CHM2120B – Organic Chemistry II

Mid-term Exam

Wednesday October 8th, 2014

Name: Marking Student No.: Scheme

Please keep your work covered at all times and keep your eyes on your own paper! Cheating or any appearance of cheating will result in an F in the course and possible expulsion from the university.

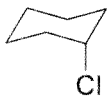
Guidelines:

- You have 80 minutes to complete the exam.
- Calculators and/or any communication devices are strictly prohibited.
- Approved molecular models are allowed.
- Only copies written in ink will be considered for re-grade.

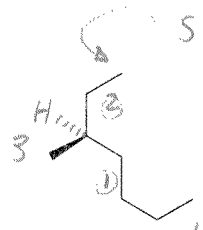
Question No.	Points
1	/6
2	/8
3	/10
4	/22
5	/10
6	/25
7	/8
Total	~~/90~~ 89

Question 1. Provide the name of the following molecules or draw the corresponding structure from the name. (6 points)

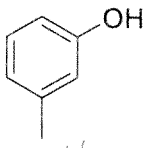
1 point each



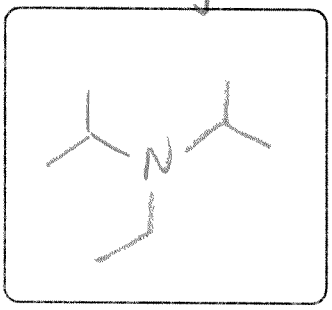
a) 1-chlorocyclo-hexane or chlorocyclohexane



b) (S)-3-methyl heptane

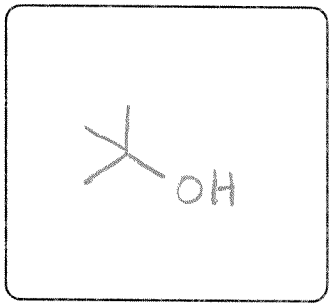


c) 3-methylbenzene-1-ol



d) diisopropylethylamine

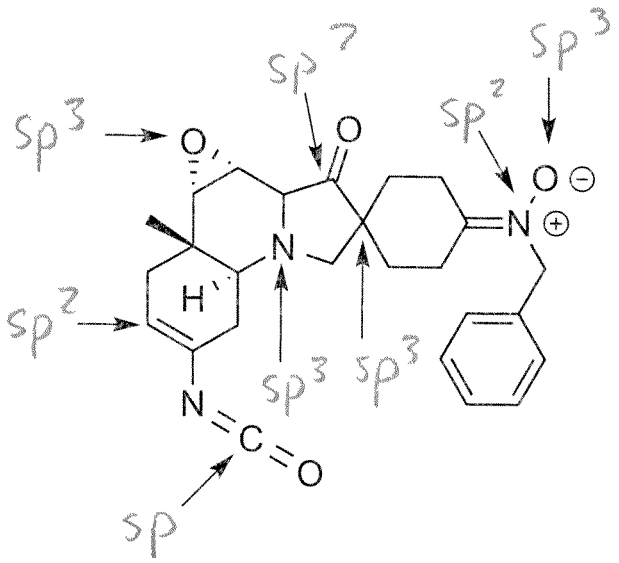
d) cyclopenta-1,3-diene or cyclopentadiene



f) *tert*-butanol

Question 2. Provide the hybridization of each atoms identified on the following molecule. (8 points)

