Answer Key

CHEM 3311-100
Exam 2, Fall 2011
Time: 2 Hours

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

Your Name (PRINTED IN CAPITAL LETTERS)

Last Name	**First Name**	**Middle Initial**

Your CU Student ID # (NOT Your Social Security Number)

_____

Your Recitation TA's Name

_____   _____ [-1 if missing or incorrect]
Last Name   **First Name**

Circle Your Recitation Day & Time [-1 if missing or incorrect]

Mon 8 AM (Clancey)   Mon 2 PM (Zhu)   Mon 5 PM (Barbour)   Tues 8 AM (Chaffey)

Tues 5 PM (Barbour)   Wed 8 AM (130) Mai   Wed 8AM (131) Clancey

Wed 11 AM (Alawneh)   Wed 12 PM (Chaffey)   Wed 5 PM (Alawneh)   Thurs 8 AM (Clancey)

Grading Details

Page # (Question #s)	Points Possible	Points Earned
3 (Q 1)	20	_____
4 (Q 2)	20	_____
5 (Q 3)	20	_____
6 (Q 4)	20	_____
7 (Q 5)	12	_____
8 (Q 5)	8	_____

TOTAL SCORE (out of 100)   _____

General Instructions

(1) This is a CLOSED BOOK exam; nothing is allowed except a few pencils or pens, eraser, and student ID.

(2) Please WRITE LEGIBLY & CLEARLY; minimize erasing! Untidy/illegible work will NOT be graded.

(3) Print your name after acknowledging the student honor code. Write your name on each exam page in the space provided.

(4) Use the back of the exam pages as scratch paper, if necessary.

(5) If suspected of/caught cheating, you will receive at best an F for the exam. The instructor reserves the right to proceed further in compliance with university policies on academic violations.

(6) You may not leave the room after the exam has started. Please leave quietly after you submit your exam to the TA or instructor.

Periodic Table

H																	He
Li	Be											B	C	N	O	F	Ne
Na	Mg											Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
Cs	Ba	La	Ha	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
Fr	Ra	Ac															

CHEM 3311 Table of Acidities

Acid	pK_a Value
HI	-10.1
HCl	-3.9
H_3O^+	-1.7
CH_3COOH	4.7
NH_4^+	9.3
Phenol	10
H_2O	15.7
Alcohols	16-18
$HC{\equiv}CH$	26
NH_3	36
$H_2C{=}CH_2$	45
CH_4	60

**1) Multiple Choice Questions (4 points each)**

(i) Predict the major product in the reaction of 3-methyl-1-butene with 1 M $HClO_4$.

(A) 2-Methyl-1-butanol

(B) 2-Methyl-2-butanol

(C) 3-Methyl-1-butanol

(D) 3-Methyl-2-butanol

(ii) Which reaction conditions would produce the best yield of 3-methyl-3-pentanol starting with (E)-3-methyl-2-pentene?

(A) Br_2, H_2O

(C) $Hg(OAc)_2$, THF-H_2O; followed by $NaBH_4$, OH^-

(B) H_2O, catalytic H_3O^+

(D) BH_3, THF; followed by H_2O_2, NaOH

(iii) Consider this reaction from a mechanistic point of view:

$$H_2C=C \begin{matrix} CH_2CH_3 \\ CH_2CH_2CH_3 \end{matrix} \quad + \quad HCl \longrightarrow$$
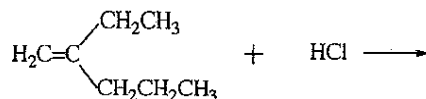
What is the stereochemical relationship between the products formed in this reaction?

(A) Diastereomers

(B) Enantiomers

(C) Structural or Constitutional Isomers

(D) Meso Compound

(iv) Select the correct IUPAC name of this compound.
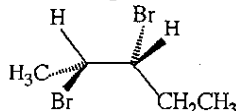
(A) (2R,3R)-2, 3-dibromopentane

