

CHEM 3311-100
Exam 3, November 19
Fall 2009

By printing my name and signing below, I pledge that
"On my honor, as a University of Colorado at Boulder student, I have neither given nor received unauthorized assistance on this
work."

Name (Please PRINT Clearly) _____ *Answer Key* _____

Your Signature _____

Please Circle Your Recitation TA's Name: **Jacque Richardson**

Noel Thomsen

Recitation Day & Time _____ (example, Monday, 8 AM)

Grading Information

Page # Points Possible Your Score

2 (Questions 1 & 2)	24	—
3 (Question 3)	34	—
4 (Question 4)	20	—
5 (Questions 5 & 6)	22	—

_____ **TOTAL (out of 100)**

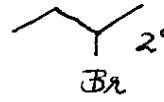
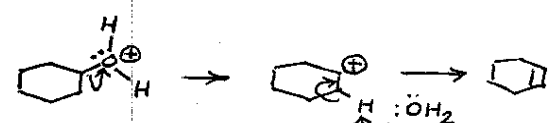
1 H	
3 Li	4 Be
11 Na	12 Mg

					2 He
5 B	6 C	7 N	8 O	9 F	10 Ne
13 Al	14 Si	15 P	16 S	17 Cl	18 Ar

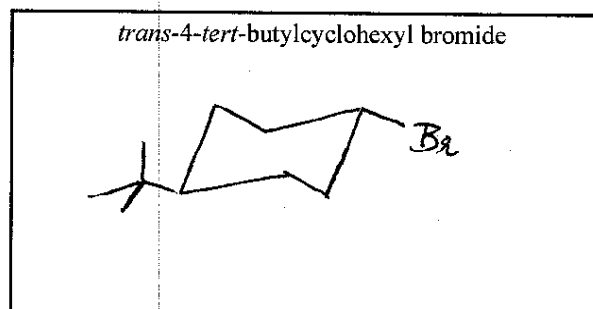
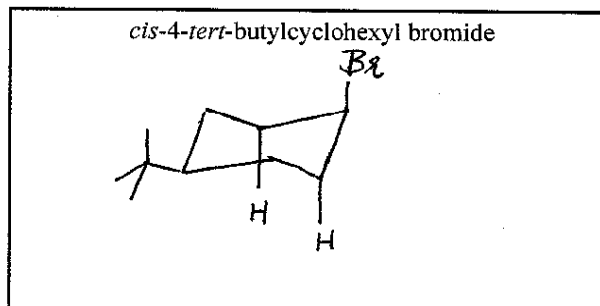
General Instructions

- (1) This is a **CLOSED BOOK** exam! No notes and molecular models are allowed.
- (2) Please **WRITE LEGIBLY & CLEARLY**; minimize erasing and draw a line through information that should not be graded. Untidy work will **NOT BE GRADED**.
- (3) Please follow instructions provided in each question. The grading rubric is based on the information requested in the question.
- (4) You have 2 hours to complete the exam.
- (5) Write your **name at the top of each page**, starting with page 2 and **sign the Honor Code pledge** on the cover page.
- (6) Scratch paper is provided. Please **DO NOT** submit scratch papers with your exam.
- (7) If caught cheating, you will receive at best an F for this exam. The instructor reserves the right to proceed further in compliance with university policies.
- (8) Please **DO NOT LEAVE THE ROOM** after the exam starts so as to minimize interruptions.
- (8) If you complete the exam early, please leave the room quietly after handing in your exam!

1. (12 points) Identify all the *true statements* and circle the letter to the left of each statement.

