CHEM 3331, Professor Zhang, Spring 2014
Third hour exam, April 15, 2014

Printed Name: KEY Student ID: _____

Recitation TA Name: _____ Recitation day and time: _____

Scores:

1)

2)

3)

4)

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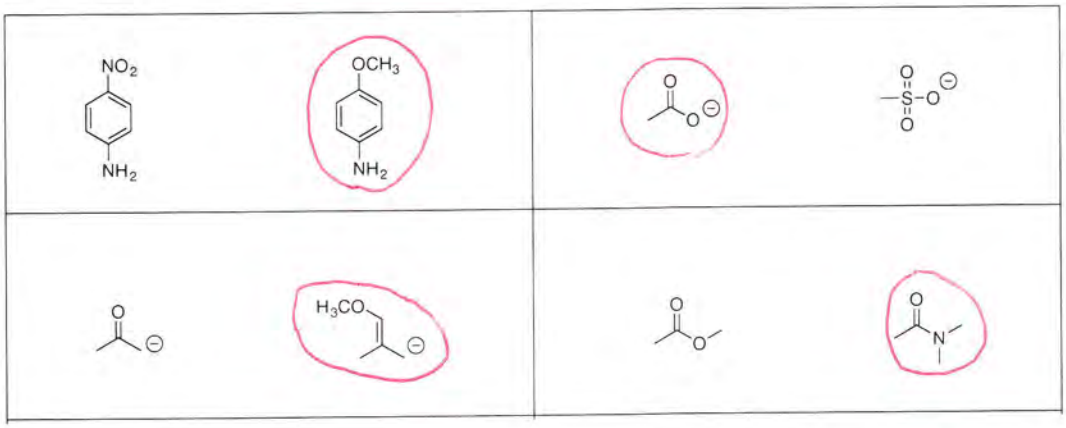
CU Honor Code Pledge: On my honor, as a University of Colorado at Boulder Student, I have neither given nor received unauthorized assistance.

This is a closed-book exam. The use of notes, models, calculators, scratch paper will not be allowed during the exam. Please put all your answers on the test. Use the backs of the pages for scratch.

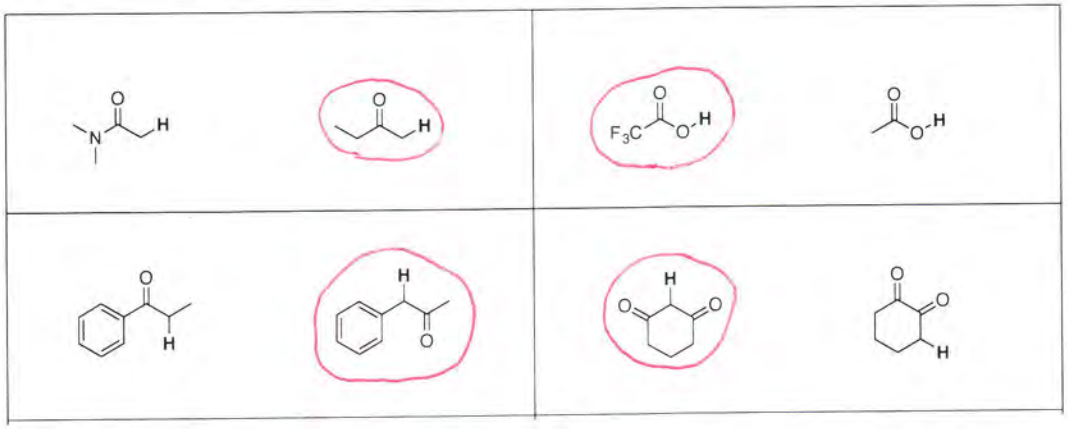
# Partial Periodic Table

| 1A | 2A | 3A | 4A | 5A | 6A | 7A | 8A |
|---|---|---|---|---|---|---|---|
| 1 H | | | | | | | 2 He |
| 3 Li | 4 Be | 5 B | 6 C | 7 N | 8 O | 9 F | 10 Ne |
| 11 Na | 12 Mg | 13 Al | 14 Si | 15 P | 16 S | 17 Cl | 18 Ar |
| | | | | | | 35 Br | |
| | | | | | | 53 I | |

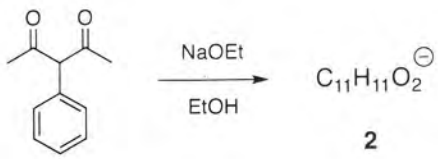
1) (26pts) a) For each of the following pairs of compounds, circle the **stronger nucleophile**. (2.5pts each)



