

**Advanced Organic Chemistry: Synthesis**

CHEM 311/511

**First Mid-term Exam**

Thursday October 8, 2009

Name: Cliff Lee

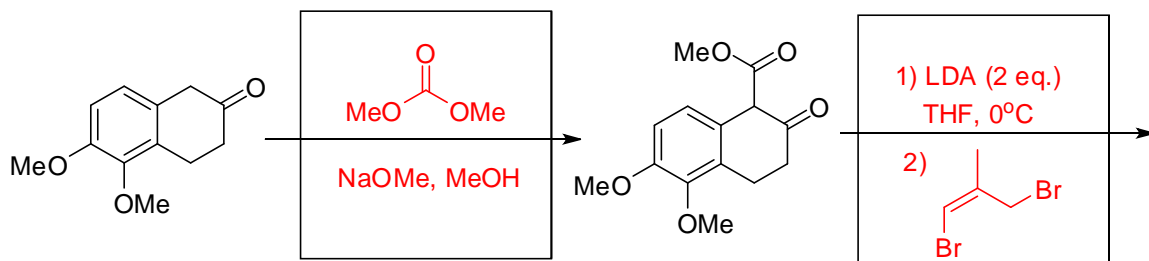
Read each question carefully before answering. Be certain you understand everything the question is requesting. Do the easy questions first. If questions appear confusing or exceedingly complex, then you may need to rethink the question. Keep in mind the intended examination topics.

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.

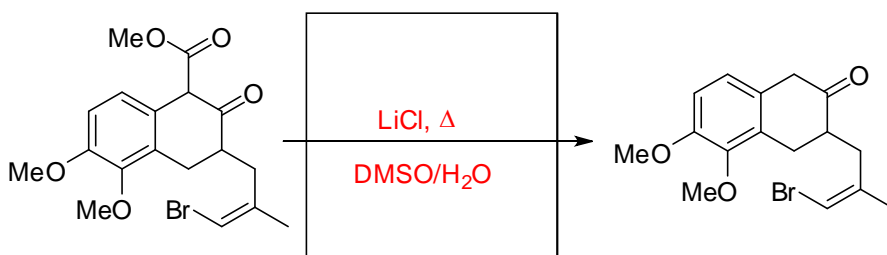
You may use models to assist in determining answers. You may use scrap paper to work out problems before entering your final answer on the exam sheets. In addition, feel free to use the back side of the exam sheets for scrap. If necessary, you may enter exam answers on the back side of the exam sheets,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

1. Box questions. Provide the necessary information, products or reagents, to complete the following reactions. Undergraduates complete six of the eight boxes and graduate students complete all eight. (30 pts.)

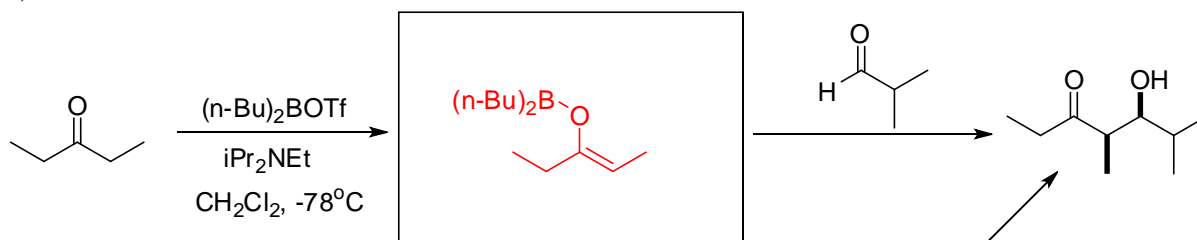
a)



D. F. Taber et al. *JACS* **2002**, *124*, 12416.

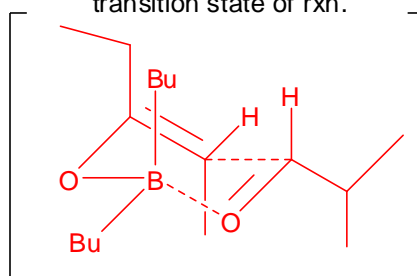


b)

