

Chem 0310
Dennis P. Curran
April 27, 2005
Final Exam

Name: _____

Signature: _____

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

1. _____ 30 points

2. _____ 10 points

3. _____ 60 points

4. _____ 40 points

5. _____ 40 points

6. _____ 20 points

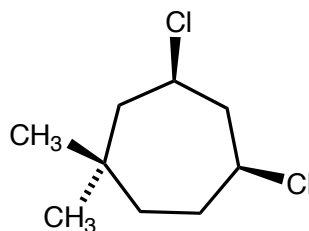
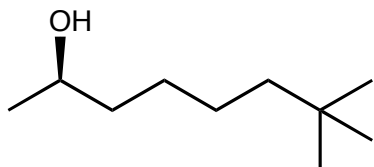
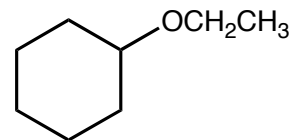
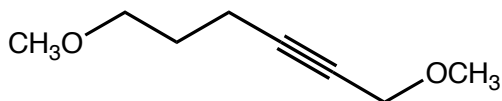
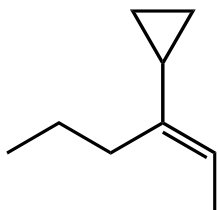
_____ Total (200 pts.)

The test has 10 pages (including this cover page) and 6 questions
The exam ends at 3:50 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).

(4*R*,4*S*)-octane-4,5-diol

(*meso*)-octane-4,5-diol

(3*S*)-1,1-dichloro-3-fluoro-
cyclohexane

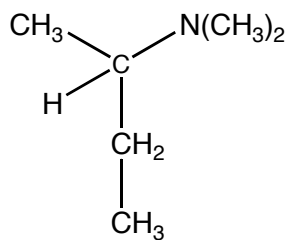
(3*Z*,5*S*)-5-chloro-4-propylhept-3-ene

but-3-ynylcyclopentane

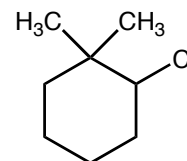
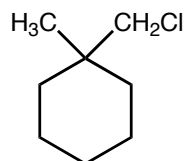
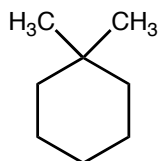
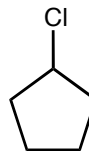
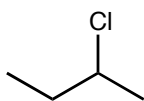
e) Rank the following C–H bonds in order of increasing bond energy. (strongest bond last)

2) Proton and Carbon-13 NMR (10 points)

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



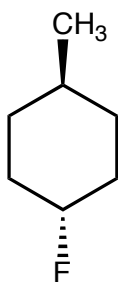
b) Indicate the number of resonances that you expect to see in the proton-decoupled (broadband-decoupled) ¹³C NMR spectrum of the following compounds.



3) Short Answer Questions (60 points)

a) Provide a specific example of an *anti* 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.



