

CHEM 3311-200, Fall 2005

Exam 2

October 20, 2005

Professor Rebecca 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 allowed; periodic table and scratch paper are attached.

DO NOT TURN PAGE UNTIL INSTRUCTED TO DO SO.

Put your name on ALL pages of the exam

Recitation Sections:

Number	Day	Time	TA
211	Monday	8 am	Kate
251	Monday	2 pm	Kate
291	Monday	5 pm	Xin
252	Tuesday	12 pm	Matt
293	Tuesday	5 pm	Jon
212	Wednesday	8 am	Greg
253	Wednesday	1 pm	Greg
292	Wednesday	5 pm	Jon
213	Friday	8 am	Xin

Average Score = 58

High Score = 97

Low Score = 12

Name: _____

1. (10 pts) Answer the following questions about the halogenation of methane via a chain radical reaction with X_2 .



A. What is the chain initiation step?
(1 pt)

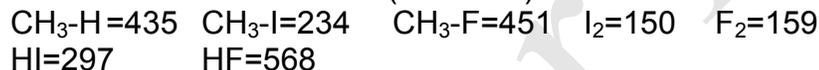


B. What are the two chain propagating steps?
(2 pts)



C. Using the BDEs given below, calculate the enthalpy of each propagation step for $X_2 = I_2$ and $X_2 = F_2$.

BDEs (in kJ/mol)



I_2 Step 1

$$\Delta H = 435 - 297 \\ = + 138 \text{ kJ/mol}$$

F_2 Step 1

$$\Delta H = 435 - 568 \\ = - 133 \text{ kJ/mol}$$

(4 pts)

I_2 Step 2

$$\Delta H = 150 - 234 \\ = - 84 \text{ kJ/mol}$$

F_2 Step 2

$$\Delta H = 159 - 451 \\ = - 292 \text{ kJ/mol}$$

D. Calculate the overall energy for the reactions of methane with iodine and fluorine.

(2 pts)

I_2

$$\Delta H_{\text{overall}} = 138 - 84 \\ = + 54 \text{ kJ/mol}$$

F_2

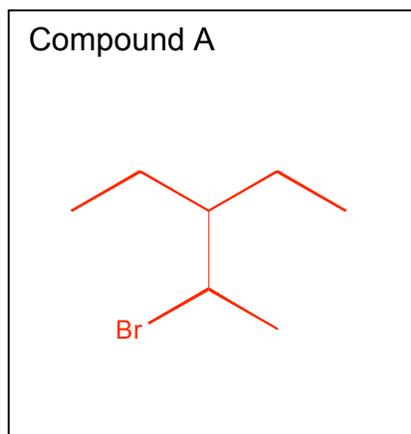
$$\Delta H_{\text{overall}} = - 133 + (- 292) \\ = - 425 \text{ kJ/mol}$$

E. Why can't iodomethane be prepared by this mechanism?
(1 pts)

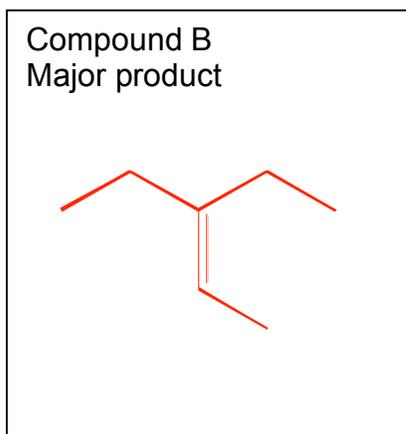
The reaction to produce iodomethane is endothermic.

