Unit 1 – Chapter 7: Atomic Structure & Periodicity **Name _____**

Assignment #1: Energy, Wavelength, Frequency Calculations **Period _____**

1) A photon of ultraviolet (UV) light possesses enough energy to mutate a strand of human DNA. What is the energy of a single UV photon and a mole of UV photons having a wavelength of 25 nm?

2) One type of electromagnetic radiation has a frequency of 107.1 MHz, another type has a wavelength of 2.12×10^{-10} m, and another type of electromagnetic radiation has photons with energy equal to 3.97×10^{-19} J/photon. Identify each type of electromagnetic radiation and place them in order of increasing photon energy and increasing frequency.

3) It takes 208.4 kJ of energy to remove 1 mole of electrons from an atom on the surface of rubidium metal. How much energy does it take to remove a single electron from an atom on the surface of solid rubidium? What is the maximum wavelength of light capable of doing this?

4) Neutron diffraction is used in determining the structures of molecules.
   a. Calculate the de Broglie wavelength of a neutron moving at 1.00% of the speed of light.
   b. Calculate the velocity of a neutron with a wavelength of 75 pm (1pm = 10^{-12} m).

5) Calculate the wavelength of light emitted when each of the following transitions occur in the hydrogen atom. What type of electromagnetic radiation is emitted in each transition?
   a. $n = 4 \rightarrow n = 3$
   b. $n = 5 \rightarrow n = 4$
   c. $n = 5 \rightarrow n = 3$

6) An excited hydrogen atom emits light with a wavelength of 397.2 nm to reach the energy level for which $n = 2$. In which principal quantum level did the electron begin?