

**Chemistry 116 Sec. A (8:00-8:50)**  
**Exam No. 2**  
**“Reaction Energetics, Alkenes and Stereochemistry”**  
**October 13, 2004**

**Instructions:** You will have 60 min. to complete the exam. At the 60 min. mark, I will request that all remaining test takers cease writing, turn their exams over, and pass them to their rightmost isle. If you finish within 55 min. you may turn in the exam at the front of the room prior to leaving. If you finish in the final 5 min. of class, please turn your exam over and remain seated until I call for the remaining exams to be turned in. *In fairness to all, anyone still working on the exam after “time” is called will receive a grade of zero!*

Be sure to read the instructions for each question. It may be helpful to skim the entire exam and solve the easier questions first.

**Exam Agreement:** I, \_\_\_\_\_, have read and agree to

(Please print)

abide by the instructions above. On my honor, I have neither given nor accepted any help during this exam.

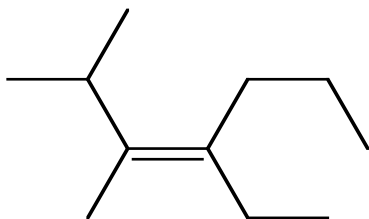
**Signature:** \_\_\_\_\_

**College:** \_\_\_\_\_

**DO NOT OPEN THIS EXAM UNTIL  
INSTRUCTED TO DO SO**

- 1) Provide an unambiguous name for each of the following molecules. For each structure, indicate whether it is chiral, achiral, or meso by circling the correct description. (14 points)

