

Ch 336  
Exam #2  
May 23, 2008

Code \_\_\_\_\_

1. (4 pts) Circle any solvents that would **NOT** be a suitable solvent for use with a Grignard reagent.

diethyl ether      ethanol      tetrahydrofuran (THF)      water

2. (2 pts) Circle the compound that cannot be made by reduction of a ketone or aldehyde with  $\text{NaBH}_4$  in methanol.

1-butanol      2-butanol      3-methyl-3-pentanol      2-methyl-1-propanol

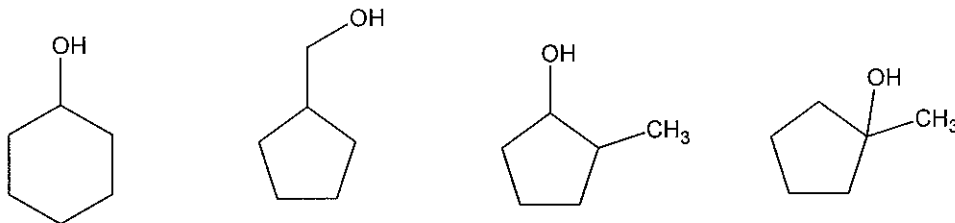
3. (4 pts) Which of the following reagents will reduce a ketone to an alcohol? Circle any which are appropriate.

$\text{H}_2/\text{Pt}$        $\text{KMnO}_4$        $\text{LiAlH}_4$        $\text{NaBH}_4$

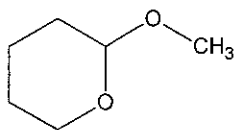
4. (2 pts) As a reducing agent,  $\text{NaBH}_4$ , donates a(n) \_\_\_\_\_ to a ketone or aldehyde. Circle your answer. Your choices are:

proton      hydrogen atom      hydride ion      hydrogen molecule.

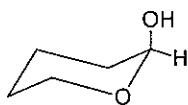
5. (2 pts) Compound A,  $\text{C}_6\text{H}_{12}\text{O}$ , is readily oxidized with  $\text{K}_2\text{Cr}_2\text{O}_7$  in  $\text{H}_2\text{SO}_4/\text{H}_2\text{O}$  to give Compound B,  $\text{C}_6\text{H}_{10}\text{O}$ . Compound B has four peaks in its  $\text{C-13}$  NMR (decoupled). Circle the compound below that fits the data for compound A.



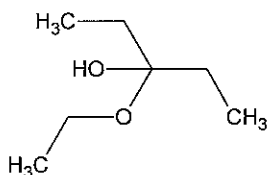
6. (8 pts) Identify each of the following compounds as an acetal, hemiacetal or neither. Indicate whether it came from an aldehyde or ketone (not applicable if it is neither). Circle your responses.



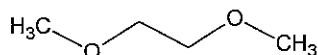
hemiacetal      aldehyde  
 acetal            ketone  
 neither



hemiacetal      aldehyde  
 acetal            ketone  
 neither

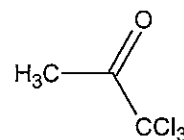
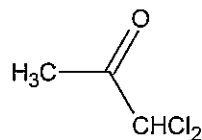
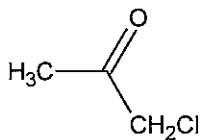
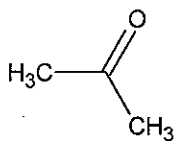
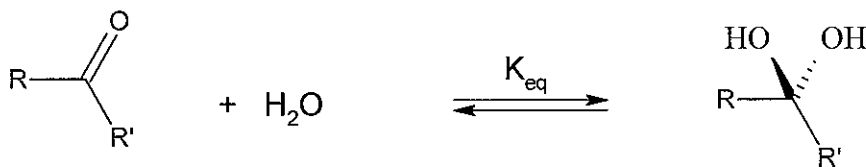


hemiacetal      aldehyde  
 acetal            ketone  
 neither

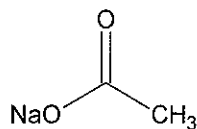


hemiacetal      aldehyde  
 acetal            ketone  
 neither

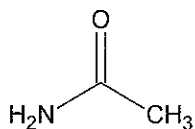
7. (4 pts) Which of the following has the largest  $K_{eq}$  for the formation of the hydrate as shown below? Circle your answer.



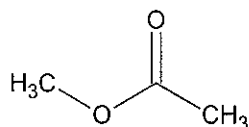
8. (3 pts) Put the letter for the molecule which best satisfies each of the following statements in the blank provided.



