Spring Semester 2020
Organic Chemistry I
Midterm Examination #1

Name (print):

Name (sign):

Recitation Instructor (name, day):

Instructions

1. Keep the exam closed until you are instructed to begin.

2. The exam consists of 6 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 1 hour and 15 minutes. If you finish within 1 hour, you may turn in your exam. The last 15 minutes, I will ask you to stay seated to maintain order in exam collection, and to limit disruption to other students.

4. Make sure to show all of your work, and this should fit into the space provided. If you need to use the back of the paper, you must make note of it in the space provided for credit.

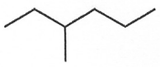
5. No bathroom breaks!!

Good Luck!

1.___IUPAC (10 points)
2.___ Stereochemistry (20 points)
3.___ Newman Projections (20 points)
4.___ Chair Conformation (20 points)
5.___ NMR (20 points)
6.___ Concept Question(10 points)

1. IUPAC Naming

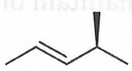
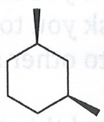
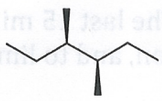
1. Chose two of the following three molecules, and provide its IUPAC name. If you do all 3, we will grade the first two (10 points, 5 points each).


Cyclopentene 3-methylhexane bicyclo[2.2.1]heptane

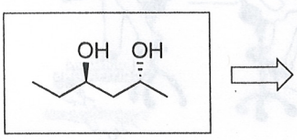
2. Stereochemistry

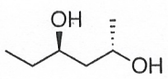
2a. Chose 2 of three of the following molecules. Label them as either chiral or achiral. If they are achiral, does it classify as meso? If you do all 3, we will grade the first two (10 points, 5 points each).

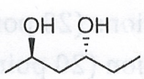




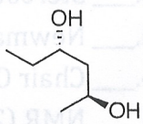
achiral achiral/meso chiral

2b. What is the relationship between the molecules on the left with the molecules on the right? Options are enantiomer, diastereomer, or identical. Chose two of three to answer. If you do all 3, we will grade the first two (10 points, 5 points each).





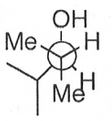




dias. identical enant

3. Newman projections

3a. Draw the additional two staggered Newman projections of the following molecule, and circle the one that is lowest in energy (10 points)

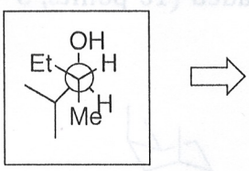


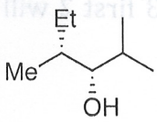
3 gauche

2 gauche
lowest in
energy

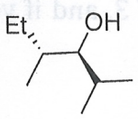
3 gauche

3b. What is the relationship between the Newman projection and the molecules on the right. Options are Identical, Enantiomer or Diastereomer. Chose 2 of 3, and if you do all 3 first 2 will be graded (10 points, 5 points each).

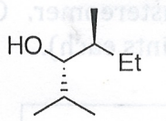




dias



dias



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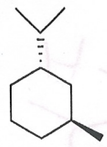
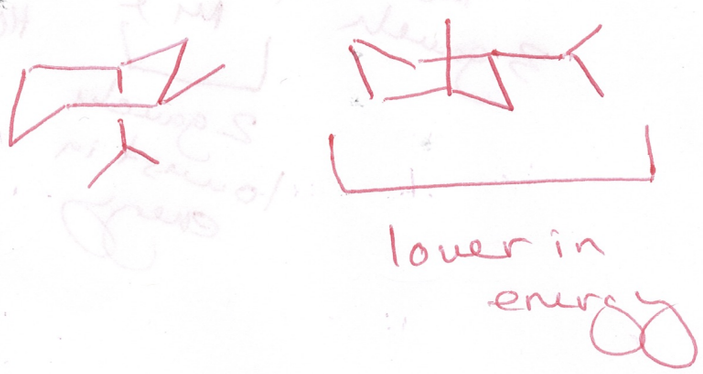
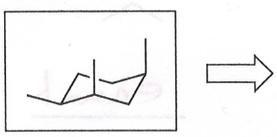
4. Chair Conformations

4a. Draw the following cyclohexane ring in its two chair conformations, and circle the one that is lower in energy.





