Chem 331
Final exam
December 13, 2002
Prof. Fox
180 minutes

The exam is open book,
Open notes. Models are permitted
Show your work in detail
300 points

WRITE YOUR NAME ON EVERY PAGE

NAME _____

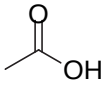
Chem 331, Final Exam. December 13, 2002 **NAME** _____

1. Identify the following functional groups (Total 10 points)

e.g.

alkene

nitrile

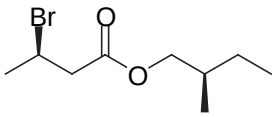


Carboxylic acid

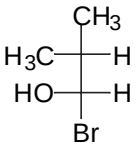
aldehyde

epoxide

2. Provide IUPAC names for the following (15 points each)

a 

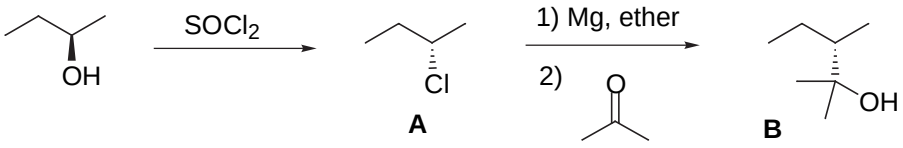
(2R)-2-methylbutyl-(3R)-3-bromobutanoate

b 

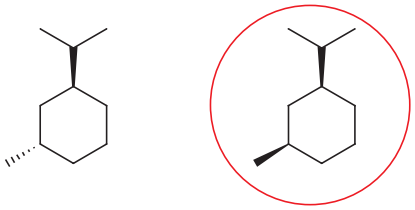
(1S)-1-bromo-2-methyl-1-propanol

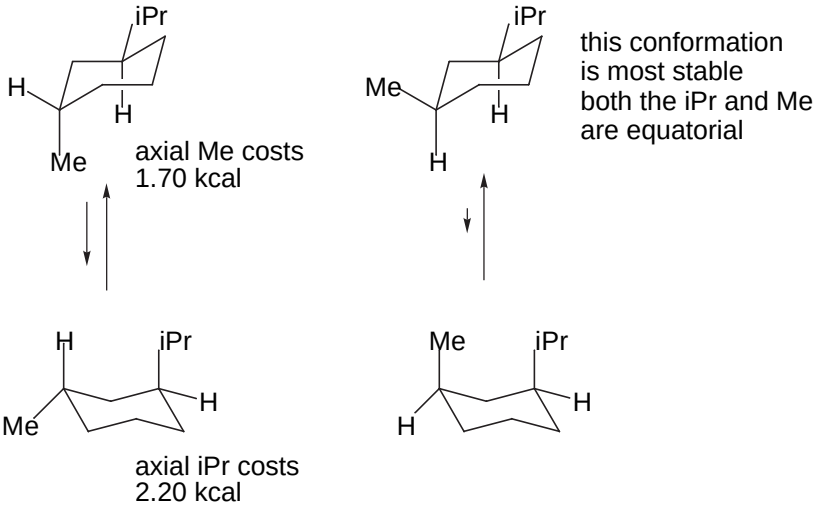
3. Draw the structures of **A** and **B**. You do not need to provide mechanisms. Stereochemistry is important!

(20 points)



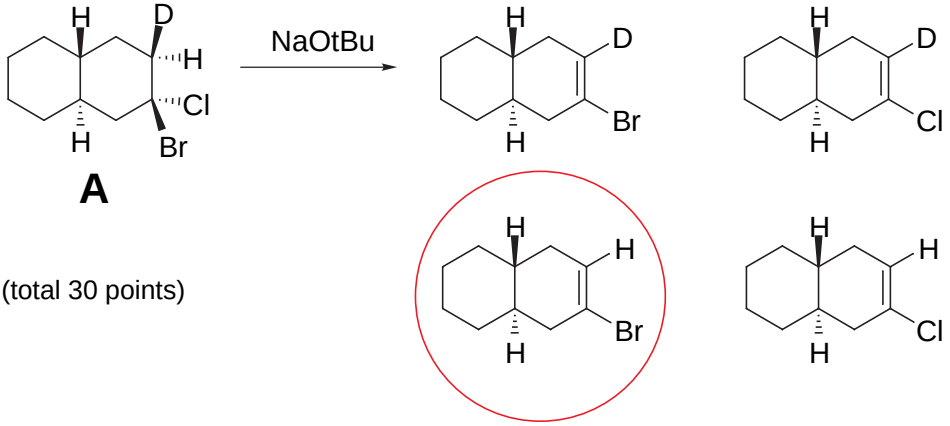
4. Circle the compound that is more stable (0 points). Draw clear 3-D chair representations of the two compounds and describe how your drawings support your answer (20 points).





