

Average = 68

High = 98

Low = 18

CHEM 3311-200 Fall 2006

Exam 2

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 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
211	Monday	8 am	Noel
251	Monday	2 pm	Carolynn
291	Monday	5 pm	Heather
252	Tuesday	12 pm	Sam
293	Tuesday	5 pm	Carolynn
212	Wednesday	8 am	Noel
253	Wednesday	1 pm	Tom
292	Wednesday	5 pm	Heather
213	Friday	8 am	Heather

Score:

Page 1 _____/21 Page 4 _____/15

Page 2 _____/14 Page 5 _____/15

Page 3 _____/15 Page 6 _____/20

TOTAL _____/100

1. (12 pts) Naloxone (shown below) has a structure that is similar to heroin. In fact, naloxone is often used to reverse a heroin overdose. Circle **all** of the terms below that describe one or more structural feature of naloxone.

(2 points each circle, -1 point incorrect circle)

Amine

Alkene

Aldehyde

Amide

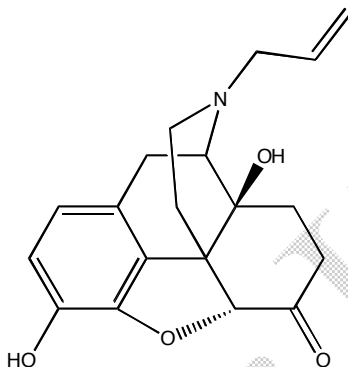
Ester

Aromatic ring

Alcohol

Ether

Ketone



Naloxone

2. (9 pts) For each of the following pairs, circle the compound that has the *lower* heat of combustion. In the box, give a brief reason for your choice.

(1 point each circle, 2 points explanation)

A. *cis*-2-methylcyclohexanol

or

trans-2-methylcyclohexanol

Both substituents are equatorial.

Book Problem 4.25

B. *cis*-3-methylcyclohexanol

or

trans-3-methylcyclohexanol

Both substituents are equatorial.

Book Problem 4.25

C. (*E*)-cyclopentene

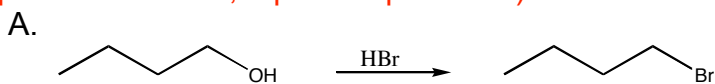
or

(*Z*)-cyclopentene

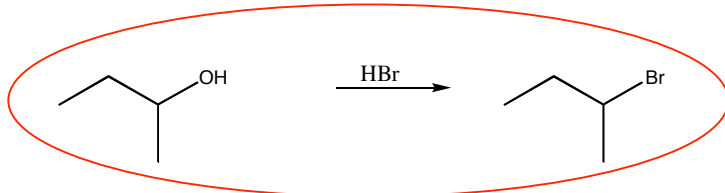
In a cycloalkane of less than 10 carbons, the *Z* isomer is more stable.

3. (6 pts) Which reactions in the following pairs will take place more rapidly? Circle your answer. In the box, give a brief reason for your choice.

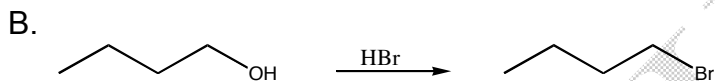
(1 point each circle, 1 point explanation)



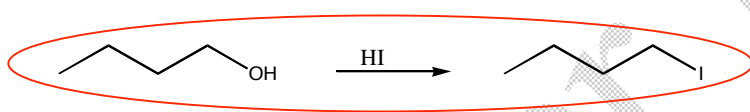
or



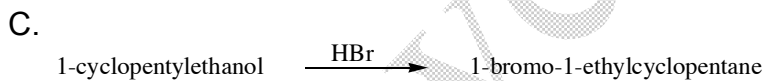
2° alcohols react faster than 1° alcohols when reacted with a hydrogen halide.
Book Problem 4.37a



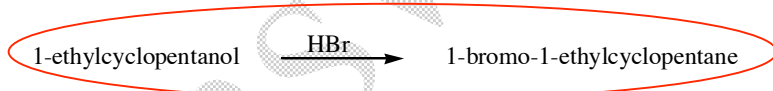
or



HI is more reactive towards an alcohol than HBr.



