Printed Name: _____

CHEM 3311, Fall 2009
Professor Walba
~~First~~ Second Hour Exam
~~September 24~~October 22, 2009

scores:

1)

2)

3)

4)

5)

_____

CU Honor Code Pledge: On my honor, as a University of Colorado at Boulder Student, I have neither given nor received unauthorized assistance.

Name (printed): _____

Signature: _____

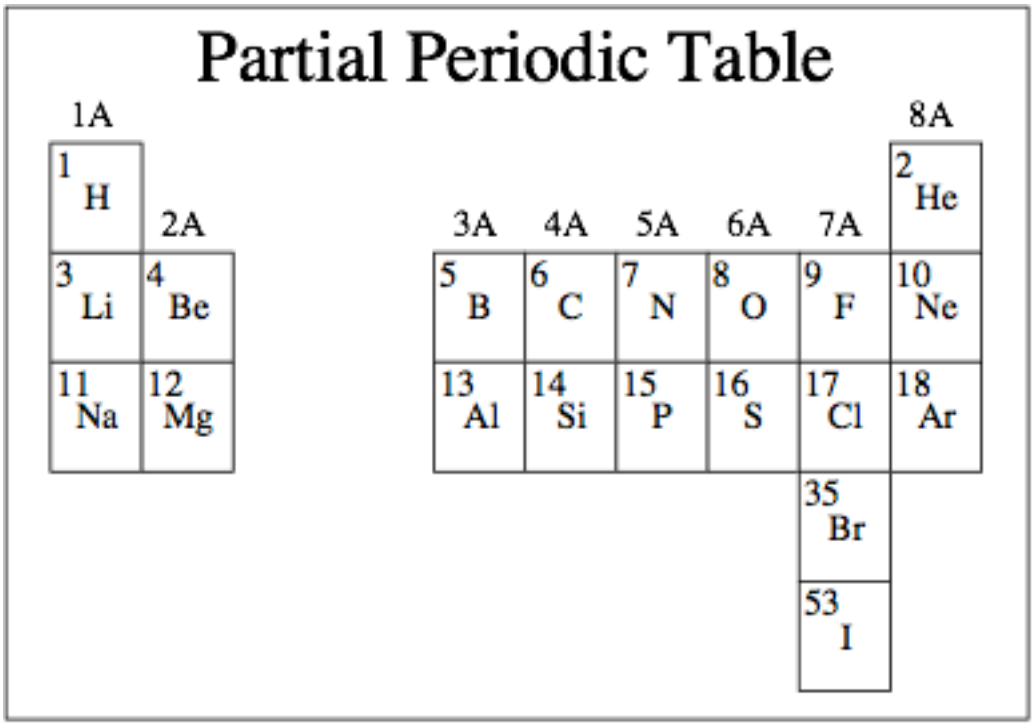
Recitation TA Name: _____

Recitation day and time: _____

This is a closed-book exam. The use of notes, models, calculators, scratch paper, or any other paraphernalia will not be allowed during the exam. Please put all you answers on the test. Use the backs of the pages for scratch.

PLEASE read the questions very carefully!

Partial Periodic Table

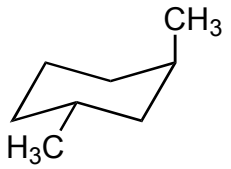


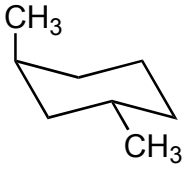
Printed Name: _____

1 (20 pts) Describe the relationship between each of the following pairs of structures using one of the following descriptors: constitutional isomers; homomers; conformers; enantiomers, or diastereomers.

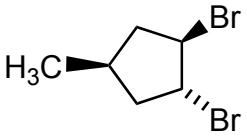
Please put your answers in the boxes

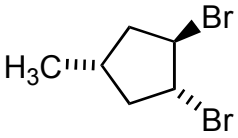
a)



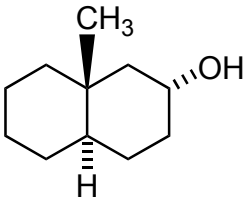


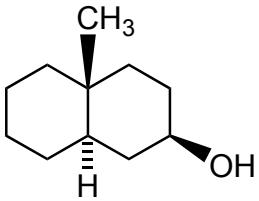
b)