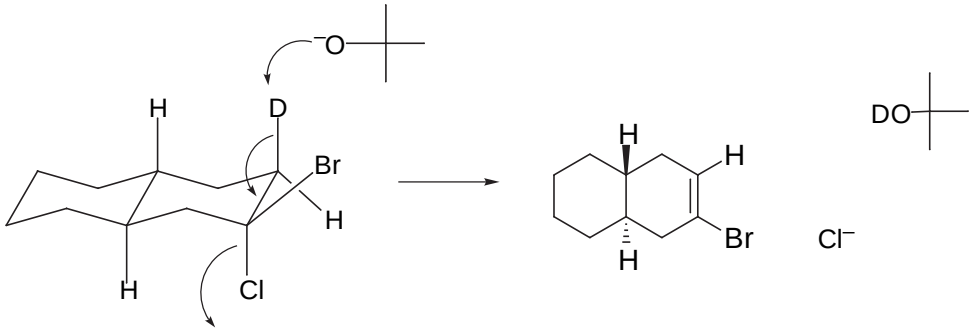
5. Compound **A** would undergo E2 elimination if treated with NaO*t*Bu. Explain which one of the four possible products below would be formed. To receive full credit, you must:

- circle the correct product (5 points)
- draw a clear 3-D representation of the trans-decalin framework **1** (12 points)
- provide a mechanism and description of why only only one compound is formed (13 points)



A

(total 30 points)

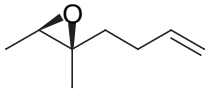


Anti-periplanar E2 elimination. The axial substituents (D and Cl) are eliminated. Trans-decalin cannot ring flip, and therefore a conformation cannot be adopted in which the Br or H is axial.

6. The reactions below would not proceed as shown. Explain why (be concise), and indicate which product would be formed instead.

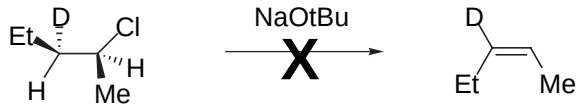
a.

(20 points)



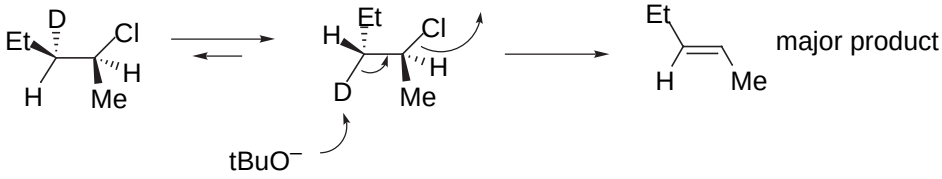
the more highly substituted (and more electron rich) double bond is the most reactive towards epoxidation

b.



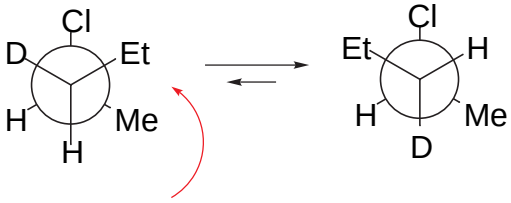
you must show a mechanism with attention to stereochemistry

(20 points)



Newman projections

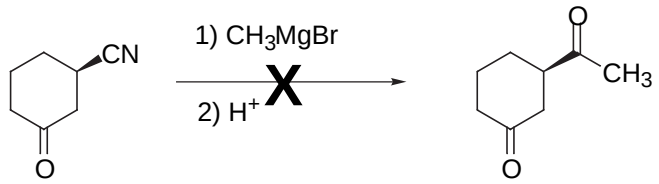
antiperiplanar elimination will predominantly occur from the more populated conformer.



this gauche interaction cost ca. 0.7 kcal/mol

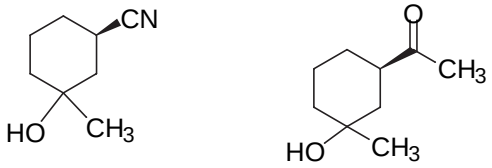
6(continued) The reactions below would not proceed as shown. Explain why (be concise), and indicate which produc would be formed instead.

c.

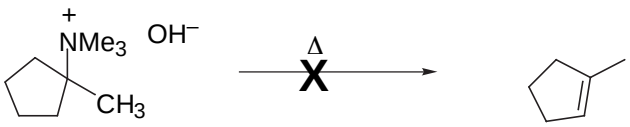


(20 points)

reduction of the nitrile is not selective in
the presence of the ketone. Either of the answers below were accepted

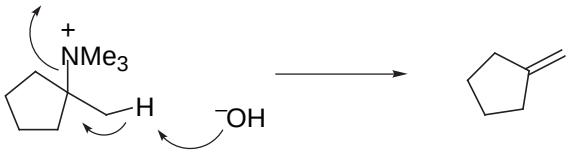


d.



