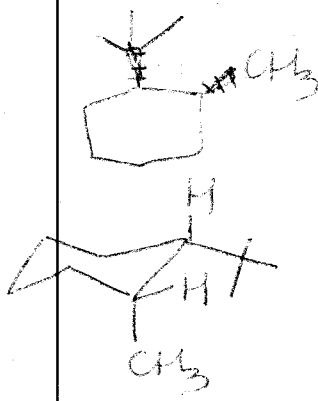
CH 253 FALL 2004 EXAM #2

1. (20 points) Multiple choice. Circle the <u>one</u> best answer for each problem below.

A. The preferred conformation of *cis*-1-*tert*-butyl-2-methylcyclohexane is the one in which:



1. the *tert*-butyl group is axial and the methyl group is equatorial.
2. the methyl group is axial and the *tert*-butyl group is equatorial.
3. both groups are axial.
4. both groups are equatorial.
5. the molecule exists in a boat conformation.

B. Which of the following pairs of compounds represent pairs of constitutional isomers?

1. 2-methylbutane and pentane
2. 2-chlorohexane and 3-chlorohexane
3. 2-bromobutane and 2-methyl-2-bromopropane
4. 1-chloropropane and 2-chloropropane
5. all of the above

C. Select the reagent(s) necessary to convert 3-bromohexane into hexane.

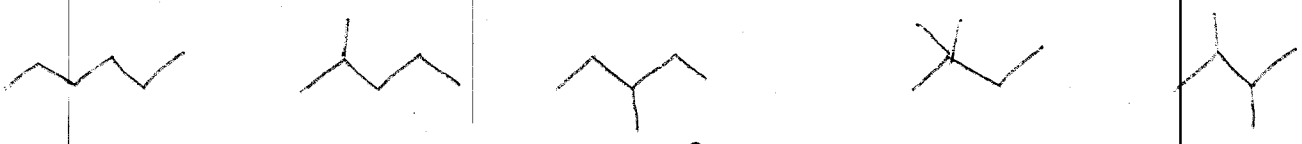
1. $Zn°/HBr$ 2. CuI 3. H_2O 4. HBr 5. NaOH

D. Which cycloalkane has the greatest ring strain?

1. cyclopropane 2. cyclobutane 3. cyclopentane
4. cyclohexane 5. cycloheptane

E. How many constitutional isomers are possible for the formula C_6H_{14}?

1. 2 2. 3 3. 4 4. 5 5. 6



F. Which is the most stable conformation of cyclohexane?

1. Chair 2. Twist 3. Boat 4. Half-chair 5. Staggered

G. Select the reagent(s) necessary to convert cyclopentene into cyclopentane.

1. H_2 and Ni 2. H_2O 3. Heat 4. Zn^0, H_3O^+ 5. Light

H. Which of these is the common name for the 1,1-dimethylethyl group?

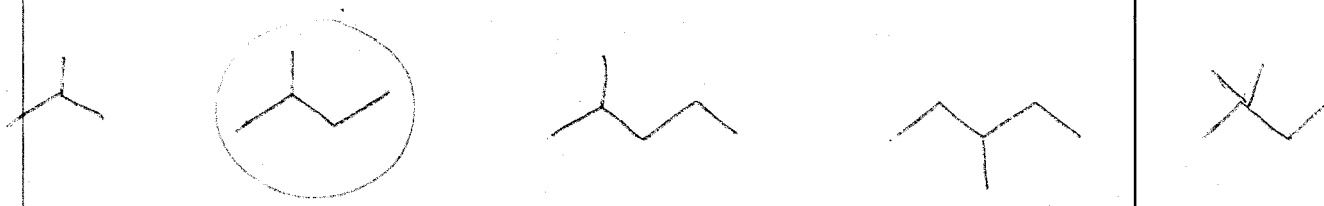
1. propyl 2. butyl 3. isobutyl 4. *sec*-butyl 5. *tert*-butyl

I. Hexane and 3-methylpentane are examples of:

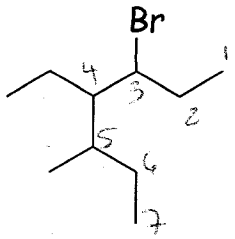
1. enantiomers 2. stereoisomers 3. diastereomers
4. constitutional isomers 5. none of these

J. What is the simplest alkane, i.e., the one with the smallest molecular weight, which possesses primary, secondary, and tertiary carbon atoms?

