CHEM 330

Final Exam
December 19, 2005

Your name: _____

This a closed-notes, closed-book exam

The use of molecular models is allowed

This exam contains 12 pages

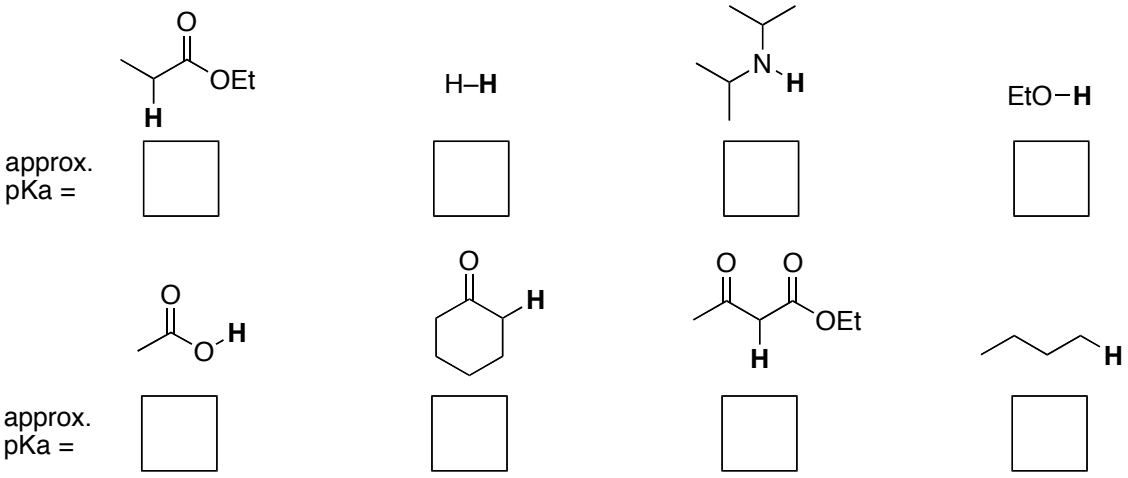
Time: 2h 30 min

1. _____ / 24
2. _____ / 24
3. _____ / 22
4. _____ / 40
5. _____ / 40
6. _____ / 40
7. _____ / 50
8. _____ / 60

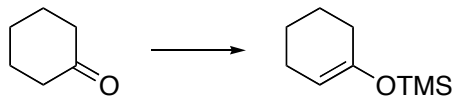
TOTAL _____ / 300 = _____ / 100

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

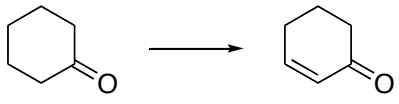
1. (24 pts.) Indicate the approximate pKa's for the ionization of the protons in boldface in the following molecules (write your answer in the box):



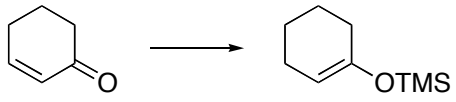
2. (24 pts) Check the appropriate box to indicate whether the following transformations involve overall oxidation, reduction, or neither, of the starting compound:

a. 

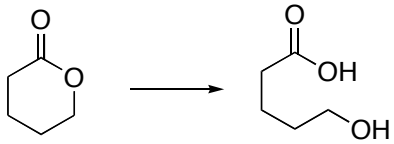
oxid. redn. neith.

b. 

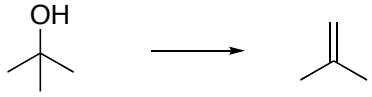
oxid. redn. neith.

c. 

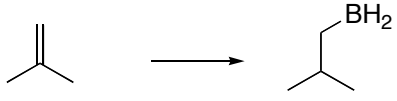
oxid. redn. neith.

d. 

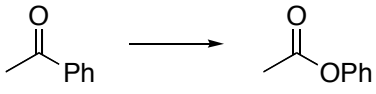
oxid. redn. neith.

e. 

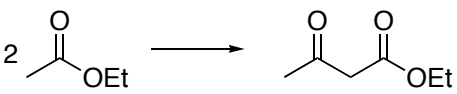
oxid. redn. neith.

f. 

oxid. redn. neith.

g. 

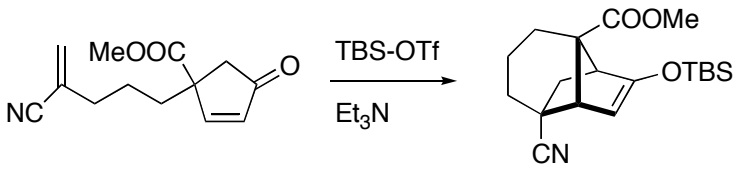
oxid. redn. neith.

h. 

