

CHEM 347 – Organic Chemistry II (for Majors)

Instructor: Paul J. Bracher

Hour Examination #2

Wednesday, March 5th, 2014

5:30–8:30 p.m.

Student Name (Printed)	
Student Signature	

Instructions & Scoring

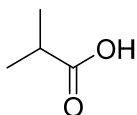
- Please write your answers on the official answer sheet. No answers marked in this booklet will be graded.
- If you wish, you may use two sheets (front-and-back) of handwritten notes and a plastic model kit.
- You may not use electronic devices or communicate with others for the duration of this exam.
- Your exam answer sheet may be photocopied.

Problem	Points Earned	Points Available
I		32
II		21
III		21
IV		26
TOTAL		100

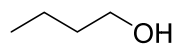
Please record all of your answers on the official answer sheet

Problem I. Multiple choice (32 points total; +4 points for a correct answer, +1 point for an answer intentionally left blank, and 0 points for an incorrect answer). For each question, select the best answer of the choices given. Write the answer, legibly, in the space provided on the answer sheet.

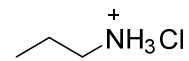
(1) _____ Which of the following five compounds is the strongest Brønsted–Lowry acid?



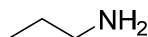
(a)



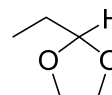
(b)



(c)

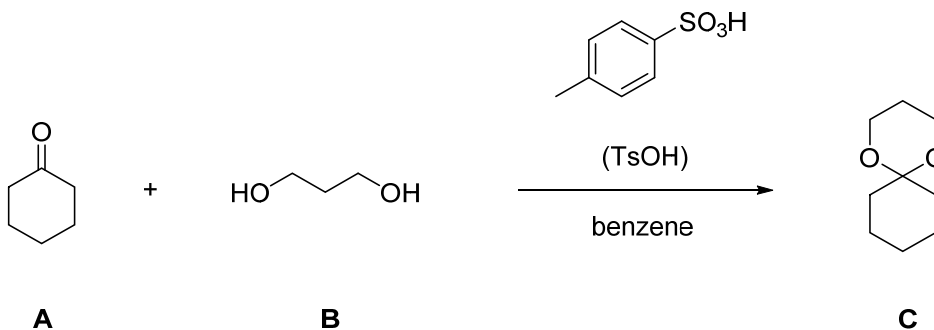


(d)



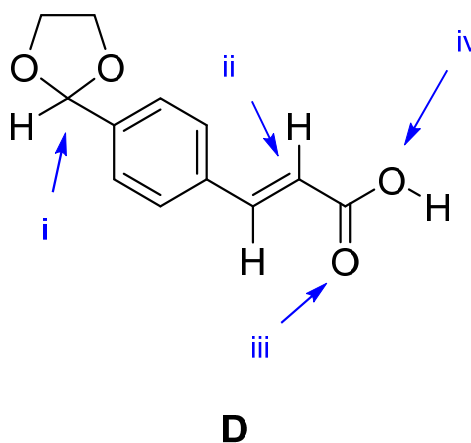
(e)

(2) _____ In the reaction drawn below, which of the following modifications would be the most effective means of increasing the percent yield of **C** from **A**?



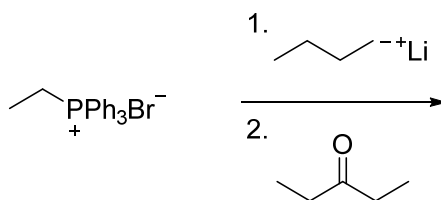
- (a) increasing the concentration of TsOH
- (b) increasing the concentration of cyclohexanone
- (c) using a Dean–Stark apparatus to distill away water as an azeotrope
- (d) using a separatory funnel to perform a Fischer ketal extraction
- (e) all of the above would decrease the percent yield of **C**

(3) _____ Which of the labeled atoms in compound **D** is not sp^2 hybridized?



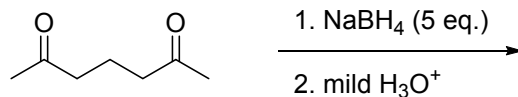
- (a) i
- (b) ii
- (c) iii
- (d) iv
- (e) all four atoms are sp^2 hybridized

(4) _____ Which of the following compounds is not a product of the reaction shown below?



