

Exam 3 Summer 2017

Name Key Seat Number \_\_\_\_\_

Student ID \_\_\_\_\_

The exam consists of 8 questions worth 104 points on a total of 8 pages. It will be scored out of 100 points. The maximum score you may receive is 100 points.

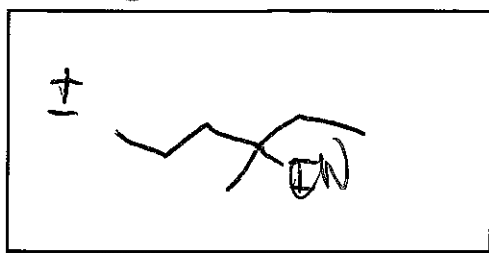
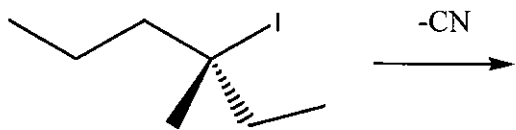
1. \_\_\_\_/16
2. \_\_\_\_/20
3. \_\_\_\_/20
4. \_\_\_\_/12
5. \_\_\_\_/16
6. \_\_\_\_/8
7. \_\_\_\_/8
8. \_\_\_\_/4 bonus

Total:

**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.

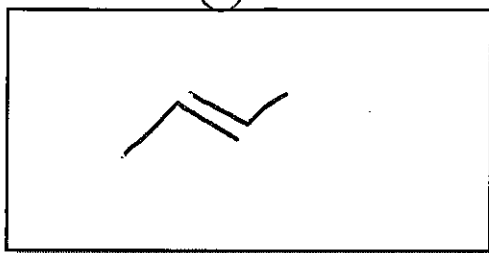
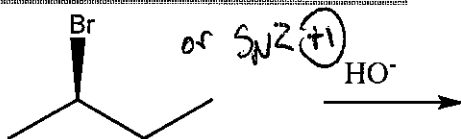
1. (16pts) Predict the ONE predominant mechanism ( $S_N1$ ,  $S_N2$ , E1, or E2) for each of the following reactions. Based on the mechanism you chose, draw the structures of the major product(s) in the box.

A. Type of mechanism:  $S_N1$  (+2)



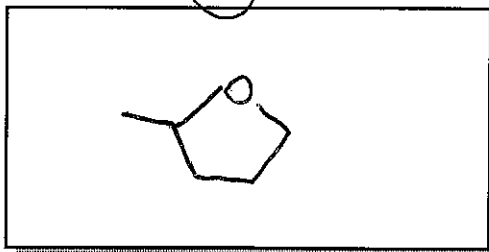
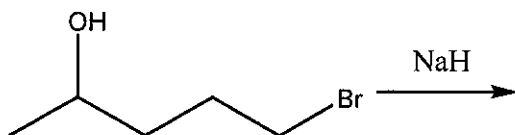
-1 stereo

B. Type of mechanism: E2 (+2)



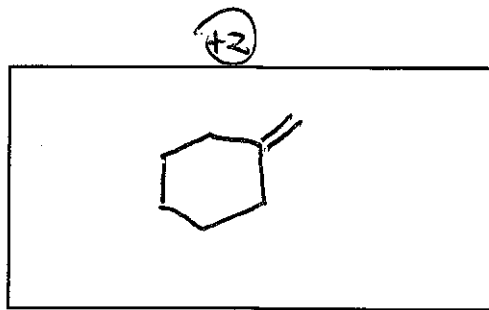
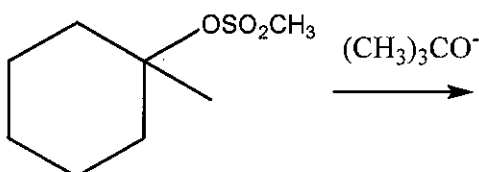
-1 regio/stereo

