

# CHEM 3331 (Richardson) Midterm Exam 3 – Nov. 15, 2022

Your Name: Key

Student ID: \_\_\_\_\_

Recitation (fill in one circle):

- 134 (Wed 12:20 w/ Will)
- 135 (Wed 1:25 w/ Will)
- 136 (Wed 2:30 w/ Will)
- 137 (Wed 3:35 w/ Will)
- 142 (Thu 10:10 w/ Ethan)
- 143 (Thu 11:15 w/ Ethan)
- 144 (Thu 12:20 w/ Ethan)
- 147 (Thu 3:35 w/ Hongxuan)

Question	Score	Out of
1		25
2		30
3		20
4		10
5		15
6		10 e.c.
<b>Total</b>		<b>100</b>

This is a closed-book exam. The use of notes, calculators, or cell phones will not be allowed during the exam. You may use models sets brought in a clear bag. Use the backs of the pages for scratch work. If your final answer is not clearly specified, you will lose points. For mechanisms, show all intermediates including correct formal charges, but do not show transition states.

**Periodic Table of the Elements**

The periodic table shows elements from Hydrogen (1) to Oganesson (118). It includes the Lanthanide series (57-71) and Actinide series (89-103) at the bottom. A legend box indicates: Atomic Number, Symbol, Name, Atomic Name.

## pKa Values

HI	-10	CH <sub>3</sub> COOH	4.7	ArOH	10	HC≡CH	26
HBr	-8	HN <sub>3</sub>	4.7	RSH	10-12	H <sub>2</sub>	35
HCl	-6	H <sub>2</sub> S	7.0	H <sub>2</sub> O	15.7	NH <sub>3</sub>	36
H <sub>3</sub> O <sup>+</sup>	-1.7	NH <sub>4</sub> <sup>+</sup>	9.3	ROH	16-18	H <sub>2</sub> C=CH <sub>2</sub>	45
HF	3.2	HCN	9.4	O=C-CH	9-25	CH <sub>4</sub>	60

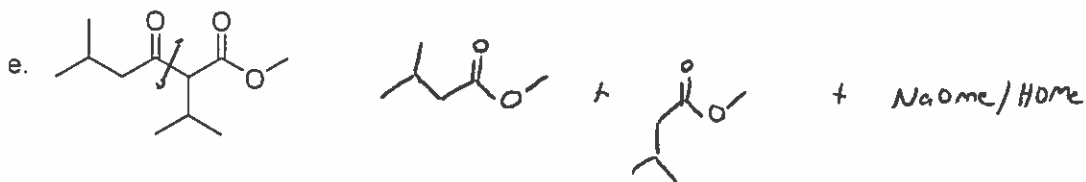
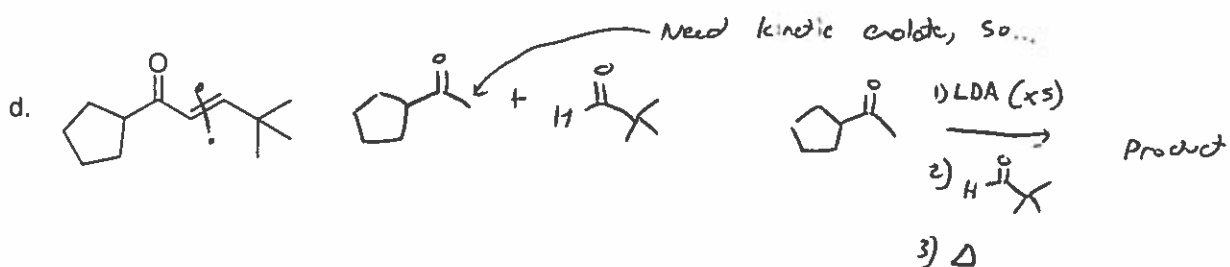
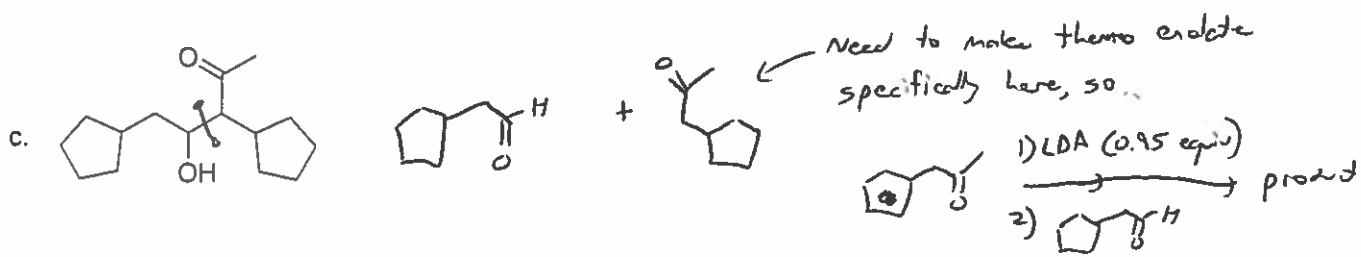
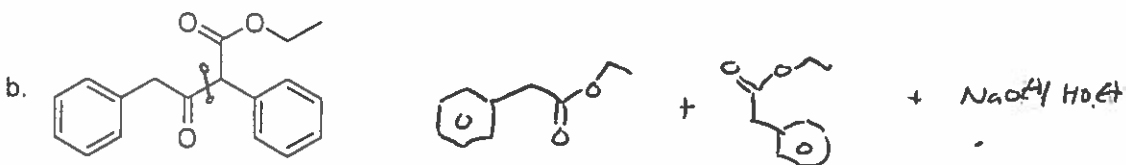
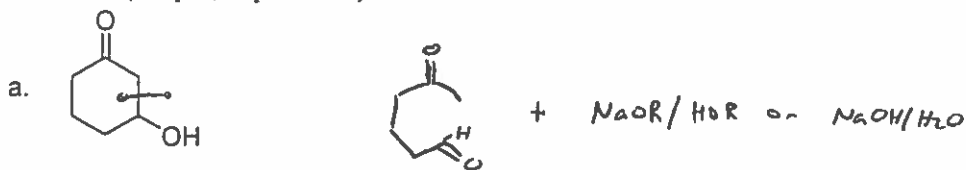
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Curve: 10.5

