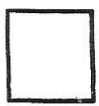
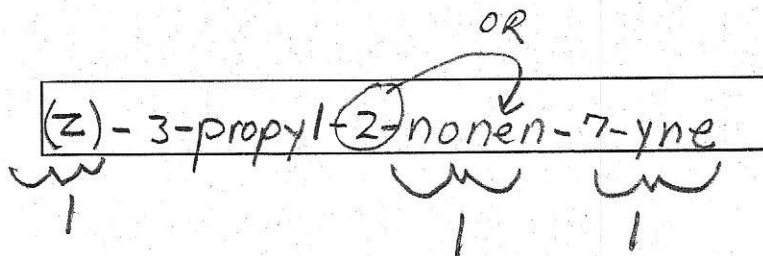
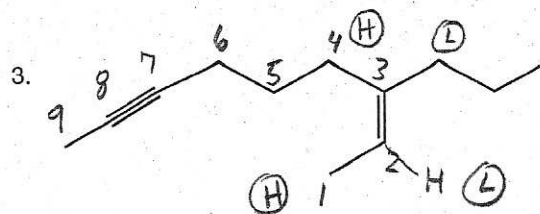
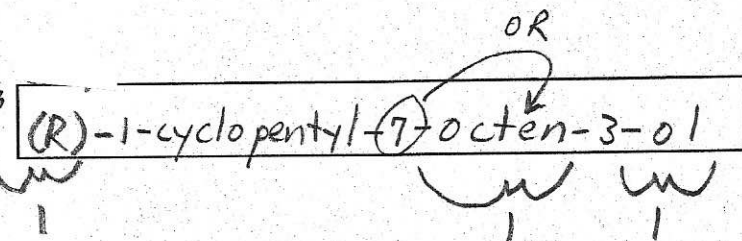
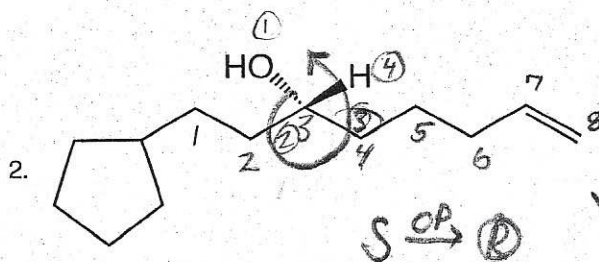
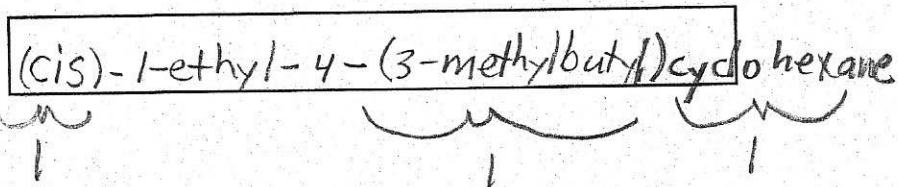
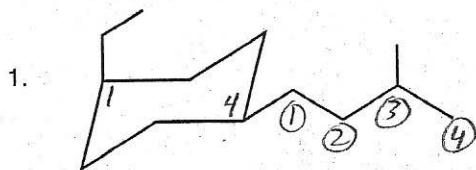


Final Exam A

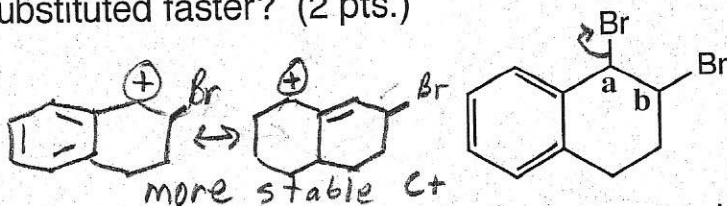
A. Nomenclature: (9 points)

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



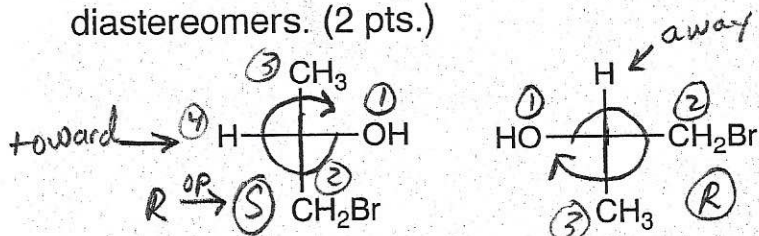
B. Facts: 27 points

1. When the dibromo compound below is dissolved in methanol, one of the bromine atoms is rapidly substituted with a methoxy group. Is the bromine atom on carbon **a** or **b** substituted faster? (2 pts.)



