

## Second 2-Hour Exam

By printing your name below, you pledge that

"On my honor, as a University of Colorado at Boulder student,  
I have neither given nor received unauthorized assistance on this work."

Name \_\_\_\_\_

Recitation TA's Name: \_\_\_\_\_ [Amy, Kate or Katie]

Recitation Day and Time: \_\_\_\_\_

Points:

Page #	Max. Points	Your Score
2	10	
3	18	
4	12	
5	10	
6	20	
7	10	
8	8	
9	14	
10	8	

\_\_\_\_\_ TOTAL (out of 100)

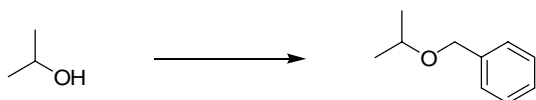
### General Instructions:

- This is a closed book exam! No notes and no molecular models may be used
- You have 2 hours to complete the exam
- Write your name on the top of each page
- Use the back of pages for scratch paper
- Don't cheat!

**Question # 1****10 pts total**

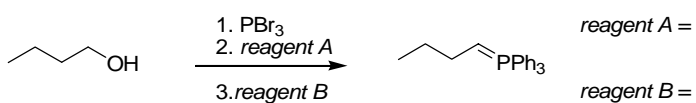
For each of the reactions below provide the reagent(s) required to form the indicated product:

a)



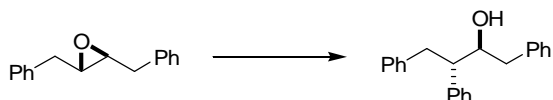
1 pt

b)



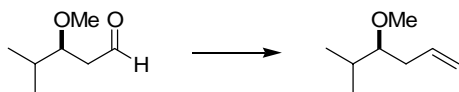
2 pt

c)



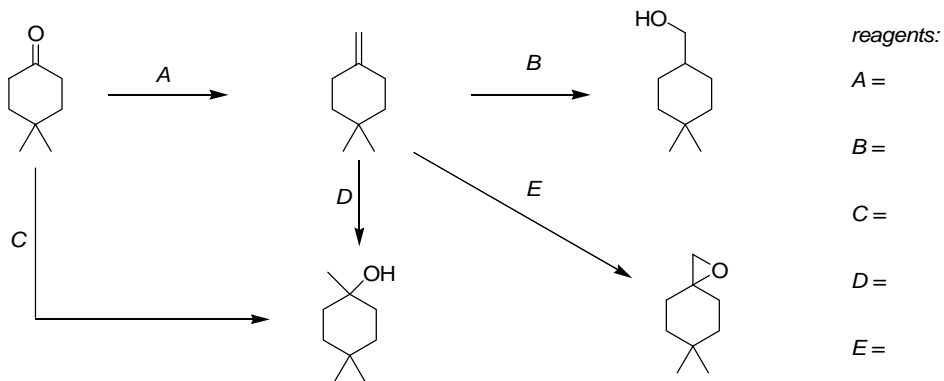
1 pt

d)



1 pt

e)



1 pt each

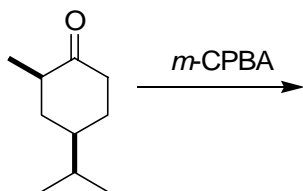
Points this page \_\_\_\_\_

## Question # 2

30 pts total

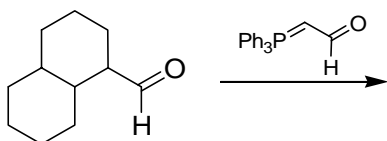
Draw the major product of the following reactions/reaction sequences. For parts (a), (b), (c), (g), and (h) you should indicate the stereochemistry of the product.

a)



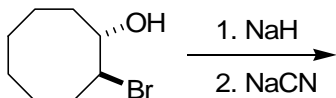
4 pt

b)



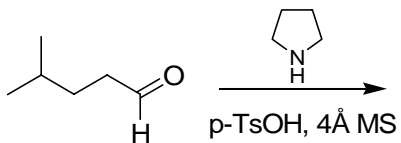
4 pt

c)



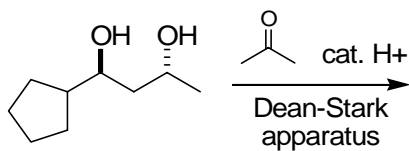
4 pt

d)



