

Advanced Organic Chemistry (CHE 311/511)
First Mid-term Examination
Nov. 29, 2007
Prof. W. P. Malachowski

Name: Amy Winehouse

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.

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.

Graduate students:

Complete 15 of 18 boxes in question 1 (3 pts. each)

Complete questions 2, 3 and 4. (10 pts. each)

Complete three of four synthesis problems in

question 5. (15 pts. each)

Total points: 120

Undergraduate students:

Complete 12 of 18 boxes in question 1 (3 pts. each)

Complete two questions out of 2, 3 and 4. (12 pts. each)

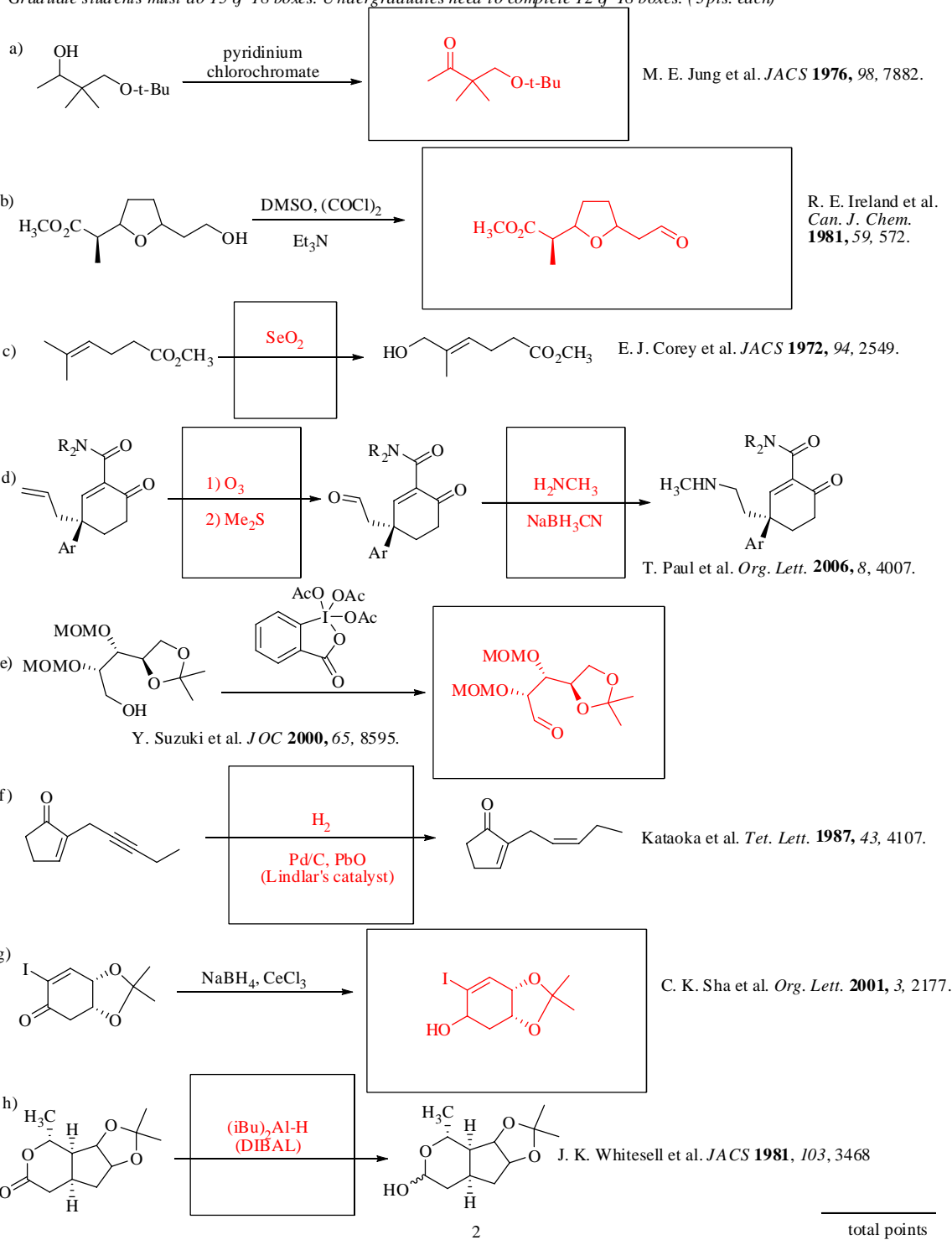
Complete two of four synthesis problems in question 5. (20

