Photoelectric Effect
Study Questions

How does changing the intensity of the light affect the current? Why? (Think blizzard, not tidal wave.)

Intensity of the light is determined by number of photons, rather than the amplitude of a wave. More photons striking the cathode cause more electrons to fly off, raising the current. Each electron is knocked off by a single photon, so the more photons, the more electron flow.

(Of course, the photons must be individually energetic enough to knock an electron around.)

Why doesn't changing the intensity affect the stopping voltage?

The electrons have to be stopped individually. The stopping voltage is the amount of energy necessary to prevent an electron from moving, even after it has absorbed a photon. Higher intensity light just means more photons, not higher energy photons, and stopping voltage is indicative of the energy of individual photons.

Which photons have more energy, those in blue light or those in red light?

"blue" photons have higher energy

Which (red or blue) requires a higher stopping voltage?

"blue" photons require higher stopping voltage

Generally speaking, what is the relationship between the frequency of light causing the current and the voltage necessary to stop that current?

Higher frequency light requires higher stopping voltage.

What is the relationship between *wavelength* and stopping voltage?

Shorter wavelength light requires higher stopping voltage

Why is the stopping voltage so similar for white and far blue light, even though the white light has about 100 times as much light as the light through any of the filters?

The stopping voltage is determined by the highest frequency photons; low frequency photons don't have much energy, and it takes relatively little voltage to stop an electron flying off the cathode when it has been tapped gently by a "red" photon. High frequency "blue" photons hit the electrons much harder, and a higher stopping voltage is needed to stop them flying off. The stopping voltage for white light is therefore determined by the energy of the highest frequency photons contained in the light.

How does the photoelectric effect in general, and your data in particular, demonstrate the quantized nature of light?

The electrons have to be stopped individually. No matter how many photons there are (that is, no matter how bright the light), the stopping voltage is the same for a given frequency. This means that the interactions between light and electron is quantized.

What property of *waves* we used in today's experiment demonstrating the quantized nature of light (i.e., the existence of *photons*)?

The energy of the individual particle is determined by the frequency of the wave.