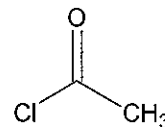
A



B



C



D

The compound that has the least stabilized carbonyl is \_\_\_\_\_.

The compound that is the most reactive to nucleophilic acyl substitution is

\_\_\_\_\_.

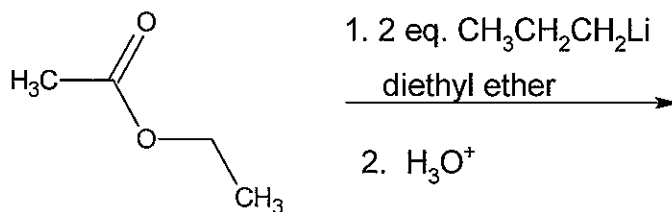
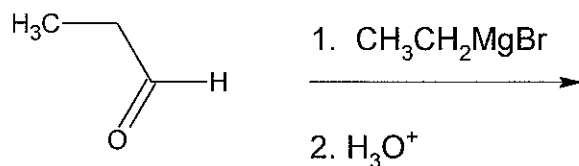
The compound that can be converted into the other three molecules directly is

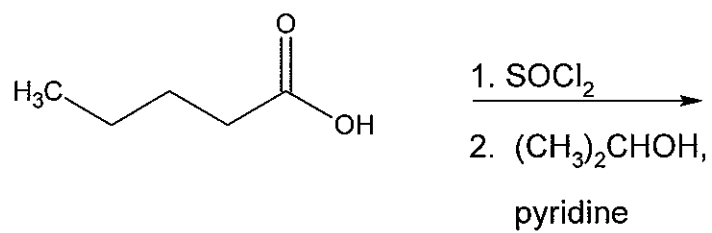
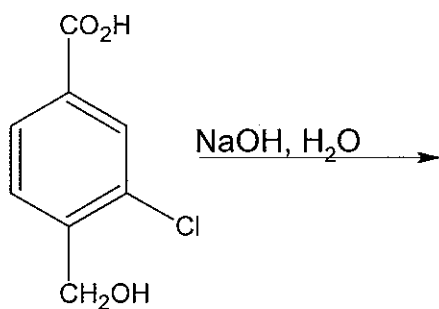
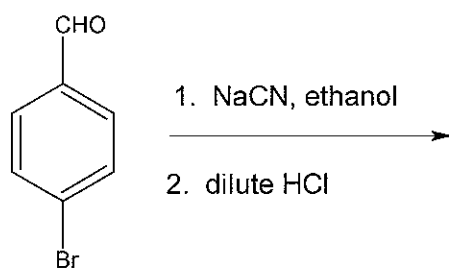
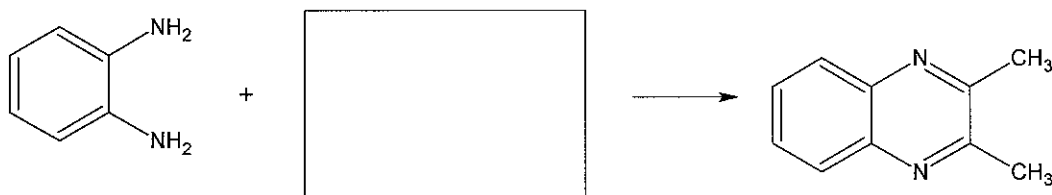
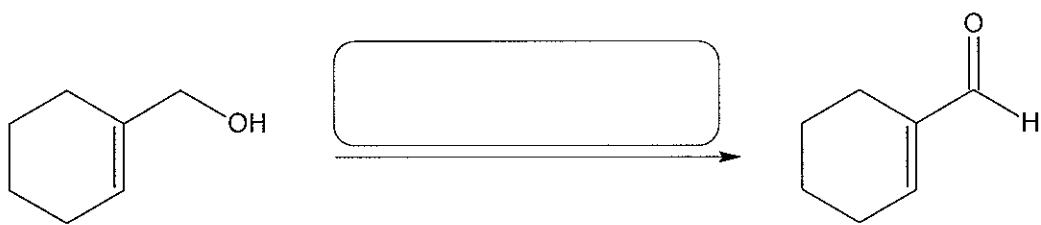
\_\_\_\_\_.

9. (3 pts) Circle any of the following functional groups that do not react with  $\text{NaBH}_4$ ?

Aldehyde      ketone      ester

10. (7 pts) Complete the following reactions.





