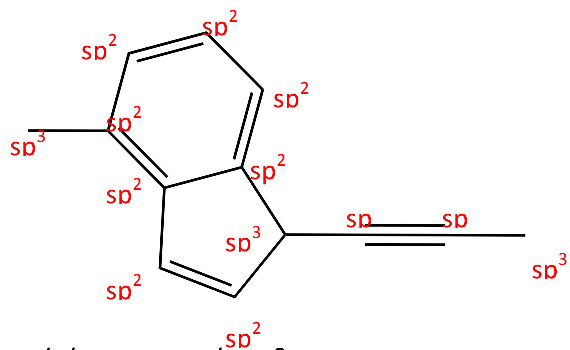
Hao Wu
Email: haowu@berkeley.edu 9/24/2013
Office Hour: Tu 5:30-6:30pm Location: Bixby Common

Chem 4A Scholars Worksheet 9

Valence Bond Theory

Questions:

1. *Consider the following molecule,*



What is the number of σ and π bonds between carbons?

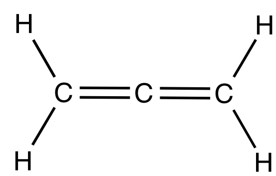
14 σ , 6 π

Write down the hybridization configuration for each of the carbon atom.

Between carbons, How many electrons are localized (only shows between two particular atoms)? How many electrons are delocalized?

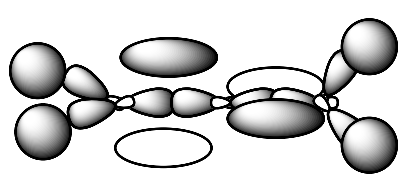
32 electrons are localized, 8 are delocaized.

2. *Consider the molecule with formula C_3H_4. It is know that the carbon atoms in the molecule are in a line, draw the Lewis structure of carbon.*



Now write down the hybridization for each carbon atom.

Use the information from your answer to the last two questions, draw the orbital interactions the molecule, clearly indicate the shape and orientation of each bond.



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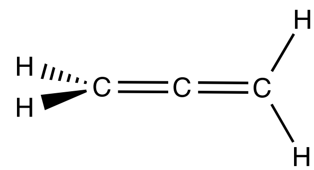
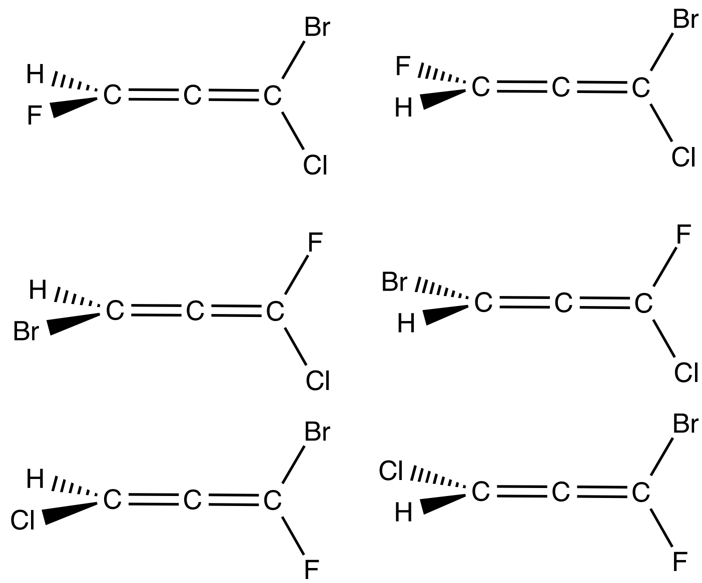
Now draw the 3D structure of the molecule.



Do you expect there to be any delocalized bonds? Why?

No, pi orbidals have different orientations.

Now consider $C_3BrHClF$, where three of the hydrogens are replaced by halogens, Draw all the isomers for this formula/.



3. *Watch the video: https://www.youtube.com/watch?v=2KlAf936E90*

The compound of interest here is NI_3, it is highly unstable. Dry NI_3 explode upon slightest vibration and produce elemental nitrogen and iodine.

Write the reaction formula.

$$2\,NI_3 \longrightarrow N_2 + 3I_3$$

With valence bond and geometric argument, explain why the product side is highly favored.

The N_2 triple bond is highly stable. Iodine atoms are large and in NI_3 there's large strain and repulsion between the atoms.

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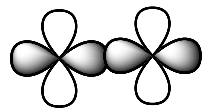
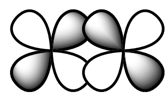
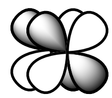
4. It is known that d oribitals can also make bonds, depending on the orientation of the d orbitals, they can make π *or* δ *bond. Guess and skech how two dxy orbitals can make these bonds.*



sigma bond



pi bond



delta bond