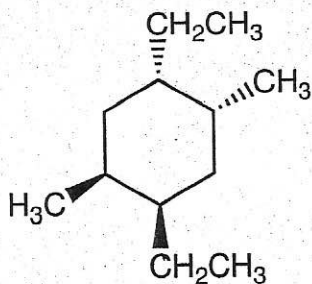
answer: a

2. Label the following pair as identical, structural isomers, enantiomers or diastereomers. (2 pts.)

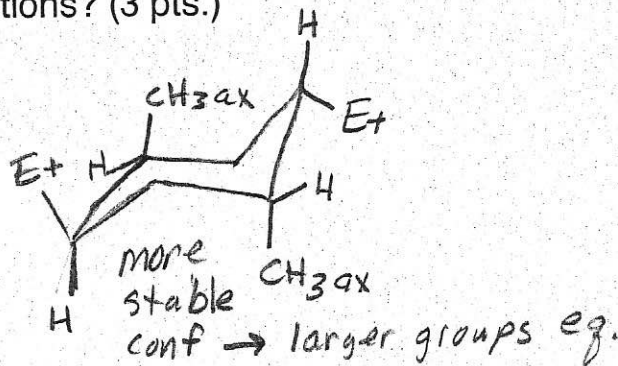


enantiomers

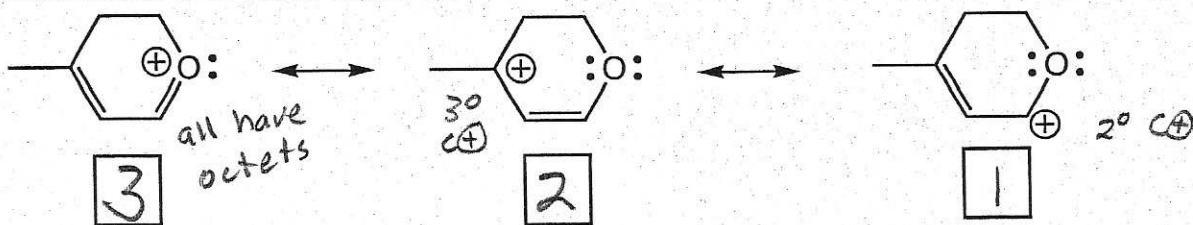
3. Consider the substituted cyclohexane below. In the more stable chair conformation, how many methyl groups are in **equatorial** positions? (3 pts.)



answer: 0



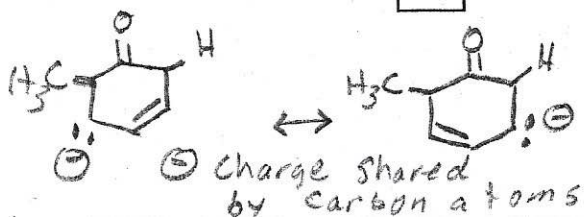
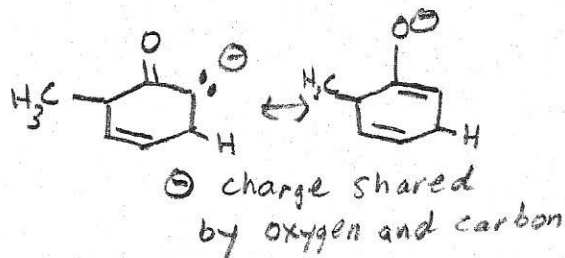
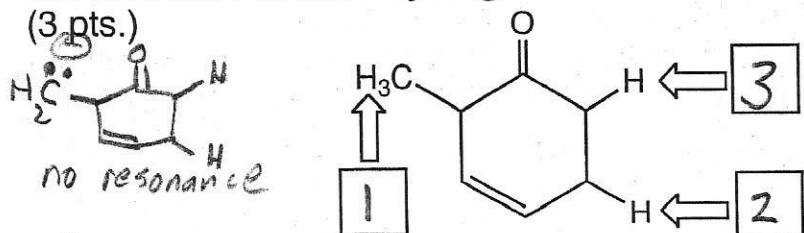
4. Consider the resonance contributors below.



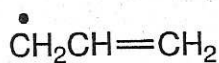
a. Place the contributors in order of increasing importance to the hybrid. (1=contributes least, 3=contributes most) (3 pts.)

b. Place the hybridization of the oxygen atom in the box. (2 pt.) sp²

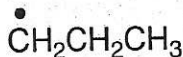
5. Place the indicated hydrogen atoms in order of increasing acidity. (1=least, 3=most) (3 pts.)



