CH108 – Conference Course – Intensive Chemistry Seminar
Fall 2011, Unique 51300

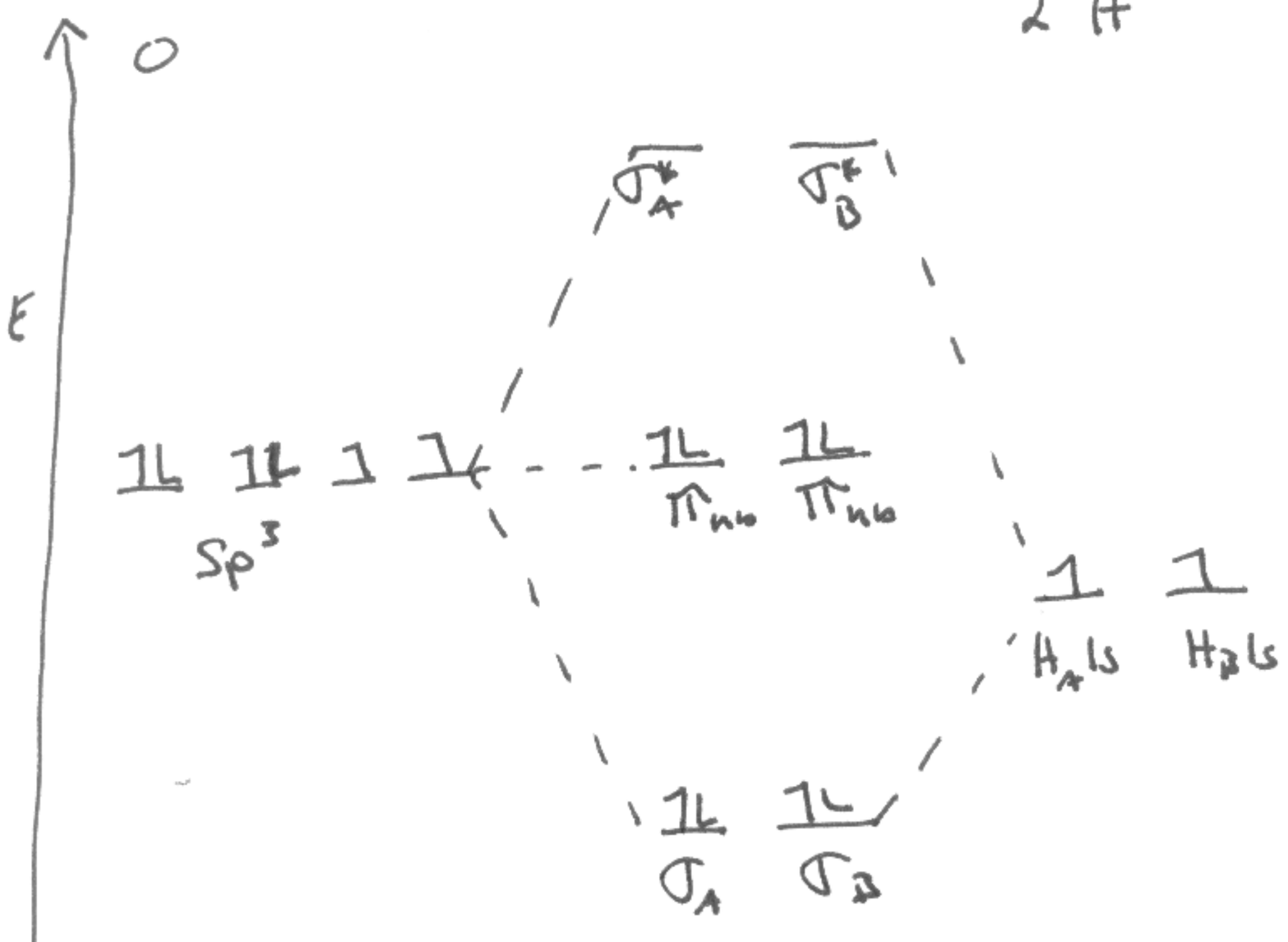
2 November 2011

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.

