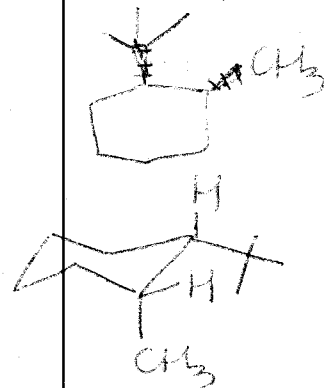


1. (20 points) Multiple choice. Circle the one best answer for each problem below.

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.

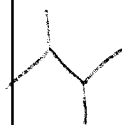
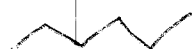
- ①. Zn^0/HBr
2. CuI
3. H_2O
4. HBr
5. $NaOH$

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?

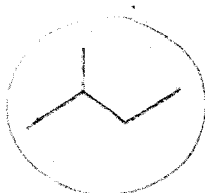
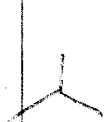
1. propyl 2. butyl 3. isobutyl 4. *sec*-butyl 5. *tert*-butyl

I. Hexane and 3-methylpentane are examples of:

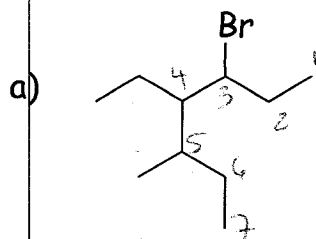
1. enantiomers 2. stereoisomers 3. diastereomers
4. constitutional isomers 5. none of these

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

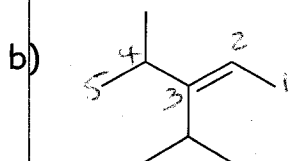
1. 2-methylpropane 2. 2-methylbutane 3. 2-methylpentane
4. 3-methylpentane 5. 2,2-dimethylbutane



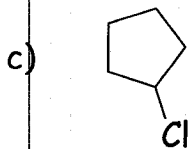
2. (18 points) Nomenclature. Name each of the following compounds using proper IUPAC nomenclature. Don't forget stereochemistry where appropriate.



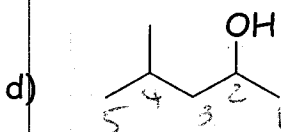
3-bromo-4-ethyl-5-methylheptane



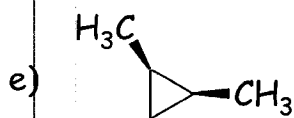
3-isopropyl-4-methyl-2-pentene



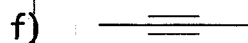
chlorocyclopentane



4-methyl-2-pentanol



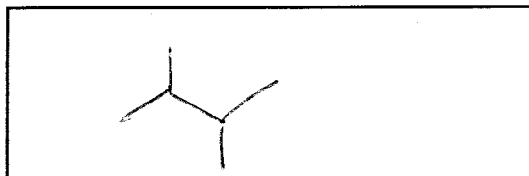
cis-1,2-dimethylcyclopropane



2-butyne

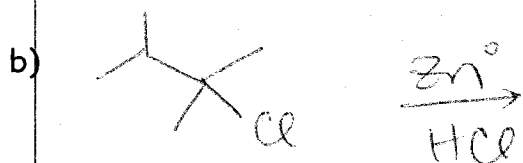
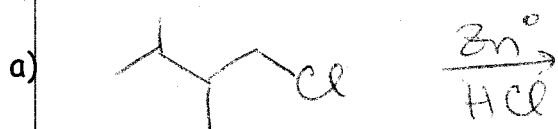
3. (15 points) An alkane with the formula C_6H_{14} can be prepared by reduction (Zn^0/HCl) of only two alkyl chlorides (formula $C_6H_{13}Cl$) and by the hydrogenation of only two alkenes (formula C_6H_{12}). Write the structure of this alkane, give its IUPAC name, and show the reactions.