6. Place the radicals in order of increasing stability. (1=least, 3=most) (3 pts.)



3 1° res stabilized

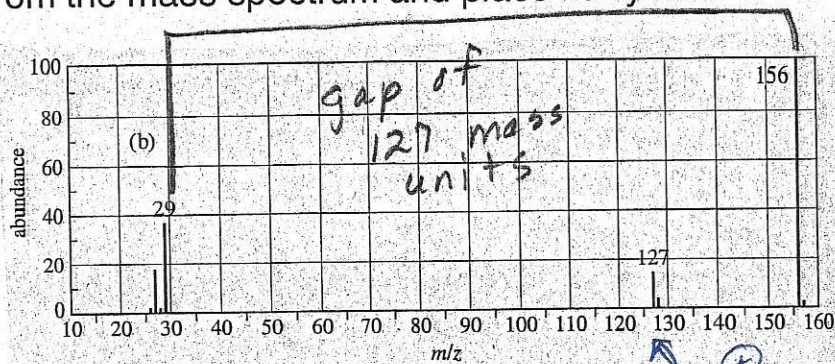


2 1° - one alkyl stabilizes



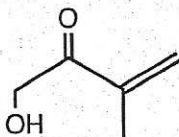
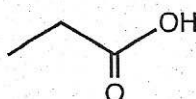
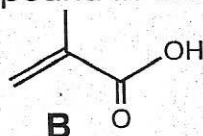
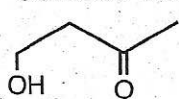
1 methyl - no stabilizing factor

7. An unknown compound contains carbon, hydrogen, and one other element. Identify the element from the mass spectrum and place its symbol in the box. (2 pts.)

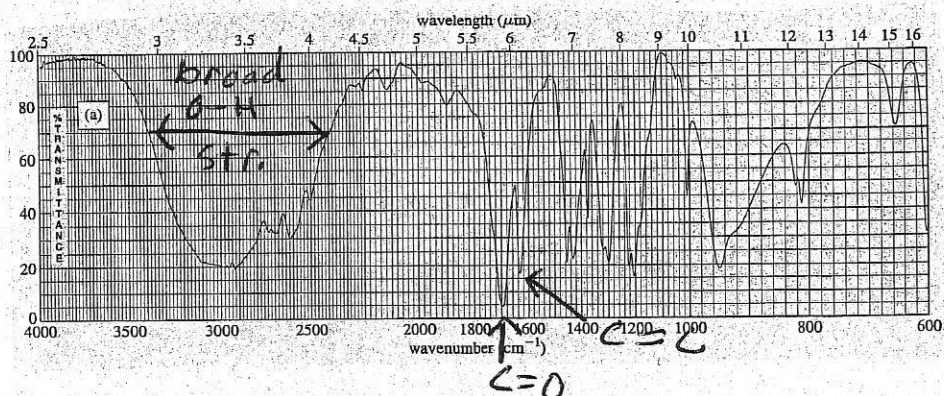


I

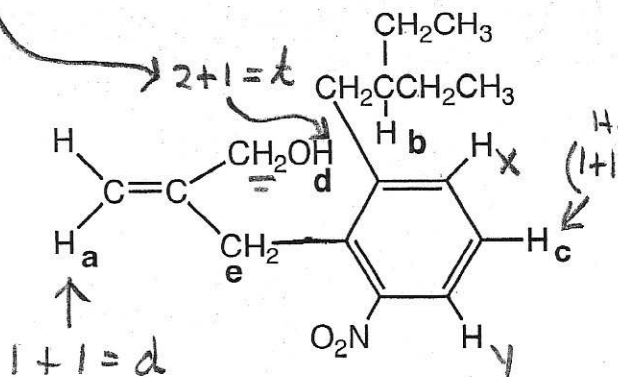
8. Carefully examine the spectrum and the compounds below. Place the letter of the correct compound in the box beside the spectrum. (2 pts.)



B



9. Answer the following questions for the molecule shown below and place the answers in the appropriate boxes. (i) What are the theoretically predicted multiplicities (splitting patterns) of the signals for the protons labeled **a**, **b**, and **c**? (ii) Under ultrapure conditions, what is the theoretically predicted multiplicity of the signal for the proton labeled **d**? (iii) What is the theoretically predicted multiplicity of the signal for the carbon atom labeled **e** in the proton spin coupled C-13 NMR? (5 pts.)



(i) multiplicity of H_a **d**

multiplicity of H_b **15** lines or pentet triplet

multiplicity of H_c **4** lines or dd (NOT q)