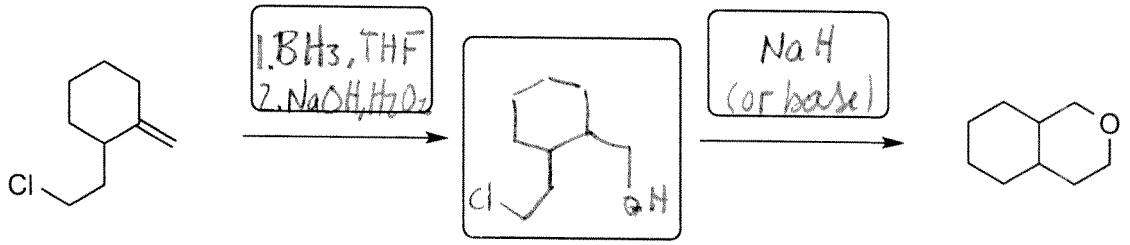
1 point each



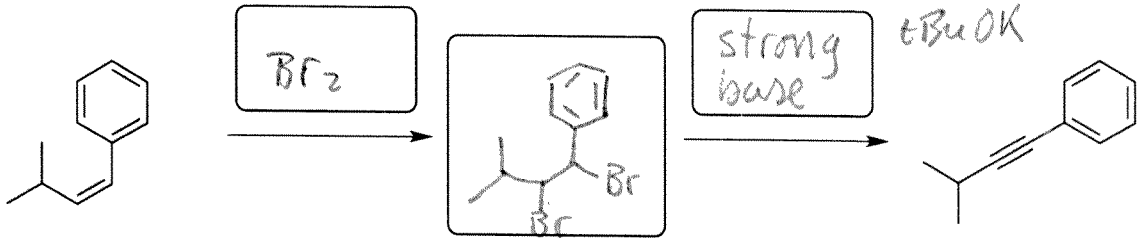
5.

Question 3. Please provide the reactants, conditions and products involved in the following transformations. (10 points)

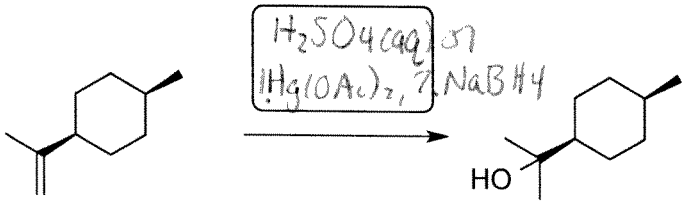
a)



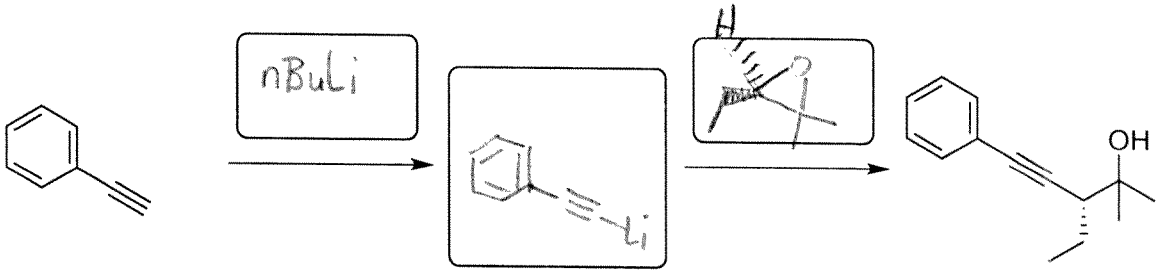
b)



c)



d)

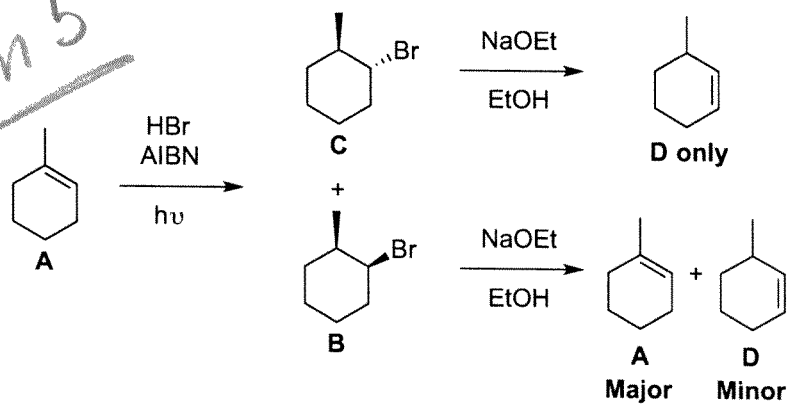


*see assignment 2A for similar problem (question 2C)

N.