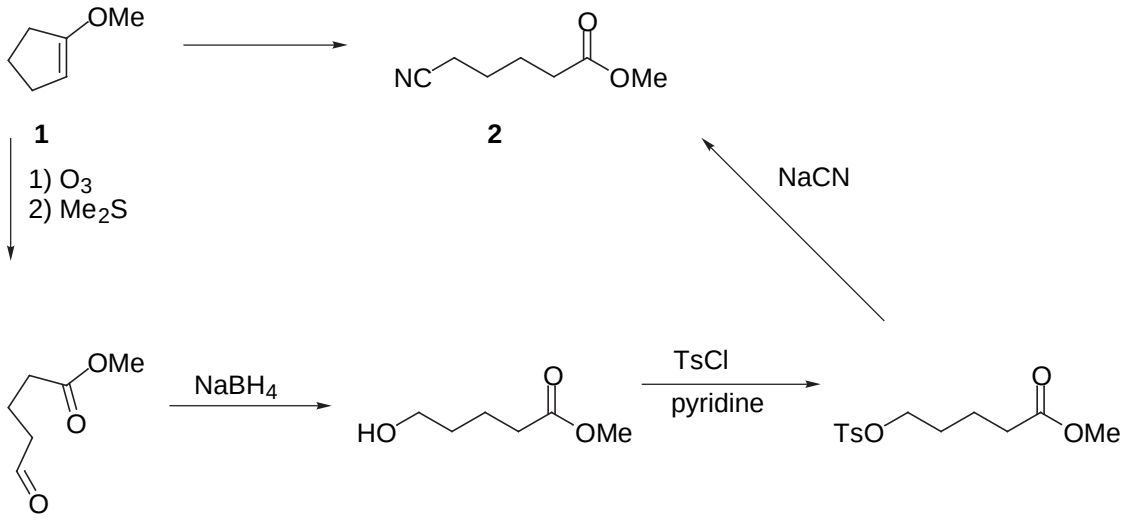
(20 points)

Hoffman Eliminations give the least substituted double bond product via reaction of the most sterically accessible hydrogen

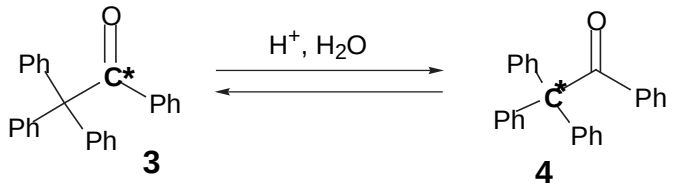


(40 points)

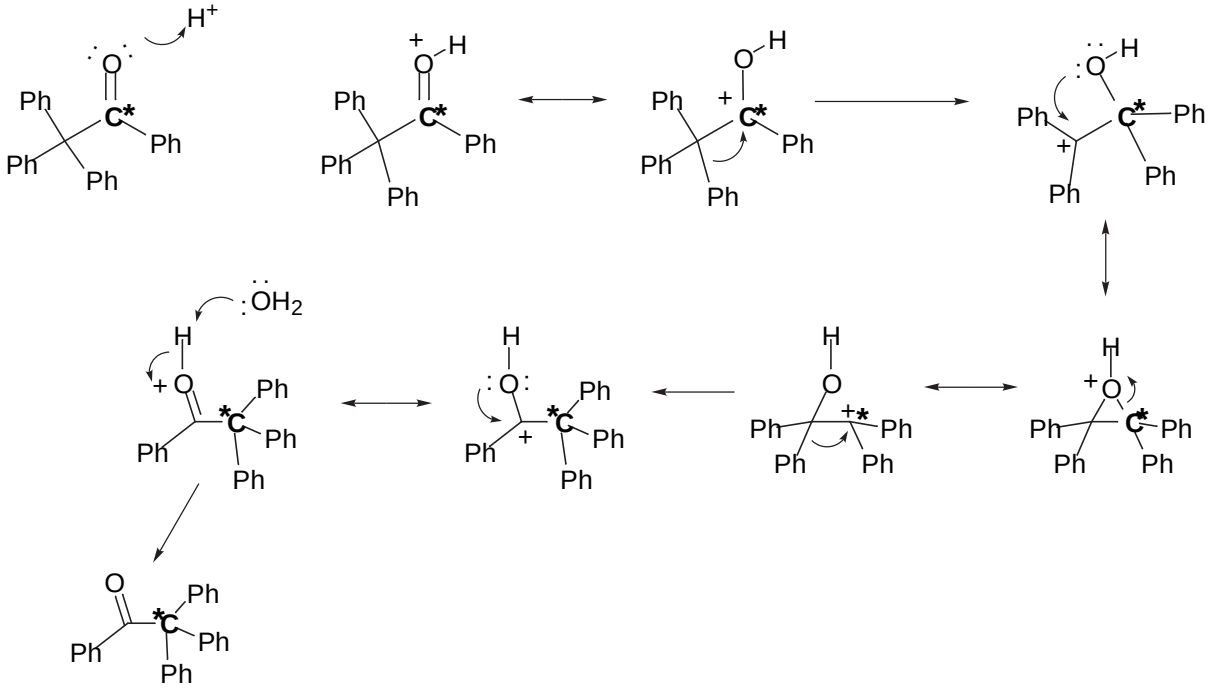
7. Propose a multistep synthesis of **2** using **1** and any other materials.