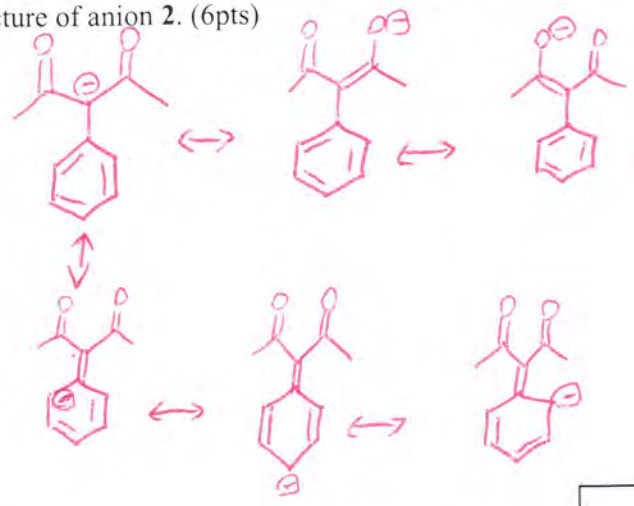
b) For each of the following pairs of compounds, circle the one that has the hydrogen (highlighted) with **lower pKa**. (2.5pts each)



c) Simple treatment of compound **1** with NaOEt gives an anion **2** with formula $C_{11}H_{11}O_2$. Draw the resonance contributors to the structure of anion **2**. (6pts)



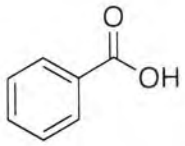

**1** **2**

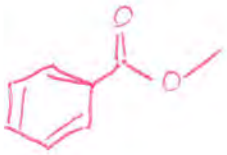




Total points for this page

2) (20 pts) Give the single major product of each of the following reactions. Aqueous workup is generally applied. For these questions, please ignore stereochemistry – the major product may be a mixture of diastereomers – ignore racemates.

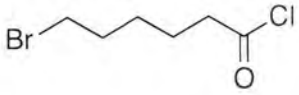
a) 

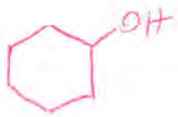
$\xrightarrow{H_2C{=}\overset{\oplus}{N}{=}\overset{\ominus}{N}}$


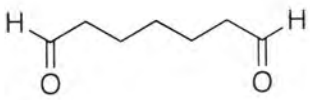

b) 

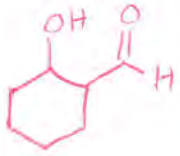
$\xrightarrow{LiAlH_4\ (excess)}$

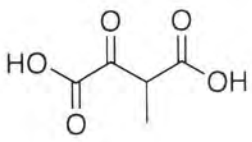


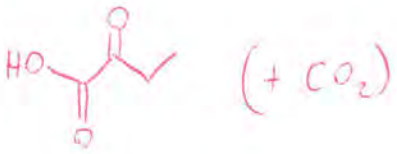
c) 

$\xrightarrow[2.\ Mg]{1.\ H_2/Pd/C,\ quinoline}$



d) 

$\xrightarrow[rt]{NaOH}$


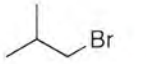

e) 

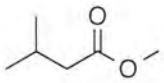
$\xrightarrow{\triangle}$


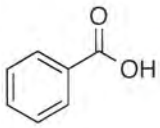


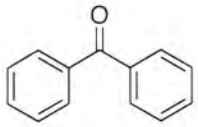

Total points for this page

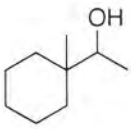
3) (20 pts) Propose reagents for accomplishing the following transformations. NOTE: more than one step may be required! Try to make your synthesis efficient (i.e. the desired product should be the major product, and generally a shorter synthesis is better than a longer one). You must use the starting material given; you may use any other reagents you need, including organometallic reagents such as Grignards, alkylithiums, and dialkyl cuprates.

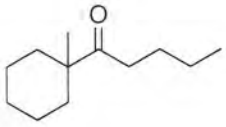
a) 

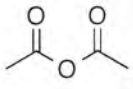
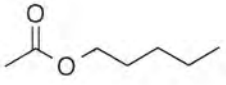
1. Mg, ether
2. $CO_2$
3. $K_2CO_3$, MeI


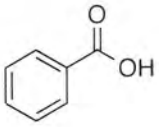
b) 

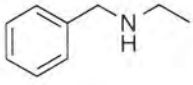
1. $SOCl_2$
2. $(\langle\rangle)_2CuLi$


c) 

1. PCC
2. LDA -78°C
3. I


d) 
HO, $Et_3N$
DMAP (1%)


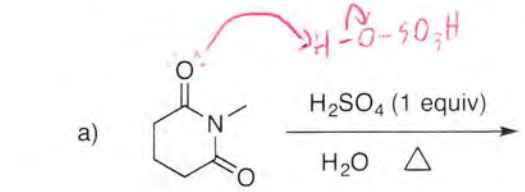
e) 

