

Name: ANSWER KEY (print) CWID: _____

Honor Pledge: I promise or affirm that I will not at any time be involved with cheating, plagiarism, fabrication, or misrepresentation while enrolled as a student at The University of Alabama. I have read the Academic Honor Code, which explains disciplinary procedures that will result from the aforementioned. I understand that violation of this code will result in penalties as severe as indefinite suspension from the University.

_____ (*signature*)

You will have **1 hour and 30 minutes** to complete this exam. When time is called please stop all work and turn in your exam.

Show all work. Partial credit will be given where appropriate.

This exam has **10** pages. Make sure you have all 10 pages, and that they are correctly copied, before starting the exam. The last page is a periodic table

You may use molecular models to help you answer questions on this exam.

You will not need a calculator or any other electronic device to complete this exam.

Please put all cell phones (turn off or to silent), ipods, calculators, or other electronic devices away in a book bag.

Your book and all notes should be placed out of sight of yourself and your neighbors before the exam begins.

<u>Problem</u>	<u>Score</u>
1	_____ (12)
2	_____ (20)
3	_____ (14)
4	_____ (8)
5	_____ (18)
6	_____ (16)
7	_____ (16)
Total	_____ (104)

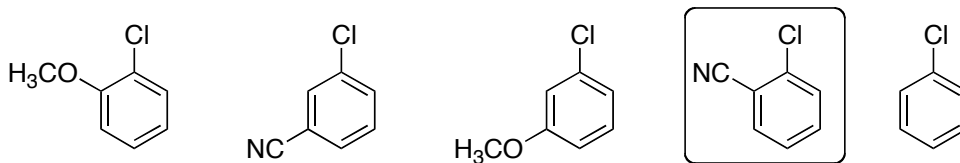
The exam is worth 100 points. There are 4 bonus points built in



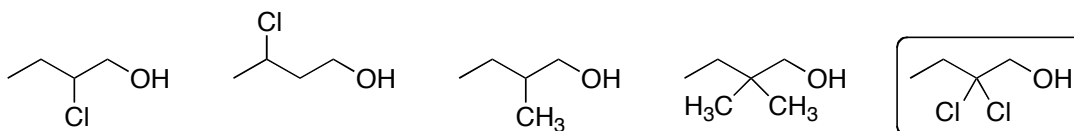
"Just for the record, Gerkins, in the absence of getting actual molecular bonds to form, duct tape is not an option."

1. For each problem below, circle the **best** answer. In each case, there is only one correct answer (12 points)

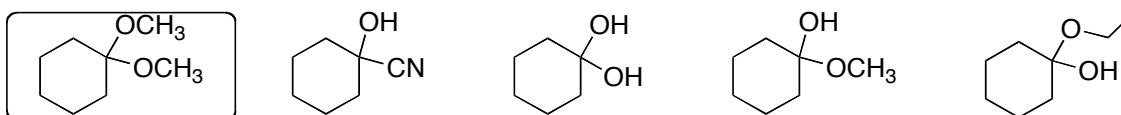
a. Which of the following would be most reactive with NaNH_2 in an $\text{S}_{\text{N}}\text{Ar}$ reaction?



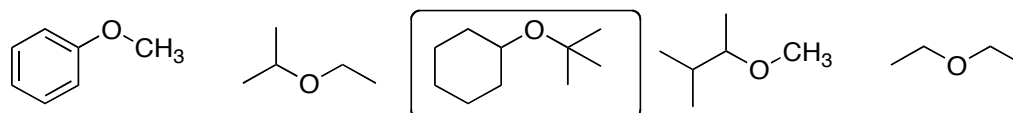
b. Which of the following would be most acidic?



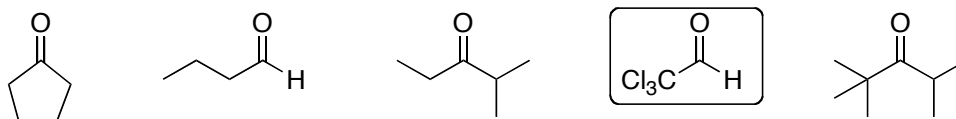
c. Which of the following would not be converted to a ketone under aqueous basic conditions?



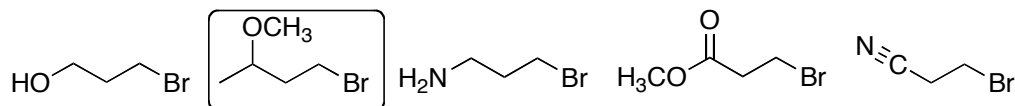
d. Which of the following ethers could not be made using the Williams ether synthesis (alkoxide plus alkyl halide)?



