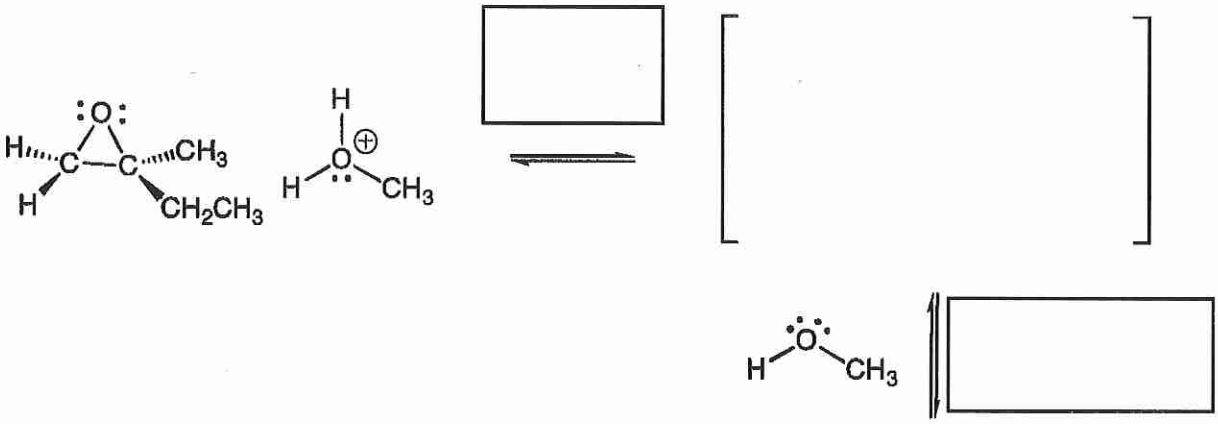
20. (25 pts.) **For the reaction of this epoxide with methanol in acid, fill in the details of the mechanism. Draw the appropriate chemical structures and use arrows to show how pairs of electrons are moved to** make and break bonds during the reaction. **For this question, you must draw all molecules produced in each step (yes, these equations need to be balanced!). Finally, fill in the boxes adjacent to the arrows with the type of step involved, such as "Make a bond" or "Take a proton away". MAKE SURE TO NOTICE THE QUESTIONS AT THE BOTTOM. Use wedges and dashes to indicate stereochemistry where appropriate, BUT if an intermediate or product is really a racemic mixture, you only need to draw one enantiomer for this problem (we are making this easier for you).**



Product(s)