- T (A) Substitution will predominate over elimination in the reaction of 1-bromopropane with $\text{CH}_3\text{CH}_2\text{ONa}$ in DMSO at room temperature.
good Nuc
1° alkyl halide *solvent favors S_N2*
- F (B) $\text{CH}_3\text{CH}_2\text{S}^-$ is both a weaker base and less nucleophilic than $\text{CH}_3\text{CH}_2\text{O}^-$ (pK_a of $\text{CH}_3\text{CH}_2\text{SH} = 10.5$).
yes *no*
- F (C) In aqueous formic acid (HCOOH), isobutyl bromide undergoes solvolysis at a faster rate than *sec*-butyl bromide.
protic solvent *Br* *1°*  *2°*
- T (D) $\text{S}_{\text{N}}2$ and E2 mechanisms represent concerted processes.
strong base 
- T (E) The reaction of cyclohexanol with H_2SO_4 is an E1 reaction.
- F (F) The reaction of 2-bromo-2-methylbutane with $\text{CH}_3\text{CH}_2\text{ONa}$ in $\text{CH}_3\text{CH}_2\text{OH}$ occurs by an E1 pathway. *E2*
Br *3° alkyl halide*

2. (12 points) *cis*-4-*tert*-butylcyclohexyl bromide reacts with $\text{KOC}(\text{CH}_3)_3$ in $(\text{CH}_3)_3\text{COH}$ 500 times faster than the *trans*-isomer. Draw the most stable chair conformation for each stereoisomer in the appropriate box. Explain in 3 or fewer sentences the observed kinetic results (i.e., why does one stereoisomer react faster under identical conditions?).



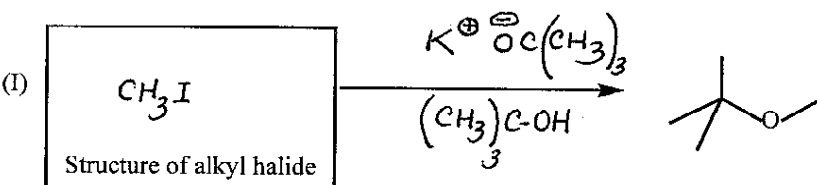
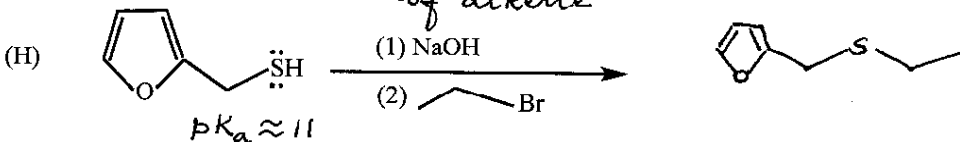
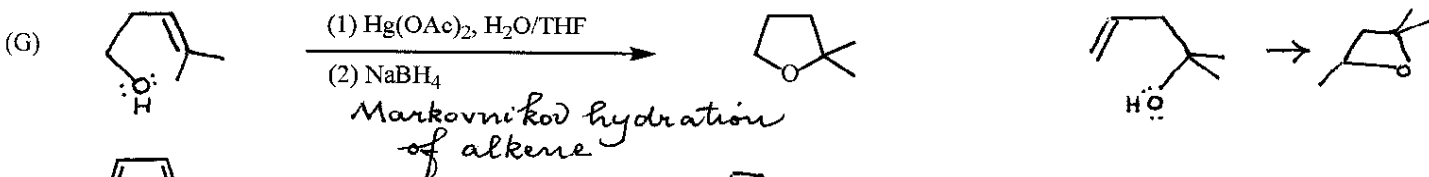
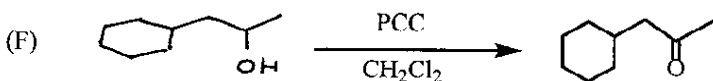
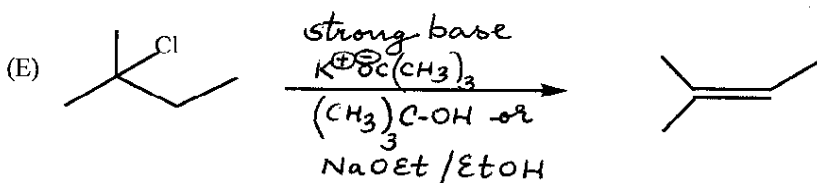
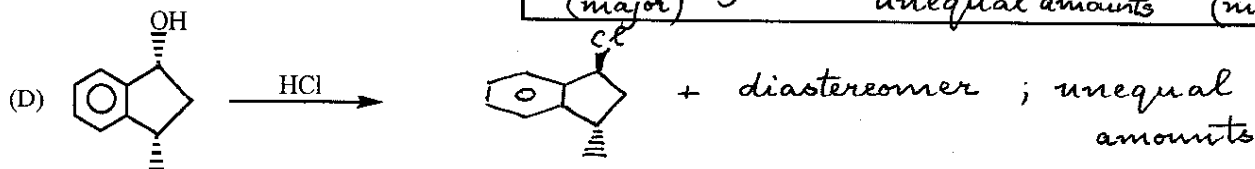
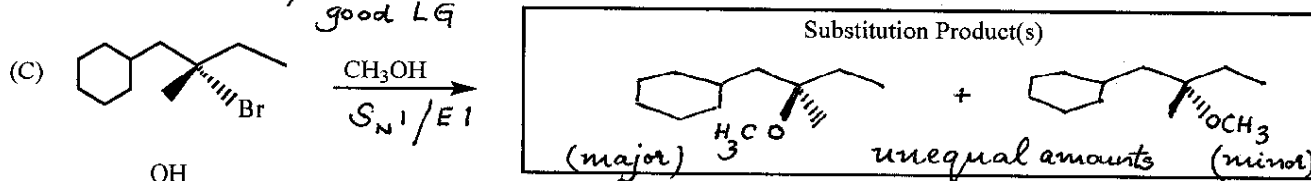
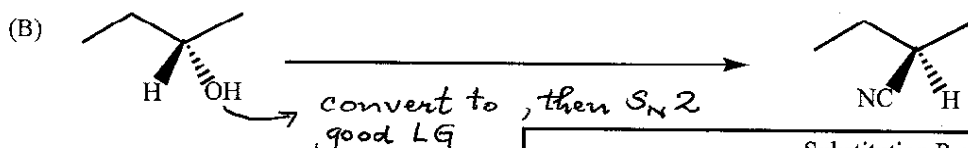
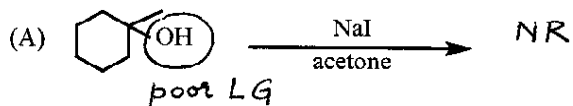
Explain the observed kinetic results in 3 or fewer sentences.