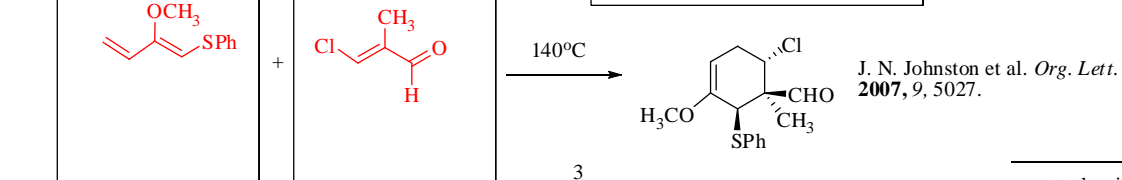
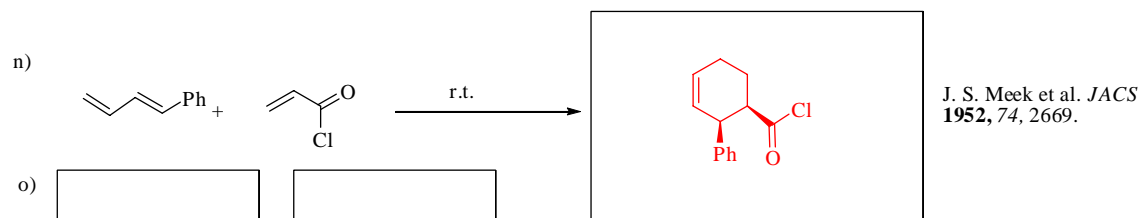
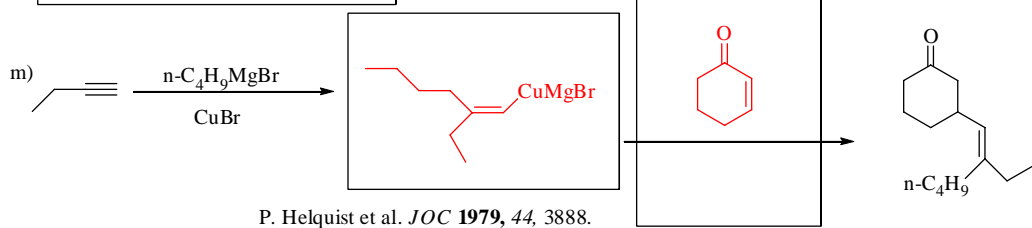
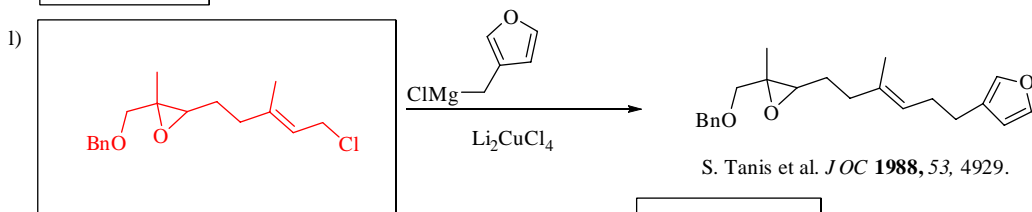
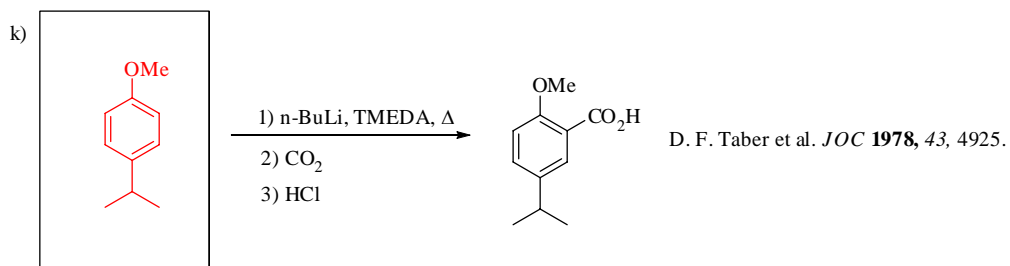
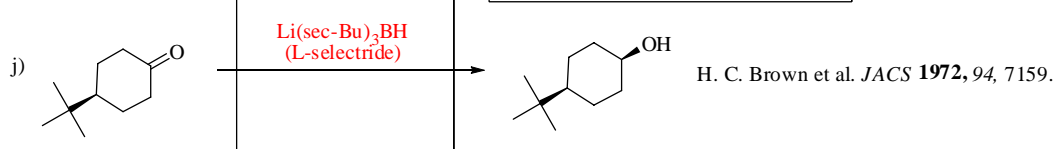
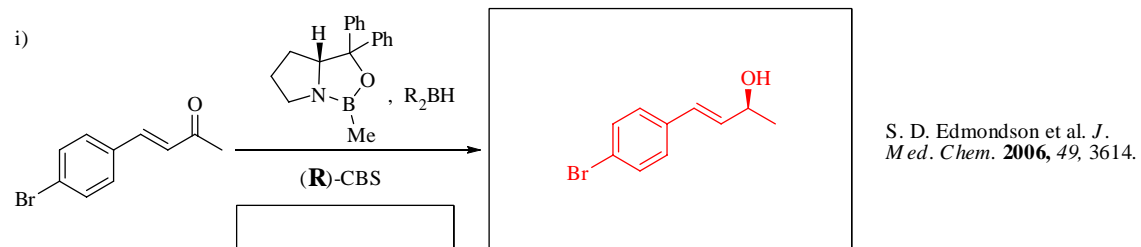
pts. each)