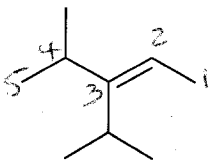
1. 2-methylpropane 2. 2-methylbutane 3. 2-methylpentane
4. 3-methylpentane 5. 2,2-dimethylbutane



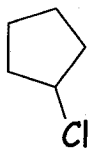
2. (18 points) Nomenclature. Name each of the following compounds using proper IUPAC nomenclature. Don't forget stereochemistry where appropriate.

a) 

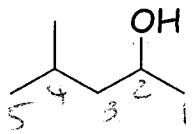
3-bromo-4-ethyl-5-methylheptane

b) 

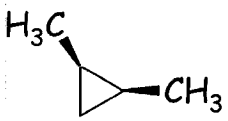
3-isopropyl-4-methyl-2-pentene

c) 

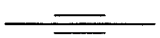
chlorocyclopentane

d) 

4-methyl-2-pentanol

e) 

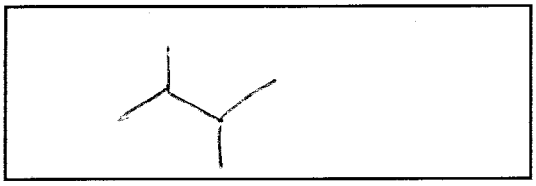
cis-1,2-dimethylcyclopropane

f) 

2-butyne

3. (15 points) An alkane with the formula C_6H_{14} can be prepared by reduction ($Zn°/HCl$) of only two alkyl chlorides (formula $C_6H_{13}Cl$) and by the hydrogenation of only two alkenes (formula C_6H_{12}). Write the structure of this alkane, give its IUPAC name, and show the reactions.

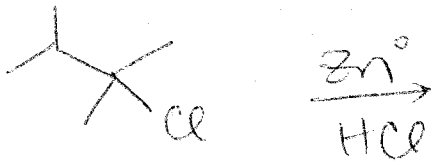
Unknown alkane:



IUPAC name: 2,3-dimethylbutane

Reduction reactions:

a) 

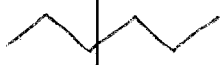
b) 

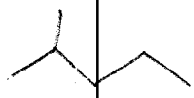
Hydrogenation reactions:

a) 

b) 

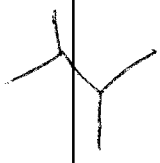
Possible answers:


3 possible chlorides


5 chlorides


4 chlorides


3 chlorides


2 chlorides

4. (6 points) Classify each of the following objects as to whether it is chiral or achiral.