2° alkyl halide
 Strong base, poor nucleophile, E2 elimination
 anticoplanar arrangement of βH , leaving group, α -& β -carbons
 Lower E_a in *cis* compared to *trans*

Major product of reaction with *cis*-4-*tert*-butylcyclohexyl bromide

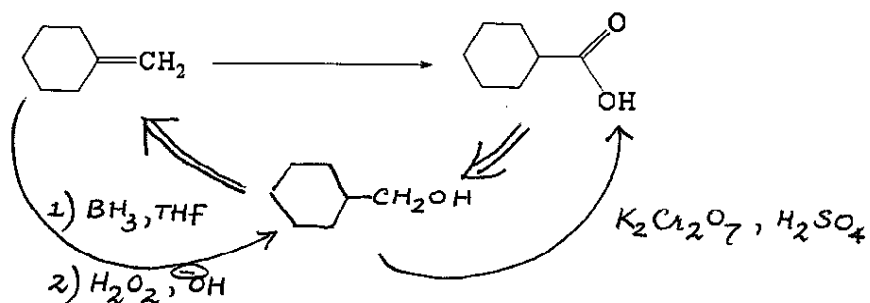


3. (34 points) Provide the missing information in each reaction. If enantiomers are formed, draw the structure of any one enantiomer and add "+ enantiomer". If diastereomers are formed, draw the structure of any one diastereomer and add "+ diastereomer". If the product is the meso compound, draw only one structure and write "meso compound". When stereoisomers are produced, indicate if they are formed in "equal" or "unequal" amounts. If no reaction occurs, please write "NR".