C. Type of mechanism:  $S_N2$  (+2)



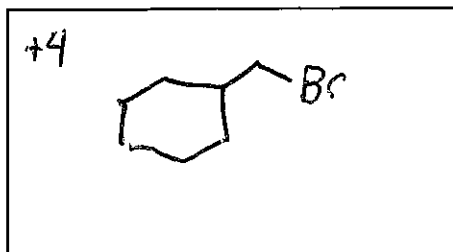
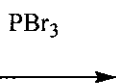
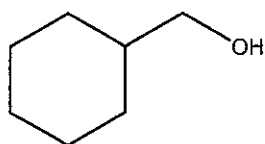
-1 wrong ring size

D. Type of mechanism: E2 (+2)



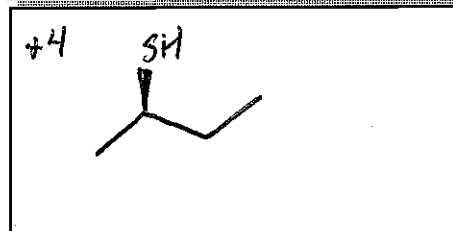
-1 Zaitsev prod

(20pts) Predict the major product(s) of 5 of the following 6 reactions. Be sure to include proper stereochemistry. Put an "X" in the box you do not want graded, or else the first 5 will be graded.

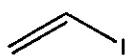


(S)-2-butanol

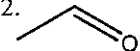
1.  $\text{CH}_3\text{SO}_2\text{Cl}$ , py  
2.  $\text{HS}^-$



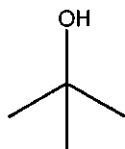
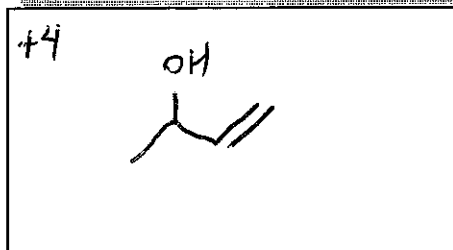
-1 stereo



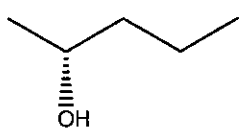
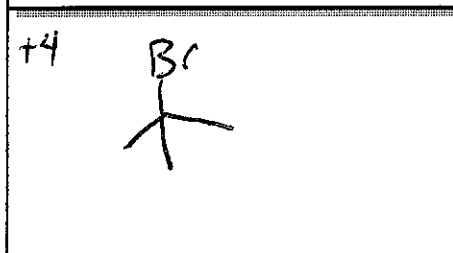
1. Mg, ether  
2.



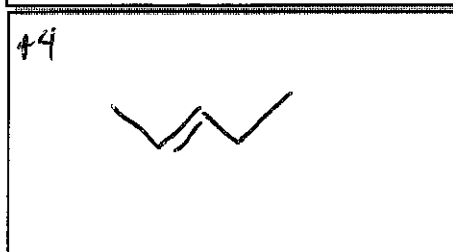
3.  $\text{H}_3\text{O}^+$



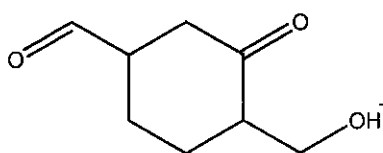
$\xrightarrow{\text{HBr}}$



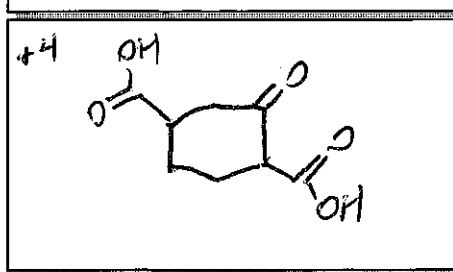
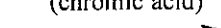
$\xrightarrow{\text{H}_2\text{SO}_4, \text{heat}}$