(ii) multiplicity of H_d **t**

(iii) multiplicity of C_e **t**

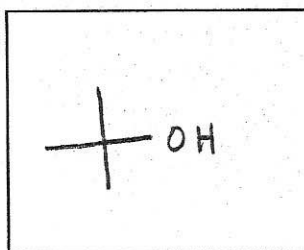
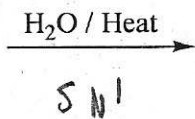
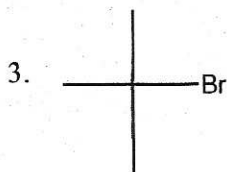
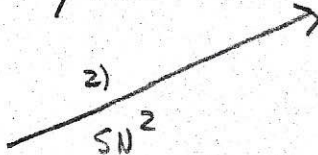
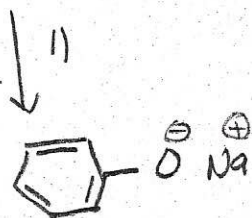
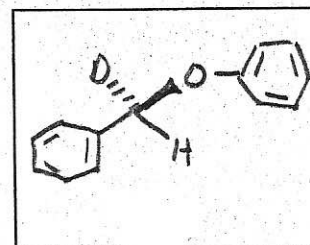
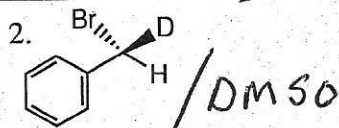
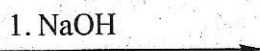
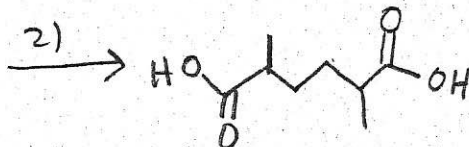
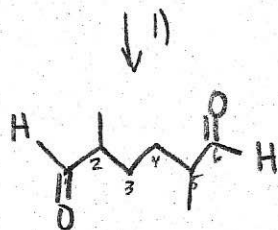
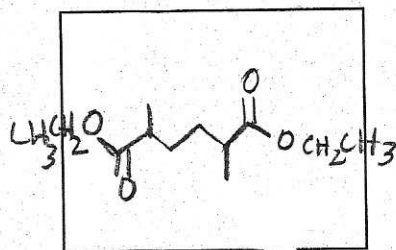
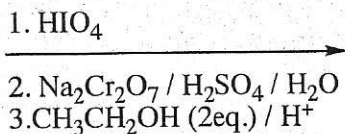
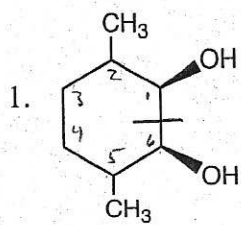
$\text{H}_b \rightarrow (2+1)(4+1) = 15$ lines

3

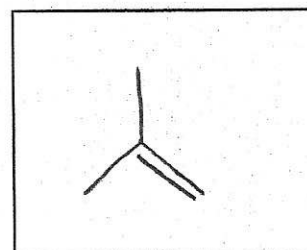
3

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

Please provide the major product in the answer box unless otherwise indicated. Indicate **stereochemistry** if applicable. **Full credit is awarded only when the product of each step in a multi-step reaction is shown below the reaction.**

