

Advanced Organic Chemistry (CHE 311/511)
Second Mid-term Examination
Nov. 23, 2004
Prof. W. P. Malachowski

Name: _____

Read each question carefully before answering. Be certain you understand everything the question is requesting. Do the easy questions first. If questions appear confusing or exceedingly complex, then you may need to rethink the question. Keep in mind the intended examination topics. The exam has a total of seven pages and five questions.

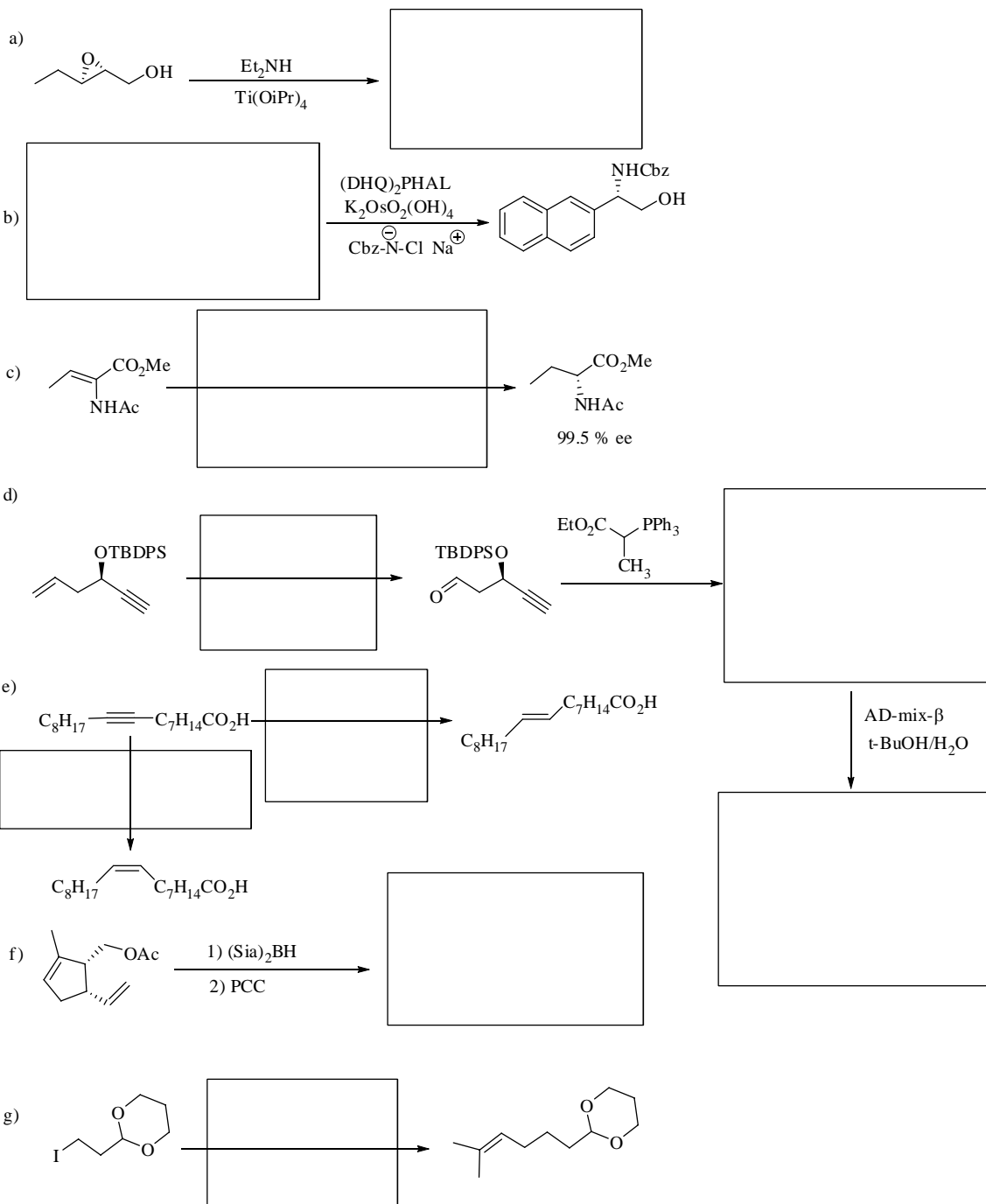
In organic chemistry, hand-drawn pictures convey specific information. Be sure the drawing you have made conveys the essential information required to answer the question. Make certain that three-dimensional pictures display the correct atom arrangements. Don't forget to include formal charges when appropriate.