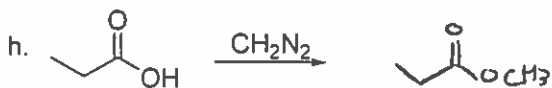
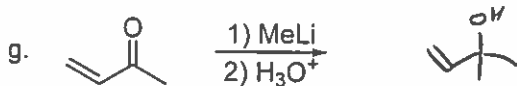
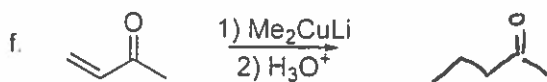
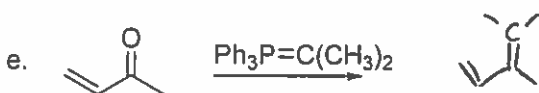
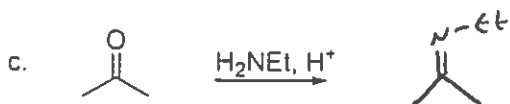
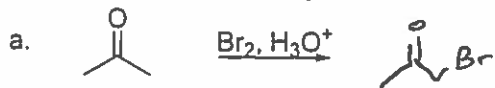
St. Dev: 22.4

max: 107

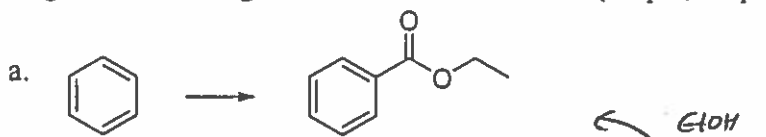
1) Devise a reaction scheme to synthesize the following compounds via an aldol or Claisen reaction. (25 pts; 5 pts each)



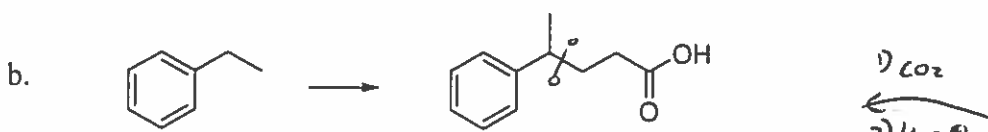
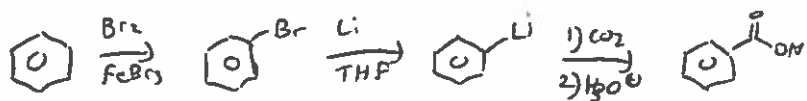
2) Predict the major product of the following reactions. If no reaction occurs, then write NR. Do not show stereochemistry. If an aldol-type reaction occurs, assume it only occurs once and does not involve subsequent additions. (30 pts; 3 pts each)



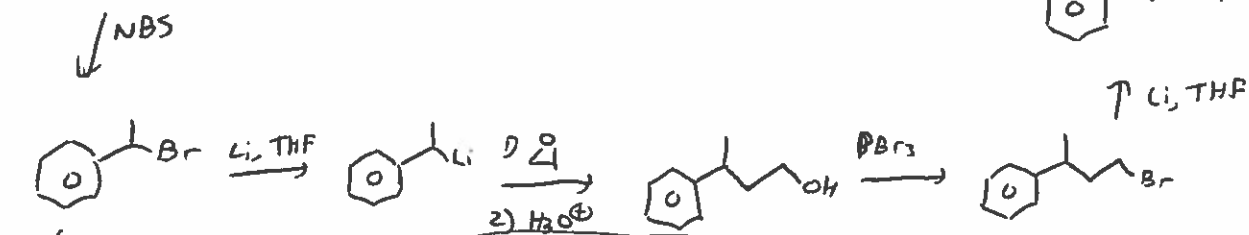
3) Find a way to synthesize the desired product from the given starting material plus any other reagents containing at most six carbon atoms. (20 pts; 10 pts each)