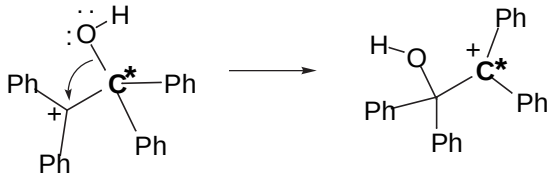
8. Propose a detailed mechanism for the interconversion of **3** and **4**. (35 points)



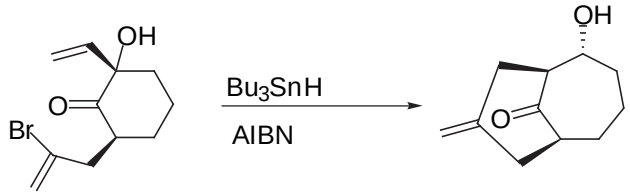
C* = C^{13}
all other carbons are C^{12}



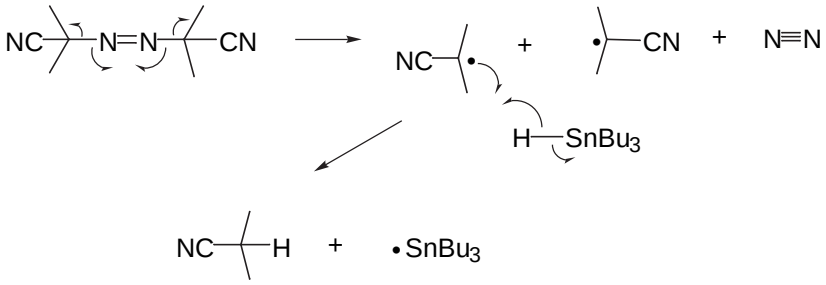
The following was NOT accepted:



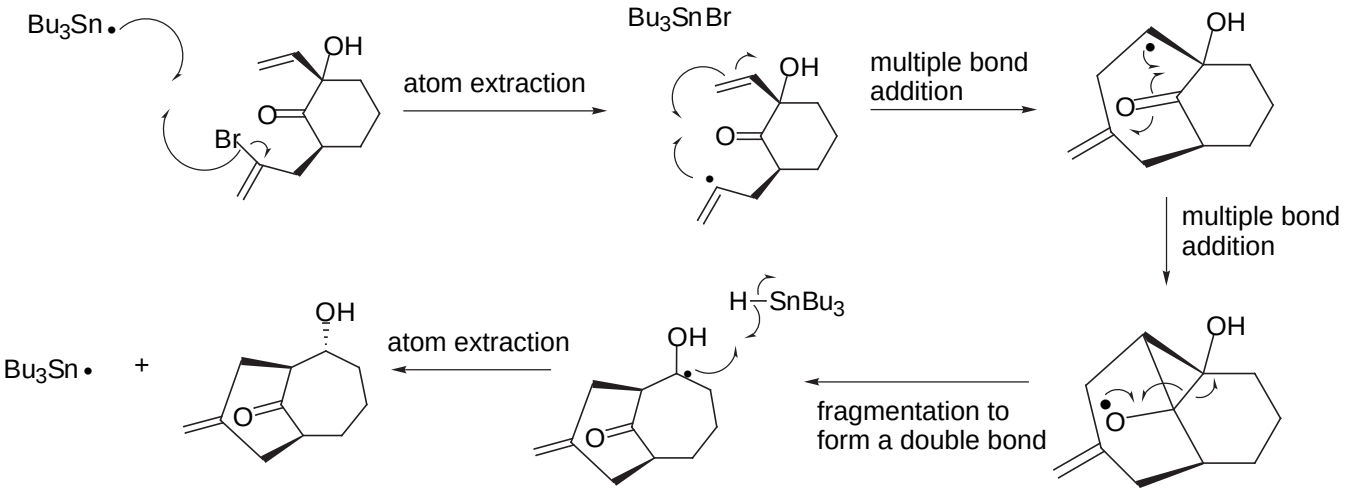
9. Propose a detailed mechanism (35 points)



Initiation



Propagation



The solution uses the three reactions that you know for radical reactions. The following was *not* accepted: single bond additions are not part of your synthetic toolkit!