a) A golf club. chiral

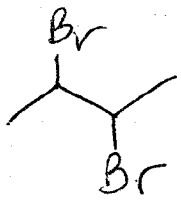
b) A hammer. achiral

c) A mitten. achiral

d) A glove. chiral

e) A foot. chiral

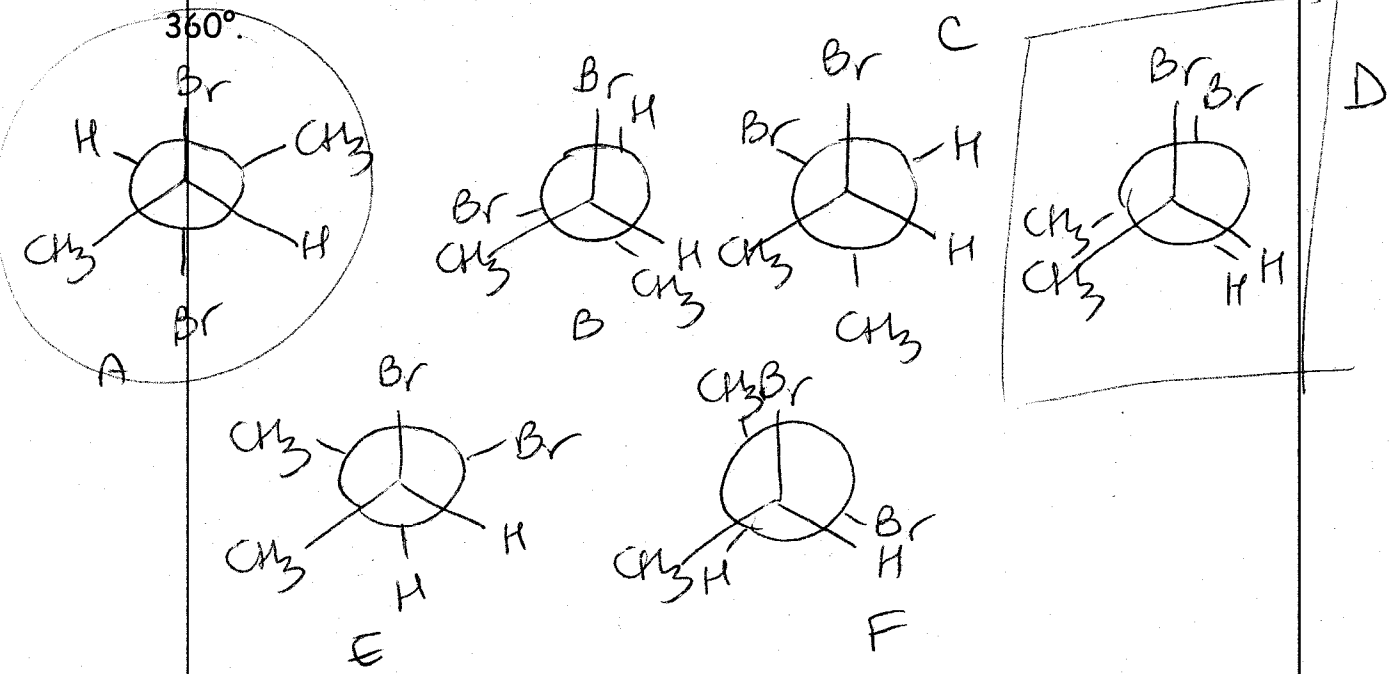
f) A coffee mug (no logo). achiral



Don't worry about stereochem

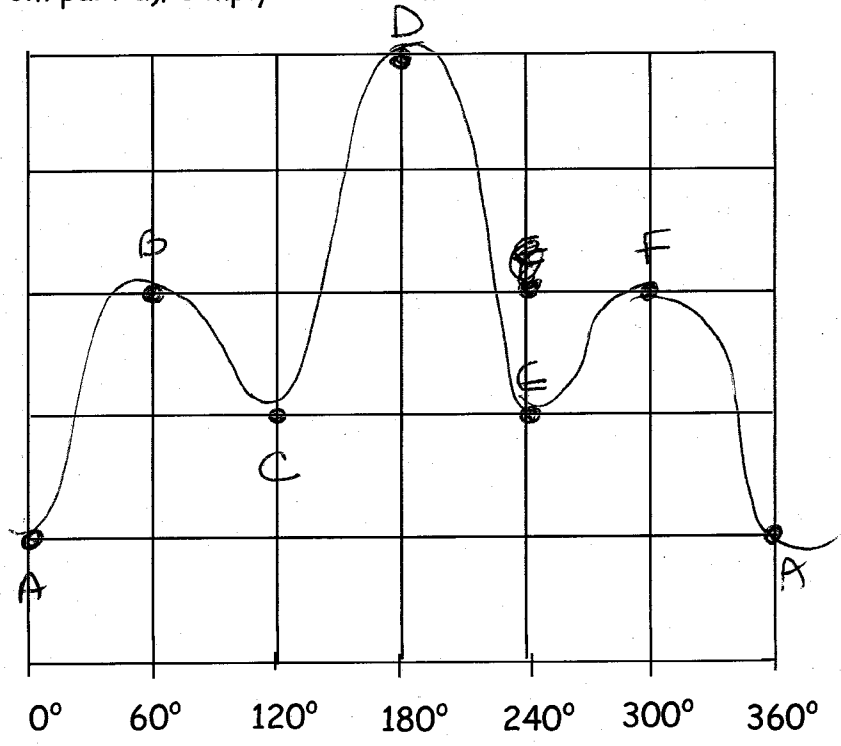
5. (14 points) Consider 2,3-dibromobutane.

a) Draw Newman projections for 60° rotations about the **C2-C3** bond, going the full 360°.



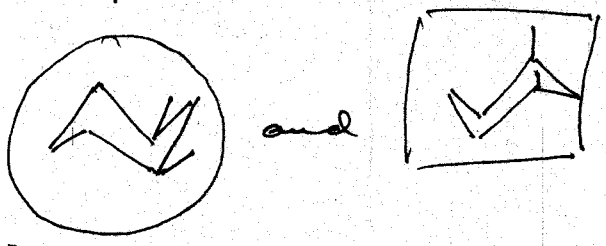
b) In your answer to part a), put a CIRCLE around the *most* stable conformation, and a SQUARE around the *least* stable conformation.

