

Practice Exam 2 Spring 2014

Name Key Room _____

Student ID _____ Seat Number _____

Circle one: 11:15AM class 12:20PM class

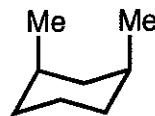
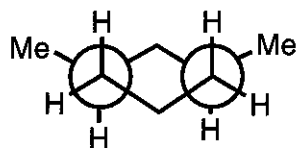
The exam consists of 10 questions on a total of 13 pages, including periodic table.

1. ____/10
2. ____/10
3. ____/10
4. ____/10
5. ____/10
6. ____/10
7. ____/10
8. ____/10
9. ____/8
10. ____/12

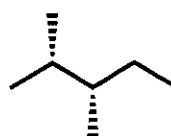
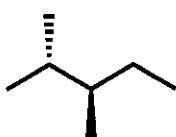
Regrading: All requests for regrades must be submitted in writing within 48 hours of the return of the exam. You must explicitly state what has been misgraded and why it is an error. The entire exam will be regraded, which could result in points being added or deducted overall.

1. (10 points)

a) (6 points) Identify the relationship between the two molecules. Write "same," "constitutional isomers," "enantiomers," or "diastereomers."

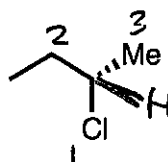


same



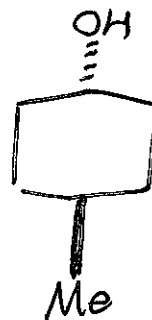
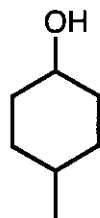
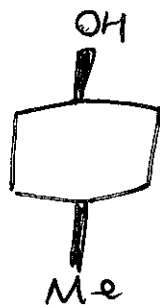
enantiomers

(S)-2-chlorobutane



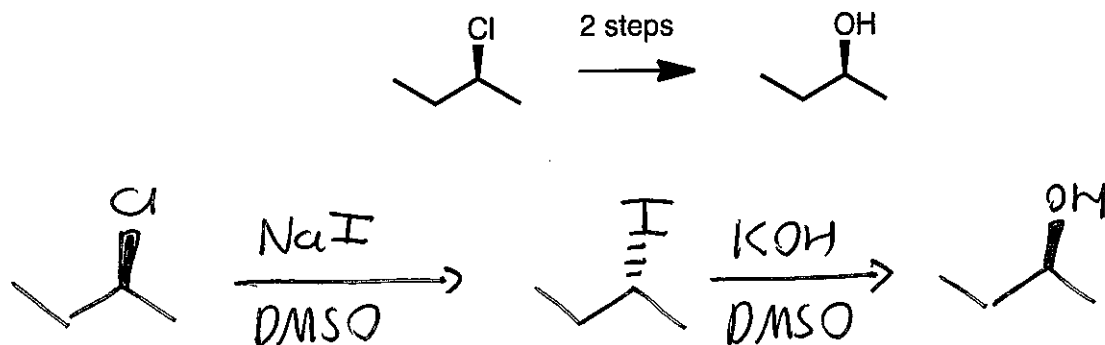
same

b) (4 points) Draw all stereoisomers of the compound illustrated below.

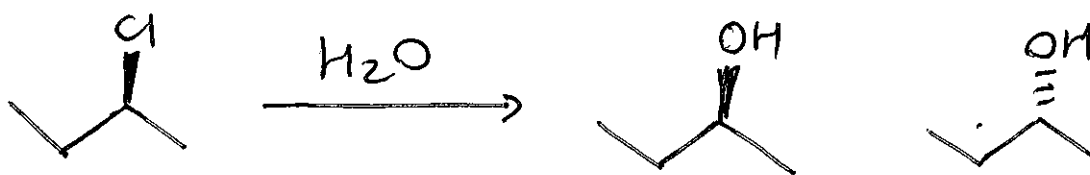


2. (10 points)

a) (6 points) At least two reactions are needed for the following process. Indicate the reagents necessary to carry out these reactions. (Note the overall retention of stereochemistry).

