

CHEM 3311-200

Exam 2

Fall 2008

By printing my name 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 \_\_\_\_\_  
Student CU ID # \_\_\_\_\_

**NOTE: Exams will be returned by your TA in recitation!**

Recitation TA's Name \_\_\_\_\_ (Bailey, Meylemans)  
Recitation Day & Time \_\_\_\_\_

**Grading Information**

Page #	Points Possible	Your Score
2 (Questions 1 & 2)	20	_____
3 (Question 3)	12	_____
4 (Questions 4 & 5)	24	_____
5 (Question 6)	22	_____
6 (Questions 7 & 8)	22	_____
		_____ TOTAL (out of 100)

**General Instructions**

- (1) This is a CLOSED BOOK exam! No notes and molecular models are allowed.
- (2) You have 2 hours to complete the exam.
- (3) Write your name at the top of each page, starting with page 2.
- (4) Use the back of exam pages for scratch paper.
- (5) **Cell phones must be turned off; cell phones, headsets, and Bluetooth devices must be placed in a backpack or on the floor, and may not be accessed during the exam.** Students violating this policy will be asked to leave and will receive a zero for the exam.
- (6) 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.

Name: \_\_\_\_\_

1. **(10 points)** Write bond-line structural formulas for ALL the constitutionally isomeric **alcohols** of molecular formula  $C_4H_{10}O$ . Assign an IUPAC name to each isomer using either the substitutive or functional class system of nomenclature. Please enter the information in the spaces provided. The number of rows may not necessarily correspond to the maximum number of alcohols but provides guidelines to facilitate grading.

Bond-line structural formula	IUPAC name

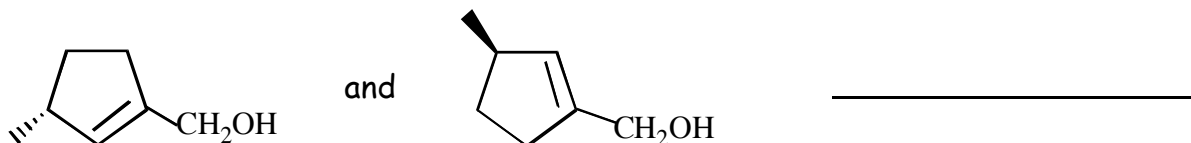
2. **(10 points)** Write a clear, legible, stepwise mechanism for the reaction of methanol with hydrobromic acid. Label each step as Step 1, Step 2, etc. and indicate whether it is a slow or fast step. For the slow step, label the mechanism as  $S_N1$ ,  $S_N2$ , E1 or E2. Please show ALL lone pairs, formal charges, and the arrow-pushing mechanism.

Name: \_\_\_\_\_

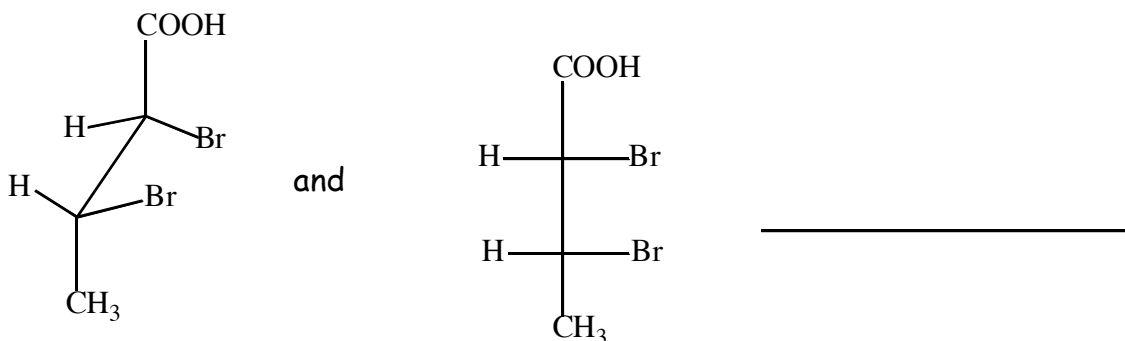
3. (12 points)

Identify the relationship in each of the following pairs as constitutional isomers, enantiomers, diastereomers, or identical (different ways of drawing the same compound). Write your answer on the line for each pair.