-1 regio  
-1 stereo

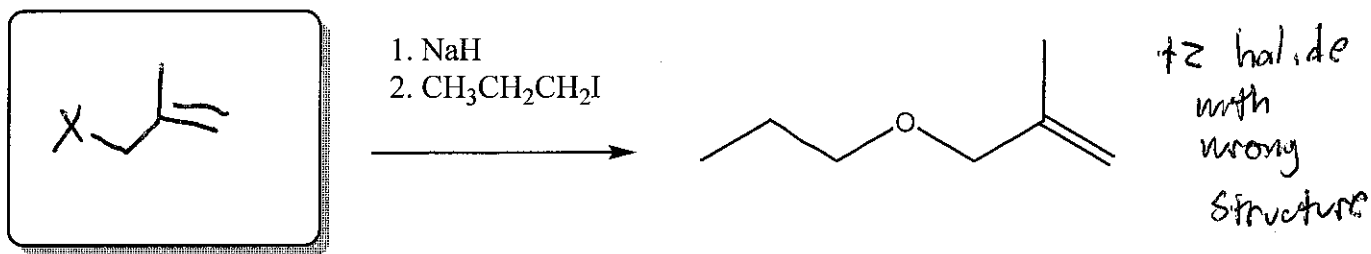
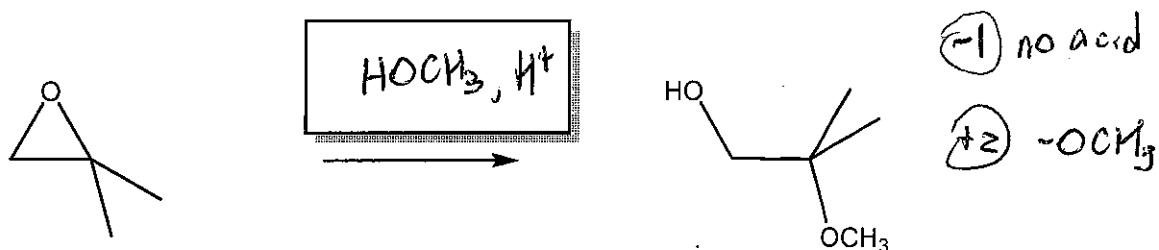
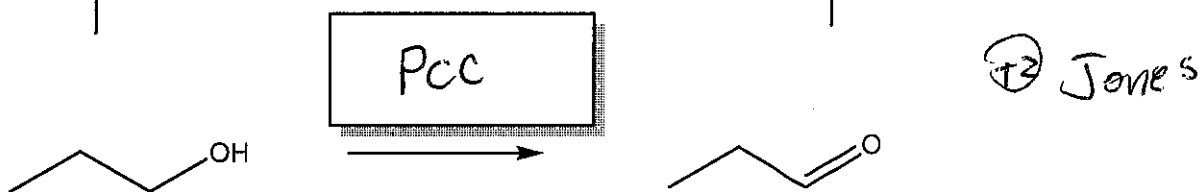
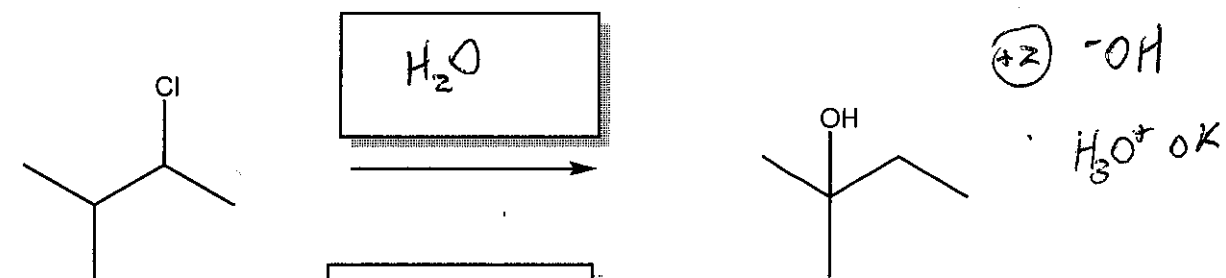
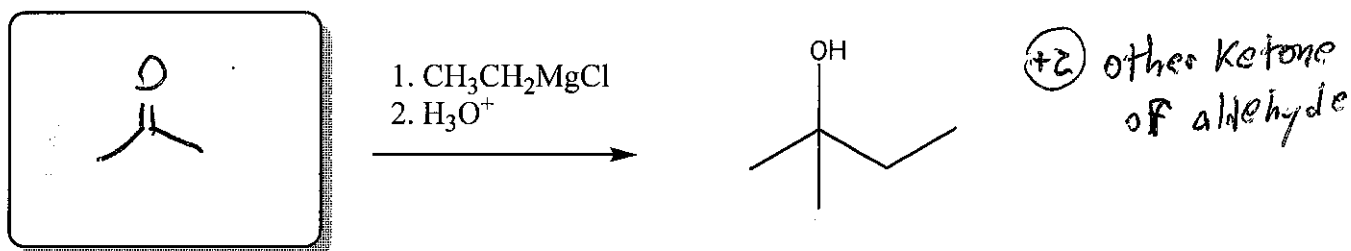
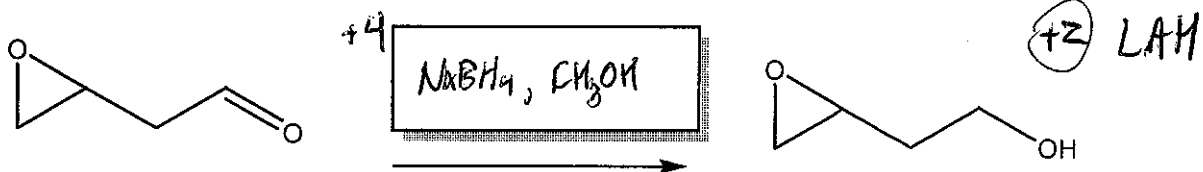