(B) (2S,3S)-2, 3-dibromopentane

(C) (2R,3S)-2, 3-dibromopentane

(D) (2S,3R)-2, 3-dibromopentane

(v) Consider the reaction of 1-methylcyclohexene with B_2H_6 in diglyme, followed by H_2O_2 in the presence of NaOH. What is the stereochemical relationship between the final products?
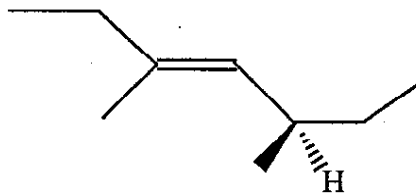
(A) Diastereomers, equal amounts

(B) Enantiomers, equal amounts

(C) Diastereomers, unequal amounts

(D) Enantiomers, unequal amounts

Total Points Possible: 20

Your Score _____

Answer Key

(PRINTED) Last Name, First Name

2) 20 points

Carefully consider the molecule shown below:

(A) What is the absolute configuration at the chiral carbon? __R__

(B) What is the stereochemistry at the double bond? __E__

(C) Consider the hydrogenation of the above compound using Pt/C. Draw the products of this reaction, carefully showing stereochemistry using wedges and dashes.
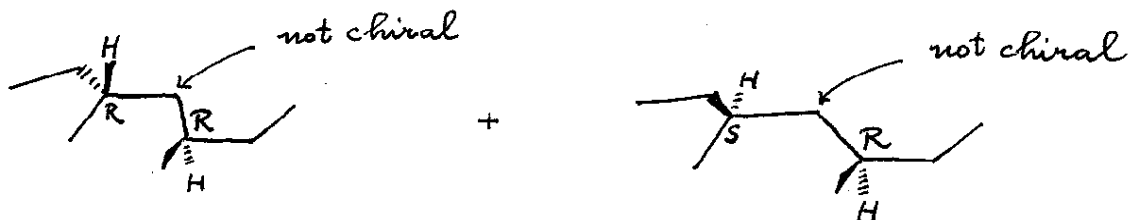
R & S labels were not required; however, they can help in assessing stereochemical outcomes.

(D) Examine the stereochemical outcome of this reaction.

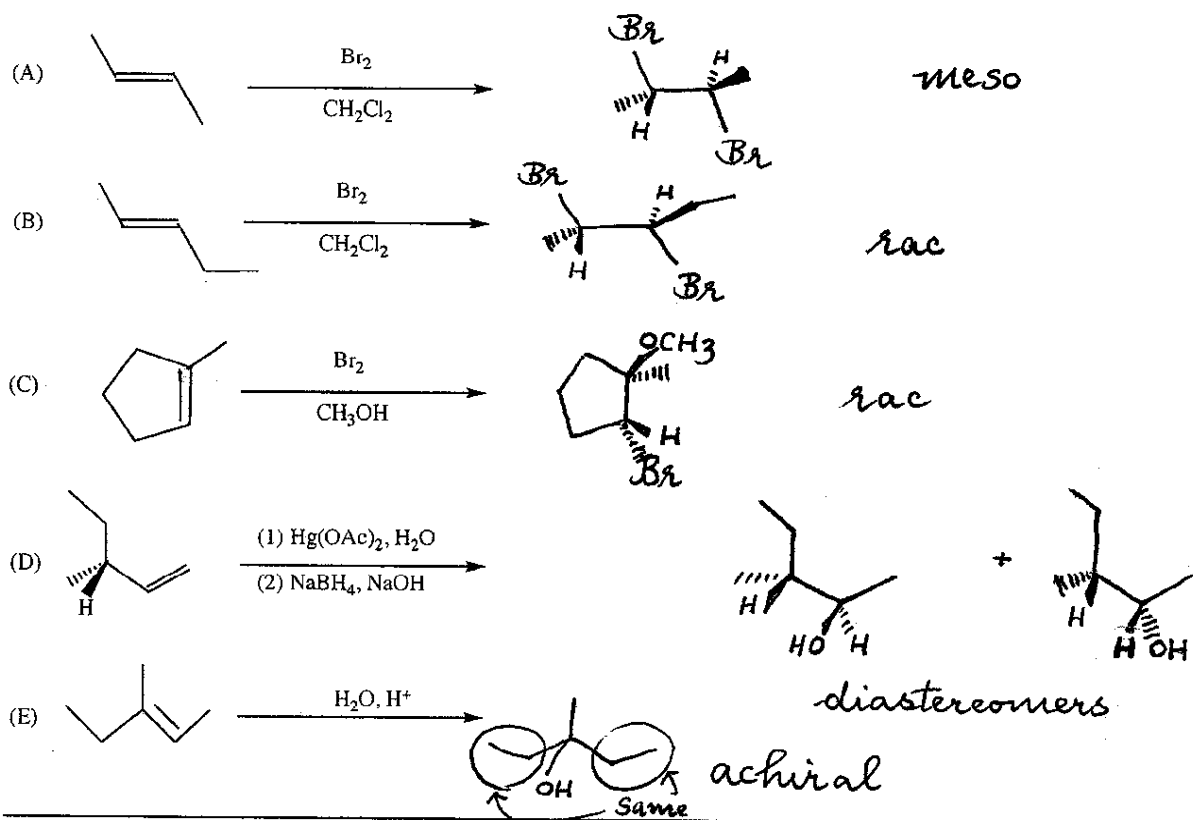(i) How are the products related (diastereomers, enantiomers, meso compound)?