Name: _____

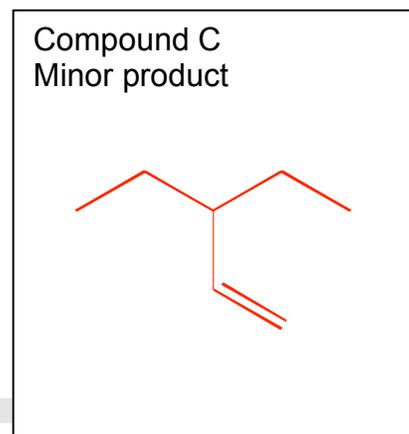
2. (10 pts) On being heated with a solution of sodium ethoxide in ethanol, compound A ($C_7H_{15}Br$) yielded a mixture of two alkenes, B and C, each having the molecular formula C_7H_{14} . Catalytic hydrogenation of the major isomer B or the minor isomer C gave only 3-ethylpentane. In the boxes given below, suggest structures for compounds A, B, and C consistent with these observations.



(3 pts)



(4 pts)



(3 pts)

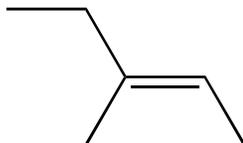
Answer 1

Name: _____

3. (5 pts) Give the stereochemical descriptor (E or Z) for the following alkenes. If more than one double bond is present in the compound, label the descriptor with the correct IUPAC number. DO NOT give the IUPAC name.

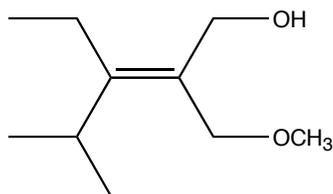
(1 pt each)

A.



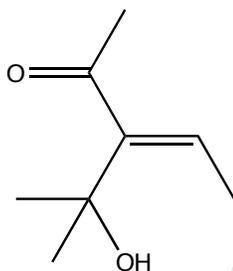
E

B.



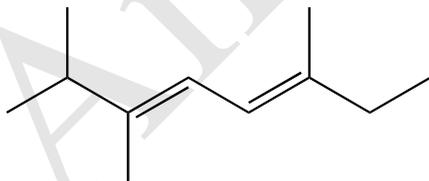
Z

C.



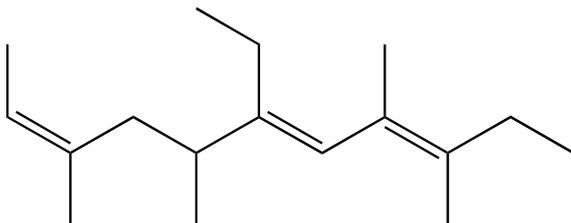
E

D.



3E, 5E

E.

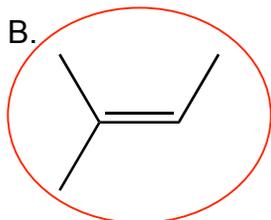


2Z, 6E, 8E

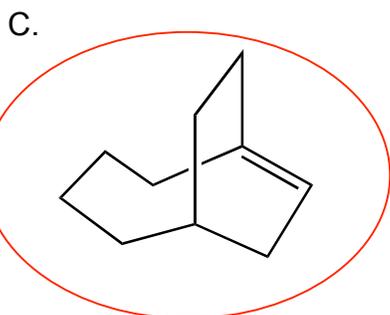
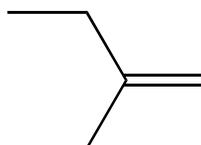
Name: _____

4. (10 pts) Circle the more stable compound in the following pairs.
(2 pt each)

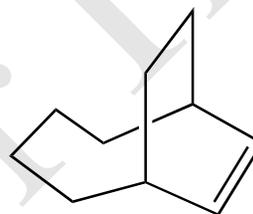
A. *cis*-4-methyl-2-pentene or *trans*-4-methyl-2-pentene



or



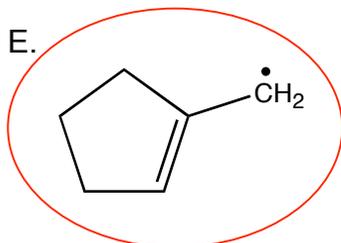
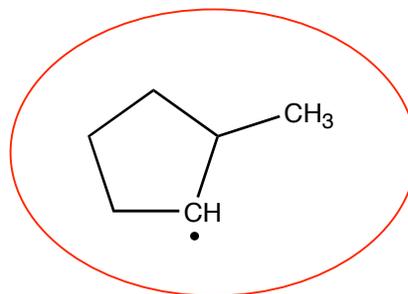
or



