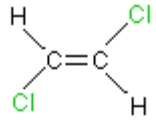
CH301 Fall 2009 Worksheet 7

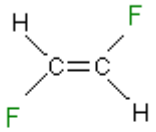
1. How can you decide whether a bond is polar or not? If a molecule has polar bonds, does that make the molecule polar?

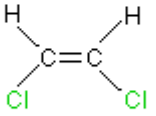
2. Fill in the chart and then rank the molecules in order of increasing polarity.

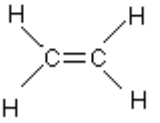
	NH3	O2	NF3	C2H5OH Note: there is an -OH group
Draw structure				
Calculate ΔEN of all bonds				
Polar or nonpolar molecule?				

3. Rank the following in order of increasing polarity:

A) 

B) 

C) 

D) 

4. Explain how carbon, with only 2 unpaired electrons, can form 4 bonds to fulfill its octet. Account for any energy changes (if you're putting in energy, where is it then released). What kind of hybrid orbitals will carbon then form?

5. Group 14 elements can all form four bonds. However, as you go down the periodic table it gets harder for them to form multiple bonds with one another like carbon can. Explain why carbon is so special.

6. Explain how each of the hybrid orbitals are constructed. Account for the electron arrangement in the shape of molecules.

sp

sp2

sp3

sp3d

sp3d2

7. Is it possible to have more hybrid orbitals than atomic orbitals of an atom?

8. For formic acid, HCOOH:

Draw the Lewis structure

Use VSEPR to determine the geometry

Identify bond angles

Identify hybrid orbitals

How many sigma an pi bonds? (Hint: There is an -OH group.)

9. The bond angle of an sp3 hybridized atom is 109.5 and that of an sp2 hybridized atom is 120. Should the bond angle increase or decrease between two hybrid orbitals when the s-character of a hybrid orbital increases?

10.Why does valence bond theory not account for bonding in polyatomic molecules like CH4?

11. Explain the difference between sigma and pi bonds. What types of orbitals are involved in each?

12. Explain why hybrid orbitals make sigma bonds.

For questions 13 through 15: Draw the Lewis dot structure for the given compound. How many sigma bonds? How many pi bonds? Name the contributing atomic orbitals.

13. CH_3COCH_3 (Acetone)

14. SF_4

15. $CH_2ClCCCH_2COOH$

16. How do we know that hybrid orbitals exist?

17. Draw the molecular orbits for Ne_2. Calculate the bond order. Use MO theory to explain why this diatom does not exist.

18. Rank the following diatoms and diatomic ions in order of decreasing bond order.
   a. B_2, C_2, N_2

   b. Be_2, F_2, O_2

   c. O_2^+, O_2, O_2^-

   d. N_2^+, N_2, H_2

19. Rank the following diatoms and diatomic ions in order of decreasing bond length.
   a. B_2, C_2, N_2

   b. Be_2, F_2, O_2

   c. O_2^+, O_2, O_2^-

   d. N_2^+, N_2, H_2

20. Draw the molecular orbits for B_2 and F_2. Which one is a magnet?