PHOTOELECTRIC EFFECT LAB

Unlike most labs, the write-up for this one will take place on this sheet and this sheet alone. Be sure to put your name at the top.

Begin by going to http://phet.colorado.edu/ and clicking on the "Play with sims" button. When the new page pops up, click on "Physics," then "Quantum Phenomenon," then "Photoelectric Effect."

You will be led through a series of questions all of which you will answer with the demo that will pop up when you hit, "RUN NOW!" on the page you have gone to. WITHOUT *PLAYING* WITH THAT DEMO, hit "RUN NOW." You should find a device that has a lamp, an intensity control, a wavelength control, two plates and a variable battery connected to a current meter.

1.) Think about light as a wave. Would you expect the intensity of light of a particular color to play a role in exciting and ejecting electrons off the metal plate? Briefly explain.

2.) With the INTENSITY slide to the far left (i.e., off), use the WAVELENGTH slider to select red light.

a.) Is red light *long wavelength* or *short wavelength*, relative to the other colors. Is it *high frequency* or *low frequency*, relative to the other colors?

b.) Use the INTENSITY slider to slowly bring the light intensity up.
Do you observe electrons being emitted from the left plate (if they are, they will move out into the region in the middle of the page).

c.) If light is acting like a wave, does your observation make sense? That is, if light is acting like a wave, wouldn't you expect some point of very high intensity to finally jar some electrons loose?

3.) Put the INTENSITY slider back to zero, then put the WAVELENGTH slider in the YELLOW range.

a.) Use the INTENSITY slider to slowly bring the light intensity up.
Do you observe electrons being emitted from the left plate?

b.) Again, if light is acting like a wave, does your observation make sense?

4.) With the INTENSITY slider to the far right (i.e., the maximum intensity):

a.) Slowly move the WAVELENGTH slider to the left. Can you find a wavelength where electrons are ejected? If so, what is that wavelength and color?

b.) Are there wavelengths beyond that wavelength that eject electrons?

c.) Does there appear to by any wavelengths that DO NOT eject electrons?

5.) Use the WAVELENGTH slider to select that "lowest" wavelength that allows electron to ejection. Start the INTENSITY slider to the far left (i.e., off), and slowly begin to move it to the right (increasing the intensity). What do you notice about the number of electrons ejected as you increase the intensity?

6.) Now set the INTENSITY slide to mid-range and slowly move the WAVELENGTH slider from the red (low frequency, long wavelength) to the blue (high frequency, short wavelength). With the INTENSITY held constant, you should notice the electron speed increasing with frequency. From an energy perspective, what does this tell you about the particles associated with higher frequency light?

7.) Last thing: With the WAVELENGTH slider on blue light, bring the INTENSITY down to 5%. Do you get electrons ejected even at this very low intensity? Does this make sense from a wave perspective?

8.) Briefly explain how "light as quantized particles" solves the questions that the wave theory can't answer.