EXAM 1

CHEMISTRY 220a

Friday, September 28, 2001

NAME (print): _____

TA:_____ Day:_____ Time:_____

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. There is a Periodic Table on the last page of the exam.

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) _____

2. (20 pts) _____

3. (20 pts) _____

4. (20 pts) _____

5. (20 pts) _____

_____

Total (100 pts)

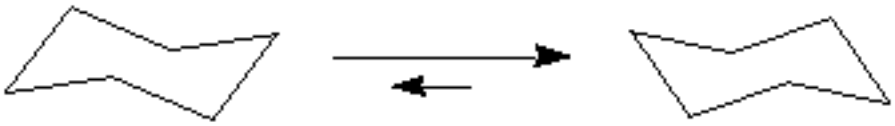
1. (20 pts) Compound **A**, $C_7H_{14}O$, is a 1,3-disubstituted **cyclohexane**. The difference in energy between its two chair conformations is 0.7 kcal/mol. [ΔG^o (kcal/mol) values for axial and equatorial substituents in mono-substituted cyclohexanes: -CN, 0.2; -Cl, 0.5;

-OH, 1.0; -COOH, 1.4; -CH_3, 1.7; -C_2H_5, 1.8.]

a) (6pts) What are the two groups attached to the cyclohexane ring? Briefly explain your reasoning.

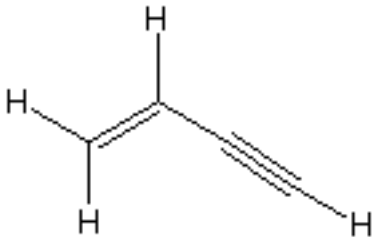
b) (6pts) Is this 1,3-disubstituted cyclohexane a cis or trans isomer? Explain briefly.

c) (8pts) Using the template below, add the groups to the cyclohexane rings paying attention to the position of the equilibrium. Briefly explain your reasoning.



A A'

2. (20 pts) Vinyl acetylene **1**, is an important intermediate in the preparation of synthetic rubber. Draw a molecular orbital representation of **1**. Include and indicate the hybridization of carbon atoms, the location of π-bonds, and an overall description (in a single word) of the shape of the molecule.



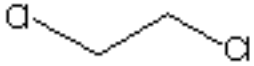
1

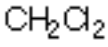
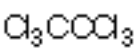
3. (20 pts; equal weight) Circle the best answer(s) in each of the following questions.

a) The dihedral angle in gauche butane

0^o	30^o	60^o	120^o	180^o

b) Compounds with a net dipole moment

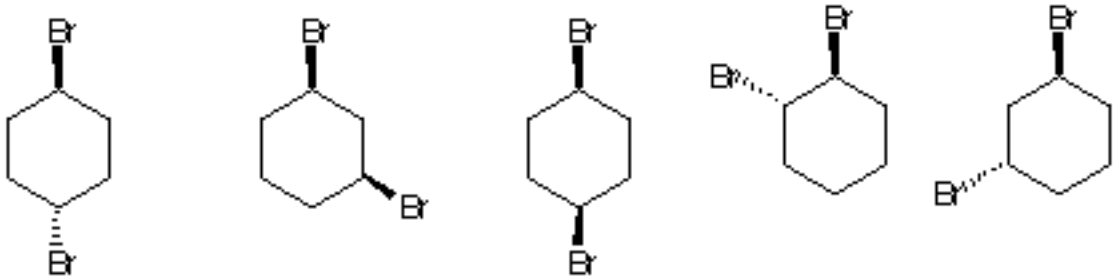
c) The least acidic of the following compounds

CH_3CO_2H	CCl_3CO_2H	HCl	C_2H_6	NH_3

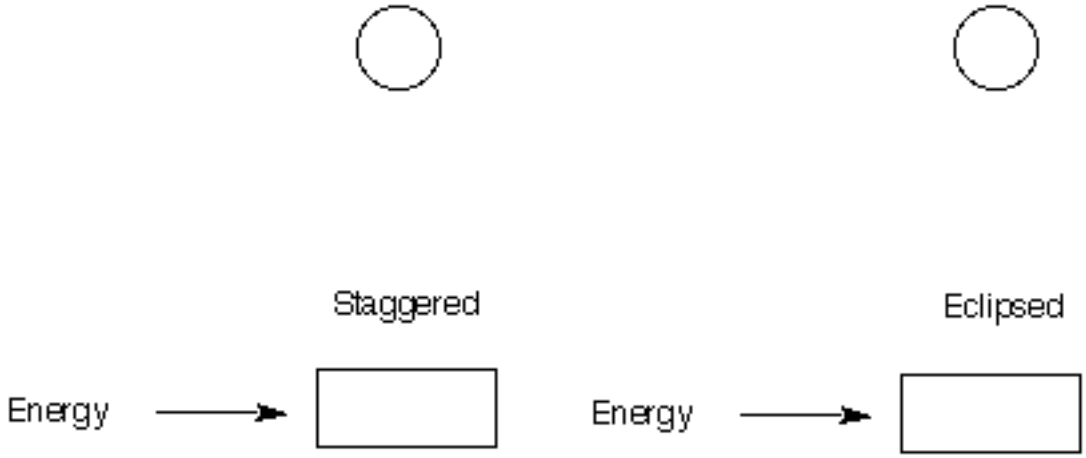
d) The 19th century chemist who concerned himself with stability of cycloalkanes.

Baeyer	Berzelius	Kekule	Liebig	van't Hoff

e) The dibromocyclohexanes that have two equatorial substituents in their most stable chair conformation.

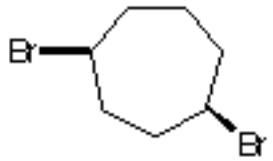


4. (20 pts) For the eclipsed and staggered conformations of 2-methylpentane viewed along the C2-C3 sigma bond, **draw a Newman projection** of the **most** stable eclipsed and staggered conformations. Place the appropriate energies in the Newman projections below. [Use the circles as templates for the 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; CH_3/H eclipsed, 1.3 kcal/mol; C_2H_5/H, eclipsed, 1.4 kcal/mol; CH_3/CH_3, eclipsed, 3.0 kcal/mol; CH_3/CH_3, gauche, 0.9 kcal/mol; CH_3/C_2H_5, gauche, 1.0 kcal/mol.]



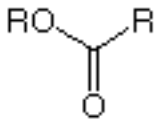
5. (20 pts) Complete the following:

a)



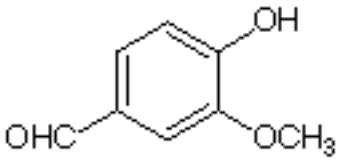
name me

b)



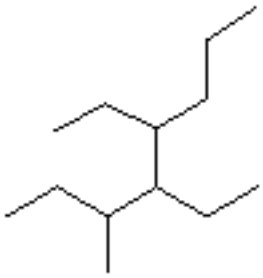
functional group

c)



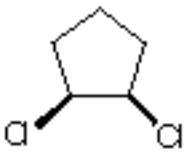
common name
(PS1)

d)



name me

e)



name me