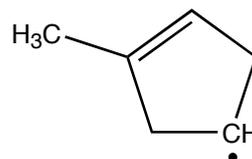
(Bredt's rule states that bridgehead alkenes are stable if one of the rings has eight or more carbons)



or



or



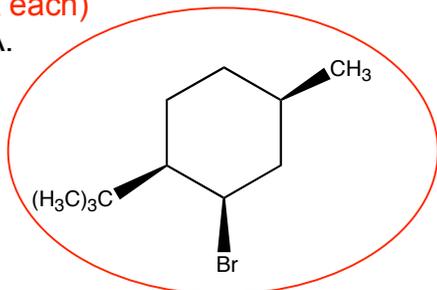
Stabilized by resonance

Name: _____

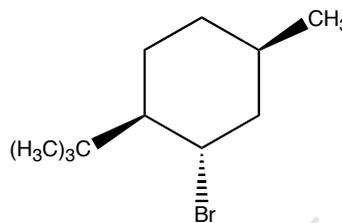
5. (3 pts) Circle the compound that will have the faster rate of reaction when undergoing an E2 reaction.

(1 pt each)

A.



or



(The most stable chair has Br in the axial position – ready for E2 elimination)

B. 2-bromo-3-methylhexane or 3-bromo-3-methylhexane

(tertiary vs secondary halide)

C. neopentyl bromide or 2-bromo-3-methylbutane

(secondary vs primary halide)

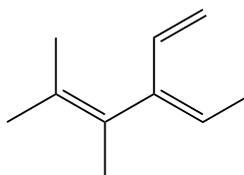
6. (2 pts) State whether the following pairs of compounds are constitutional isomers, stereoisomers, conformers, resonance structures, the same structure, or have no relation. Place your answer in the box.

(1 pt each)

A.

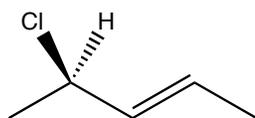


and

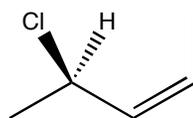


Constitutional Isomers

B.



and



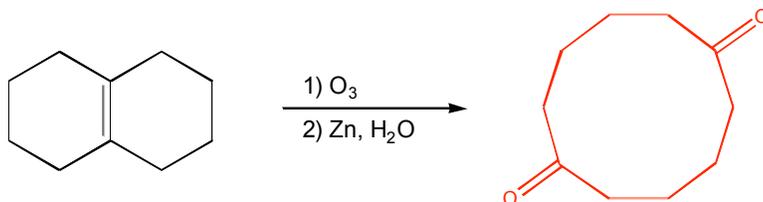
Stereoisomers

Name: _____

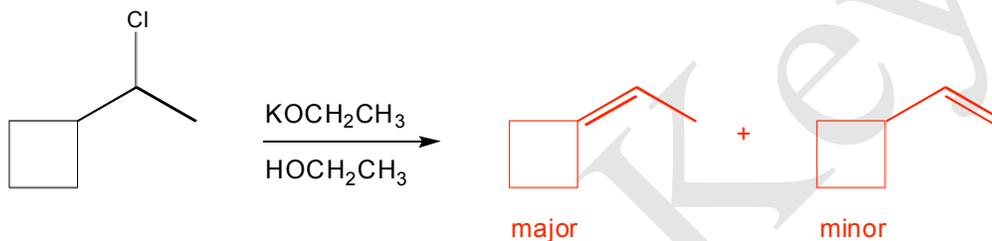
7. (15 pts) Give the organic products for the following reactions. Where possible, clearly label the major and minor products.

(3 pts each)

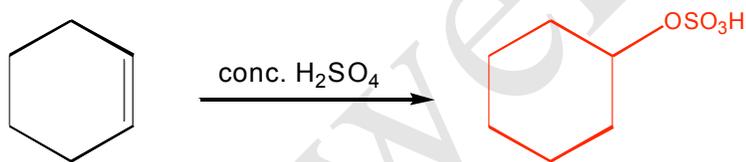
A.



