Problem Set 2

1. Read Chapter 3 Section 4. You should be familiar with why alkane hydrocarbons are nonpolar and therefore hydrophobic in nature. You should understand why simple alkanes have relatively low boiling and melting points, and be able to explain the trend in increasing b.p. and m.p. as the number of carbon atoms (i.e., the molecular weight) of alkanes increases. What type of intermolecular interactions occur between hydrocarbons?

2. Read Chapter 3 Sections 5 and 6. You should be aware of the major uses of alkanes as our major source of energy (natural gases and liquid petroleum) via combustion with oxygen.

3. Review the material in Chapter 1 Sections 13-19 on hybridization, molecular shapes, the general rules of hybridization and geometry, how to draw three-dimensional molecules, and bond rotation to refresh your memory on concepts that determine molecular shape and structure: valence-shell electron-pair repulsion theory (VSEPR theory), hybridized orbitals (sp, sp^2 and sp^3 hybrid orbitals), and the relationship between hybridization and molecular flexibility or rigidity. This material from General Chemistry is the foundation for understanding the structures and conformations of alkanes and cycloalkanes. Practice the solved problems in those sections to test your confidence in understanding those concepts.

4. Read Chapter 3 Sections 7-9. You are responsible for knowing the structures of simple (normal) alkanes and branched alkanes. You should know the conformations of the simple alkanes (ethane, propane and butane), and how to represent different conformations using perspective drawings, Newman projections and Sawhorse structures. You should be familiar with terms associated with different conformations and their relative energies (conformational analysis): eclipsed, staggered, skew, gauche, anti, totally eclipsed, torsion (dihedral) angle, torsional strain and energy, and steric strain and energy. What is the difference between torsional strain and steric strain? What is the origin of both? You should be able to apply those concepts and principles to higher simple alkanes as well as branched alkanes.

Work the following problems found in Chapter 3 Sections 7-9 of the text: **Problems 11-13**.

Work the following problems found at the back of Chapter 3: **Problems 34f, 40, 44, 48-50.**

Note: Problems related to the structures, conformations and energies of cycloalkanes will be addressed in Problem Set 3.

We will begin discussing the structures, conformations and naming of simple and substituted cycloalkanes (cyclic alkanes) shortly. I recommend that you read the material in Chapter 3 Sections 10-16 to become familiar with that material.