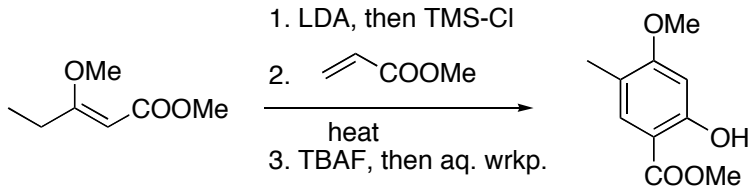
oxid. redn. neith.

3. (22 pts.) Write detailed mechanisms for the following known reactions:

a.



b.



4. (40 pts.) Write a chemical equation to show an example of the following reactions encountered in class (**do not** write mechanisms – just the reactions):

   Prasad reduction:

   Cannizzaro reaction:

   Robinson annulation:

   Miller silyl enol ether synthesis:

5. (40 pts) Check the appropriate box to indicate whether the following statements are true or false.

a. The copper atom undergoes reductive elimination in the following reaction:

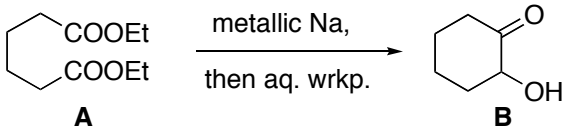
true ☐ **false** ☐

b. The following transformation may be induced by the use of Me_2CuLi:

true ☐ **false** ☐

c. Treatment of **A** with metallic Na, followed by aqueous workup, will result in formation of **B**:

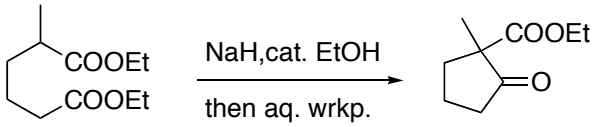
true ☐ **false** ☐



A **B**

d. The reaction shown below will give compound **C** as the major product:

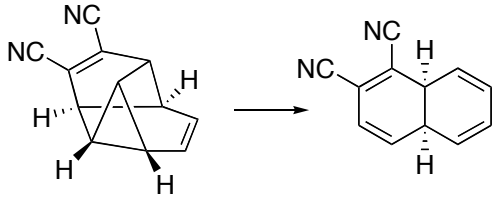
true ☐ **false** ☐



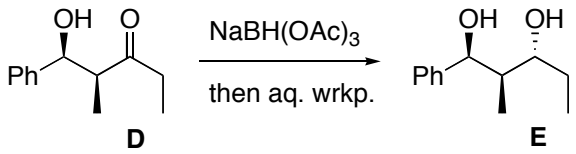
C

e. The reaction shown below is a reverse Diels-Alder:

true ☐ **false** ☐

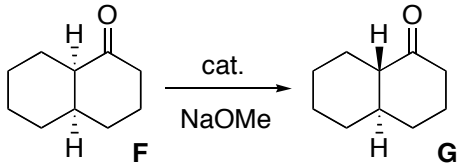


f. Treatment of **D** with $NaBH(OAc)_3$ followed by aqueous workup yields **E** as the major product: **true** ☐ **false** ☐



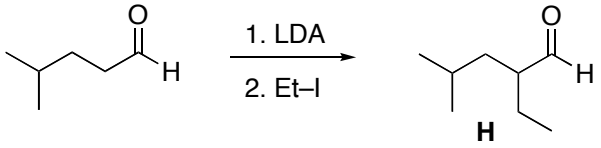
D **E**

g. Treatment of **F** with catalytic NaOMe will cause isomerization to **G**: **true** ☐ **false** ☐



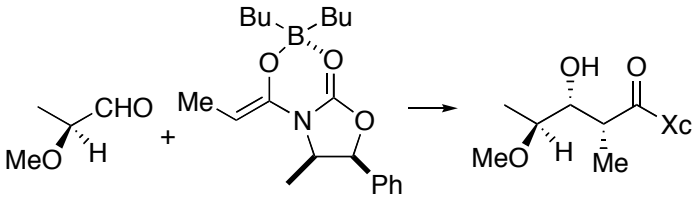
F **G**

h. The following sequence represents a good method for the preparation of **H**: **true** ☐ **false** ☐

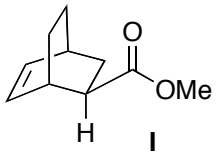


H

i. Substrate and reagent in the reaction shown below are stereochemically mismatched: **true** ☐ **false** ☐

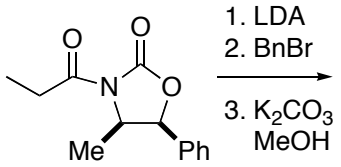


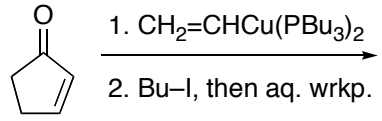
j. Compound **I** shown below is the product of an *endo*-Diels-Alder reaction: **true** ☐ **false** ☐

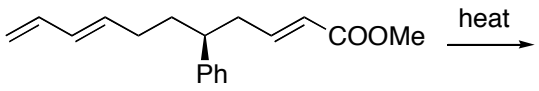


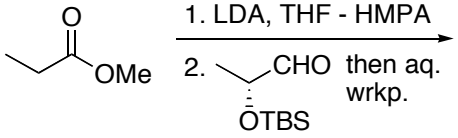
I

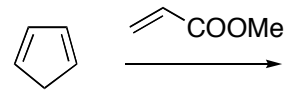
6. (40 pts.) Predict the structure of the major product expected from the following reactions. Note: **It is not necessary to draw mechanisms**.

