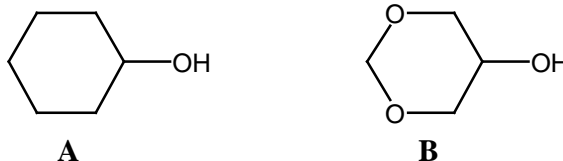


**REVIEW PROBLEM SET**  
CH241-2001F

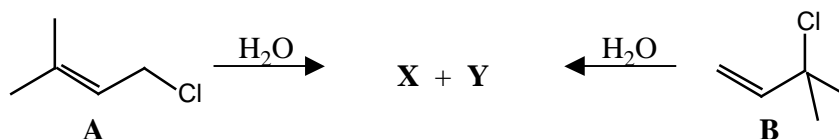
[1] Provide brief answers to the following questions.

(a) Compare rotation about the boron-nitrogen bond in  $\text{BH}_2\text{NH}_2$  with the carbon-carbon bond in  $\text{CH}_3\text{CH}_3$ . Which one has the greater barrier to rotation? Why?

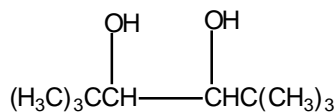
(b) The hydroxy group prefers to be equatorial in **A** and axial in **B**. Explain.



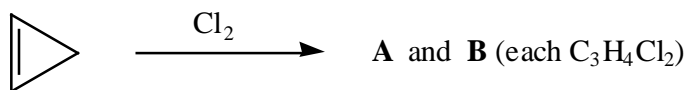
(c) Under  $\text{S}_{\text{N}}1$  conditions, the two chlorides **A** and **B** give the same two alcohols **X** and **Y** in the same ratio. Identify **X** and **Y** and provide a mechanistic explanation as to why they are produced in the same ratio.



(d) Write Newman projections for the chiral and meso forms of the following molecule looking down the bond connecting the two stereogenic centers. Explain why the hydroxy groups prefer to be gauche to each other in the chiral form but not in the meso form.



[2] Chlorine adds across the double bond of cyclopropene to give two products, **A** and **B**.



(a) What are the structures of **A** and **B** and how are the two related to each other?

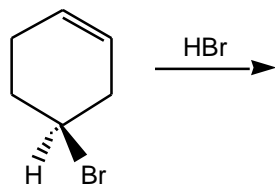
(b) Draw another stereoisomer of **A** (or **B**) that is **not formed** in this reaction. Let's call this **C**.

(c) Carefully write a mechanism for this reaction to show why only **A** and **B** are formed but not **C**.

(d) Can you distinguish **A** and **B** by  $^1\text{H}$  NMR spectroscopy? How about **A** and **C**? Explain.

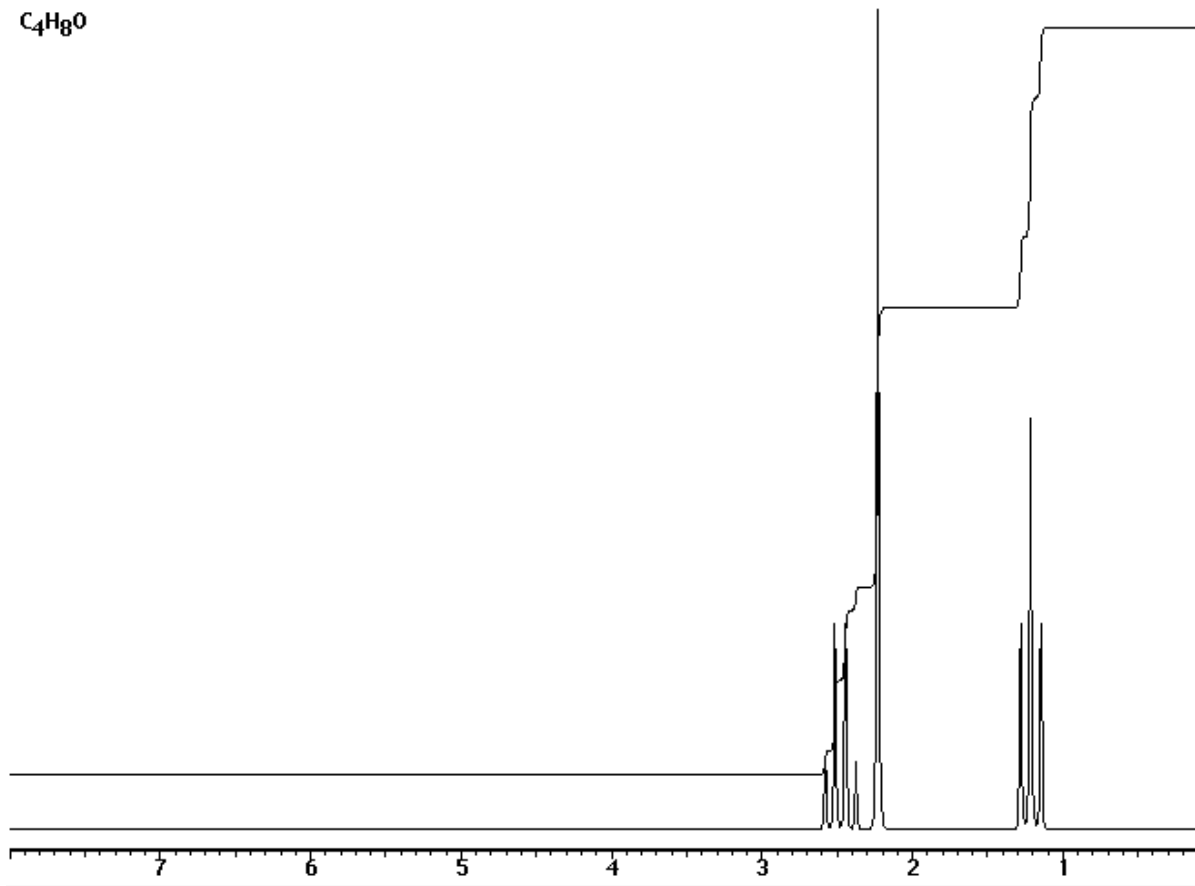
(e) Which do you think is least stable, **A**, **B**, or **C**? Give two reasons to support your answer.

