

# CHEM 3331 (Richardson) Midterm Exam 3 – Nov. 19, 2024

Your Name: Key

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

Recitation TA (fill in one circle):

- 134 (Phil Pham)
- 135 (Phil Pham)
- 136 (Max Abreu)
- 137 (Max Abreu)
- 141 (Phil Pham)
- 142 (Phil Pham)
- 143 (Zehao Yuan)
- 144 (Tania Shahvali)
- 147 (Tania Shahvali)

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

This is a closed-book exam, except for one double-sided sheet of 8.5 x 11" paper. The use of 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). A legend indicates the format: Atomic Number, Symbol, Name, and Atomic Mass.

## 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

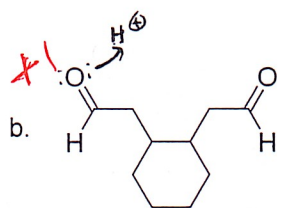
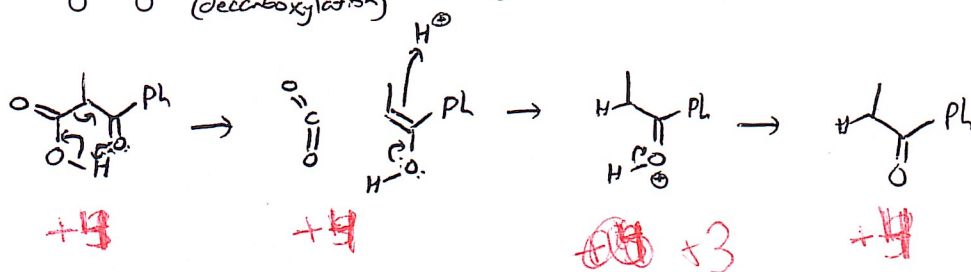
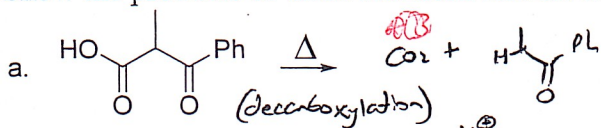
Aug = 63.1

Curve = 12

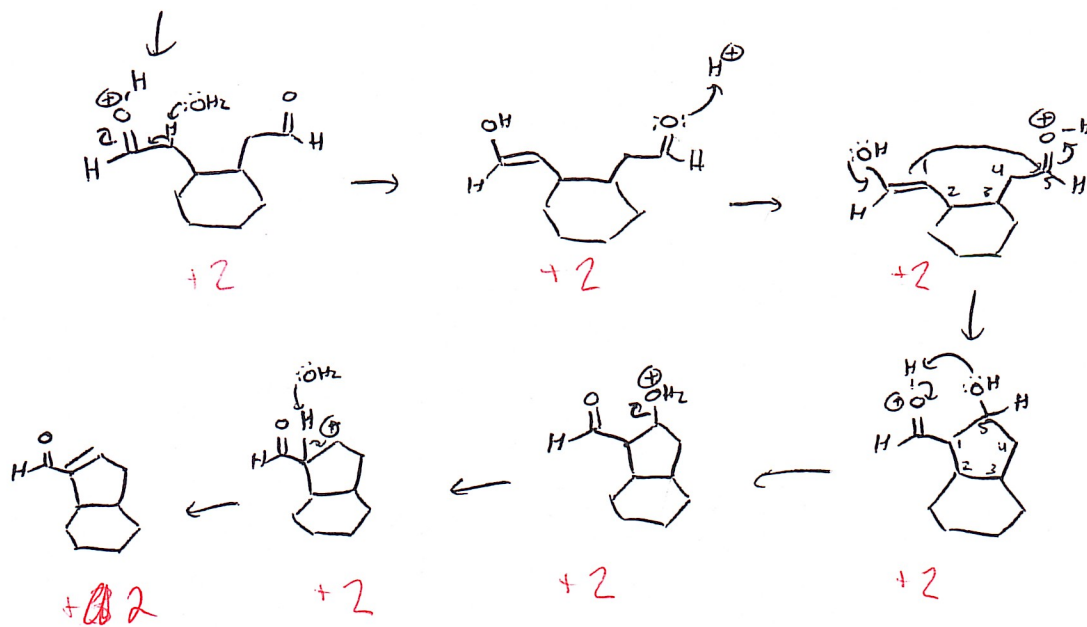
St Dev = 25.1

Max = 109

1) Show the products of these reactions and the mechanism for their formation. (30 pts).

