

**Chem 0310**  
**Dennis P. Curran**  
**April 20, 2009**  
**Final Exam**

Name: \_\_\_\_\_

Signature: \_\_\_\_\_

Answer all questions on this exam. If you need more space than that provided, use the back of any page.

1. \_\_\_\_\_ 30 points

2. \_\_\_\_\_ 10 points

3. \_\_\_\_\_ 60 points

4. \_\_\_\_\_ 40 points

5. \_\_\_\_\_ 40 points

6. \_\_\_\_\_ 20 points

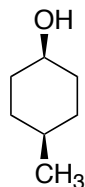
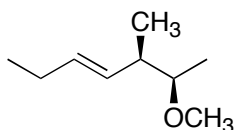
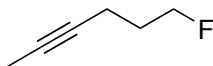
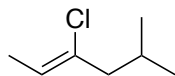
\_\_\_\_\_ Total (200 pts.)

The test has 10 pages (including this cover page) and 6 questions  
The exam ends at 5:50 sharp!

Good Luck !!!

1) Names (30 points)

a) Provide IUPAC names for the following structures. Don't forget R/S, cis/trans or E/Z if needed (15 points).



b) Provide clear structures for the following names (15 points).

cyclopentyl isobutyl ether

(3*R*)-3,7-dimethyloct-6-en-1-ol

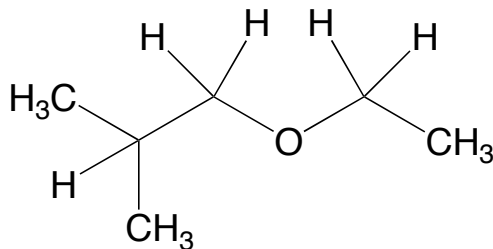
(*Z*)-meso-2,5-dichloro-3-hexene

(*E*)-4-isopropoxyhept-3-ene

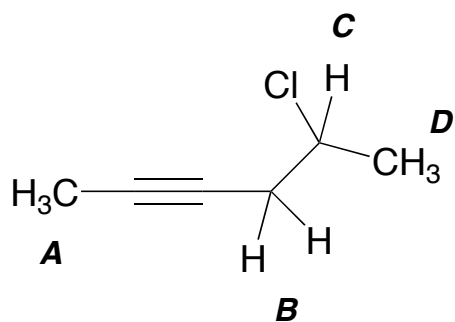
2-methyl-3-hexyne

2) Proton NMR (10 points)

a) Indicate the multiplicities (singlet, doublet, triplet, quartet, etc.) expected for the protons in the following molecule:



b) Assign the resonances **A–D** listed below to each of the responsible protons in the following molecule.

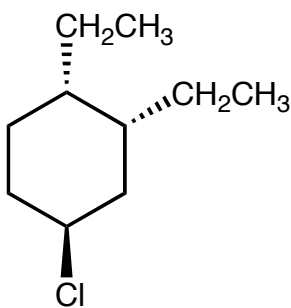


$\delta$ in ppm	multiplicity	your assignment
3.7	sextet	
2.2	doublet	
1.6	singlet	
1.5	doublet	

3) Short Answer Questions (60 points)

a) Provide a specific example of a syn addition reaction of a disubstituted alkene (give starting material, reaction conditions and product(s)).

b) Draw all chair forms of the following molecule and indicate which one is the most stable. Explain your choice in a few words.



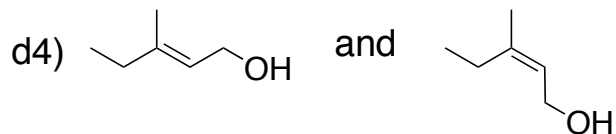
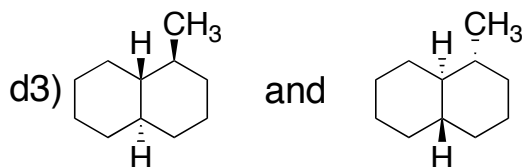
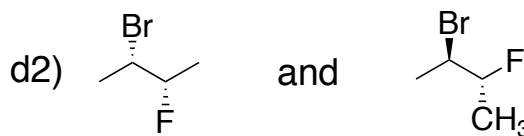
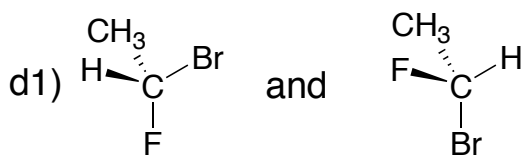
c) Define the following terms:

c1) constitutional isomers

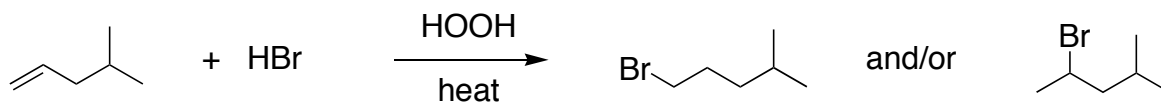
c2) oxidation

3 cont.) Short Answer Questions (60 points)

d) Are the following pairs of structures enantiomers, diastereomers, constitutional isomers, or the same?



e) Using some of the bond dissociation energies (BDE) provided, calculate the  $\Delta H^0$  for the following two reactions. Are the reactions exothermic or endothermic?