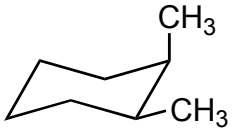


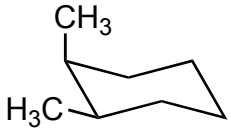
c)



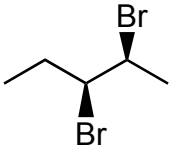


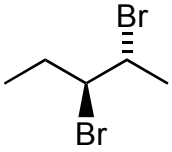
d)





e)





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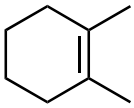
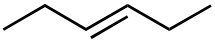
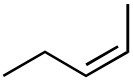
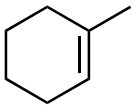
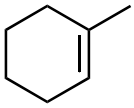
2. (20 pts) Give the single major product of each of the following reactions, carefully showing stereochemistry using wedges and dashes. If a racemate is formed, show only one enantiomer of the product, and label it "rac."

a)  $\xrightarrow{H_2, Pt/C}$

b)  $\xrightarrow{Br_2}$

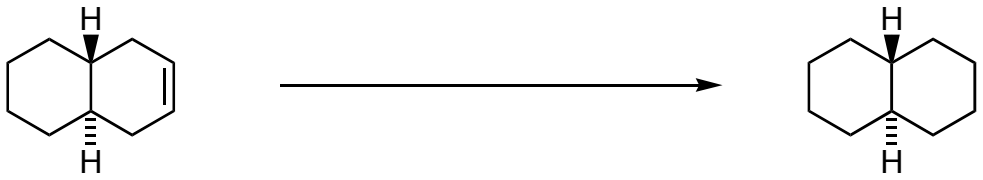
c)  $\xrightarrow{Br_2}$

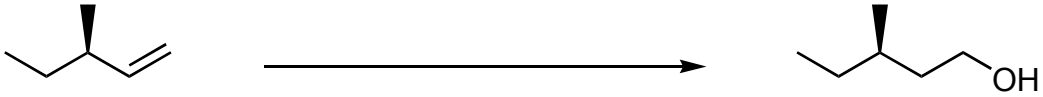
d)  $\xrightarrow{Br_2, H_2O}$

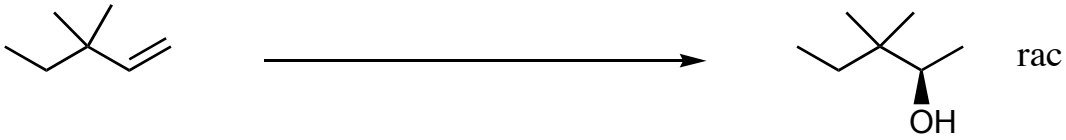
e)  $\xrightarrow[2.\ H_2O_2, NaOH]{1.\ BH_3 \bullet THF}$

Printed Name: _____

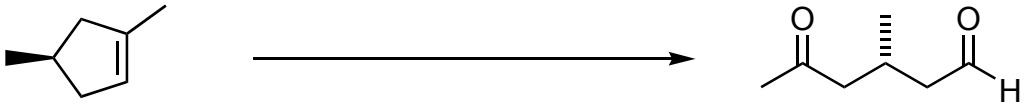
3 (20 pts) Propose reagents for accomplishing each of the following reactions. Make your reaction efficient (i.e. the target product should be the major product). Assume chiral starting materials and products are single pure enantiomers unless they are labeled "rac."

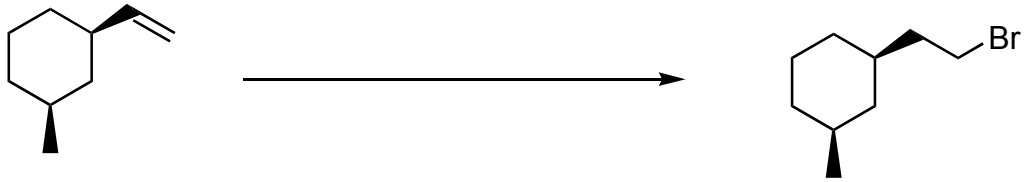
a) 

b) 

c) 

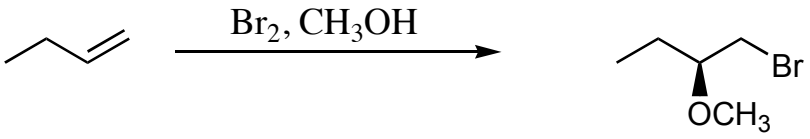
rac

d) 

