

CHEM 3311-100 Spring 2007

Exam 2

Professor R. Hoenigman

High = 98

Low = 14

Average = 61

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 hour and 30 minutes 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
121	Tuesday	8 am	Kelly
131	Tuesday	1 pm	Kelly
141	Wednesday	8 am	Greg
151	Wednesday	12 pm	Greg
153	Wednesday	12 pm	Kelly
152	Wednesday	5 pm	Kelly
171	Thursday	12 pm	Greg

SCORE:

Page 1 _____/10 Page 4 _____/15

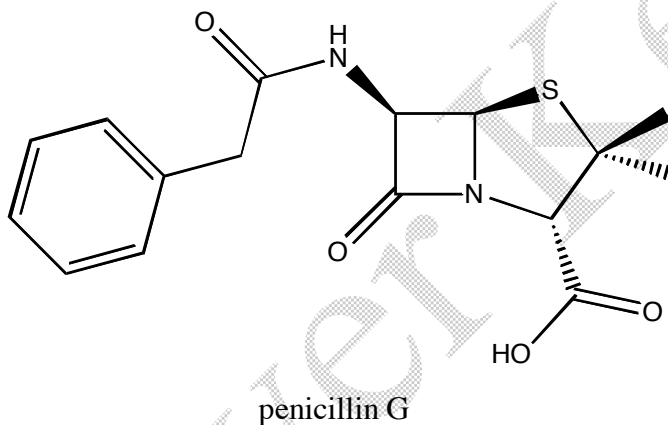
Page 2 _____/18 Page 5 _____/10

Page 3 _____/24 Page 6 _____/23

TOTAL _____/100

1. (4 pts) Penicillin is one of the most widely prescribed drugs. Circle **all** of the terms below that describe one or more structural feature of penicillin G.

Alcohol	Aldehyde	Alkene
Amide	Amine	Aromatic ring
Carboxylic acid	Ester	Ether
Ketone	Sulfide	Thiol



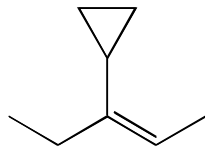
2. (6 pts) Explain why 1-chloropentane (b.p. = 108 °C) has a lower boiling point than 1-iodopentane (b.p. = 157 °C). Please be specific in your answer.

Iodine is more polarizable than chlorine. Therefore iodine will have stronger London forces that will require more energy (e.g. higher temperature) to break.

3. (6 pts) Give the IUPAC name for each of the following compounds.

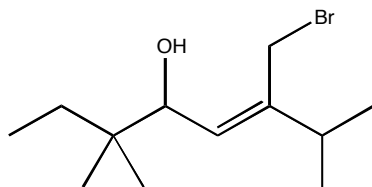
(3 pts each)

A. Book Problem 5.6d



(Z)-3-cyclopropyl-2-pentene

B.

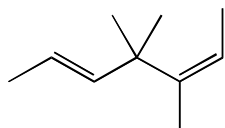


(Z)-6-(bromomethyl)-3,3,7-trimethyl-5-octen-4-ol

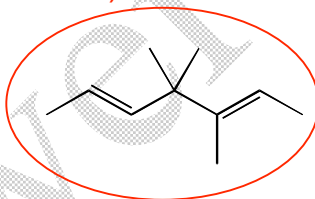
4. (12 pts) For each of the following pairs, circle the species with the lower heat of combustion. In the box, give a brief reason for your choice.

(3 pts each -1 pt circle, 2 pts explanation)

A.

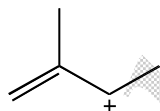


or

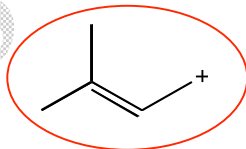


E isomer is more stable than Z isomer

B.



or



More stable resonance structures

C.

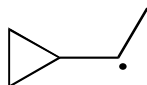
2,3-dimethyl-2-pentene

or

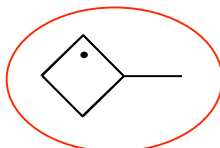
3,4-dimethyl-1-pentene

More substituted double bond is more stable

D.



or

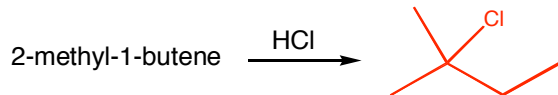


Less ring strain

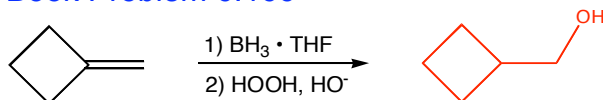
5. (24 pts) Give the major organic product(s) of each of the following reactions. If necessary, clearly show the stereochemistry of the products. If no reaction occurs, write NR.

