Chem WS Name_____

1. The visible region of the spectrum goes from 400 nm to 700 nm. What is the frequency range of the visible spectrum?
2. List the regions of the electromagnetic spectrum and the wavelengths of radiation associated with each region.
3. Red light with a wavelengths of 6708 A is emitted when lithium is heated in a flame.
   a. What is the frequency of this radiation?
   b. What is the energy of this radiation per photon? Per mole of photons?
4. A carbon-oxygen double bond in certain organic molecule absorbs radiation that has a frequency of 6.0 x 10^{13} s^{-1}
   a. To what region of the spectrum does this radiation belong?
   b. What is the wavelength of this radiation?
   c. What is the energy of this radiation per photon? Per mole of photons?
   d. A carbon-oxygen bond in a different molecule absorbs radiation with frequency equal to 5.4 x 10^{13} s-1 Does this radiation give more or less energy?
5. Many spectroscopists prefer using frequencies to wavelengths when describing electromagnetic radiation. Can you think of an advantage to use of frequencies? (A main concern of spectroscopists is the energy of radiation that is either emitted or absorbed.)
6. What are the wavelengths associated with the following:
   a. An alpha particle (mass = 6.64 x 10-27 kg) traveling at 3.0 x 108 m/s?
   b. A 1000 kg automobile traveling at 100 km/hr?
7. Make a plot of energy vs. n for the Bohr hydrogen atom for n = 1 to n = 50.
   a. What is the energy of the Bohr hydrogen atom when n = ?
   b. What is the ionization energy for the Bohr hydrogen atom? (i.e. the energy required to move an electron from n = 1 to n =)?
8. How much energy is required to ionize a mole of hydrogen atoms?
9. What region of the spectrum would you look in to find the radiation associated with the n = 4 to n = 1 transition of the Bohr hydrogen atom?
10. It is reasonable to report values for the position of a 1 kg cannon ball that have an uncertainty of 10^{-2} cm. Using the Heisenberg Uncertainty Principle, what is the uncertainty in the velocity?
11. Use the wave mechanical model to explain the quantized nature of the orbits of a hydrogen atom.
12. A chemistry book lists the radius of the hydrogen orbital as 1 A. Will the electron ever be further than 1 A from the nucleus?
13. Which of the following sets of quantum numbers are allowed?
   a. n = 7, l = 7, m_l = 0
   b. n = 7, l = 0, m_l = 1
   c. n = 7, 1 = 5, m_l = -3
   d. n = 3, l = -1, m_l = 0
   e. n = 0, l = 0, m_l = 0
14. Write n, l, m_l, and m_s, quantum numbers for the 4 electrons of a boron atom in the excited state.
15. How many half filled orbitals do each of the following have in the ground state?
   a. 0 b. B c. Ar d. Mn e. K f. Cf g. Zn
16. The first and second ionization energies for argon are 1525 and 2665 kJ per mole. Calculate Zeff for the first and second electrons removed.
17. In which orbital would an electron have a greater likelihood of being near the nucleus 4f or 6s?
18. Order the following groups from smallest to largest radius.
   a. Ar, Cl^-, K^+, S^{-2} b. C, Al, F. Si c. Na, Mg, Ar, P d. I^-, Ba^{+2}, Cs^+, Xe
19. Which of the following will have the most exothermic electron affinity? the least?
   a. Ge, Si, C b. Cl, Cl^-, Cl^+.
20. Properties of the alkali metals are discussed in Section 7.14. List some properties that you would expect for the alkaline earths, Be, Mg, Ca, Sr, and Ba.