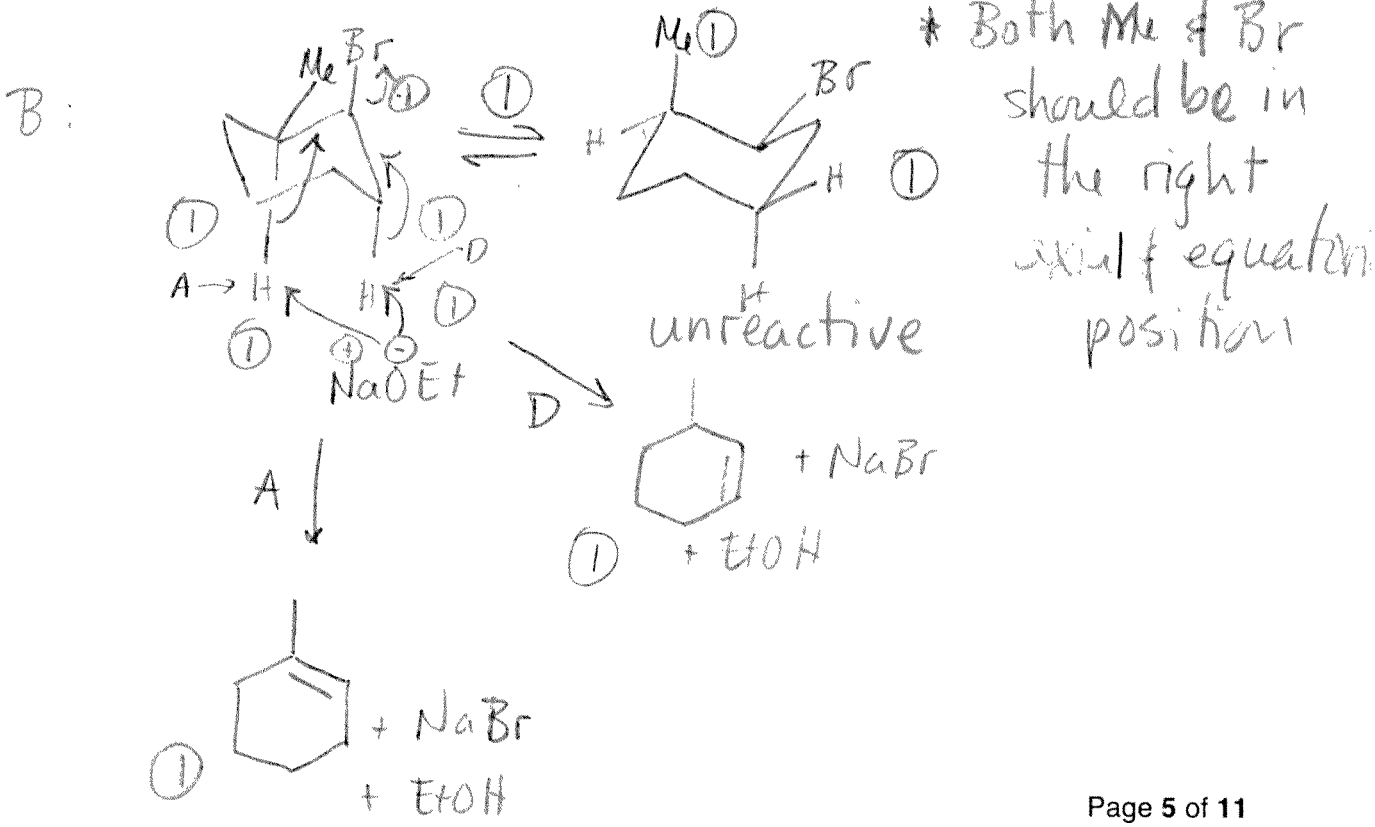
Question 4. When 1-methylcyclohexene **A** is treated with hydrobromic acid and AIBN under photolytic conditions, a mixture of diastereomer **B** and **C** is obtained. The diastereomers are then separated. Subsequent treatment of diastereomer **B** with sodium ethoxide in ethanol results in a mixture of regioisomers **A** and **D**. However, treatment of diastereomer **C** under the same conditions yields exclusively regioisomer **D**.