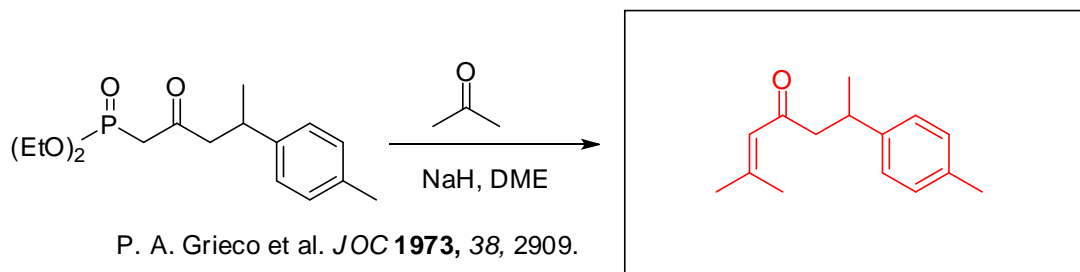


D. A. Evans et al. *JACS* **1981**, *103*, 3099.

transition state of rxn.

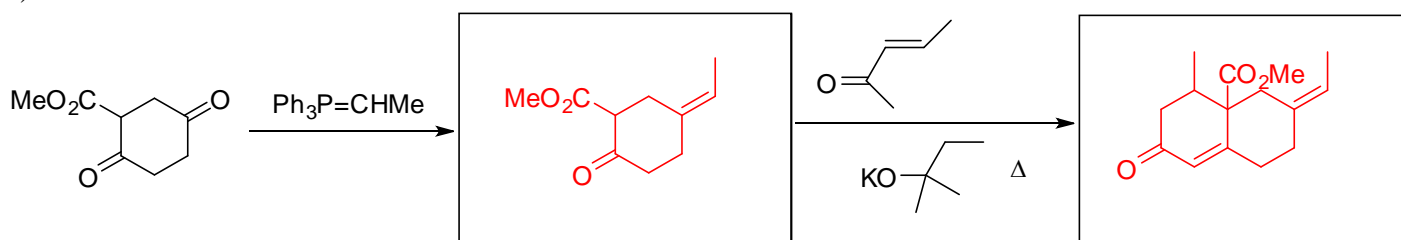


c)



P. A. Grieco et al. *JOC* **1973**, *38*, 2909.

d)



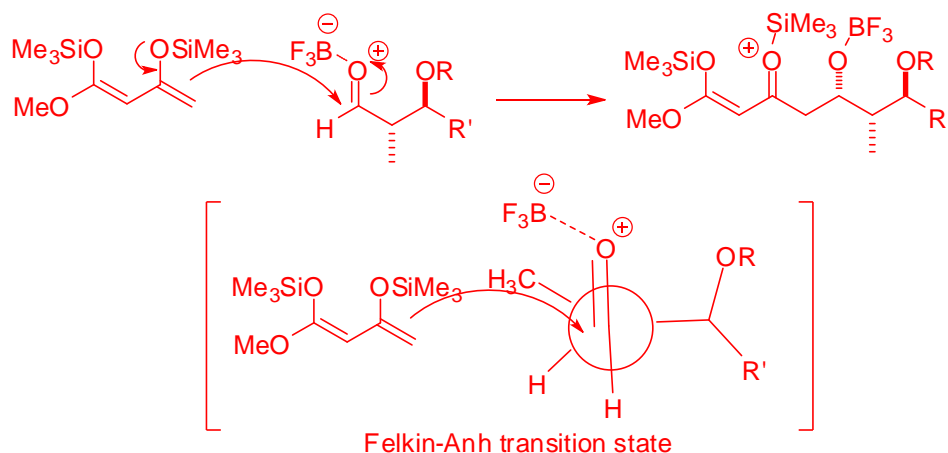
J. A. Marshall et al. *JOC* **1971**, 36, 594.