Unknown alkane:



IUPAC name: 2,3-dimethylbutane

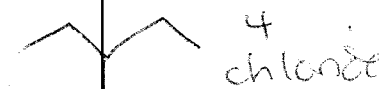
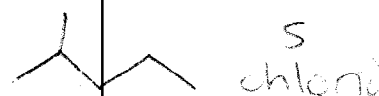
Reduction reactions:



Hydrogenation reactions:



Possible answers:



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

a) A golf club. ~~achiral~~ chiral

b) A hammer. achiral

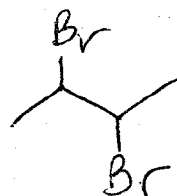
c) A mitten. achiral

d) A glove. chiral

e) A foot. chiral

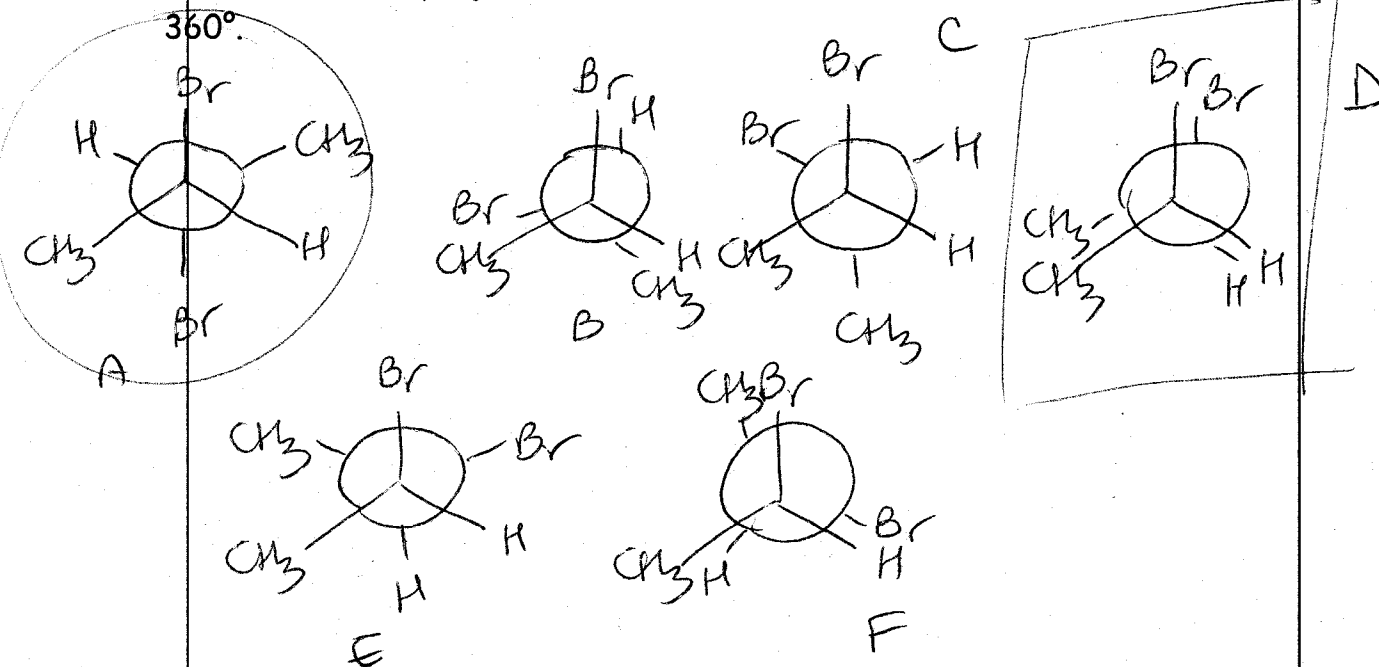