*See assignment 2C, question 5

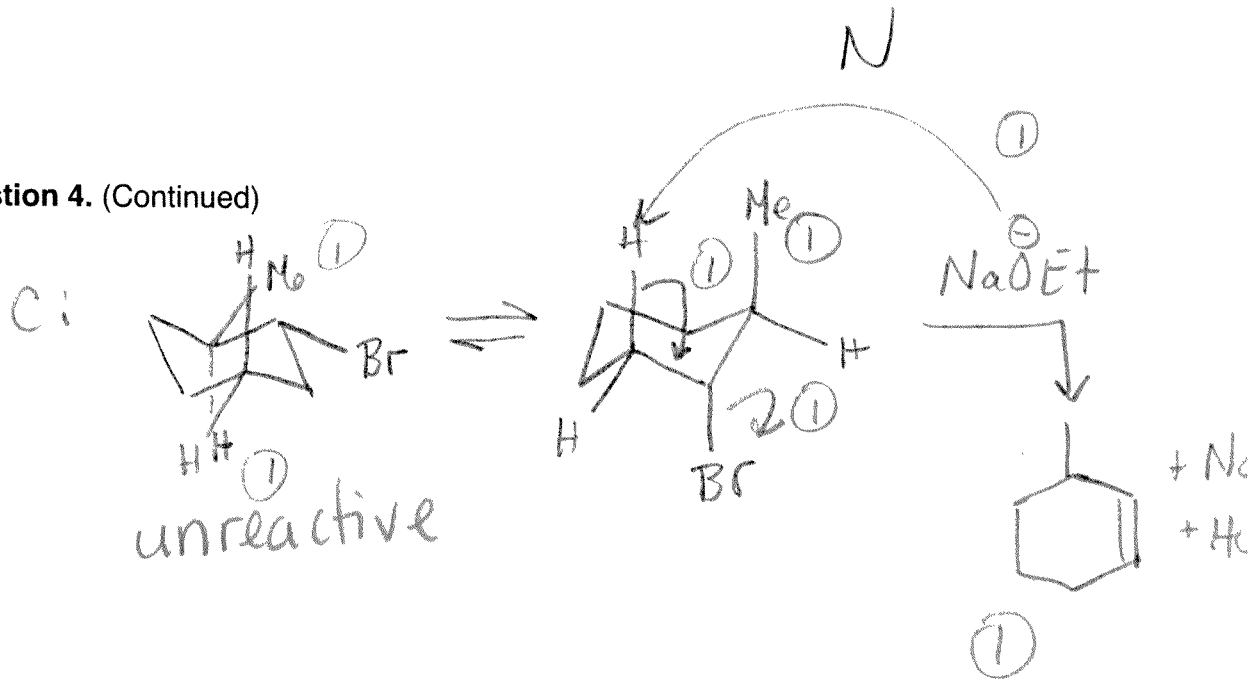


a) Provide a detailed mechanism for the formation of the products from the reactions of diastereomers **C** and **B**. Your answer should involve a detailed analysis of the conformational equilibrium for each diastereomer. (17 points)

B:



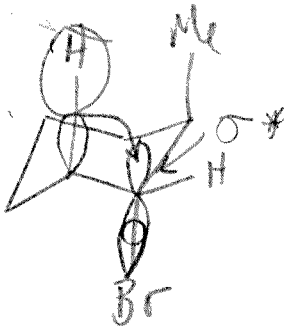
Question 4. (Continued)



b) Clearly explain why diastereomer **C** yields exclusively regioisomer **D**. (6 points)

- only one of the two possible chairs of diastereomer C has a C_β-H that is anti-perriplanar with C_α-Br.