Total points: 100

Bonus points: *Up to 10 bonus points will be awarded for additional correct answers.*

1. Provide the necessary information (product, reagent or starting material) to complete the following reactions.
 Graduate students must do 15 of 18 boxes. Undergraduates need to complete 12 of 18 boxes. (3 pts. each)



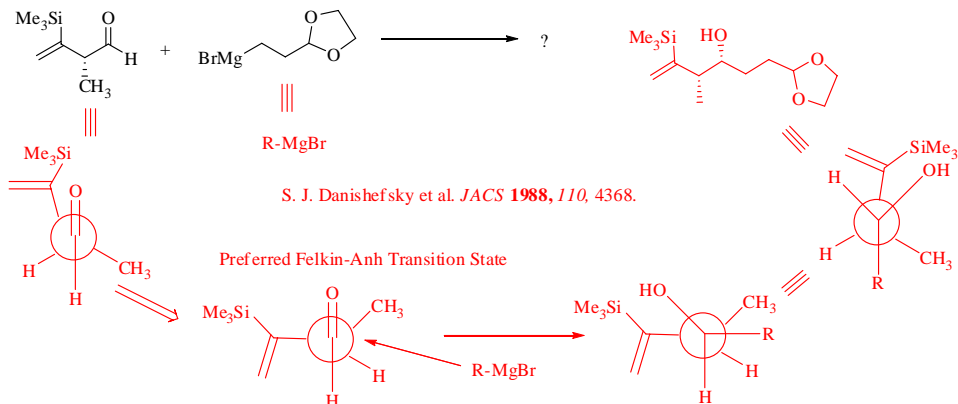


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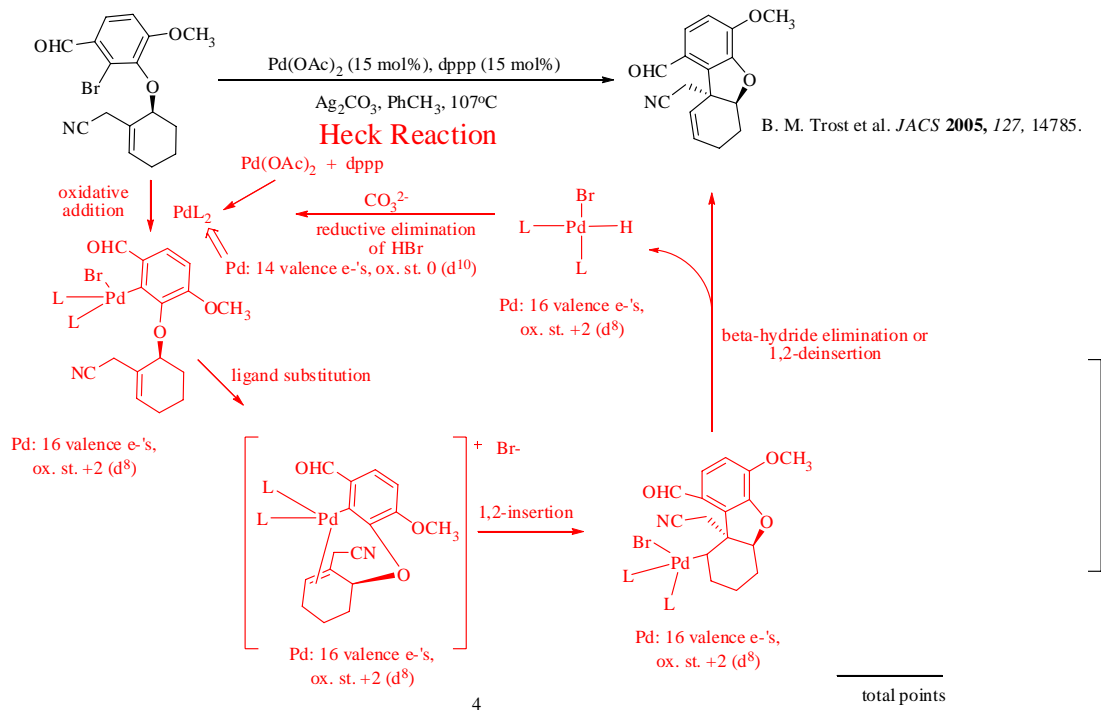
total points

Graduate students must answer questions 2, 3 and 4 (10 pts. each). Undergraduates only need to answer two of these three questions (12 pts. each).

2. Show the product and rationalize the outcome of the following reaction by drawing the transition state.



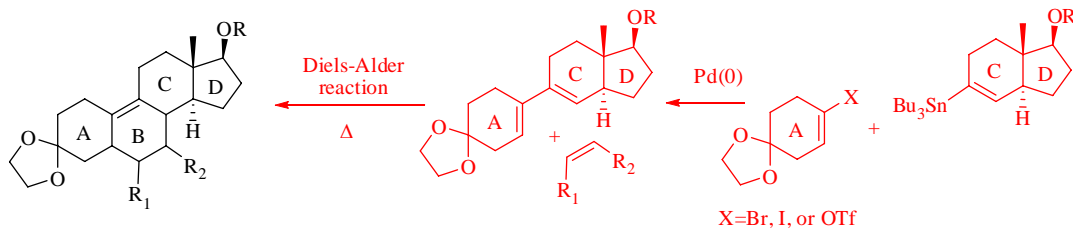
3. a) Draw a reasonable mechanism for the reaction shown below.
 b) Label the type of reaction occurring in each step of the catalytic cycle.
 c) Select one of the transition metal complex intermediates and determine the number of valence electrons and the oxidation state of the metal. You may abbreviate where appropriate.



4. A unique protocol for the synthesis of the steroid skeleton shown below was recently described by A. de Meijere and co-workers (*Org. Lett.* **2007**, 9, 517). The sequence involved generating the steroids with diverse substituents in the R₁ and R₂ positions. The new method for steroid synthesis by the authors used a sequential Stille cross coupling reaction followed by a Diels-Alder reaction to create the skeleton.

a) Based on your understanding of these reactions, sketch the starting materials for this sequence and show the reactions including reagents.

b) How would different groups at R₁ and R₂ be introduced?



R₁ and R₂ modified by using different dienophiles in the Diels-Alder reaction.

5. Provide a series of synthetic reactions to transform the starting material to the product shown.

Graduate students need to answer three of the four syntheses questions (15 pts. each) and undergraduates need to answer two of the four questions (20pts. each).

