

CHEM 3311-200, Fall 2005

**Exam 1**  
September 22, 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.

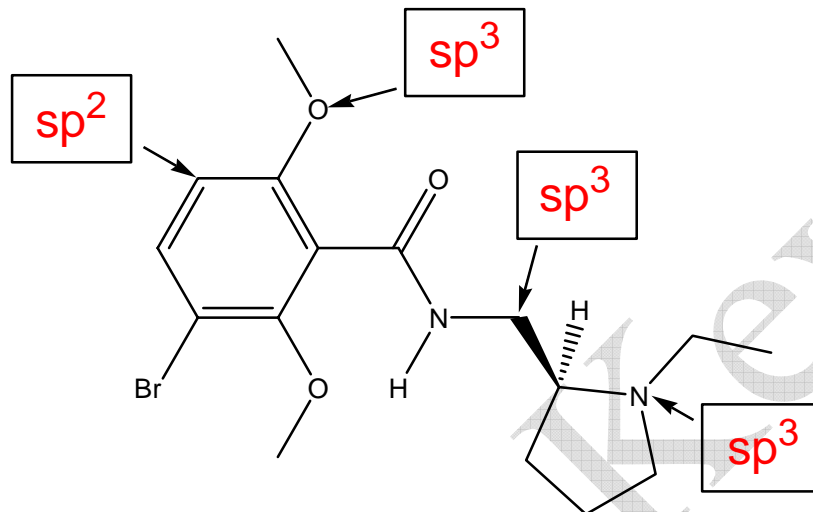
DO NOT TURN PAGE UNTIL INSTRUCTED TO DO SO.

Average Score = 64

High Score = 94

Low Score = 22

1. (10 pts) Remoxipride (shown below) was once a promising antipsychotic drug. However, in 1993 it was pulled from the market due to an association with several cases of aplastic anemia.



A. Circle **all** of the terms below that describe one or more structural feature of Remoxipride.

- |  |   |  |
|--|---|--|
| <input checked="" type="radio"/> Amine | <input type="radio"/> Alkene            | <input checked="" type="radio"/> Non-aromatic ring |
| <input checked="" type="radio"/> Amide | <input type="radio"/> Ester             | <input checked="" type="radio"/> Aromatic ring     |
| <input type="radio"/> Alcohol          | <input checked="" type="radio"/> Halide | <input type="radio"/> Ketone                       |
| <input type="radio"/> Thiol            | <input checked="" type="radio"/> Ether  | <input type="radio"/> Aldehyde                     |

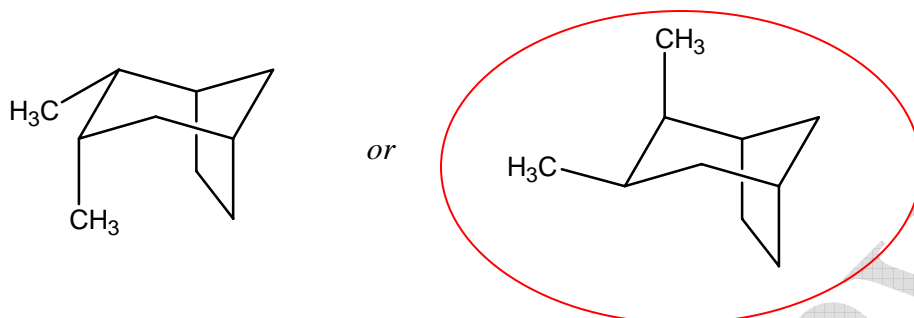
(1 pt correct circle, -1 pt missing or incorrect circle)

B. In the boxes above, write the hybridization of the indicated atom.

2. (10 pts) Circle the more stable stereoisomer in each of the following pairs and give the reason for your choice.