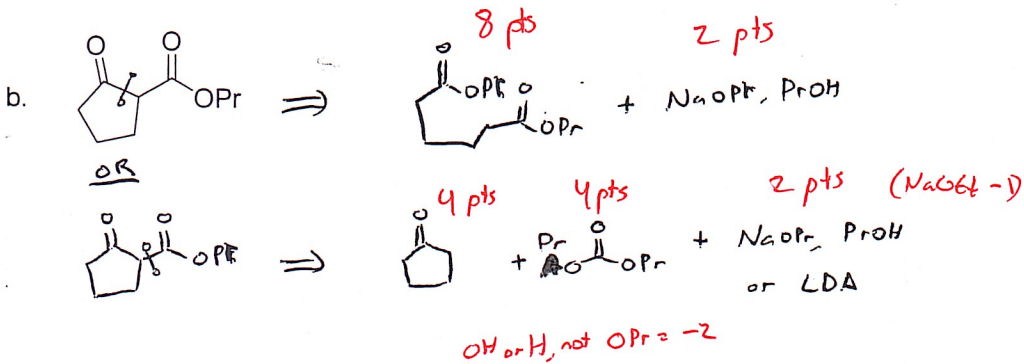
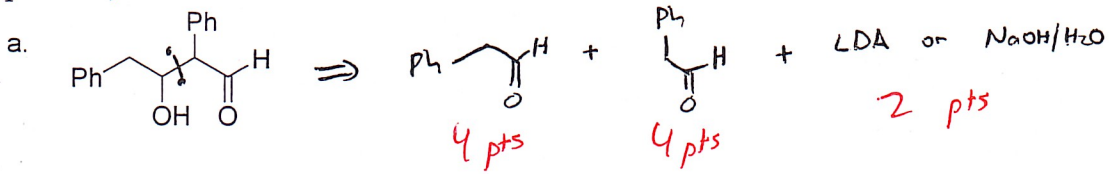


For any H<sup>+</sup> xfer steps intra or intermolecular is OK.

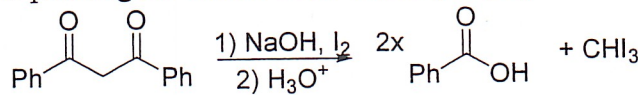


-7 pts for base catalyzed rxn

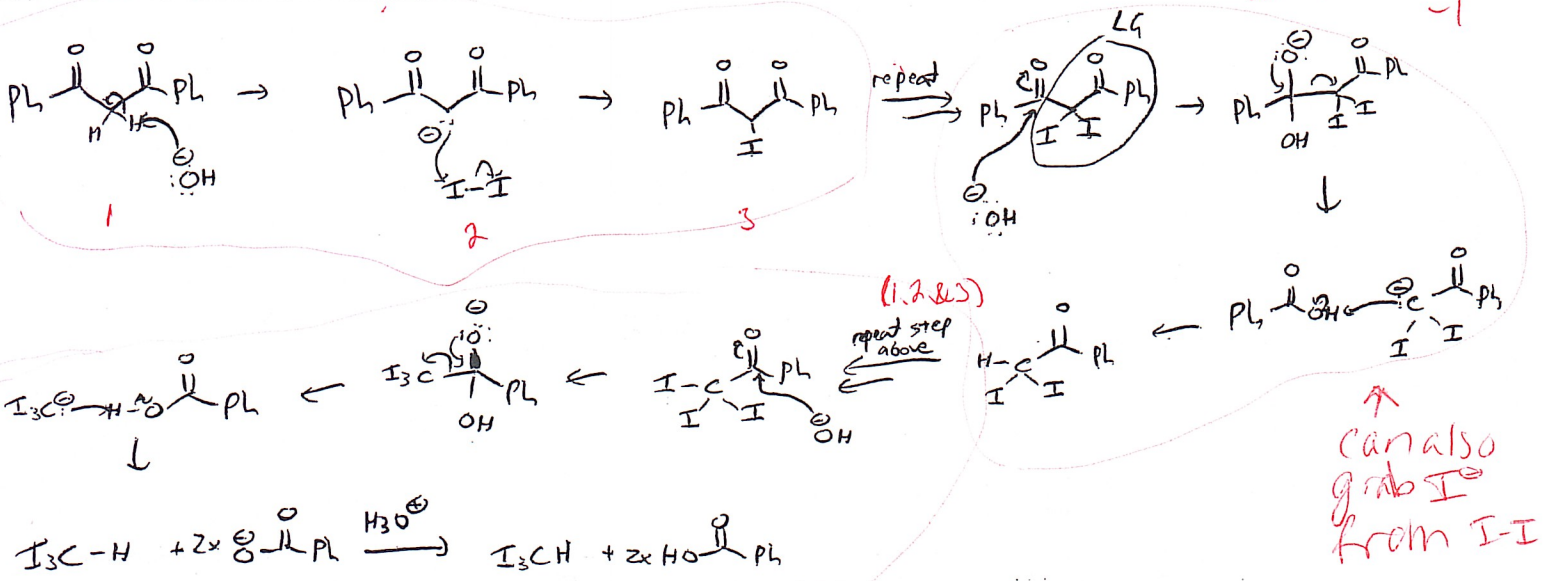
2) Show how you would use an aldol or Claisen reaction to make each compound. (20 pts; 10 pts each)