Diastereomers

(ii) If the product is not the meso form, are the products obtained in equal or unequal amounts?

Unequal amounts

Total Points Possible: 20   *Your Score* _____

3) 20 points

Give the single major product of each of the following reactions, carefully showing stereochemistry using wedges and dashes.
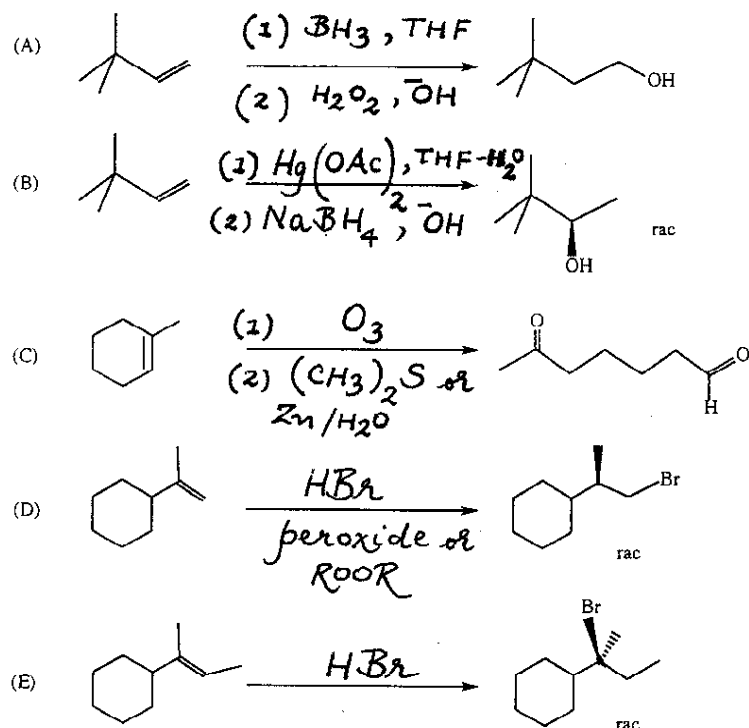
- If a racemate is formed, draw only one enantiomer of the product and label it "rac".
- If a meso compound is formed, draw one structure and label it "meso".
- If diastereomers are formed, draw BOTH stereomers.

(A) Br_2 / CH_2Cl_2 →   **meso**

(B) Br_2 / CH_2Cl_2 →   *rac*

(C) Br_2 / CH_3OH →   *rac*

(D) (1) Hg(OAc)$_2$, H$_2$O   (2) NaBH$_4$, NaOH   →   + *diastereomers*

(E) H_2O, H$^+$ →   *achiral* Same

Workspace

Total Points Possible: 20

Your Score _____

4) 20 points

Propose reagents to accomplish each of the following transformations. Make your reaction efficient (i.e., the target product should be the major product). Two-step reaction sequences may be required; be careful to indicate the separate steps in the sequence.

