

Problem Set 8

1. The energy levels of the hydrogen atom can be written as $E_n = -\frac{13.6}{n^2}$ eV.

If some external electrons, with fixed kinetic energy 12.5 eV, hit hydrogen atoms at ground state $n = 1$ (assume that one electron hit one atom at a time), with all or part of external electron energy absorbed by the atoms, the atoms will emit a photon or photons afterwards. What are the possible energies of these emitted photons?

- 2.

Show that the de Broglie wavelength of an electron accelerated from rest through a small potential difference V is given by $\lambda = 1.226/\sqrt{V}$, where λ is in nanometers and V is in volts.

3. Consider a wavefunction at $t = 0$ written as:

$$\psi_E = e^{ikx} + Re^{-ikx}$$

Calculate the probability density as a function of x in terms of constants R, k .