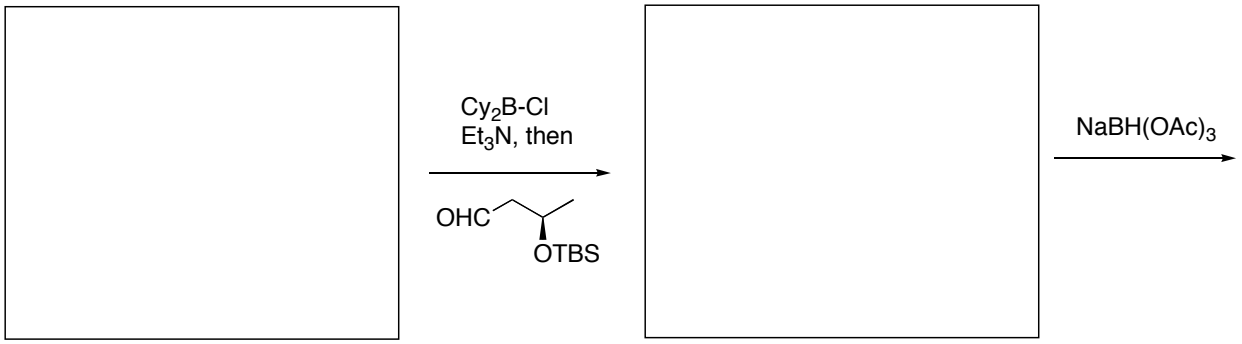
5. (40 pts.) Complete the following diagrams by writing all the missing reagents / intermediate products in the appropriate boxes. **Important**: (i) aqueous workups are understood; (ii) compounds must be drawn with the correct configuration of all stereogenic centers.

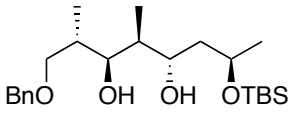
a.



(*Org. Lett.* **2010**, *12*, 5146)

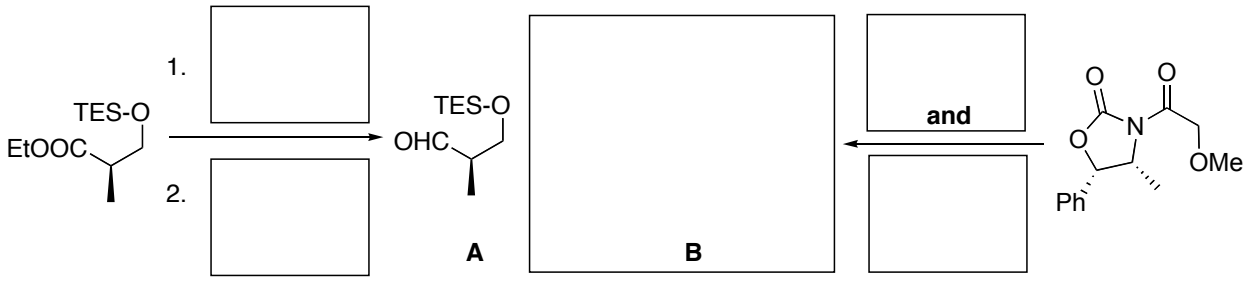
b.



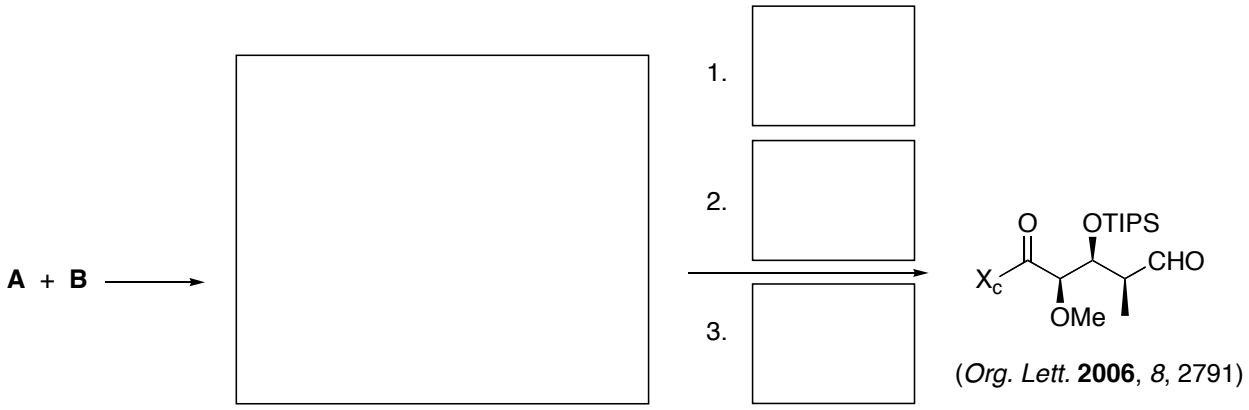


(*Org. Lett.* **2010**, *12*, 5530)

c.