3 pt

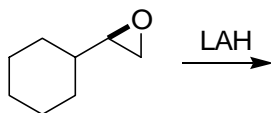
e)



3 pt

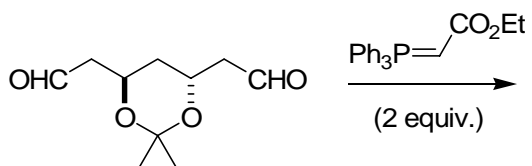
Points this page \_\_\_\_\_

f)



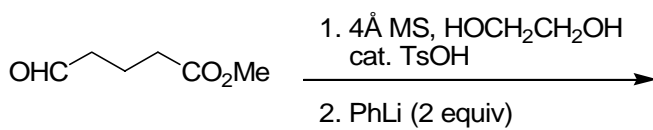
2 pt

g)



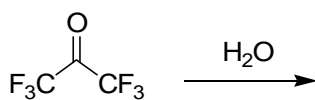
4 pt

h)



4 pt

i)



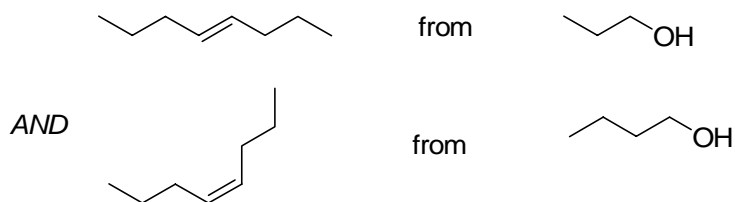
2 pt

**Question # 3****30 pts total**  
(10 points each)

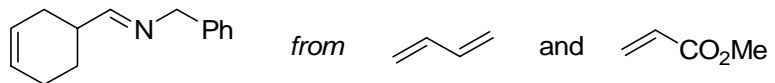
Do any three of the four following options. YOU MUST CROSS OUT THE ONE YOU DO NOT WANT GRADED. If you answer all four without crossing one out we will not count the highest score!

How would you synthesize the following molecules from the starting materials shown using any inorganic reagents you chose plus organic compounds of less than 8 carbons? Be sure to show the products of each step if your synthesis requires more than one step.

a)



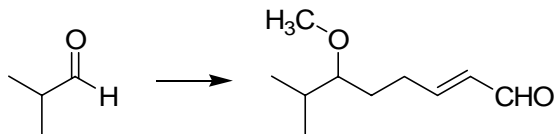
b)



c)



d)

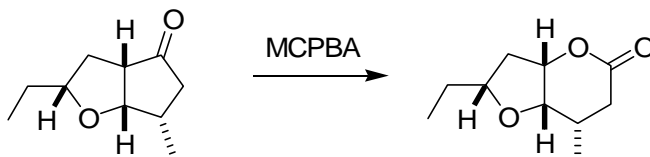


**Question # 4****30 pts total**

Write mechanisms for the following three reactions/reaction sequences, and answer any associated questions. *Be sure to show all the intermediates and all the arrows required for each step [including aqueous workup if it is required].*

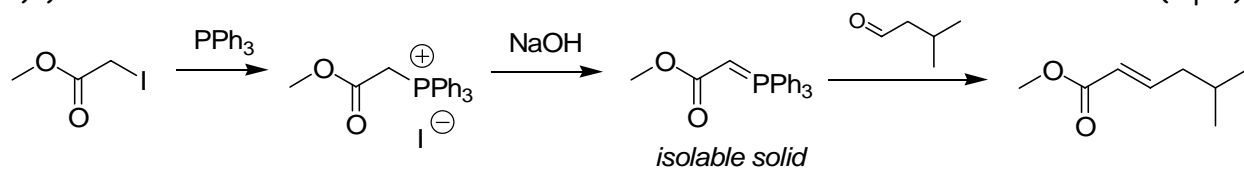
a)

(8 pts)





a) i)



ii) This Wittig reaction gives the (*E*)-olefin as a product. Draw a transition state that explains why the two groups end up on opposite sides of the alkene in the product [6 pts]

c)

(8 pts)

