

**Fall Semester Organic Chemistry I  
Final Exam Makeup**

**Name (print):**

**Name (Sign) :**

**Instructions:**

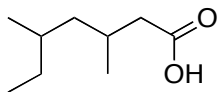
1. Keep the exam closed until you are instructed to begin.
2. The exam consists of 9 questions. The first thing you should do is make sure that no pages are missing. If a page is missing, notify a proctor immediately.
3. You will have **2 hrs** to complete the exam, at which time pencils must be put down. Budget your time wisely.
4. Make sure to show all of your work, and make it clear what your thought process was. Answers should fit in the space provided. If you need to use the back of the sheet of paper, you must make note of it in the space allotted for credit.

**Breakdown**

- |                                     |                    |
|-------------------------------------|--------------------|
| 1. Nomenclature (12 points)         | _____ / 12         |
| 2. Newman Projection (8points)      | _____ / 8          |
| 3. Acid/Base Chemistry (8 points)   | _____ / 8          |
| 4. Chair Conformation (10 points)   | _____ / 10         |
| 5. Reactions (12 points)            | _____ / 12         |
| 6. Mechanism (15 points)            | _____ / 15         |
| 7. Synthesis (15 points)            | _____ / 15         |
| 8. NMR (10 points)                  | _____ / 10         |
| 9. General Spectroscopy (10 points) | _____ / 10         |
| <b>total</b>                        | <b>_____ / 100</b> |

**1) Nomenclature (12 points)**

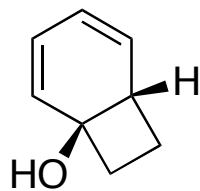
- a. Give the IUPAC name of the following molecule (3 points)



**name:** \_\_\_\_\_

- b. Draw [5.1.1] bicyclononane in line-angle notation (3 points)

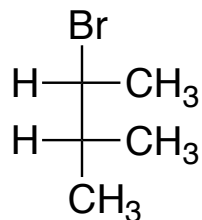
- c. Circle all of the stereogenic centers (chiral centers) on the following molecule and name them as R or S. Is this molecule chiral or achiral, and if achiral is it meso (6 points)?



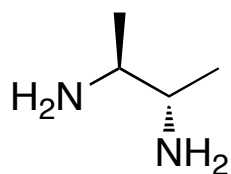
**2) Newman Projections (8 points)**

Convert the following molecules into a Newman projection and convert them into their lowest energy conformations

a) Down middle C-C bond (4 points)



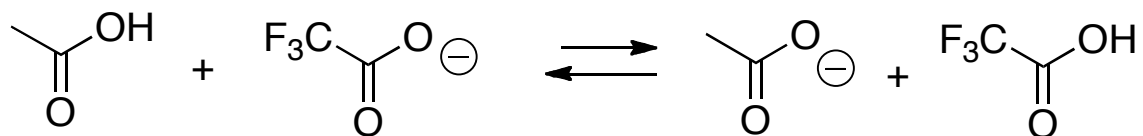
b) (4 points)



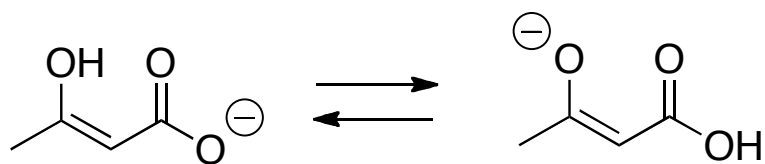
3) Acid/Base Chemistry (8 points, 4 points each)

Predict which way the equilibrium of the following reactions would lie and explain your answer.

a)

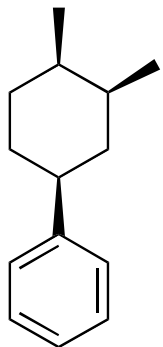


b)

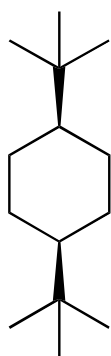


#### 4) Chair Conformation (10 points)

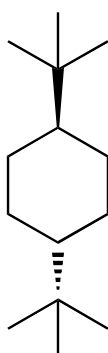
a. Draw both chair conformations of the following molecule and circle the one that is lower in energy (5 points).



b. *Trans* 1,4-ditertbutyl cyclohexane can exist in a chair conformation. The *cis* stereoisomer cannot, and exists in the twist boat conformation. Explain this phenomena, using structures to help illustrate and support your answer (5 points).

