CH301H – Principles of Chemistry I: Honors
Fall 2012, Unique 51390
6 November 2012

1. H_2O: An important molecule.

    a) Draw the Lewis dot structure of H_2O in the correct VSEPR geometry.

    b) Draw the O atom hybrid orbitals necessary to achieve this geometry.

    c) Construct the MO diagram of H_2O.

    d) How does this MO diagram support or contradict your Lewis dot structure?

2. In this exercise, you will draw the structures of the three simplest 2-carbon molecules. For each, i) draw the Lewis dot structure with the correct VSEPR geometry, 2) draw the full set of hybrid orbitals around each central carbon atom, 3) draw the hybrid orbital overlap to make the full molecule, and 4) describe the relative orientation of the H atoms on the two carbons.

a) C_2H_6

b) C_2H_4

c) C_2H_2

3. Dipropylene (C_3H_4) has a different geometry than ethylene (C_2H_4). Prove that to yourself. Follow the same sequence of steps for determining the structure of dipropylene as for Problem 2 above.

4. The molecule nitramide ($N_2O_2H_2$) was long thought to be planar. However, new experiments have recently shown that it is nonplanar. Determine the bonding and structure of the molecular orbitals necessary to make both a planar and a nonplanar version of the molecule. The connectivity of the atoms in nitramide is shown below, however this is NOT the Lewis structure (i.e. I have shown you which atoms are bonded to which, not the bond orders or the position of any lone pairs).