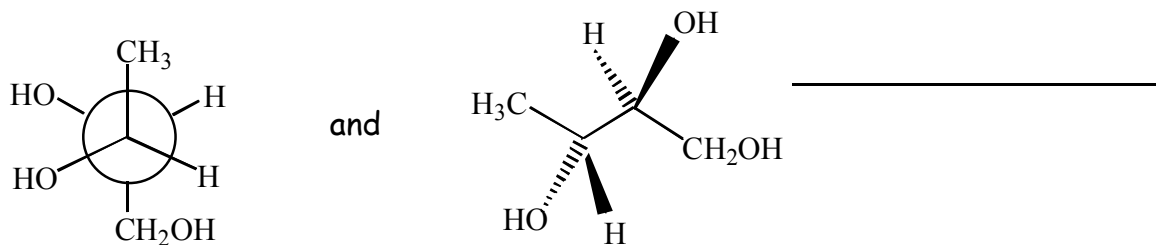
(A)



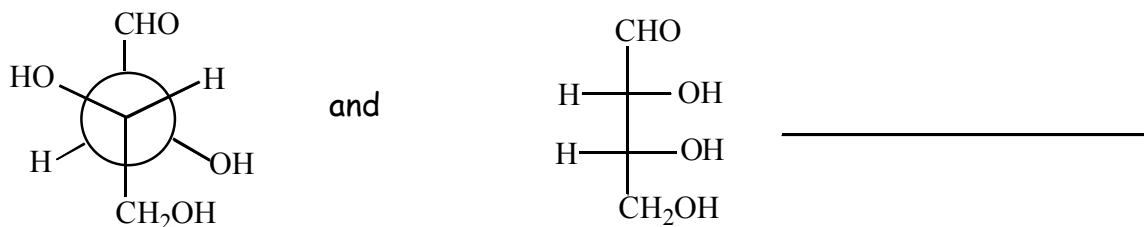
(B)



(C)



(D)



Name: \_\_\_\_\_

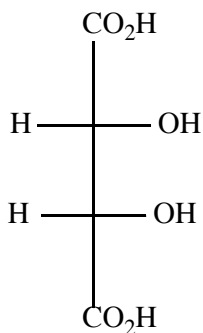
4. (12 points) Consider the gas-phase reaction of ethane with chlorine at high temperatures (420°C). Show the **detailed mechanism** for the **propagation steps** in the formation of chloroethane. Please write each step in the rectangular box provided. The number of boxes shown has no relation to the number of steps. Please show all lone pairs or unpaired electrons and the appropriate arrows CLEARLY.


5. (12 points)

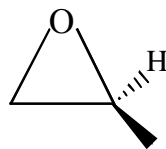
Identify each compound as achiral, chiral, and/or meso by **circling the correct label(s)** listed below each compound. Do NOT circle labels that are NOT relevant to the molecule shown (points will be deducted).