excess  
Jones reagent  
(chromic acid)



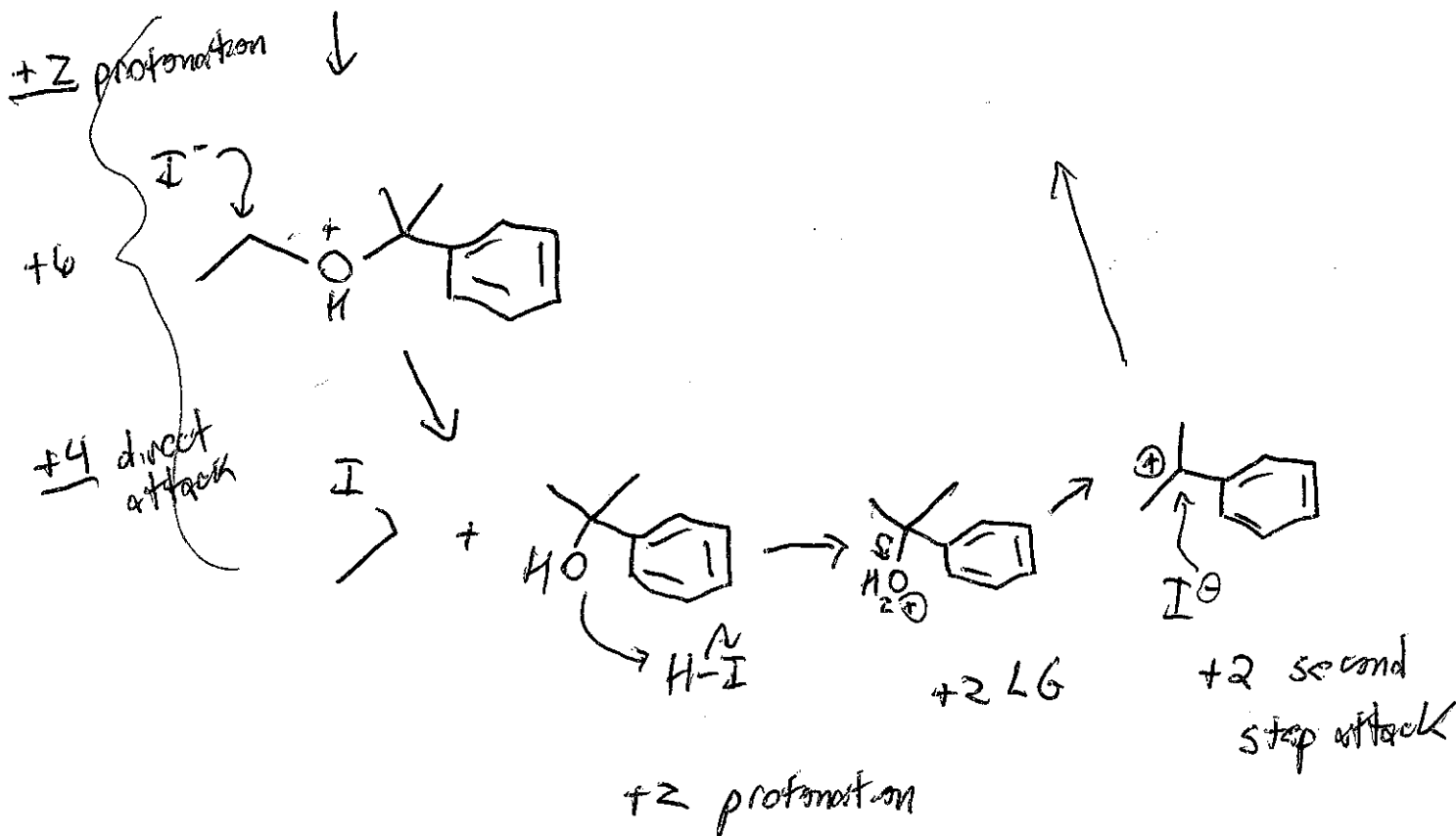
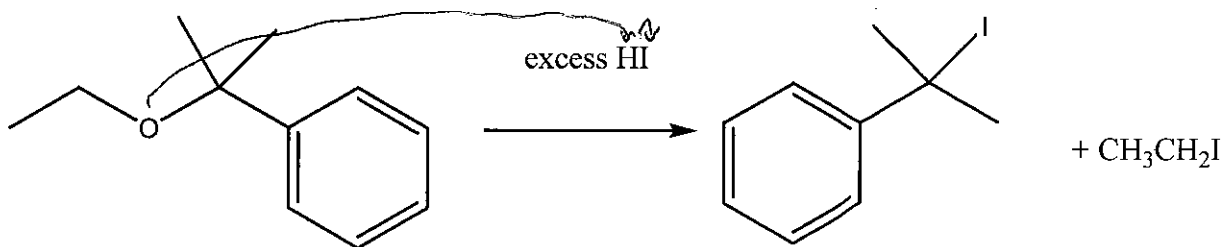
-1 aldehyde