then:



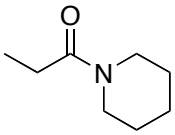
(*Org. Lett.* **2006**, *8*, 2791)

6. (40 pts.) Predict the structure of the major product expected from the following reactions. Notes: **(i) it is not necessary to draw mechanisms; (ii) aqueous workups at appropriate stages are understood.**

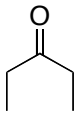
a. EtOOC COOEt
1. NaH, cat. EtOH
then CH_2=CH-CH_2Br
2. Aq. NaBr, DMSO,
reflux

b. COOH
1. $SOCl_2$
2. Meldrum's acid, Et_3N
3. HO , reflux
4. excess NaH,
I I

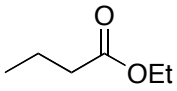
c. Me
O
1. Li, liq. NH_3
then
O
2. CH_3ONa

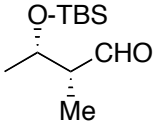
d. 

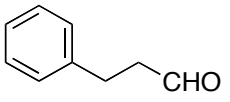
1. LDA, THF
2. Ph-CHO

e. 

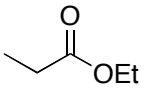
1. 9-BBN-OTf
Et_3N
2. Ph–CHO

f. 

1. LDA, THF
2. 

g. 

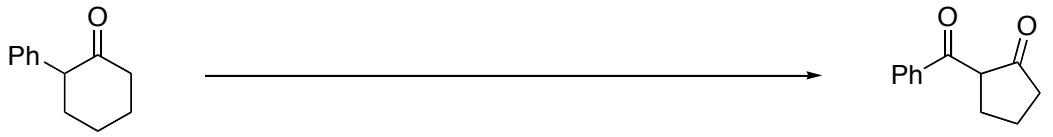
excess HCHO
aq. NaOH

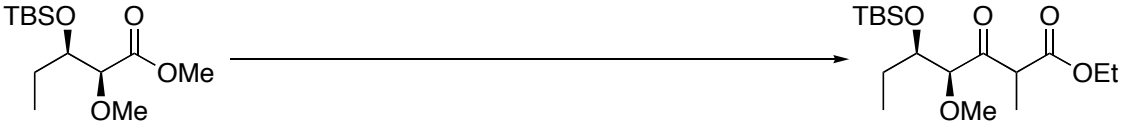
h. 

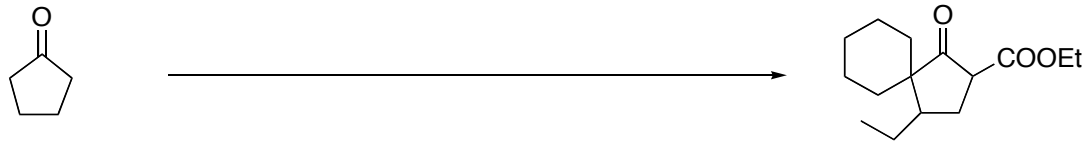
1. LDA, THF / HMPA
2. Ph–CHO

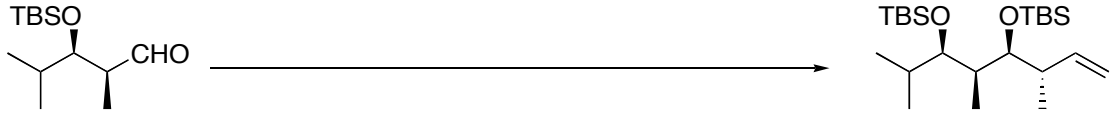
7. (40 pts.) Complete the following equations by indicating all the reagents that are necessary to effect the transformations shown. Provide your answers as a numbered list of reagents, in the correct order, written over/under the reaction arrows.

   Note: aqueous workups are understood and are not to be included in your answers.

a. 

b. 

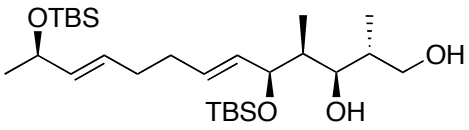
c. 

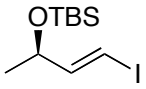
d. 

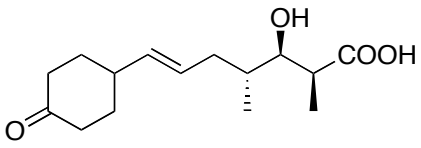
e. 

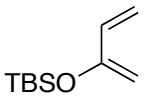
8. (40 pts.) Propose a method to achieve the enantioselective synthesis of the molecules shown below starting with the suggested building blocks. Be careful about protecting groups and configurations of stereocenters. Assume the availability of all needed reagents, auxiliaries, etc. Present your answer as a **clear** flowchart.

It is not necessary to draw mechanisms or to indicate aqueous workups.

a. 

starting with: 

b. 

starting with: 

Happy Holidays !