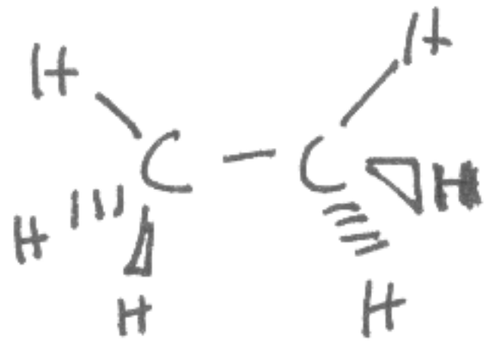


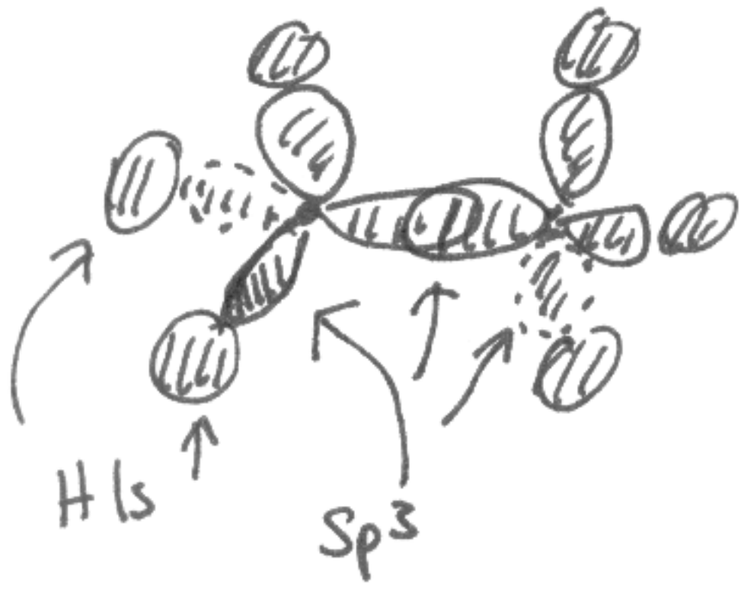
d) How does this MO diagram support or contradict your Lewis dot structure?

The MO shows 2 σ bonds and 2 nonbonded lone pairs.

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.

