

Final Exam

Chemistry 3331

December 10, 2008

Name (PRINT) _____
Last, First

Signature _____

ID # _____

PLEASE CIRCLE CLASS TIME

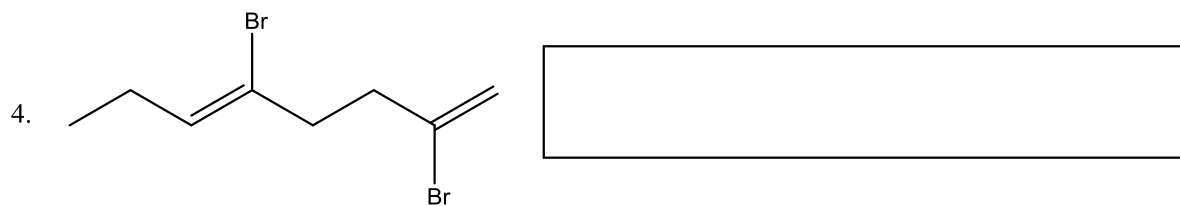
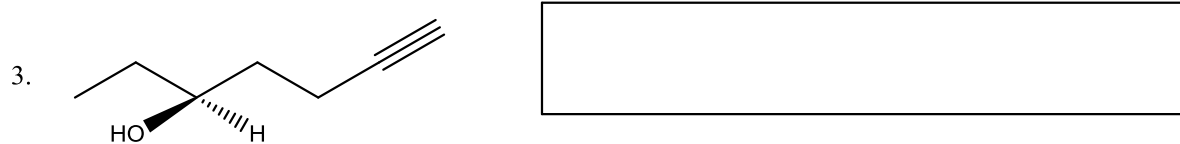
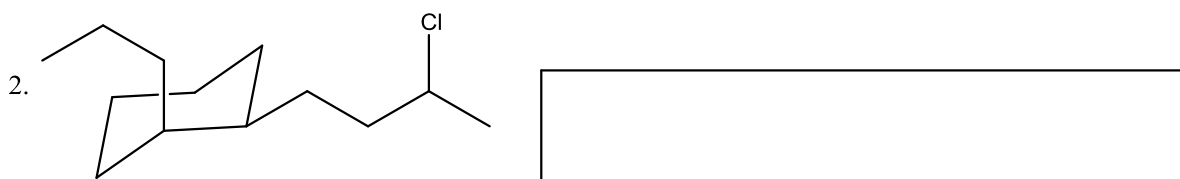
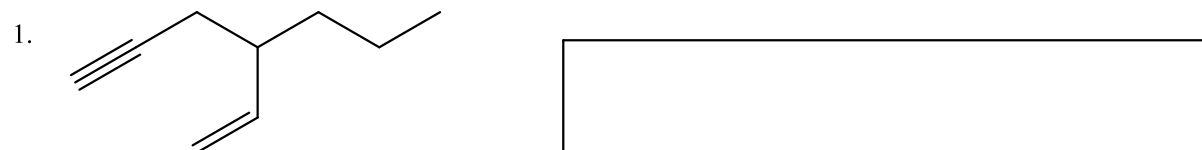
10:00 AM

1:00 PM

NOTE: Present your ID when you return the exam booklet

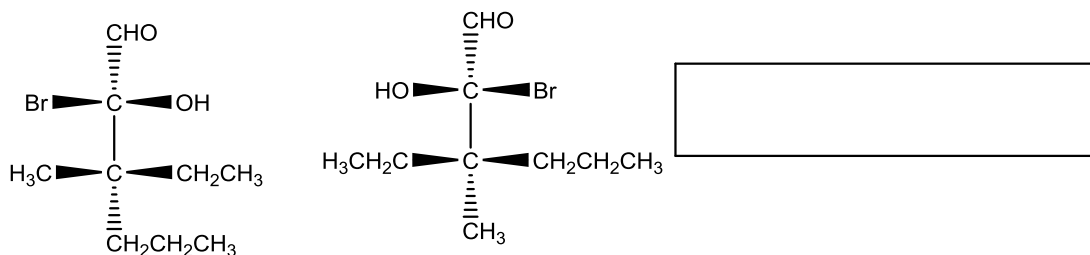
A. Nomenclature: (12 points)

Give an acceptable IUPAC name for each of the following compounds. Be sure to indicate the **stereochemistry** where appropriate.

