6. What are the two types of stereoisomers and how are they related? Using these terms, draw all possible stereoisomers of the molecule shown below. Label each in terms of their relationship to the others.

7. Assign the R and S configuration at each stereocenter of the following molecules. Identify all meso compounds.
Discussion Problems 6 for Oct. 17, 18, 2011

1. (a) Draw all of the possible stereoisomers of 2,3-butandiol in 3-D. Indicate the relationship between each of the stereoisomers (i.e. enantiomers or diastereomers) you have drawn and label any meso compounds. Use your models!

2-D structure

A

B

C

A + B = enantiomers
A + C = diastereomers
B + C = diastereomers

(b) Which of the isomers are chiral? Which are achiral?

A + B are chiral
C is achiral

(c) To be achiral, a compound must have internal symmetry. Draw any achiral compounds from above in conformations where their internal mirror planes are evident.

2. (a) Draw the possible stereoisomers of 2-pentanol. Assign R and S to each stereocenter.

(R)  

(S)

(b) What is the relationship between the stereoisomers you drew in part (a)?

enantiomers
(c) Draw the carbocation(s) which would be the intermediates of the dehydration of these two stereoisomers. Are they different or the same? Are they chiral or achiral? You need to consider the geometry of the carbocation about the carbon bearing the positive formal charge.

The two carbocations are the same. The geometry about the carbon bearing the formal positive charge is trigonal planar. There is a mirror plane running through the carbocation. It is achiral.

3. Name the following including R,S. Also label each structure as cis or trans. Redraw in chair conformation(s). Circle the lowest energy conformation for each.
4. Draw the two ring flip conformers of cis,trans-1,3,5-trimethylcyclohexane. Determine the $\Delta G^\circ$ between the two conformations. The $\text{CH}_3-\text{CH}_2$ 1,3 diaxial interaction = 15 kJ/mol. Using the equation $\Delta G^\circ = -2.303RT \log K_{eq}$ calculate the percentage of each conformer present at 25°C.

$$\Delta G = -15 \text{ kJ/mol} = -15,000 \text{ J/mol} = -2.303 RT \log K_{eq}$$

$$-15,000 = -2.303 (8.314)(298) \log(K_{eq})$$

$$K_{eq} = 425.5 = \frac{\text{moles conformation B}}{\text{moles conformation A}} = \frac{N_B}{N_A}$$

Consider a sample of 1.0 mol total, then $N_A + N_B = 1.0$ and $N_A = 1 - N_B$

$$425.5 = \frac{N_B}{1 - N_B} \quad \text{Solve for } N_A + N_B = N_A = 0.003 \Rightarrow 0.3\% \text{ A}$$

$$N_B = 0.997 \Rightarrow 99.7\% \text{ B}$$

5. Draw all the isomers of dimethylcyclohexane in their most stable chair conformation. Label them as chiral, achiral and/or meso.