- (a) lithium bromide
- (b) triphenylphosphine oxide
- (c) 3-ethyl-2-pentene
- (d) butane
- (e) all of the above are products of the reaction

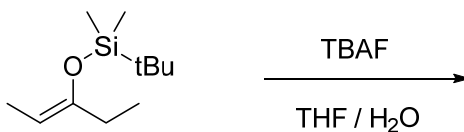
- (5) _____ How many different organic products (in >10% yield) are produced from **E** in the following reaction? (Hint: Be careful with your stereochemistry!)



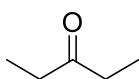
E

- (a) zero (no reaction)
- (b) one
- (c) two
- (d) three
- (e) four

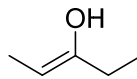
- (6) _____ Which of the following compounds will be the major product (present in highest concentration) when compound **F** is treated with a solution of tetrabutylammonium fluoride (TBAF) dissolved in a mixture of THF and water?



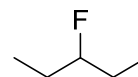
F



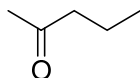
(a)



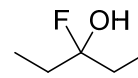
(b)



(c)

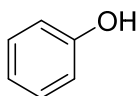


(d)

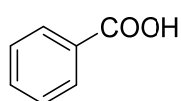


(e)

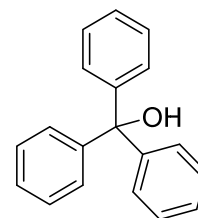
- (7) _____ Compound **G** has an odor of marzipan. **G** produces a silver mirror on the side of the reaction vessel when treated with silver oxide in aqueous ammonium hydroxide (Tollens' reagent). The compound gives the ^1H NMR and IR spectra shown below. Which of the following structures is consistent with the data provided for compound **G**?



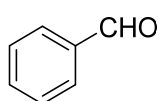
(a)



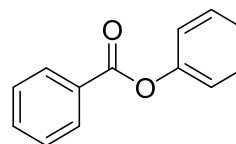
(b)



(c)

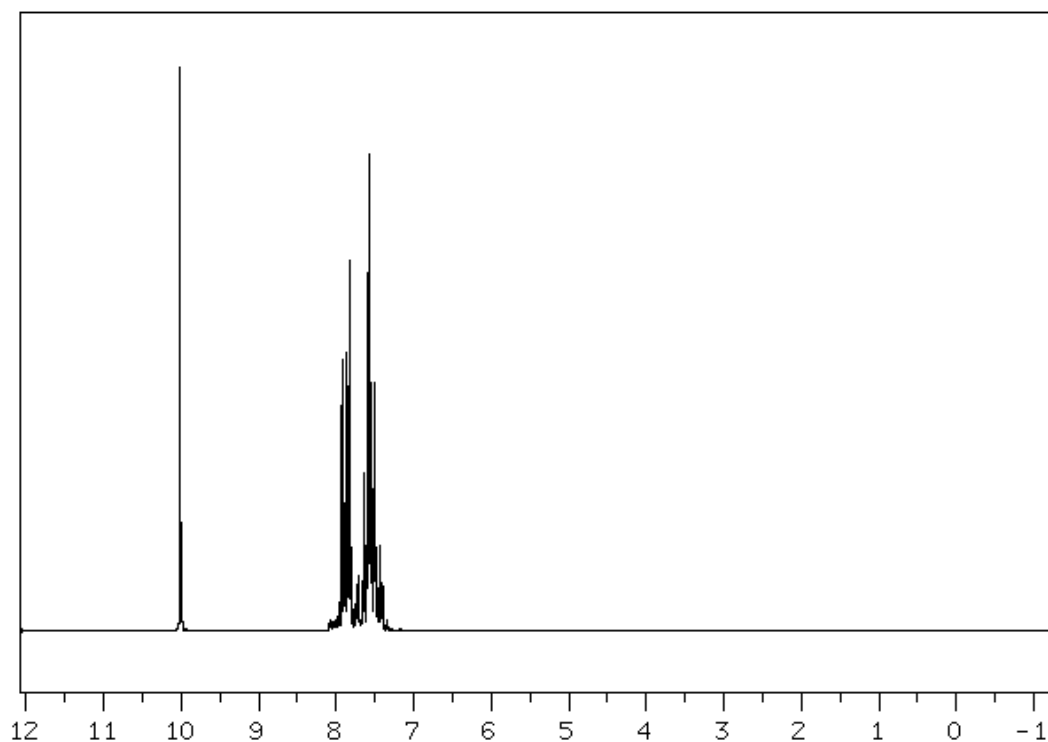


(d)