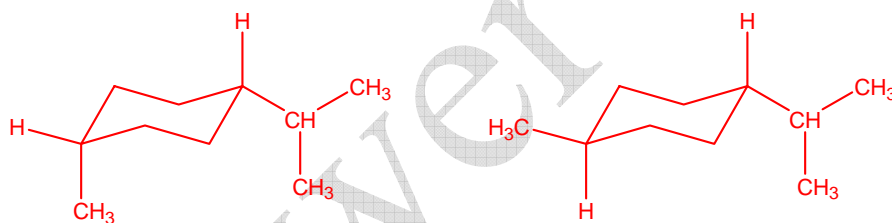
Book problem 3.38

A.



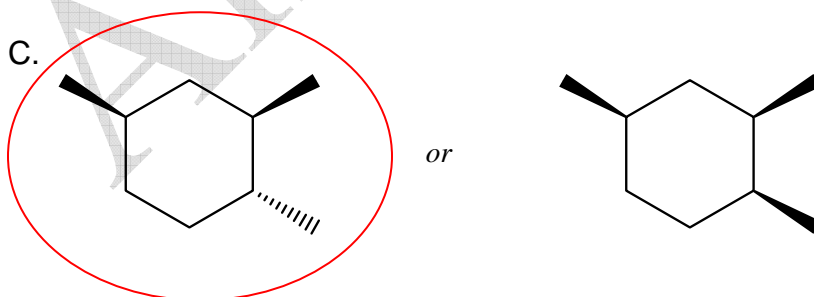
The circled structure has lower energy 1,3-diaxial interactions.  
(1 pt circle, 2 pt explanation)

B. *cis*-1-isopropyl-4-methylcyclohexane or *trans*-1-isopropyl-4-methylcyclohexane



The *trans* isomer has both substituents in the equatorial position.  
(1 pt circle, 2 pt explanation)

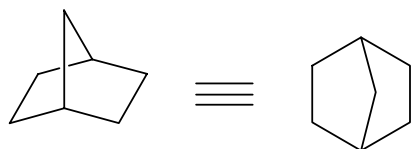
C.



The circled structure has all the substituents in the equatorial position.  
(2 pt circle, 2 pt explanation)

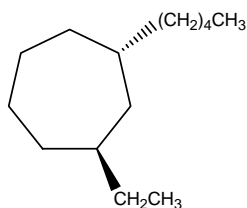
3. (10 pts) Give IUPAC names for the following compounds. (2 pt each)

A. Norbornane (Book problem 3.14)



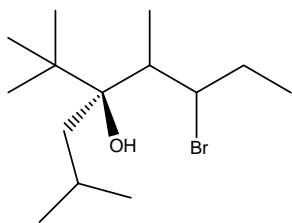
bicyclo[2.2.1]heptane

B.



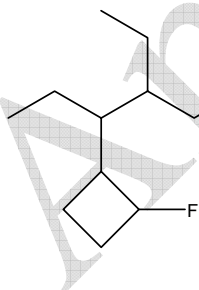
trans-1-ethyl-3-pentylcycloheptane

C.



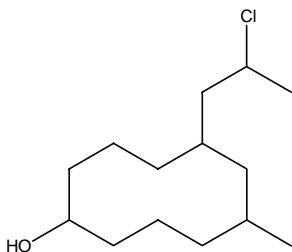
6-bromo-4-tert-butyl-2,5-dimethyl-4-octanol

D.



3-ethyl-4-(2-fluorocyclobutyl)hexane

E.



5-(2-chloropropyl)-7-methylcyclodecanol

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

A. acid with  $pK_a = 10$

or

acid with  $K_a = 1.7 \times 10^{-4}$

$pK_a = 3.77$

B. 1-propanol

or

1-bromo-1-propanol

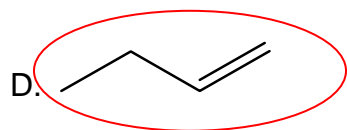
(inductive effect)

C.  $(CH_3)_2NH$

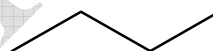
or

$CH_3NHCOCH_3$

(conjugate base stabilized by resonance)



or



(conjugate base stabilized by resonance)

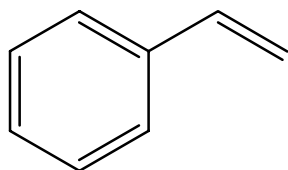
E.  $NH_4^+$

or

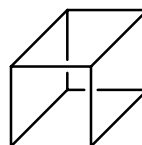
$CH_3OH_2^+$

(oxygen is more electronegative than nitrogen)

5. (5 pts) A compound with the molecular formula  $C_8H_8$  gives off 3600 kJ/mol when burned in air. An isomer of this compound has a heat of combustion of 4200 kJ/mol. One of the isomers is styrene, the other is cubane.



