Unit 3 HW #3: Electronic Structure of Atoms

1. Fill in the blanks with the appropriate terms:
   a. A discrete quantity (often of energy) is called a quanta
   b. Planck discovered that atoms emit energy in discrete quantities.
   c. Electrons, like light, can behave as ____waves or as ____particles
   d. Electrons in higher energy levels than expected are called _____excited
   e. A packet of light waves is called a _____photon
   f. Energy required for an electron to move up in energy level comes in the form of _____heat. Energy released as an electron moves back down in energy levels comes in the form of _____light
   g. The distance from peak to peak of a wave is called _____wavelength_____
   h. The number of peaks that pass a given point in a given amount of time is called _____frequency_____
   i. According to the _____Heisenberg_____ Uncertainty Principle, it is impossible to know both the _____speed__ and ___ ___location of an electron simultaneously.
   j. A 3-D region where an electron is likely to be found is called an ___orbital
   k. A place in atom where an electron cannot be is called a __node
   l. S orbitals are _____spherical in shape, come in sets of _1, and can hold a total of _2 electrons.
   m. P orbitals are _____figure 8 shaped, come in sets of ___3, and can hold a total of _6 electrons.
   n. D orbitals are _____clover leaf shaped, come in sets of _5, and can hold a total of _10 electrons.
   o. F orbitals are _____flower shaped, come in sets of ____7, and can hold a total of _14 electrons.
   p. There are ___7 possible energy levels.
   q. Any one orbital can hold at most 2 electrons. This is known as the _Pauli_ exclusion principle. When an orbital contains 2 electrons, they must have opposite ____spins.
   r. According to _____Hund's rule, when electrons are added to equal energy orbitals, each orbital receives ____1 electron before any orbital receives a __2nd electron.

2. Solve the following problems involving the energy of light.
   a. A certain photon of light has a wavelength of 422 nm. What is the frequency of the light? 7.11×10^{14} Hz How much energy does this photon possess? $4{,}71 \times 10^{-19}$ JWhat color would this light appear? violet
   b. When neon gas at low pressure is subjected to high voltage electricity, it emits waves of light. One of the more intense waves in the visible spectrum has a frequency of 4.69×10^{14} Hz. What is the wavelength of this light in nanometers? 640. nm Is this light visible? Yes If so, what color is it? orange
   c. How many waves of the light described in (b) would be needed to reach a length of 1.0 yards? 1.4×10^{6} waves
   d. What is the energy of a photon of light with a frequency of 7.39×10^{24} Hz? 4.90×10^{-9} JWhat is the wavelength of this photon? 4.06×10^{-8} nm
   e. A certain light has a wavelength of 6.8×10^{-6} m. What is the frequency of the light? 4.4×10^{13} Hz What color is this light?
   f. A photon of light has an energy of 2.84×10^{-19} J. What is the wavelength of this light? 701 nm
   g. A photon of light has a frequency of 6.91×10^{14} Hz. What is the energy of this quantum of light? 4.58×10^{-19} J What color is this light? violet
   h. Calculate the frequency of light that has a wavelength of 3.0 feet. 3×10^{8} s^{-1}
   i. What is the energy of light that has a wavelength of 1.0 miles? 1.2×10^{-28} J
   j. Ocean waves travel at approximately 5.00 miles/hour, and the crests pass a fixed point at the rate of 16.5 waves per minute. What is the wavelength of ocean waves in nanometers? 8.13×10^{9} nm

3. Application.
   Watch the video at this link (https://www.youtube.com/watch?v=nPHegSuII_M) and be prepared to discuss.