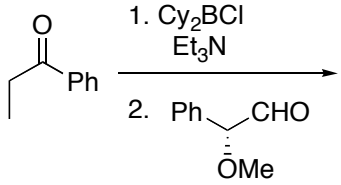
a. 

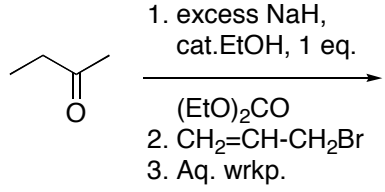
b. 

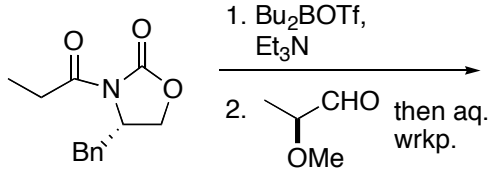
c. 

d. 

e. 

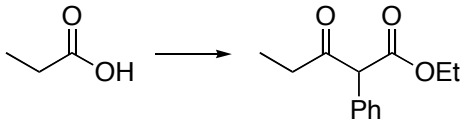
f. 

g. 

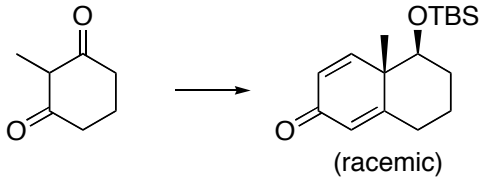
h. 

7. (50 pts.) Indicate a method to accomplish the transformations shown below. In each case, a multistep sequence (= not just one reaction, but several) may be necessary. Assume the availability of all required reagents (e.g, bases, alkyl halides, etc.). Present your answer as a flowchart. Note: **It is not necessary to draw mechanisms**.

a.

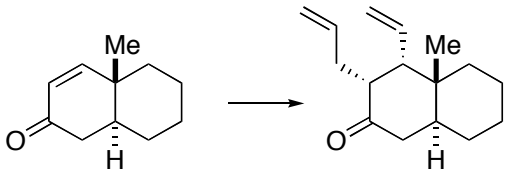


b.

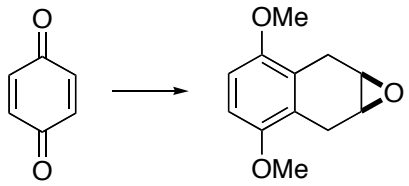


(racemic)

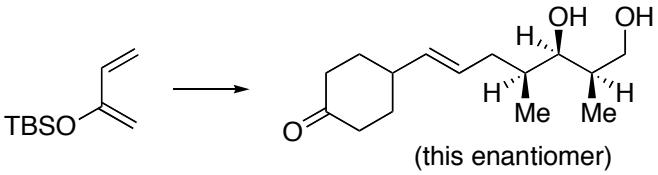
c.



d.

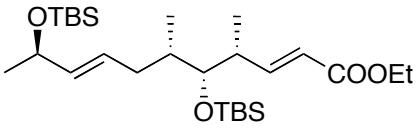


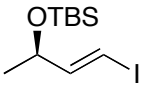
e.

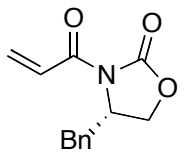


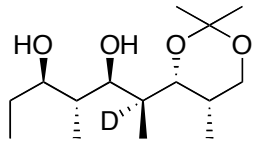
(this enantiomer)

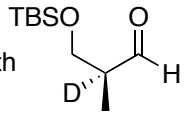
8. (60 pts) Propose a method to achieve the enantioselective synthesis of the molecules shown below. Be careful about protecting groups and relative/absolute configurations of stereocenters. Assume the availability of all required reagents, chiral auxiliaries, etc.

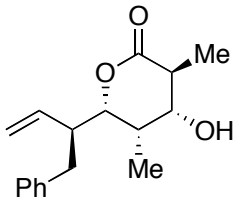
a. 

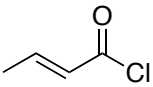
starting with 

and 

b. 

starting with 

c. 

starting with 

Happy Holidays !