

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, ν , 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: $\frac{d^2x}{dt^2} + \omega^2 x(t) = 0$

For the time $t=0$ initial (boundary) conditions $x(0)=A$, $x'(0)=v_0$