(3 pts each)

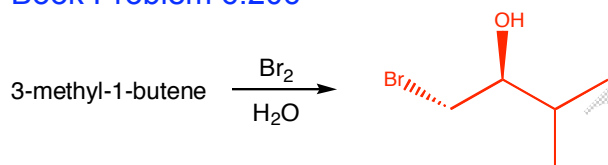
A. Book Problem 6.4b



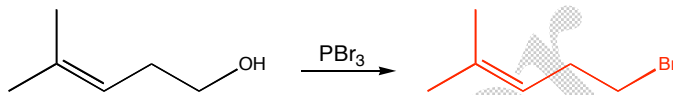
B. Book Problem 6.16c



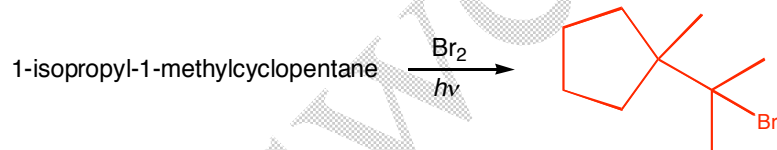
C. Book Problem 6.20c



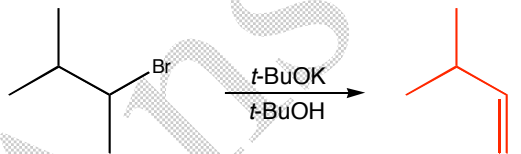
D.



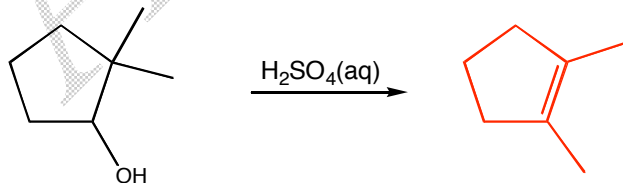
E. Book Problem 4.19b



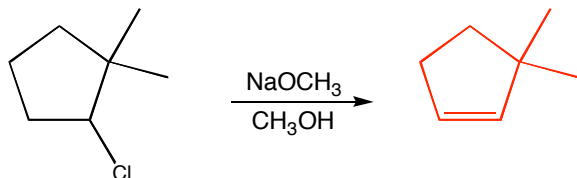
F.



G.



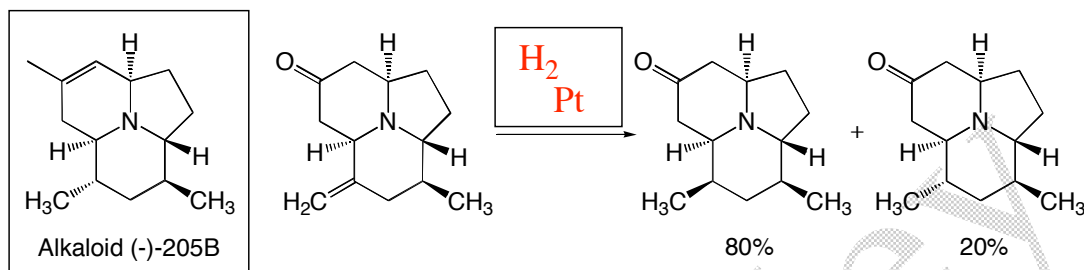
H.



6. (5 pts) Many organic chemists are involved in the synthesis of natural products (naturally occurring organic compounds). Alkaloid (-)-205B (shown below) has been isolated from a frog found in Panama. One step (of many steps) in a recent synthesis of this natural product attempted to introduce the *trans* methyl substituents into the six-membered ring.

(A. B. Smith III and D. -S. Kim, *J. Org. Chem.* **2006**, *71*, 2547-2557)

Partial Synthesis:

