10.4: Exercise Questions

1. Please draw a representation of the HOMO and LUMO of cinnamic acid.
2. Can the HOMO of one molecule of cinnamic acid interact with the LUMO of another molecule of cinnamic acid? If not, why?
3. If excited by light, what orbital would the electron be promoted into? Please describe which orbital this would be the in the ground state. (Please note that this orbital would now be referred to as the photo HOMO.
4. Please show the overlap of the LUMO of the ground state of cinnamic acid with the photo HOMO you drew in the previous question. Do these orbitals have appropriate symmetry and similar energy to be able to react?
5. This question will walk you through the process (step-by-step) of calculating the wavelength of light needed to mediate the promotion of an electron from the HOMO to the LUMO.

   A. Please fill out the following table with energy values for the L.U.M.O. and H.O.M.O. of cinnamic acid. The HOMO – LUMO gap is the absolute value of the difference in energy between the HOMO and LUMO.

	Energy, eV
HOMO	
LUMO	
HOMO-LUMO Gap	

   B. Next you should take the HOMO-LUMO gap in electron volts (eV) and convert the energy gap to joules (j) using the conversion of 1 eV = 1.6 x 10-19 j. For full credit you should show your work.

   C. Light has what we call wave particle duality. This means that light has properties that are wavelike and properties that are particle light. The energy of a particle of light, known as a photon, is related to the frequency of the light wave by the equation shown below. For full credit you must show your work. *[Math Processing Error]*

   D. Next you should convert the frequency of light from Hz to nm by using the equation that relates wavelength of light to frequency of light. For full credit you should show all of your work.