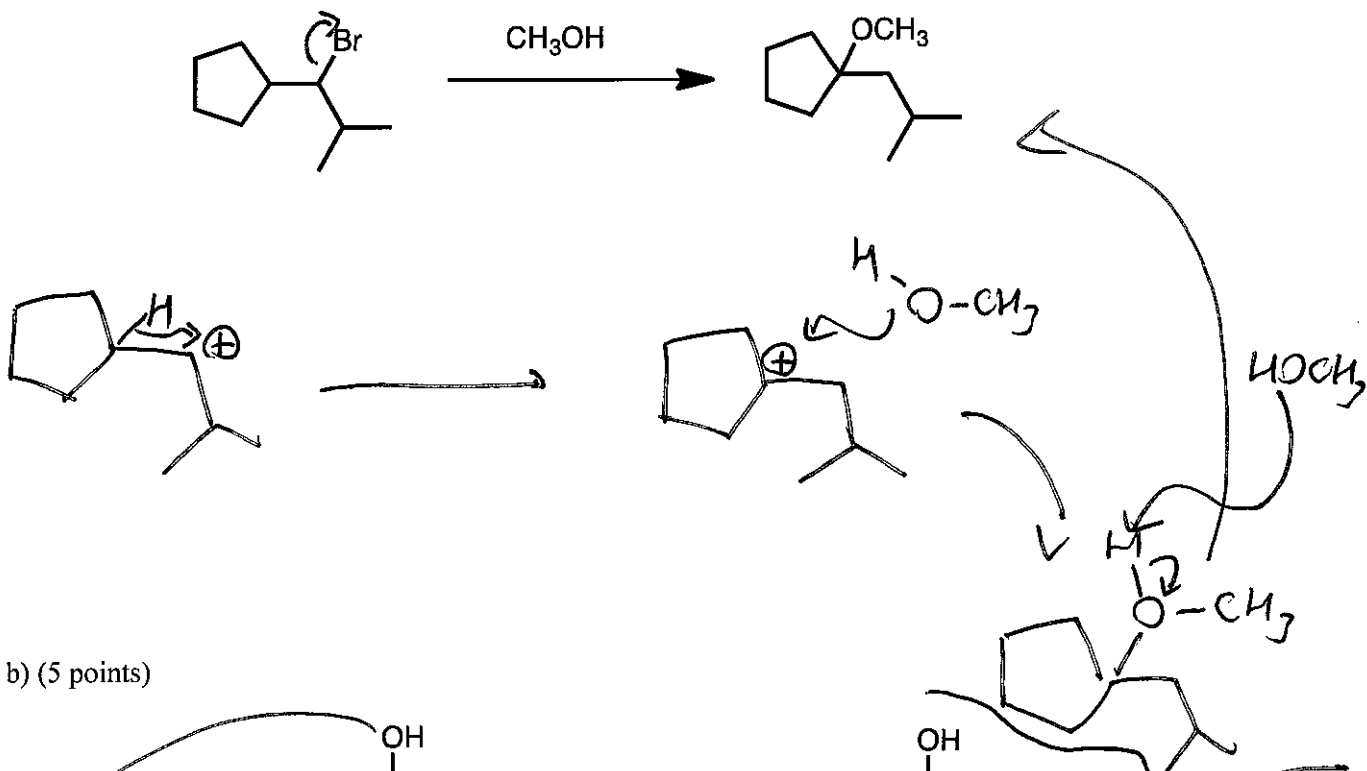


b) (4 points) What reagents would be necessary to make the same final product but as a racemic mixture?

