South Pasadena • AP Chemistry

Name ______________________________
Period ___ Date ___/___/___

7 • Atomic Structure

CALCULATION PRACTICE — 2

Formulas and Constants					
$c = \lambda \upsilon$	$E = h\upsilon$	$E = \frac{hc}{?}$	$E_n = -\frac{Rhc}{n^2}$	$\lambda = \frac{h}{mv}$	$\frac{1}{?} = R\left(\frac{1}{2^2} - \frac{1}{n^2}\right)$
$c = 2.998 \times 10^8$ 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?

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?

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?

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.)

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?