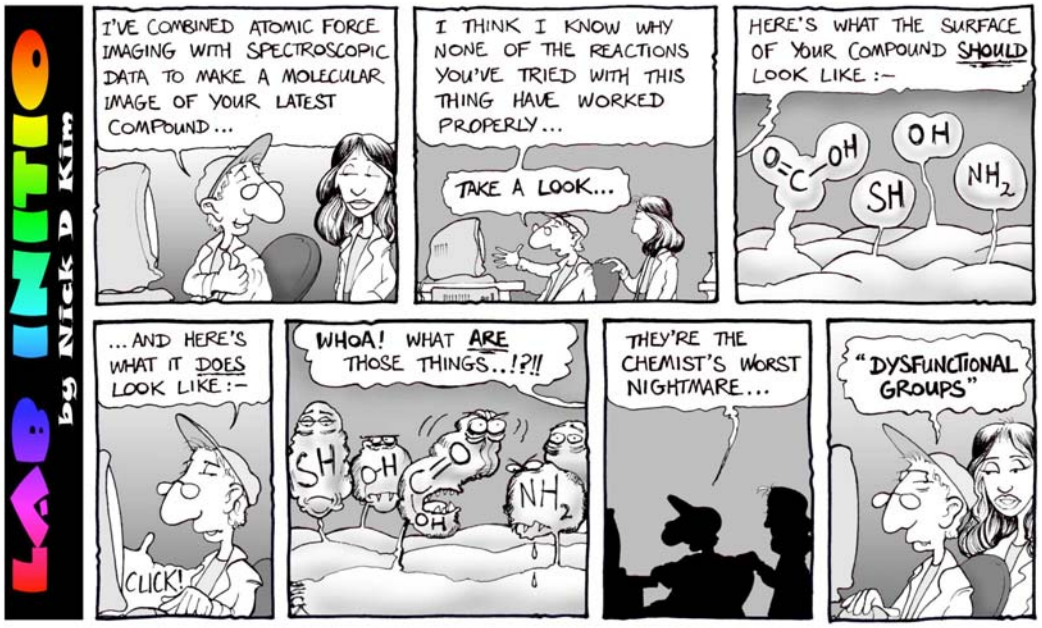
# Midterm Exam 03
12 April 2002

**NAME** KEY




Please read through each problem carefully. Enter your answers in the spaces provided.

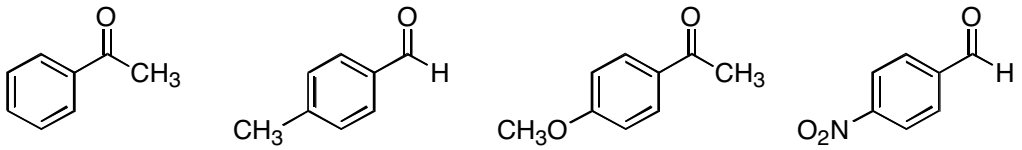
| | | |
|---|---|---|
| Problem 1 | 8 pts | _____ |
| Problem 2 | 8 pts | _____ |
| Problem 3 | 12 pts | _____ |
| Problem 4 | 20 pts | _____ |
| Problem 5 | 15 pts | _____ |
| Problem 6 | 27 pts | _____ |
| Problem 7 | 10 pts | _____ |
| bonus | 5 pts | _____ |
| **TOTAL** | | _____ |

A note about drawing structures: you should make your drawings as clear as possible to understand. Stereochemistry should be indicated unambiguously using conventional drawing techniques (eg. bold wedges and dashes). If you use anything besides line drawings, you need to include the hydrogens.

The most common mistake on an exam is not reading the question carefully. I suggest you go through the exam and answer the questions that come easily. Then go back and tackle the more challenging problems. Finally, check any work you have done, but remember, your first instinct is usually correct.

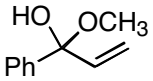
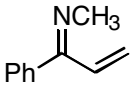
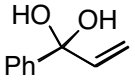
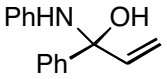
If you need scrap paper or more room, use the back of the test pages.

