

### Exam 3

Professor R. Hoenigman

I pledge to uphold the CU Honor Code:

Signature \_\_\_\_\_

Name (printed) \_\_\_\_\_

Last four digits of your student ID number \_\_\_\_\_

Recitation TA \_\_\_\_\_

Recitation number, day, and time \_\_\_\_\_

**You have 1.5 hours to complete this exam.**

No model kits or calculators allowed.

Periodic table and scratch paper are attached.

**DO NOT TURN THIS PAGE UNTIL  
INSTRUCTED TO DO SO.**

**Recitation Sections:**

#	Day	Time	TA
111	Monday	8 am	Noel
151	Monday	2 pm	Noel
191	Monday	5 pm	Noel
113	Tuesday	8 am	Noel
193	Tuesday	5 pm	Noel
112	Wednesday	8 am	Doug
152	Wednesday	11 am	Jon
192	Wednesday	5 pm	Doug
153	Thursday	8 am	Noel

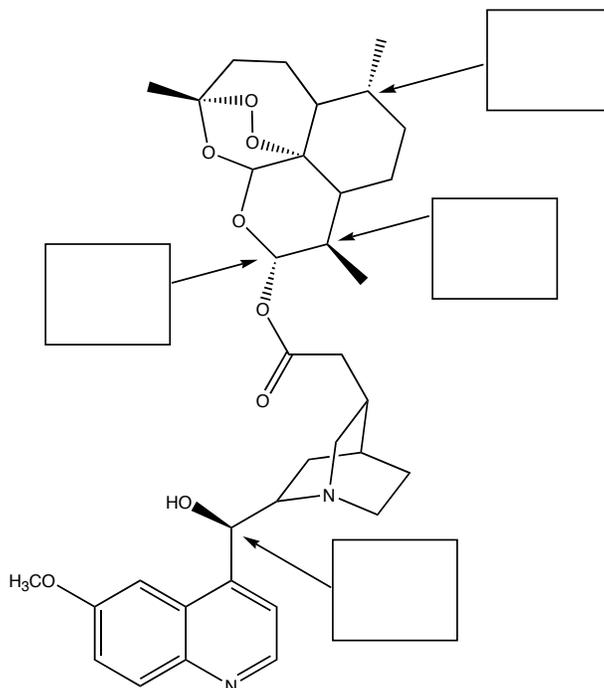
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Page 2 \_\_\_\_\_/10      Page 5 \_\_\_\_\_/26

Page 3 \_\_\_\_\_/20

**TOTAL \_\_\_\_\_/100**

1. (8 pts) One area of pharmaceutical research is the development of hybrid drugs. A hybrid drug is a combination of two drugs into a single compound. Hybrid drugs sometimes have the benefit of being more active than either component drug, and also help treat drug resistant strains of disease. Shown below is a hybrid of quinine and artemisinin, two drugs used to treat malaria. In the boxes below give the stereochemical designator for each indicated chirality center.



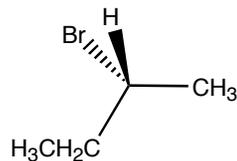
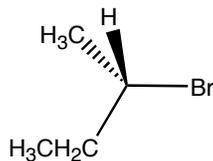
2. (12 pts) A) In the boxes below draw the indicated compound. B) Based on what we know about nucleophiles and leaving groups, we suspect that the reaction of (*R*)-2-chlorobutane with sodium iodide in acetone would not be useful as a synthesis of (*S*)-2-iodobutane. Explain.

(*R*)-2-chlorobutane

(*S*)-2-iodobutane

3. (10 pts) Circle the relationship between the following pairs of compounds.

A.



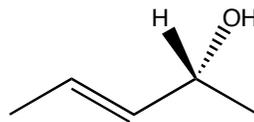
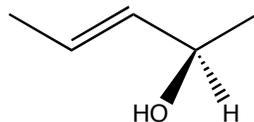
Identical

constitutional isomers

enantiomers

diastereomers

B.