3) When the compound shown below is exposed to NaOH and I<sub>2</sub>, it forms the products shown below. Show a mechanism for this reaction and explain why it works, even though this is not a typical setup for a haloform reaction. If the same step happens multiple times, you only need to show the arrow pushing for one of these times. (20 pts)

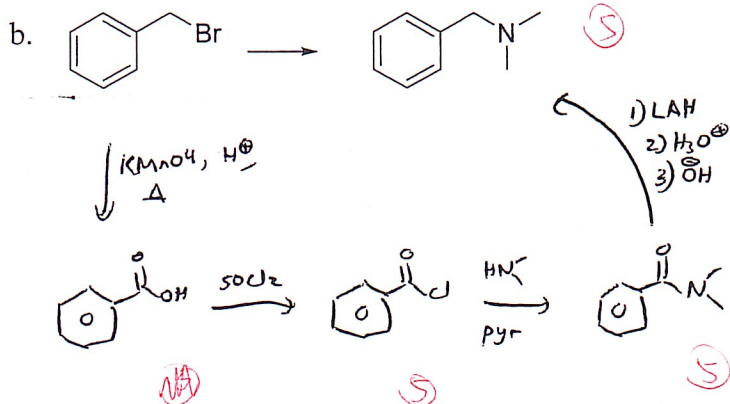
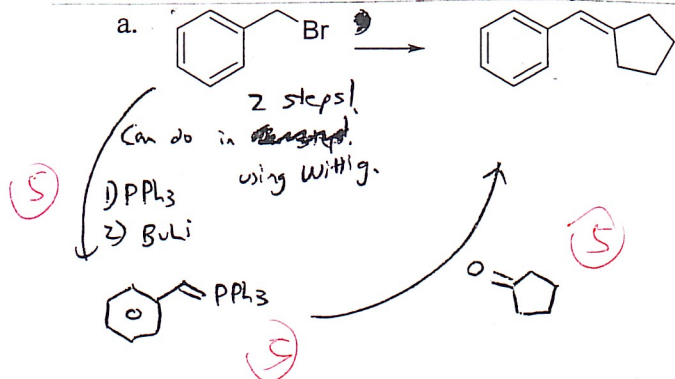


missing small detail like arrow/charge -1



3 parts each worth total of 6.5 pts

4) Find a way to synthesize the desired product from any reagents containing at most six carbon atoms, or triphenylphosphine, or any transition metal catalyst. (30 pts)

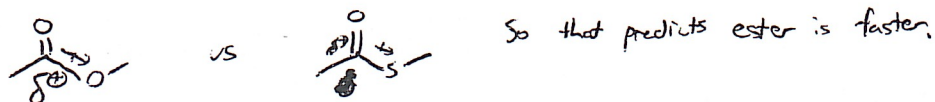


5) Extra credit! You are trying to hydrolyze both the compounds shown below (an ester and a thioester) using  $NaOH, H_2O,$  and heat. Which reaction would proceed faster, and why? (10 pts e.c.)

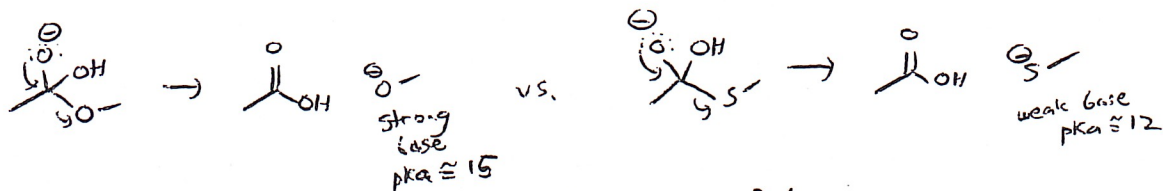


Can argue this 2 ways:

1)  $\delta^+$ : Ester group is more EN  $\rightarrow$  bigger  $\delta^+$   $\rightarrow$  more electrophilic.



2) LG ability:



$OS^-$  is better LG, so that predicts thioester is faster. In real life, LG ability ends up winning, & thioester is faster. But full points for either way.