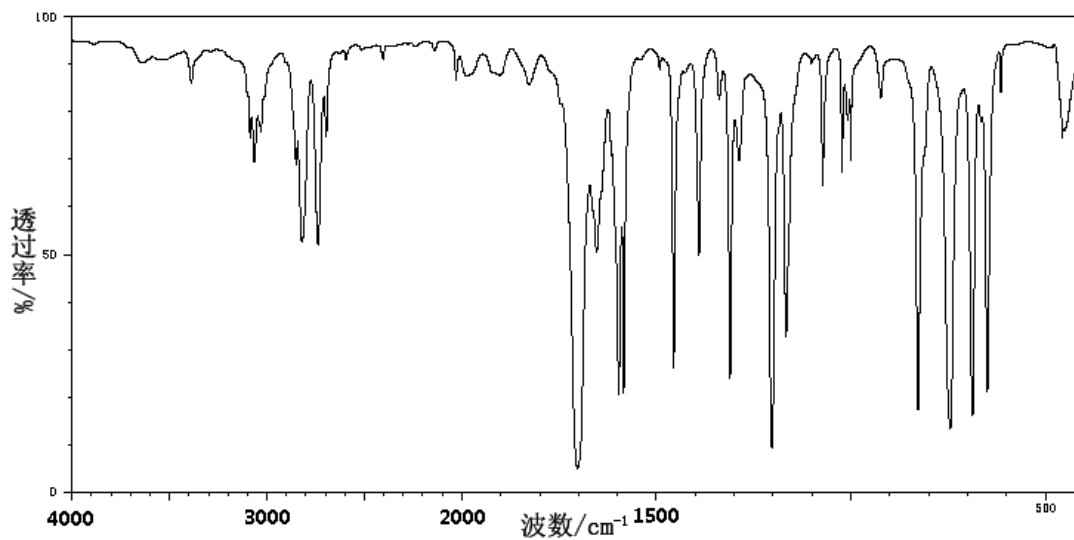


(e)

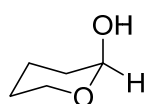
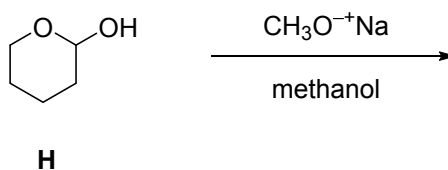
^1H NMR:



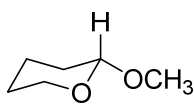
IR:



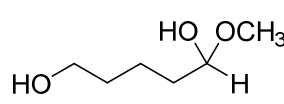
- (8) _____ Which of the following four compounds will have the lowest concentration when 1 mmol of compound **H** is dissolved in methanol, treated with 0.01 mmol of sodium methoxide, and stirred for a few minutes?



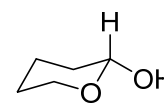
(a)



(b)

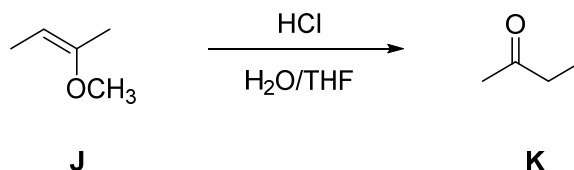


(c)



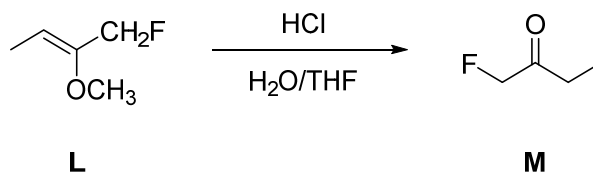
(d)

Problem II. Mechanism (21 points). Enol ethers hydrolyze in the presence of catalytic acid to yield ketones and aldehydes.



(a) (16 points) Draw a sensible mechanism for the conversion of **J** to **K** in aqueous acid. Tetrahydrofuran (THF) is used as a co-solvent because the solubility of the enol ether is relatively low in water. Remember to use proper “curved arrow notation” to account for the movement of electrons in the making and breaking of bonds. Show all intermediates and significant resonance forms that account for the stability of these intermediates in the reaction.