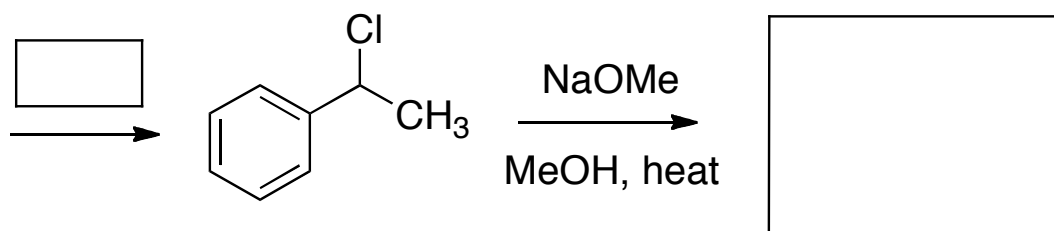
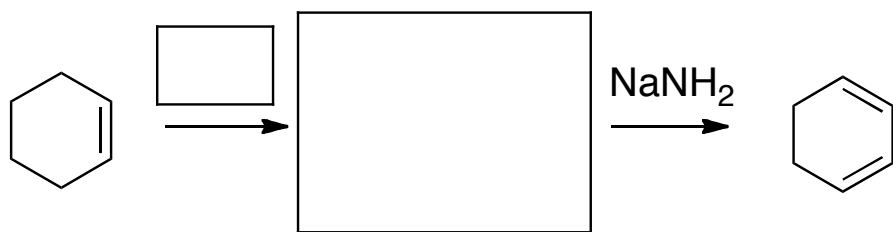


*cis*



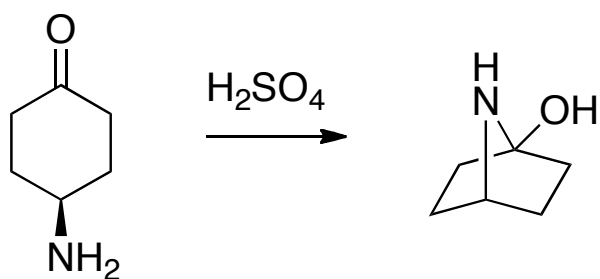
*trans*

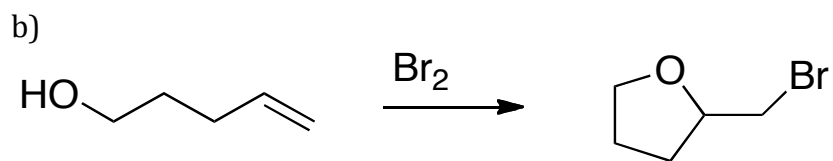
5) Reactions (12 points)



6) Mechanisms (15 points, 5 points each)

a)

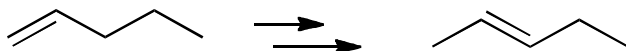




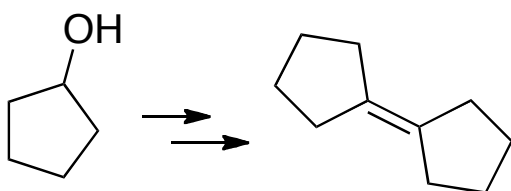
7) Synthesis (15 points, 5 points each)

Propose a synthesis of the following molecules using the starting materials shown as your only carbon-based starting material. **Show all of your intermediates.**

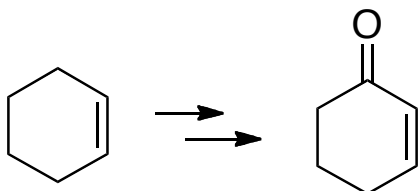
a)



b)

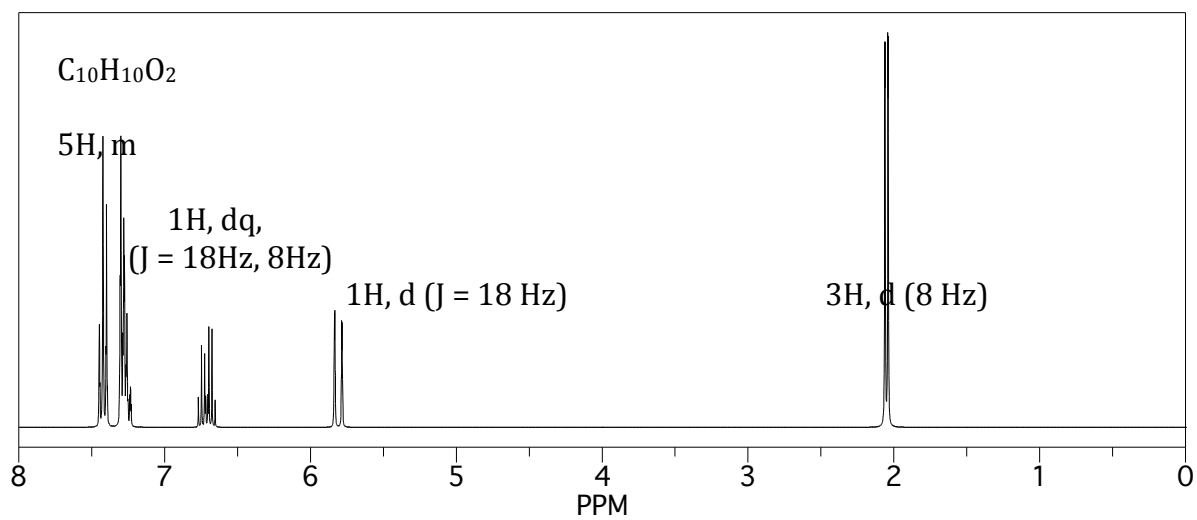


c)





### 8) NMR question



### 9) Spectroscopy (general)

Using 2 types of spectroscopy of your choosing (IR, NMR, MS), explain 2 key, specific and noticeable differences that you would expect to observe spectroscopically between the starting material (A) and product (B).

