WKS
Hybridization and orbital diagrams
Name________________________________
Period_________ Date_________

1) Why are sp\(^3\), sp\(^2\) and sp orbitals all called hybrid orbitals? 

2) How many sp\(^3\) orbitals does an sp\(^3\) hybridized atom have? What is the bond angle between them?

3) How many sp\(^2\) orbitals does an sp\(^2\) hybridized atom have? What is the bond angle between them?

4) How many sp orbitals does an sp hybridized atom have? What is the bond angle between them?

5) Label the hybridization (sp\(^3\), sp\(^2\) or sp) of all elements except for hydrogen in the molecule to the right. 
(The first atom is done for you.)

6) When any two orbitals overlap and make a covalent bond, the orbitals either overlap as a sigma bond (\(\sigma\)) or as a pi bond (\(\pi\)). Describe which type of bond (\(\sigma\), \(\pi\), or none) is being represented by the orbital overlaps in the following situations:

a) 

b) 

c) 

d) 

e) 

7) Label all of the orbitals (s, p, sp\(^3\), sp\(^2\), or sp) in these orbital diagrams and label all bonds as sigma (\(\sigma\)) or pi (\(\pi\)).

a) Orbital representation of 

b) Orbital representation of 

H—C≡C—C—H 

H—C≡N:
c) Orbital representation of

\[
\begin{align*}
\text{Cl} & \quad \text{C} \quad \text{O} \\
\end{align*}
\]

8) **Draw an orbital diagram for each of the molecules below.** To do so, do the following steps:

- On the structure given, label the hybridization of each atom in given structure (sp^3, sp^2, or sp)
- Draw the outline of the orbital diagram for the molecule. Make sure to draw the right number of hybrid orbitals around each atom and draw them oriented at correct angles. *(For example, if an atom is tetrahedral, it is sp^3 hybridized and so there are four sp^3 orbitals oriented tetrahedrally.)* Don’t forget the needed “p orbitals” for sp^2 and sp hybridized atoms.
- Label the diagram with the correct types of orbitals—sp, sp^2, sp^3 or p.
- Label all sigma (\(\sigma\)) and pi (\(\pi\)) bonds. Put in all lone pairs.

a) \[
\begin{align*}
\text{H} & \quad \text{N} \quad \text{N} \quad \text{Br} \\
\end{align*}
\]

b) \[
\begin{align*}
\text{CH}_3 & \quad \text{C} \equiv \text{C} \quad \text{O} \quad \text{H} \\
\end{align*}
\]