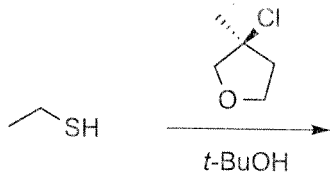
- Have allignment so that C_β-H can donate into the σ^* of the C_α-Br



3 points

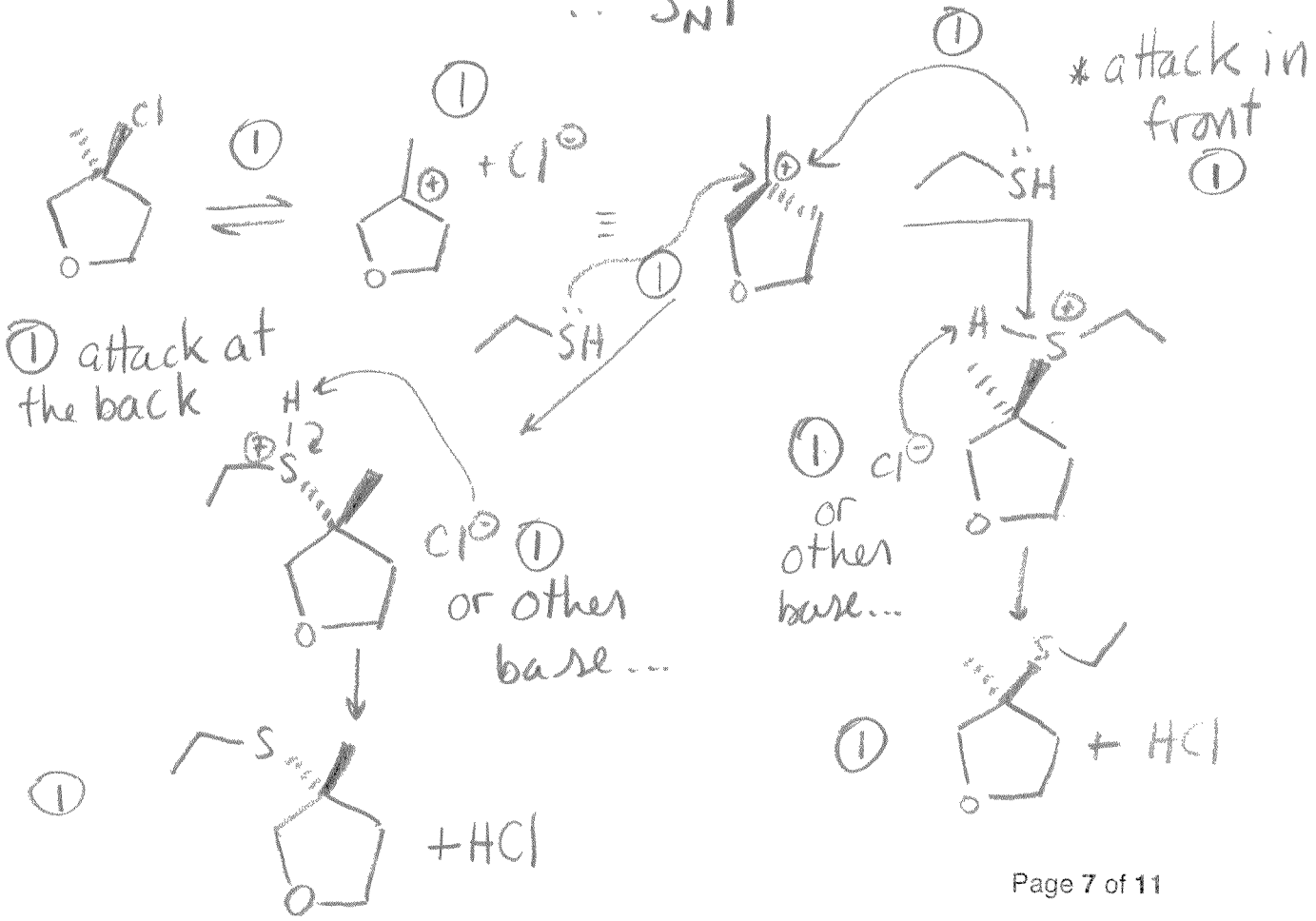
explanation of drawing = 3 points
or
drawing