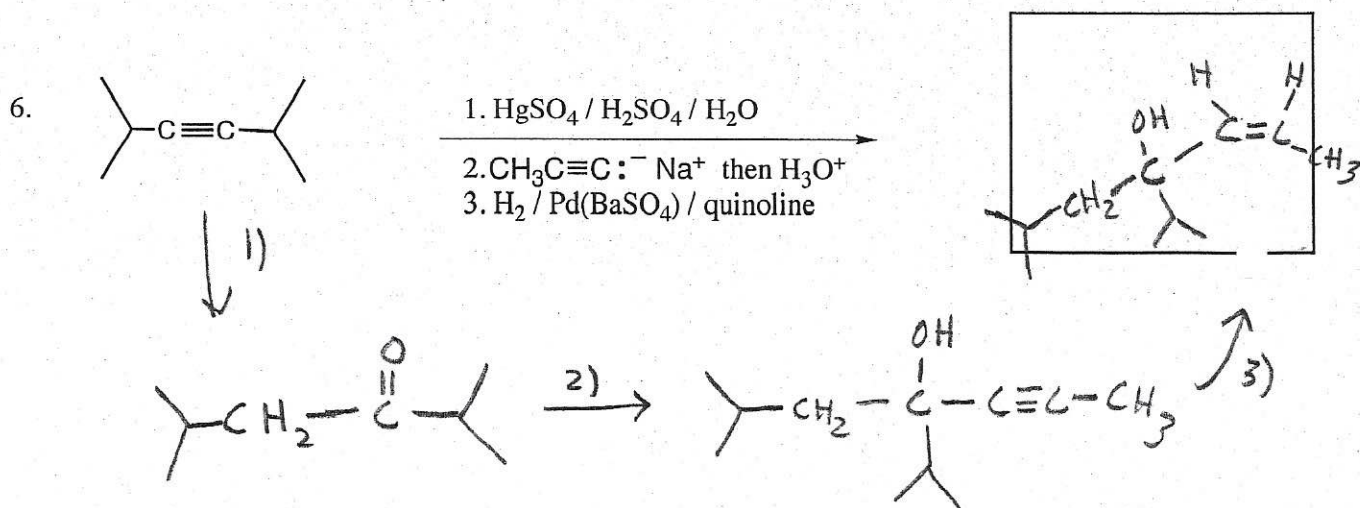
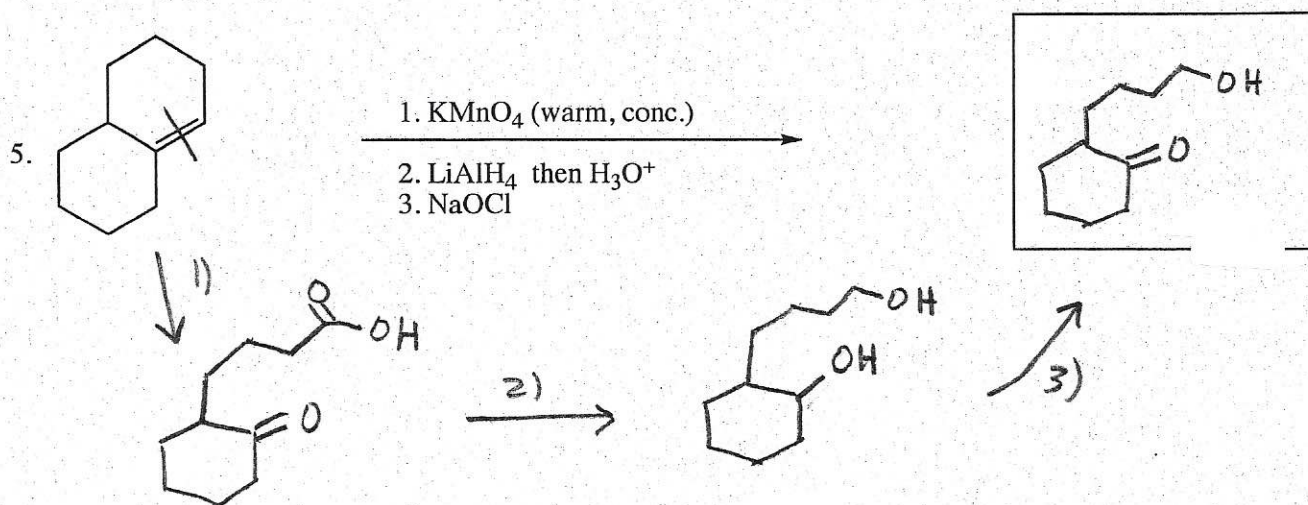
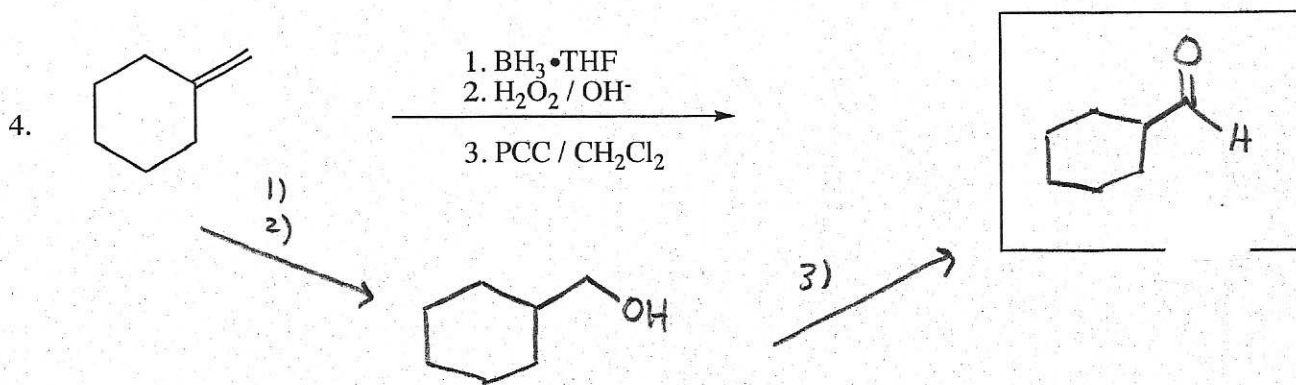