BDE's in kcal/mol, **alkene** C=C (pi), 66; C-H, 109; **alkane** C-Br, primary, 70; secondary, 71  
**alkane** C-C, 88; primary C-H, 101; secondary C-H, 99; **H-Br**, 87

f) Provide specific examples of each of the following:

f1) a racemic mixture

f3) a mercuronium ion

f5) a tertiary radical

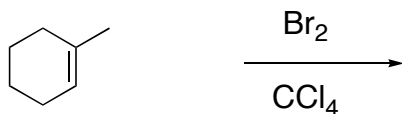
f2) a polar aprotic solvent

f4) a trisubstituted alkene

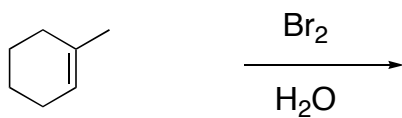
4) Reaction Products. (40 points)

Predict the product or products of the following reactions. Be sure to show stereochemistry if relevant. (4 points each)

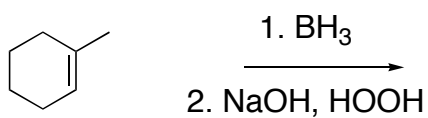
a)



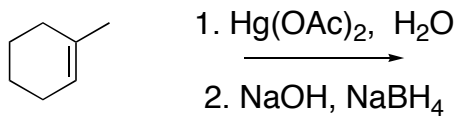
b)



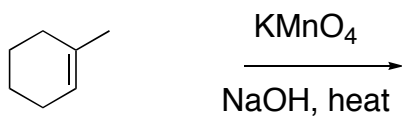
c)



d)

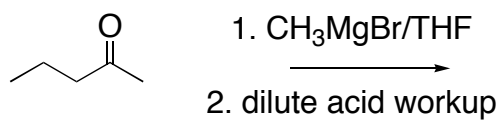


e)

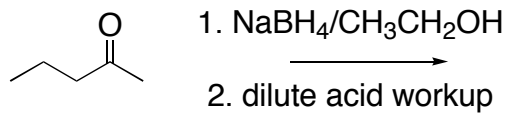


4 cont.) Reaction Products.

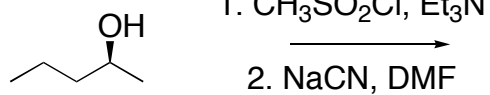
f)



g)



h)



i)

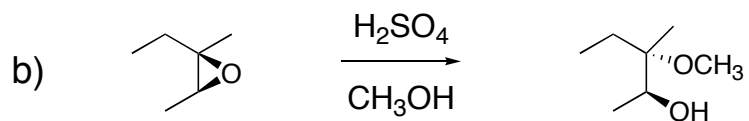
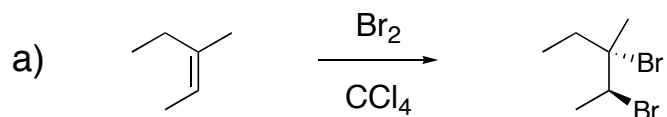


j)

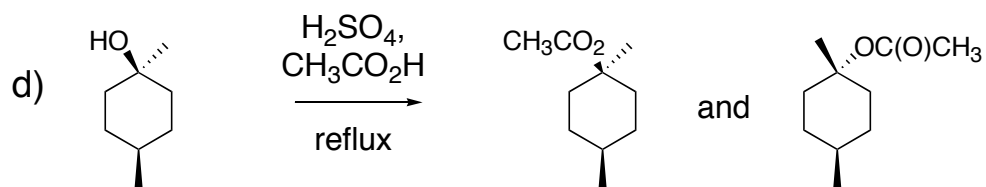
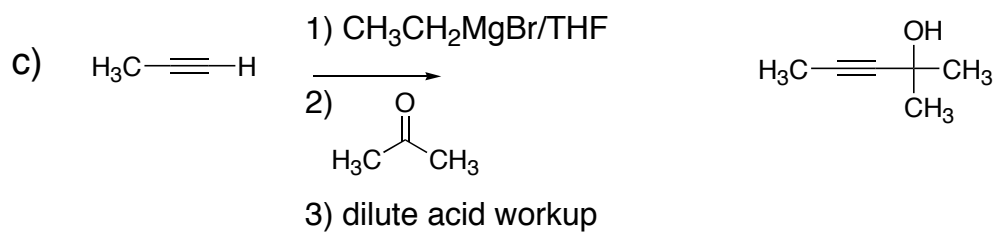


5) Mechanisms (40 points)

Write clear, step-by-step mechanisms for the following reactions. Use arrows to track electron flow. Be sure your mechanism accounts for the indicated stereochemical outcome (10 points each).



5 cont.) Mechanisms (40 points)



6) Multi-step Synthesis (20 points). Provide reasonable reaction sequences for **two of the following three** transformations. You can use any needed organic or inorganic reagents. Count the carbons carefully!