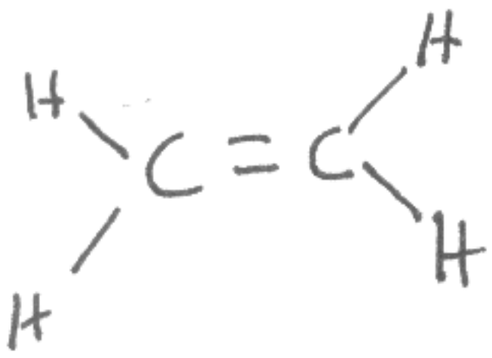
a) C_2H_6



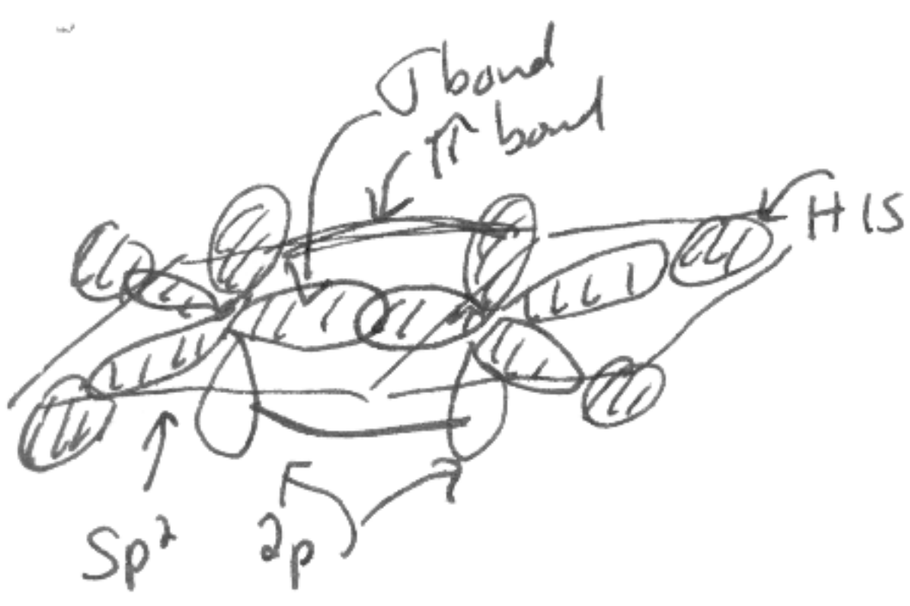


all H atoms are tetrahedral around their central C atom

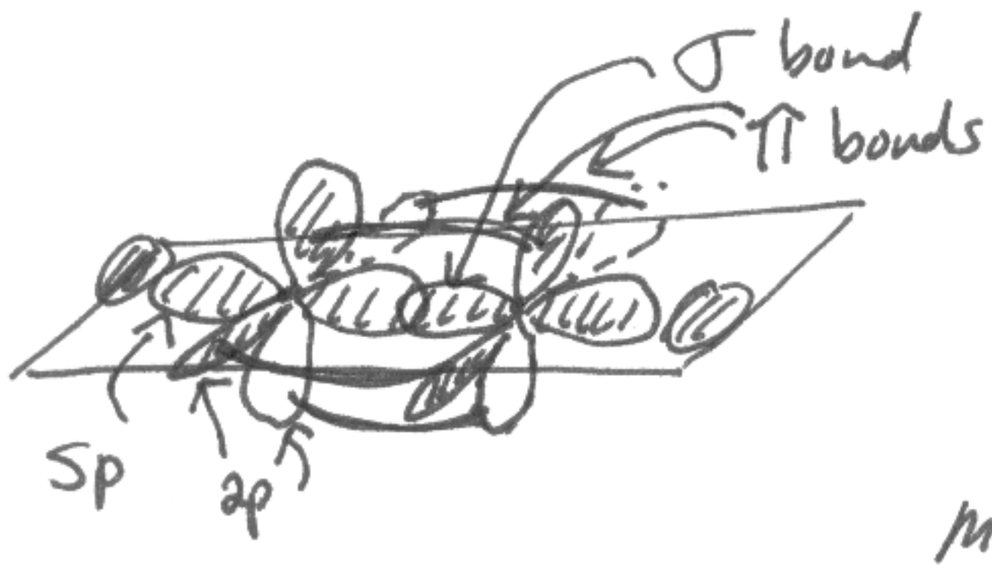
b) C_2H_4



H atoms on both C are in the same plane

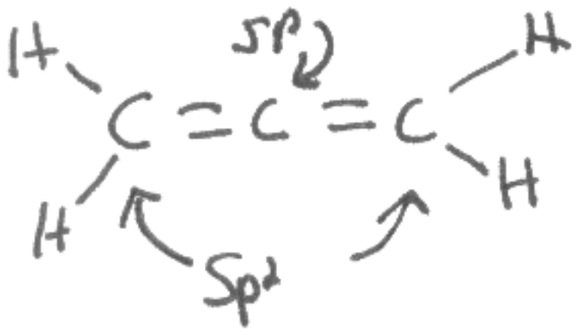


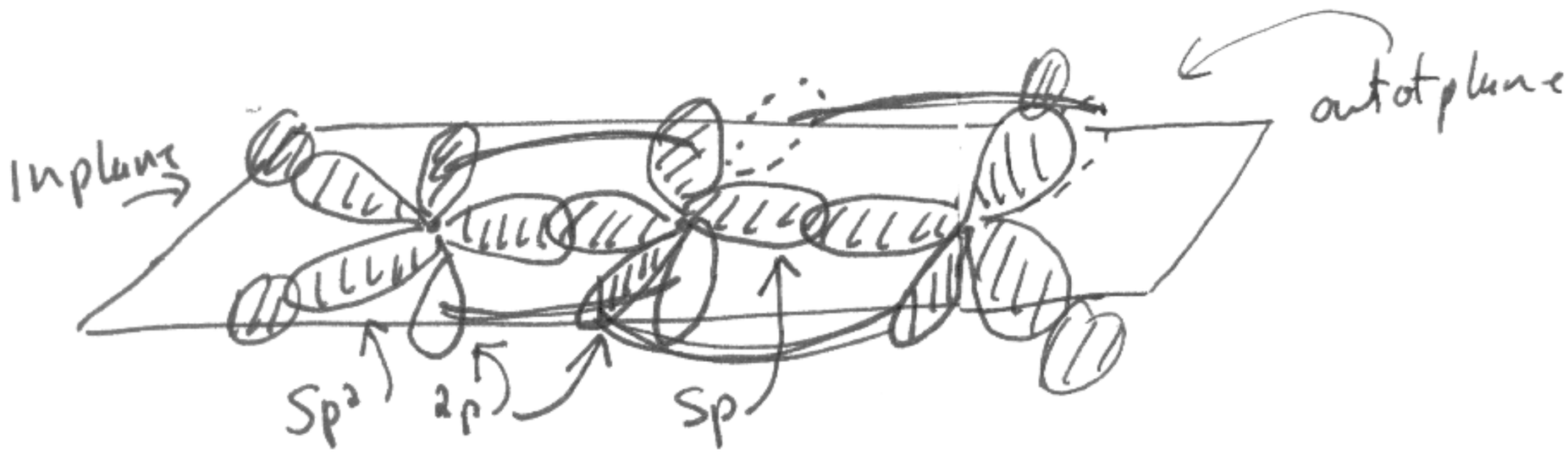
c) C_2H_2 $H-C\equiv C-H$



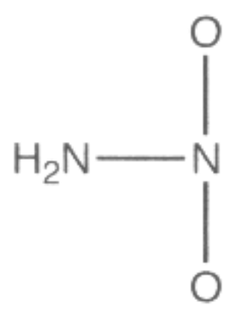
molecule is linear - H atoms are in the same plane

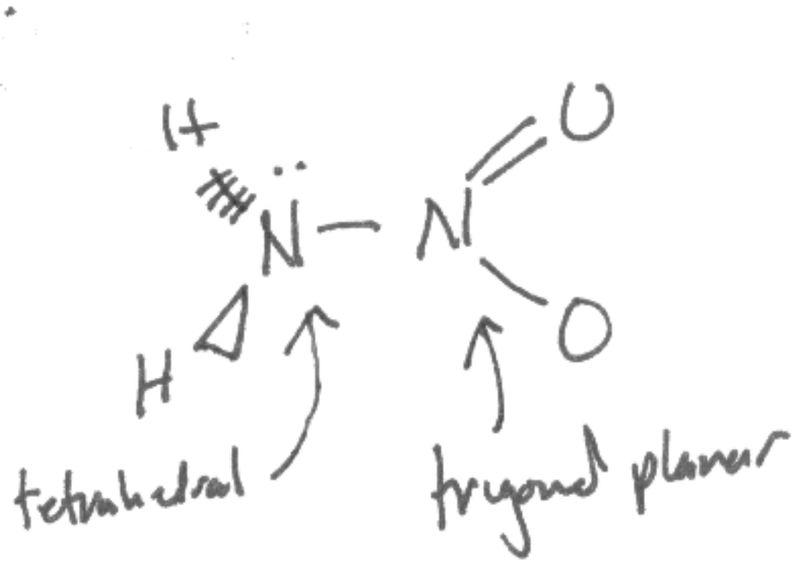
3. At the very end of class Tuesday I made the claim to you that dipropylene, C_3H_4, has a different geometry than ethylene (C_2H_4). Prove that to yourself. Follow the same sequence of steps for determining the structure of dipropylene as for Problem 2 above.



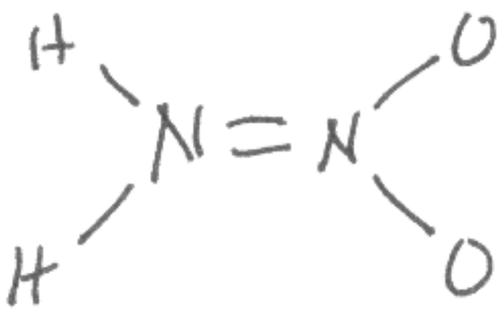


4. The molecule nitramide ($N_2O_2H_2$) was long thought to be planar. However, new experiments have recently shown that it is nonplanar. Determine the bonding and structure of the molecular orbitals necessary to make both a planar and a nonplanar version of the molecule. The connectivity of the atoms 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).





2 H atoms are out of the plane of the molecule



Both N are trigonal planar, H and O atoms are all in the same plane.