Question 5. Provide a mechanism for the following transformation and predict the product(s) that will be formed. (10 points)



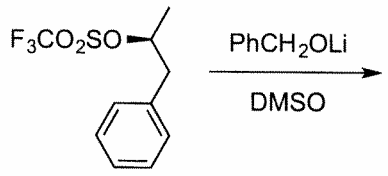
- bulky Non-nucleophilic solvent
- tertiary halide group
- decent polarizable nucleophile (SH)

∴ S_N1

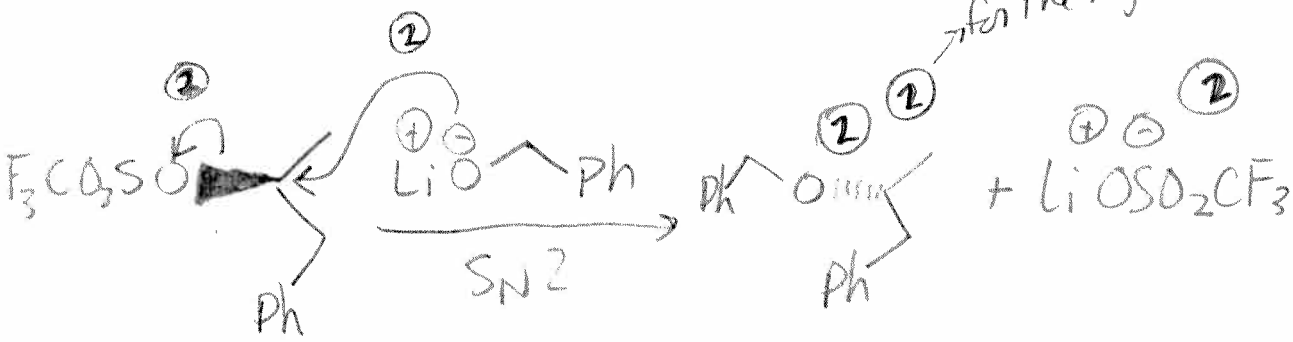


J

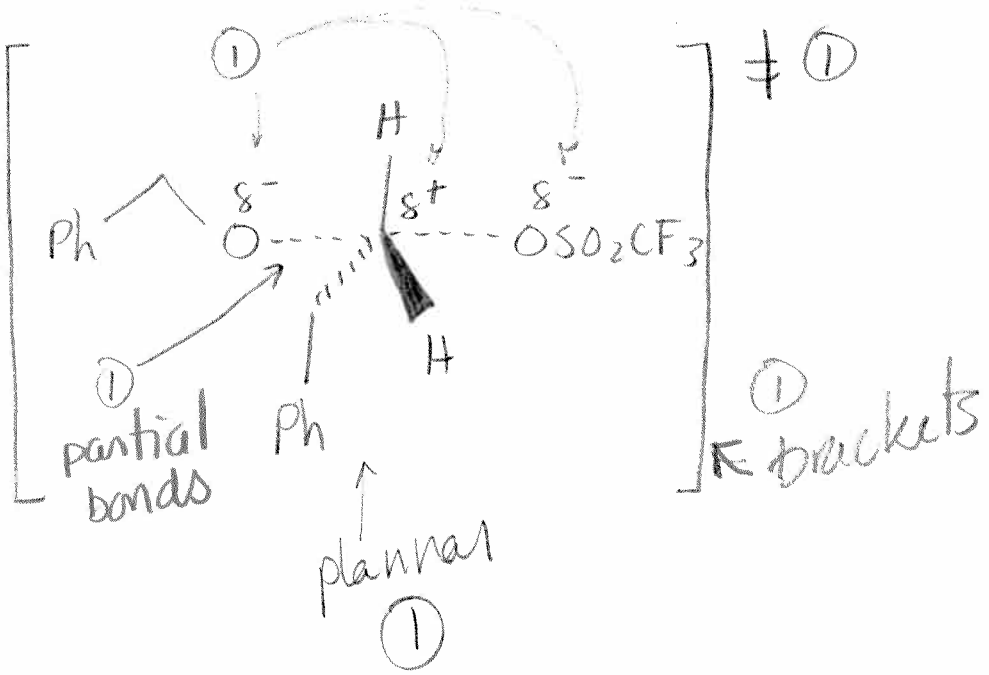
Question 6. For the following substitution reaction…



