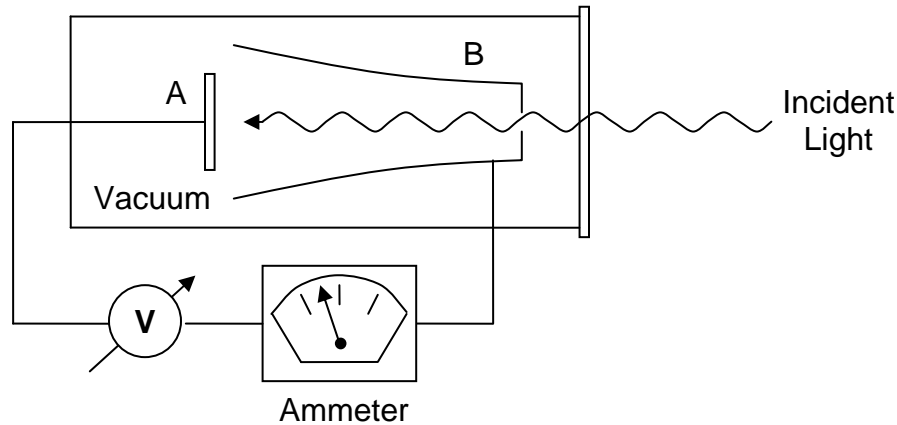
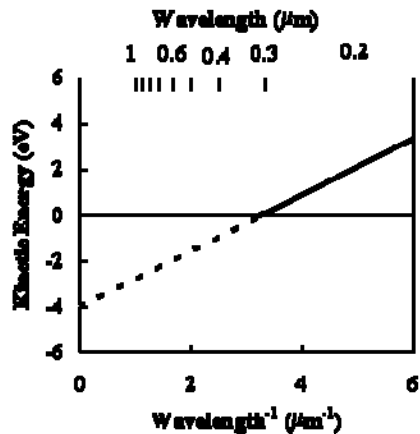


ECE 352 Assignment 1 – Photoelectric Effect – Due 9 AM Friday Sept 13th



1. (1) Label the positive and negative terminals for the voltage source in the experimental setup shown above, such that the current can be brought to zero.
2. (1) What is the conversion factor between an electron volt (eV) and a Joule?
3. (3) What is the longest wavelength of light required to free an electron from a Tungsten target, $\Phi \sim 4.5$ eV, with an electrostatic potential of 1V between the target (+) and the collecting terminal (-)?
4. (2) The cutoff frequency (below which no photoelectric current is observed) for sodium is measured to be $\nu = 2.41 \times 10^{14}$ Hz when $V = -1$ V. What is the work function of sodium, and what minimum frequency of light is required to extract the photon?
5. (2) The results of an experiment on an unknown target material are shown in the graph below.



Below which frequency does electron emission cease? What is the work function of this material?

6. * (requires extra thought) (4) If electrons that interact with the incident light don't receive enough energy to escape from a material, what happens to this energy transferred from the photon to the electron? What measurement would provide an indication of how much of the incident photon energy was absorbed in the sample?
7. (3) A photon having an energy of twice the work function impinges on a target of work function Θ . Which of the following is most accurate:
- (a) An electron having an energy of Θ will be ejected.
 - (b) An electron having an energy of $\Theta/2$ will be ejected.
 - (c) Any ejected electron will have a kinetic energy of less than or equal to Θ .
 - (d) The electron ejected electron will have a kinetic energy of less than or equal to $\Theta/2$.
 - (e) Two electrons will be released.
8. (3) The intensity of solar radiation is 1366.1 W/m^2 in space. This light strikes a 10 m^2 solar panel of a satellite. Assuming that all the light is absorbed, how much force (momentum per second) is transferred? (Recall that the more general form of Newton's Law: $F=dp/dt$.) If the satellite has a mass of 500 kg , what is the rate of acceleration produced by photon momentum, and how long will it take to increase the speed of the satellite by 1 m/s ?
9. (a) Find a solution to Schroedinger's equation in 1D for an electron in free space (i.e. $U=0$ and no boundaries).
- (b) What are the allowed energies, E ? Are they quantized or continuous?
 - (c) Show that $\lambda=h/p$ and $E=h\nu$.
10. Find the ground state kinetic energy in electron volts of an electron trapped within a 0.2 nm wide infinite one dimensional square well.