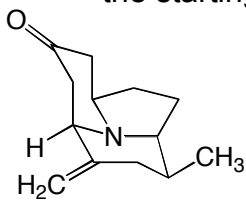


A. What kind of reaction is occurring? (1 pt)

Hydrogenation

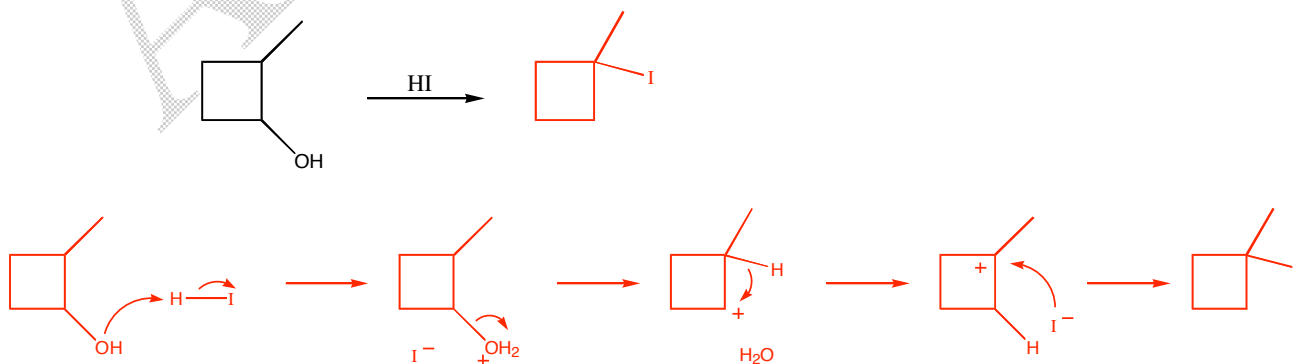
B. In the box above, propose reagents for this reaction. (2 pts)

C. Why did this particular attempt fail? Why isn't the major product of this reaction the desired compound with the *trans* methyl substituents? Hint: the starting material can also be drawn as: (2 pts)

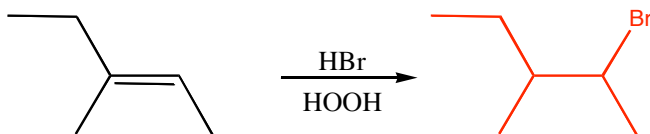


Hydrogenation occurs at the less hindered face of the double bond. In this case, hydrogenation occurs on the bottom side of the double bond, resulting in the methyl groups being predominately *cis*.

7. (10 pts) Fill in the organic product of the following reaction and, using arrows to show the flow of electrons, draw a mechanism to account for its formation.



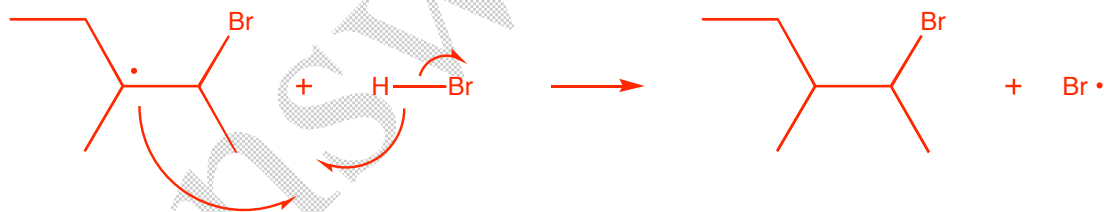
8. (10 pts) Fill in the organic product of the following reaction and, using fishhook arrows to show the flow of electrons, draw a mechanism to account for its formation. Be sure to label any initiation, propagation, or termination steps.



Initiation



Propagation



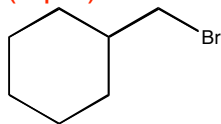
Termination

(any two radicals coming together)

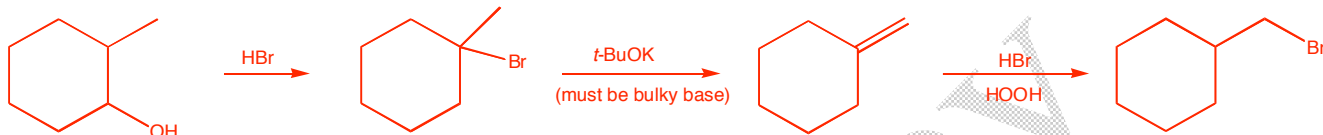


9. (23 pts) Propose an efficient synthesis for each of the following transformations. You may use any reagents you like.

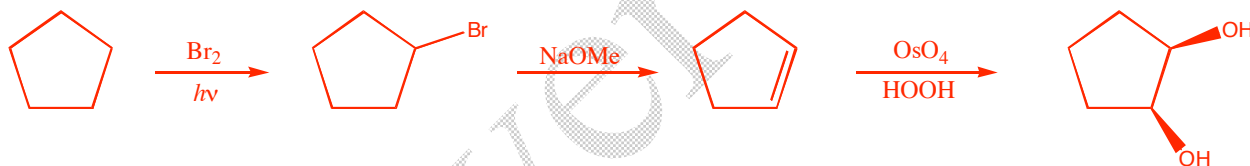
A. (8 pts)



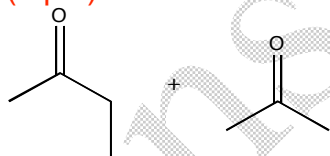
starting from 2-methylcyclohexanol



B. *cis*-1,2-cyclopentanediol starting from cyclopentane (7 pts)



C. (8 pts)



starting from 3,3-dimethyl-1-pentene

