

**Fall Semester Organic Chemistry I  
Mid-Term Exam 1**

Name (print): **Answer Key**

Name (Sign) :

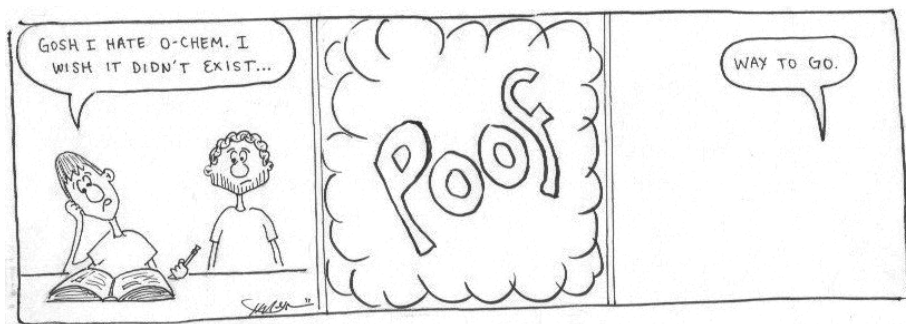
Email Address (1 bonus point):

**Instructions**

1. Keep the exam closed until you are instructed to begin.
2. The exam consists of 10 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 hr and 15 minutes 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 the sheet of paper, you must make note of it in the space allotted for credit.

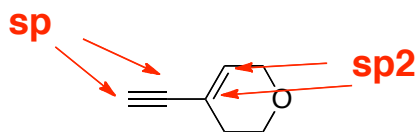
**Breakdown**

1. \_\_\_ / 5
2. \_\_\_ / 10
3. \_\_\_ / 15
4. \_\_\_ / 5
5. \_\_\_ / 15
6. \_\_\_ / 10
7. \_\_\_ / 10
8. \_\_\_ / 10
9. \_\_\_ / 10
10. \_\_\_ / 10
- total \_\_\_ / 100

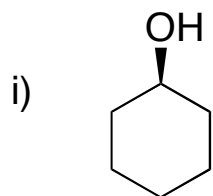


<http://greensidecomic.blogspot.com/>

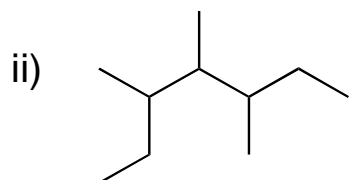
1) Label all sp and sp<sup>2</sup> hybridized carbons on the following molecules (5 points)



2) Give the IUPAC name of the following molecules (10 points, 5 points each)

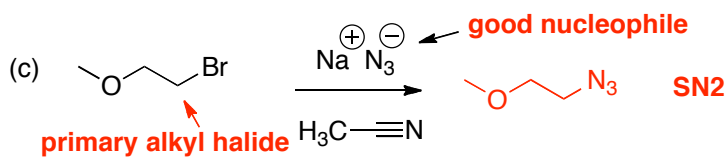
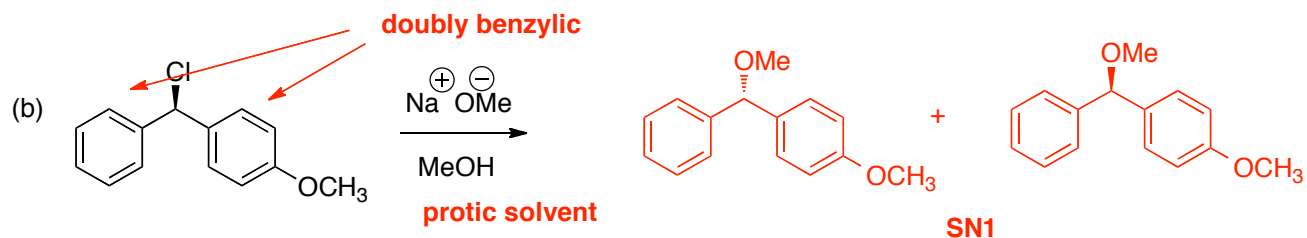
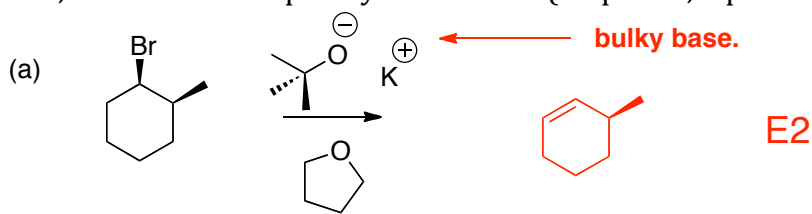


name: **cyclohexanol**

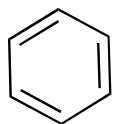


name: **3,4,5-trimethylheptane**

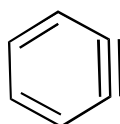
3) Predict the major product(s) of the following reactions. Specify whether the reaction is SN<sub>1</sub>, SN<sub>2</sub>, E<sub>1</sub> or E<sub>2</sub> and explain your answer. (15 points, 5 points each)



