Molecular Models 1
Post-Lab Questions

1. Why can we ignore the disposition of the lone pairs on terminal atoms?

2. How does bonding change for O₂, N₂ and F₂? How do you expect this to affect their chemistry? Why?

3a. Describe the structural changes that occur for the molecules BH₃, CH₄, NH₃, H₂O, HF as the central atom changes. According to the Lewis/VSEPR theory of bonding why do these changes occur?

b. What are the ideal bond angles in each compound? Which ones are expected to be distorted?

c. Give the hybridization of the central atom in each molecule.

4. Borane, BH₃, actually exists as diborane, B₂H₆, but the bonding in diborane can not be adequately described by a Lewis dot structure. Why?

5a. Compare the structures in Group A where the central atoms are in the same group of the periodic table (i.e., SiH₄ and CH₄, NH₃ and PH₃, and H₂O and H₂S). What structural similarities do you see for elements in the same group?

b. Now consider the compounds containing P and S in Group C. What structural differences do you observe within a group in the periodic table? How are these differences explained in Lewis theory? In valence bond theory?

c. How do you expect the chemistry of the elements to change descending a group, given the different structures available to the heavier elements?

6a. Calculate the formal charges and oxidation numbers on each atom for the following chemical species CO, CO₂, CO₃²⁻.

b. Describe the structural and electronic changes that occur when oxygen atoms are sequentially added to CO. According to VSEPR theory why must the structure change?

7. Describe the structural and electronic changes that occur when oxygen atoms are sequentially added to SO₂ to give SO₃ and then SO₄²⁻.

8. What structural and electronic changes accompany protonation (adding an H⁺ to) CO₃²⁻ (to form HCO₃⁻) and SO₄²⁻ (to form HSO₄⁻)?

9. Describe the structural and electronic changes that occur when an electron is removed from NO₂⁻ to give NO₂ and then another electron is removed to give NO₂⁺.

10a. Classify the molecules you have constructed in part F by their functional group.

b. Identify the hybridization about each carbon atom.