or



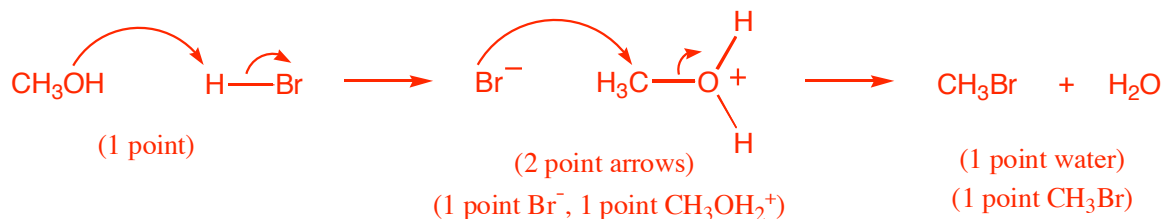
3° alcohols react faster than 2° alcohols when reacted with a hydrogen halide.
Book Problem 4.37b

(see page 7 for these structures)

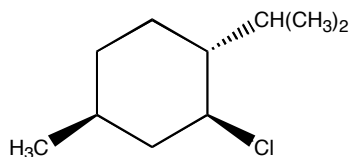
4. (8 pts) Write an arrow pushing mechanism for the preparation of methyl bromide from methanol and hydrogen bromide. In the box below, state whether this is an S_N1 or S_N2 reaction. Book Problem 4.40

S_N2
(1 point)

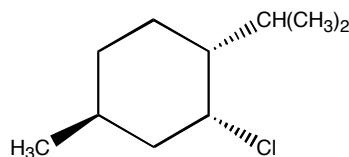
(-5 points if an S_N1 mechanism is drawn)



5. (15 pts) Menthyl chloride and neomenthyl chloride have the structures shown below. One of these stereoisomers undergoes elimination on treatment with sodium ethoxide in ethanol much more readily than the other.



Menthyl chloride



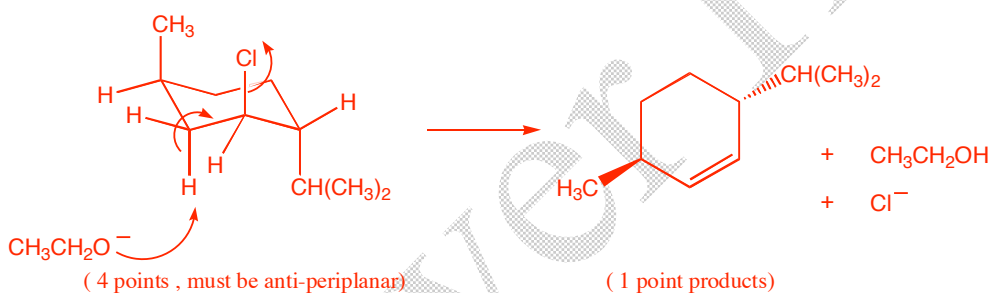
Neomenthyl chloride

Book Problem 5.41

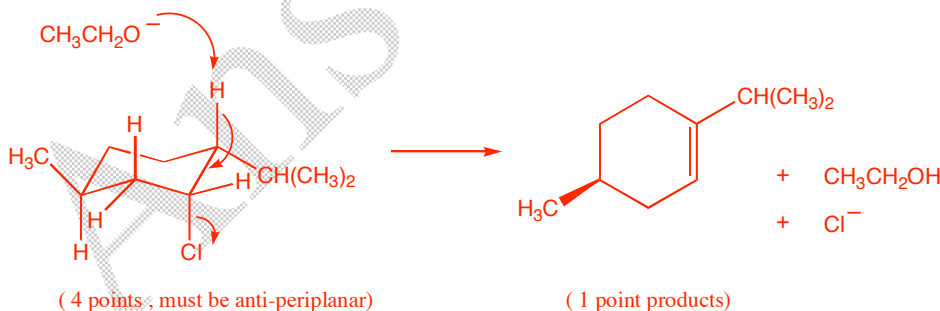
A. Using arrows to show the flow of electrons, draw a mechanism to account for the dehydrohalogenation of each of the isomers. Be sure to draw neat chair cyclohexanes.