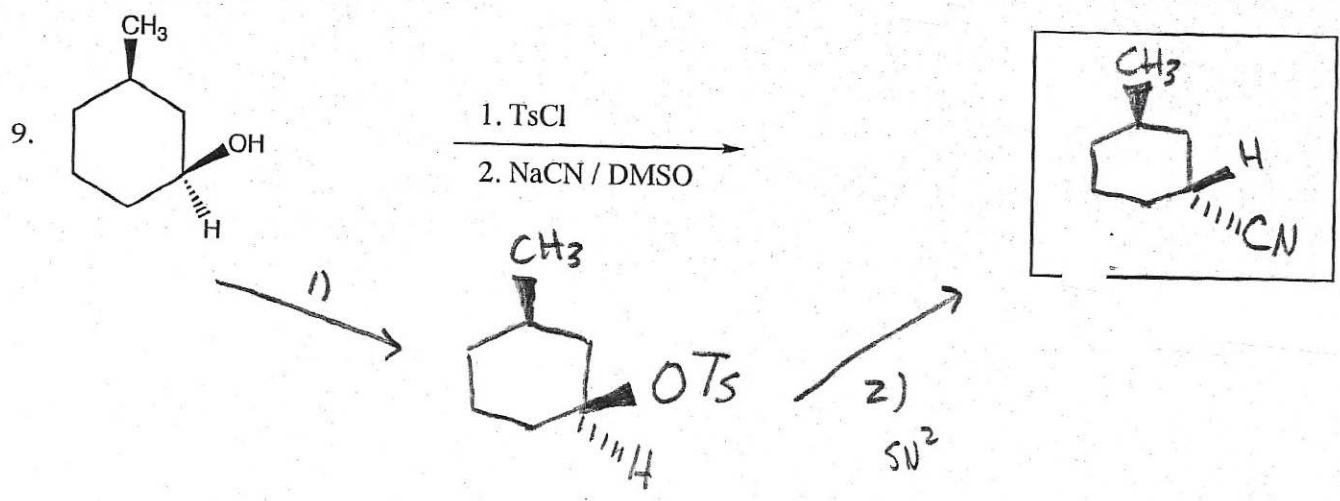
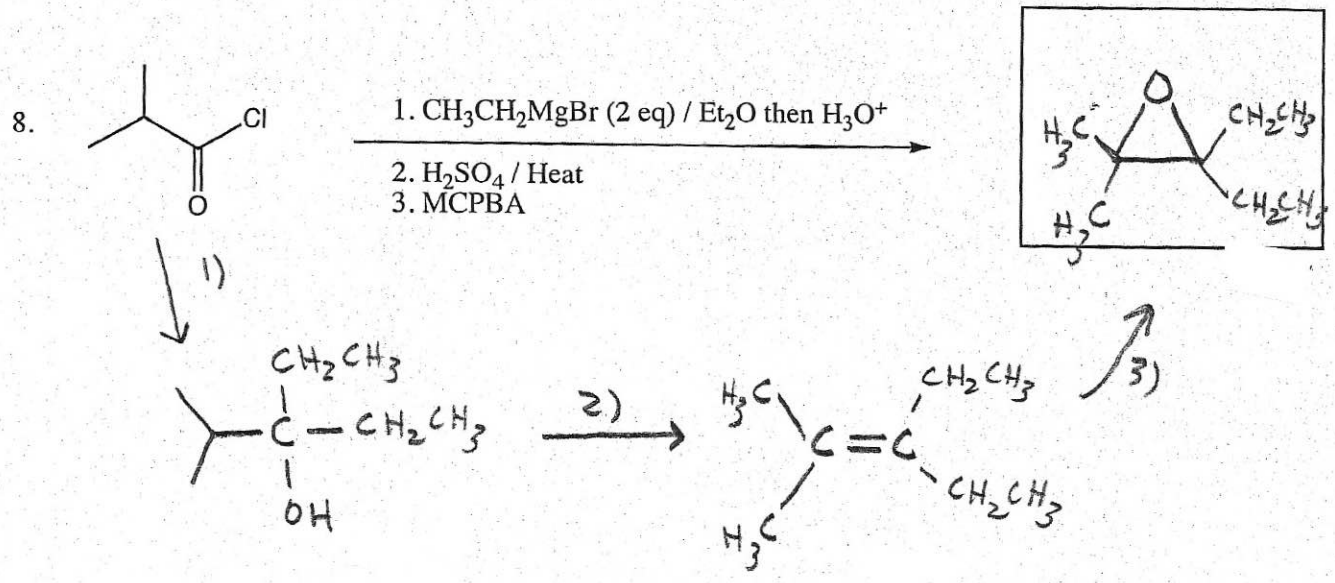
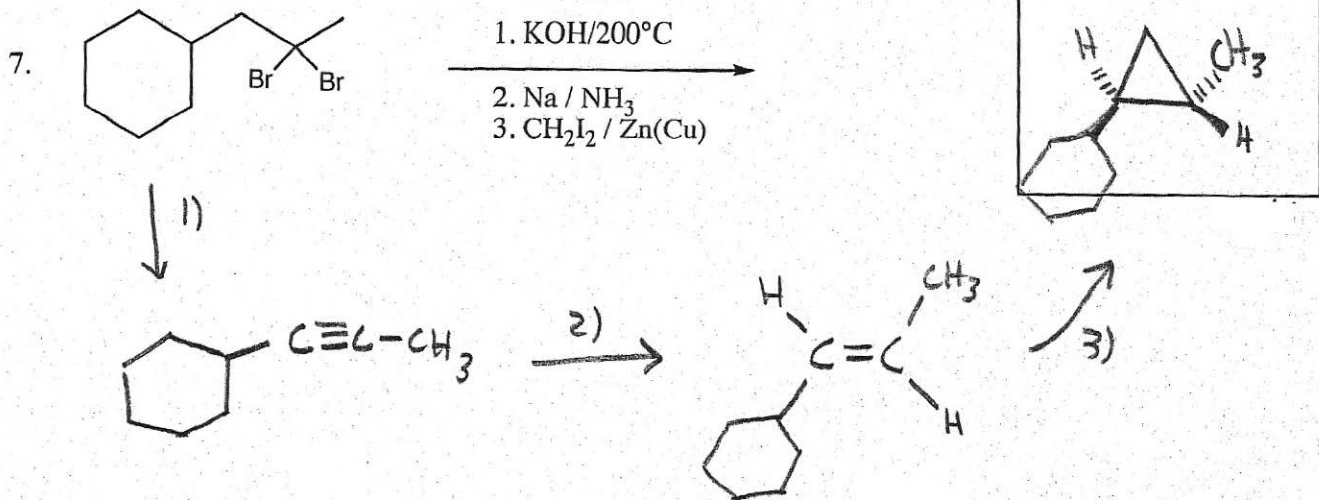
Major



