Chapter 1 Lecture Outline **Introduction to Structure and Models of Bonding**

assigned problems: 1-2, 5-6, 9-11, 13, 16-17, 19, 21-22, 24, 28-29, 32-33

Key Concepts and Learning Goals

- be able to write complete Lewis structures for organic molecules
- be able to identify the local orbital structure for valence electrons in any Lewis structure
- be able to write resonance structures for molecules and evaluate their relative importance
- write Lewis-Linnett structures of molecules with odd electron bonds
- be able to predict the atom geometry in organic structures from Lewis structures
- identify pi systems and # pi electrons in molecules
- know relative atom electronegativites, polarizabilities, van der Waal radii, and avg C-C bond length and strength
- predict bond polarity and relative molecule dipole moments
- be able to construct group orbitals for methyl, methylene, and related common organic substructures
- write pi MO diagrams for organic pi systems
- be able to evaluate molecular structure and reactivity based on an orbital deconstruction of molecular electron density

I. Atomic Orbitals, Atom Hybridization, and Molecular Geometry
   A. quantum numbers and atomic orbital functions
   B. atom electron configuration - ground states and excited states and Hund's rule
   C. sigma and pi bonding, atom hybrid orbitals, and atom geometry in molecules

II. Lewis Structures of Organic Molecules - a valance bond approach
   A. Lewis structures: show all valence electrons, obey octet rule, include formal charges, include resonance structures as needed
   B. identifying conjugated pi-systems
   C. cases when pi-electron delocalization does not occur in molecules with contiguous p-orbitals
   D. Lewis-Linnett structures and odd-electron bonds

III. Atom Electronic Properties and Effects on Molecular Structure
   A. atom and group electronegativities and bond polarity
   B. bond and molecule dipole moments
   C. atom sizes, bond lengths, and molecular dimensions
   D. atom and molecule polarizability

IV. Molecular Orbital Theory and Common Group Orbitals
   A. introduction to MO theory of organic molecules
      1. the Schrodinger Equation
      2. the total wave function and its square
      3. a molecular orbital and the LCAO approximation
   B. pi-system MOs
      1. linear pi systems
      2. cyclic pi systems
   C. symmetry adapted orbitals - delocalized sigma bonds
      1. molecular symmetry and symmetry terms
      2. CH_3 group orbitals
      3. CH_2 group orbitals
   D. ethane, ethene, and formaldehyde orbital structure and their FMOs
   E. summary of basic tenants of qualitative molecular orbital theory

V. Orbital Structure of Reactive Intermediates and Aromatic Structures
   A. hyperconjugation
   B. α-amino radicals and the 3-electron pi bond
   C. arenium cation intermediate in toluene ring bromination
   D. propene conformation