B.



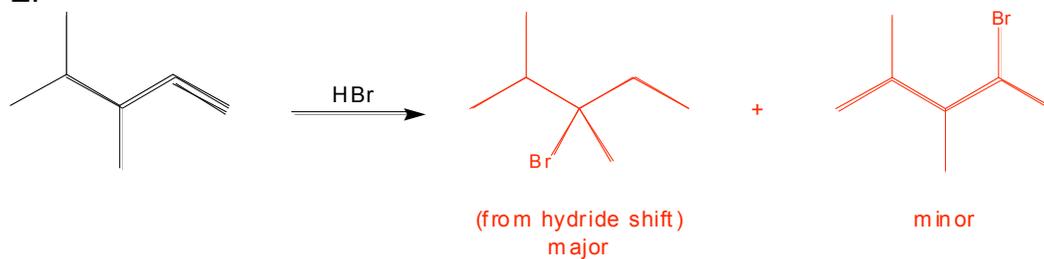
C.



D.



E.

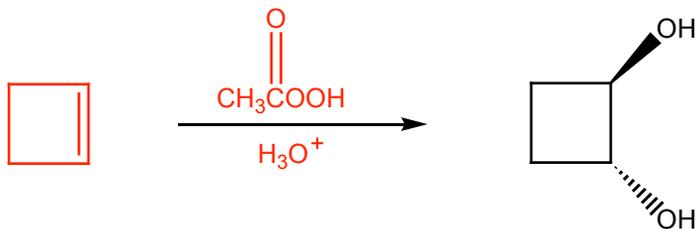


Name: _____

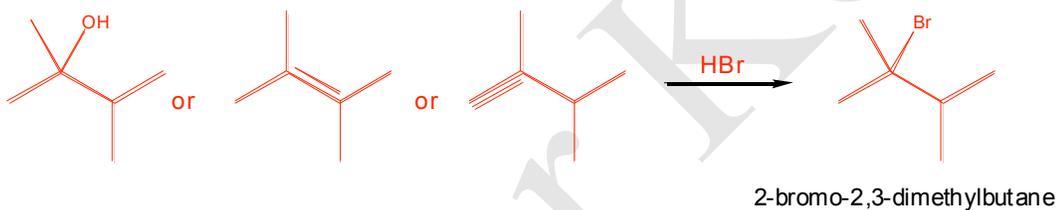
8. (20 pts) Fill in the missing reactants and reagents for the following reactions.
(3 pts for reactant, 2 pts for reagents)

There is more than one way to do some of these transformations.

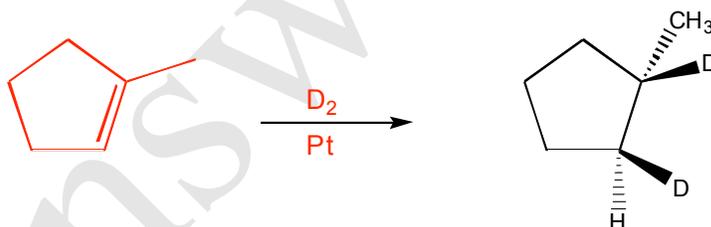
A.



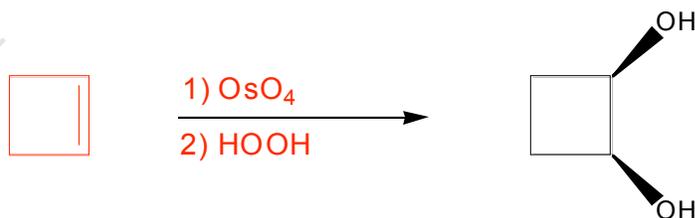
B.



C.



D.