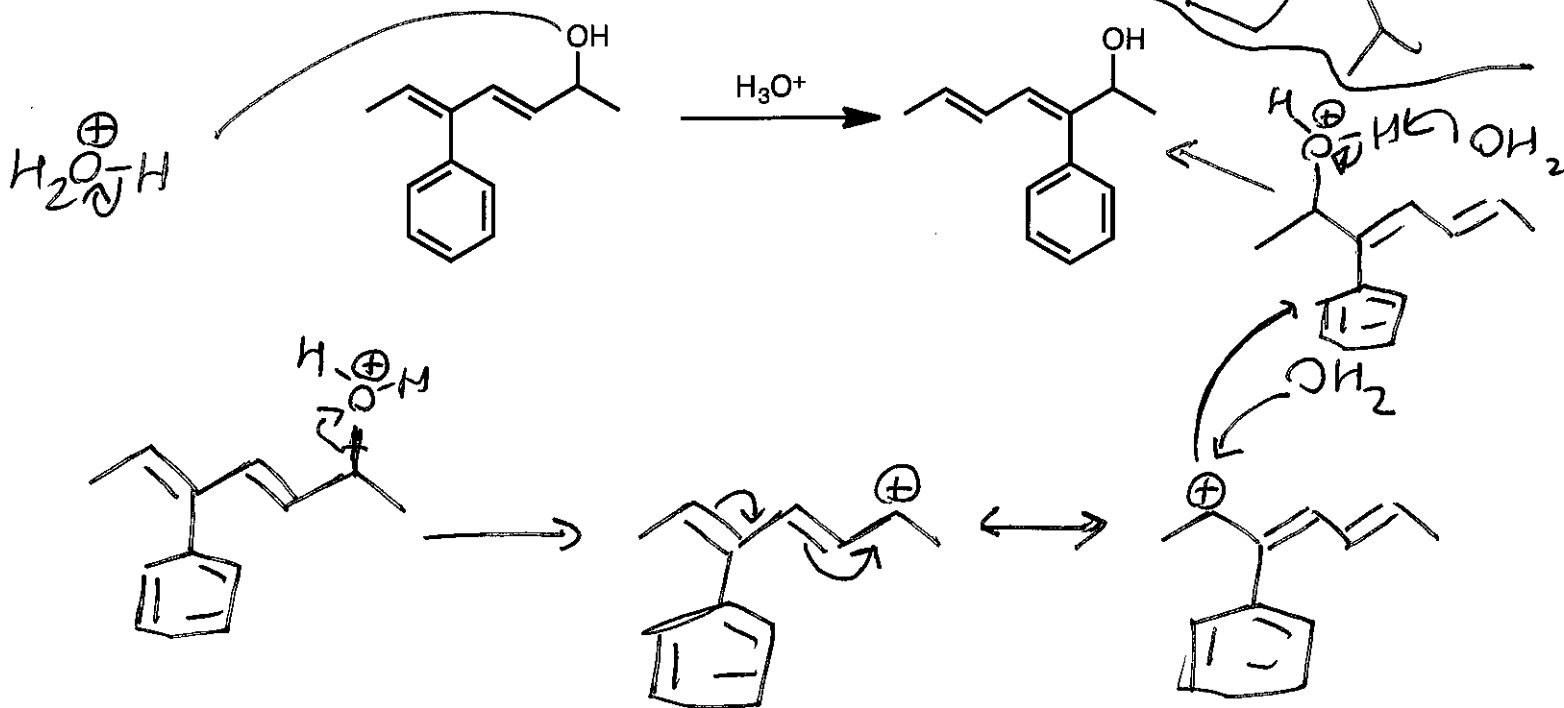


3. (10 points) Please draw mechanisms with all intermediates and arrows for the following reactions

a) (5 points)

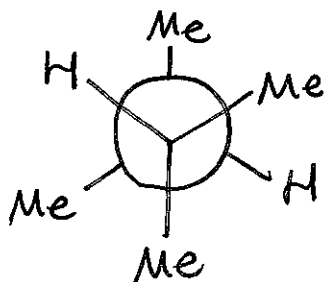


b) (5 points)

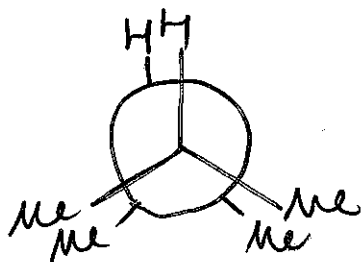


4. (10 points)