1. Rank the following carbonyls in order of decreasing reactivity for nucleophilic addition where 1 is most reactive, and 4 is least reactive. (8 pts)

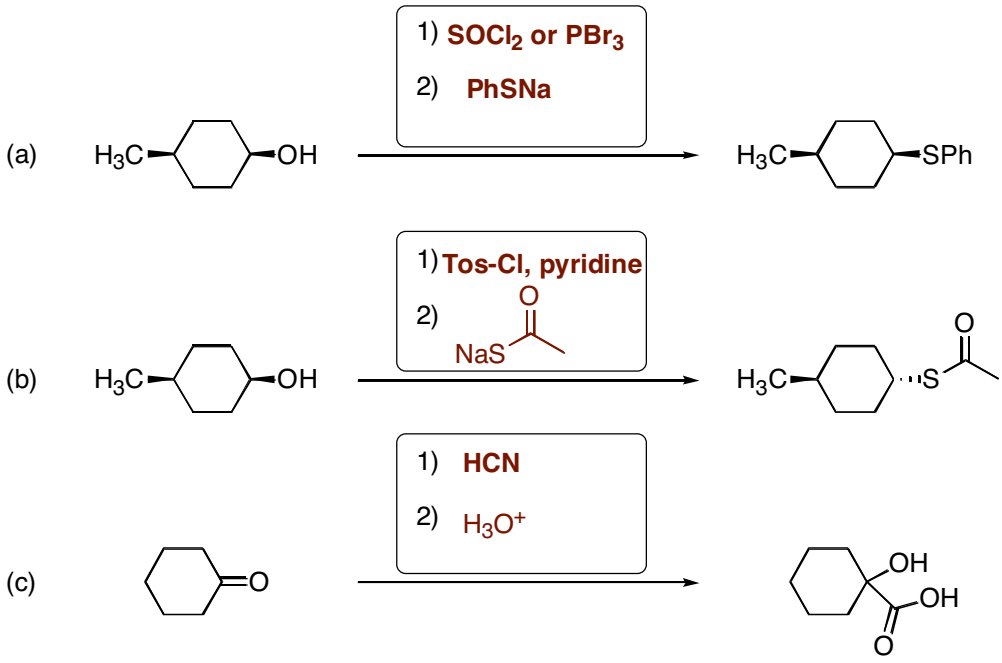


| 3 | 2 | 4 | 1 |
|---|---|---|---|

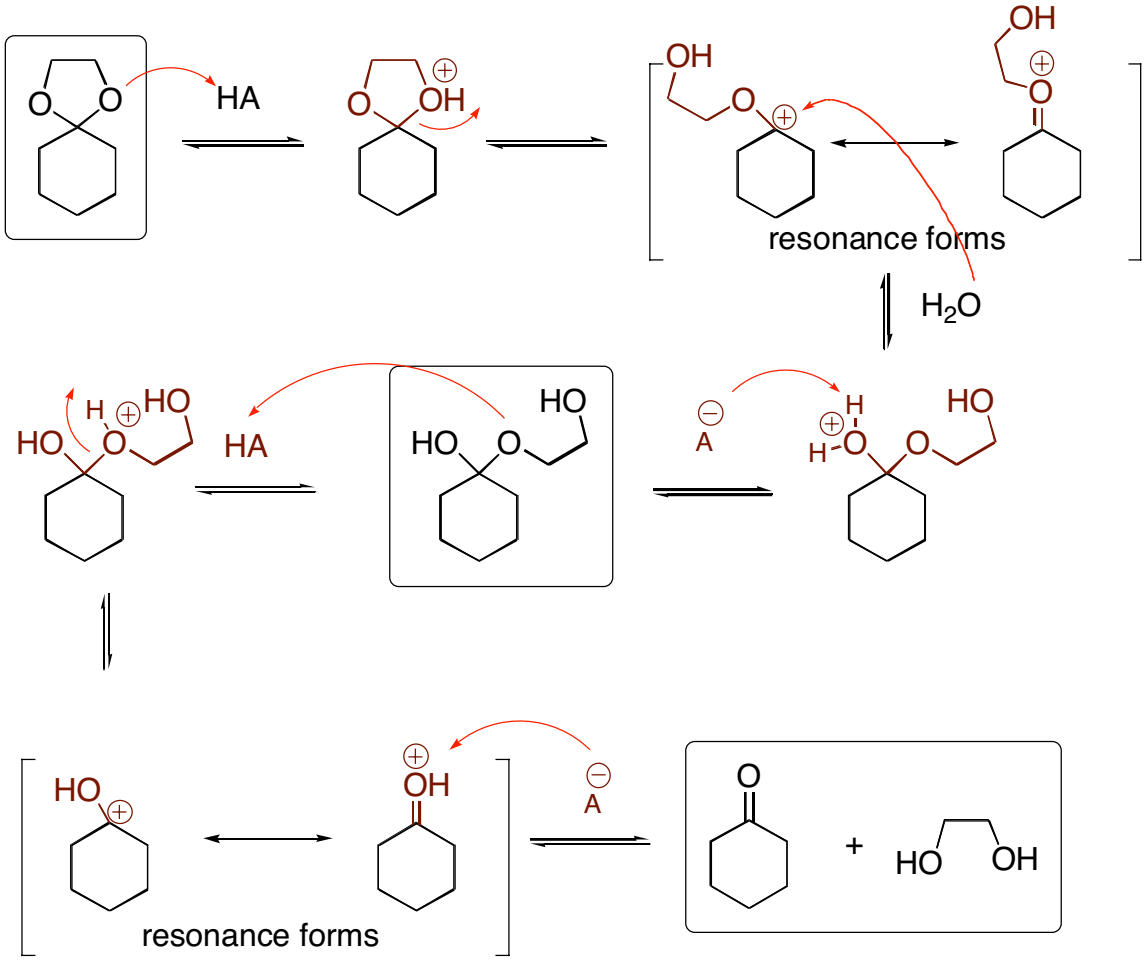
2. Place a check mark in the box that best describes the following molecules. (8 pts)