Minor

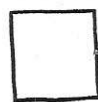
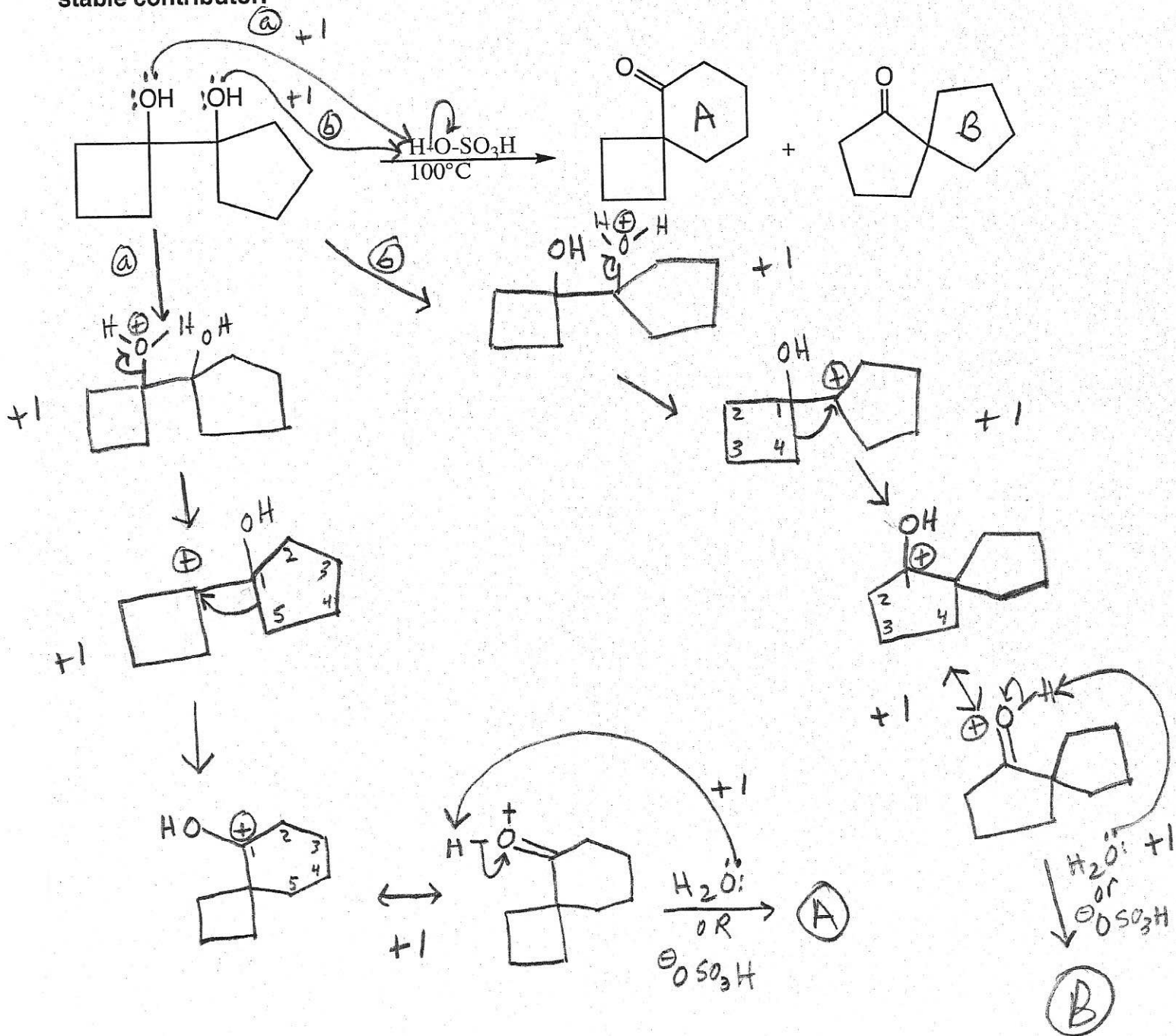