f) A coffee mug (no logo). achiral

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



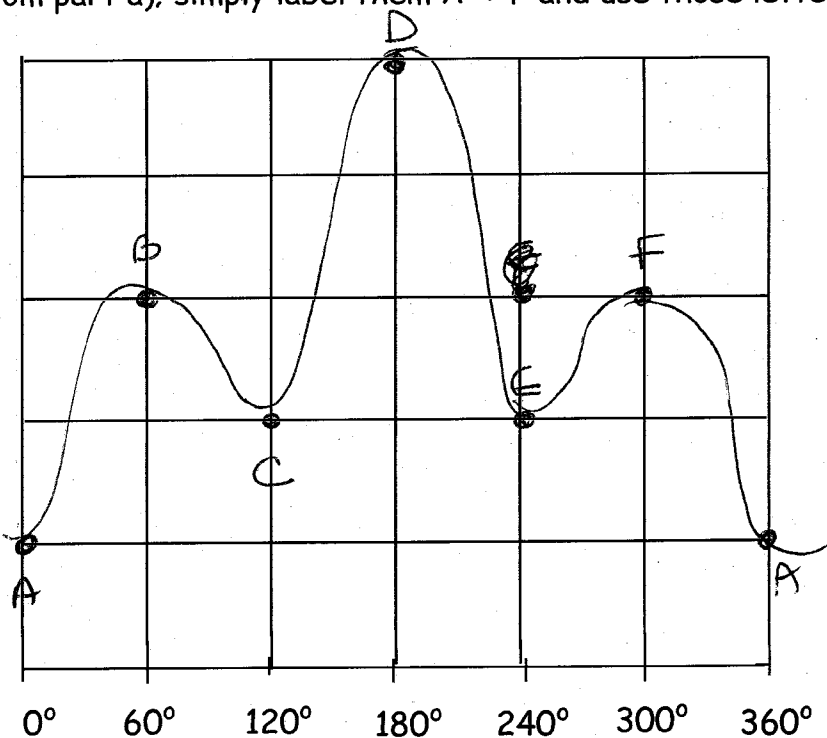
Don't worry about stereochemistry

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



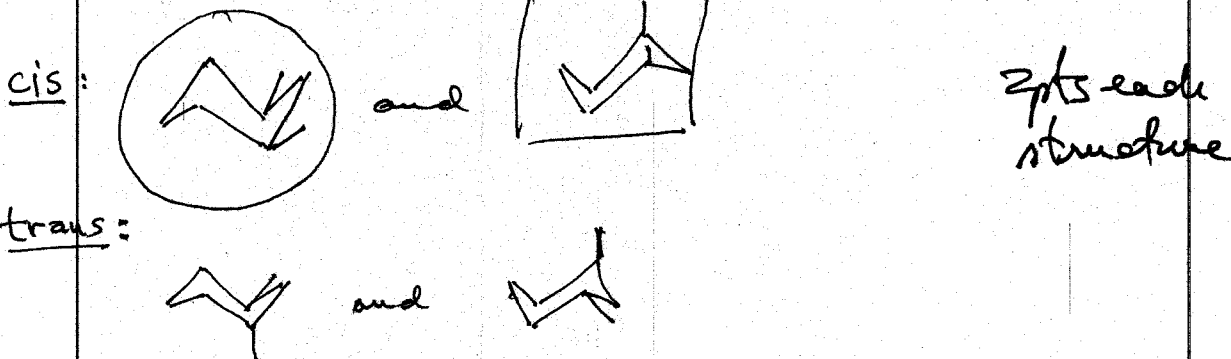
b) In your answer to part a), put a CIRCLE around the *most* stable conformation, and a SQUARE around the *least* stable conformation.

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).

