Chemistry and Math

1. The blue line in the spectrum of the hydrogen atom, λ = 434 nm, results from an electron dropping from the n = 5 level to the n = 2 level.
(a) Calculate in kJ/mol the energy of photons of light of wavelength 434 nm
(b) Draw a diagram that shows the energy levels from n = 2 to n = 5 also showing n = ∞

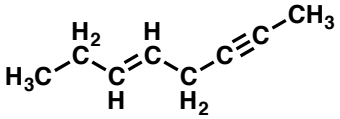
energy of a photon = hc/λ
h = 6.626×10^{-34} J·s
c = 2.998×10^{8} m/s

2. The formula for formal charge is:
FC = group# - 1/2# shared electrons - # unshared electrons
What is the FC on the atoms of the following molecules?

F_2SO
NO_2^-
I_3^-
$KrCl_2$

3. Construct the Lewis structure of O_3 and draw the other resonance structure.
(a) Draw the hybrid that is a better representation of ozone.
(b) Based on this, what would be the observed formal charge (or electron density) on the atoms in ozone?
(c) What is the molecular geometry of the central oxygen (non-math question!)

4. Consider the following organic molecule:



It contains a C/C triple bond, a C/C double bond and C/C single bonds (along with many C-H bonds). Carbon atoms that have triple bonds are said to be sp hybridized, carbon atoms that have double bonds are said to be sp^2 hybridized, and carbon atoms that have only single bonds are said to be sp^3 hybridized. Hybridized orbitals are mixtures of the s and p orbitals you've discussed. Hybridization is often necessary to account for the observed shapes and bond lengths of molecules. For example, one s orbital and two p orbitals comprise an sp^2 orbital.
(a) What is an sp3 orbital comprised of?
(b) What is an sp orbital comprised of?
(c) For each type of hybrid orbital, what percentage of each is p?
(d) Recall that s and p refer to principle quantum numbers. Use this information and the percentages you calculated above to rank the lengths of these three types of C/C bonds.

5. Calculate the standard cell potential for the reaction: $2\ Ag + Cu^{2+} \rightarrow 2\ Ag^+ + Cu$
Given: $Ag^+ + e^- \rightarrow Ag$ 0.80
$Cu^{2+} + e^- \rightarrow Cu$ 0.34