

Chemistry 110B
SECOND EXAM
February 22, 2008

Name (print) _____

Note: Your exam should consist of 5 pages including this cover sheet. Skim the entire exam and solve the easiest problems first. (Hint: page 2 consists of questions straight out of Solomons)

From **Episode 113**: "The Maestro" written by Larry David:

JERRY: Ya know I feel a little funny calling somebody Maestro.

KRAMER: Why?

JERRY: Because it's a stupid thing to be called.

KRAMER: Jerry he's a conductor.

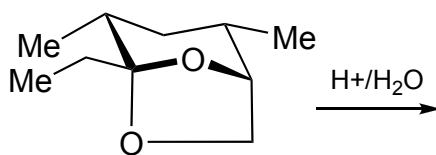
JERRY: Oh conductor. He conducts the Policeman's Benevolent Association Orchestra.

KRAMER: Well, he's still a conductor... you should see him do 'Flight of the Bumble Bee'!

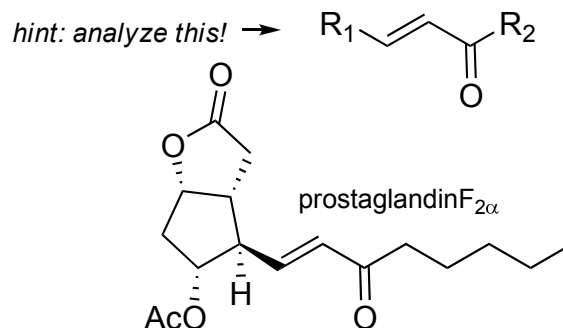
BE SURE TO ANSWER THE BONUS QUESTION ON PAGE 5!

DO NOT OPEN THIS EXAM UNTIL INSTRUCTED TO DO SO

1. Treating multistriatin with dilute aqueous acid leads to the formation of a product, $C_{10}H_{20}O_3$, which shows a strong infrared peak near 1715 cm^{-1} . Propose a structure for the product. 8 pts.

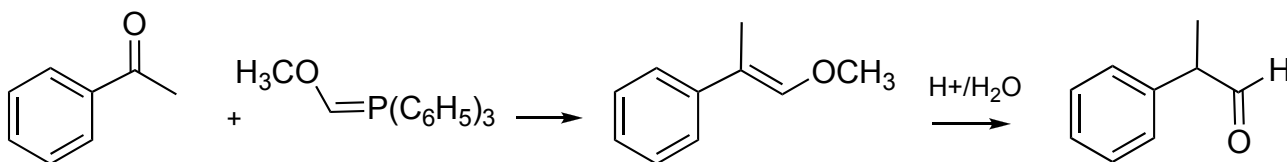


2. A Horner-Wadsworth-Emmons reaction was used to form the (*E*)-alkene in Corey's synthesis of prostaglandin $F_{2\alpha}$. Write structures for the phosphonate ester and carbonyl reactants used in this process. 8 pts



3. When the aldol reaction of acetaldehyde is carried out in D_2O , no deuterium is found in the methyl group of unreacted aldehyde. However, in the aldol reaction of acetone, deuterium is incorporated in the methyl group of the unreacted acetone. Explain the difference in behavior. 8 pts

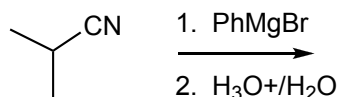
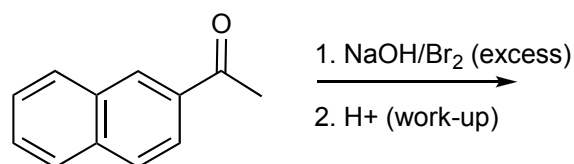
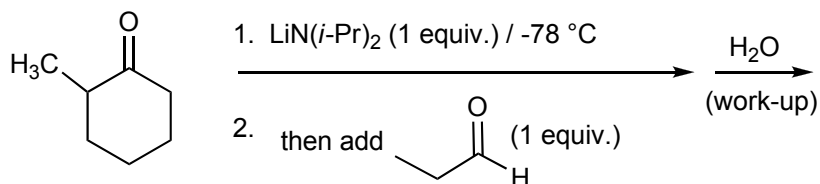
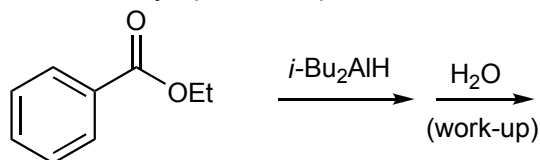
4. The Wittig reaction can be used for the synthesis of aldehydes, for example,



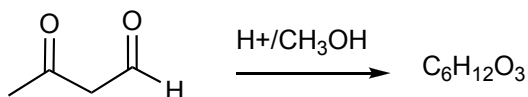
a. How would you prepare $H_3COCH=P(C_6H_5)_3$? 4 pts

b. Show with a mechanism how the second reaction produces an aldehyde. 6 pts

5. Predict the major product expected for each reaction shown. State "NR" if no reaction is expected. (5 pts ea)

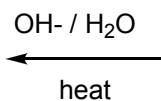
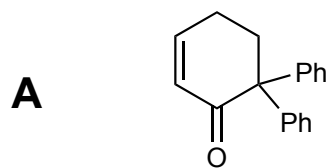


6. In acidic methanol, 3-oxobutanal is transformed into a compound with the molecular formula $\text{C}_6\text{H}_{12}\text{O}_3$ and the following ^1H NMR and IR data: 2.19 ppm (s, 3H), 2.75 (d, 2H), 3.38 (s, 6H), 4.89 (t, 1H); IR: 1715 cm^{-1} . Use the spectral data to explain the structure of the product (assign the spectral data to the structure) and provide a detailed mechanism for the formation of the new compound. (10 pts)

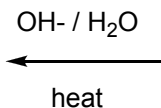
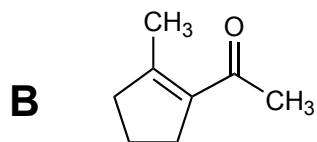


7a. What starting materials would you use to make compounds A and B via an intramolecular aldol cyclization? 10 pts

4



C



D

7b. Write a detailed step-by-step mechanism to account for the formation of compound A from C. 10 pts

7c. In your mechanism, **label the retro-aldol step** and push electrons in the appropriate intermediate to show the retro-aldol reaction. 4 pts

7d. Use compound A or B (choose wisely--one would work well and one would not!) and reagents of your own choosing to demonstrate an example of a Michael addition reaction. A detailed mechanism is not necessary--just supply the reagents and the structure of the product. 10 pts

Chemistry 110b
SECOND EXAM
February 22, 2008

Name (print) _____

| Page | Points | Score |
|-------|--------|-------|
| 2 | 34 | |
| 3 | 30 | |
| 4 | 34 | |
| bonus | 2 | |
| Total | 100 | |

Bonus: Who was a co-discoverer of the aldol reaction, and what is he probably most famous for?