2. Mechanism questions. Both undergraduates and graduate students complete two of the three mechanism questions. (30 pts.)

a) Provide the mechanism of the reaction and draw the transition state that explains the stereoselectivity of the product.

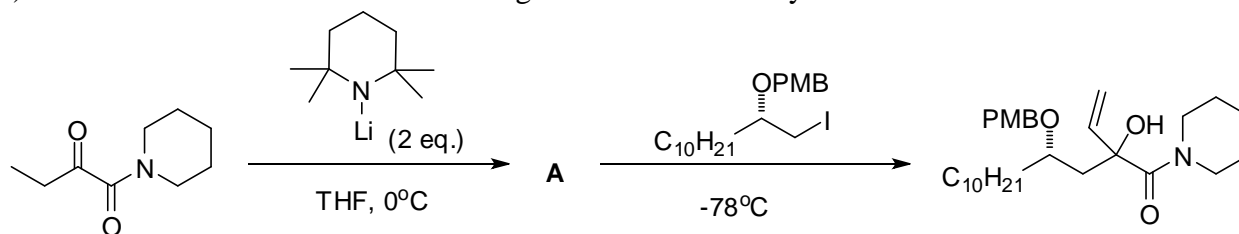


D. A. Evans et al. *JACS* **2002**, 124, 5654-5.

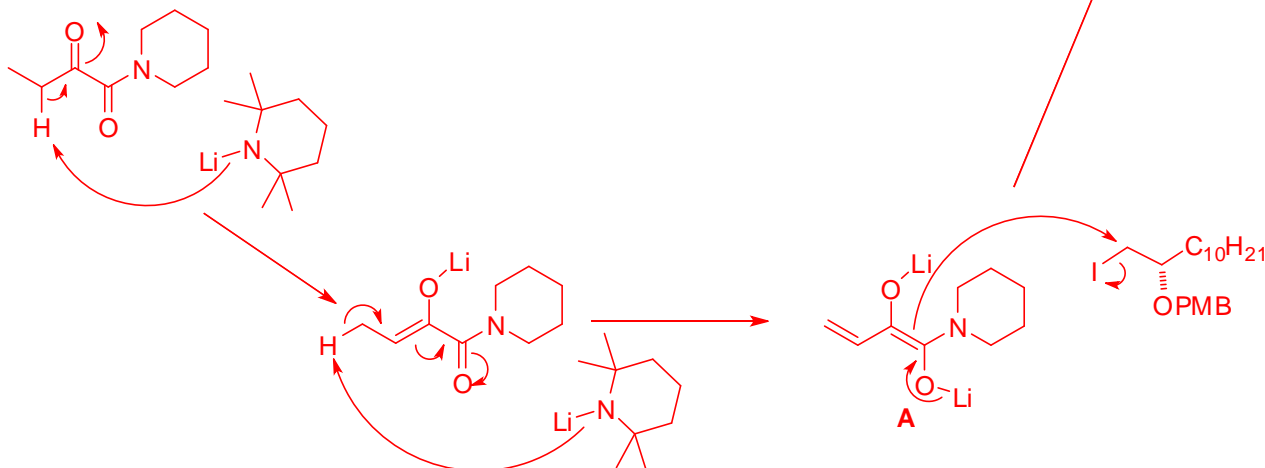


Felkin-Anh transition state

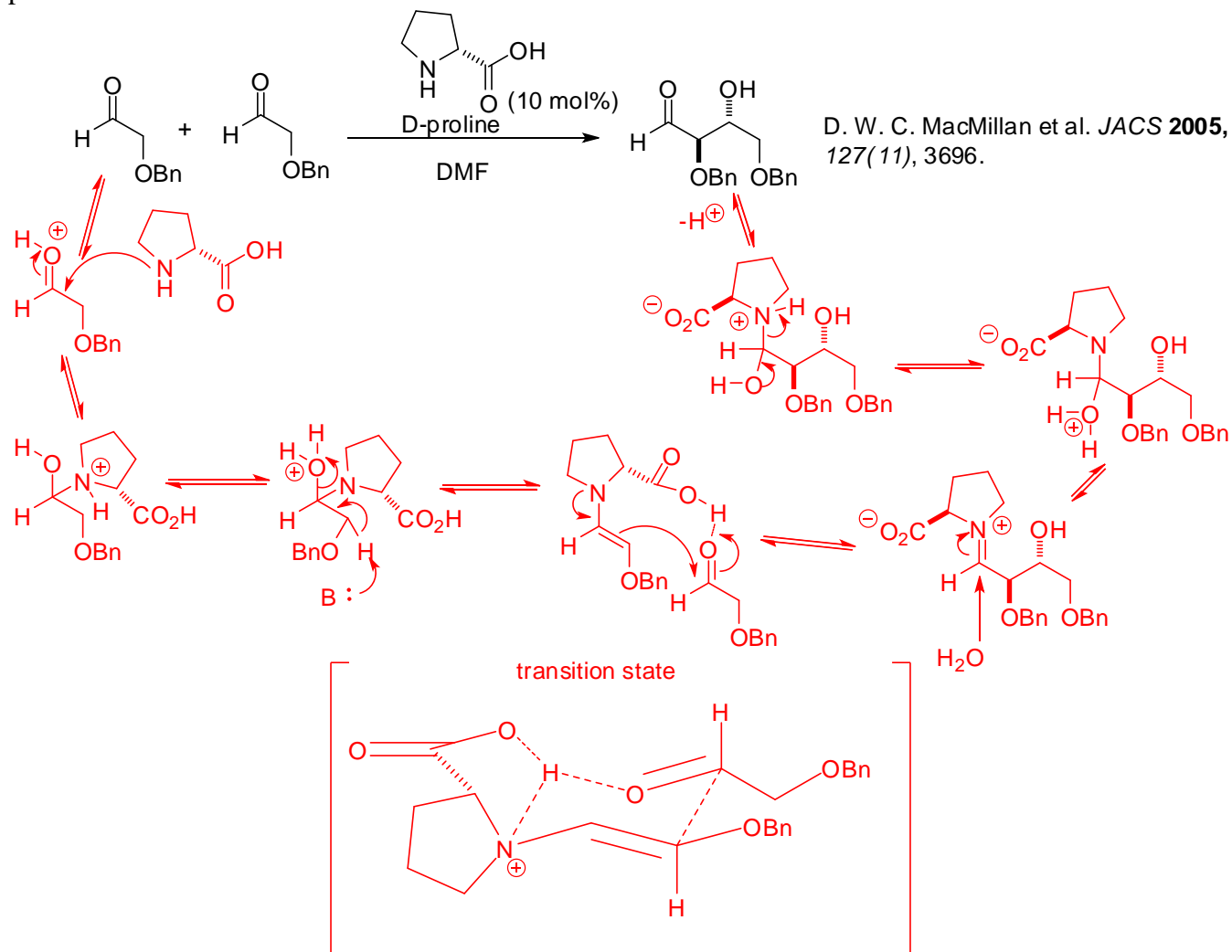
b) Provide a mechanism for the following reaction and identify the structure of **A**.