4) Benzene is a perfectly stable compound. Benzyne, on the other hand, is highly reactive and has to be made *in situ* where it is then completely consumed. Using what you know about hybridization, explain the differences in stabilities of benzene and benzyne (5 points).



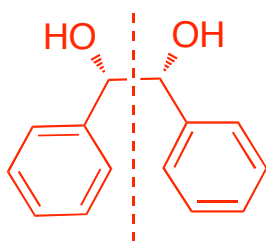
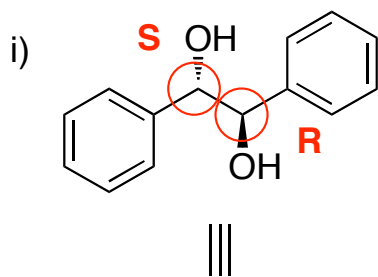
benzene



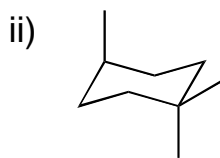
benzyne

The bond angles on benzene are all  $\sim 120^\circ$ , which is consistent with what an  $sp^2$  hybridized carbon would want. Benzyne has two  $sp$  hybridized carbons, which would like to be  $180^\circ$ , but are being forced into a  $120^\circ$  angle, thereby forming an enormous amount of ring strain.

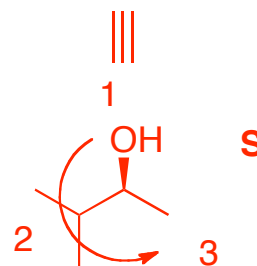
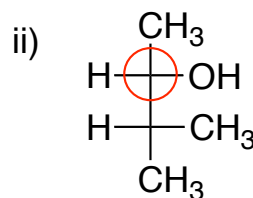
5) For each of the following molecules below, (a) circle all stereocenters in the molecule and designate them as (R) or (S), and (b) label the molecule as chiral or achiral. If achiral, specify whether or not it is meso. (15 points, 5 points each)



achiral, meso

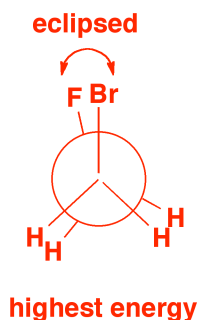
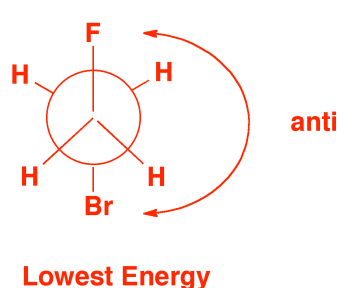
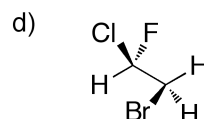
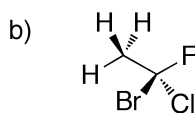
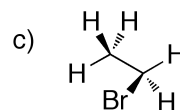
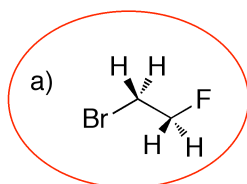
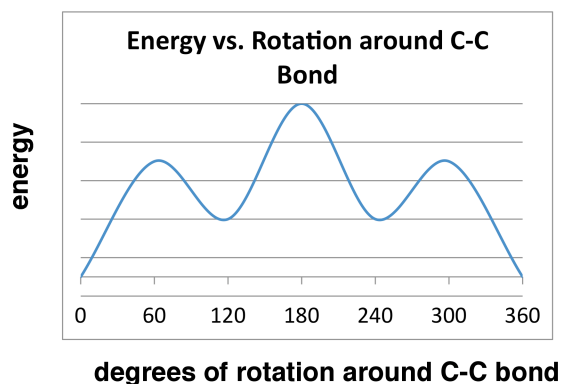