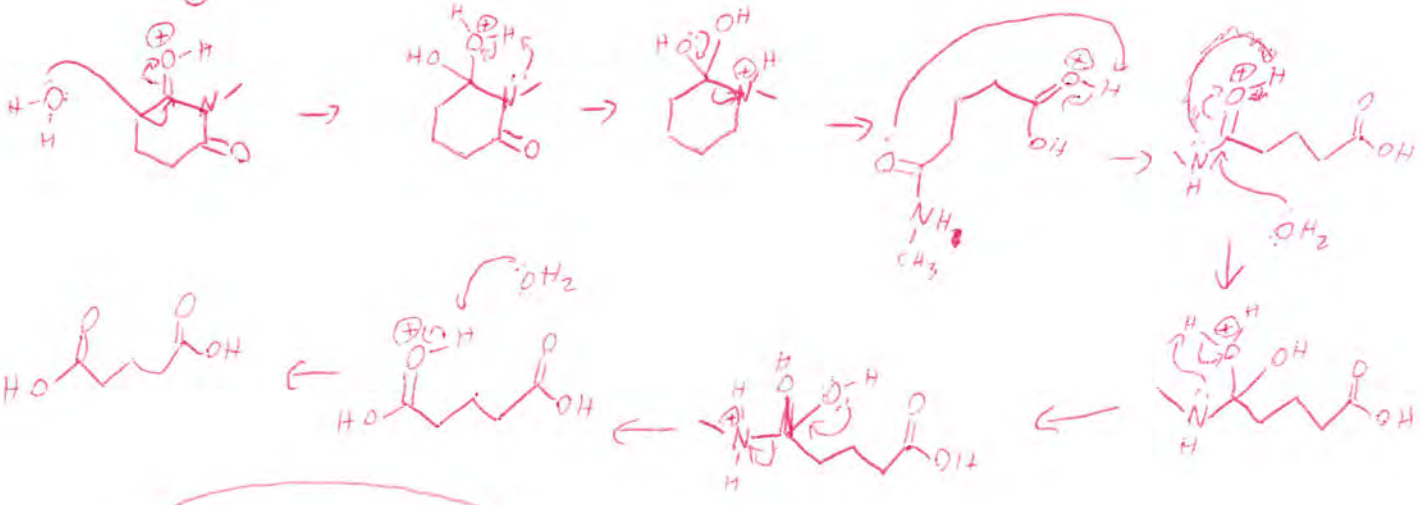
1. $H_2N$, $H_2SO_4$ (1%), MS
2. LAH



Total points for this page

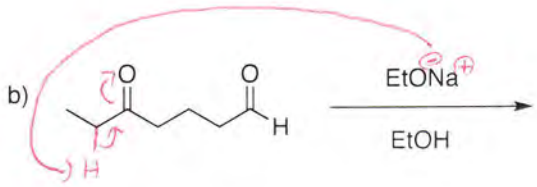
4) (16 pts) Provide the products and mechanisms for the following **two (2)** reactions. Show every intermediate with the proper changes and all the arrows required for each step of the reaction. (2 pts for product, 6 pts for mechanism).

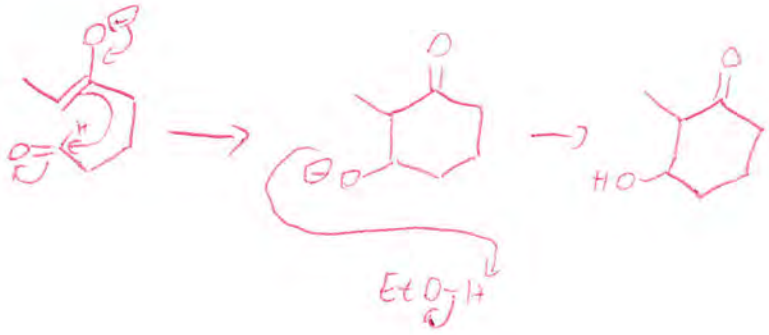
a)



b)