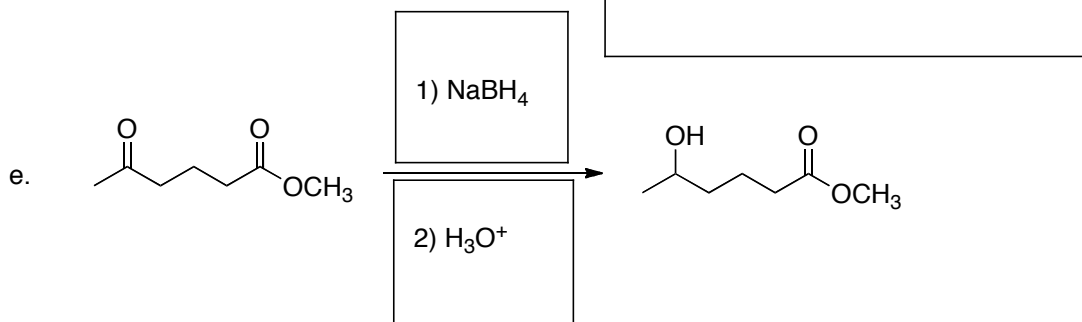
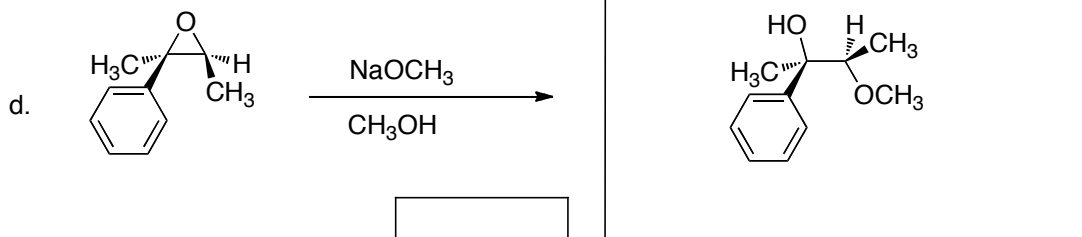
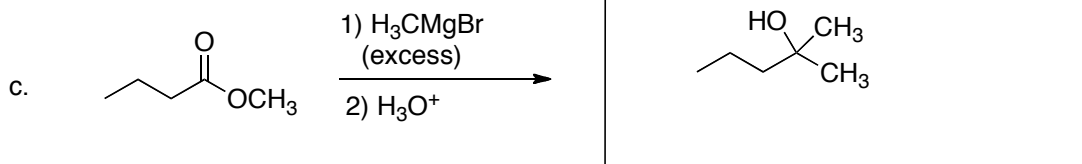
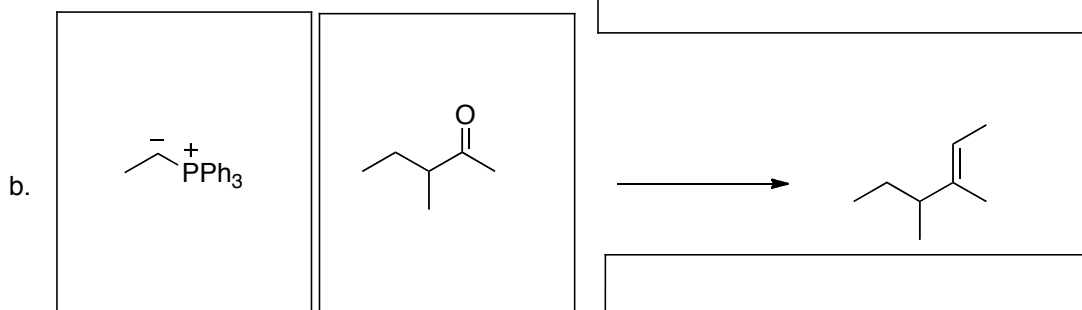
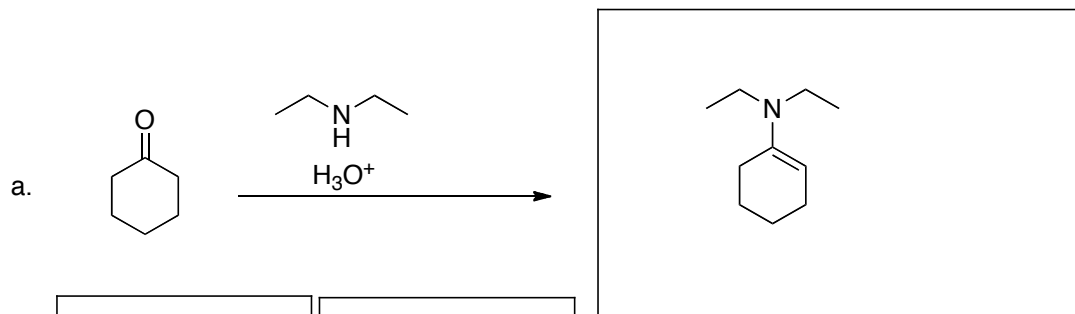
e. Which carbonyl would give the largest equilibrium concentration of hydrate when dissolved in water.