4b. What is the relationship between the Chair conformation and the molecules on the right. Options are Identical/same chair, Identical/chair flip, enantiomer or diastereomer. Chose 2 of 3, and if you do all 3 first 2 will be graded (10 points, 5 points each).



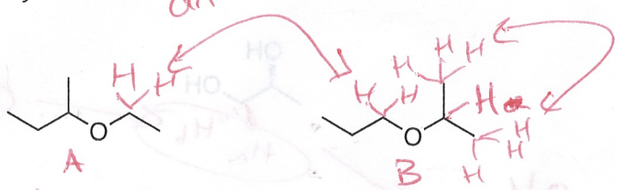
enant

identical/
chair
flip

enant.

5. NMR Spectroscopy

5a. What would be two key differences between the following two molecules by 1H NMR that would help you easily distinguish between them? In other words, what would be a signal that you would observe on one that you would not observe in the other, making sure to mention location in the NMR, splitting pattern, and integration. (10 points, 5 points each)

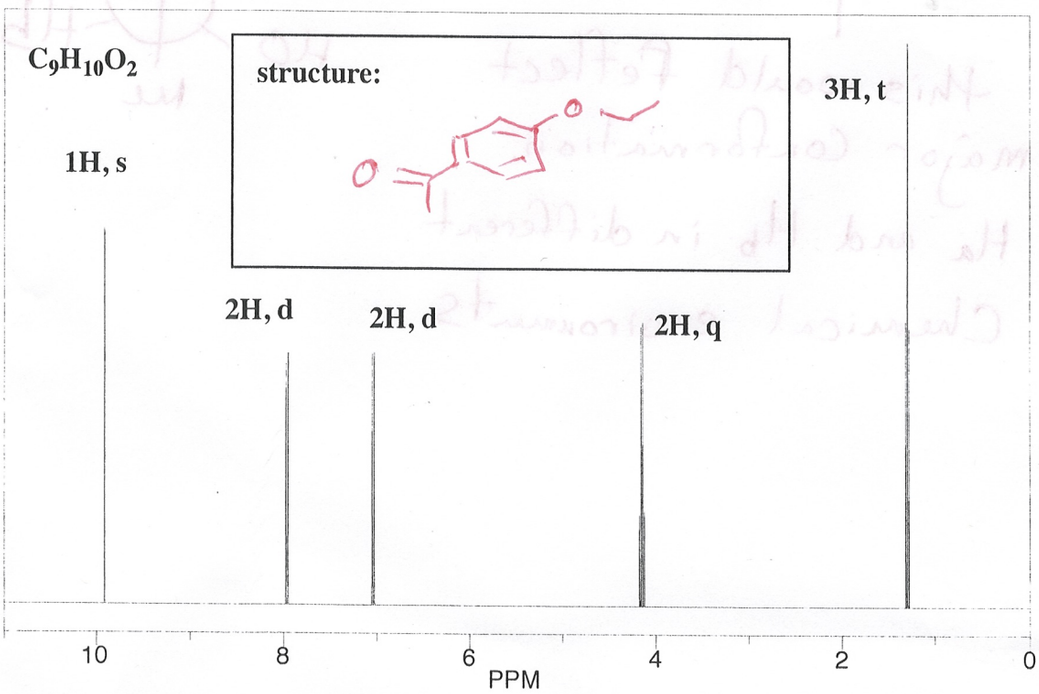


example answers

Difference 1: B would have a doublet @ ~ 1.5 integrating to 6H. This would not be in A

Difference 2: A would have quartet @ ~ 3.5 whereas B would have triplet. Both integrating to 2H

5b. Provide a structure that is consistent with the following NMR and molecular formula (10 points)



6. (Concept Question) The concept of diastereotopicity is one in which geminal protons on molecules with stereochemistry are not chemically equivalent, and thus show up in unique places on the NMR spectra. Which set of geminal protons on the following molecule would be 'chemically non-equivalent', and why. Please use Newman projections to help support your answer.