Styrene

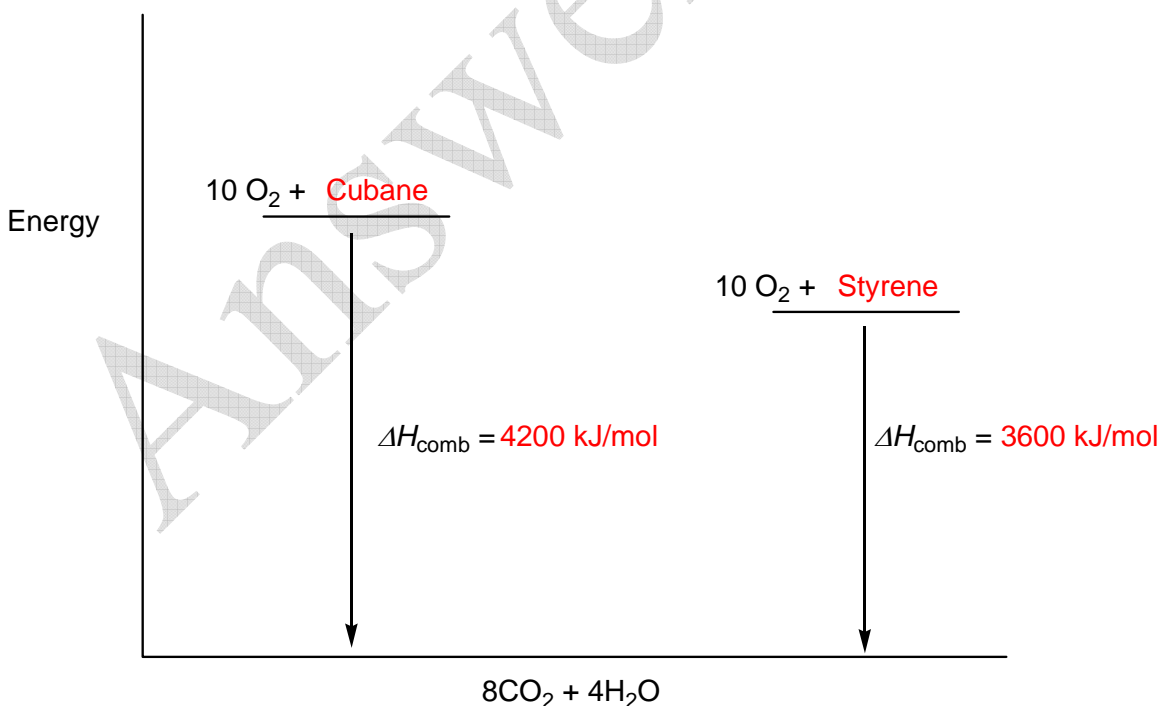


Cubane

A. Which  $C_8H_8$  isomer is more stable?

Styrene  
(cubane has quite a bit of ring strain)

B. Use the energy diagram below to illustrate your answer. Fill in the missing compounds and heat of combustion values.

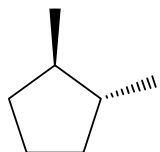


(1 pt each correct answer)

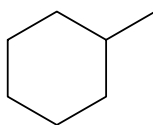
6. (10 pts) State whether the following pairs of compounds are constitutional isomers, stereoisomers, conformers, resonance structures, the same structure, or have no relation. Place your answer in the box.

(2 pt each)

A.

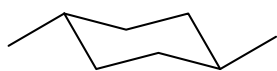


and



Constitutional Isomers

B.

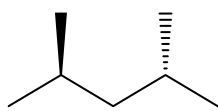


and



Same Structure

C.