achiral

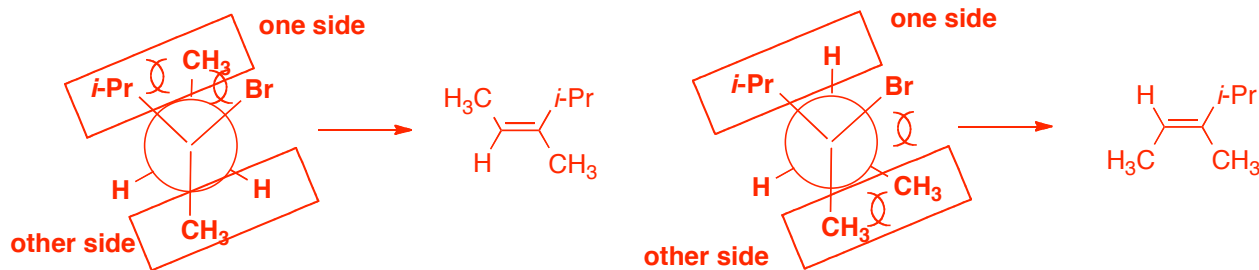
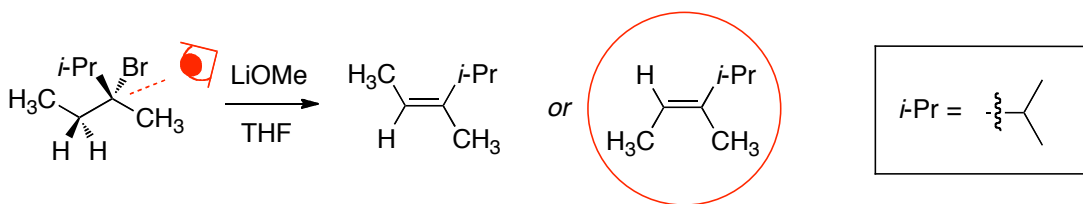


chiral

6) Of the four possible molecules, which would have the energy diagram shown? Show the Newman projection of the molecule you have chosen at its highest (180) and lowest (0 and 360) energy levels. (10 points)

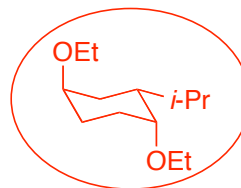
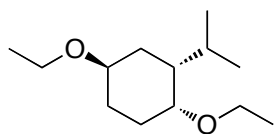


7) The following reaction is an E2 reaction where two possible isomers can be formed. Which product would you expect to form, and explain your answer using structures. (10 points)



Gauche interaction between *i*-Pr and CH<sub>3</sub> is greater in energy than a CH<sub>3</sub> and CH<sub>3</sub>. Therefore, Newman on right is lower in energy and product resulting from that Newman is more likely to form.

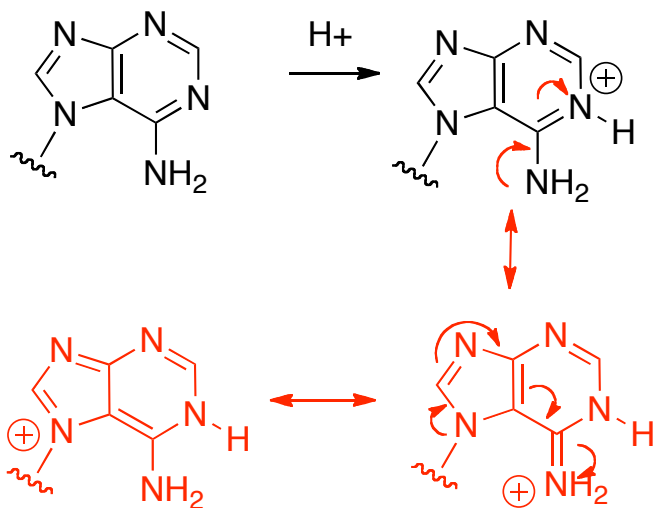
8) The A value for an ethyl ether is 0.9 kcal/mol, and for an isopropyl group is 2.1 kcal/mol. Draw both chair conformations of the molecule below, and using the A values given, predict which conformation is lower in energy. (10 points)



Lower in Energy

**2 axial ethyl ethers only results in a 1.8 kcal/mol increase in energy, whereas one isopropyl group results in a 2.1 kcal/mol increase in energy.**

9) Draw two resonance forms that demonstrate how the positive charge generated through the protonation of adenine can be delocalized onto two other nitrogen atoms (10 points, 5 points each).



10) Propose a mechanism for the following transformation. (10 points)

