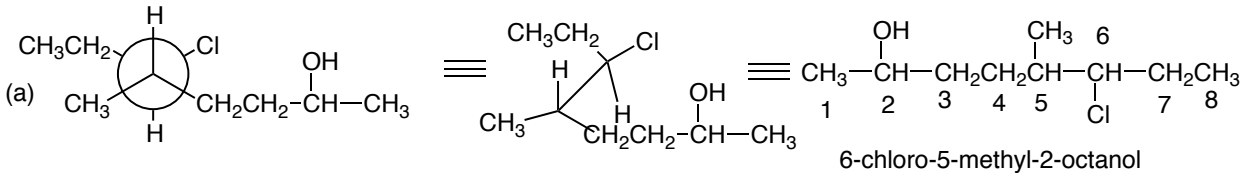
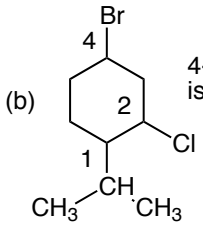
L. I. U.

Chem. 121, Sect 012, Exam 1 Fall, 2012, 100 points

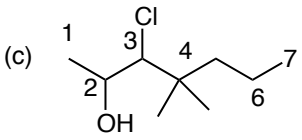
1. Name the following molecules. For (a) you must also make a saw-horse drawing and an expanded drawing. As well as name the molecule. (20 pts)

(a) 

6-chloro-5-methyl-2-octanol

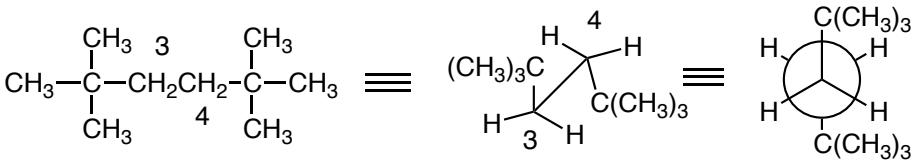
(b) 

4-bromo-2-chloro-1-isopropylcyclohexane

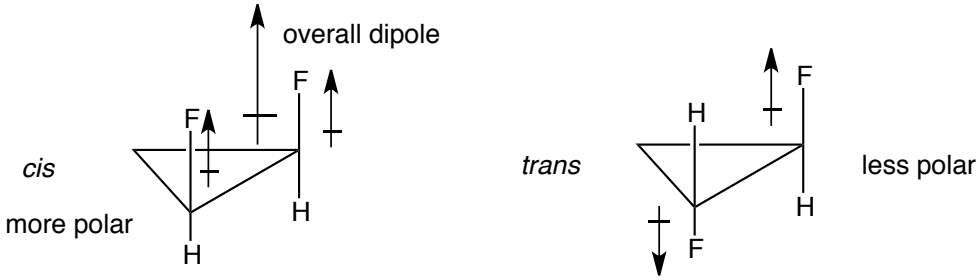
(c) 

3-chloro-4,4-dimethyl-2-heptanol

2. Draw a Newman projection of the low energy conformation of 2,2,5,5-tetramethylhexane looking down the C3-C4 bond and for partial credit first make an expanded drawing. (10 pts)

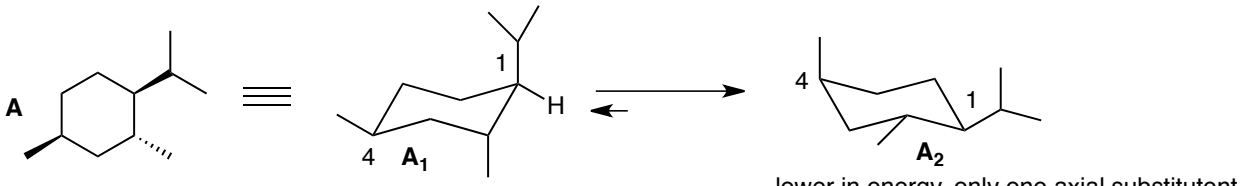


3. Which molecule is more polar, *cis*- or *trans*-1,2-difluorocyclopropane? Explain your answer by making careful three-dimensional drawings of each molecule, showing clearly the relationship between the substituents, the individual dipole moments and the overall dipole moment for each molecule. (10 pts)

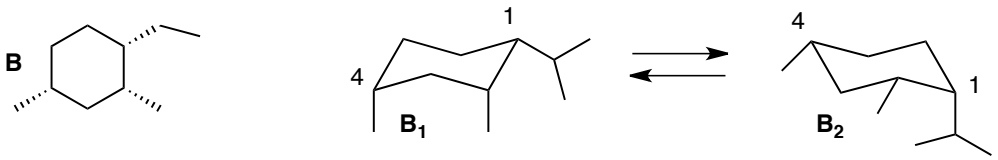


In the *cis* isomer, the dipoles point in the same direction and reinforce each other; in the *trans* isomer, the dipoles point in opposite directions and cancel.

4. Which molecule would have the lower heat of combustion, **A** or **B**? To answer this question, you must make careful three-dimensional chair drawings of both molecules, showing both conformations and how they interconvert by means of the ring-flip and identifying in each case which conformation would have the lower heat of combustion and then finally choosing the lowest overall heat of combustion. (15 pts)



lower in energy, only one axial substitutent and the large isopropyl group is equatorial.



B_1 and **B_2** are similar in energy; **B_1** has two axial methyls but **B_2** has the axial isopropyl, the large substituent so they tend to balance.

Overall, **A** is lower in energy than **B** because it has the conformation in which there is only an axial methyl and the large isopropyl group is equatorial alaong with the other methyl group.

5. For the following acid-base reactions, identify the acid and the base, give the product of the reaction, show the movement of the electrons using the arrow formalism, show all charges, and also calculate the equilibrium constant for the reaction. If the equilibrium constant is very unfavorable, you can simply state NO REACTION. For reaction (b), simply indicate the position of the equilibrium. (25 pts)

(a) $CH_3CH_2-C(=O)-O-H$ + $CH_3-\ddot{N}-CH_3$ (H) ⇌ $CH_3CH_2-C(=O)-O^-$ + $CH_3-\overset{+}{N}H-CH_3$

Pka 4.8 pKaH 11.3 Keq = $10^{6.5}$ TO THE RIGHT pKa 11.3

(b) $F-B(F)-F$ + $\ddot{O}(CH_3)-CH_2CH_3$ ⟶ $F-B^-(F)-O^+(CH_3)-CH_2CH_3$ equilibrium to the right

(c) CH_3CH_2-O-H + $Na^+\ ^-Br$ ⇌ No reaction; the base is too weak to remove a proton

pKa 16 pKaH -6 Keq = 10^{-22}

6. Draw 4 isomers of $C_4H_{10}O$. (20 pts) **BONUS:** Draw 2 more.