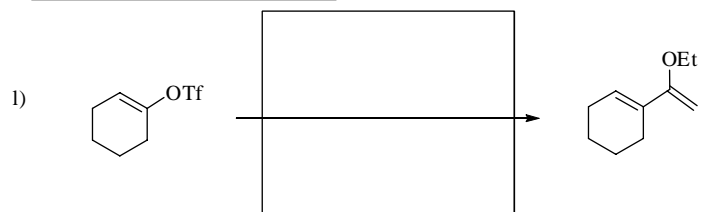
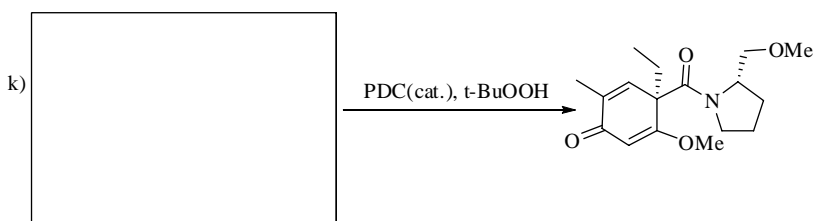
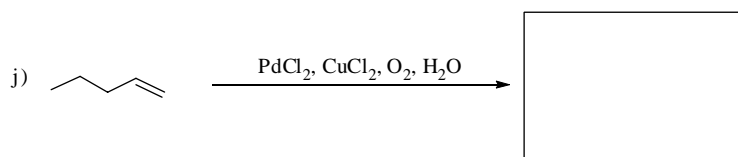
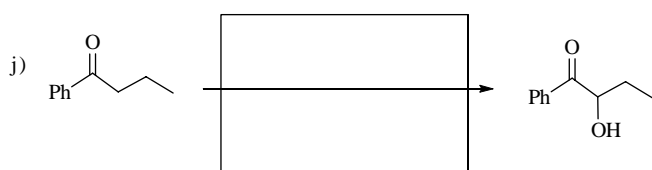
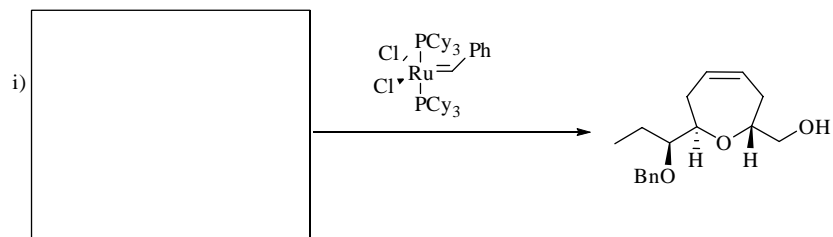
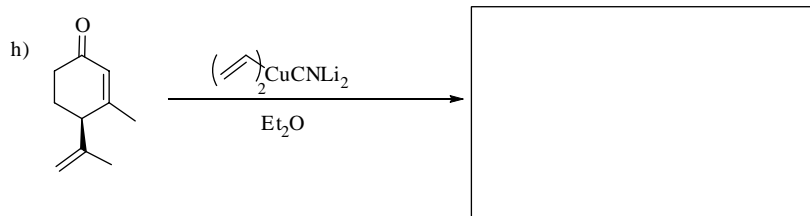
You may use models to assist in determining answers. You may use scrap paper to work out problems before entering your final answer on the exam sheets. In addition, feel free to use the back side of the exam sheets for scrap. If necessary, you may enter exam answers on the back side of the exam sheets, however you must clearly indicate which problems are located on the back of the exam pages.

Note that question 5 on page 6 has different requirements of graduate students and undergraduate students. Although the point total for the page is the same, *graduate students must answer three of four questions, while undergraduates only have to answer two of four.*

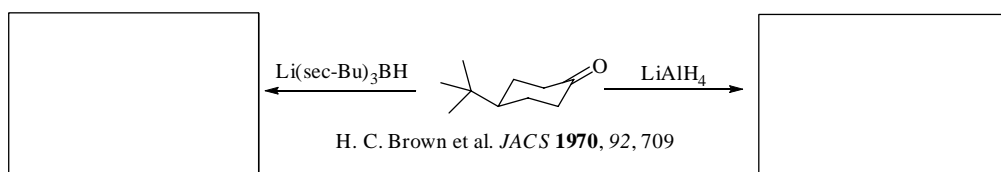
Bonus points: Bonus points will be awarded for extra correct answers in question 1, 4 and 5.

1. Provide the necessary information (product, reagent or starting material) to complete the following reactions and answer the associated questions. Answer 10 of the 16 questions. (4 pts. each) One bonus point for each additional correct answer.





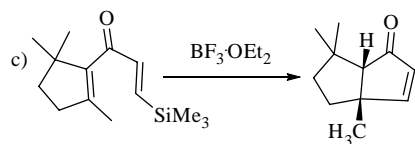
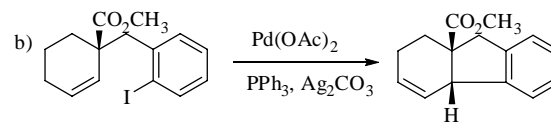
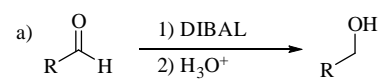
2. a) Draw the product of the reactions shown below. (3 pts. each)



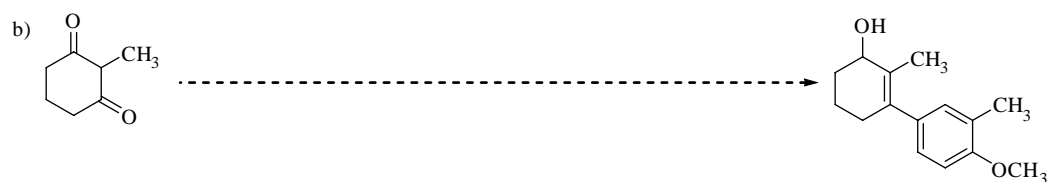
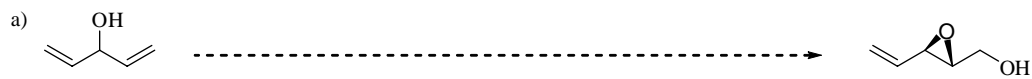
b) Explain why different products result based on the different choice of reagent. (4 pts.)

3. Show three reactions that are commonly used to make organolithium reagents. (12 pts.)

4. Choose two of the three reactions shown and write a mechanism for the reaction. (14 pts.) Four bonus points will be awarded for a third correct mechanism.



5. Provide reactions to transform the starting material on the left to the product on the right. You may use any reagents or reactants to accomplish this task. **Undergraduate students:** Answer two of the four synthesis questions below. (12 pts each.) **Graduate students:** Answer three of the four synthesis questions. (8 pts. each) Note: when the synthesis indicates a stereochemically pure product is formed, then full credit will result from strategies that properly address this challenge. Five bonus points will be awarded for each additional synthesis that is correct.



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