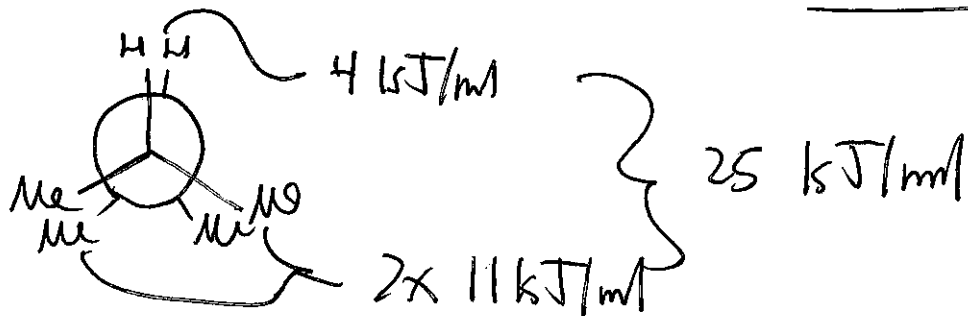
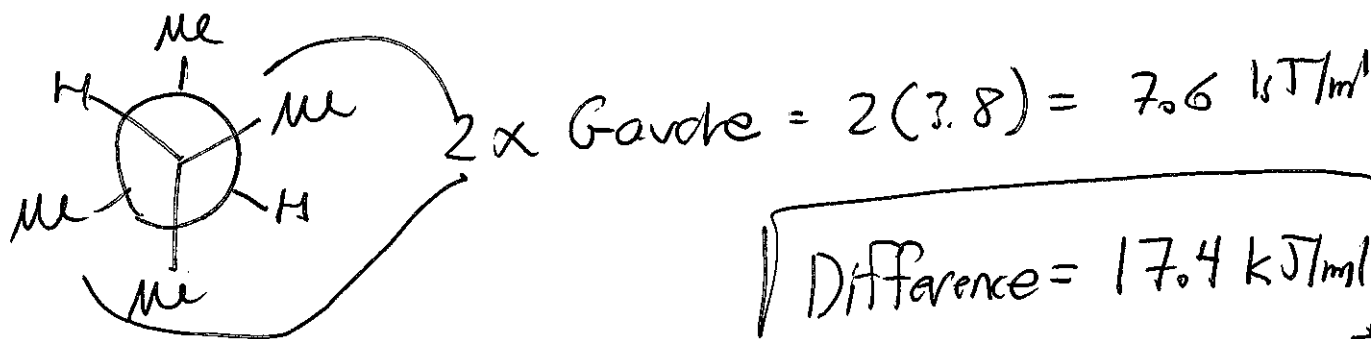
a) (4 points) Draw the lowest energy conformation of 2,3-dimethylbutane. Use a Newman projection to illustrate your answer.



b) (4 points) Draw the highest energy conformation of 2,3-dimethylbutane. Use a Newman projection to illustrate your answer.

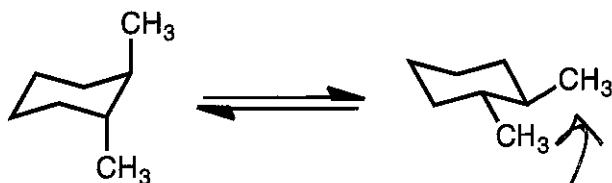


c) (2 points) Using the values provided at the end of the exam, what is the energy difference between these two conformations.



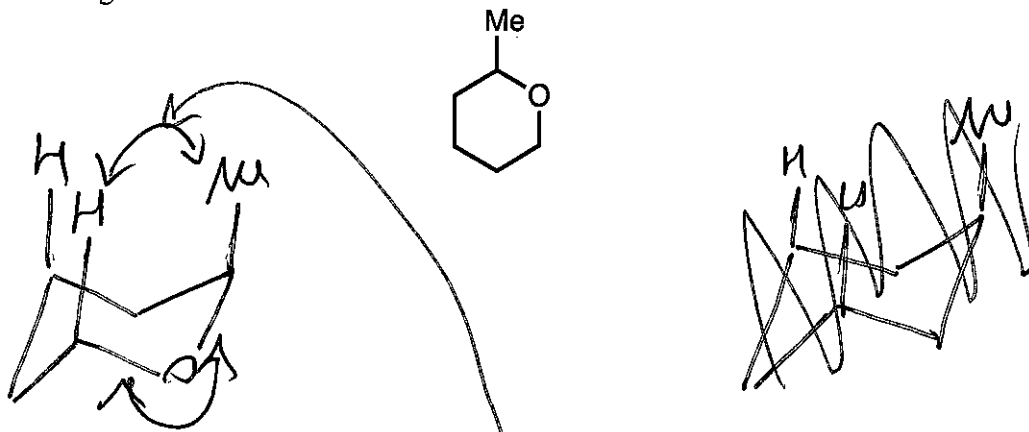
5. (10 points)

