How Does the Intensity of Light Change with Distance?

https://www.sciencebuddies.org/science-fair-projects/project-ideas/Elec_p028/electricity-electronics/measure-intensity-of-light
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Experimental Procedure

1. Set up your multimeter to measure the resistance of the photoresistor, as shown in Figure 2.
    a. Plug the black multimeter probe into the port labeled COM.
    b. Plug the red multimeter probe into the port labeled VΩmA.
    c. Connect the multimeter probes to the leads of the photoresistor using alligator clips.
    d. Set the multimeter dial to measure resistance in the 200 Ω range.
    e. Turn the multimeter's power switch to ON.
    f. If this is your first time using a multimeter, see the Science Buddies reference How to Use a Multimeter (http://www.sciencebuddies.org/science-fair-projects/references/how-to-use-a-multimeter), particularly the section How do I measure resistance? (http://www.sciencebuddies.org/science-fair-projects/references/how-to-use-a-multimeter#qmultimetermeasureresistance) to learn more.

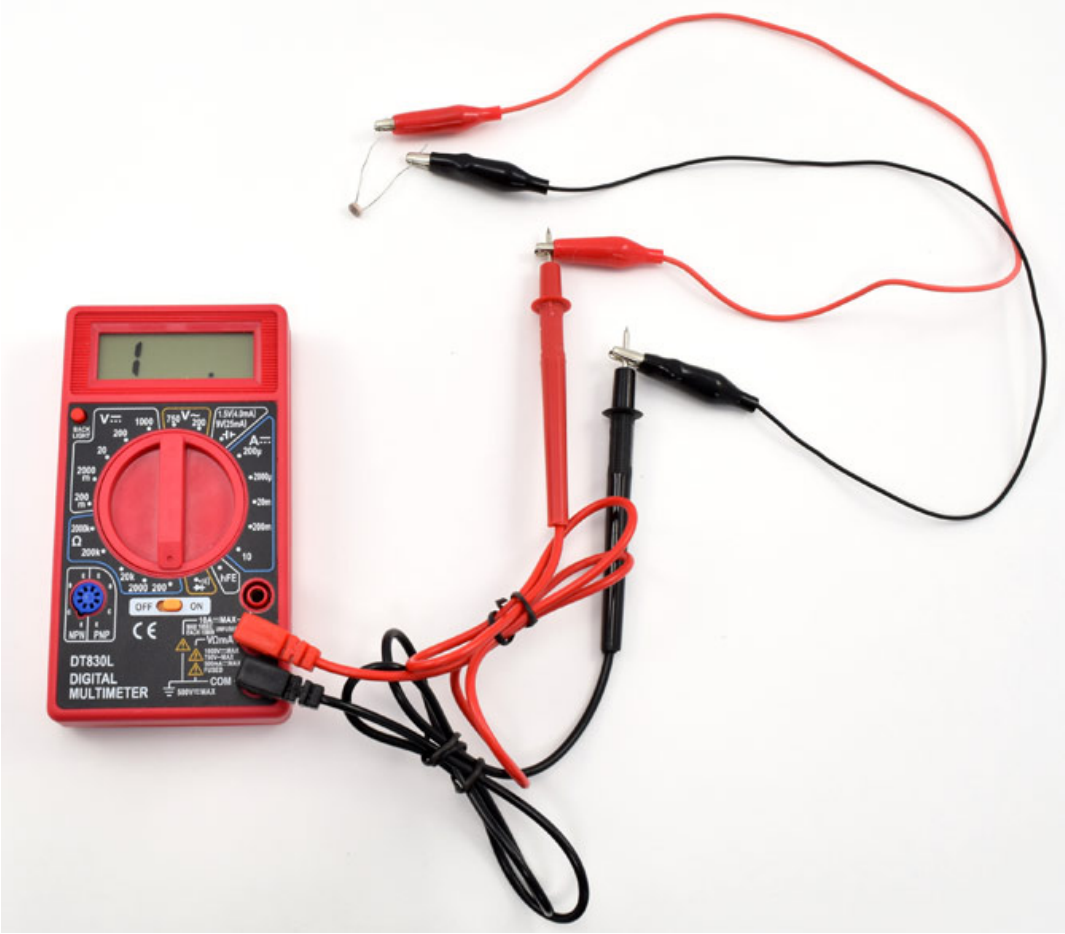

Figure 2. How to connect your multimeter to the photoresistor.