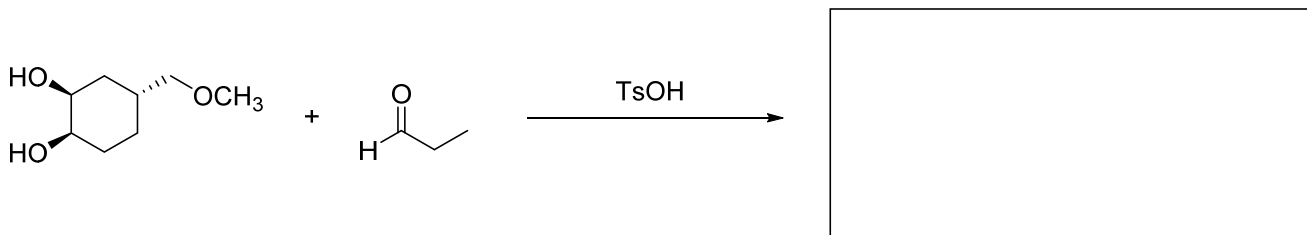
(b) (5 points) Would you expect the rate of hydrolysis of **L** (below) to be faster or slower than the rate of hydrolysis of **J**? Very briefly explain why in the space provided.



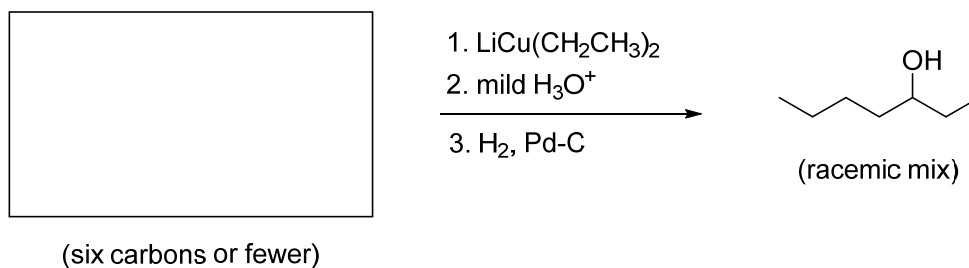
faster or slower
than above?

Problem III. Reactions (21 points). The following chemical reactions are missing their starting materials, products, or reagents. Write the missing compounds into the empty boxes below, as appropriate. For missing products, draw the single organic product that you expect to be produced in the highest yield among all of the possibilities. In some cases, there will be more than one correct answer that will merit full credit.

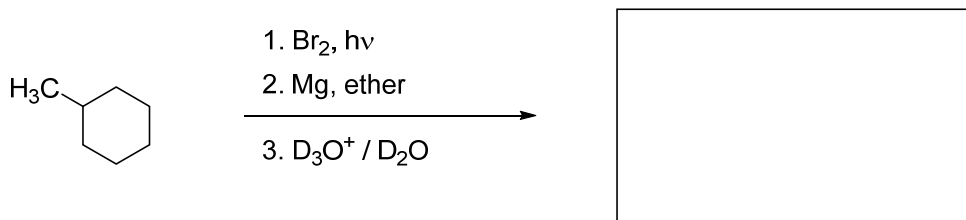
(a) (7 points)



(b) (7 points)

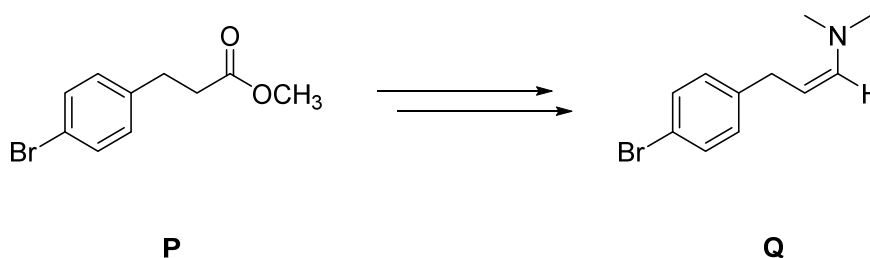


(c) (7 points)



Problem IV. Synthesis (26 points). Design efficient synthetic routes for compounds **Q** and **S** using compounds **P** and **R** as starting materials, respectively. You may use any other reagents or molecules you wish, so long as you do not violate the spirit of the problem by ignoring the starting materials.

(a) (10 points)



(b) (16 points)