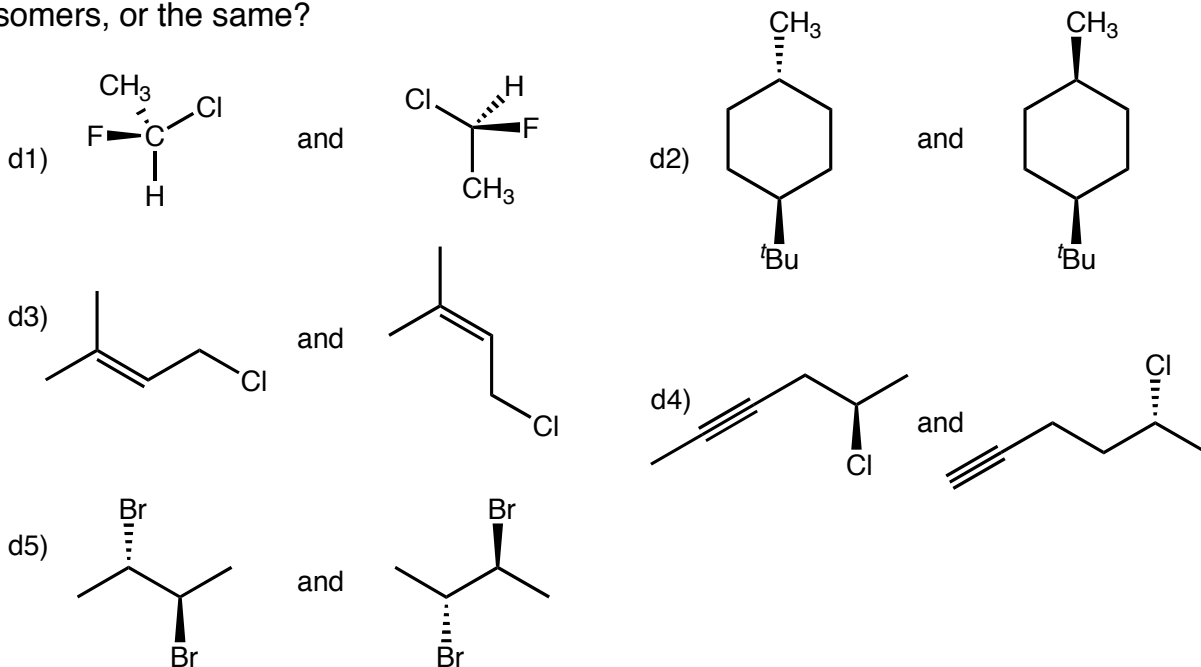
c) Define the following terms:

c1) conformational isomers

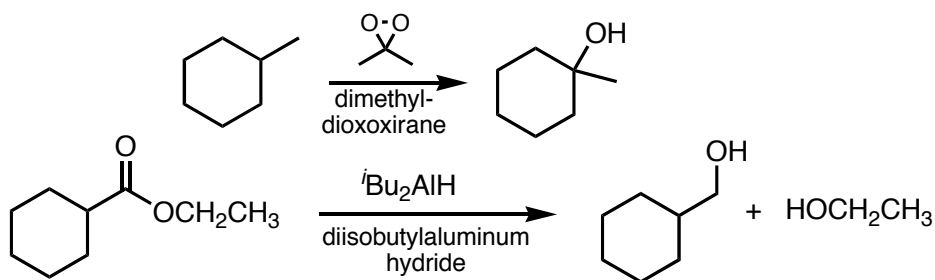
c2) diastereomers

3 cont.) Short Answer Questions (60 points)

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



e) Indicate whether each of the following two reactions is a **reduction**, an **oxidation** or **neither**.



f) Provide specific examples of each of the following:

f1) a pair of enantiomers

f2) an alkene with no E/Z isomers

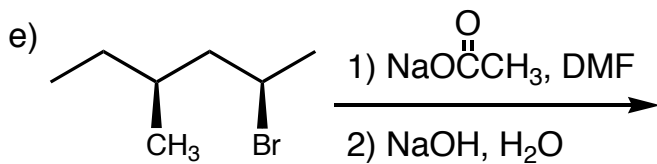
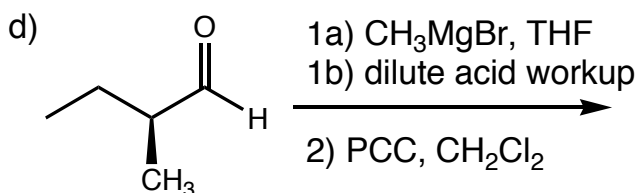
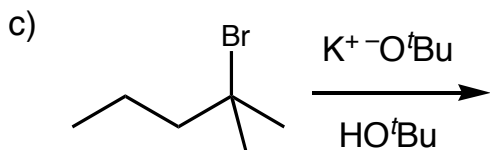
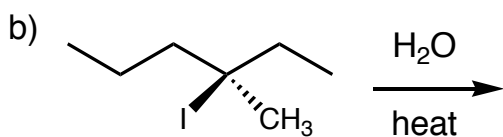
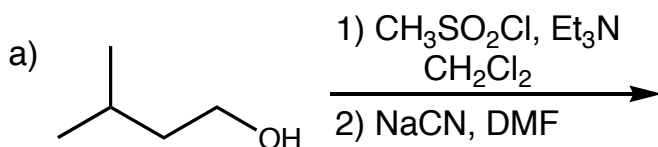
f3) a bromonium ion