3. (10pts) Provide the reagents or starting materials necessary for 5 of the following 6 reactions. .  
 Put an "X" in the box you do not want graded, or else the first 5 will be graded.



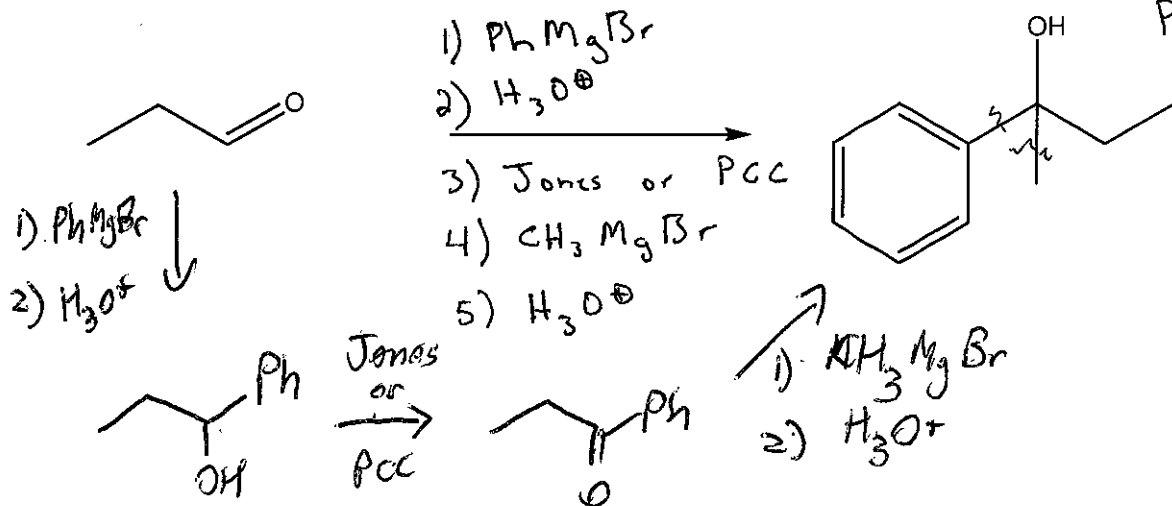
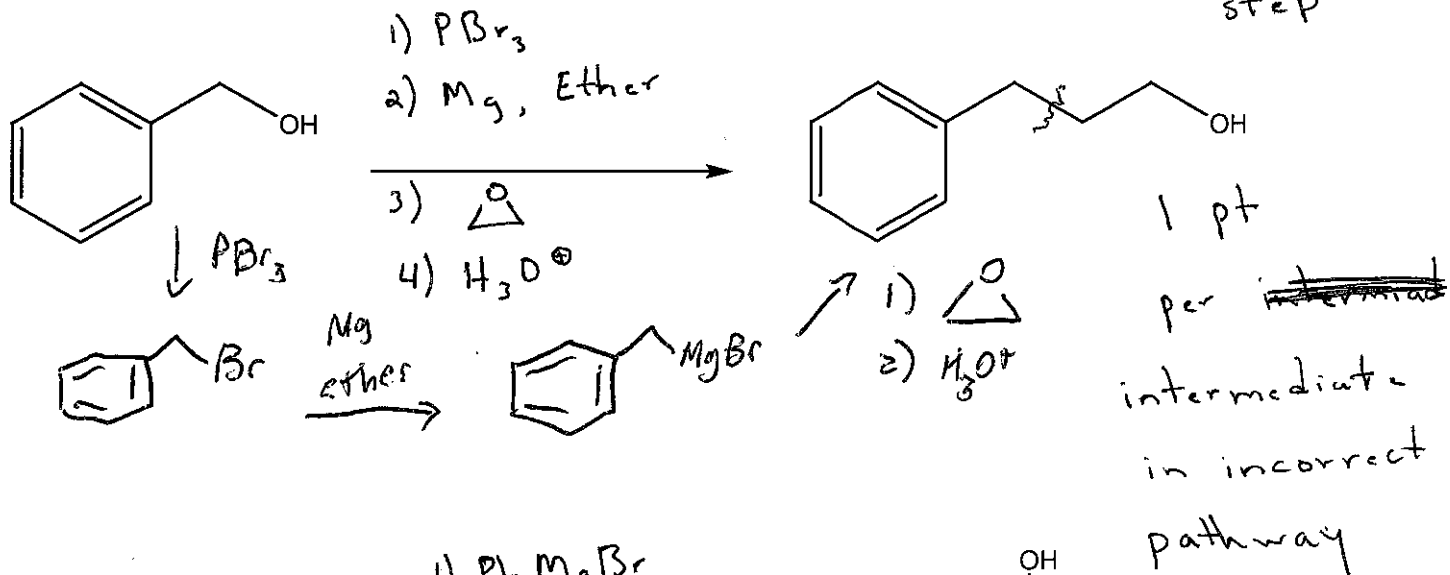
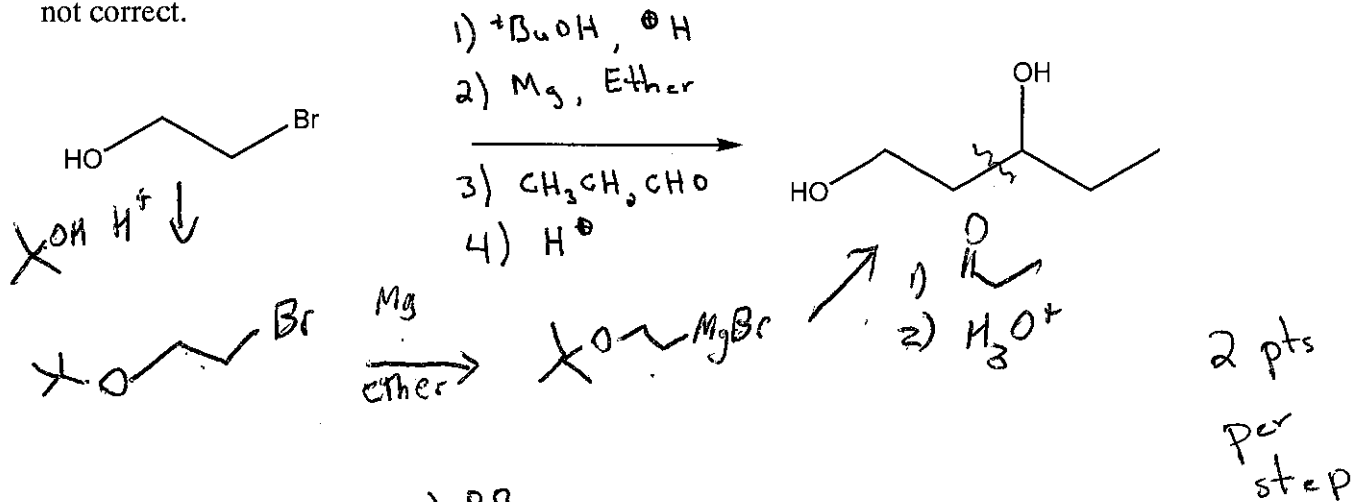
+6 S<sub>N</sub>2 +6 S<sub>N</sub>1 either order

