Bonding worksheet 5

1) What is the difference between a continuous spectrum and an atomic emission spectrum?

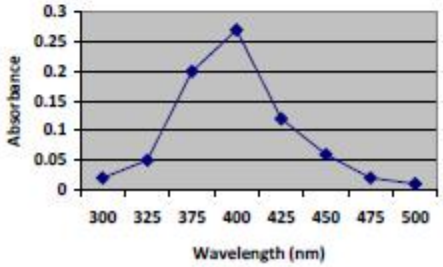
2) Explain why every element has a distinct atomic emission spectrum.

3) An electron is promoted from the n=2 to the n=3 energy level in a hydrogen atom. Does the electron release or absorb energy during this transition?

4) Hydrogen atoms can absorb and emit photos containing 4.8×10^{-19} J of energy.
   a. If a hydrogen atom absorbs a photon containing 4.8×10^{-19} J of energy, what component of the atom experienced an increase in energy?
   b. What can be said about the difference in energy between two of the sublevels in a hydrogen atom. Justify your answer.
   c. If a hydrogen atom emits a photon containing 4.8×10^{-19} J of energy, what component of the atom experienced a decrease in energy?

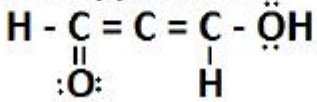
5) What factors are necessary in order to cause an electron transition during an ultraviolet/visual (UV/Vis) spectroscopy experiment?

6) Use the UV/Vis spectra below to determine which wavelength of light is experiencing the highest degree of absorbance by the molecules in the sample under investigation.



7) Explain what happens within the structure of a molecule during an ultraviolet/visual (UV/Vis) spectroscopy experiment.

8) Would it be possible to conduct an UV/Vis spectroscopy experiment on a sample of the compound below? Justify your answer

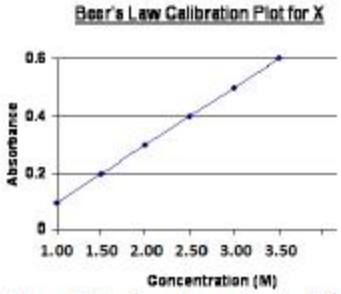


9) Would it be possible to conduct an UV/Vis spectroscopy experiment on a solution containing a colored compound? Justify your answer.

10) Would it be possible to conduct an UV/Vis spectroscopy experiment on a solution containing a colorless compound? Justify your answer.

11) A UV/Vis spectrometer was used to determine the concentration of an unknown colored compound in solution. The cuvette had a path length of 1.00 cm and the molar absorptivity was found to be 0.296 $M^{-1}cm^{-1}$. Find the concentration of the unknown compound in solution if the absorbance was measured to be 0.314 A.

12) A spectrometer with a 1.00 cm path length cuvette was used to measure the absorbance of a solution containing an unknown colored compound. At 624 nm the absorbance was measured to be 0.400 A.
    a) Use the Beer's Law plot below to find the molar absorptivity of the solution.



    b) Find the concentration if the absorbance was 0.684 A.

13) Explain how absorption of electromagnetic radiation occurs in infrared (IR) spectroscopy experiments.

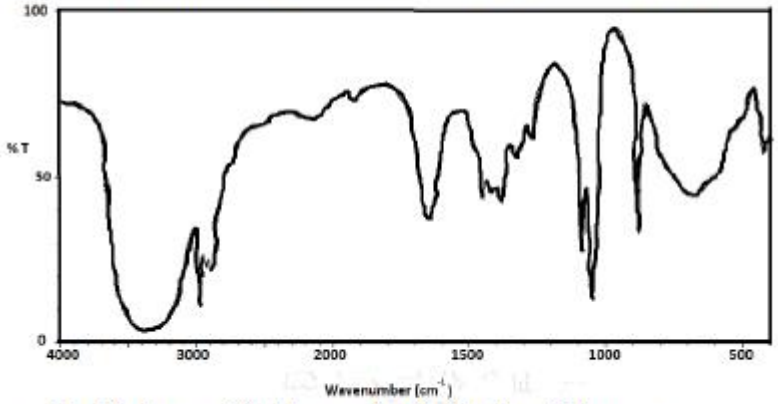
14) If you were to design an experiment to determine the differences between some of the energy levels in a pure sample of a molecular compound, would you choose to use an infrared (IR) spectrometer or an ultraviolet/visual (UV/Vis) spectrometer? Justify your answer.

15) If you were to design an experiment to determine the different types of atoms and bonds that make up a pure sample of an unknown compound, would you choose to use an infrared (IR) spectrometer or an ultraviolet/visual (UV/Vis) spectrometer? Justify your answer.

16) If you were to design an experiment to identify an unknown compound, would you choose to use an infrared (IR) spectrometer or an ultraviolet/visual (UV/Vis) spectrometer? Justify your answer.

17) If you were to design an experiment to find the concentration of a compound in solution, would you choose to use an infrared (IR) spectrometer or an ultraviolet/visual (UV/Vis) spectrometer? Justify your answer.

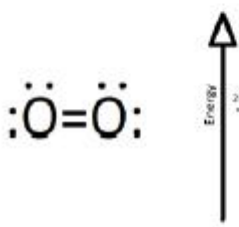
18) Below is an infrared spectrum of ethanol, CH_3CH_2OH. The functional group for alcohols (-OH) always peaks between wavenumbers 3650 cm^{-1} and 2500 cm^{-1}.



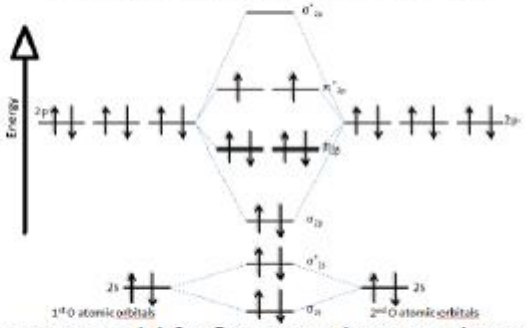
a. Identify the peak that is associated with the –OH group.
b. Do the peaks on infrared spectra point up or down? Justify your answer.

19) The Lewis structure and molecular orbital diagram for O_2 are below. Experimental evidence shows that liquid O_2 is paramagnetic, as it is attracted to magnetic fields.

Lewis Stricture – O_2



Molecular Orbital (MO) Diagram – O_2



a. Does the Lewis structure model for O_2 support these experimental findings? Justify your answer.
b. Does the molecular orbital diagram for O_2 support these experimental findings? Justify your answer.