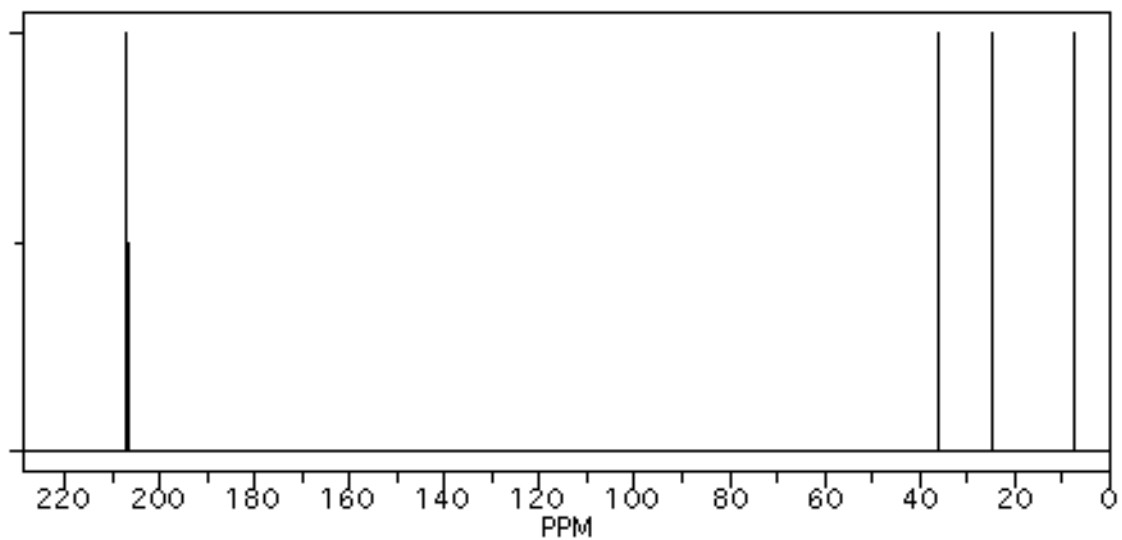
[3] Complete the equation shown below and answer the questions that follow.