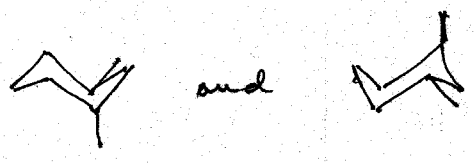
c) Sketch a rotational energy diagram on the axes below. You don't have to redraw your Newmans from part a); simply label them A -> F and use those letters on your sketch.



6. (15 points) Consider all 1,3-dibromocyclohexanes (don't forget isomer possibilities).

a) Draw all possible chair conformations for this molecule (including ring flips).

cis:  and

trans:  and

2pts each structure

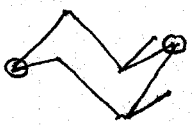
b) Put a CIRCLE around the *most* stable conformation. Is this cis or trans?

c) Put a SQUARE around the *least* stable conformation. Is this cis or trans?

} 2pts each

d) Referring to your answer in part b), is this a chiral molecule? Why or why not? (Short answer, please!)

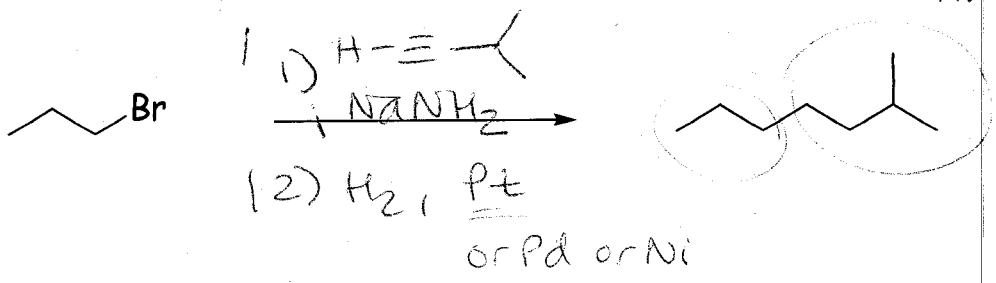
No - achiral 2pt

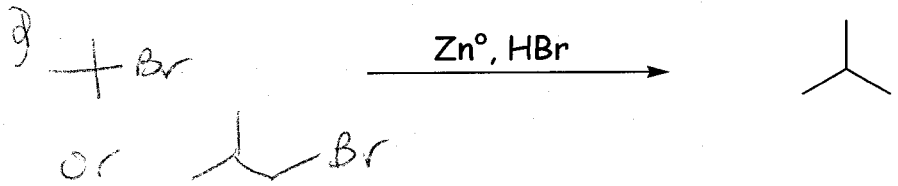
 has a plane of symmetry through the carbons that are circled

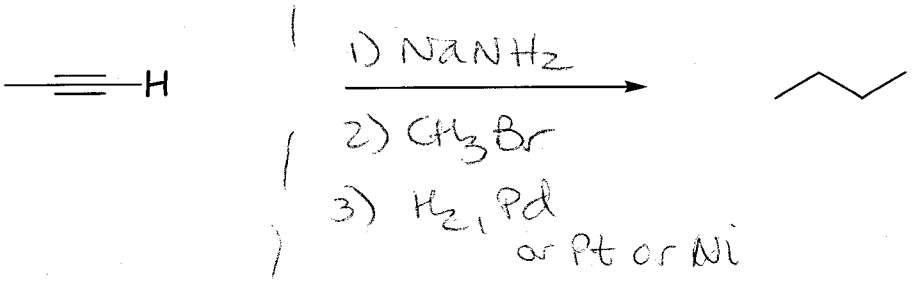
2pts

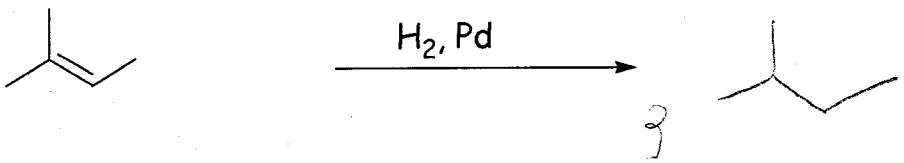
all possible

7. (12 points) Each of the following reactions is missing either reactant(s), reagent(s), or product(s). Fill in the missing information so as to complete the reaction. Keep in mind that "NRX" (no reaction) is always a viable *product*. Indicate stereochemistry where appropriate.

a) 

b) 

c) 

d) 

Extra Credit:

Samuel Clemens is better known as... who? Mark Twain