CHEM 3331 **Hour Exam #2** **Name**_____
Dr. Minger **July 26, 2022**

Circle your recitation section number/TA name:

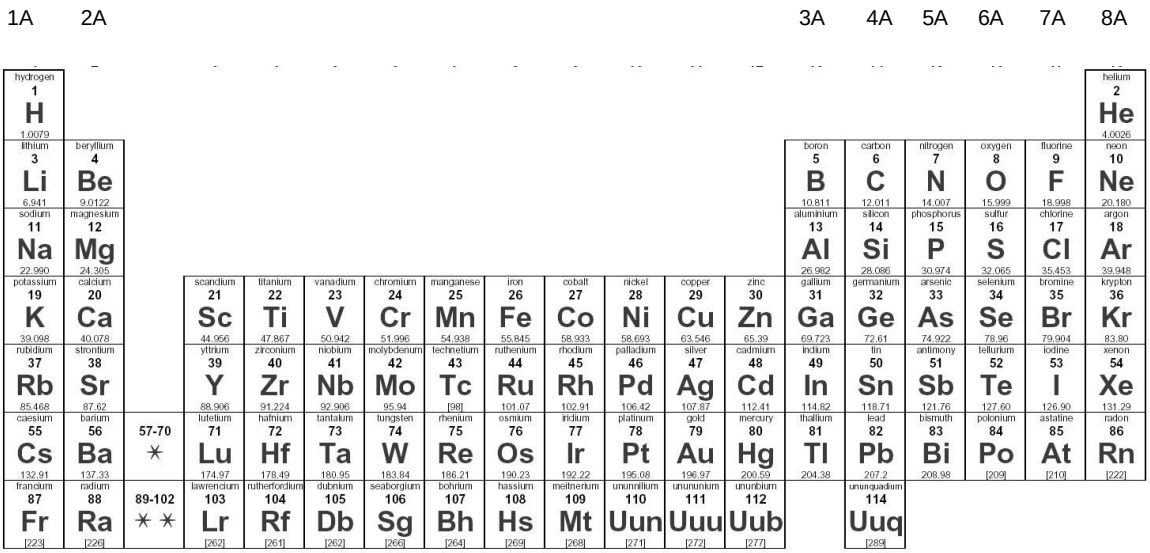
211	Hongxuan	214, 223	Will
212	Brandon	221	Qiucheng
213	Alan	222	James

Please sign the Honor Code pledge even though you've taken the quiz:

I pledge that on my honor, as a University of Colorado at Boulder student, I have neither given nor received unauthorized assistance on this exam.

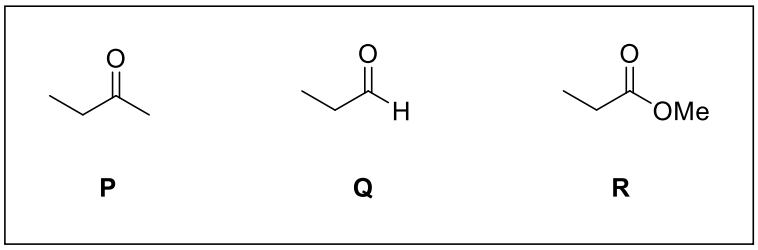
_____
Signature

General Instructions: There are 6 pages of questions plus this cover sheet. Be sure you have them all. Read each question carefully so that you know exactly what is being asked and what you need to write or draw. DO NOT USE COLORED INK. Your work on scratch pages will not be graded, so be sure everything you want graded is written on the exam itself. Finally, only the responses inside the provided boxes will be graded, so make sure that what you want graded is inside the box!



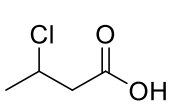
Multiple choice (questions 1-5). Circle the best answer to each of the following questions. (10 pts)

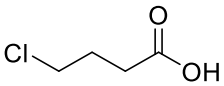
1. Place the three compounds in order of **decreasing electrophilicity** (most electrophilic to least electrophilic).

