

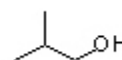
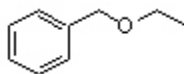
I. Nomenclature:

1. Draw the structure of each compound listed below. (6 points)

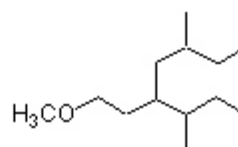
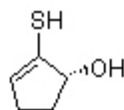
THF

mCPBA

2. Provide a common name for each of the following structures. (9 points)

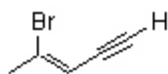
 CH_2Cl_2


3. Identify the correct IUPAC name for each of the following compounds. (16 points)



- a) (S) 2-mercaptocyclopent-3-en-1-ol
 b) (S) 2-mercapto-2-cyclopentenol
 c) (R) 3-hydroxycyclopentene-2-thiol
 d) (R) 2-mercapto-2-cyclopentenol
 e) (R) 5-hydroxy-1-cyclopentenethiol

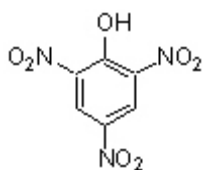
- a) 1-methoxy-4-methyl-3-(1-methylbutyl)hexane
 b) 4-(2-methoxyethyl)-3,6-dimethyloctane
 c) 3,6-dimethyl-4-(2-methoxyethyl)octane
 d) 3-sec-butyl-1-methoxy-5-methylheptane
 e) 3,6-dimethyl-5-(2-methoxyethyl)octane



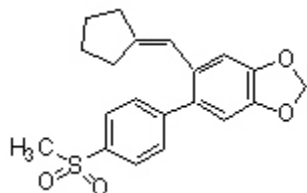
- a) (E) 2-bromo-2-penten-4-yne
 b) (Z) 2-bromo-2-penten-4-yne
 c) (E) 4-bromo-3-penten-1-yne
 d) (Z) 4-bromo-3-penten-1-yne
 e) (E) 4-bromo-1-pentyn-3-ene

- a) cis 2-cyclohexene-1,5-diol
 b) trans 2-cyclohexene-1,5-diol
 c) cis-5-cyclohexene-1,3-diol
 d) trans-4-cyclohexene-1,3-diol
 e) cis 4-cyclohexen-1,3-diol

4. Provide a correct systematic name for picric acid. (3 points)

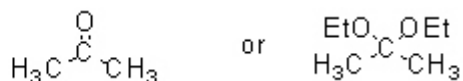
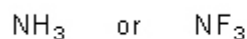


5. Circle and identify all significant functional groups in the anti-inflammatory agent shown below (*J. Med. Chem.*, **2003**, 5484). (8 points)



II. Theory:

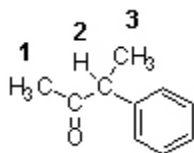
1. In each pair below circle the compound with the greater molecular dipole moment. (6 points)



2. In each pair below circle the compound expected to have the higher boiling point. (6 points)

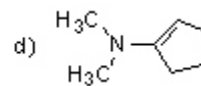
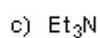
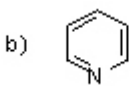
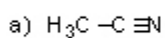


3. Rank the protons indicated in the structure below in order of increasing pKa value. (Lowest listed first, 4 points)

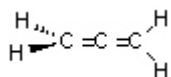


- a) 1-2-3 b) 2-3-1 c) 3-1-2 d) 3-2-1 e) 2-1-3 f) 1-3-2

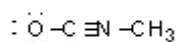
4. Which nitrogen among all compounds shown below is most basic? (3 points)



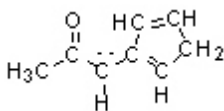
5. Show how p atomic orbitals overlap to form π molecular orbitals in allene, shown below. (4 points)



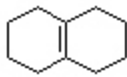
6. Fill in any missing formal charges on the structure below, and then predict the hybridization of each C, N, and O. (10 points)



7. Draw all resonance structures for the compound shown below. Circle the major contributor. Fill in any missing formal charges. (12 points)



8. Which sequence ranks the following alkenes in order of increasing heat of hydrogenation? (Lowest listed first, 4 points)

**1****2****3**

- a) 1-2-3 b) 2-3-1 c) 3-1-2 d) 3-2-1 e) 2-1-3 f) 1-3-2

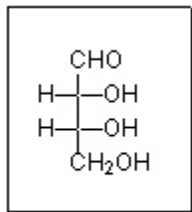
9. Use the bond dissociation energy table on the last page of this exam to predict whether the following reaction is endothermic or exothermic, and by how many kcal/mol. (4 points)



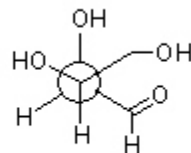
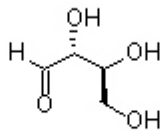
10. Provide a rate equation for the reaction above. (3 points)

III. Conformations and Stereochemistry

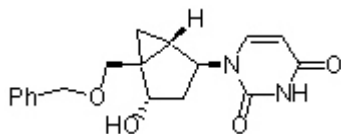
1. Given D-(-)-erythrose in the Fisher projection below, label the other two compounds as diastereomer, enantiomer, or same structure as D-(-)-erythrose. (6 points)