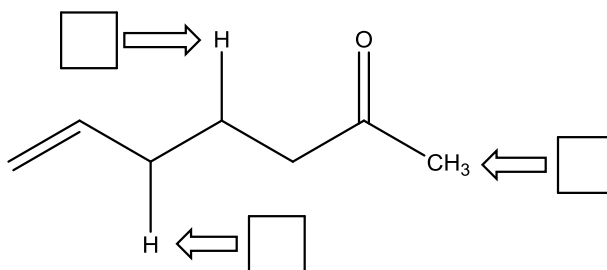


B. Facts: 22 points

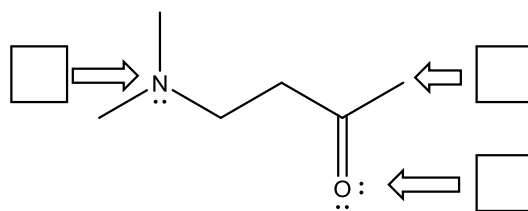
1. Label the following pair as identical, structural isomers, enantiomers, or diastereomers. (3 pts)



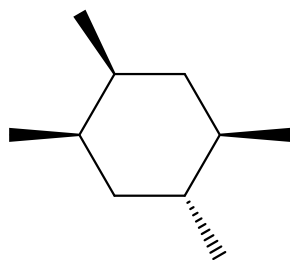
2. Place the indicated hydrogens in order of increasing acidity. (1=least acidic, 3=most acidic) (3pts)



3. Provide the hybridization of the indicated atoms. (3pts)



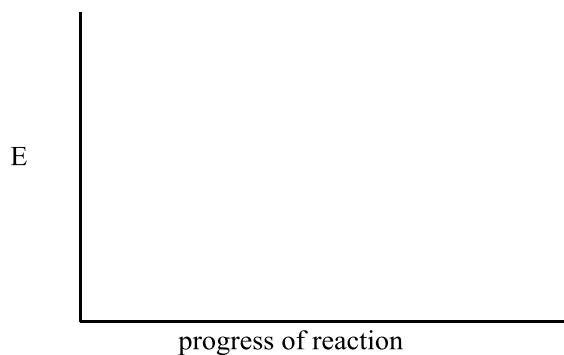
4. Consider the tetramethylcyclohexane isomer below. In the more stable chair conformation, how many methyl groups are in equatorial positions? (3pts)



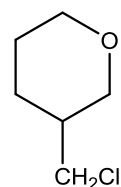
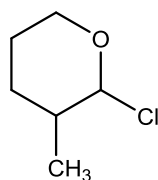
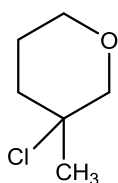
answer:



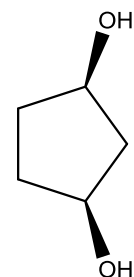
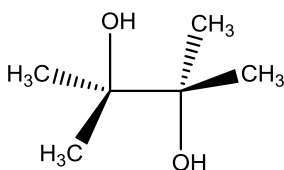
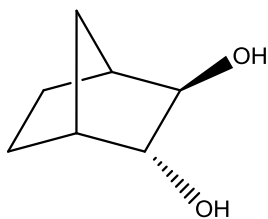
5. Sketch the reaction energy diagram for a two-step reaction that has the following characteristics: exothermic overall, endothermic first step, rate determining second step. (3pts)



6. Place the following chlorides in order of increasing reactivity in the SN1 process. (1=lowest reactive, 3 = most reactive) (3pts)