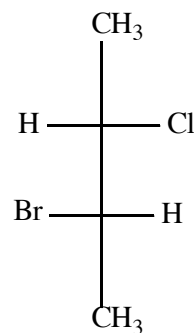
achiral  
chiral  
meso



achiral  
chiral  
meso



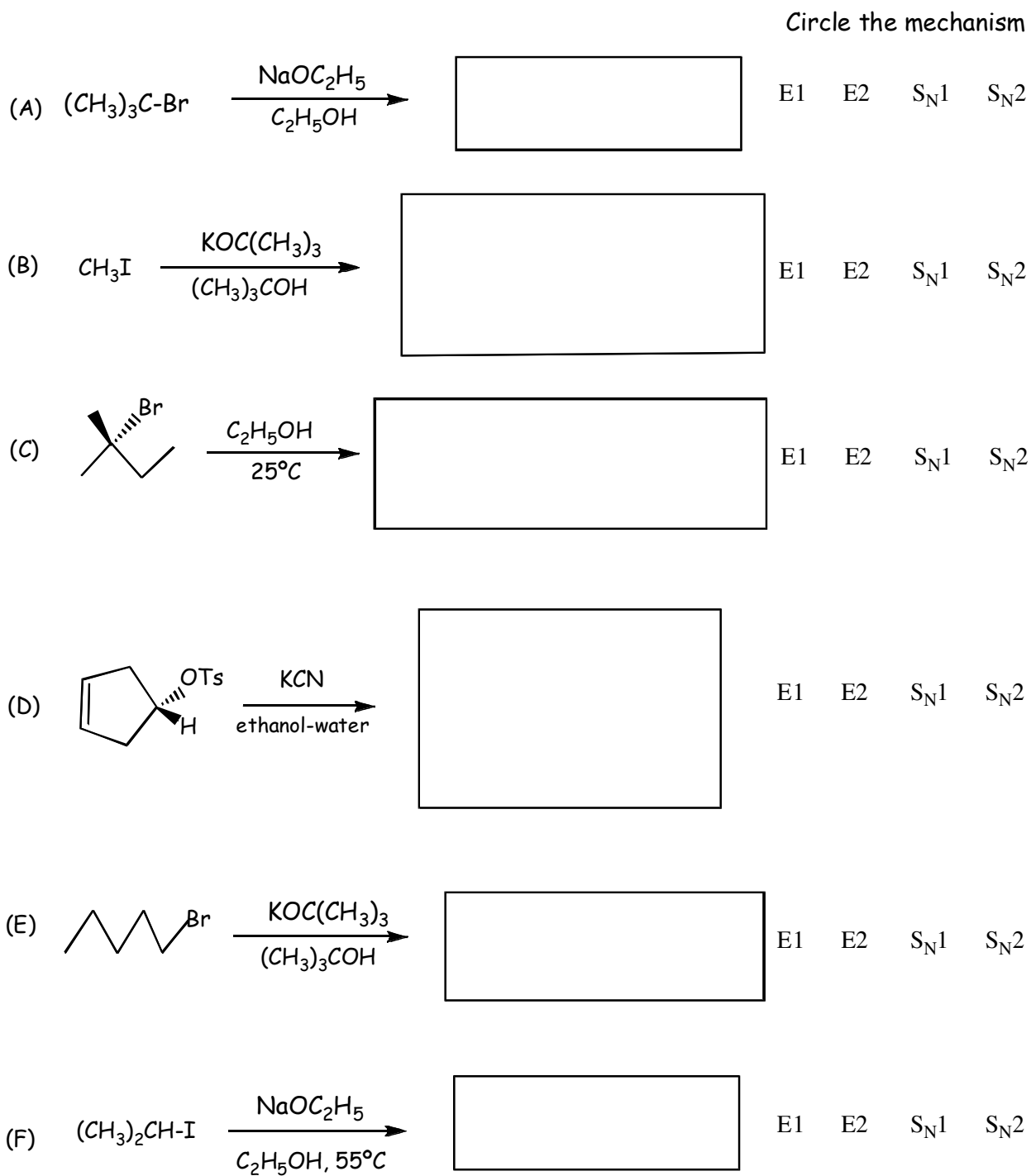
achiral  
chiral  
meso



achiral  
chiral  
meso

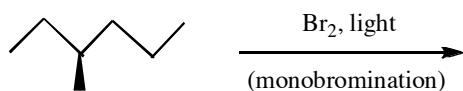
Name: \_\_\_\_\_

6. (22 points) Draw the structure of the **major product(s)** of each reaction. Circle the mechanism that accounts for the formation of this product.



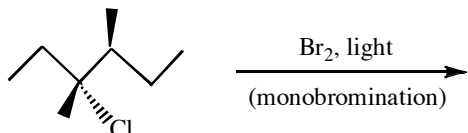
Name: \_\_\_\_\_

7. (12 points) Draw the correct stereochemistry of the product(s) for each reaction and specify, where necessary, whether you obtain equal or unequal amounts of enantiomers or diastereomers.



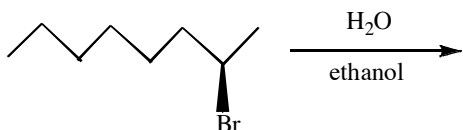
Circle one answer in each row of choices

enantiomers or diastereomers  
equal amounts                      unequal amounts



Circle one answer in each row of choices

enantiomers or diastereomers  
equal amounts                      unequal amounts

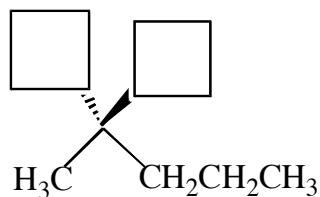


Circle one answer in each row of choices

enantiomers or diastereomers  
equal amounts                      unequal amounts

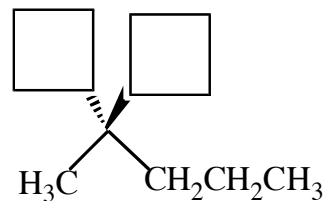
8. (10 points)

When **(S)-2-chloropentane** is reacted with lithium diethylcopper under  $S_N2$  conditions, an optically pure **3-methylhexane** is formed. The nucleophile is the ethyl carbanion. Complete the reaction shown below by placing the information requested in the appropriate boxes. Circle the absolute configuration at the stereogenic center in the product of the reaction.



**(S)-2-Chloropentane**

Place the appropriate atom of group of atoms in each box to complete the structure of **(S)-2-Chloropentane**



**( )-3-Methylhexane**  
(optically pure)

Place the appropriate atom of group of atoms in each box to complete the structure of optically pure **(?)-3-Methylhexane**

The absolute configuration at the chiral carbon in the optically pure (?)-3-Methylhexane is:

**R**                      **S**                      (Circle the correct answer)