11. (4 pts) Rank the following compounds in order of *increasing* rate of hydrolysis. Place the letters representing the compounds in the blanks provided.

- A. acetamide
- B. acetic anhydride
- C. acetyl chloride
- D. ethyl acetate

\_\_\_\_\_ < \_\_\_\_\_ < \_\_\_\_\_ < \_\_\_\_\_

12. (4 pts) The compounds shown below have similar molecular weights but significantly different boiling points. Match the compound with its boiling point.

Boiling points (°C) : 28, 57, 100, 141

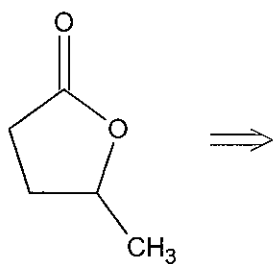
\_\_\_\_\_ methyl acetate

\_\_\_\_\_ 2-butanol

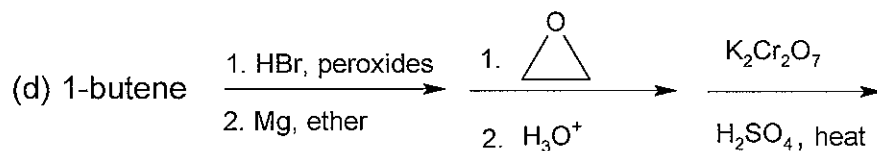
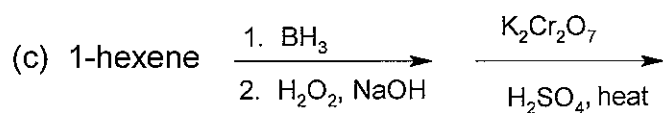
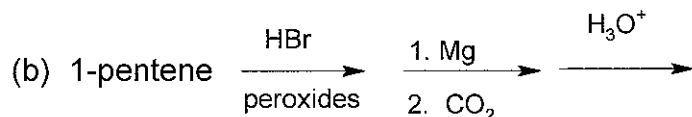
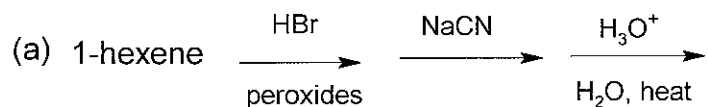
\_\_\_\_\_ 2-methylbutane

\_\_\_\_\_ propanoic acid

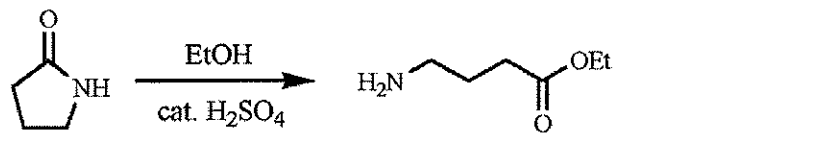
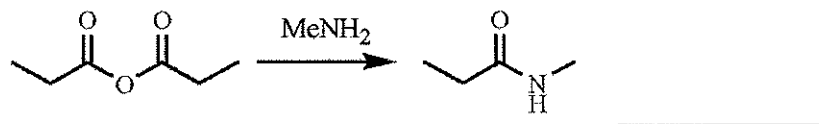
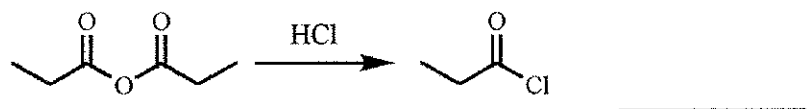
13. (4 pts) Draw the parent carboxylic acid of the following lactone.



14. (8 pts) Circle the letter preceding the reaction for any method shown below which will give hexanoic acid as the major product. There may be one or more correct methods. If a method will not work, draw the product that will be obtained at the end of the sequence. The correct product must be shown for credit.



15. (6 pts) Indicate if the following reactions will occur by writing the words "yes" or "no" in the blanks provided.

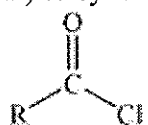
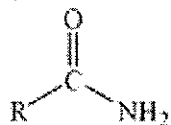
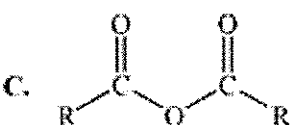
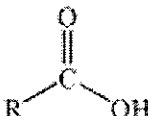


Questions 16-21 are multiple choice questions (18 pts) . Circle the letter of the correct response. There will be only one correct response.