a) (5 points) Based on A-values you would expect the difference between the two conformations to be 15.2 kJ/mol. However, the difference in energy between the two conformations is actually 11.4 kJ/mol. Provide an explanation for the discrepancy.



Gauche interactions destabilizes this conformation. Therefore it is higher in energy than expected based on A-values.

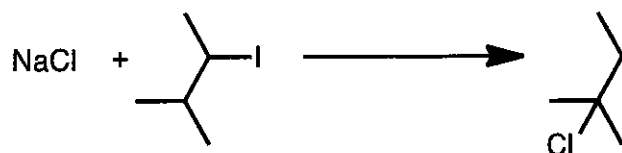
b) (5 points) Carbon-oxygen bonds are shorter than carbon-carbon bonds. Using that information, explain why the equatorial preference for the methyl group of the molecule illustrated below is greater compared to methylcyclohexane. To receive full credit, support your answer with figures and text.



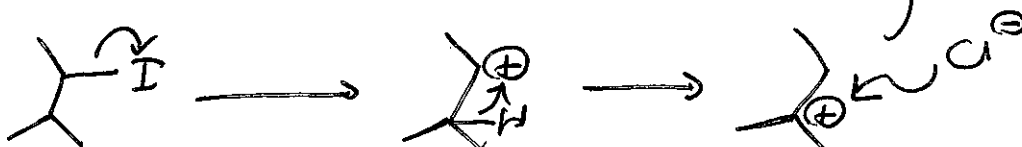
because the bonds are shorter

the Me and H are closer and thus have greater steric strain

6. (10 points) For the process illustrated below, answer the following questions.



a) (3 points) Draw a mechanism for the reaction illustrated above.

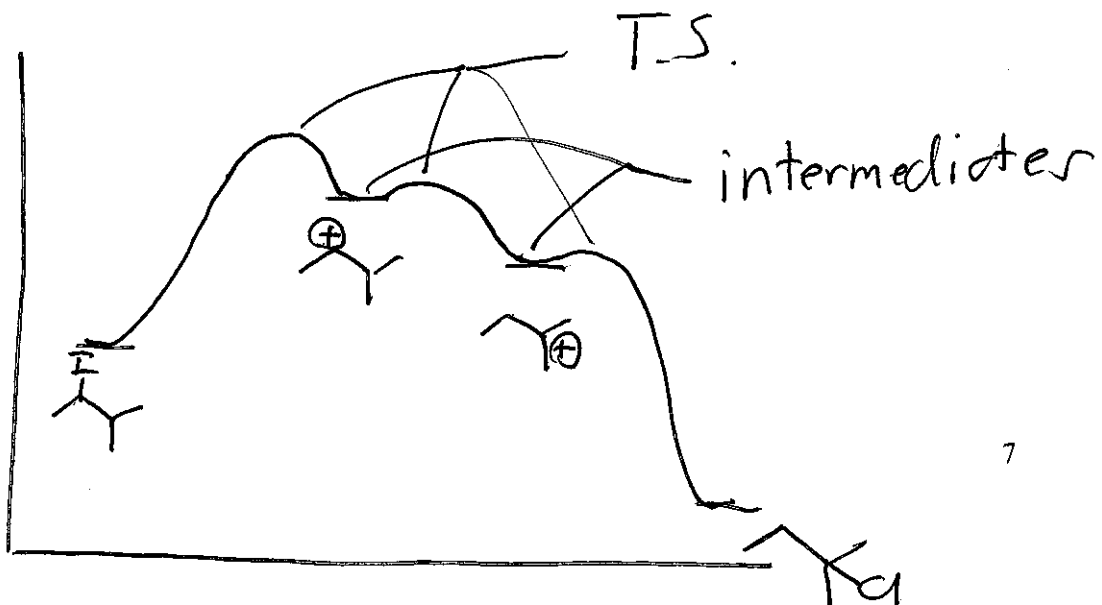


a) (2 points) What happens to the rate if the concentration of the alkyl iodide is doubled and the concentration of NaCl is tripled. To receive full credit you must support your answer.