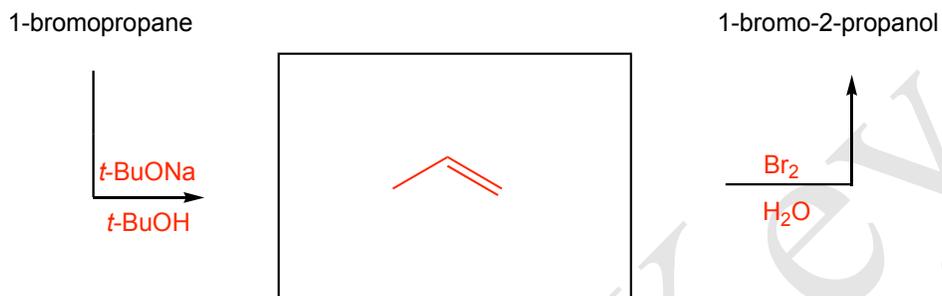


Name: _____

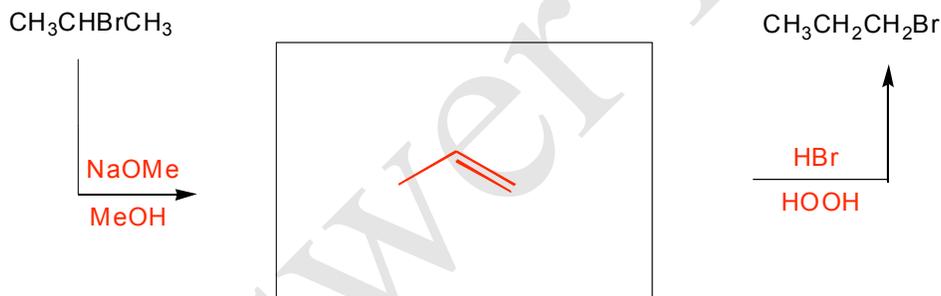
9. (15 pts) Each of the following transformations can be carried out in two or three steps. For each transformation show above and/or below the arrows the necessary reagents and between the arrows show the organic intermediate that is formed in the first reaction and serves as the starting material for the second reaction.

(1 pt reagents, 2 pts intermediates)

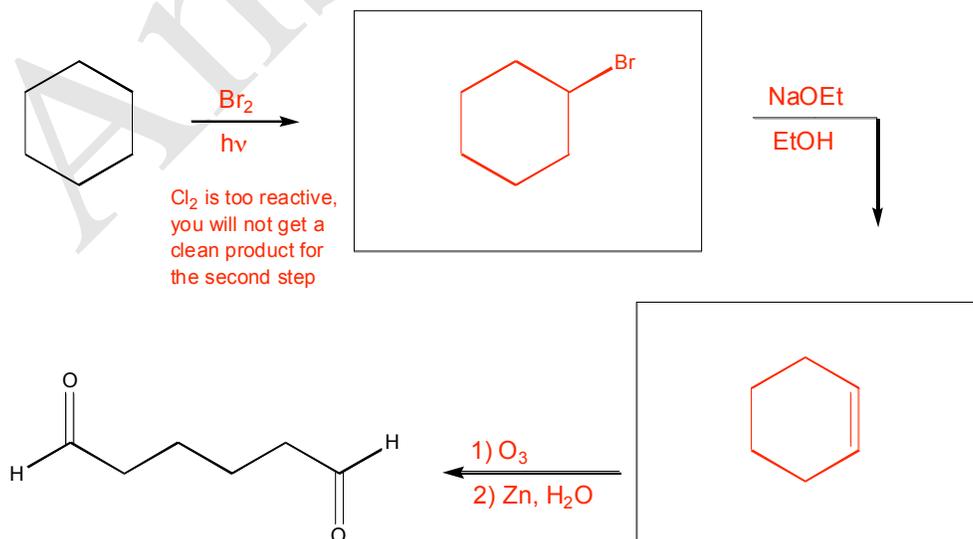
A.



B.