(5 points each mechanism)

Menthyl chloride:



Neomenthyl chloride:



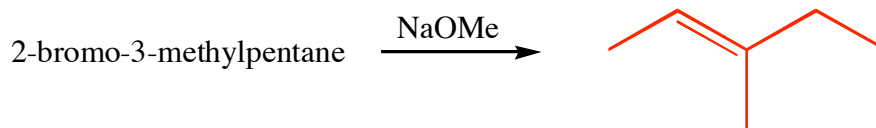
B. Which reacts faster, menthyl chloride or neomenthyl chloride? Why?
(2 points for correct isomer, 3 points for explanation)

Neomenthyl chloride reacts faster than menthyl chloride in an E2 reaction because the most stable conformation of neomenthyl chloride has the necessary anti-periplanar geometry. Menthyl chloride must first chair flip to a higher energy conformation to achieve the anti-periplanar transition state, thus raising the activation energy (and slowing the rate) of the reaction.

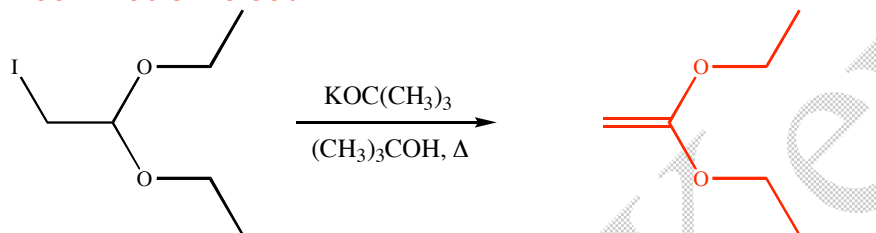
6. (15 pts) Give the single major organic product of the following reactions.

(3 points each)