a) Give the mechanism and predict the product(s) of the reaction. (10 points)

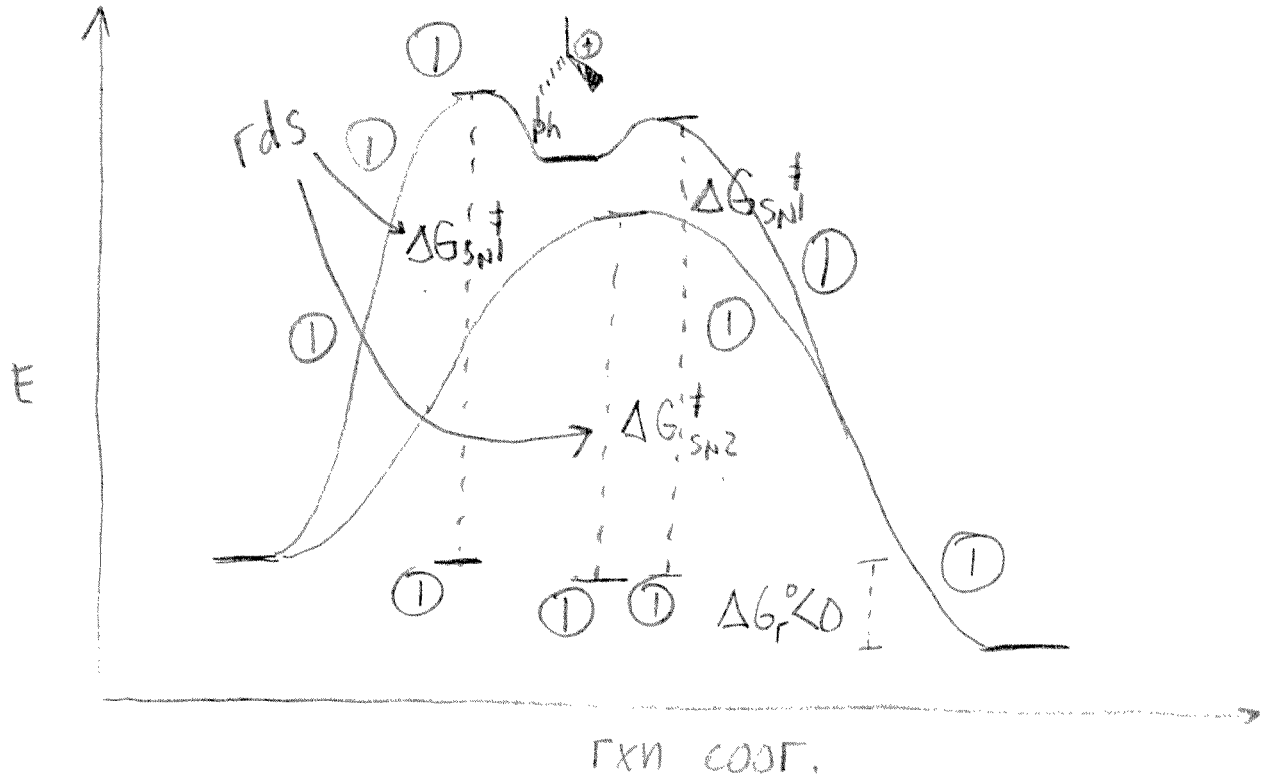


b) Draw the transition state for the formation of the major product(s). (5 points)