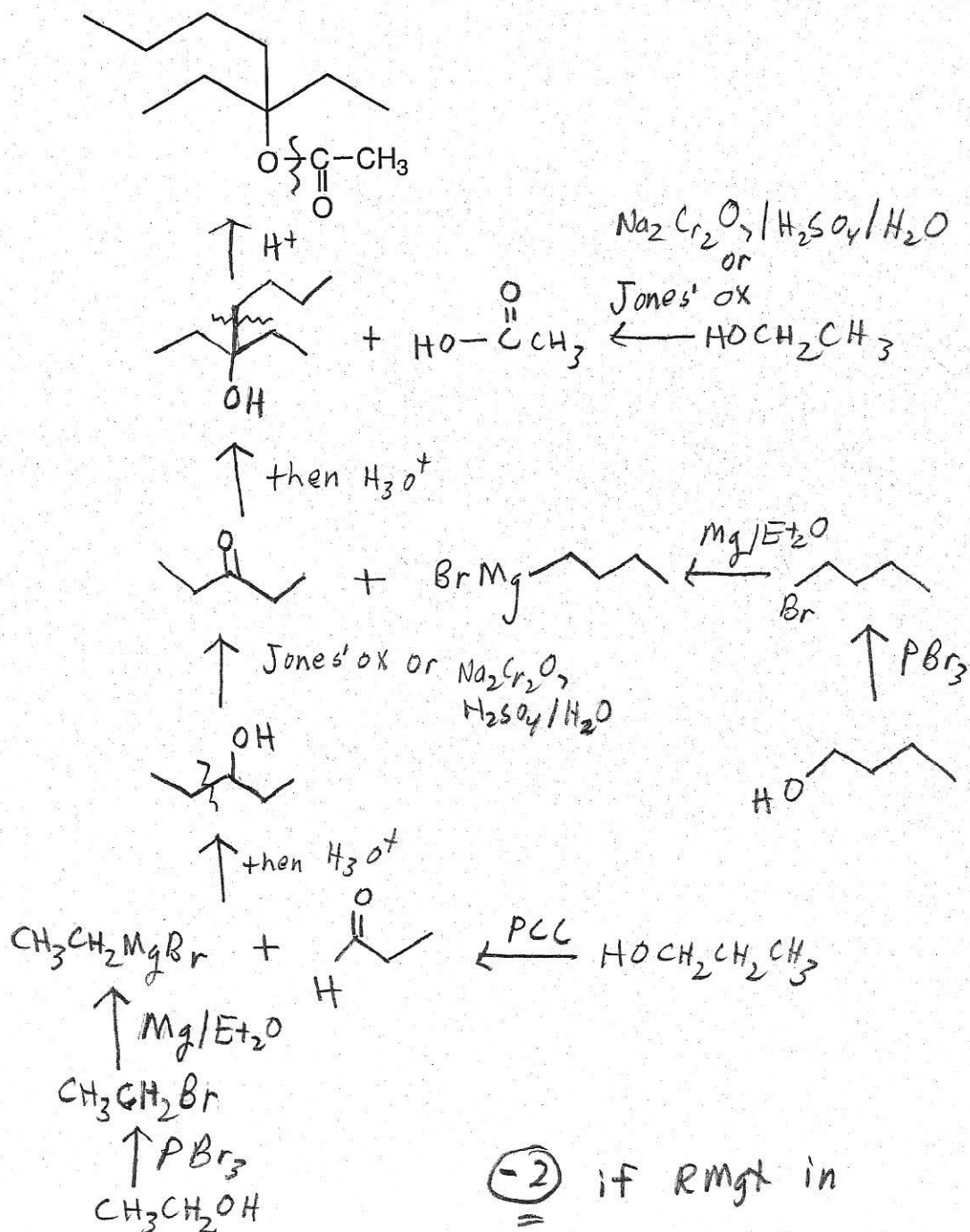
D. Mechanisms: (10 points)

Provide a clear mechanism to explain the formation of the products shown. Use curved arrows to indicate "electron flow". Remember to show only one step at a time. Show all intermediates and all formal charges. If more than one resonance contributor is possible, be sure to show the more stable contributor.



E. Synthesis: 10 Points

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



-2 if RMgX in presence of -OH

or R-C(=O)-MgX



F. Spectroscopy: 8 Points

A compound with the formula $C_7H_{16}O$ exhibits the IR, 1H NMR, and proton-spin decoupled ^{13}C NMR spectra shown below. Please identify this compound and draw the structure in the box provided below.