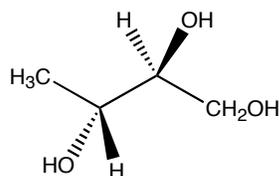
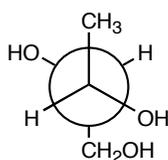
Identical

constitutional isomers

enantiomers

diastereomers

C.



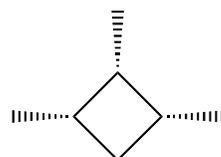
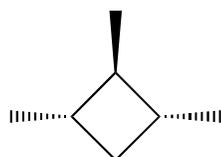
Identical

constitutional isomers

enantiomers

diastereomers

D.



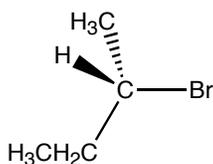
Identical

constitutional isomers

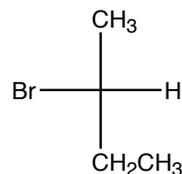
enantiomers

diastereomers

E.



and



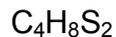
Identical

constitutional isomers

enantiomers

diastereomers

4. (10 pts) In the box below, draw the major organic product of the following reaction. Using arrows to show the flow of electrons, propose a mechanism for its formation. To the left, circle the term that best describes this mechanism.



$\text{S}_{\text{N}}2$

E2

$\text{S}_{\text{N}}1$

E1

Electrophilic  
addition

Radical

None of  
these

5. (10 pts) In the box below, draw the major organic product(s) of the following reaction. Using arrows to show the flow of electrons, propose a mechanism for its formation. To the left, circle the term that best describes this mechanism.



$\text{S}_{\text{N}}2$

E2

$\text{S}_{\text{N}}1$

E1

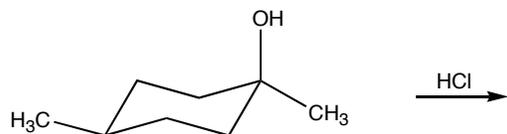
Electrophilic  
addition

Radical

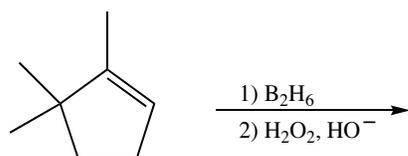
None of  
these

6. (24 pts) Give the major organic product(s) of each of the following reactions. If necessary, clearly show the stereochemistry of the products. **If no reaction occurs, write NR. Write "meso" under any meso compounds.** Note: some problems have more than one step.

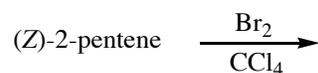
A.



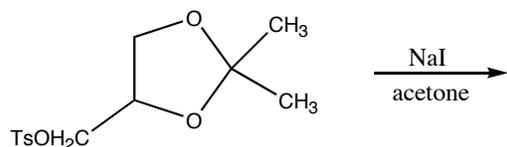
B.



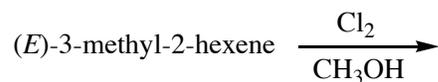
C.



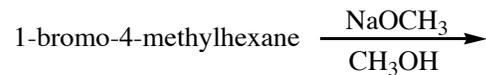
D.



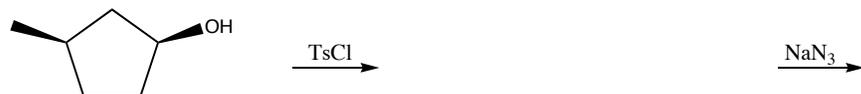
E.



F.



G.



7. (26 pts) Propose an efficient synthesis for each of the following transformations. You may use any reagents you like. Be sure to show any intermediates. (Do not draw a mechanism.)

A. ( $\pm$ )-1-azido-3,4,4-trimethylpentane      *starting from*      (*R*)-2,2,3-trimethylpentane  
(azido = N<sub>3</sub>)

B. NCCH<sub>2</sub>CH<sub>2</sub>CN      *starting from*      ethyl alcohol