2. Set up your experiment, as shown in Figure 3.
    a. If possible, set the experiment up in a room with no windows, or do the experiment at night. If this is not possible, find a room with as little external light as possible. The photoresistor is very sensitive; even a little bit of light leaking under a door can affect your readings.
    b. Turn off all other lights in the room except the single lamp you will use for the experiment.
    c. If necessary, remove the lamp shade from your lamp.
    d. Set up your tape measure to measure distance from the lamp.
    e. Tape your photoresistor to a cardboard box so it is level with the lamp. The face of the photoresistor (the side with the squiggly lines) should be facing directly toward the lamp.

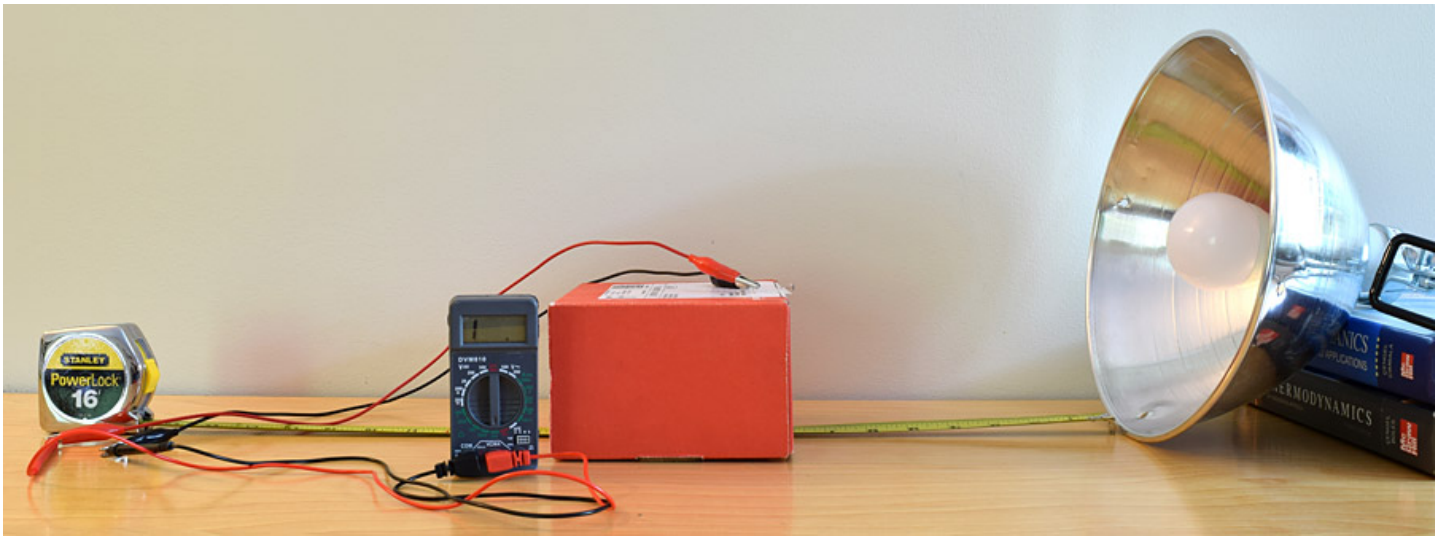

Figure 3. Experimental setup.

3. Measure the resistance of the photoresistor as you increase the distance from the lightbulb (for example, every 10 cm).
    a. Take at least three readings at each distance and calculate an average.
    b. Try to take measurements over a range of at least several meters. If you have space, you can go even farther, but remember that stray ambient light will affect your readings.
    c. *Note*: The resistance will increase as you move away from the light source. If the screen of your multimeter reads "1 .", then the resistance has exceeded the range of the multimeter dial setting. Rotate the dial up one resistance setting (for example, from "200" to "2000") to increase the range. Make sure you pay attention to units. A prefix of "k" means "kilo-ohms" (kΩ).
4. Convert the resistance values to illuminance in lux using Equation 1 (hold your mouse cursor over the equation to magnify it). *Note*: This equation is an approximation. See the Variations (#makeityourown) section to learn more about the source of Equation 1.
   Equation 1:

$$E = \frac{375.81}{R^{1.034}}$$

   where
    - **E** is the illuminance in lux
    - **R** is the resistance in kilo-ohms (so make sure to convert to kΩ before using Equation 1 if you took your readings in Ω)

5. Make a graph of illuminance versus distance. Does the relationship follow the inverse square law? Advanced students should generate a best-fit curve and determine the R-squared value.