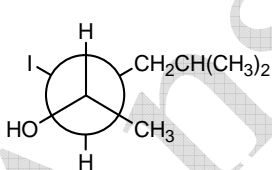


and

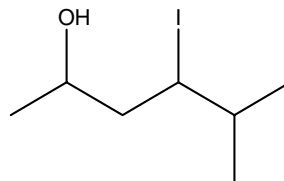


Same Structure

D.



and



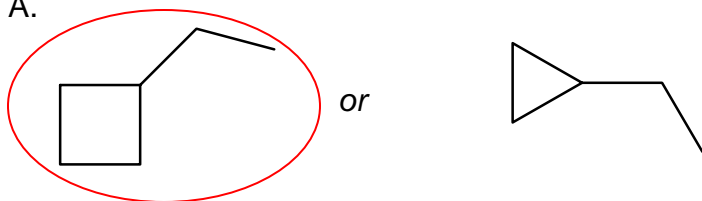
Constitutional Isomers

E. 3-chloro-2-ethyl-5-methylhexane and 4-chloro-2,5-dimethylheptane

Same structure

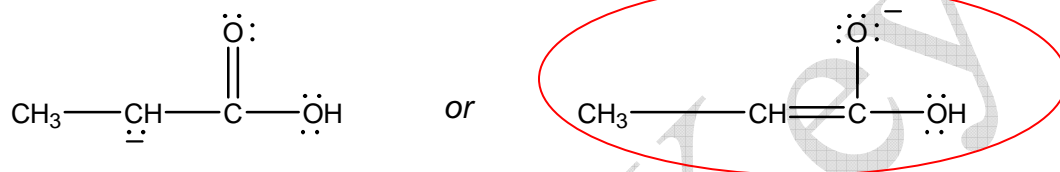
7. (10 pts) Circle the more stable structure in each pair. (2 pt each)

A.



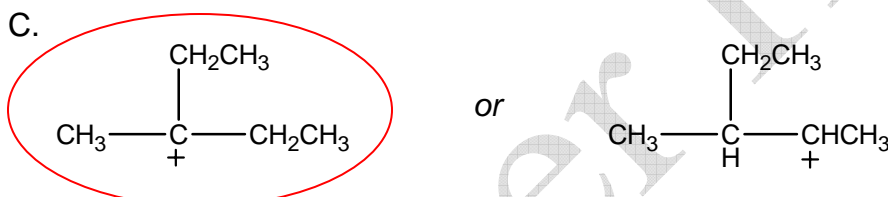
Less ring strain.

B.



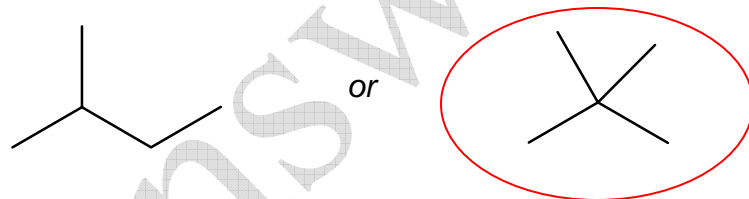
Negative charge is on more electronegative atom.

C.



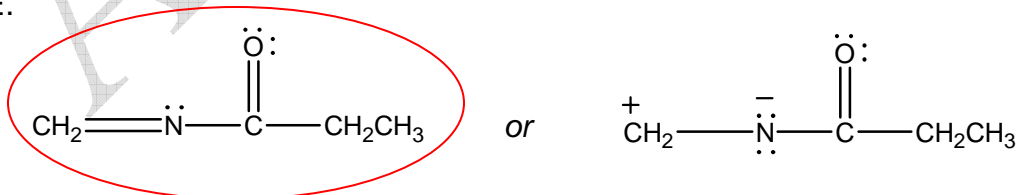
Tertiary cations are more stable than secondary cations.

D.



Branched alkanes are more stable than their unbranched isomers.