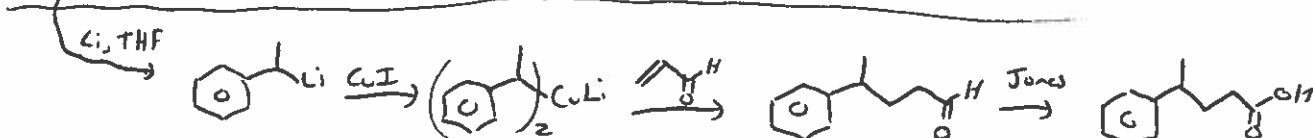
One option:



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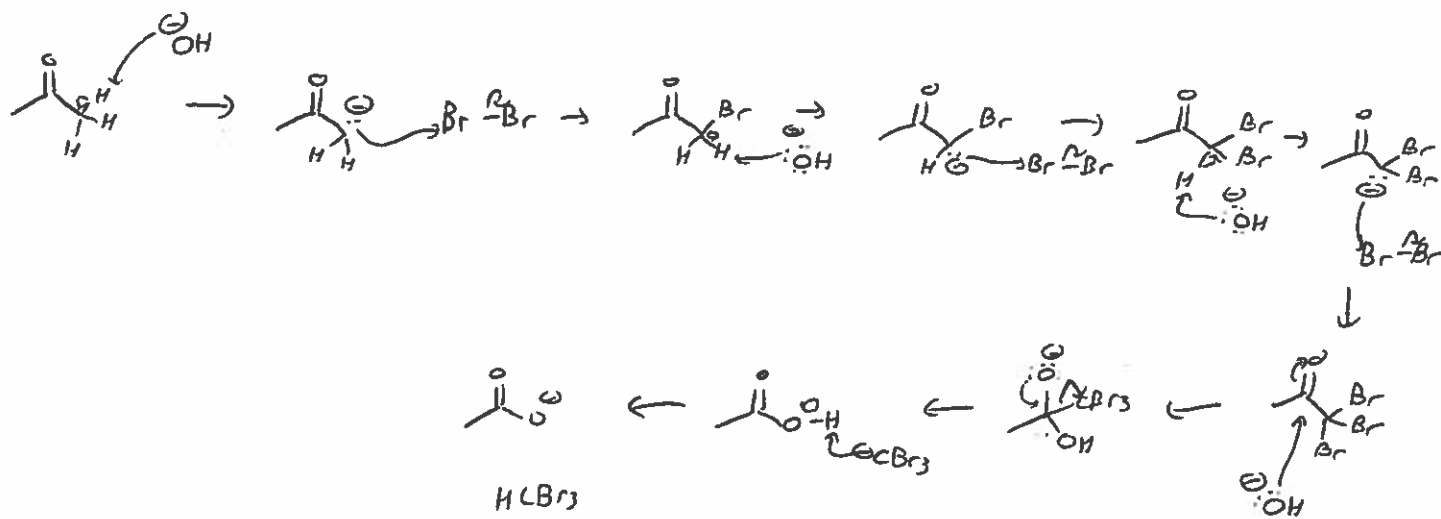


Another option:

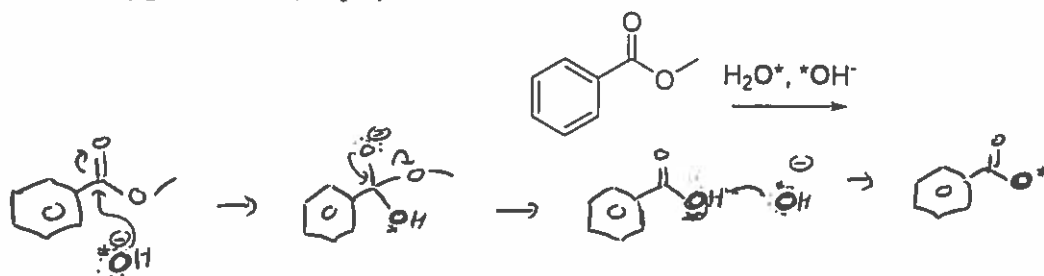


4) Write out the mechanism for this reaction. (10 pts)

(OK to show enolate as  $\overset{\ominus}{C}H_2$  or  $\overset{\ominus}{O}C=CH_2$ ) CC(=O)C  $\xrightarrow{Br_2, NaOH, H_2O}$



- 5) In an attempt to study the mechanism of saponification, you react methyl benzoate with  $^{18}\text{O}$ -labeled hydroxide in  $^{18}\text{O}$ -labeled water (labels are marked as  $\text{O}^*$  below). Show the product of this reaction and the mechanism for its formation, including the location(s) of any labeled oxygen atoms. (15 pts)



- 6) Extra credit! The first few steps of the reaction shown below resemble an aldol or Claisen reaction. Suggest a reasonable mechanism for this reaction. (10 pts extra credit)

