Assignment 10

Due Wednesday, November 17

Topics: This week, we examine how the electronic arrangements of multielectron atoms provide clues to many properties of atoms, including atomic size and orbital energies. Next, we move on to the combination of two or more atoms to form molecules. The valence electron configurations of atoms provide a basis for understanding the ways in which atoms interact and join together to form diatomic and polyatomic molecules. The remainder of the course will focus on descriptions of bonding, or the interactions that hold molecules together. We will begin our discussion with the localized electron pair model, which is a simplistic but nonetheless extremely useful model for bonding. Lewis structures do not describe the three-dimensional shapes of molecules, but they contain valuable information that can be used to predict molecular structures according to the valence shell electron pair repulsion (VSEPR) model. The VSEPR model is based on simple geometric arguments, but its predictions generally agree well with experimental observations of molecular structures. They also provide a basis on which to begin to understand the polarity of molecules, which is of critical importance in understanding intermolecular interactions.

Reading & Problems: Zumdahl, 6th edition

Date	Lecture	Reading	Problems
Wednesday, 11/10	Periodic properties	Section 12.15 p 576-577.5	12: 86, 100, 118, 120
Friday, 11/12	Periodic properties & Bonding	Section 12.16 thru p 580.5, 13.1-13.4	12:88, 94,96,122,124 13:15,22,27
Monday, 11/15	Lewis structures, resonance, formal charge	Sections 13.6, 13.9 – 13.12	13: 52, 54, 72, 74, 98
Wednesday, 11/17	VSEPR, Molecular dipoles	Section 13.13	

Challenge Problem

Consider an alternative universe in which there are *three* possible values of the spin quantum number m_s ($m_s = -1, 0, +1$). Answer the following questions, assuming that the usual rules for the other three quantum numbers, n, ℓ, and m_ℓ, and the relative orbital energies still apply.

a. Re-state the Pauli Exclusion Principle as it applies to this alternative universe. In other words, determine the maximum number of electrons that a given orbital can contain.

b. Draw the version of the periodic table that would be appropriate for this alternative universe. Include at least the first 50 elements (Z = 1–50). It is sufficient to identify each element by its atomic number (Z), but if you prefer to use elemental symbols or names, you can assume that the usual correlation between atomic number and elemental symbol or name still applies.

c. Write the ground state electron configuration for the element of atomic number 50 (Sn).

d. Among the first 50 elements, identify by atomic number(s) or elemental symbol(s):

   i. the first transition metal.

   ii. the element that has the greatest electronegativity.

   iii. the component ions of an ionic compound that has the formula XY_2.

   iv. the noble gases.