Chemistry II - Atomic Structure Example Problems

Relationship between wavelength and frequency:

ex> Calculate the frequency of red light with a wavelength of 650. nm. [4.62×10^{14} Hz]

ex2> Photosynthesis uses 660.-nm light to convert CO_2 and H_2O into glucose and oxygen gas. Calculate the frequency of this light. [4.55×10^{14} Hz]

ex3> What is the wavelength of 95.5 FM? [3.14 m]

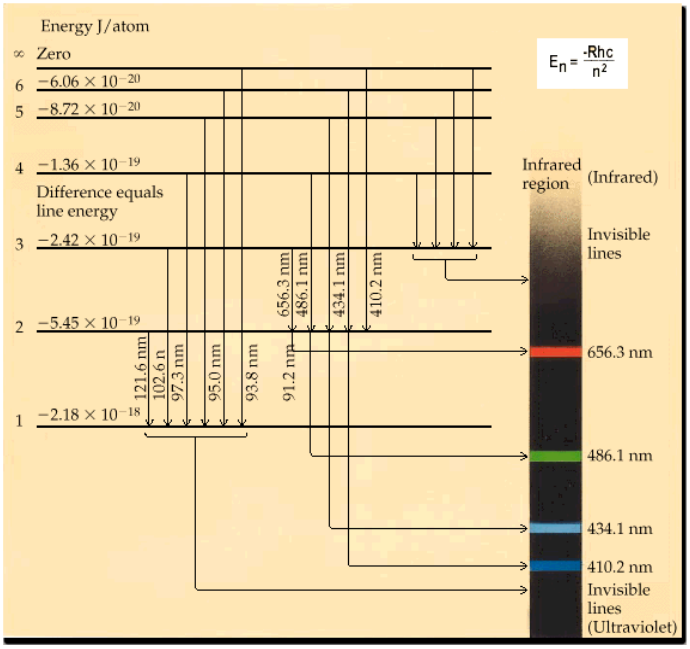
Relationship between energy and frequency:

ex> The blue color in fireworks is often achieved by heating copper (I) chloride to about 1200 °C. Then the compound emits blue light with a wavelength of 450 nm. How much energy is emitted per photon of this blue light? [4.42×10^{-19} J]

Relationship between wavelength, mass, and velocity:

ex> Compare the wavelength for an electron (mass of 9.11×10^{-31} kg) traveling at the speed of 1.0×10^{7} m/s with than for a ball (mass of 0.10 kg) traveling at 35 m/s. [$\lambda_{electron} = 7.27 \times 10^{-11}$ m, $\lambda_{ball} = 1.9 \times 10^{-34}$ m]

Bohr model and orbit energies:



ex> What is the energy given off when an excited hydrogen electron falls back from n = 6 to n = 1? [-2.117 x 10^{-18} J]

ex2> What is the wavelength associated with this emission? [9.383 x 10^{-8} m = 93.83 nm]

ex3> Calculate the energy required to excite the hydrogen electron from n = 1 to n = 2. [1.633 x 10^{-18} J]

ex4> Calculate the wavelength of light that must be absorbed by a hydrogen atom in its ground state to reach the excited state of n = 2. [121.6 nm or 1.216 x 10^{-7} m]