| | | ketone hydrate | acetal | hemiacetal | hemiaminal | imine | enamine |
|---|---|---|---|---|---|---|---|
| a) |  | | | X | | | |
| b) |  | | | | | X | |
| c) |  | X | | | | | |
| d) |  | | | | X | | |

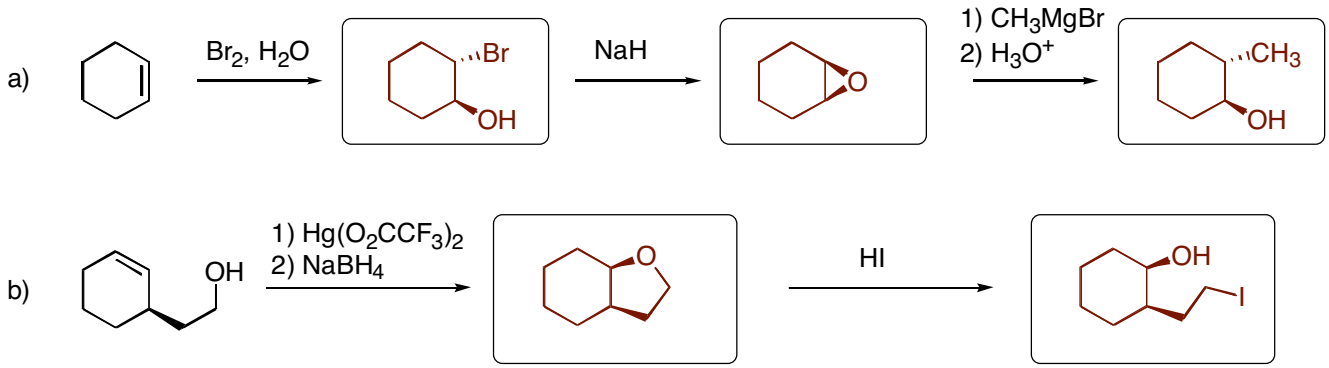
3. Provide the reagents necessary for the following reactions. (12 pts)



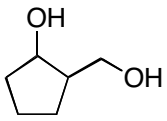
4. The mechanism for the hydrolysis of an acetal is partially shown below. This is the reverse of acetal formation. The starting material, products, and an intermediate along the way have been provided. Complete this mechanism by showing all arrows for electron movements and filling out the partially drawn structures. Include any additional acid or conjugate base necessary for the mechanism. (20 pts)

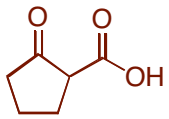


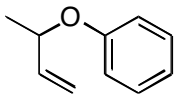

5. Complete the following reaction sequences. (15 pts)

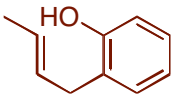


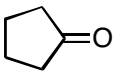
6. Draw the major product for the following reactions. (27 pts)