f4) a tertiary alcohol

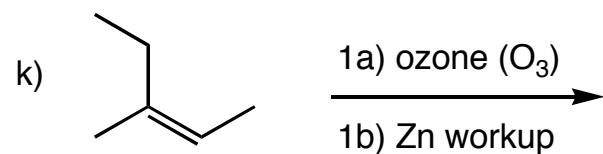
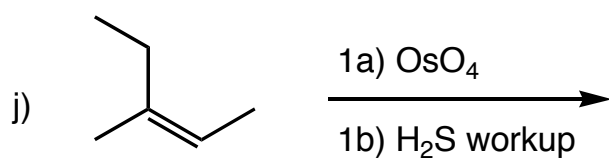
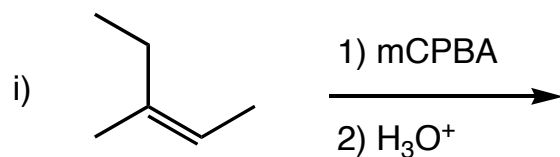
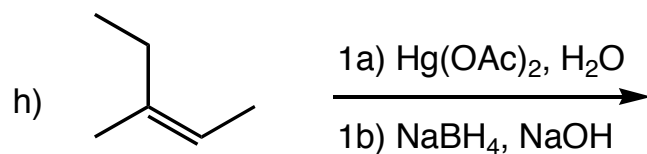
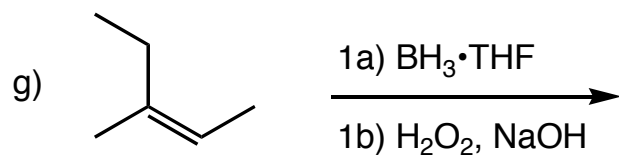
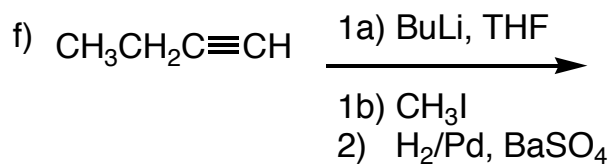
f5) an excellent electrophile for an S_N2 reaction

4) Reaction Products. (60 points)

Predict the product or products of the following reactions. Be sure to show stereochemistry if relevant. Note: "1a, 1b" indicates different parts of the same reaction, while "1, 2" indicates different reactions. (6 points each)

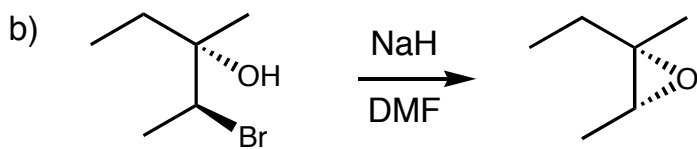
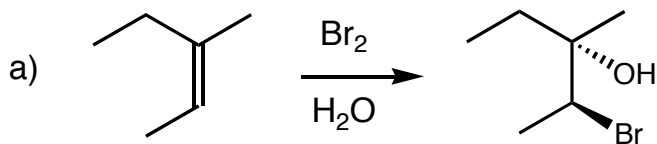


4 cont.) Reaction Products.

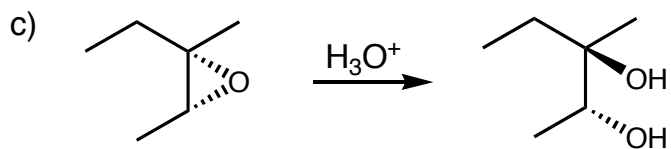


5) Mechanisms (40 points)

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).



5 cont.) Mechanisms (40 points)



d) The reaction in part **c** can be conducted in the presence of H_2O^{18} (O^{18} an isotope of O^{16} with two more neutrons). Using your mechanism in part **c**, predict which oxygen(s) in the product will be O^{18} and which oxygen(s) will be O^{16} . Explain your choice.

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. More than one step will be needed.