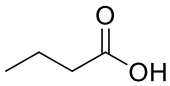


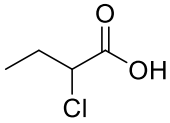
a. Q > P > R
b. P > Q > R
c. P > R > Q
d. R > Q > P
e. Q > R > P

2. Select the **most acidic** carboxylic acid.



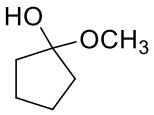


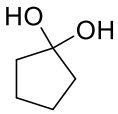


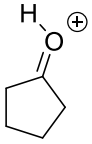


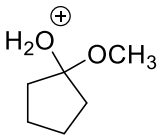
All four of these compounds have the same acidity

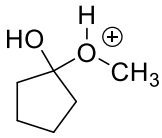
3. Select the structure that is **not** an intermediate in an acetal formation mechanism.



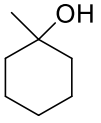


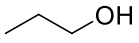


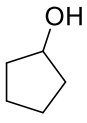


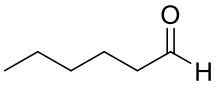


4. Select the compound that **cannot** be oxidized using the Jones reagent.







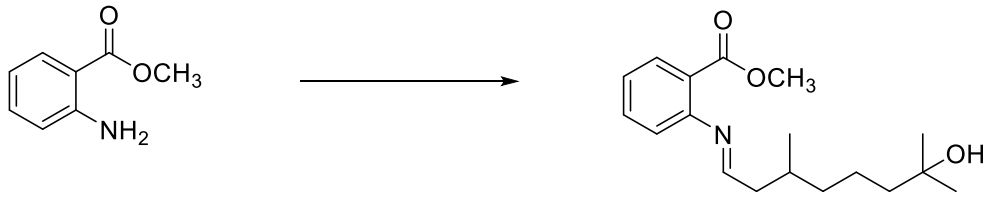


5. Recently, legendary pigeon chemist Professor Burblecoo set up his research laboratory (which employs hundreds of hardworking pigeon chemists, as shown in the photograph) on the roof of a commercial building. Unfortunately, the building owner is strongly opposed to pigeons doing chemistry and began to periodically spray the roof with a chemical called methyl anthranilate to repel these dedicated scientists.

Hundreds of pigeon chemists at work in the Burblecoo Laboratories

Methyl anthranilate is used in the food industry as a flavoring agent. It has the scent and flavor of grapes and is found in substances such as grape Kool-Aid. However, pigeons hate the smell of grapes.

In response to this chemical warfare, Professor Burblecoo and his team performed a reaction that converts the methyl anthranilate into a compound called aurantiol:



methyl anthranilate **aurantiol**

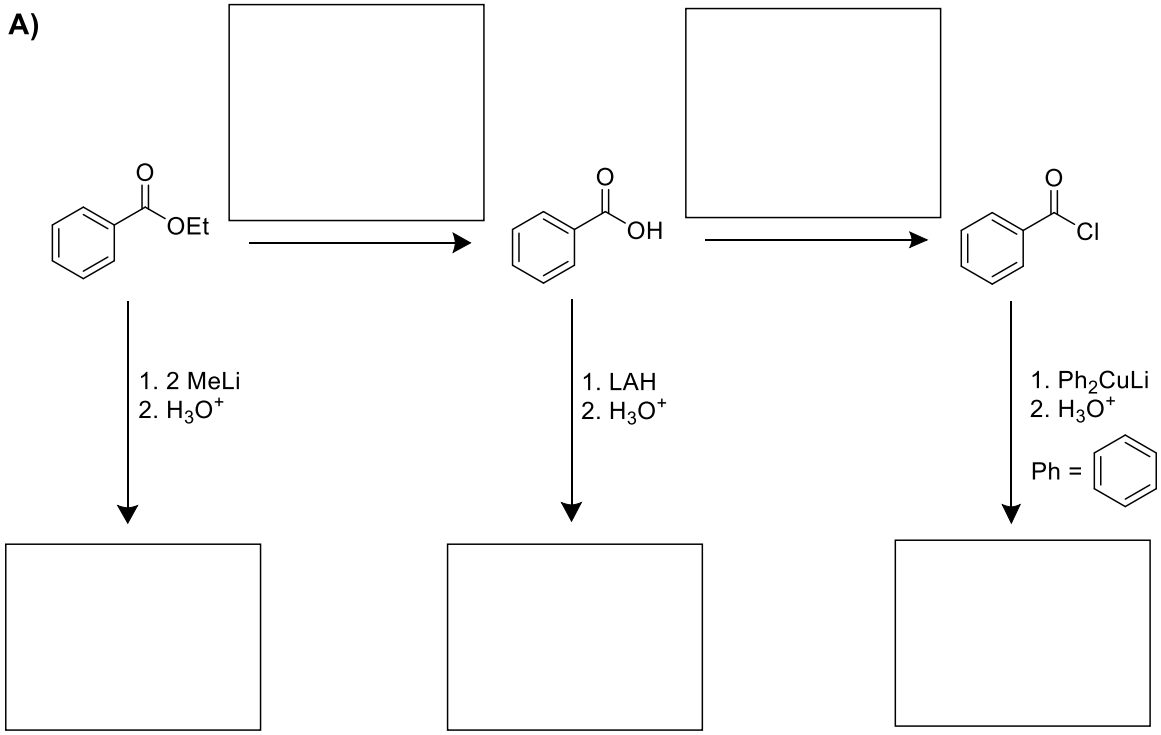
Although the reaction was successful, the product (aurantiol) also smells like grapes, so the Burblecoo Laboratories are now seeking a new facility.