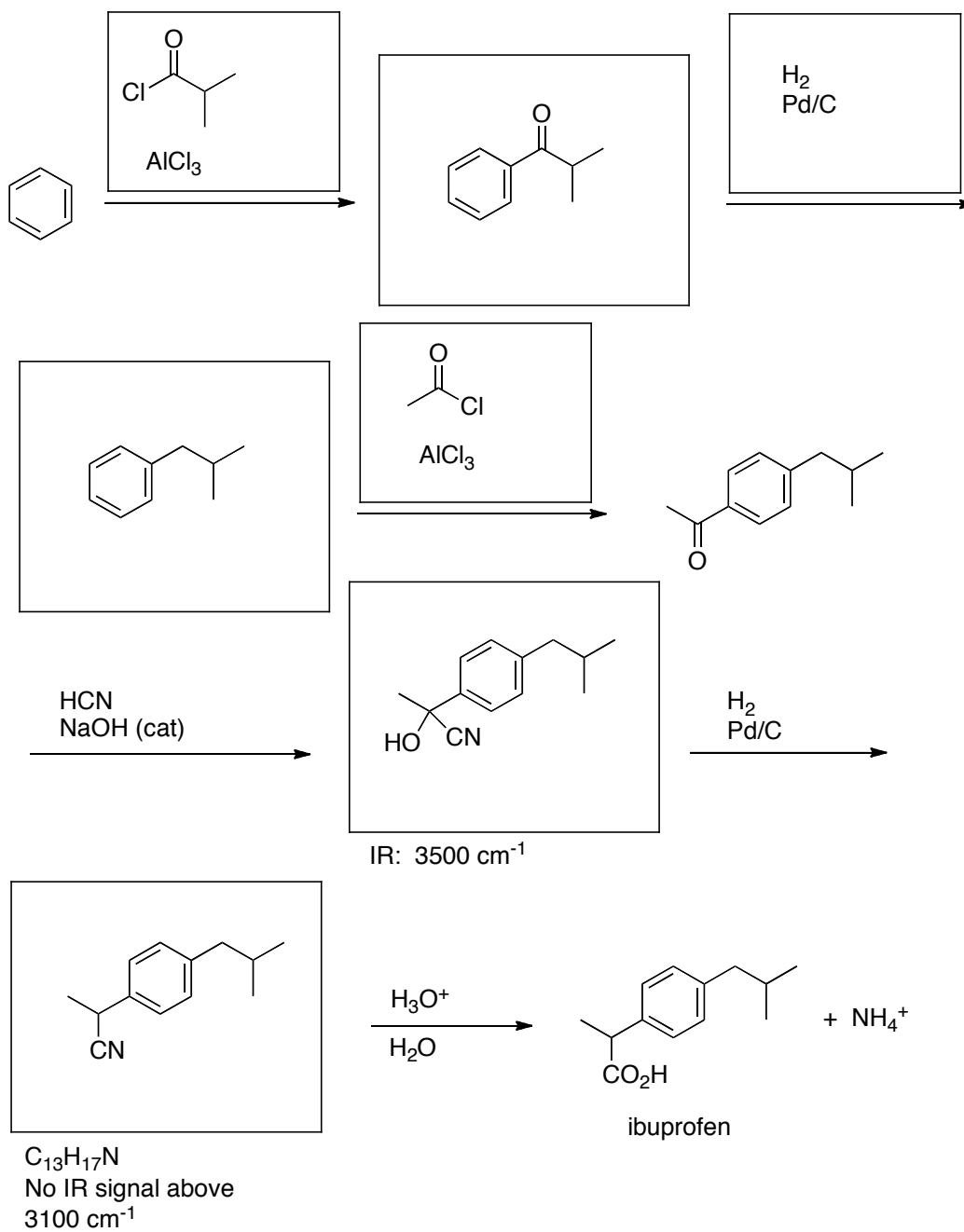
f. Which alkyl halide could be used to generate a stable Grignard reagent?