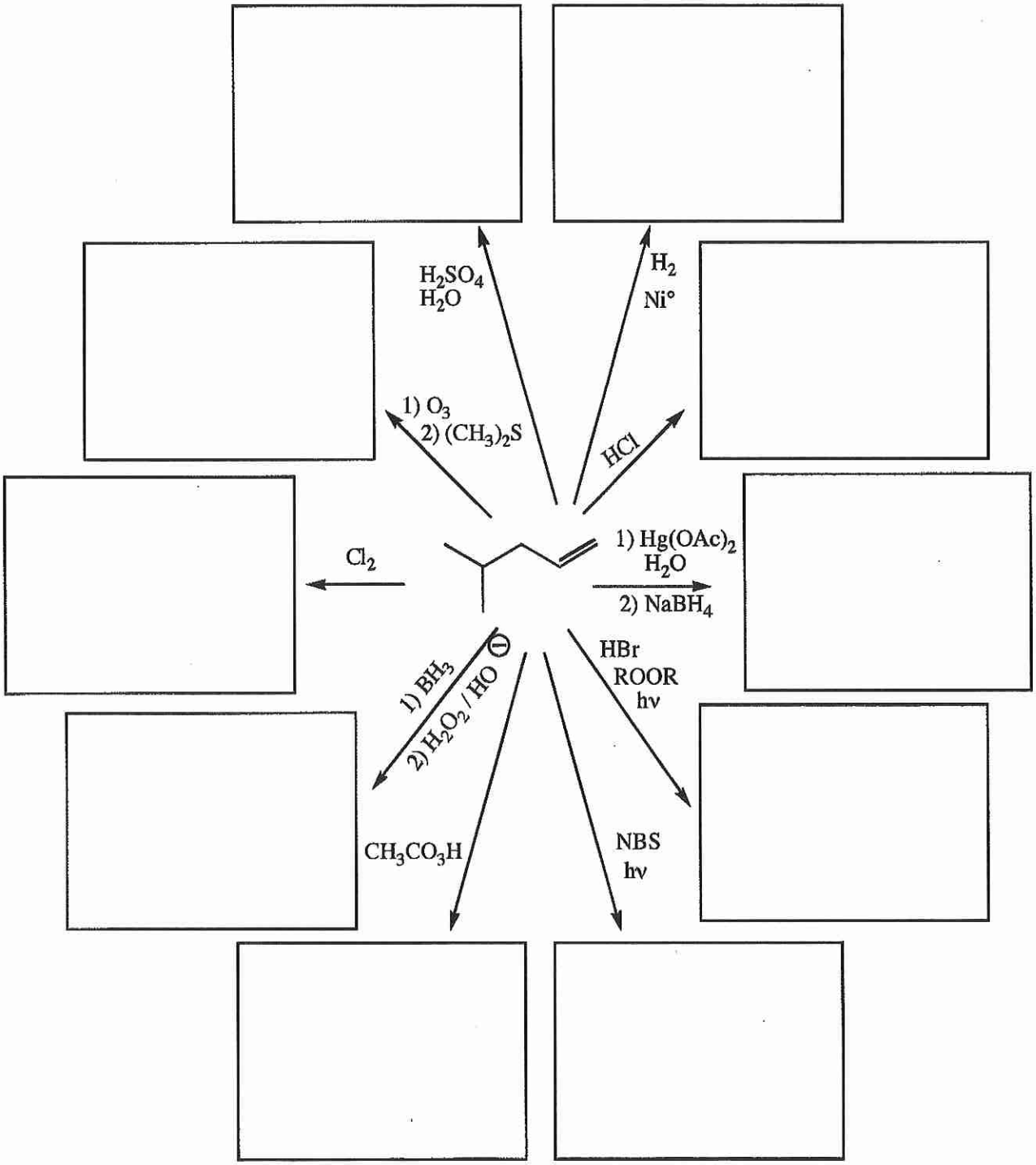
A) (2 pts) During the reaction, would the pH rise, fall, or stay the same. In one sentence, explain your answer.

B) (2 pts) Of the four energy diagrams listed on page 11, which one best describes the reaction mechanism you drew:

C) (4 pts) **For this part of the question, ignore all proton transfer steps.** For each step that involves a nucleophile reacting with an electrophile, **draw a circle around the nucleophile and a box around the electrophile.**

NOTICE ALL THREE PARTS OF THIS (A-C)

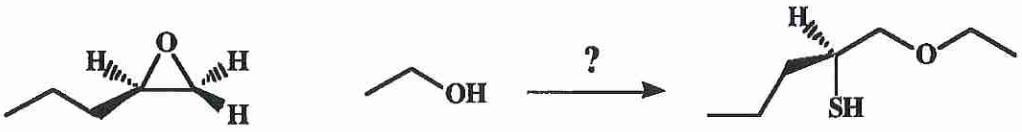
21. (3 or 5 pts each) For the following, complete the reactions with the predominant product or products. You must indicate stereochemistry with wedges and dashes. You must draw all stereoisomers produced as predominant products and write "racemic" under the structures when appropriate. Assume no rearrangments take place.



22. These are synthesis questions. You need to show how the starting material can be converted into the product(s) shown. You may use any reactions we have learned. Show all the reagents you need. Show each molecule synthesized along the way and be sure to pay attention to the regiochemistry and stereochemistry preferences for each reaction.