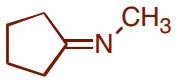
(a) 

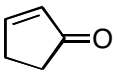
$CrO_3$, $H_3O^+$
(Jones Reagent)


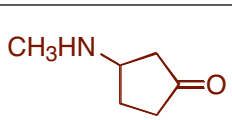

(b) 

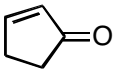
heat 250 °C


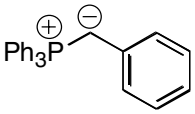

(c) 

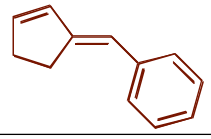
$CH_3NH_2$
HA Catalyst


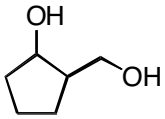

(d) 

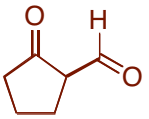
$CH_3NH_2$


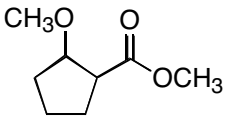

(e) 

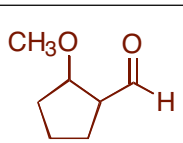


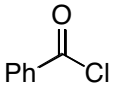
(Wittig Reagent)


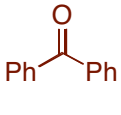
(f) 

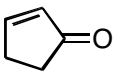
PCC
(pyridinium chlorochromate)


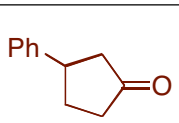

(g) 

1) DIBAH
2) $H_3O^+$
(diisobutyl aluminum hydride)


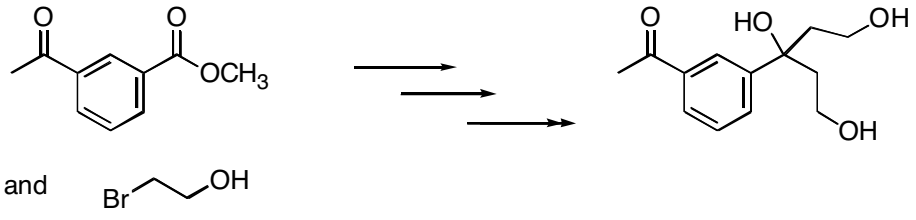

(h) 

$Ph_2CuLi$


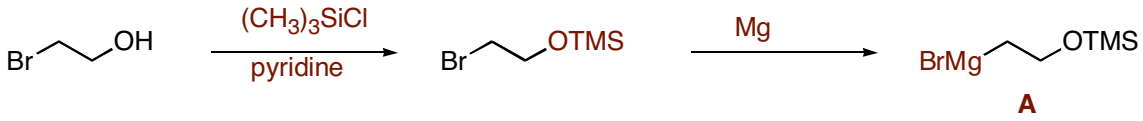

(i) 

1) $Ph_2CuLi$
2) $H_3O^+$


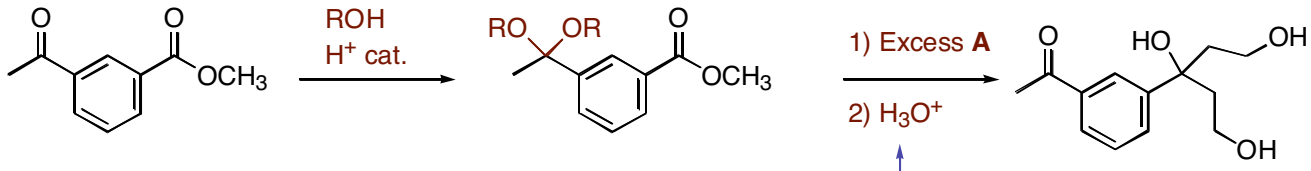
7. Starting from the two starting materials shown below, show how you would synthesis the product on the right. (10 pts)




**Protect the Alcohol to make Grignard**




**Protect the Ketone for the Grignard Reaction**




Acid will protonate the alkoxide. It will also deprotect the acetal and the TMS group.

**BONUS:** Draw the mechanism for a Wolff-Kishner reduction. (5 pts)