(A)

$$(1)\ BH_3,\ THF$$
$$(2)\ H_2O_2,\ {}^-OH$$

(B)

$$(1)\ Hg(OAc)_2,\ THF\text{-}H_2O$$
$$(2)\ NaBH_4,\ {}^-OH$$

rac

(C)

$$(1)\ O_3$$
$$(2)\ (CH_3)_2S\ \text{or}$$
$$Zn/H_2O$$

(D)

$$HBr$$
$$peroxide\ or$$
$$ROOR$$

rac

(E)

$$HBr$$

rac

Workspace

Total Points Possible: 20

Your Score _____

(PRINTED) Last Name, First Name
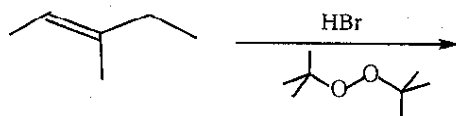
Answer Key

5) 20 points total

Propose arrow-pushing mechanisms for each of the following reactions. Show ALL intermediates in each mechanism, but do NOT show transition states. Draw complete structures showing formal charges, lone pairs, or unpaired electrons as appropriate.
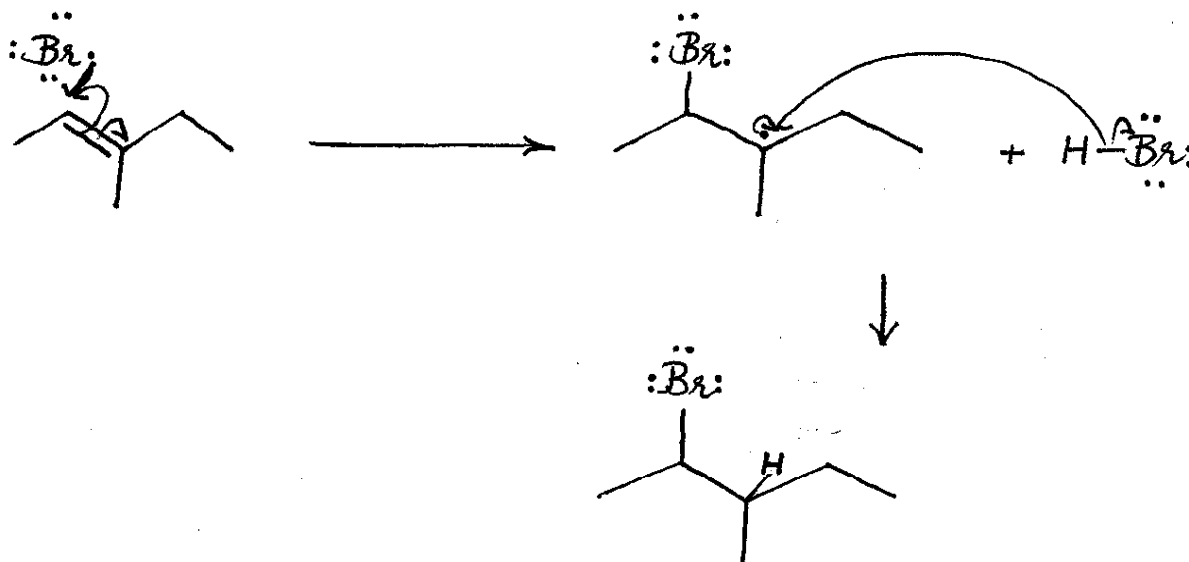
(A) 5 points

BH_3, THF
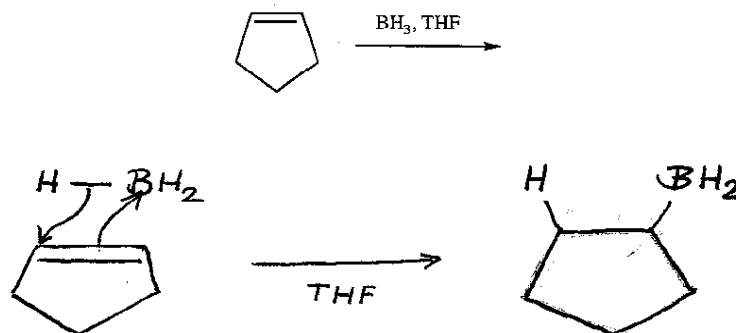
(B) 7 points
Propagation steps ONLY for the reaction:

HBr

NOTE: **3 Points will be deducted for writing initiation or termination steps in this section!**

Total Points Possible: 12

Your Score ____

5) Continued....

Propose arrow-pushing mechanisms for each of the following transformations. Show ALL intermediates in each mechanism, but do NOT show transition states. Draw complete structures showing formal charges and lone pairs.

(C) 8 points