

Chemistry 416, Fall Semester 1993, Dr. Glaser

Quiz I: "UV/Vis Spectroscopy", Monday, September 13, 1993, 20 minutes, not announced

Your Name:

Question 1. Terminology.

Fill in the blanks as required (or chose from the selection given in parentheses). (9 points)

UV/Vis spectroscopy explores the electronic structure of molecules by providing information about the energy splittings between the ground state and _____ states of the molecules. Most organic molecules are closed shell systems in the ground state, that is, all electrons are paired and the multiplicity is _____. Excitation of such a molecule with a UV/Vis photon leads to an excited _____ (give multiplicity) state. This excited state may decay via a reaction, that is _____ decay occurs, and these kind of processes are in the focal point of photochemists. In spectroscopy, we are more concerned with non-reactive decay channels, that is, the processes summarized under the heading _____ decay. The relaxation of the initially formed excited state may involve simple emission; this process is called _____. On the other hand, the initially formed excited state may undergo a process known as _____ leading to a more stable excited state because of Hund's rule. Emission from this state is called _____. The absorption and the emission spectra show fine structure due to vibrational states and a consequence of the _____ factor; a factor that reflects that the excitation/relaxation is a "vertical process" because the time scale of the excitation is so much _____ (faster, slower) than the time scale for molecular motion. Molecular motions occur with a frequency of typically ___ Hz whereas electronic excitations occur within about _____ seconds (give nano, pico, or such). The emission spectra show fine structure due to the vibrational states of the _____ state whereas the absorption spectra provide information about the vibrational states in the _____ state. If the molecules are chiral, then we can also record the _____ spectrum, or ORD for short. The ORD spectrum shows the change of _____ as a function of the wavelength. For absorbing molecule, an S-shaped part is superimposed onto the normal ORD curve. This is the so-called _____ effect. Hexahelicene contains an _____ chromophore and it shows very strong ORD. **OVER**

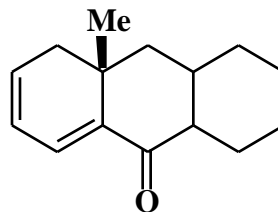
Points for Question 1:

Points for Question 2:

Points for Question 3:

Total Points:

Questions 2 and 3 both refer to the molecule shown to the right. Note that the table with “Woodward’s Rules” will be shown on transparency during the exam!!



Question 2. Increment Systems.

Using Woodward’s rules, predict the absorption of the ____ ____ transition for the ketone shown in chloroform. Show your work, don’t just give the final number. (8 points)

Question 3. Octant Rule.

Using the octant rule, predict the sign of the Cotton effect for the configuration shown. Show your work; don’t just give the sign. (8 points)