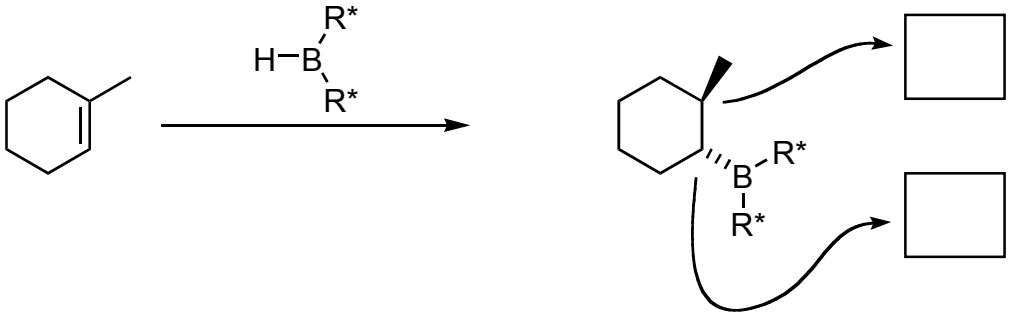
e) 

Printed Name: _____

4 (20 pts) a) Propose an arrow-pushing mechanism, showing all reactive intermediates (no transition states), for the following reaction. Indicate the stereochemistry of your intermediates using wedges and dashes.

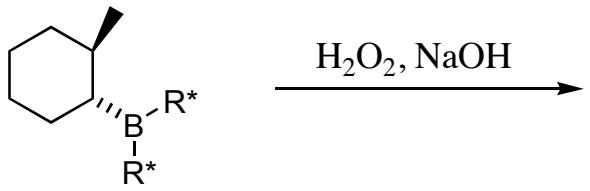


b) Chiral borane reagents exist, which can give one enantiomer of product from an achiral starting material, as indicated in step 1 below (R* means a chiral group). Give the configuration of the stereocenters in the product using the R/S stereochemical descriptors. Put your answers in the boxes.

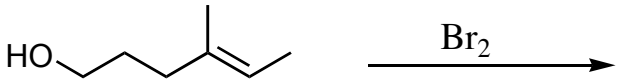


4. – continued

c) Give the structure of the product (ignore what happens to the R* groups) which forms in step 2 of the sequence shown below. Be sure to show the stereochemistry using wedges and dashes.



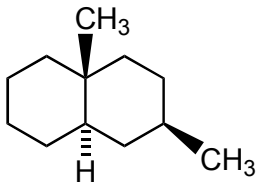
d) When compound **1** is treated with Br_2 in an unreactive solvent such as CH_2Cl_2, a single clean product is formed as a racemate. This product has molecular formula $C_7H_{13}BrO$. Give the structure of the product – draw only one enantiomer, carefully showing stereochemistry using wedges and dashes.



1

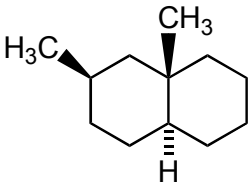
Printed Name: _____

5 (20 pts) a) Draw perspective chair structures for each of the decalin isomers given below, and **circle the more stable isomer**.



1

Perspective chair structure for compound **1**



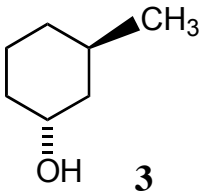
2

Perspective chair structure for compound **2**

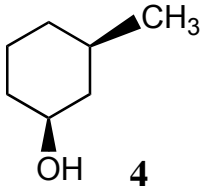
5 – continued

b) The hydroxyl group on a cyclohexane ring behaves as if it were larger than H, but smaller than CH_3. For example, a single 1,3-diaxial OH – H interaction causes about 1/3 the strain of a 1-3-diaxial CH3 – H interaction. As expected, this is close to the strain in gauche propanol.

For compounds trans-3-methylcyclohexanol (**3)** and cis-3-methylcyclohexanol (**4)**, carefully draw two flip-chair conformers for each compound. For each isomer, circle the more stable conformer. Also, circle the more stable isomer (**3** or **4**).



3



4

The more stable isomer should be circled

Two flip-chair structures for compound **3**, more stable conformation circled

Two flip-chair structures for compound **4**, more stable conformation circled