Dougherty Valley HS AP Chemistry
Atomic Structure – Extra Calculations

WORKSHEET #2*

Name: **Date:** **Period:** **Seat #:**

Directions: Any worksheet that is labeled with an * means it is suggested extra practice. We do not always have time to assign every possible worksheet that would be good practice for you to do. You can do this worksheet when you have extra time, when you finish something early, or to help you study for a quiz or a test. If and when you choose to do this Extra Practice worksheet, please do the work on binder paper. You will include this paper stapled into your Rainbow Packet when you turn it in, even if you didn't do any of this. We want to make sure we keep it where it belongs so you can do it later if you want to (or need to). If you did the work on binder paper you can include that in your Rainbow Packet after this worksheet. If we end up with extra class time then portions of this may turn into required work. If that happens you will be told which problems are turned into required. Remember there is tons of other extra practice on the class website…and the entire internet! See me if you need help finding practice on a topic you are struggling with.

Formulas and Constants					
$c = \lambda \upsilon$	$E = h\upsilon$	$E = \frac{hc}{\lambda}$	$E_n = -\frac{Rhc}{n^2}$	$\lambda = \frac{h}{mv}$	$\frac{1}{\lambda} = R\left(\frac{1}{2^2} - \frac{1}{n^2}\right)$
$c = 2.998 \times 10^8$ m/s $h = 6.626 \times 10^{-34}$ J·s $Rhc = 2.18 \times 10^{-18}$ J $R = 1.0974 \times 10^7$ m^{-1}					

1. Sketch the electron energy levels (n=1 through n=5) for the hydrogen atom.

2. Calculate the energy of an electron in the n=2 energy level of hydrogen. Calculate the energy of an electron in the n=3 energy level. What is the difference in energy of these two levels? If a photon of light had this energy, what would its wavelength be? (E_2=-5.45E^{-19} J, E_3=-2.42E^{-19} J, Δ=3.03E^{-19} J, λ=6.6E^{-7} m)

3. Use the Rydberg equation above to calculate the wavelength of a photon when n=3. How does this compare with your answer in question 2? (λ=6.56E^{-7} J)

4. An electron moves from the n=5 to the n=1 quantum level and emits a photon with an energy of 2.093×10^{-18} J. How much energy must the atom absorb to move an electron from n=1 to n=5? What is the wavelength of this energy? (λ=9.491E^{-8} m)

5. An electron moves with a velocity of 2.5×10^8 cm/s. What is its wavelength? (The mass of an electron is 9.109×10^{-28} g.) Remember: J = Kg•m^2/s^2 (λ=2.9E^{-10} m)

6. Calculate the wavelength (in nanometers) associated with a 1.0×10^2-g golf ball moving at 30. m/s (about 67 mph). How fast must the ball travel to have a wavelength of 5.6×10^{-3} nm? (λ=2.2E^{-25} nm, 1.18E^{-21} m/s)