

OBJECTIVES

- **Observe** and **measure** the photoelectric effect using a phototube and photoelectric-effect device.
- **Calculate** the maximum kinetic energy of the emitted electrons using the measured value for the stopping voltage.

MATERIALS LIST

- adhesive tape
- black construction paper
- insulated connecting wire
- lens supports
- light sources and power supply
- meterstick and meterstick supports
- multimeter or dc voltmeter
- photoelectric-effect device with amplifier and filters
- wood block

In this laboratory, you will explore the photoelectric effect.

SAFETY

- **Avoid looking directly at a light source. Looking directly at a light may cause permanent eye damage. Put on goggles.**
- **Never close a circuit until it has been approved by your teacher. Never rewire or adjust any element of a closed circuit. Never work with electricity near water; be sure the floor and all work surfaces are dry.**
- **If the pointer on any kind of meter moves off scale, open the circuit immediately by opening the switch.**

PROCEDURE**Preparation**

1. Read the entire lab, and plan what measurements you will take. In this laboratory, use black paper to shield the photoelectric-effect device from room lights and block all light when zeroing and when inserting filters.
2. If you are not using a datasheet provided by your teacher, prepare a data table with thirteen columns and four rows. In the first row, label the columns *Filter*, I_1 (mA), ΔV_1 (V), I_2 (mA), ΔV_2 (V), I_3 (mA), ΔV_3 (V), I_4 (mA), ΔV_4 (V), I_5 (mA), ΔV_5 (V), I_6 (mA), and ΔV_{stop} (V). In the first column, label the second through fourth rows *Blue*, *Green*, and *Red*.

Stopping Voltage

3. Connect the voltmeter across the photoelectric-effect device. **Do not turn on the power supply or light source until your teacher approves your setup.** With approval, read the current meter on the device. Turn on the power supply and adjust it until the current meter reads 15 mA. Set the zero point by turning the voltage-adjustment knob on the device until the applied potential difference stops the photocurrent. (The current meter should show the initial reading.) Adjust the “Zero adjust” (or similar) knob until the current meter reads zero. Turn off the device.
4. Make a tube from a sheet of black paper. Place the blue filter into the clips. Use the xenon bulb if available. Set up the apparatus as shown in **Figure 1**, and have your teacher approve your setup. Turn on the light and the device.