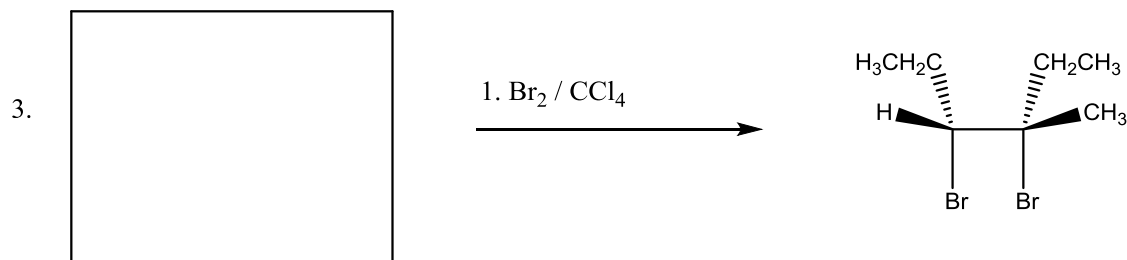
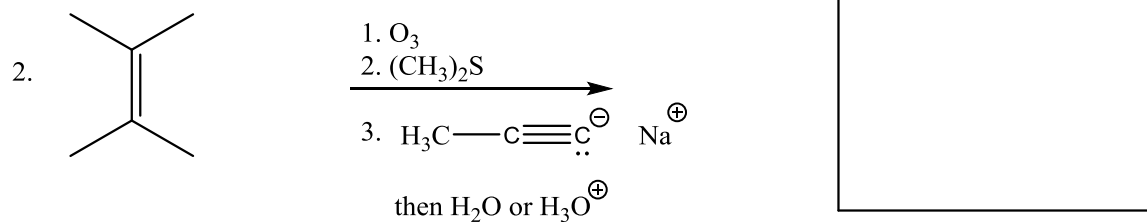
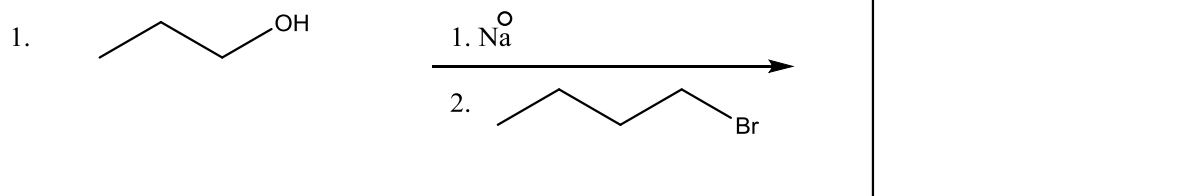


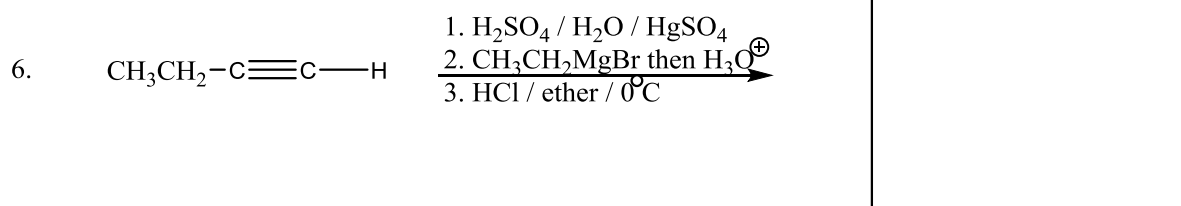
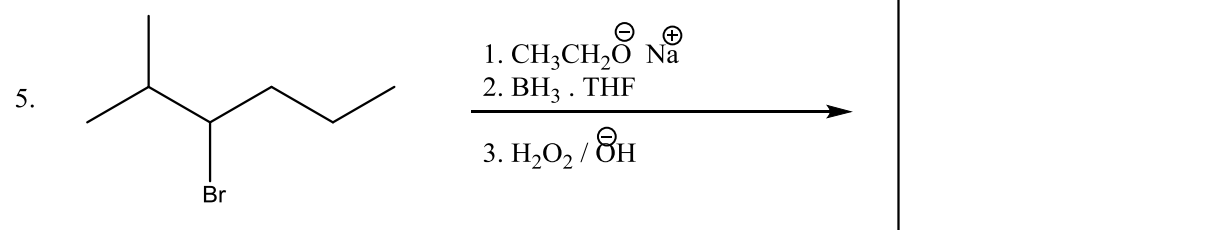
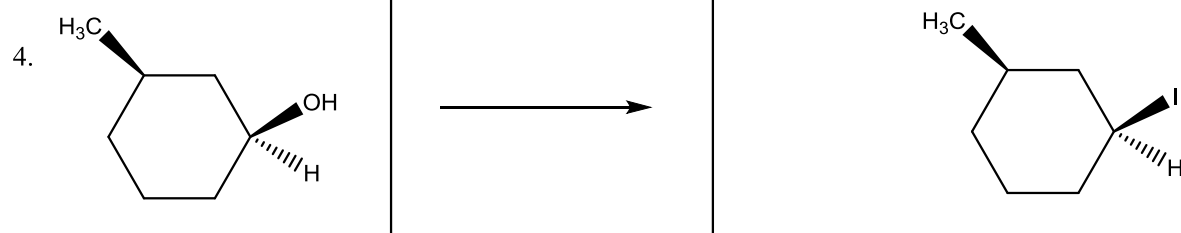
7. Consider each of the diols below. If they diol undergo cleavage with periodic acid (HIO₄), place a Y in the box. If it cannot undergo cleavage with periodic acid, place an N in the box. (3 pts)



