Name:_____ Date:_____ Period:_____

Honors Physical Science

Calculations with the Bohr Atom

Equations: $E=hf$ $E_n = \frac{E_1}{n^2}$ $E=E_H-E_L$ $h=6.63\ E^{-34}\ J\bullet s$

$E_1= -13.6eV$ *(for hydrogen)* $1\ eV= 1.6E^{-19}J$

1. Calculate the energy in joules of photons of light with frequency 6.00 x 10^{14} Hz.

$E = hf$

$= (6.63\times10^{-34}\ Js)\left(6.00\times10^{14}\ \frac{1}{s}\right) = 3.98\times10^{-20}\ J$

2. Calculate the frequency in hertz of photons of light with energy of 2.00 x 10^{-19} J.

$f = \frac{E}{h} = \frac{2.00\times10^{-19}\ J}{6.63\times10^{-34}\ Js} = 3.02\times10^{14}\ Hz$

3. Calculate the energy associated with the n = 5 state of the Bohr model of the hydrogen atom.

$E = \frac{-13.6}{n^2} = \frac{-13.6}{(5)^2} = -0.544\ eV$

$-0.544\ eV$

4. What is the energy of a photon that is emitted when an electron transitions from the n = 5 energy level to the n = 2 energy level in a hydrogen atom?

$E = \frac{-13.6}{n^2}$

$4.58\times10^{-19}\ J$

$E_{high} - E_{low} = 2.86\ eV \left(\frac{1.6\times10^{-19}\ J}{1\ eV}\right)$

n = 2: $E = \frac{-13.6}{(2)^2} = -3.4\ eV$

n = 5: $E = \frac{-13.6}{(5)^2} = E = -0.544$

5. Calculate the frequency of the photon from #4. (1 eV = 1.6 x 10^{-19} Joules)

$f = \frac{E}{h} = \frac{4.58\times10^{-19}\ J}{6.63\times10^{-34}\ Js}$

$= 6.91\times10^{14}\ Hz$