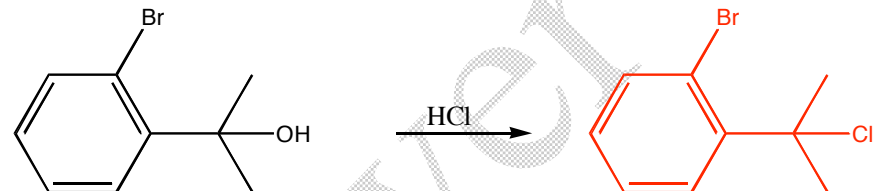
A. Book Problem 5.32e



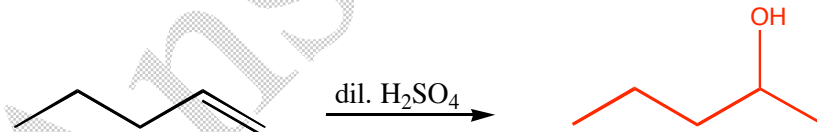
B. Book Problem 5.38b



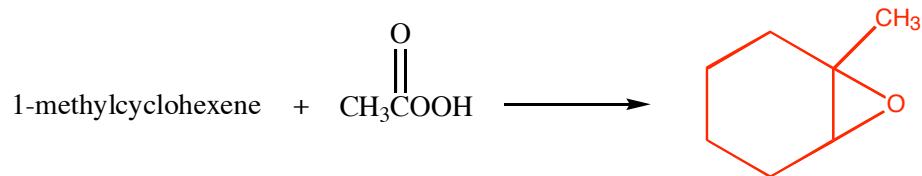
C. Book Problem 4.36c



D. Book Problem 6.26e



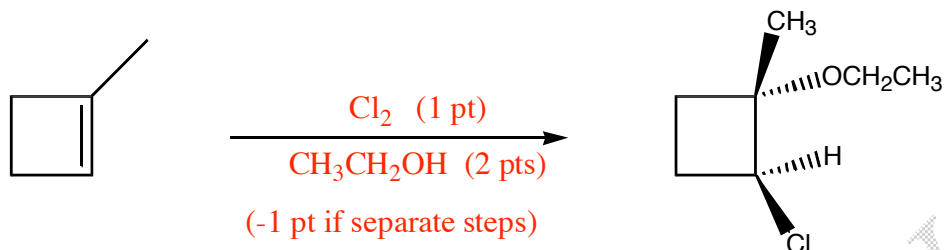
E. Book Problem 6.28i



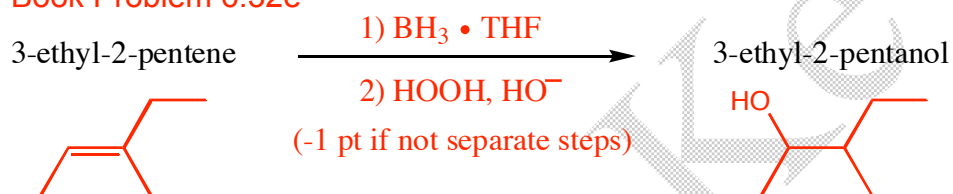
7. (15 pts) Propose reagents for accomplishing the following transformations. The desired product should be the major product of the reaction.

(3 points each)

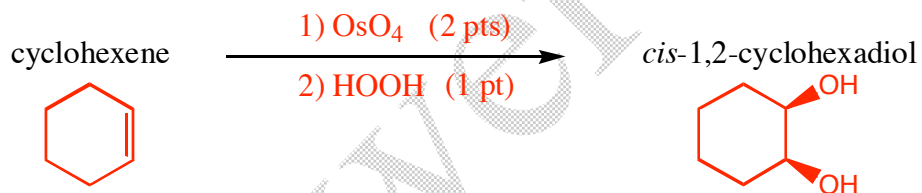
A.



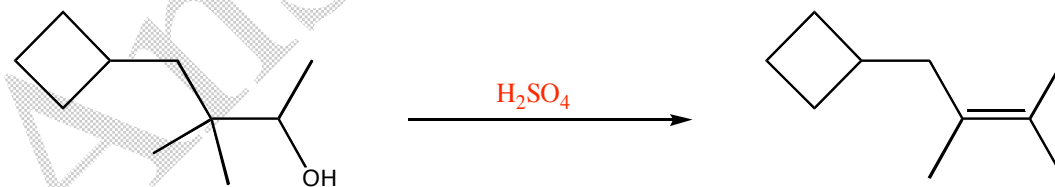
B. Book Problem 6.32e



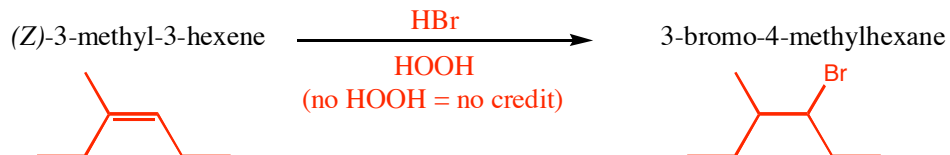
C.



D.



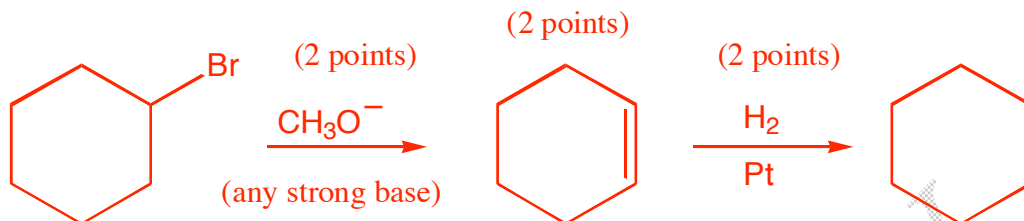
E.