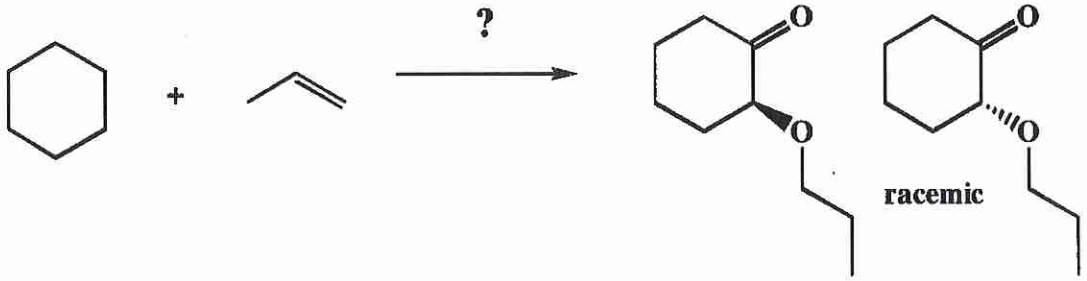
For this one, all of the carbon atoms in the product must come from the starting materials shown.

G) 10 pts



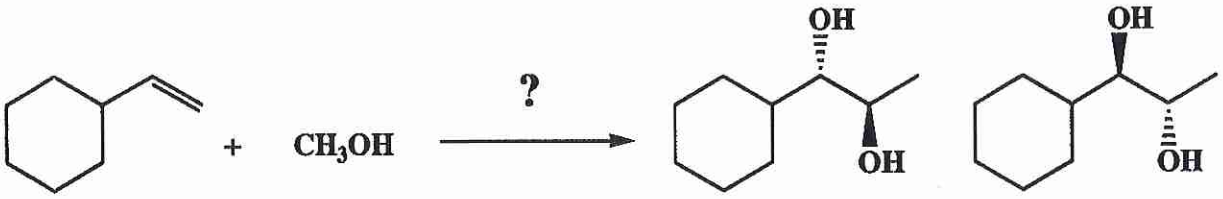
24 (cont).) These are synthesis questions. You need to show how the starting material can be converted into the product(s) shown. You may use any reactions we have learned provided that the product(s) you draw for each step is/are the predominant one(s). Show all the reagents you need. Show each molecule synthesized along the way and be sure to pay attention to the regiochemistry and stereochemistry preferences for each reaction. You must draw all stereoisomers formed, and use wedges and dashes to indicate chirality at each chiral center. Write racemic when appropriate. **All the carbons of the product must come from carbons of the starting material.**

D) (16 pts)



17. (cont.) These are synthesis questions. You need to show how the starting material can be converted into the product(s) shown. You may use any reactions we have learned. Show all the reagents you need. Show each molecule synthesized along the way and be sure to pay attention to the regiochemistry and stereochemistry preferences for each reaction. **If a racemic mixture is produced at any point in the synthesis,you must indicate it by drawing both enantiomers and writing "racemic".**

D. (22 pts) All of the carbons in the products must come from the starting materials.



Racemic

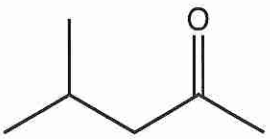
Tue: determine # of equivalent hydrogens for each molecule + the ratio of integrations for each

Signature_____ Pg 4 _____(15)

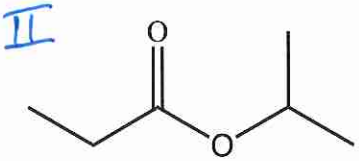
Fri - ~~assign~~ match spectra to molecule

7. (15 pts total) On the following three pages there are NMR spectra. The relative integrations are given above each signal. Each NMR spectrum has a letter on it. **In the spaces provided, write the appropriate letter underneath the molecule that would produce that spectrum.** Notice that not all of the molecules below will have letters underneath them, as there are only three spectra but nine molecules.