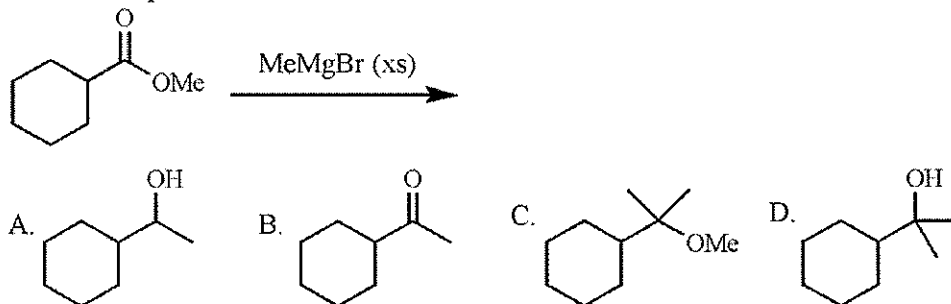
16. Why is pyridine included in the reaction of an acid chloride and an amine or alcohol?

- A. Pyridine will deprotonate the amine or alcohol and make it a better nucleophile/
- B. Pyridine will neutralize the acid by-product of the reaction.
- C. Pyridine will protonate the carbonyl of the acid chloride making it more reactive.
- D. Pyridine will absorb the heat of the reaction.

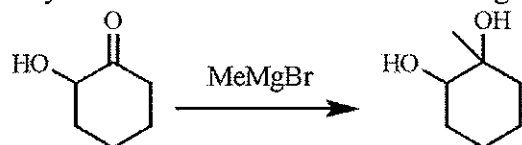
17. Which of the following compounds cannot be used as an immediate precursor (starting material) to synthesize an ester?

- A.  B.  C. 
- D.  E. All of them can be used.

18. What is the product?



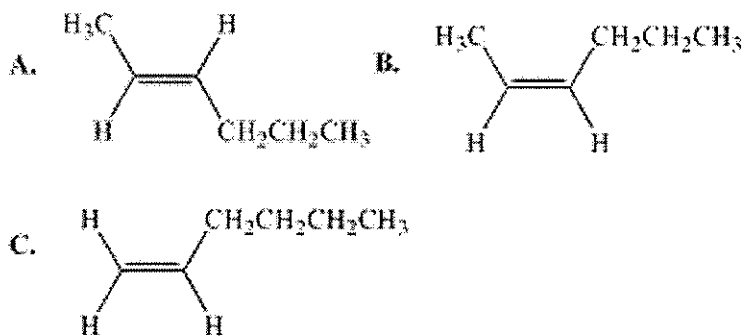
19. Why would the alcohol in the following compound need to be protected before reaction?



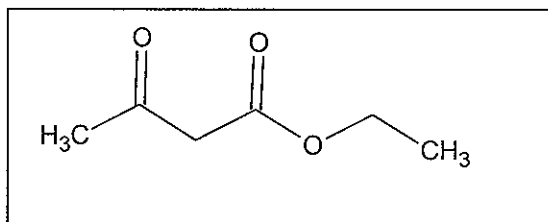
- A. If it isn't protected, the product will be a carboxylic acid.
- B. The Grignard reagent will react with the alcohol before the ketone.
- C. Magnesium is Lewis acidic and will coordinate with the alcohol.
- D. There is no need to protect the alcohol.

20. Why are ketones less reactive than aldehydes?
- A. They are more sterically hindered.
  - B. Ketones are less electron deficient due to donation from the two alkyl groups.
  - C. Ketones are more reactive.
  - D. They are more sterically hindered and ketones are less electron deficient due to donation from the two alkyl groups

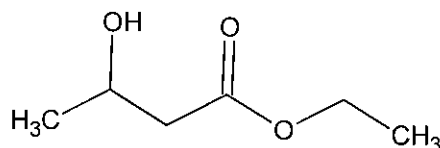
21. Which of the following products is formed by Wittig reaction of  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CHO}$  with  $\phi_3\text{P}=\text{CHCH}_3$ ?



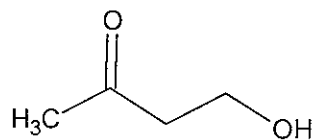
22. (10 pts) Write a synthesis that converts the starting material shown in the box into each of the products indicated below. The syntheses may involve a single step or multiple steps.



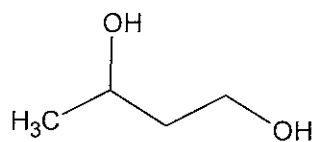
a.



b.



c.



23. (7 pts) Complete the following reaction sequences.