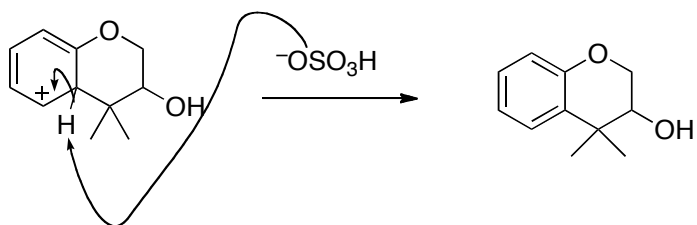
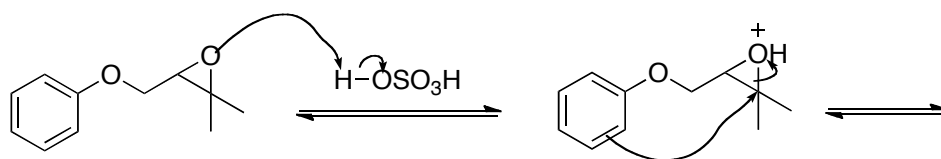
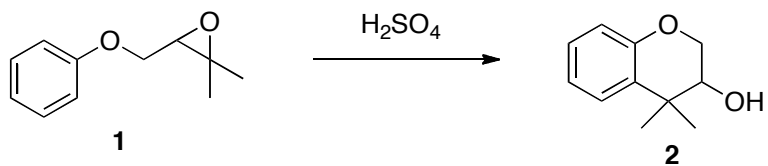
2. For each reaction below, provide the missing starting material(s), reagent(s), or product(s). For reactions in which more than product can be formed, draw each major product. You should not include products formed as minor products, however. You do not need to indicate side products from the reagents used. Where necessary, clearly indicate the stereochemistry of the products obtained or starting materials. (20 points)



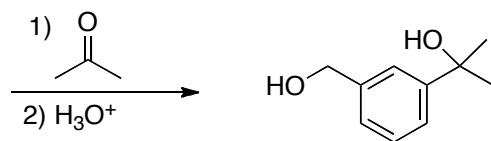
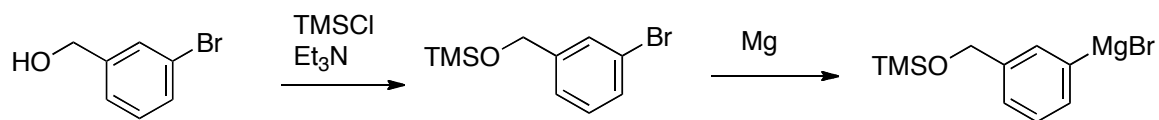
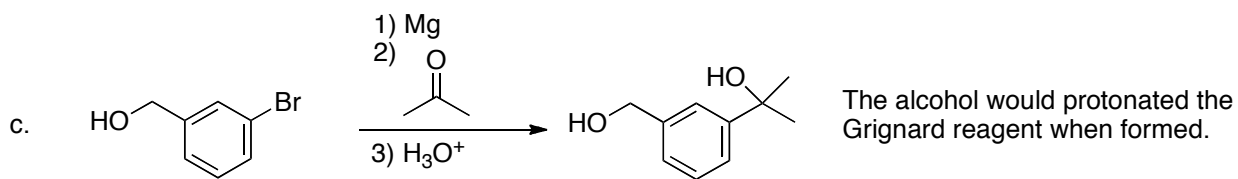
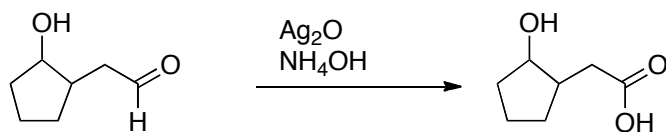
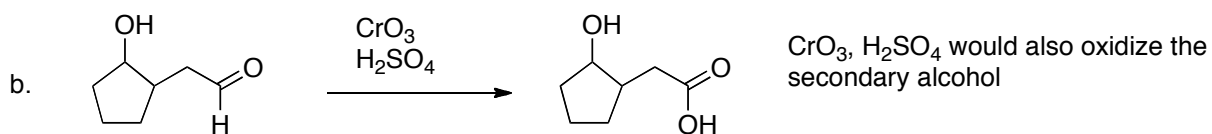
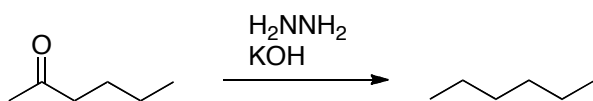
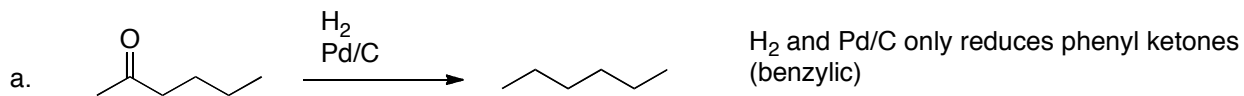
3. The synthesis of ibuprofen, which is the active ingredient in Advil, is outlined below. Fill in each missing reagent or structure. Important IR data for some of the missing products are provided as hints. (14 points)