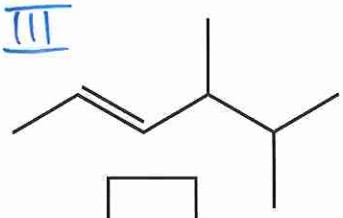
I



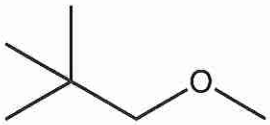
II



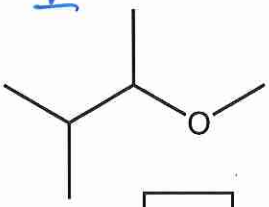
III



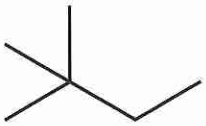
IV



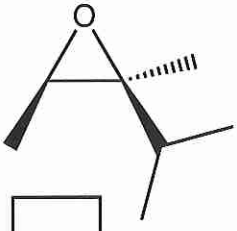
V



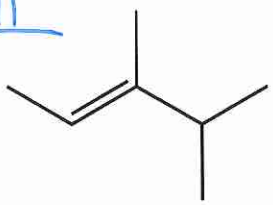
VI



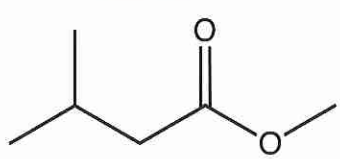
VII



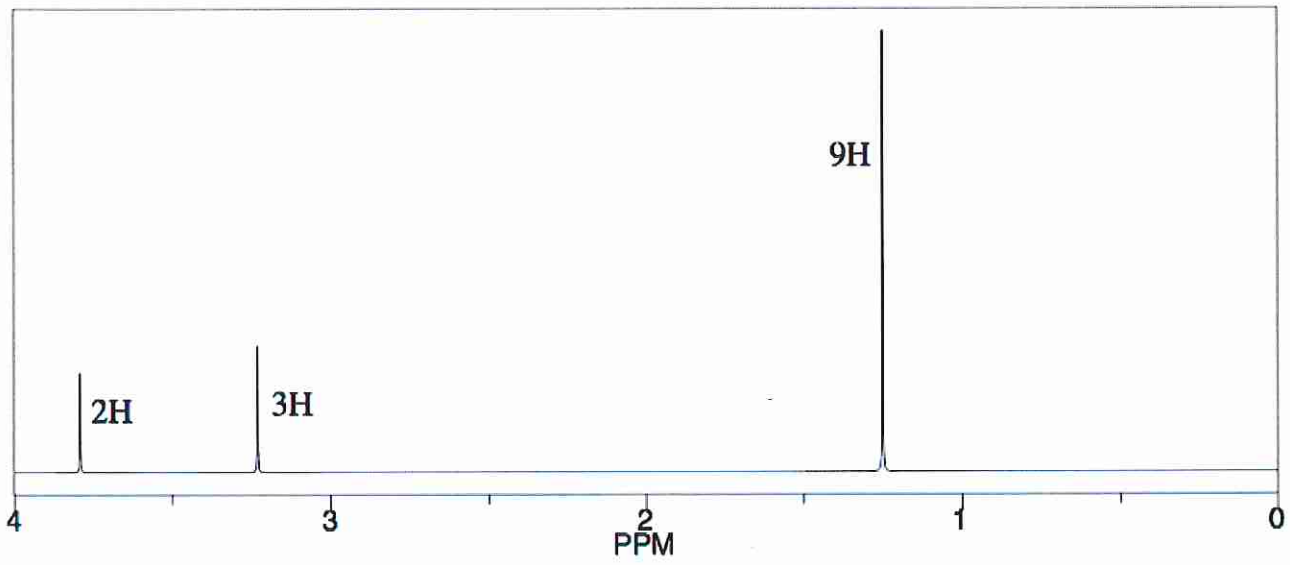
VIII



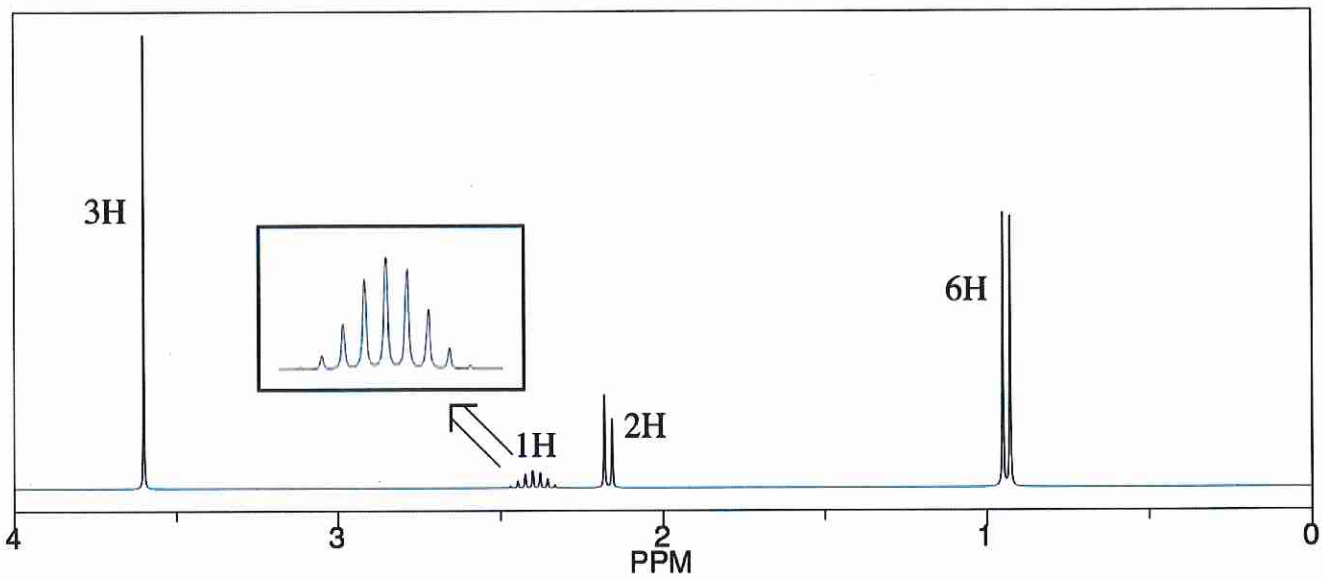
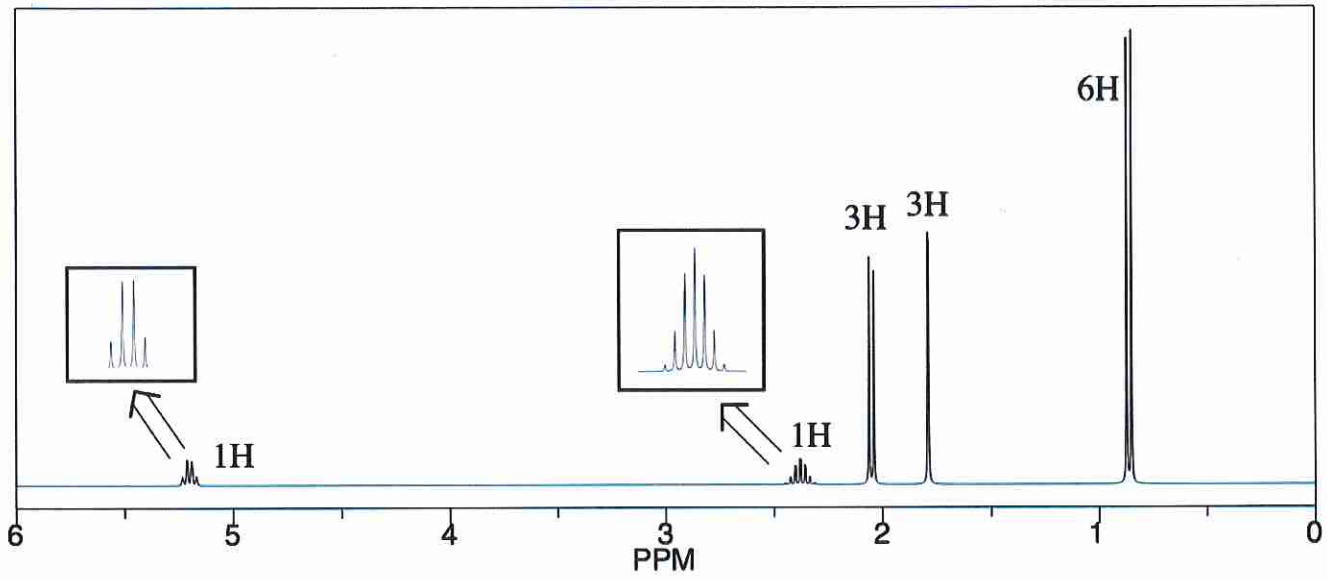
IX



Spectrum A



Spectrum B



Spectrum C