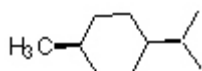
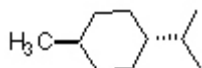
D-(-)-erythrose



2. The compound below is an antiviral agent. Label all chiral centers as R or S. (*J. Med. Chem.* **2003**, 5045, 8 points)



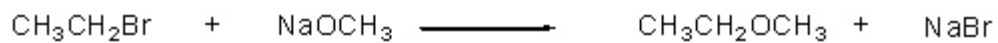
3. Draw the two cyclohexane structures in their most stable conformations, label substituents as equatorial or axial, and then circle the structure that is most stable. (10 points)



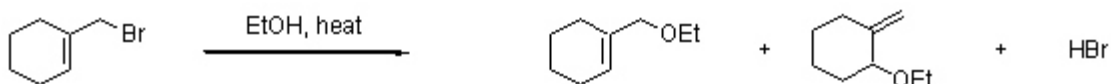
4. The relationship between the two cyclohexane structures above is _____, and _____ structure(s) is/are chiral. (4 points)
- a) enantiomeric, both d) diastereotopic, both
 b) enantiomeric, neither e) diastereotopic, only one
 c) diastereotopic, neither

IV. Mechanism:

1. Draw the transition state of the reaction shown below. (4 points)

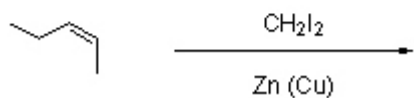
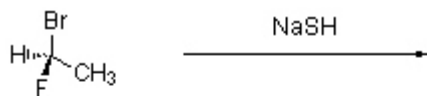


2. Provide a thorough arrow pushing mechanism that accounts for all products shown below, and circle which organic product is most **stable**. (10 points)

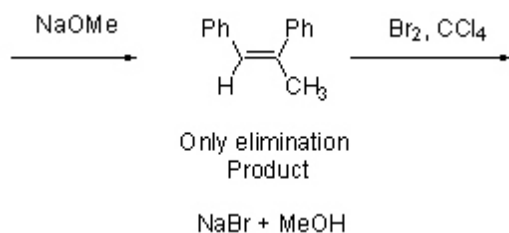


V. Reactions:

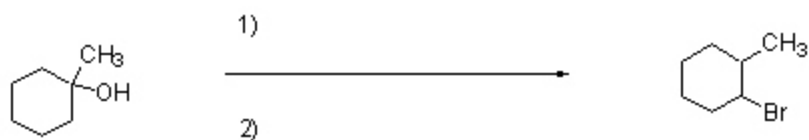
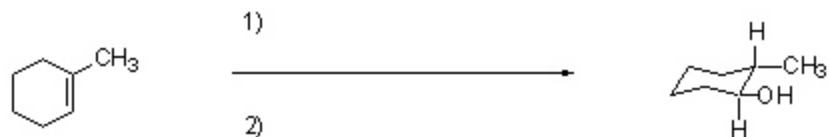
1. Provide the correct products of the following two reactions. Include any relevant stereochemistry. (8 points)



2. Paying close attention to stereochemistry, draw the necessary starting material and product of the following sequence of reactions. (8 points)



3. Complete the following transformations by filling in the necessary reagents. (21 points)

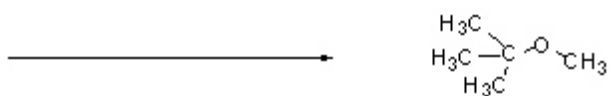
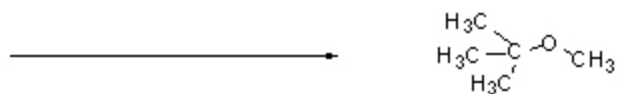


4. Predict the necessary reagents and product for the two reactions below. (8 points)

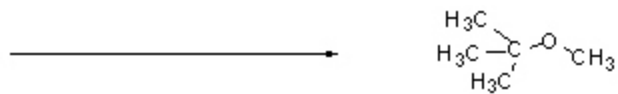


VI. **Synthesis:**

1. Using S_N2 , S_N1 and an addition reaction, show three different methods of synthesis for *tert*-butyl methyl ether. You may use whatever organic compound you choose for starting materials. (15 points)

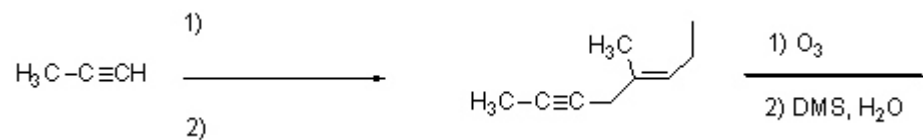
 S_N2  S_N1 :

Addition:



VII. Extra Credit:

1. Complete the following synthesis (5 points)



2. Why did the chicken cross the road? (Please be brief, 5 points)

You scored _____ points out of 200 points possible, which corresponds to ____%. See <http://courses.weber.edu/> to check your overall lecture grade .