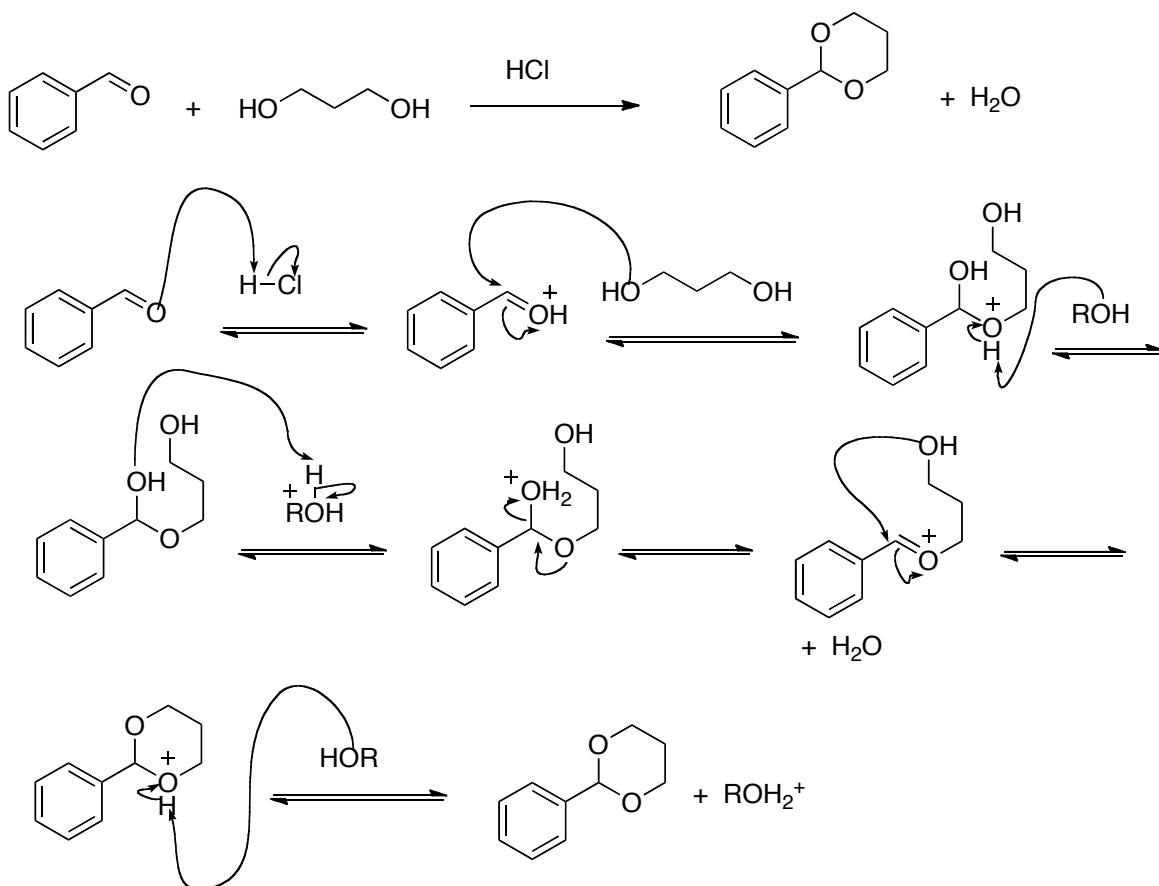
4. Treatment of epoxide **1** with H_2SO_4 results in the formation of **2**. Propose a mechanism to show how **2** is formed in this reaction. (8 points)



5. Each reaction below would fail to give the indicated product. In each case, briefly (<10 words) explain why the reaction as written would fail. Below the reaction, propose an alternate synthesis of the desired compound from the indicated starting material. More than one step may be required in some cases. (18 points)



6. Provide a detailed electron-pushing mechanism for the reaction shown below. Show each step using arrows to show the movement of electrons. Clearly indicate all formal charges. (16 points)



ROH = alcohols, water

7. Starting from the indicated molecule(s), provide an efficient synthesis of the desired product. An efficient synthesis should give the desired product as the major product in each step. In addition to the indicated starting material(s), you may use any other necessary reagents. (16 points)