A) circle one



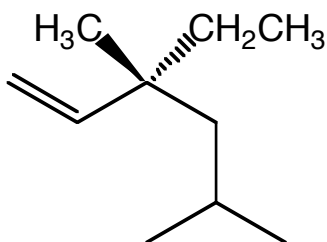
chiral

achiral

meso

*Z*-4-Ethyl-2,3-dimethyl-3-heptene

B) circle one



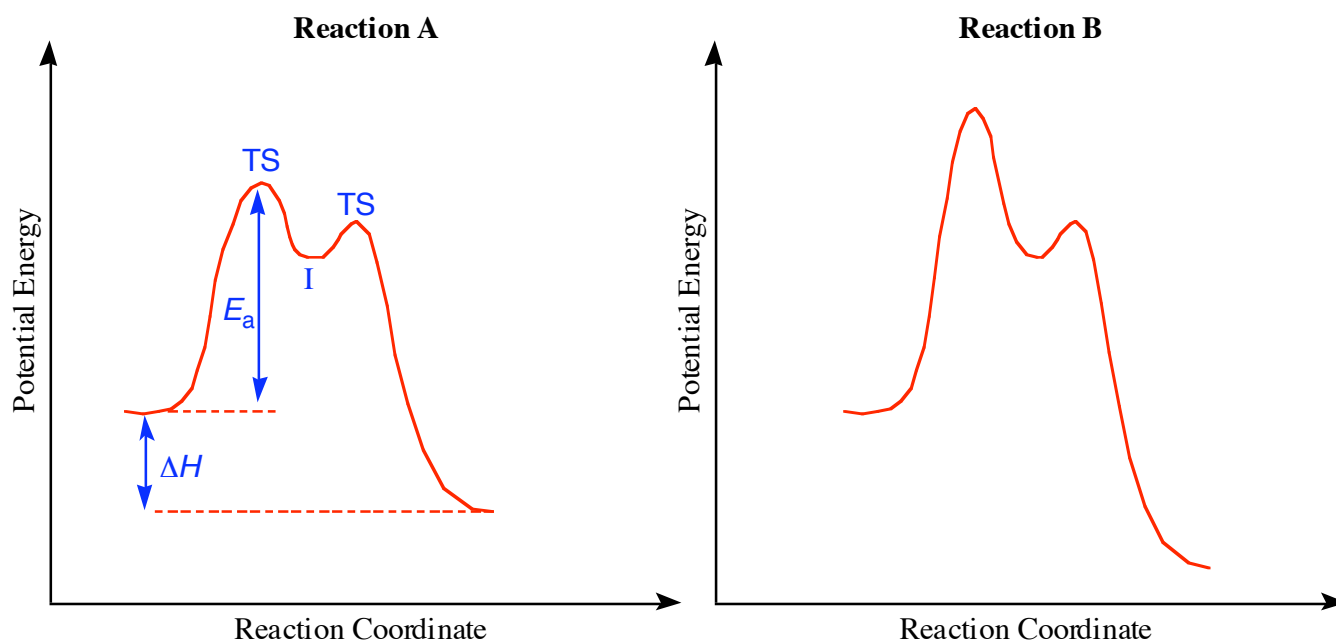
chiral

achiral

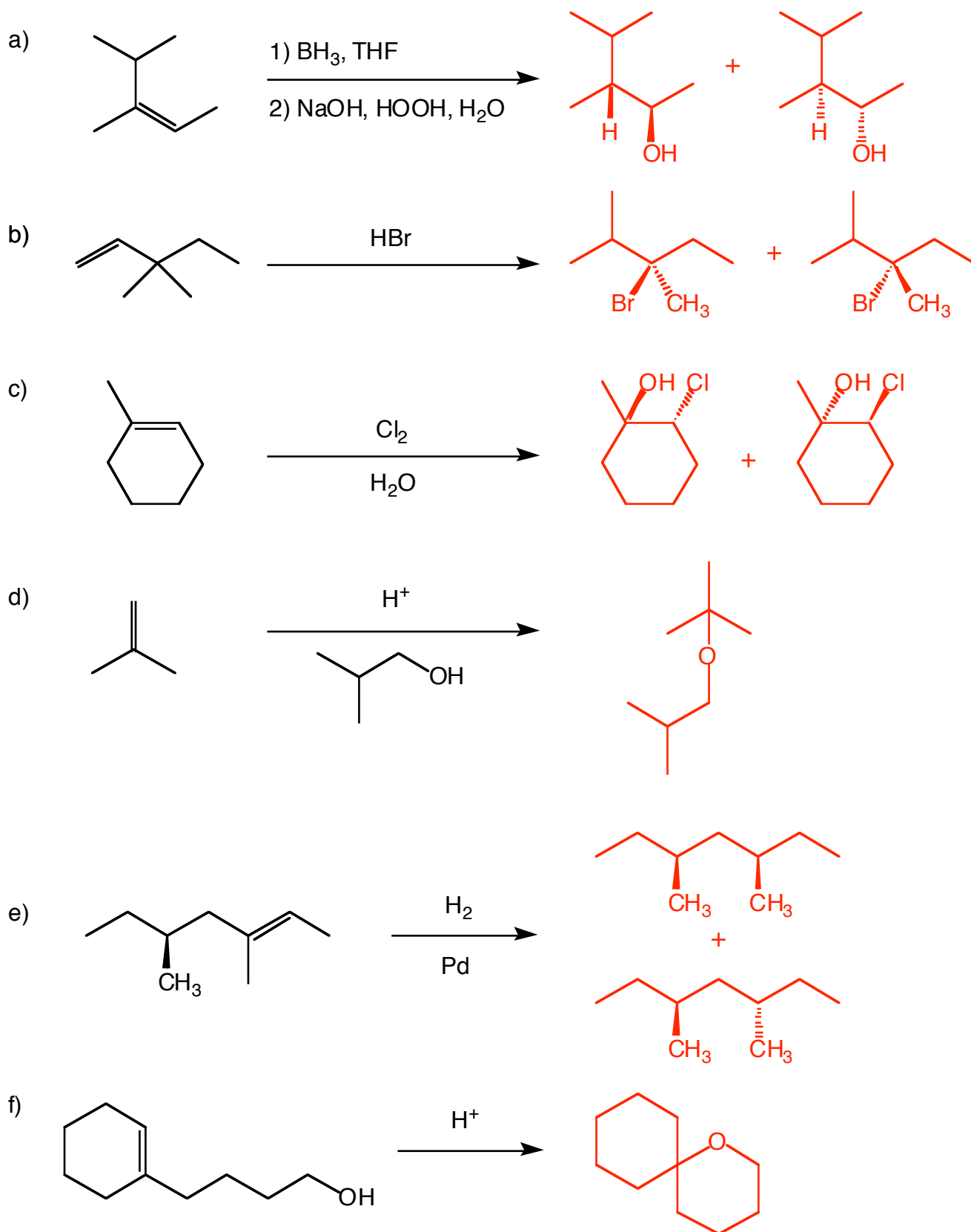
meso

*R*-3-Ethyl-3,5-dimethyl-1-hexene

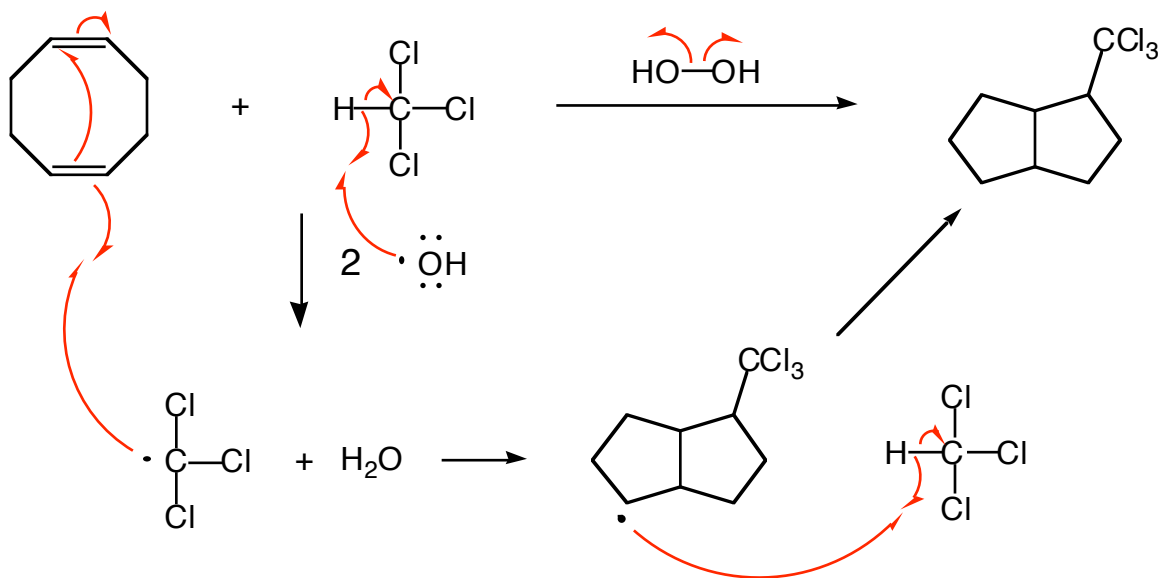
- 2) Two blank energy diagrams are provided. For Reaction A, draw a two step reaction in which the first step is rate-determining, and one which is overall exothermic. For Reaction B, draw a two step reaction that is *slower* than reaction A, but *more exothermic* overall. Label any transitions states, intermediates, the  $E_a$ , and  $\Delta H$  of at least one of the reactions. Your relative energies between diagrams A and B must be clearly shown. (10 points)



