Name: _____ Date: _____

Unit 2.7
VESPR & Bond Hybridization

1. Draw lewis structures, predict the shape and give the approximate bond angle for each of the following compounds:

Compound/ Ion	Lewis Structure	Predicted Shape	Approximate Bond Angle	Polar or Non-polar (with brief explanation) JUST THE HIGHLIGHTED CELLS
Sulfate ion				
Water				
Carbon dioxide				
Ammonia				
Nitrate ion				
Carbonate ion				
Ozone (O_3)				
Boron trichloride				

Name: _____ *Date:* _____

Compound/ Ion	Lewis Structure	Predicted Shape	Approximate Bond Angle	Polar or Non-polar (with brief explanation) JUST THE HIGHLIGHTED CELLS
Sulfur hexafluoride				
Sulfur dichloride				
Xenon tetrafluoride				
Phosphorus pentafluoride				
Nitrogen trifluoride				
Phosphorus trifluoride				
CH_4				
CCl_2F_2				
OF_2				
ICl_4^-				

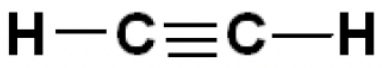
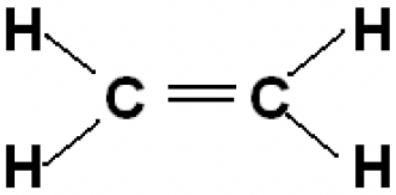
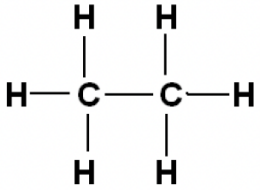
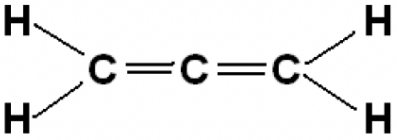
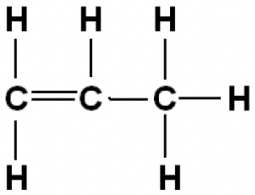
Name: _____ *Date:* _____

Compound/ Ion	Lewis Structure	Predicted Shape	Approximate Bond Angle	Polar or Non-polar (with brief explanation) JUST THE HIGHLIGHTED CELLS
IOF_5				
I_3^-				
BrF_3				
SOF_4				
$XeOF_4$				
XeO_2F_2				

2. The charge clouds of both methane (CH_4) and ammonia (NH_3) are arranged in a tetrahedral geometry. Explain why the actual bond angles in methane (CH_4) are 109.5˚ while the actual bond angles in ammonia (NH_3) are 107.3˚.

3. Explain why CH_4 has a tetrahedral geometry while SF_4 has a seesaw shape.

4. In the following structures identify the shape around each carbon atom and the bond angles emerging from each carbon atom.

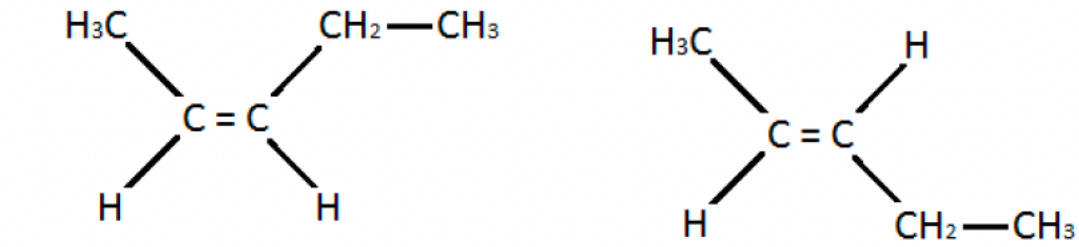
Structure	Shape around each carbon atom	Bond angles
		
		
		
		
		

5. Identify the type of hybridization (type of hybrid orbitals) around the central atom in each of the structures listed below. You drew the diagrams for these molecules in question 1.

a. Sulfate ion _____
b. Water _____
c. Carbon dioxide _____
d. Ammonia _____
e. Nitrate ion _____
f. Carbonate ion _____
g. Ozone (O_3) _____
h. Boron trichloride _____
i. Sulfur dichloride _____
j. Nitrogen trifluoride _____
k. Phosphorus trifluoride _____
l. CH_4 _____
m. CCl_2F_2 _____
n. OF_2 _____

6. The following questions pertain to σ-bonds and π-bonds.
   a. Which type of bond has a greater amount of bond energy? Justify your answer.

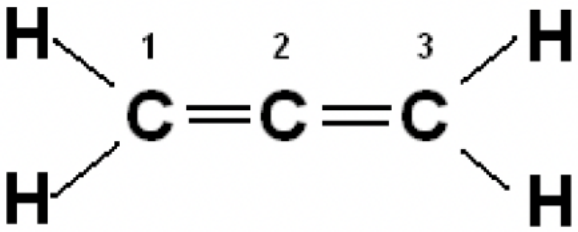
   b. Which type of bond causes the following isomers? Justify your answer.



   c. Extended networks of π-bonds can cause a delocalization of electrons. Explain how this occurs.

   d. What is the difference between a σ-bond and a π-bond?

7. Use the structure below to answer the following question.



   a. What type of hybrid orbitals from around the first carbon?

   b. What type of hybrid orbitals form around the second carbon?

   c. How is the double bond between the first and second carbon formed? Reference the types of orbitals involved in the bonds and the methods of bonding.

8. Use the structure below to answer the following questions.

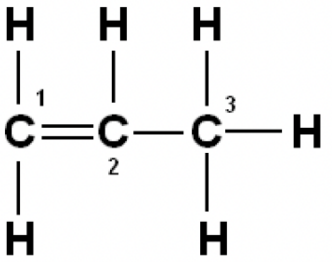
   a. Why type of hybrid orbitals form around the carbon?

   b. How many σ-bonds are there between the carbon and the nitrogen?

   c. How many π-bonds are there between the carbon and the nitrogen?

   d. How many unmorphed p-orbitals remain on the carbon atom in this compound?

9. Use the structure below to answer the following questions.



   1. What type of hybrid orbitals form around the second carbon?

   2. What type of hybrid orbitals form around the third carbon?

   3. How many unmorphed p-orbitals remain around the first carbon?

   4. How many σ-bonds exist in the entire structure?

   5. How many π-bonds exist in the entire structure?