$$\text{Rate} = k [\text{R-I}]$$

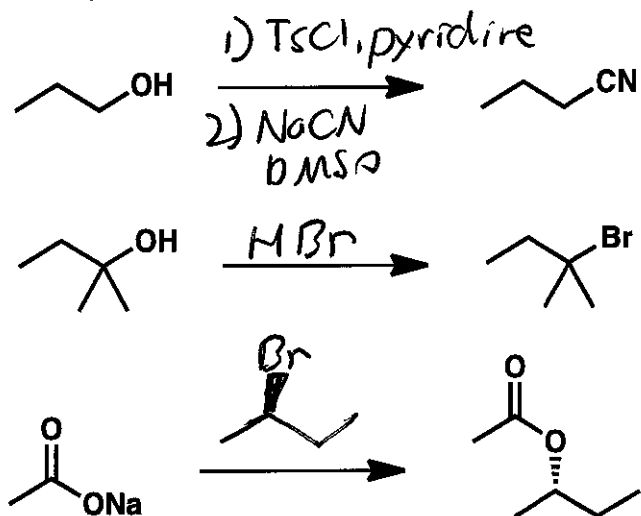
Thus the reaction rate will double.
(concentration of NaCl has no effect on rate)

b) (5 points) Draw a reaction coordinate energy diagram for the reaction above. (You may assume the reaction is exergonic) Clearly identify all intermediates and transition states and relative energies.

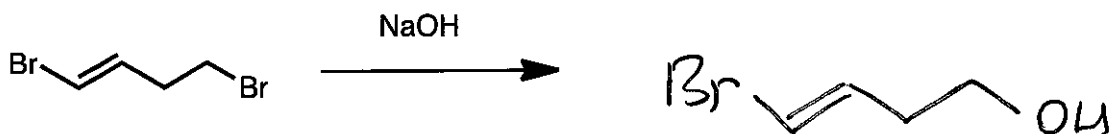
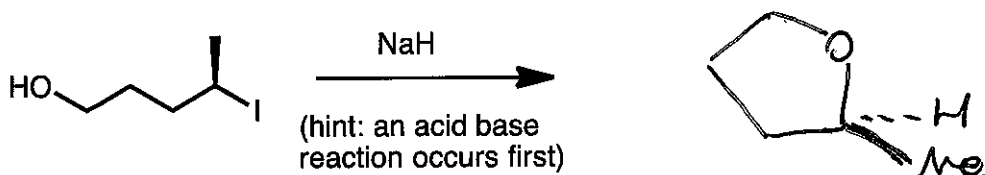


7. (10 points)

a) (6 points) Identify the reagents necessary to achieve the following substitutions (2 points each)

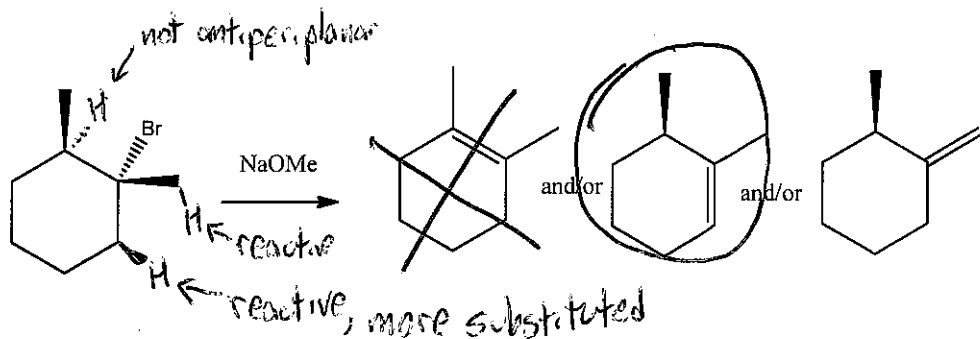


b) Please draw the product(s) of the following substitution reactions. (2 points each)

