CHEM455 - Homework 1B
Due Mon. April 7 by 4pm in Soumya Samai’s mailbox in Bagley Hall

This is HALF of homework #1. The other HALF is the math self-review, and is due earlier (on Friday). Turn your answers in on a separate page with your name at the top. Circle ALL answers. Staple your work together.

Textbook:
P1.18 – x-rays and unit conversion practice
P1.19 – work function and Planck’s constant
P1.26 – hydrogen atom transitions
P2.18 – energy levels, degeneracy and Boltzmann factors

1) a) Calculate the frequency, \( \nu \), and the energy (in eV) per photon for electromagnetic radiation with a wavelength of 500 nm.
b) express the units in terms of wavenumbers (cm\(^{-1}\))
c) What ‘color’ is this radiation?
d) What is a general formula for finding the energy in eV of a photon whose wavelength we know in units of nm?
e) How much momentum does this 500 nm-wavelength photon have?
f) What speed would an electron have to travel to have the same momentum as this photon?

2) Suppose that a 100W source radiates 600 nm light uniformly in all directions. The human eye is remarkably sensitive. Assume that a person can detect see this light if only 20 photons per second enter a dark-adapted eye (pupil diameter of 7 mm). How far from the source can the light be seen under these conditions? What color is this light?

3) Solve the differential equation: \( \frac{d^2 x}{dt^2} + \omega^2 x(t) = 0 \)
For the time \( t=0 \) initial (boundary) conditions \( x(0)=A, \ x'(0)=v_0 \)