Chem 125 Final Exam
180 points
10:30 am - 12:30 pm
June 6, 2016

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<th>Problem</th>
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**Academic Honesty Policy.** Academic honesty is strictly enforced on homework, exams, and other aspects of this course. Academic dishonesty will result in a failing grade in the class and a letter in the student's file. Activities constituting academic dishonesty include:

**Cheating**
- Copying from others during an examination.
- Communicating exam answers with other students during an examination.
- Offering another person's work as one's own.
- Taking an examination for another student or having someone take an examination for oneself.
- Tampering with an examination after it has been corrected, then returning it for more credit.
- Using unauthorized materials, prepared answers, written notes, or concealed information during an examination.

**Dishonest Conduct**
- Stealing or attempting to steal an examination or answer key from the instructor.
- Allowing another student to copy off of one's own work during a test.

**Collusion**
- Any student who knowingly or intentionally helps another student perform any of the above acts is subject to discipline for academic dishonesty.

I understand and will abide by this academic honesty policy: __________________________ (signature)

Seat: _______
1. Write a curved-arrow mechanism for this reaction. Make sure to show each step of the reaction and all reactants, intermediates, products, charges, and important lone pairs of electrons. (Problem 4.20, 20 points)

NOTE: Fluorosulfonic acid (HO-SO₂-F) is a strong acid, like sulfuric acid (HO-SO₂-OH) but stronger.
2. The cyclobutene below undergoes thermal rearrangement to form the products shown via two possible ketene intermediates. Show the curved arrows and name the pericyclic process involved in the formation of the intermediates and both products. (Problem 5.10. 20 points total)

![Chemical Structure](image)

**NOTE:** Ketenes have the structure $R_2C=O$

**a. mechanism and ketene intermediate for the formation of product A**

![Mechanism Diagram](image)

**b. mechanism and ketene intermediate for the formation of product B**

![Mechanism Diagram](image)
3. Show how you would prepare the following products from the given starting materials. When more than one step is required, show each step distinctly. (Problems 6.12, 6.27, 6.33. 20 points each, pick two, 40 points total)

PICK TWO OF THE THREE PROBLEMS. If you work all three, cross out the one that you do not want graded. Otherwise only the first two will be graded.
4. Show how you would prepare the following products from the given starting materials. When more than one step is required, show each step distinctly. (Problems 7.9, 7.18, 7.26. 20 points each, pick two, 40 points total)

PICK TWO OF THE THREE PROBLEMS. If you work all three, cross out the one that you do not want graded. Otherwise only the first two will be graded.

five-membered ring lactams from very easily from the corresponding hydroxy acids.

The addition of acrylate, acrylonitrile is often low yielding. The authors use the diene in butan-2-one and add HMPA (pentaerythritol) to get a good yield.
5. Show how you would synthesize the following compound starting with compounds containing six carbon atoms or fewer as the only organic starting materials. You may use any other inorganic reagents you choose and organic reagents that don't get incorporated into the final product, such as TBDMSI, Ph₃P, LDA, PCC, DCC, p-TsOH, TsCl, etc. (Problems 8.2, 8.3, 8.6. 20 points each, pick two, 40 points total)

PICK TWO OF THE THREE PROBLEMS. If you work all three, cross out the one that you do not want graded. Otherwise only the first two will be graded.
6. The following four NMR spectra are of isomeric monosubstituted aromatic esters with formula $C_{10}H_{12}O_2$. Make no attempt to interpret the aromatic protons in the area between 7.1 and 7.4 ppm. Draw the structures of the compounds. (Supplemental Problem 25. 20 points total)

SPECTRUM A. Write the structure of the compound in the box.

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\[ \text{Structure A} \]
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SPECTRUM B. Write the structure of the compound in the box.

```
\[ \text{Structure B} \]
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SPECTRUM C. Write the structure of the compound in the box.

SPECTRUM D. Write the structure of the compound in the box.

PLEASE REVIEW THE ACADEMIC HONESTY STATEMENT ON PAGE 1 AND SIGN IT IF YOU ARE ABLE