CH301 Fall 2009 Practice Quiz 3 Answer Key

1. Which of the bonds below could be found in a non-polar molecule?
   I. C=C
   II. H-F
   III. B-Cl
   1. I
   2. II
   3. III
   4. I and II
   5. I and III
   6. II and III
   7. I, II and III

A C=C bond could be found in any symmetrical molecule (e.g. C_2H_4), which would be non-polar. An H-F bond could only be found in the molecule H-F because both species can form only a single bond. A B-Cl bond could be found in a symmetrical molecule (e.g. BCl_3) and so could be found in a non-polar molecule.

2. Consider the molecule below; how many different hybridizations are required to describe all of its central atoms? (Note: the non-bonding electrons are omitted)

   1. 1
   2. 2
   3. 3
   4. 4
   5. 5

The central atoms, from left to right, have hybridizations of sp, sp, sp^3, sp^3, sp^2, sp^2.

3. Which of the following does not have a pyramidal molecular geometry?
   1. IOF_3
   2. $XeCl_4$
   3. PH_3
   4. AsI_5

The molecule IOF3 would have a see-saw geometry because its lone pair would go into the equatorial position.

4. Which of the following molecules is/are polar?
   I. SO_2
   II. O_3
   III. CH_2F_2
   1. I
   2. II
   3. III
   4. I and II
   5. I and III
   6. II and III
   7. I, II and III

SO_2 has polar bonds and an asymmetrical molecular geometry and is therefore polar. O_3 is a famous exception to the simple guidelines for molecular polarity and is polar in spite of having only non-polar bonds. CH_2F_2 is asymmetrical and thus its dipoles do not cancel - it is polar.

5. Which of the compounds below would have the greatest number of pi bonds?
   1. XeO_3
   2. $CH_3NHCHCCH$

3. $C(NH_2)_4$
4. HSCN
5. SO_2

Xenon tetroxide would have 3 pi bonds, all of the other choices have 2 or less.

6. Which of the molecules below will contain a $\sigma_{sp2,sp3}$ bond?
   1. $SiH_3CHCHCH_3$
   2. CH_3PHCH_3
   3. CF_3CBr_3
   4. CH_2SF_2