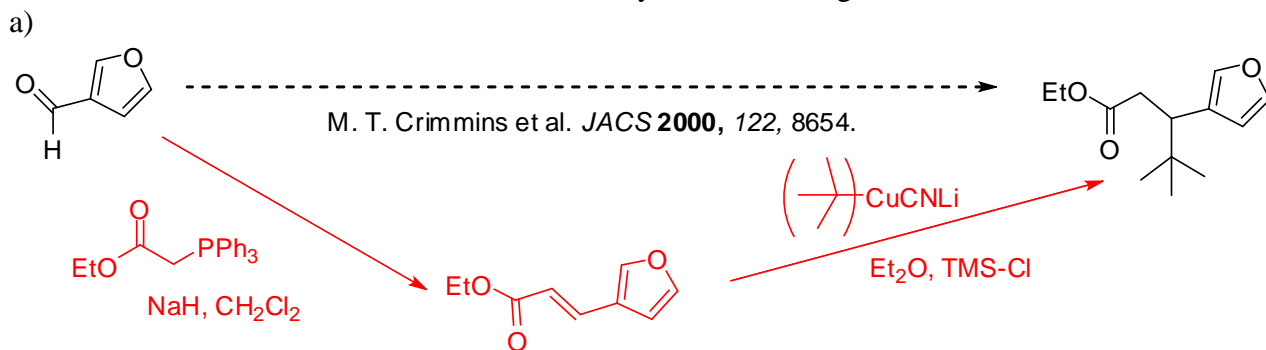
S. Marsden et al. *JACS* **2007**, 128, 12600.

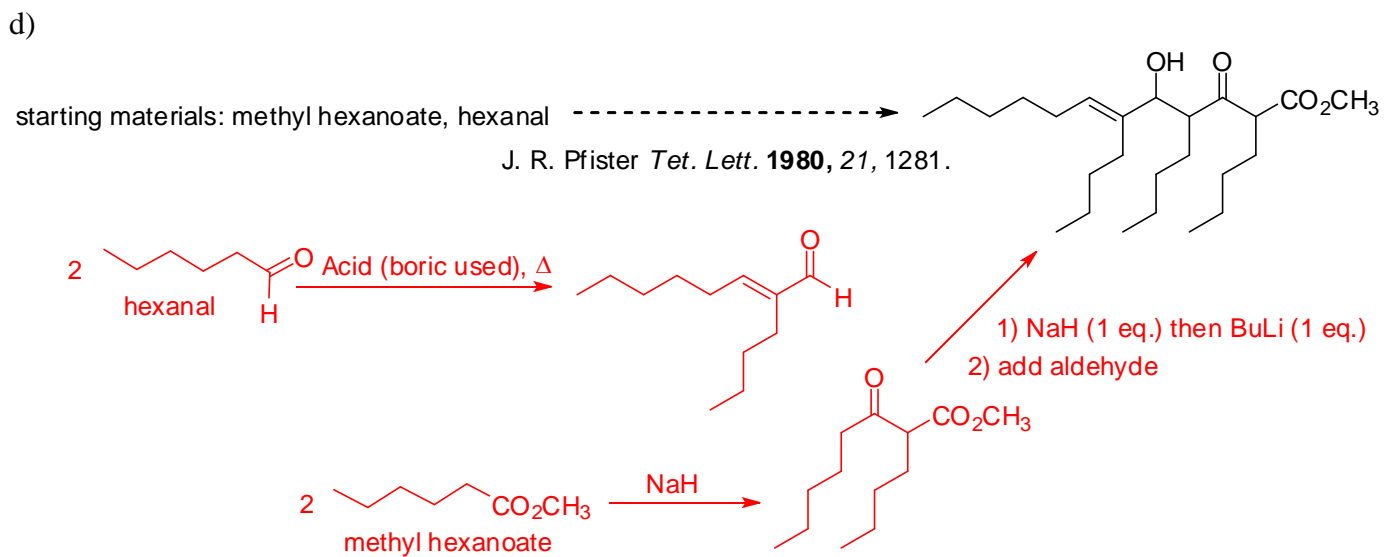
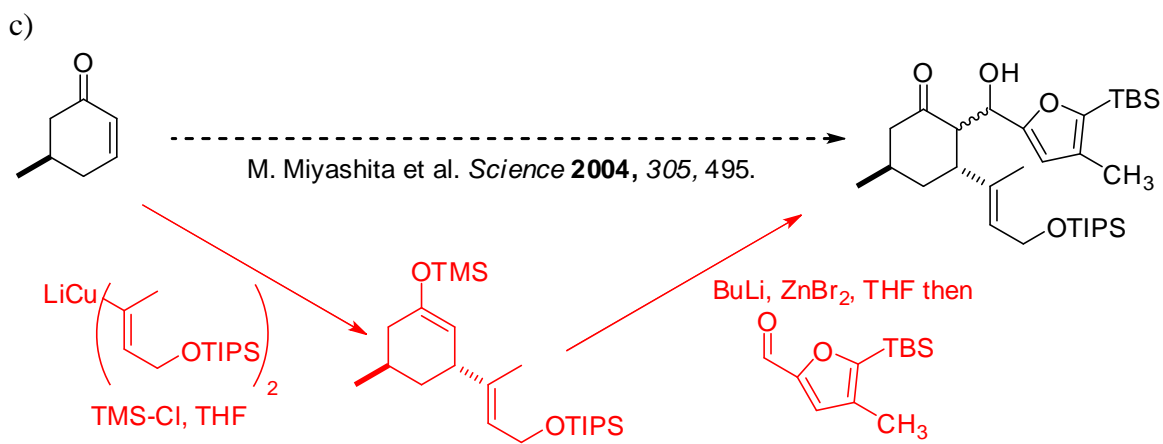
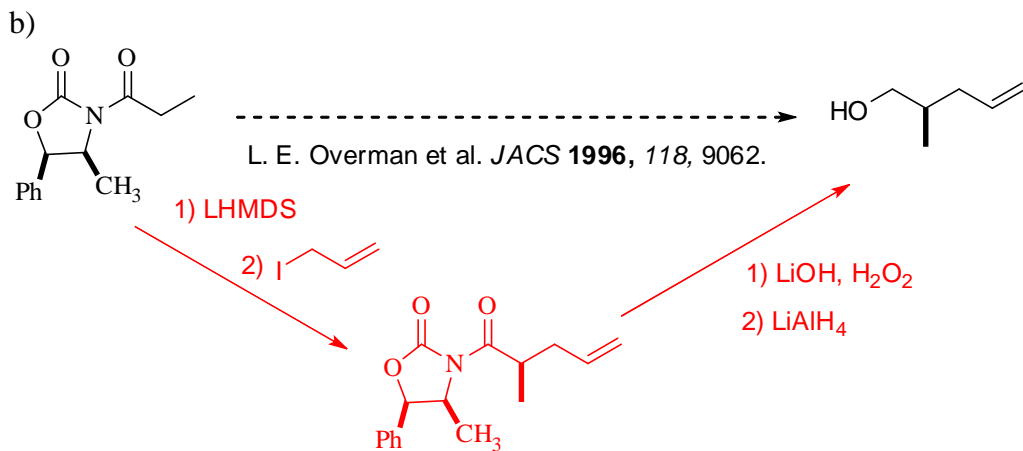


c) Provide the mechanism of the reaction and draw the transition state that explains the stereoselectivity of the product.



3. Synthesis questions. Provide a series of synthetic reactions to transform the starting material to the product shown. Graduate students must do three of four syntheses; undergraduates need to do two of four. (30 pts.)





4. Stereoselectivity and name reactions. Undergraduates and graduate students do both questions.

a) Identify one reaction on the exam that demonstrates relative stereocontrol and one reaction that demonstrates absolute stereocontrol. (5 pts.)

absolute stereocontrol demonstrated in 2a, 2c, 3b, and 3c.

relative stereocontrol demonstrated in 1b.

b) Identify at least two name reactions in the previous exam questions. In the case of multiple parts to a question be as explicit as possible. (5 pts.)

aldol reaction: 2b, 3c, 3d.

Mukaiyama aldol reaction: 2a.

Claisen condensation: 1a (box 1), 3d.

Robinson annulation: 1d (box 2)

Wittig reaction: 1d (box 1), 3a.

Horner-Wadsworth-Emmons: 1c.