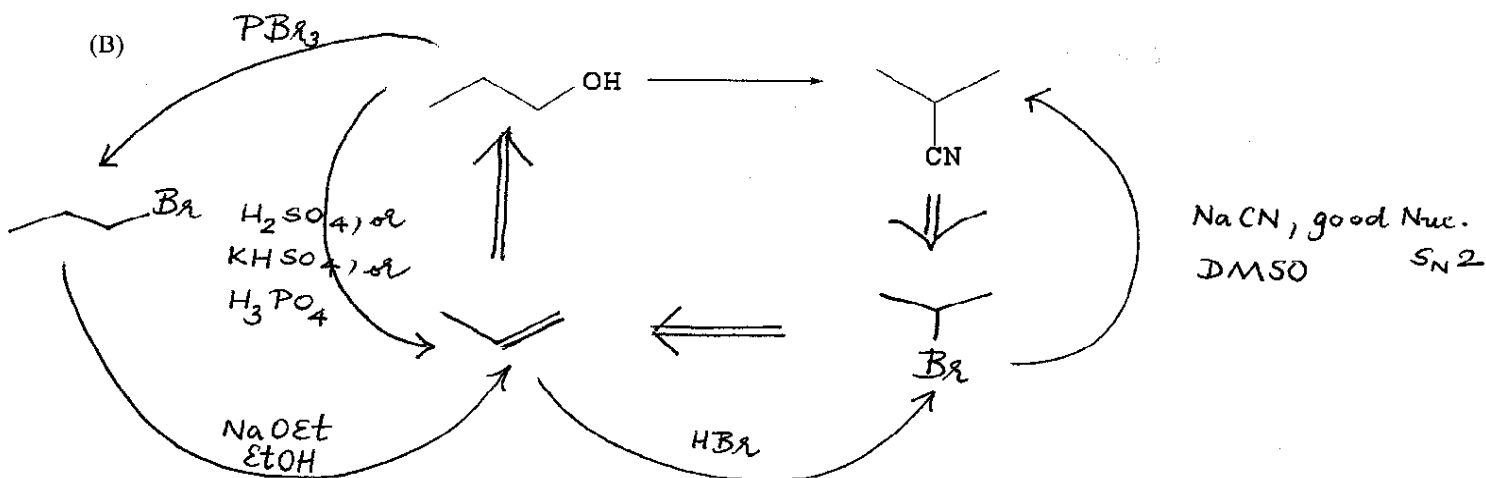


4. (20 points) Please write down each reaction that you propose to carry out these transformations. You must show the reagents and solvents used in each step. Please show CLEARLY the product in each step that serves as the substrate for the next step. You may use any organic or inorganic reagents.

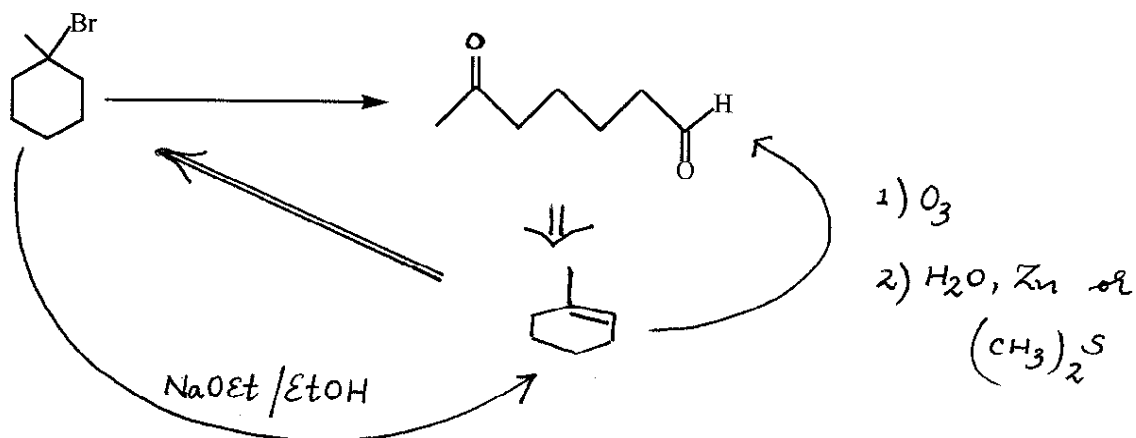
(A)



(B)