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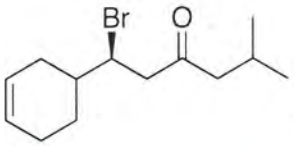
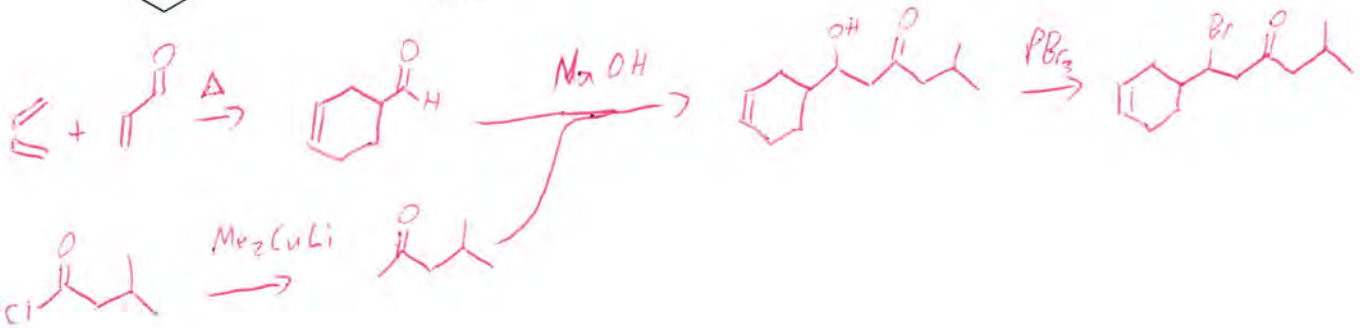
5) (18 pts) Propose a synthesis of each of the following **three (3)** targets. Allowed starting materials include any organic molecules containing **five (5)** carbons or less. You may use any necessary inorganic reagents. Try to make your synthesis efficient (i.e. the desired product should be the major product, and generally a shorter synthesis is better than a longer one). More than one step may be required. Please show all the intermediates in your synthesis (not intermediates in the mechanisms, but actual isolated molecules on the path from starting materials to product).

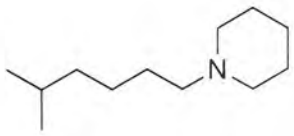
a)

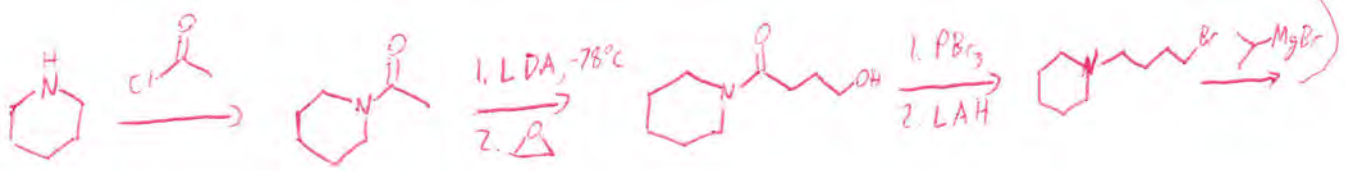



rac.




b)

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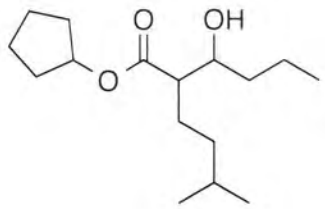
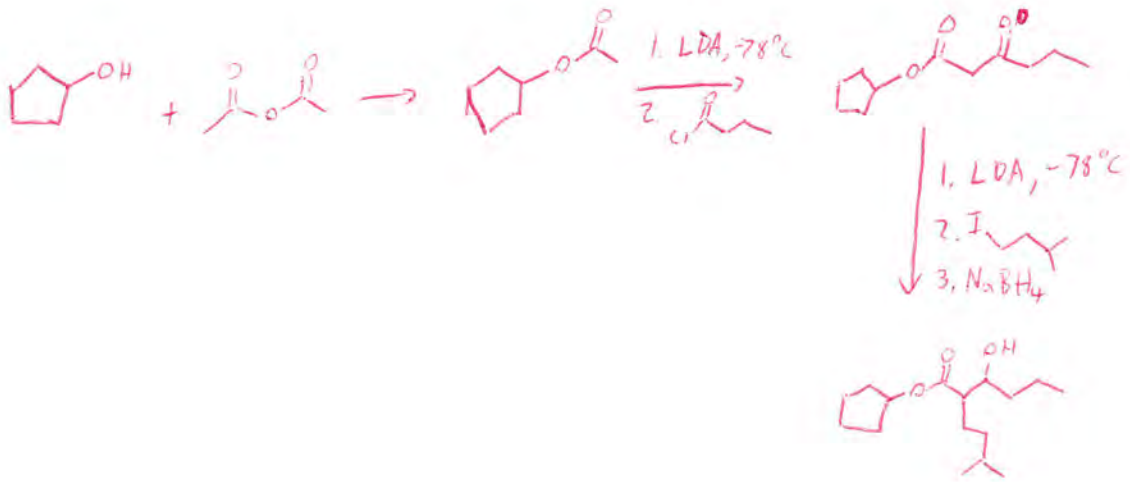
c)



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