Workshop module 12 - Physics 114, Spring 2010

- 1. You find that when UV light with a wavelength of 254 nm from a mercury arc falls upon a clean copper surface, the stopping potential necessary to stop emission of photoelectrons is 0.181 V. a) What is the photoelectric threshold wavelength for this copper surface? b) What is the work function for this surface?
- 2. How would you expect the ionization energy of Ne to compare to Li? How about the radius? Why?
- 3. How would you expect the wavelength of the K α x-ray line for tungsten to compare to that for gold? Do you understand why Z-1 comes into the relevant equation?
- 4. Phosphors that coat the inside of a fluorescent lamp convert ultraviolet radiation (from the mercury vapor discharge inside the tube) into visible light. Make a qualitative schematic diagram of the allowed atomic energy levels that illustrates how this works. Could one also make a phosphor that converts visible light to ultraviolet?
- 5. Which device can resolve smaller details in a sample: an electron microscope or a visible light microscope? Why?
- 6. Some fraction of you are struggling to reach the point where you get paid to study xray photographs of the innards of people. Radio waves pass through bodies too ... Why don't we make radio wave photos of the body to study as a diagnostic tool?
- 7. A monochromatic (all one frequency) beam of light excites hydrogen atoms in a glass tube. Light of 10 different frequencies is observed to be emitted by the gas in the tube as the hydrogen atoms fall back to the ground state. What is the energy of the photons in the incident monochromatic beam of light?
- 8. How many quantum states are available to electrons in the n=3 state of a multielectron atom, according to Schroedinger's theory of the atom?
- 9. A sample of atoms is prepared so they each have electrons in an excited metastable state with a lifetime of 3.7 ms. The electrons eventually drop down into the ground state and emit light in the process. How well known is the energy of the electron in the metastable state? How wide is the spectral line emitted by these atoms as the electron drops back into the ground state?
- 10. Estimate roughly the spread of momenta of protons bound within an atomic nucleus.