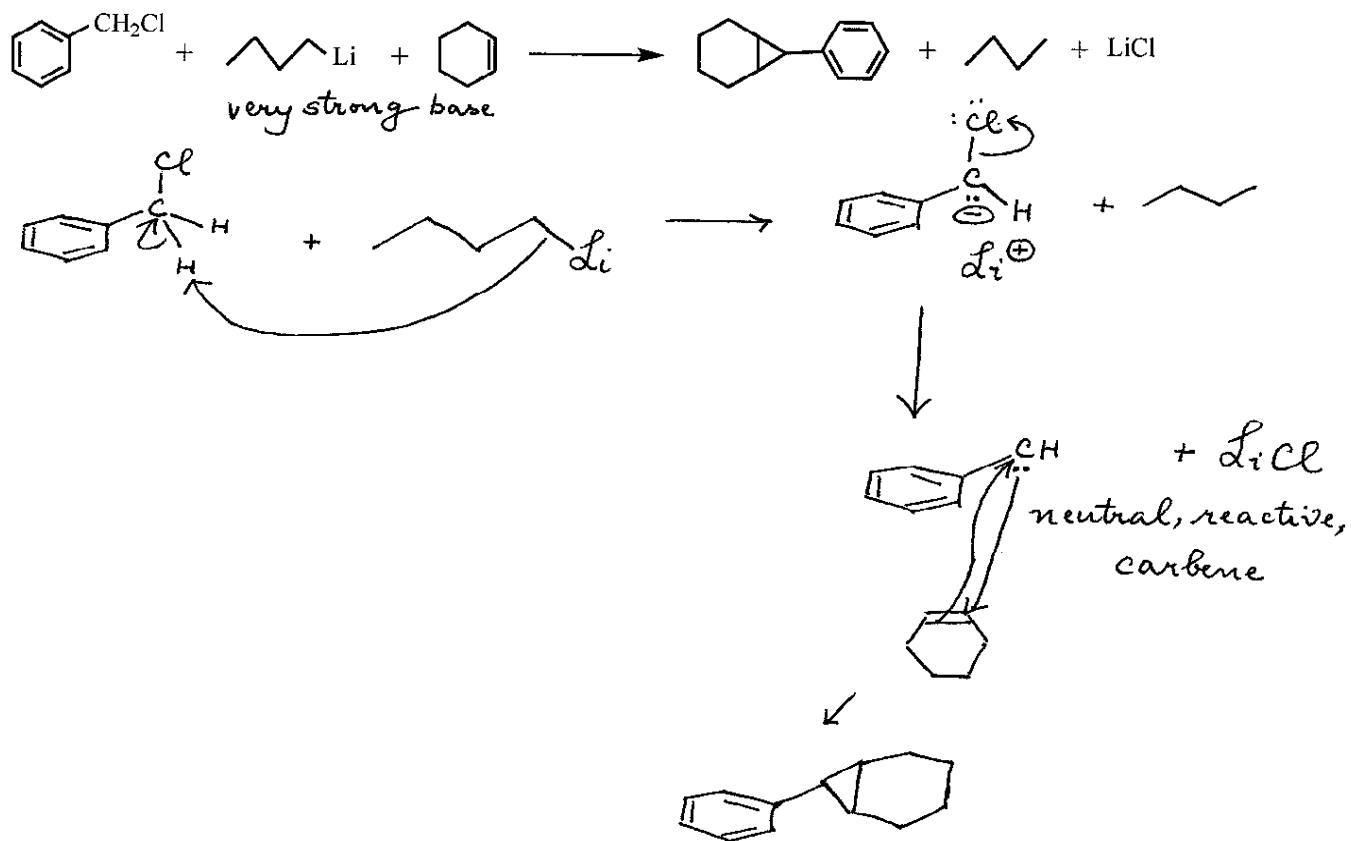


(C)



Points earned on this page _____

5. (10 points) Provide a mechanism for the reaction shown below. To earn partial credit, your mechanism must be CLEARLY LEGIBLE, and you must show all lone pairs and formal charges as well as the curved-arrow notation.



6. (12 points) Provide a synthesis of the molecule (or its enantiomer) starting with the reactant shown below. You may use any organic or inorganic reagents and/or solvents. Please write down each reaction that you propose and clearly show the reagents/solvents and product in each step of your synthesis.