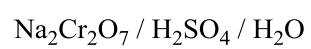
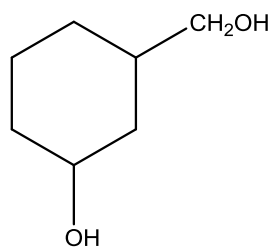
C. Reactions: Total= 36 points, 4 points each

Please provide the major product unless otherwise indicated in the answer box. Be sure your drawing indicates stereochemistry if applicable. Partial credit is awarded only when intermediate products in a multi-step reaction are shown below the reactions.

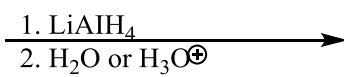
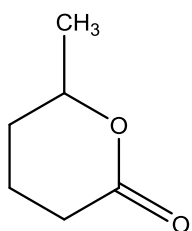




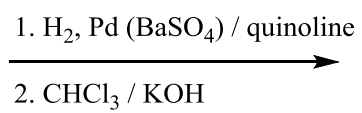
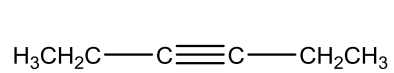
7.



8.

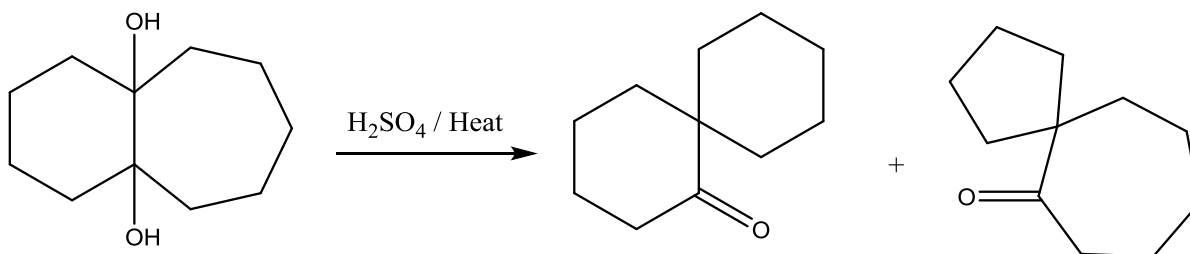


9.



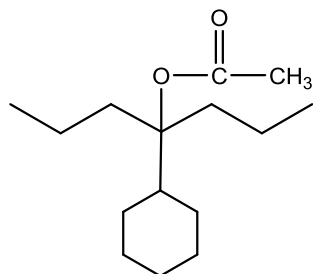
D. Mechanisms: 10 points

Provide a clear mechanism to explain the formation of the product shown. Use curved arrows to indicate "electron flow". Remember to show only one step at a time. Show all intermediates and all formal charges. Do not show transition states.



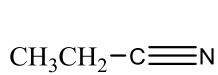
E. Synthesis: 10 points

Synthesize the molecule below using any of the following reagents: cyclohexane, alkenes, or alcohols of **four carbons or less**, cyclohexane, any inorganic reagents, and any oxidizing or reducing agents.

