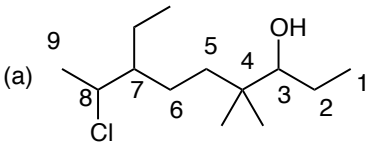
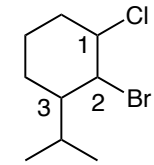
L. I. U.

Chem. 121, Sect 008, Exam 1 Fall, 2012, 100 points

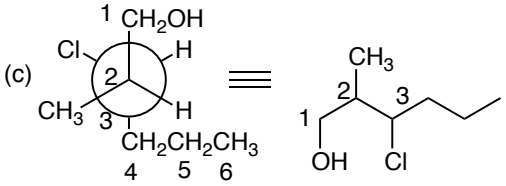
1. For the following molecules, first make expanded drawings and then name the molecules. (20 pts)

(a) 

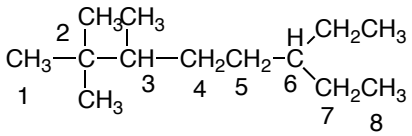
8-chloro-7-ethyl-4,4-dimethyl-3-nonanol

(b) 

2-bromo-1-chloro-3-isopropy-lcyclohexane

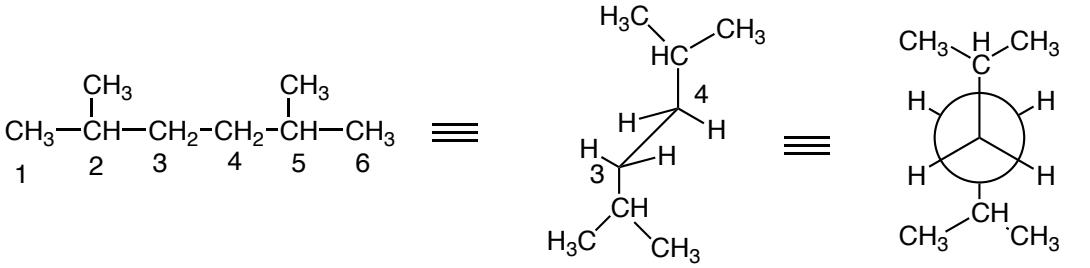
(c) 

3-chloro-2-methyl-1-hexanol

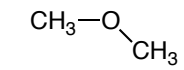
(d) $(CH_3)_3CCH(CH_3)CH_2CH_2CH(CH_2CH_3)_2$ ≡ 

6-ethyl-2,2,3-trimethyloctane

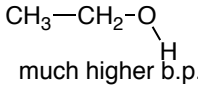
2. Draw a Newman projection of the low energy conformation of 2,5-dimethylhexane looking down the C3-C4 bond and for partial credit first make an expanded drawing. (10 pts)



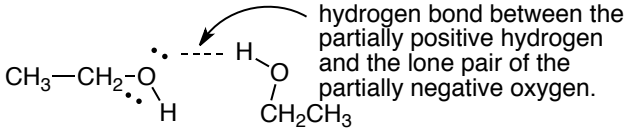
3. (a) Draw two constitutional isomers of C_2H_6O. (b) Which isomer has the higher boiling point? Explain and make a careful drawing to illustrate your answer. (10 pts)



much lower b.p.

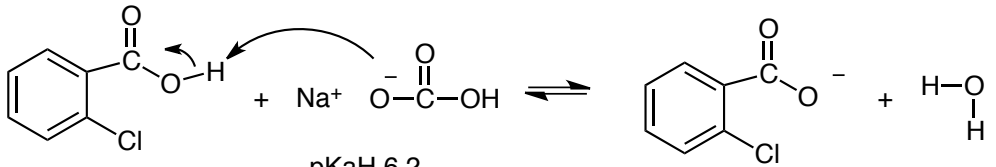


much higher b.p.



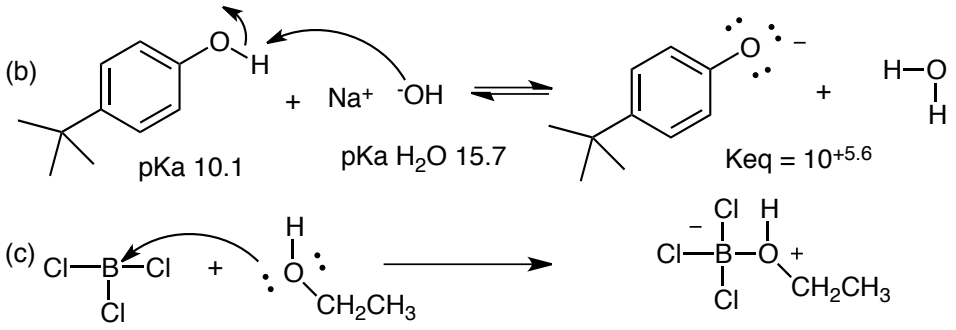
due intermolecular hydrogen-bonding

4. 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. (25 pts)

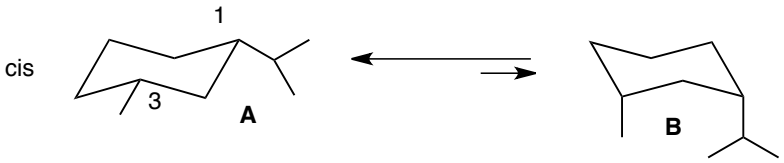
(a) 

pKa 2.92 pKaH 6.2

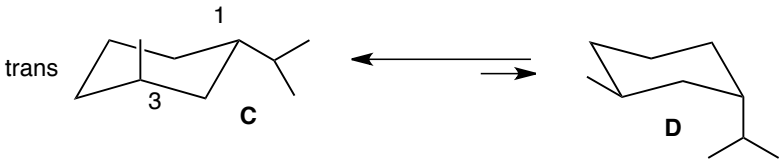
$K_{eq} = 10^{+3.28}$ Equilibrium is favorable; it lies to the right.



5. Which molecule would have the lower heat of combustion, *trans*-1-isopropyl-3-methylcyclohexane or *cis*-1-isopropyl-3-methylcyclohexane? To answer this question you must make careful three-dimensional chair drawings of both molecules, showing both conformations 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)



Conformation **A** in the *cis*-isomer is much lower in energy than conformation **B,** since both substitutents are in the low energy equatorialj conformation in which theree is no bad 1,3-diaxial interaction.



Conformation **C** is lower in energy than conformation **D**, since the larger isopropyl group is in the less crowded equatorial position in **C**.

Overall, the *cis*-isomer is lower in energy than the *trans*-isomer since int he *cis*-isomer both substituents can adopt an equatorial position. Therefore,the *cis*--isomer would have the lower heat of combustion.

6. Draw 4 isomers of C_5H_{10}. (20 pts). **BONUS:** Draw 2 more.