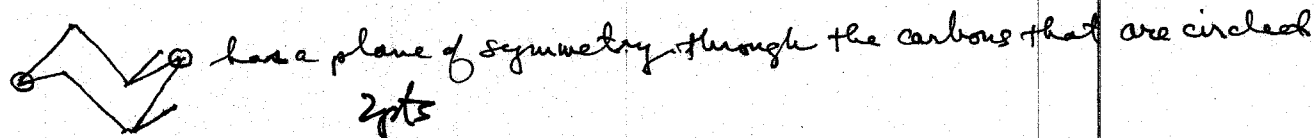


b) Put a CIRCLE around the *most* stable conformation. Is this cis or trans? } 2pts each

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

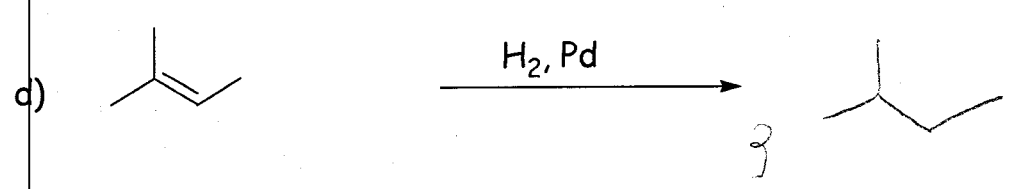
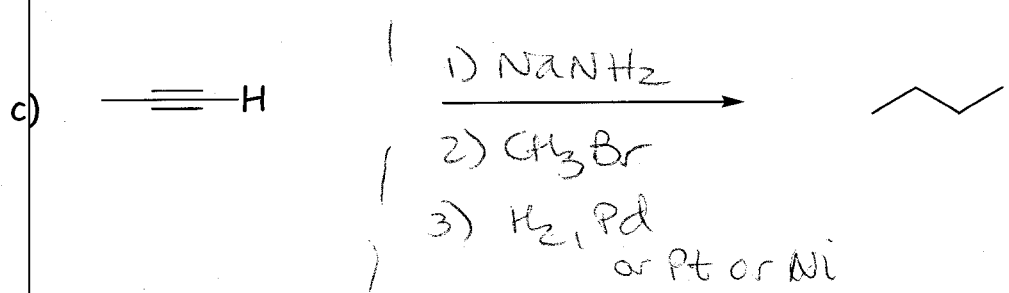
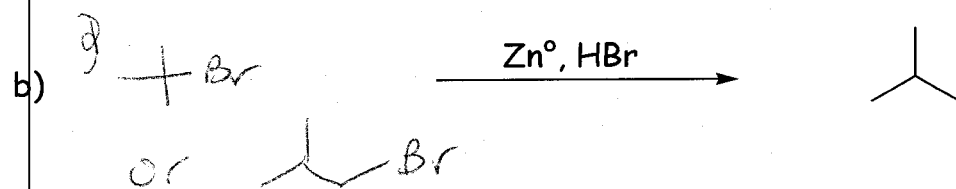
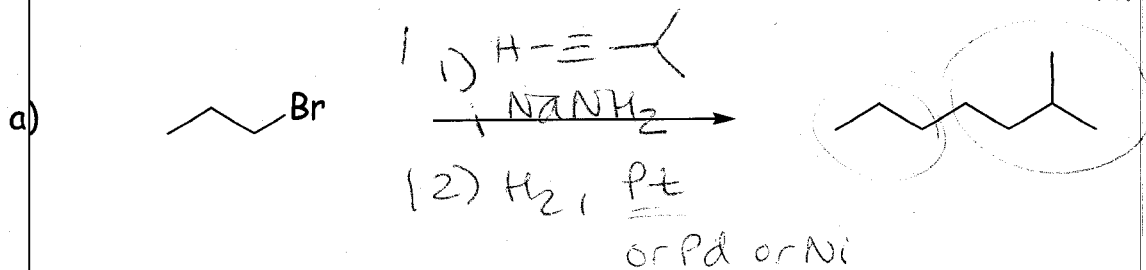
d) Referring to your answer in part b), is this a chiral molecule? Why or why not? (Short answer, please!)

No - achiral 2pt



is 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.



Extra Credit: 2

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