

# Training for Educators

## Light & Photons

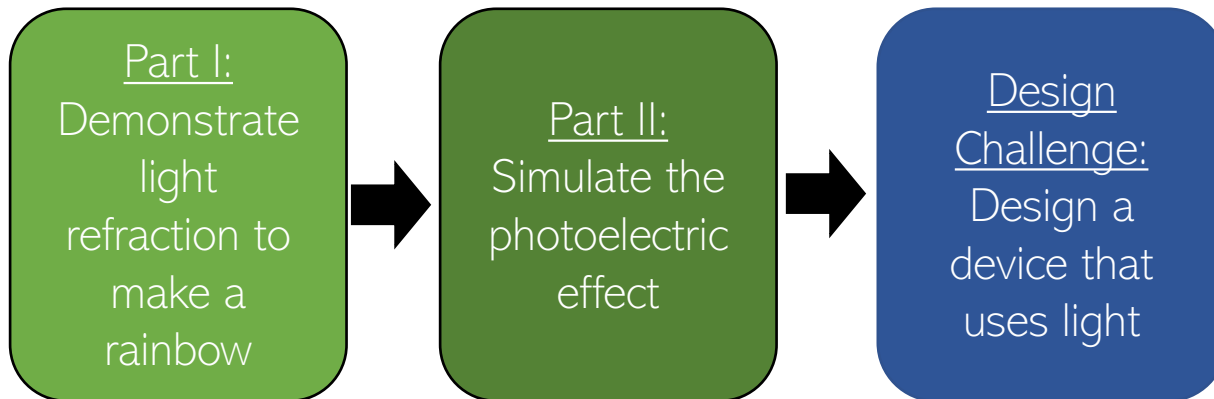
Primary Level

Ages 5-11

# Purpose of the lab

- The purpose of this lab kit is to introduce light through demonstration and experiments. Students will think about light behaving as a wave through refraction and dispersion. The manual will also prompt students to think about light as a particle using the photoelectric effect.
- The main takeaways are:
  - Light is a type of energy that helps us see.
  - Light is both a wave and particle.

# Summary of experiments



There are 2 experiments/activities and one design challenge.

# Supplies list

- Spray bottle
- Water
- Ruler or measuring tape
- Cardstock (heavy paper)
- Straws (or wooden dowels or sticks)
- Colored markers (or colored pencils or crayons)
- Marbles
- Tape
- Scissors

# Safety considerations

Before the students begin the laboratory, please take into consideration the following safety concerns:

- Students should never look directly at the Sun. This can permanently damage their eyes. If you are using the Sun as a light source, have the students look at a sunny spot on the ground or on the horizon away from the direction of the Sun.

# Setting up your space

- Gather your supplies and separate by experiment(s) on your table.
- These are our recommendations:
  - Each student should have a pencil or pen.

Groups of 2-4 students can be given the following supplies:

- 1 piece of cardstock (heavier) paper
- 2 wooden dowels or straws
- 2 marbles

The class can share the following supplies:

- Spray bottles
- Tape
- Scissors
- Colored markers

# Part I. Rainbow in a Bottle

- Set-up:
  - Each group of 2-4 students can share a spray bottle filled with water.
- Procedure:
  - Students should spray the water bottle a few times in the direct sunlight.
- Results:
  - Students will see a rainbow appearing from light shining through the water and bending to produce a band of colors.

