

EXAM 1
CHEMISTRY 220a
Friday, September 23, 2005

NAME (print): _____

TA: _____ Day: _____ Time: _____

No Calculators! Take a few moments to look over the exam. Answer each question on the exam paper.

Important clues and structures are in **bold**.

Do all **preliminary** drawing or computations on the work sheets at the end of the exam. The work sheets will not be graded.

The exam is 55 minutes.

STOP writing and hand in your exam when you are asked to do so.

REMEMBER: Neatness is to your advantage.

1. (20 pts) Conformation I _____

2. (20 pts) Orbitals _____

3. (20 pts) Potpourri _____

4. (20 pts) Conformation II _____

5. (20 pts) Nomenclature _____

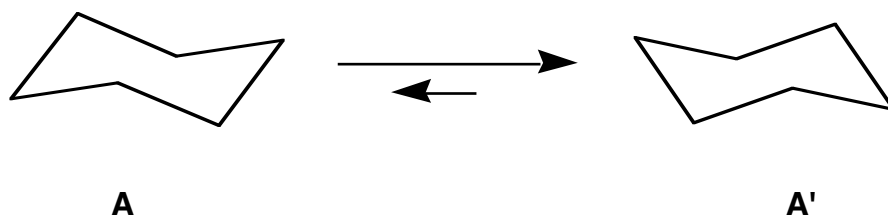
Total (100 pts)

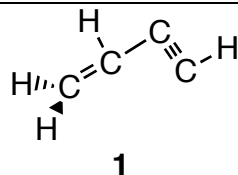
1. Conformation I (20 pts); Compound **A**, $C_7H_{14}O$, is a 1,3-disubstituted **cyclohexane**. The difference in energy between its two chair conformations is 0.8 kcal/mol. [ΔG° (kcal/mol) values for axial and equatorial substituents in mono-substituted cyclohexanes: -CN, 0.2; -Cl, 0.5; -OH, 1.0; -COOH, 1.4; -CH₃, 1.8; -C₂H₅, 1.9]

a) (7 pts) What are the two groups attached to the cyclohexane ring? Briefly explain your reasoning.

b) (6 pts) Is this 1,3-disubstituted cyclohexane a cis or trans isomer? Explain briefly.

c) (7 pts) Using the template below, add the groups to the cyclohexane rings paying attention to the position of the equilibrium. Briefly explain your reasoning.



<p>2. Orbitals (20 pts): Vinyl acetylene 1 is an important intermediate in the preparation of synthetic rubber.</p>	 <p style="text-align: center;">1</p>
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a) (8 pts) Comment on the errors present in structure **1**. Redraw it.

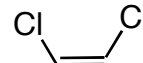
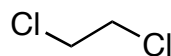
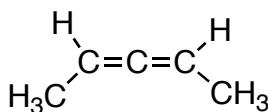
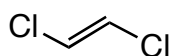
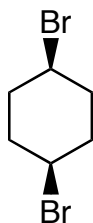
b) (12 pts) Provide a molecular orbital representation of **1**. Include and indicate the hybridization of carbon atoms and the location of π -bonds.

3. Potpourri: (20 pts; equal weight) Complete each of the following questions.

a) **Circle** compound(s) containing atoms with bonds having 33% s-character.



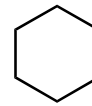
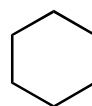
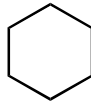
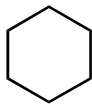
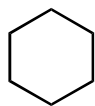
b) **Circle** the compounds with a net dipole moment.



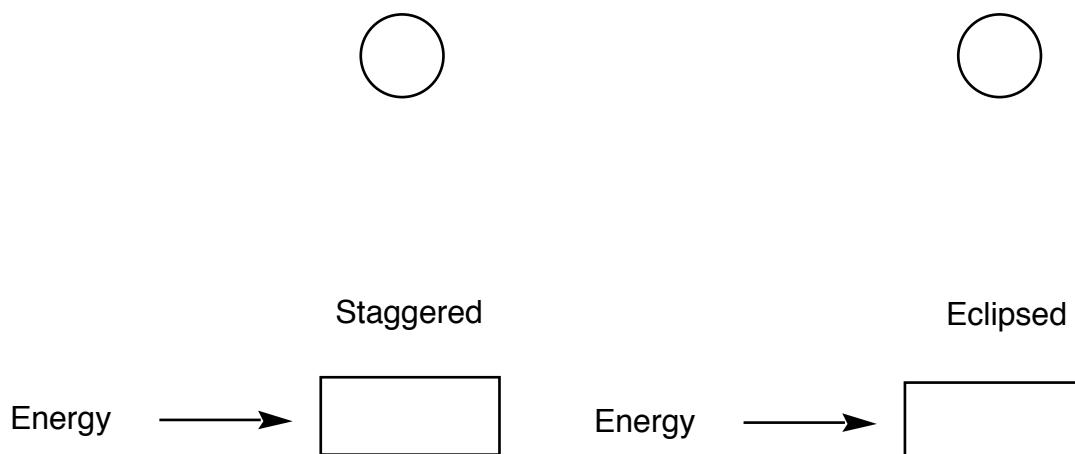
c) **Circle** the **least** acidic of the following compounds.



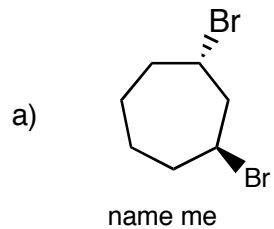
d) Using the templates below, draw (bold and dashed lines) the dibromocyclohexanes that have two equatorial substituents in their more stable chair conformation.



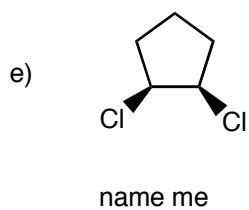
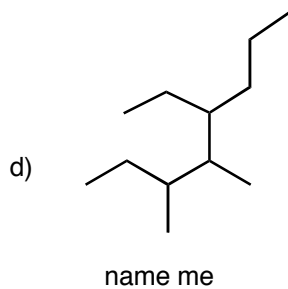
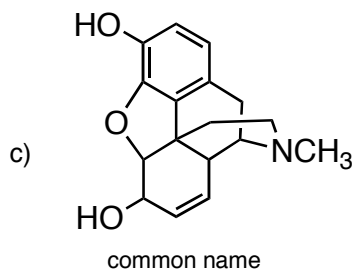
4. Conformation II (20 pts): For the eclipsed and staggered conformations of 2-methylpentane viewed along the C₂-C₃ sigma bond, **draw a Newman projection** of the **most** stable eclipsed and staggered conformations. Place the appropriate energies in the Newman projections below. [Use the **circles** as templates for the Newman projections.] Calculate the energy (kcal/mol) of both conformations. Place your answer in the appropriate **box**. Show work. [H/H, eclipsed, 1.0 kcal/mol; CH₃/H eclipsed, 1.3 kcal/mol; C₂H₅/H, eclipsed, 1.4 kcal/mol; CH₃/CH₃, eclipsed, 3.0 kcal/mol; C₂H₅/H, gauche, 0 kcal/mol; CH₃/CH₃, gauche, 0.9 kcal/mol; CH₃/C₂H₅, gauche, 1.0 kcal/mol.]



5. Nomenclature (20 pts): Complete the following:



functional group



Work Sheets

Work Sheets

Work Sheets