Homework 3  
September 24, 2003

Problems from the text:
Chapter 4:  2-55--except 42-46, 48, 50-52 (Newman Projections, Alkanes, Cyclic Molecules)
Chapter 6:  2-8, 10-11, 27, 30, 34, 35, 37, 43, 49 (Alkenes)
Chapter 8:  1, 2, 18-20, 22, 45 (Alkynes)

Read:  Sections 3.4, 3.7, 6.3, 6.5, 6.6, 8.2 in the text
Memorize:  Table 4.2

Additional problems:

1. Draw an Orbital Interaction Diagram for a 2s atomic orbital and a 2px atomic orbital. In a second Orbital Interaction Diagram indicate how the molecular orbitals change if a 2py or 2pz atomic orbital is used rather than the 2px atomic orbital.

2a. Using a Newman Projection and siting along the Cα-Cβ bond, draw the most stable conformation of the amino acid Valine.

2b. You have synthesized a 20 amino-acid peptide in the lab. The amino acids are connected by peptide bonds between the amino and carboxylate groups of adjacent amino acids. Every fourth or fifth amino acid is Leucine. The peptide is conformationally quite flexible. Your lab partner suggests that you could decrease the conformational flexibility of the peptide by replacing the Leucine residues with Isoleucine. Is this a reasonable suggestion? Why?

3. Draw a 3D (three-dimensional) diagram of ethane in which you explicitly draw all of the bonding orbitals (i.e. represent the bonds not as lines, but as, for example, an sp³ orbital overlapped with an s orbital). Your structure should represent the most stable conformation of ethane.

4a. t-Butylbromide can ionize to form a bromide anion and a t-butyl cation. What is the hybridization of C in the t-butyl cation? What is the angle between the methyl groups in the t-butyl cation?

4b. The Ea for this reaction is +23 kcal/mol. What is the half-life of this reaction?