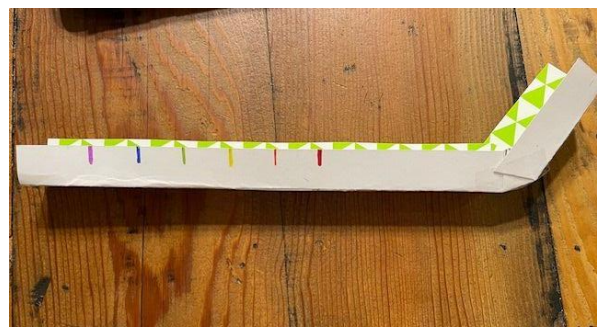
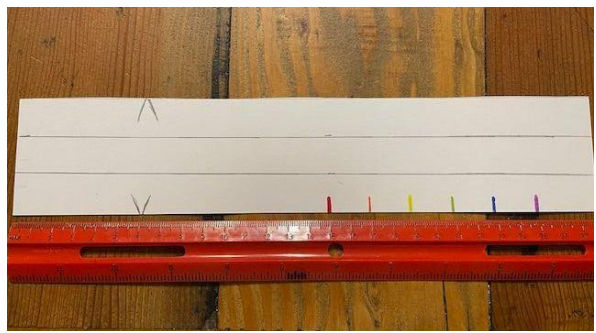
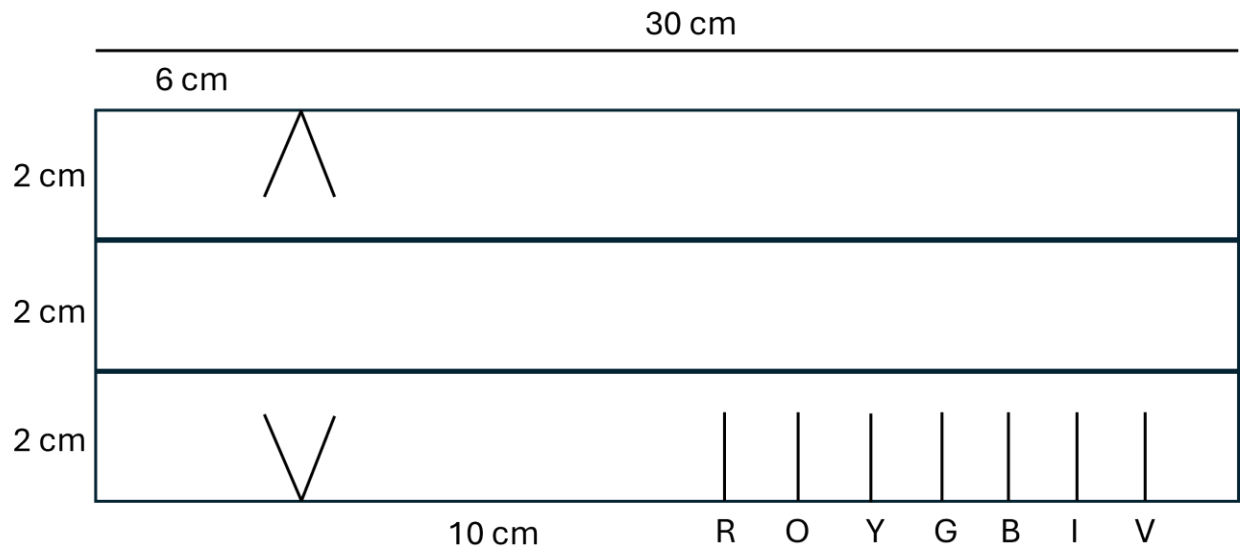
The takeaway is that light exhibits wave-like properties such as refraction (or bending) and this produces a rainbow!

# Part II. Modelling the Photoelectric Effect

- Set-up:
  - Each group (2-4 students) will need cardstock paper, straws (or wooden dowels), and marbles.
- Procedure:
  - Students will prepare a ramp and release marbles from different heights on the ramp (marked by colors) toward a marble at the bottom of the ramp.
- Results
  - Students should see that certain heights (“energies”) will cause the bottom marble to launch off of the ramp. This is analogous to the photoelectric effect.

The takeaway is that light exhibits particle-like properties through the photoelectric effect and only certain light energies can eject electrons (marbles) out of metal (off of the ramp).

# Part II. Modelling the Photoelectric Effect



Dimensions of ramp to be constructed. Note that this is not drawn to scale and should not be directly printed and used. (Bottom left) Ramp construction prior to cutting and taping. (Bottom right) Complete ramp construction.

# Design challenge

Students are asked to design a device that uses light to do something useful. They have seen in previous experiments that light can be described as a wave and as a particle and there are many sources of light (Sun, light bulb, etc.).

- Questions to ask the students (encourage creativity)
  - What are different sources of light that you could use in your tool?
  - How could what you have learned about light in this kit be useful in your tool? Consider refraction and the photoelectric effect.