CH301H – Principles of Chemistry I: Honors
Fall 2011, Unique 51040
Homework, Week 10

1. Construct the MO diagram of all period 2 homonuclear diatomics (you should have already done this on your own). For each molecule, determine the bond order, and determine whether the MO diagram gives a molecular electron configuration that is similar to or different from the prediction of the Lewis dot structure.

2. Sketch the shapes of the σ and π molecular orbitals for the H_2^+ molecule. Figure 6.5 in your book is a good reference, but don't just copy the figures – make sure you understand their shape.

3. Define the σ and π ground state molecular orbitals.

4. Predict which molecule has the greater bond length, H_2 or He_2^+. Justify your answer.

5. Construct the MO diagram of CN. Do your molecular orbitals give you an electron configuration that is similar to or different from the prediction of the Lewis dot structure?

6. The bond length of the transient heteronuclear diatomic CF is 1.291 Å. When this is ionized, the molecular ion CF^+ has a bond length of 1.173 Å. Using an argument based on the MO diagram, explain why the CF bond shortens with the loss of an electron.

7. Fluorine gas can be ionized in the gas phase to produce F_2^+. For both F_2 and F_2^+, determine the following (you can use your MO diagram from problem 1, or redraw it for each of these species):

a) Molecular electron configurations;
b) Bond order;
c) Predict which molecule has the greater bond dissociation energy. Justify your answer.