Homework 2
EE 362 Electronic, Magnetic, & Optical Properties of Materials (Spring 2025)
Friday, January 31, 2025

1) Find the kinetic energy (J & eV), momentum, and velocity of an electron that has the same wavelength as a) orange light (600 nm) and b) blue light (475 nm).
2) 2.13 Hint: $\Delta KE = (dKE/dp)\,\Delta p$
3) 2.20
4) 2.26
5) 2.34 Hint: relative probability is $|\Psi(x)|^2/|\Psi(0)|^2$
6) 2.36
7) 2.41 Also, find the wavelength and frequency of the photon emitted if an electron drops from a) second to first energy level, b) third to second energy level, and c) fourth to third energy level.
8) A proton with a kinetic energy of 700 eV, traveling in the x-direction from $-\infty$ in a region of zero potential energy (Region I), is incident on a finite potential barrier at $x = 0$ of 4.5 keV that is 0.25 pm wide (Region II) followed by another zero potential region (Region III). a) Find the voltage required to give a proton initially at rest this energy. b) Find the velocity of the proton. c) Find the de Broglie wavelength of the proton. d) Find the wave numbers in Regions I, II, and III. e) Find the exact and approximate transmission coefficient, i.e., tunneling probability (unitless and %). f) How wide would the barrier need to be for the tunneling probability to be 0.1%?

Due Wednesday, February 5, 2025

Note: Carry *at least* **8** significant figures on constants/parameters in calculations. Give answers with **6** significant figures.