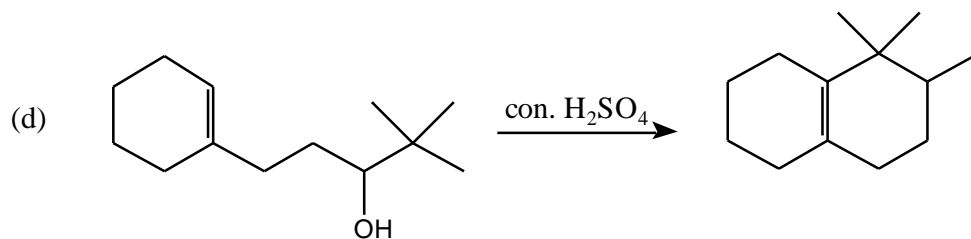
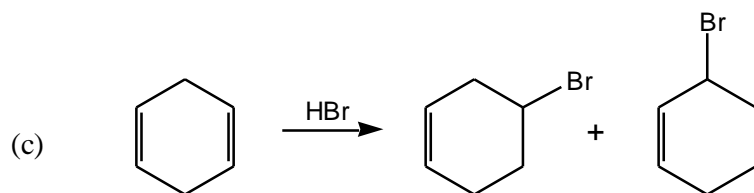
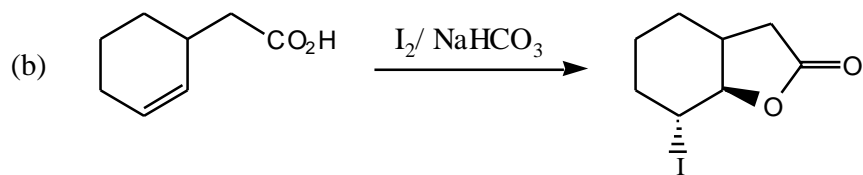
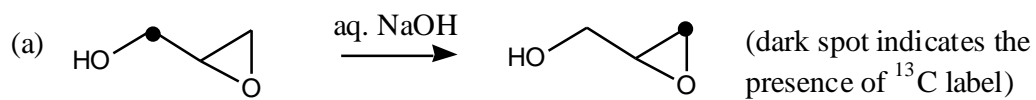
- What is the configuration at the stereogenic center of the substrate?
  - Draw the most stable conformation of each of the products formed in the reaction.
  - Examine each product and tell whether it is chiral or achiral.
  - How are the products related to one another?
- [4] Identify the structure of compound **A** given the following clues. Explain your reasoning.
- The molecular formula of **A** is  $\text{C}_8\text{H}_{16}$ . It has four types of carbons.
  - The bromination of **A** gives an optically inactive dibromide that cannot be resolved into enantiomers.
  - The reaction of **A** with  $\text{KMnO}_4$  followed by aqueous sodium hydroxide gives a racemic mixture of diols.
  - The ozonolysis of **A** followed by reductive work-up gives a single compound of the formula  $\text{C}_4\text{H}_8\text{O}$  that gives the  $^1\text{H}$  and  $^{13}\text{C}$  NMR shown below.

$\text{C}_4\text{H}_8\text{O}$

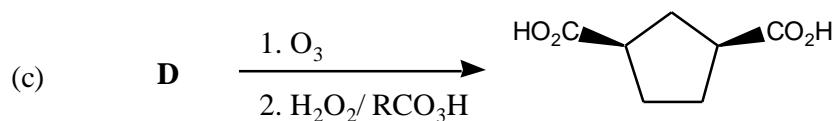
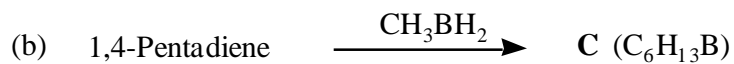
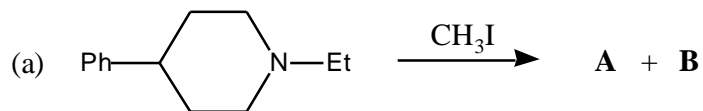




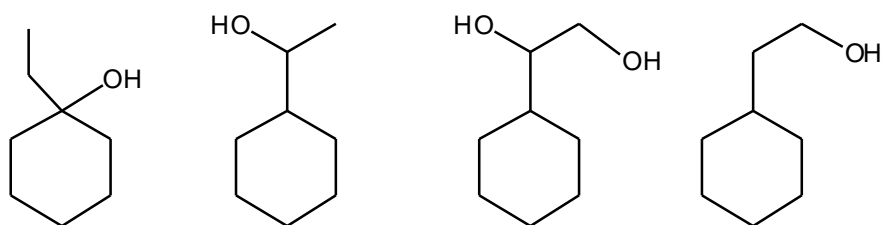
[5] Propose reasonable mechanisms for the following reactions.



[6] Provide structures for **A** through **D** in the following reactions.



[7] Starting from the **same alkene** show how you would synthesize the following compounds. You need not show mechanisms but you must identify the alkene and provide the reagents.



[8] Provide efficient synthetic routes to the following compounds from the indicated starting materials. No mechanisms are required.

(a)  $(\pm)$ -*Cis*-1-bromo-2-methylcyclohexane from 1-methylcyclohexene

