CH 221 Chapter Five Study Guide

- Be able to describe the main features of valence bond theory. Realize that valence bond theory views bonding as arising from the idealized overlap between two atomic orbitals; the electron density remains localized along the bond axis, but the overall energy of the system does not change.

- Be able to describe the main features of molecular orbital theory. Realize that the number of molecular orbitals always equals the number of atomic orbitals used in the combining atoms. Know that some of the bonds will be bonding and others will be antibonding.

- Understand how a sigma bond forms. Know the three types of sigma bond formation (s+s, p+s, p+p).

- Understand the concept of pi bonds under both molecular orbital and valence bond theories.

- Be able to use the concept of orbital hybridization to describe the bonding form of atoms in molecules. Know how to assign sp, sp^2, sp^3, sp^3d, and sp^3d^2 hybridization to the appropriate atoms, and know what geometry each of these hybridization forms will give the molecule (ex: sp = linear, etc.)

- Be able to draw molecular orbital diagrams for all diatomic molecules (Li_2, O_2, etc.) up to neon. Know how to handle a charged diatomic molecule (ex: O_2^{2-}) using molecular orbital theory. Realize that you will be expected to determine the ***correct*** molecular orbital diagram for oxygen, fluorine and neon diatomics.

- Be able to apply Hund's Rule and the Pauli Exclusion Principle when assigning electrons to molecular orbitals.

- Be able to predict paramagnetic behavior and the bond order from molecular orbital diagrams. Know what these predictions mean for the molecule.

- Be able to solve and understand the assigned problems in problem set #5.