Which of these reagents did the pigeon chemists use when converting methyl anthranilate to aurantiol? (Other reagents may be involved too; just pick the one that the pigeons had to use.)

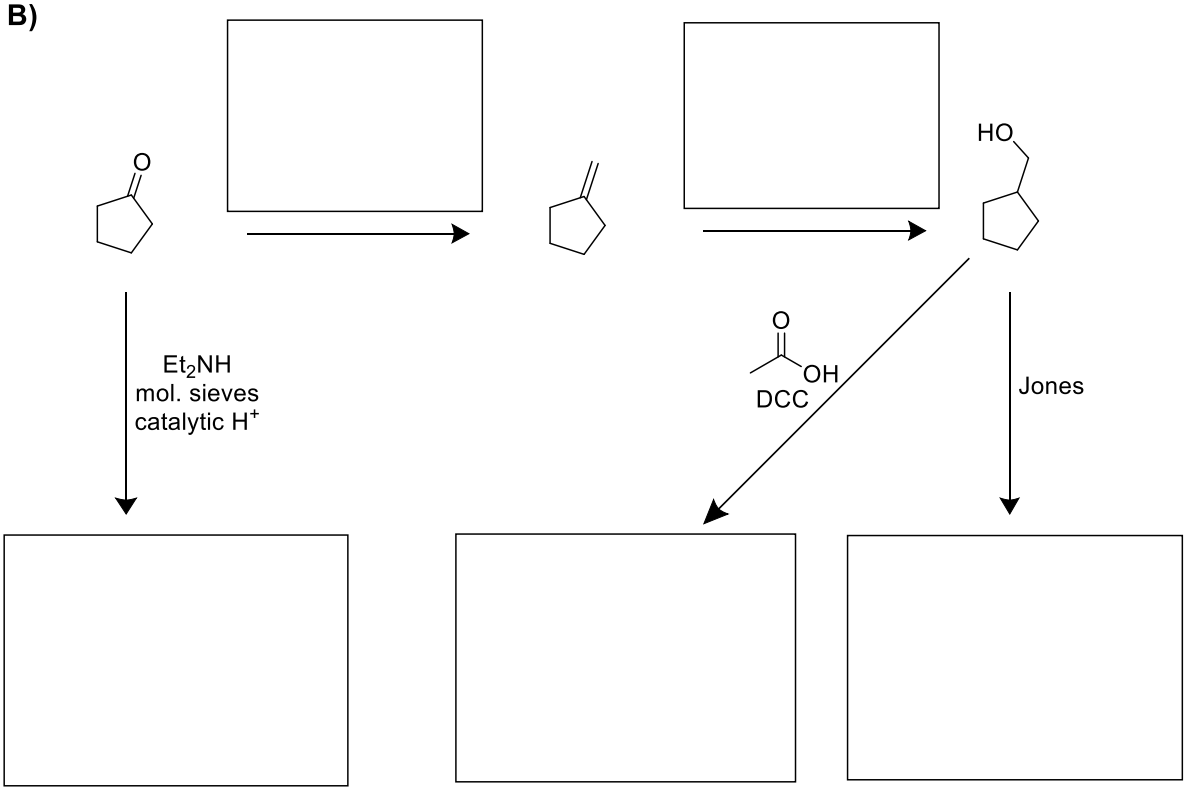
Aqueous base (KOH, H_2O)	An aldehyde	PCC or Jones	LAH or $NaBH_4$	A phosphorus ylide