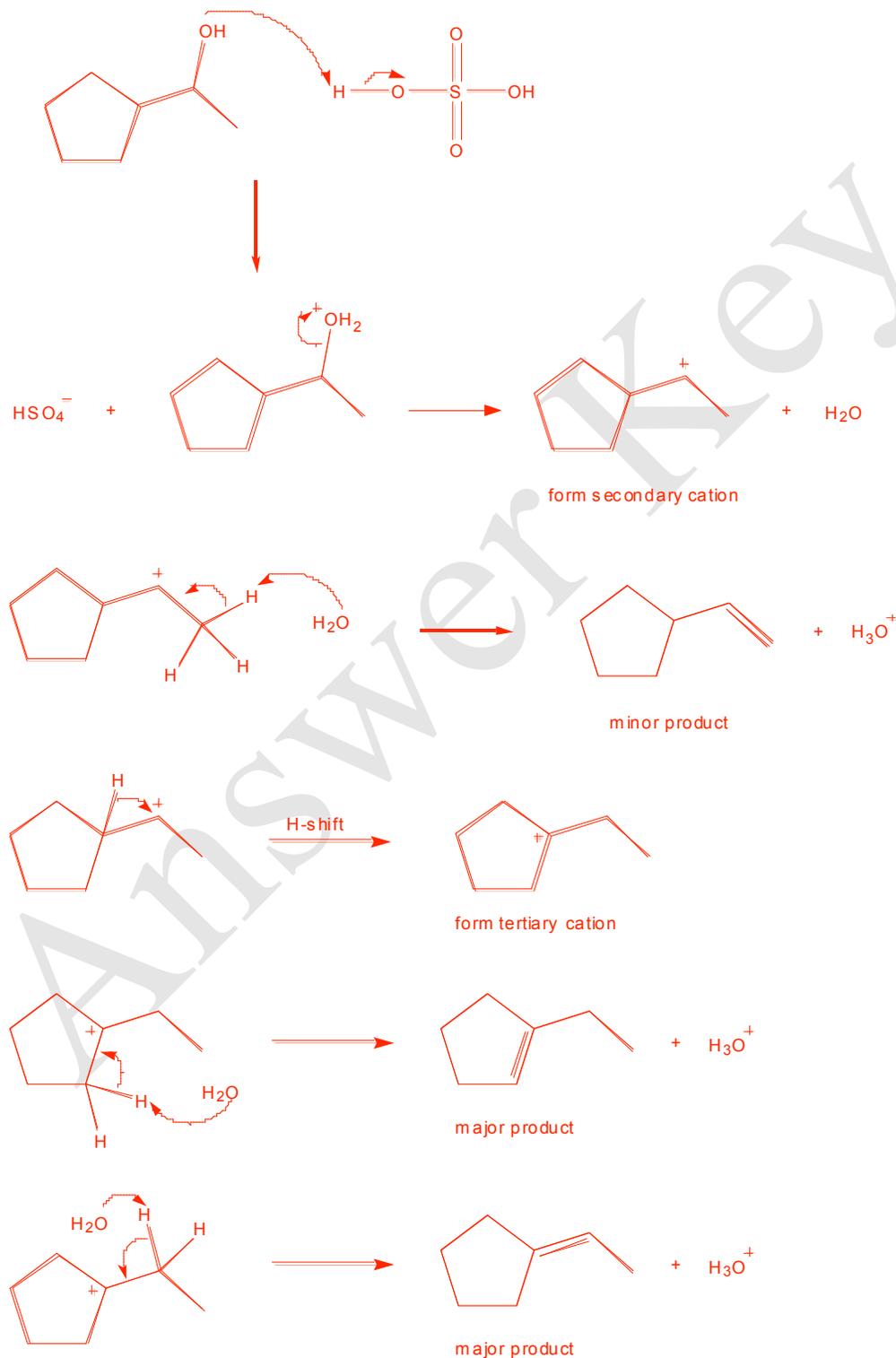
C.



Name: _____

10. (10 pts) Draw an arrow-pushing mechanism for the E1 dehydration of the alcohol shown below. Be sure to account for the formation of all major and minor products.

(must show all products and arrows to receive full credit)



Name: _____

Score:

Page 2 _____

Page 7 _____

Page 3 _____

Page 8 _____

Page 4 _____

Page 9 _____

Page 5 _____

Page 10 _____

Page 6 _____

Total _____

Answer Key