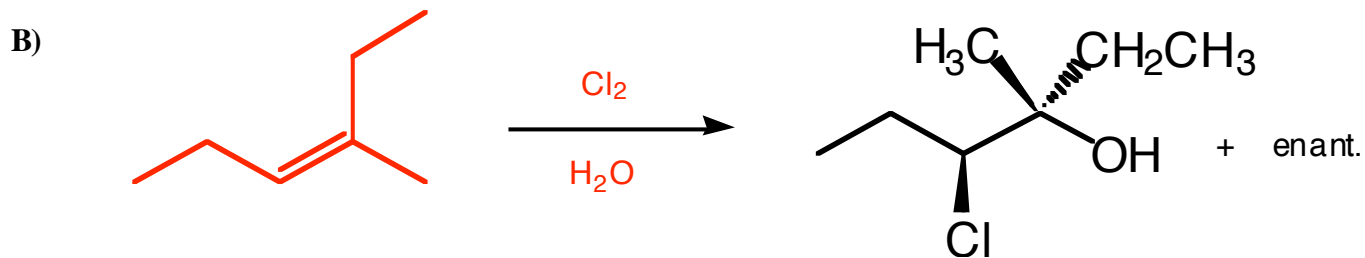
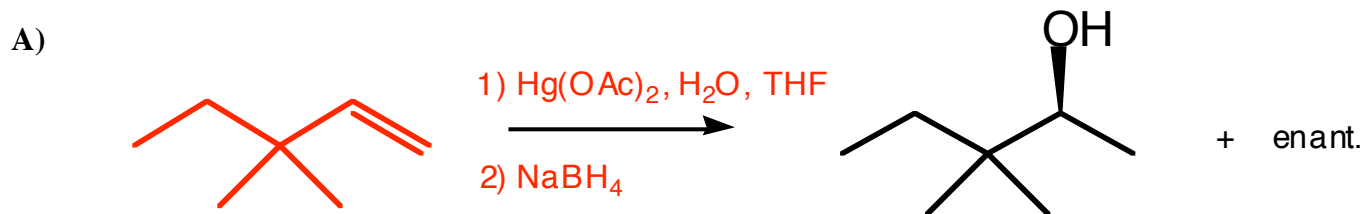
3) Predict the *major* organic product of each of the following reactions. If more than one product is equally favored, draw each product. (36 points)



4) Provide a mechanism for the following transformation. For full credit, be sure to show all intermediates and formal charges along the way. *Hint: use half-arrows throughout.* (12 points)

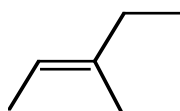


5) Provide the compound and reagents needed to synthesize the following products? (10 points)

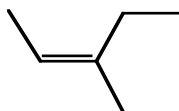


6) Define the relationship between the following pairs of compounds by choosing from the following: enantiomers, diastereomers, identical, constitutional isomers, or nonisomers. Then answer the questions that follow each pair. *I will not grade any out-of-box explanations.* (18 pts)

A)



A



B

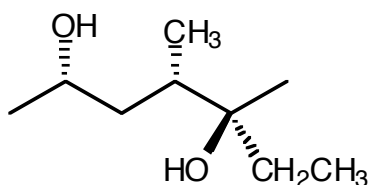
Diastereomers

Will a 50:50 mixture of these two rotate plane polarized light? yes or no

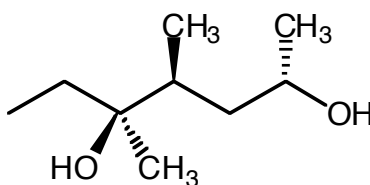
Why or why not?

Each is achiral

B)



A



B

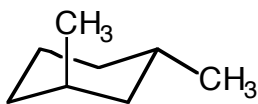
Identical

Will a 50:50 mixture of these two rotate plane polarized light? yes or no

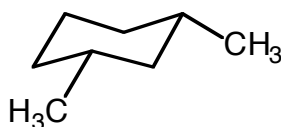
Why or why not?

They are the same and the compound is chiral so there really is no mixture, just 100% of a chiral molecule.

C)



A



B

Diastereomers

Will a 50:50 mixture of these two rotate plane polarized light? yes or no

Why or why not?

A is chiral and rotates plane polarized light. B is achiral and does not have an effect on plane polarized light. So in a mixture, A will rotate the plane polarized light while B has no effect whatsoever.