PHYS 225: Applications of Modern Physics **Marie Lopez del Puerto**

HW #12

1. **(Kasap 3.7) Photoelectric effect** A photoelectric experiment indicates that violet light of wavelength 420 nm is the longest wavelength radiation that can cause the photoemission of electrons from a particular multi-alkali photocathode surface.

a. What is the work function of the photocathode surface, in eV?

b. If a UV radiation of wavelength 300 nm is incident upon the photocathode surface, what will be the maximum kinetic energy of the photoemitted electrons, in eV?

c. Given that the UV light of wavelength 300 nm has an intensity of 20 mW/cm^2, if the emitted electrons are collected by applying a positive bias to the opposite electrode, what will be the photoelectric current density in mA/cm^2?

2. **(Kasap 3.9) Photoelectric effect** A multi-alkali metal alloy is to be used as the photocathode material in a photoemissive electron tube. The work function of the metal is 1.6 eV, and the photocathode area is 0.5cm^2. Suppose that blue light of wavelength 420 nm with an intensity of 50 mW/cm^2 is incident on the photocathode.

a. If the photoemitted electrons are collected by applying a positive bias to the anode, what will be the photoelectric current density assuming that the quantum efficiency η is 15 percent? *Quantum efficiency* as a percentage is the number of photoemitted electros per 100 absorbed photons and is defined as

$$Quantum\ \ efficiency = \frac{Number\ \ of\ \ photoemitted\ \ electrons}{Number\ \ of\ \ incident\ \ photons}$$

What is the kinetic energy of a photoemitted electron at 420 nm?

b. What should be the voltage and its polarity to extinguish the current?

c. What should be the intensity of an incident red light beam of wavelength 600 nm that would give the same photocurrent if the quantum efficiency is 5 percent at this wavelength? (Normally the quantum efficiency depends on the wavelength).