J

c) Clearly represent, using an energy diagram, the relative energy difference between the S_N1 and S_N2 involved in this transformation. Provided that the reaction is exothermic, comment on the rate of the reaction. (10 points)

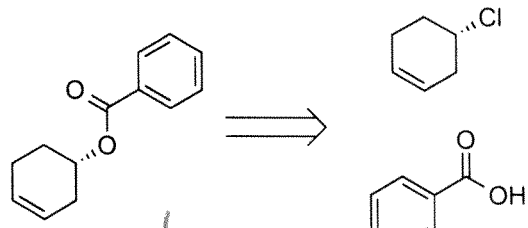


(1) $\Delta G^{\ddagger}_{SN2} < \Delta G^{\ddagger}_{SN1\,carbo.}$ ∴ rate of S_N2 is greater than the rate of S_N1

N

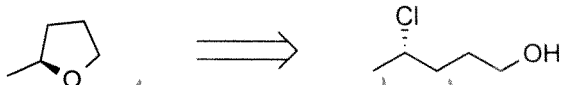
Question 7. Devise a synthesis for the formation of one of the following products. You may choose between synthesis **A** or **B**. Only one synthesis will be corrected, clearly identify the synthesis you want to be marked. Otherwise, only the first answer to appear will be considered. Full marks will only be obtained for the shortest possible synthesis (least number of steps) from the reactions seen in class. (8 points)

Choose ONE between...

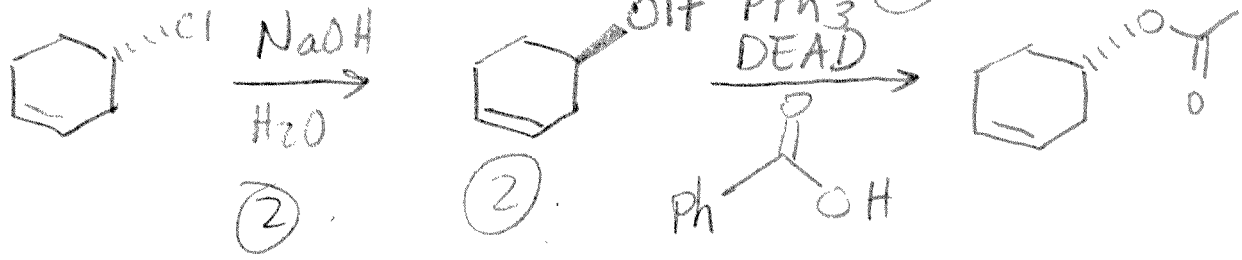
A 

product starting mat.

OR

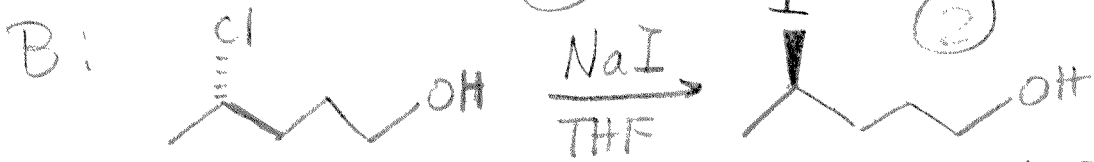
B 

product starting mat.

A: 

(2) (2) (2) (2) for inversion!

if Tosylation (1) point only.
(7 out of 8 max) (2)

B: 

(2) NaH, DMSO
↑ or another base but must be polar aprotic solvent because of SN2

(2) for inversion!