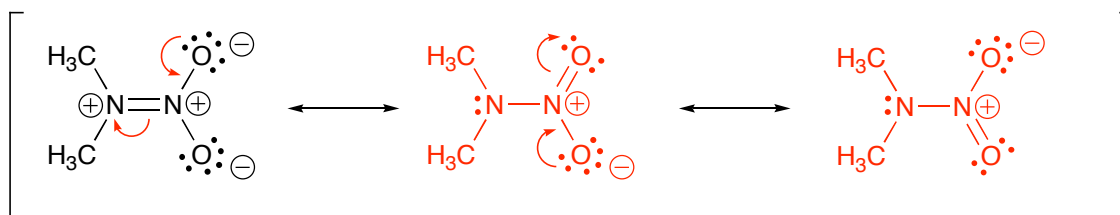
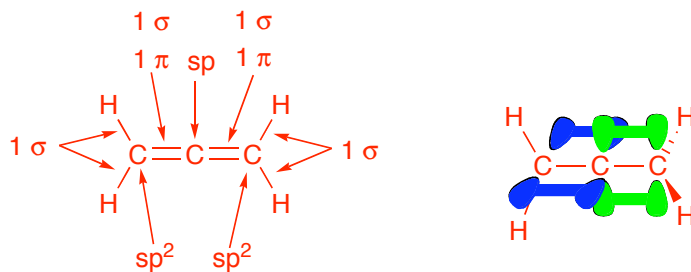


1. Below is an insignificant resonance structure for a nitroamine. Draw two significant resonance structures, and draw curved arrows to show how the electrons move from one resonance structure to the next. Briefly explain why your two resonance structures are more important than the first one.



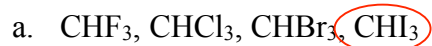
The second and third resonance structures are more important because they have fewer total formal charges—only one positive and one negative each as opposed to the two positive and two negative in the first structure. Notice the net charge on the molecule is still zero.

2. Draw the Lewis structure for allene, H_2CCCH_2 , indicating the hybridization of each carbon atom, and the quantity of sigma and pi bonds present between each of the atoms. Then, draw a 3-dimensional orbital diagram showing all the sigma and pi bonds.



In the orbital diagram it's okay to show the sigma bonds as lines as long as you indicate that's what they are. The central carbon has two perpendicular p orbitals which form pi bonds to the carbons on either side. Since the pi bonds are perpendicular to each other, the pairs of hydrogens will be perpendicular to each other also. In my drawing the left pair of hydrogens is in the plane of the paper since the pi bond is perpendicular to the paper. The right pi bond is in the plane of the paper so the hydrogens must be perpendicular (shown with a wedge and dashed line)

3. For each of the series below, circle the molecule which has the *highest* boiling point, and briefly indicate why.



Iodine is the largest of the halides shown so it will have the largest amount of London forces and therefore the highest boiling point (even though CHF_3 will have the largest molecular dipole moment, the London forces will prevail).



Pentane will have the highest boiling point because it has the highest molecular weight which makes for more London forces.



This one is slightly more complex. Only the second and third have hydrogen bonds so they will boil higher than the other two. Of the two with hydrogen bonds, ethanol's hydrogen bonds are stronger because oxygen is more electronegative, which will give it the highest boiling point.