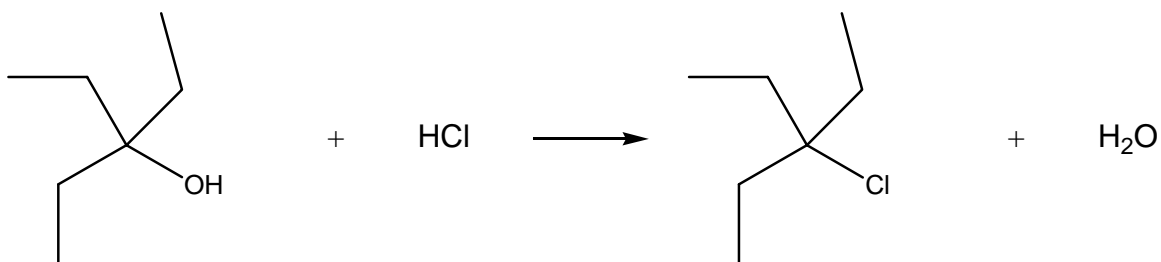
E.



Less charge separation.



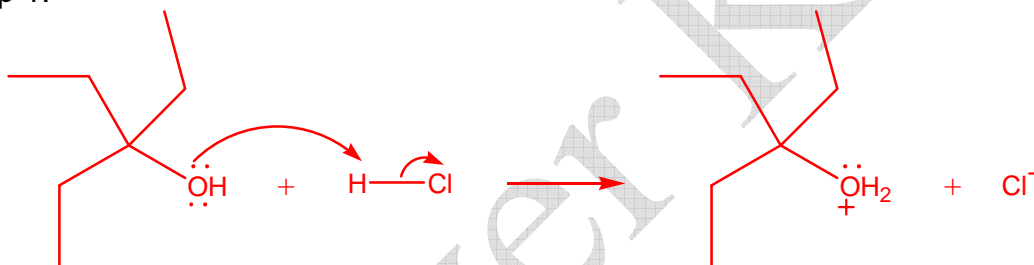
8. (15 pts) The following reaction occurs via a three step mechanism.



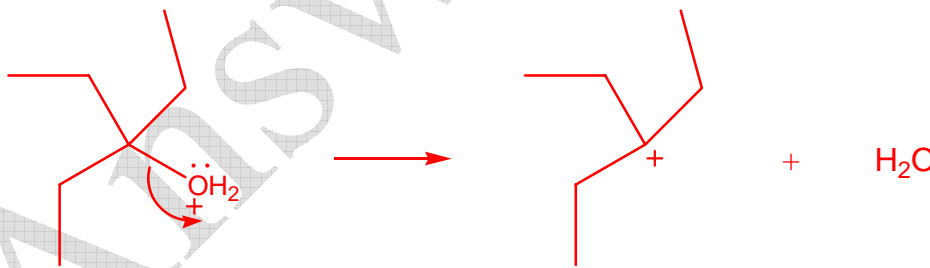
Show each step of the mechanism below, using arrows to show the movement of electrons.

(5 pt each step, -1 for missing formal charge, -2 for missing or bad arrows, -2 for wrong structure)

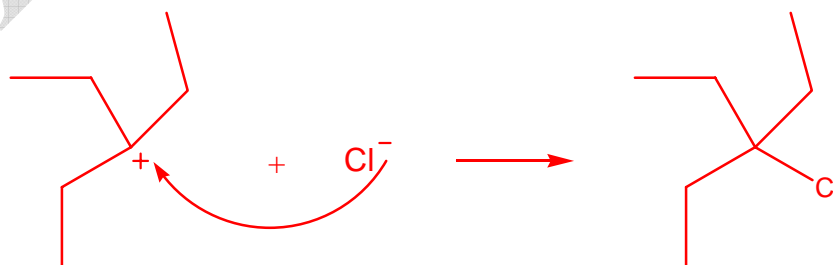
Step 1:



Step 2:



Step 3:



9. (20 pts) Draw bond-line formulas for all the constitutional isomers that have the formula  $C_8H_{18}$  and that would be named in the IUPAC system as trimethylpentanes.

(5 pt each, -5 pt for missing and duplicate structures)

