Quiz 4
Chemistry 172
(Winter 08-09)
Name _____________________

1) Predict whether a sigma (s), pi (p), or no bond (n) forms from the following orbitals coming together on the x axis.
   a) $p_x$ and $p_y$ __n__
   b) $p_x$ and $p_x$ __s__
   c) sp$^3$ and s __s__
   d) sp$^2$ and $p_x$ __s__
   e) sp$^2$ and sp __s__
   e) sp$^3$ and $p_y$ __n__

For 2-4, refer to the structure below:

2) There are _____13______ sigma bonds and _____3_____ pi bonds.

3) Identify the expected hybridization of each atom.
   A (carbon) __sp__
   B (carbon) __sp$^2$__
   C (nitrogen) __sp$^3__

4) Provide the value of each indicated angle.
   1 (C-C-C) __180__
   2 (C-C-C) __120__
   3 (C-N-H) __109.3__

5) As the number of bonds between two carbons increases, which one of the following decreases?
   a) number of electrons between the carbon atoms
   b) bond energy
   c) bond length
   d) formal charge

6) Draw the number and relative energy of 2s and 2p orbitals of an atom before hybridization and the number and relative energy levels of the orbitals that are formed in the atom after sp hybridization

   before hybridization
   2p ____ ____ ____
   __sp ____ ____ ____

   after hybridization
   2p ____ ____ ____
   sp ____ ____ ____

2s ____

7) Provide a rationale as to why the 1s orbitals are not included in the formation of hybrid orbitals.
   Valence electrons are not in the 1 s orbitals and not involved in bonding. They are smaller than the 2s and 2p orbitals and may not combine as well

8) Identify the type of hybridization in the oxygen and the carbons below. Describe what orbitals are employed to form each of the bonds in this molecule.
   O is sp$^3$ hybridized and C is sp$^2$ hybridized
   The sp$^3$ orbitals of O form a $\sigma$ bond with the 1s of H and with the sp$^2$ of C
   The sp$^2$ orbitals of the right C form $\sigma$ bonds with 1s of H, sp$^3$ of O, and sp$^2$ of the other C.
   The sp$^2$ orbitals of the left C form $\sigma$ bonds with 1s of H, sp$^3$ of the other C
   The unhybridized p of each C forms a $\pi$ bond.
For each molecule below provide the requested information in the appropriate blank. A correct Lewis dot structure is required to answer these correctly.

a) \( \text{SeO}_3 \)  
   __________ hybridization  
   _______ polar or non-polar  
   _______ electron arrangement  
   _______ molecular shape

b) \( \text{PF}_3 \)  
   __________ hybridization  
   _______ polar or non-polar  
   _______ electron arrangement  
   _______ molecular shape

c) \( \text{SF}_4 \)  
   __________ hybridization  
   _______ polar or non-polar  
   _______ electron arrangement  
   _______ molecular shape

d) \( \text{SiCl}_4 \)  
   __________ hybridization  
   _______ polar or non-polar  
   _______ electron arrangement  
   _______ molecular shape

e) \( \text{HCN} \)  
   __________ hybridization  
   _______ polar or non-polar  
   _______ electron arrangement  
   _______ molecular shape

f) \( \text{PCl}_5 \)  
   __________ hybridization  
   _______ polar or non-polar  
   _______ electron arrangement  
   _______ molecular shape

g) \( \text{IF}_5 \)  
   __________ hybridization  
   _______ polar or non-polar  
   _______ electron arrangement  
   _______ molecular shape
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<td>a) SeO₃</td>
<td>__________ hybridization</td>
<td>__________ polar or non-polar</td>
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<td>b) PF₃</td>
<td>__________ hybridization</td>
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<td>c) SF₄</td>
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<td>d) SiCl₄</td>
<td>__________ hybridization</td>
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<td>e) HCN</td>
<td>__________ hybridization</td>
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<td>f) PCl₅</td>
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