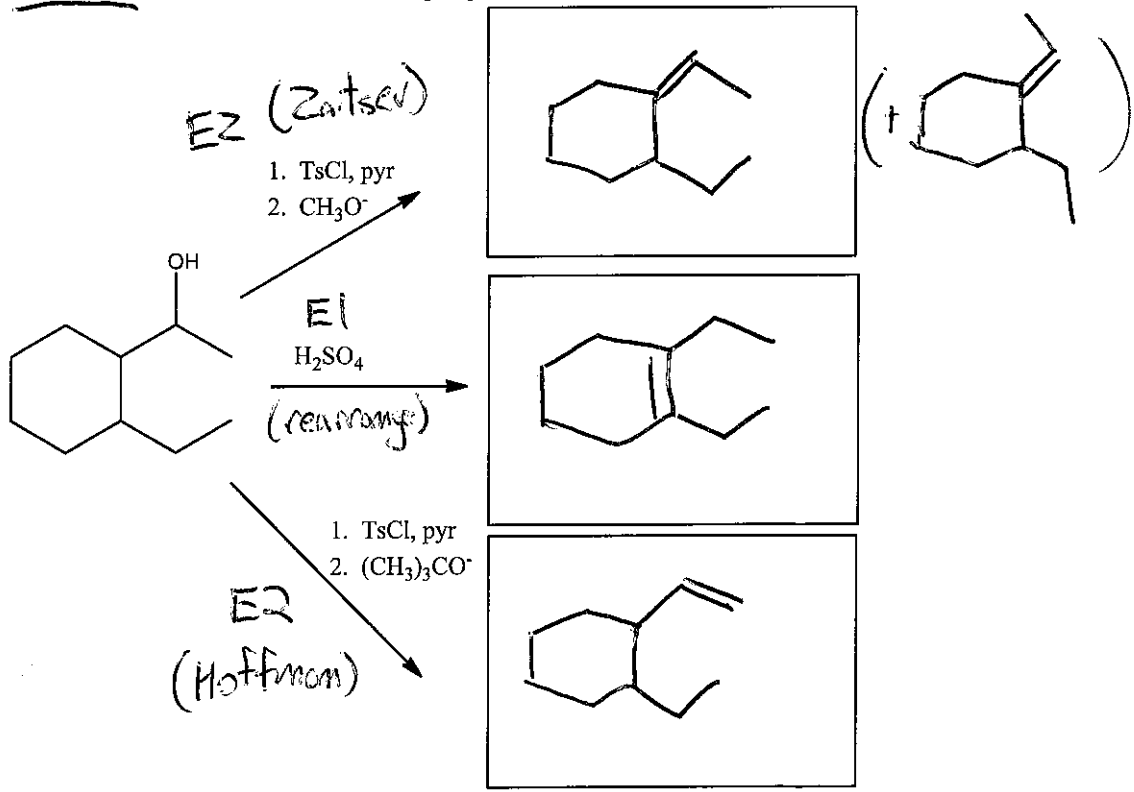


8. (10 points)