8. (20 pts) Propose an efficient synthesis for the following transformations. You may use any reagents you like.

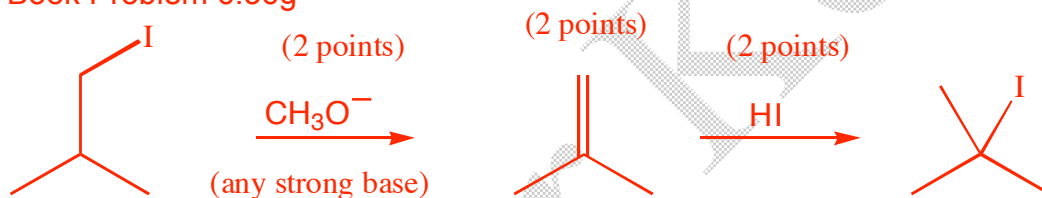
(-2 points for each unnecessary step)

A. cyclohexane starting from bromocyclohexane (6 points)

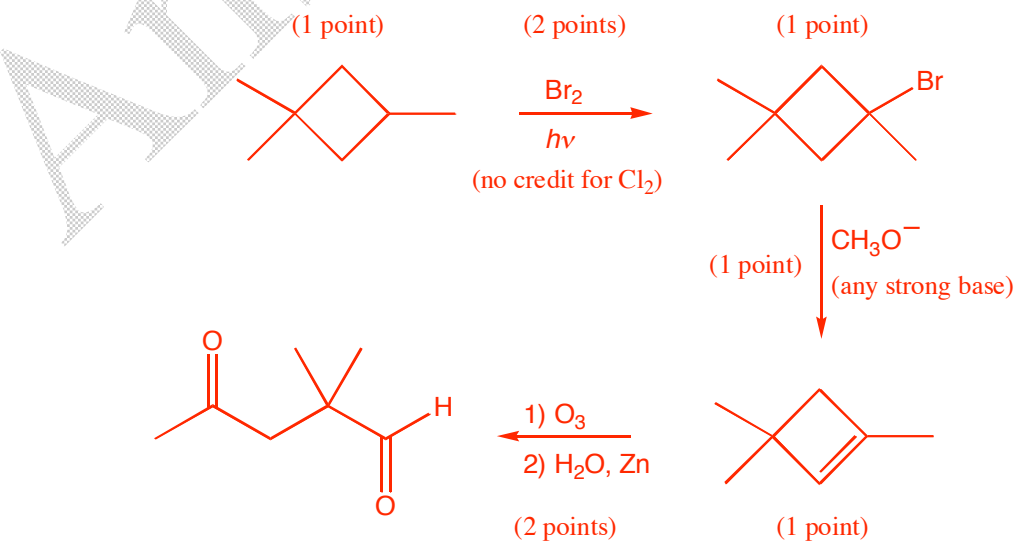
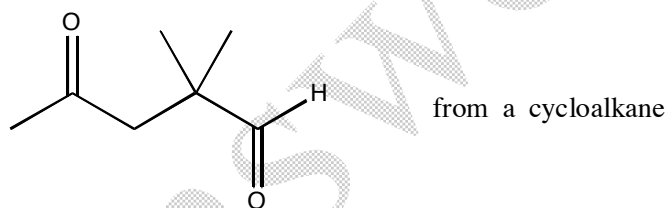


B. *tert*-butyl iodide starting from isobutyl iodide (6 points)

Book Problem 6.36g

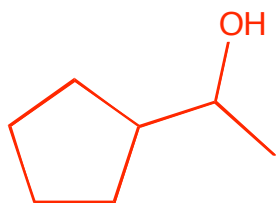


C. (8 points)

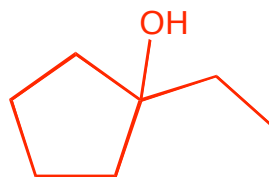


Scratch Page

Structures from problem 3c:



1-cyclopentylethanol



1-ethylcyclopentanol

Answer Key

Scratch Page

Answer Key