Name _____

Photoelectric Effect Inquiry

Experiment 1:
Shine a red laser pointer on a prism. What do you observe?

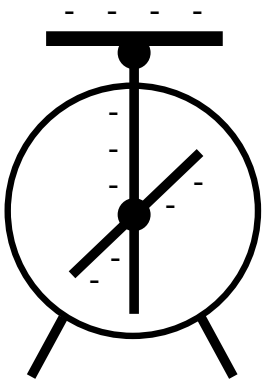
Shine a white flashlight on a prism. What do you observe?

Recall that the angle of refraction depends on the index of refraction of the material, n. In many materials, the value of n depends on the wavelenght of the light, so that different wavelenghts refract different amounts.

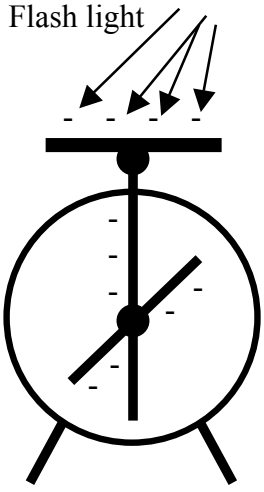
What does this tell you about "white" light? What does this tell you about the color of light?

Behaviors of light such as diffraction and interference show that light behaves like a wave. It's wavelenght corresponds to its color.

Experiment 2:
Use fine sandpaper to clean the surface of a piece of aluminum, and then tape the aluminum to the ball on top of the electroscope, so that it is in electrical contact. The sanded surface should be faceing up. Place a negative static charge on the aluminum, so that the electroscope's needle is deflected. Do this by rubbing a rubber balloon or PVC pipe in your hair, and touching the negatively charged balloon or PVC to the aluminum.



Question 1:
How can you tell if the charge remains on the aluminum? How can you tell if the charge is somehow removed from the aluminum?



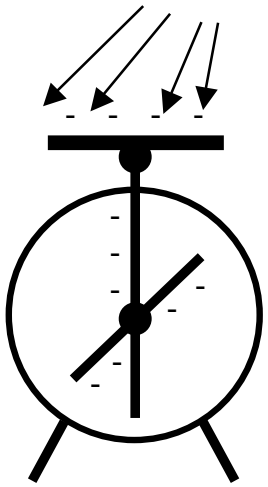
Question 2:
Predict whether there will be a change in the needle's deflection if you shine a regular flashlight on the aluminum.

Try it. (Don't touch the aluminum, that would dissipate the charge.) What do you observe?

Name _____

Question 3:

Predict whether there will be a change in the needle's deflection if you shine different color light on the aluminum, such as red (laser pointer) and ultraviolet (UVC wand). Always make sure you start with a negative charge on the aluminum.



Try it. What do you observe?

You should have found that only the UV light made the negative charge leave the aluminum. Therefore this behavior seems to be related to the light's color. Let's investigate whether it's related to the light's intensity.

Question 4:

Shine white, red, and UV light on the negatively charged aluminum, but this time vary the distance between the light and the aluminum. Does the distance, and therefore the intensity, effect the results?

You should have observed that only the UV light made the negative charge leave the aluminum, no matter how high the light's intensity. The UV light may dissipate the charge faster when it is closer to the aluminum, and the light is more intense.

The ejection of electrons from a metal by light is called the Photoelectric effect. Electrons are bound to surfaces with an energy that depends on the type of material. If enough energy is transferred to such an electron, the electron can be freed from the surface. The light is freeing the electrons by transferring energy. The energy of the light seems to be related to the light's color, and not its intensity. This is surprising, since the energy of most waves is related to its intensity! Thus, the Photoelectric effect supports the idea that light is made up of particles with certain energy, not waves!