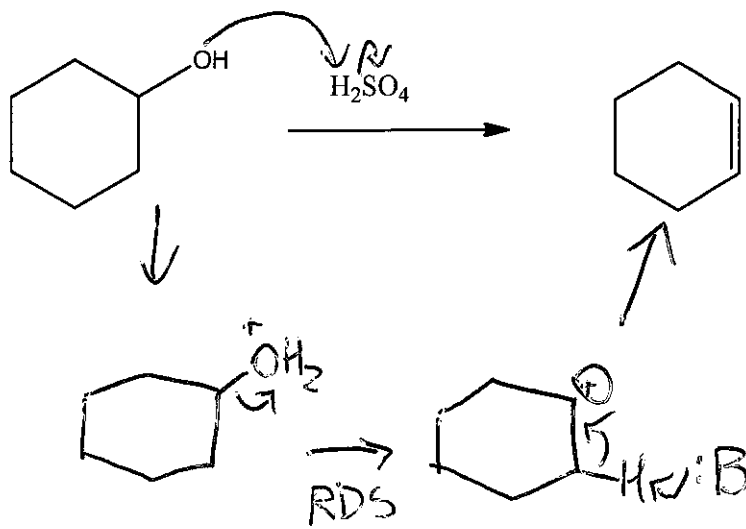
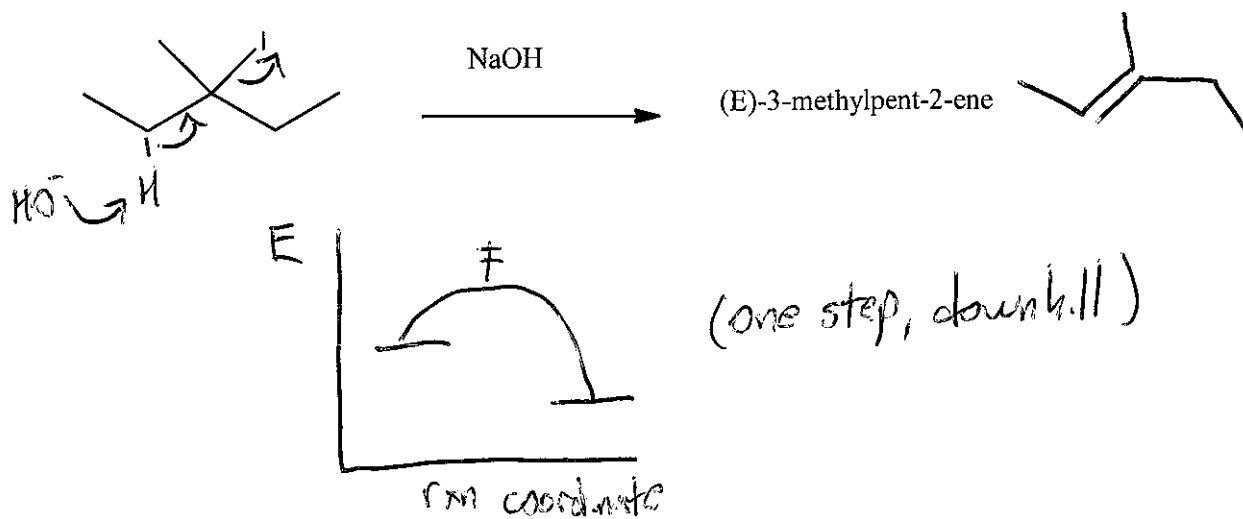
a) (4pts) Three possible products are given for this E2 elimination. Circle the major product, and cross out the one that will not form.



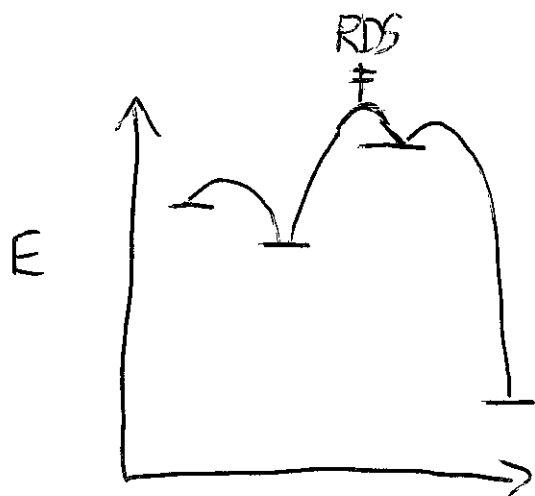
b) (6 points) Three different sets of reagents lead to three different major products for these elimination reactions. Draw the major product in each case.



9. (8 points) Provide mechanisms for these reactions. Also draw an energy diagram for each reaction, assuming that it is overall exothermic.



$\text{:B} = \text{any solvent/weak base}$



3 steps, downhill overall,
second step is RDS

10. (12 points) For each of the reactions below, indicate the major mechanism(s) by which it proceeds as either E1, E2, S_N1, S_N2, or a mixture of these mechanisms. Then draw the major product of each reaction. (Partial credit will be given for a major product consistent with the mechanism selected, even if the selected mechanism is incorrect. If the major product given is inconsistent with the selected mechanism, then it is wrong.)