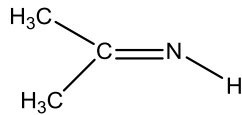


F. Spectroscopy: 11 points

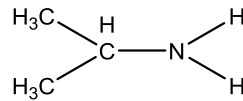
1. Which of the following compounds has the highest frequency carbon-nitrogen bond stretching vibration? Place the compound's letter in the box provided. (2 pts)



A



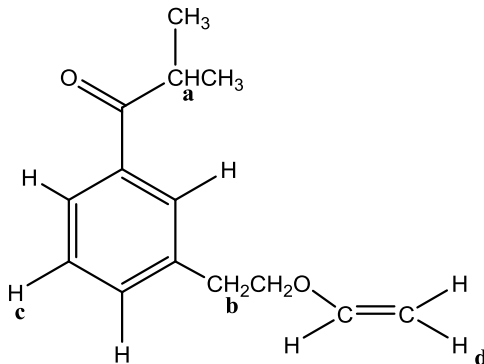
B



C

answer:

2. Place the answers to the following questions in the appropriately labeled boxes. a) How many distinct types of protons does the compound below have? b) What are the theoretically predicted multiplicities (splitting patterns) of the signals for the protons labeled **a**, **b**, **c**, and **d**? (5 pts)



(i) number of distinct protons

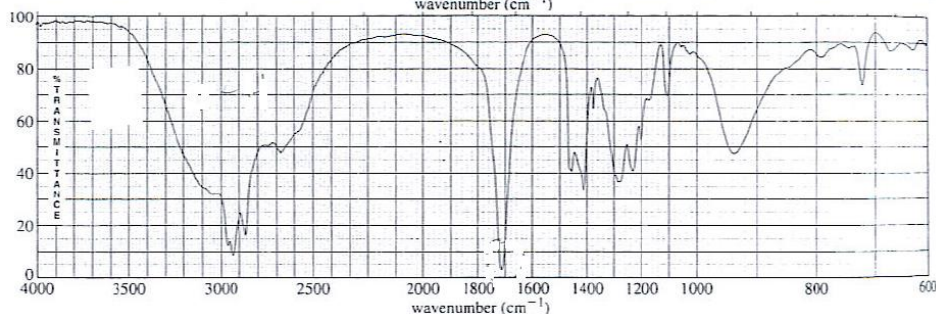
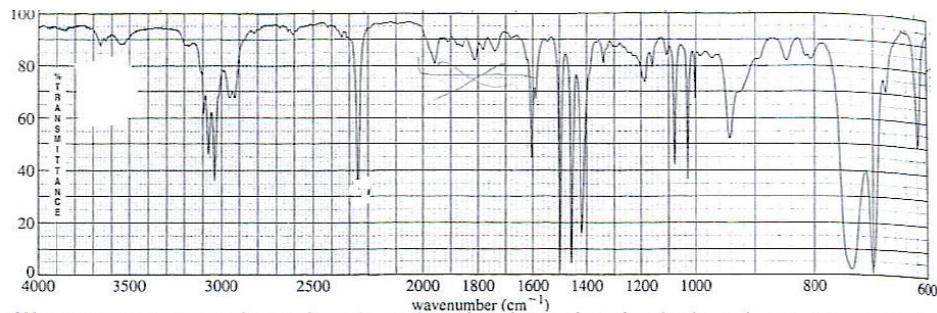
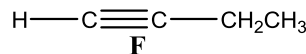
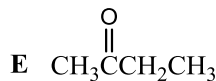
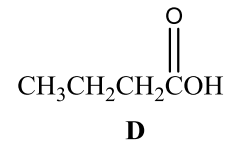
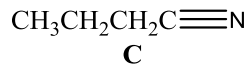
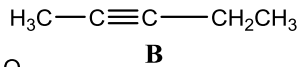
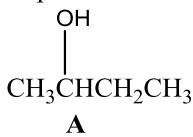
(ii) multiplicity of H_a

multiplicity of H_b

multiplicity of H_c

multiplicity of H_d

3. Carefully examine the two infrared spectra below and the compounds below. Place the letter of the compound in the box beside the spectrum. (4 pts)



G. Spectroscopy BONUS Question: 10 points

A compound with the formula $C_5H_{12}O$ exhibits the IR and HNMR spectra shown below. Please identify this compound and draw the structure in the box provided below.