4. (12pts) Provide an arrow mechanism for this reaction, including all intermediates.

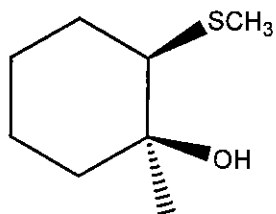
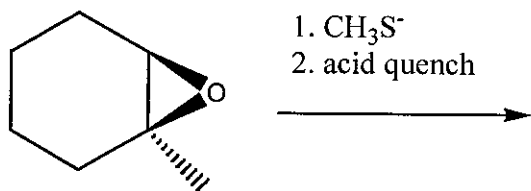


+8 each

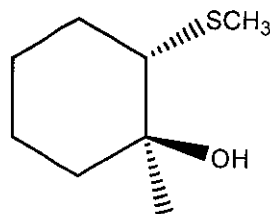
5. (16pts) Provide all the reagents necessary for 2 of the following 3 multistep syntheses. Clearly mark the one you do not want graded with an "X" or the first two will be graded. You should draw intermediates along the pathway in order to get partial credit even if the whole answer is not correct.



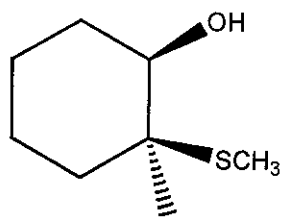
6. (8pts) Four possible products of this epoxide ring opening are given below. Underneath each product, explain whether it will form as a major product or a minor product, or if it will not form at all due to regioselectivity and/or stereospecificity of the mechanism.



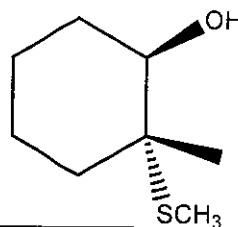
Not formed because  
Nu<sup>-</sup> must attack from  
back face (stereospecific)



Major - attack from  
back face (stereospecific)  
and on less hindered carbon  
(regioselective)