6. In each box, supply either missing reagents or the major organic product of the requested reaction. Work outside the boxes will not be graded. (30 pts)

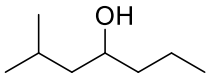
A)

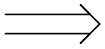


B)

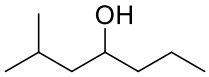


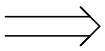
7. **Alcohol retrosynthesis.** In each box, draw the requested organic precursor to the alcohol, along with any reagents needed to transform the precursor into the alcohol. Some boxes may have more than one possible correct solution (i.e., combination of organic compound and reagent); please draw only one. (18 pts)



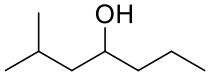


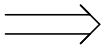
Carbonyl compound + reducing agent





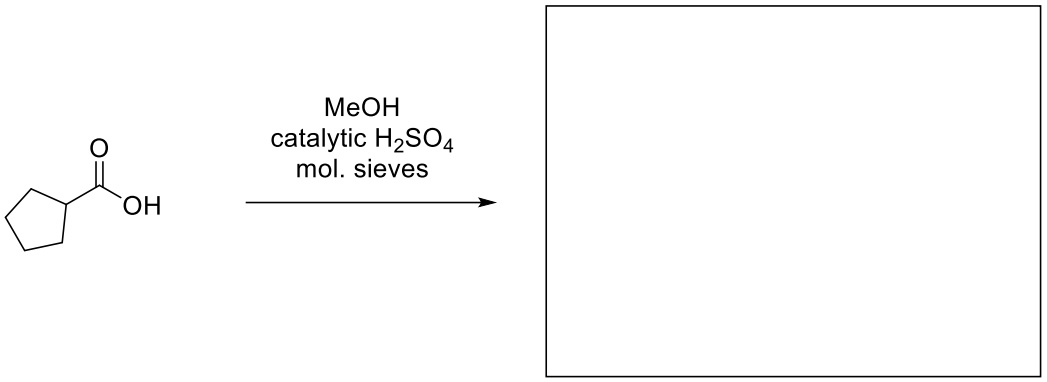
Carbonyl compound + Grignard/organolithium reagent



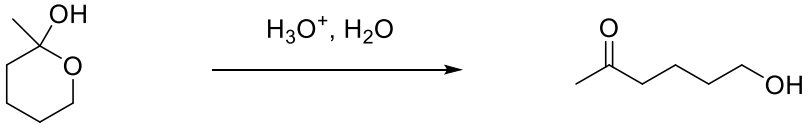


Epoxide + organocuprate

8. Draw the major organic product of the following reaction conditions and draw a mechanism to illustrate its formation. Include all necessary electrons, curved arrows, and nonzero formal charges. (21 pts)



9. Draw a mechanism to illustrate the following transformation. Include all necessary lone pair electrons, curved arrows and nonzero formal charges. (9 pts)



10. Propose a multi-step synthesis of the target molecule shown at the right, using the starting materials on the left and any other reagents you need. Show the reagents needed for each step and the product of each step. Do not show any mechanisms. (12 pts)

Write your answer like this (actual number of steps may vary):	**A** *starting material* → reagent(s) → **B** → reagent(s) → **C** → reagent(s) → **D** *target*