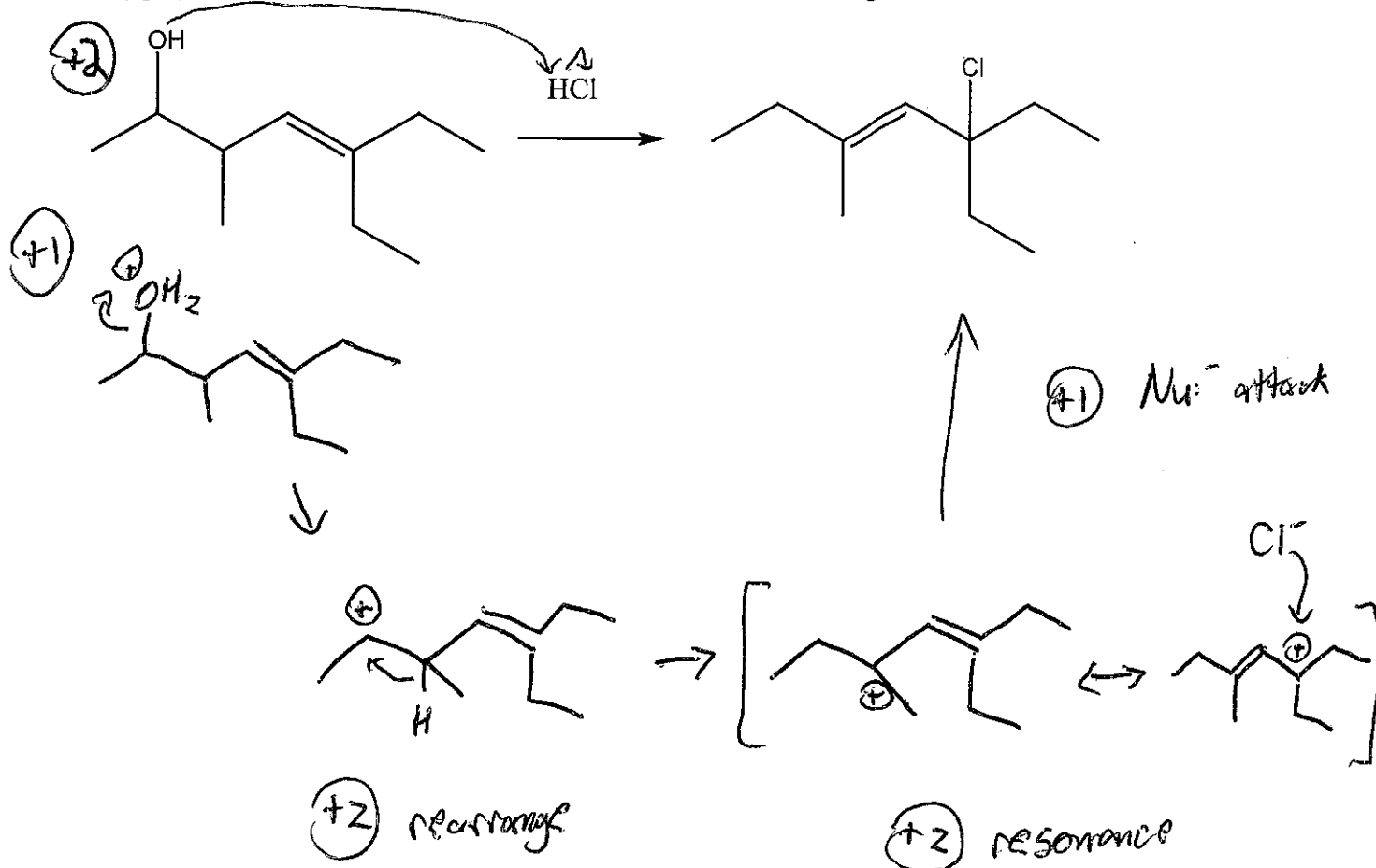


Not formed because  
Nu<sup>-</sup> must attack from  
back face (stereospecific)

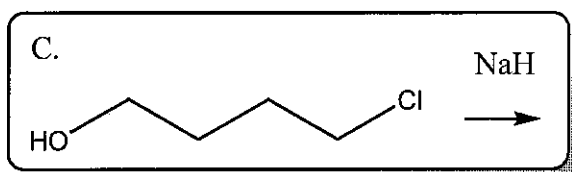
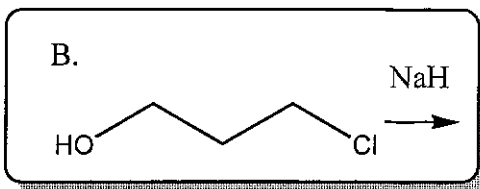
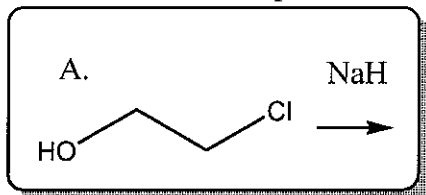


Minor - attack is from  
back face (stereospecific)  
but is on more hindered  
side (regioselective)

7. (8pts) Provide an arrow mechanism for this reaction, including all intermediates.



8. (4pts bonus) Which of the following reactions that form cyclic ethers would be fastest, and which is slowest? Explain.



(+2) (A) Fastest - entropy argument  
 (+2) (B) Slowest - strain argument