

LEDs and Photoresistor Fun (CBL Module #1 Fall 2022)



This little light of mine – your first LED circuit

Let's get a LED to light up! Build the complete circuit shown below in Figure 1. Make sure to properly orient the LED.

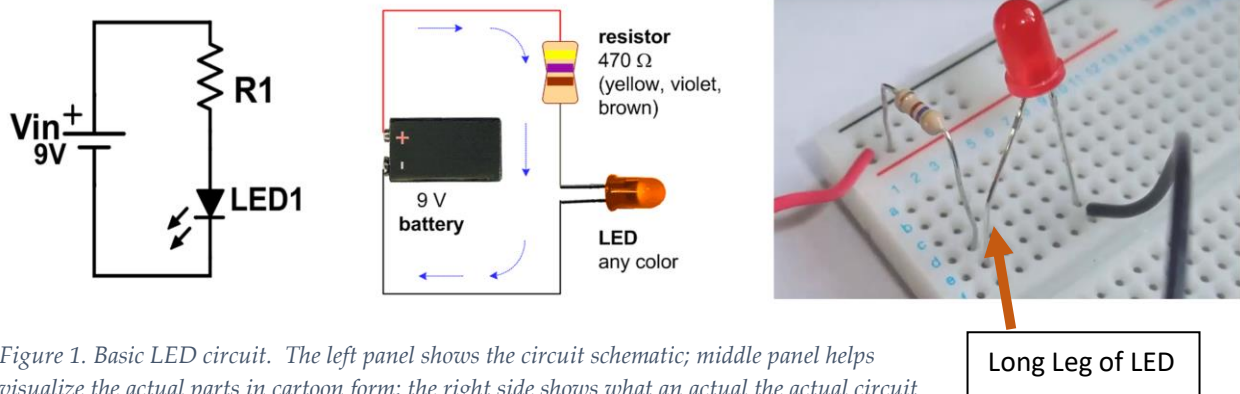


Figure 1. Basic LED circuit. The left panel shows the circuit schematic; middle panel helps visualize the actual parts in cartoon form; the right side shows what an actual the actual circuit looks like. Image adapted from: <https://www.electroschematics.com/2573/led-circuit/> and quickstartworkbook.com. Note: an Arduino power source (5V/GND) can be used in place of the 9V battery.

1. What are some applications of an LED turning on (or off)?
2. What is a circuit?
3. What is an LED?
4. What is a resistor and why do we need it in this circuit?
5. In the next section, we'll see how we can change the 470 ohms resistor into a light sensing element to make something cool happen with our LED!

Let there be light – a light sensitive resistor circuit

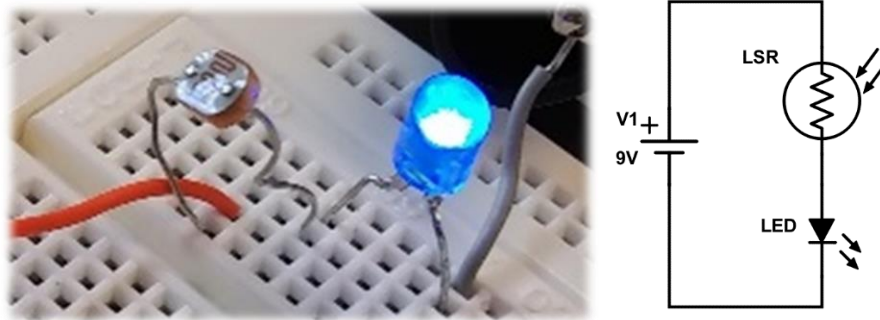


Figure 2. LED and Photocell Circuit. The brightness of the LED is controlled by the intensity of light hitting the CdS photocell (aka light sensitive resistor). Note: the power source V1 can be supplied by +5V/gnd of the Arduino Uno R3, in place of the 9V battery.

1. Grab a CdS photocell and LED (red or blue typically work best; they are easiest to see).
2. Explore how the CdS photocell works. Measure the resistance with the CdS photocell in bright light (such as laser pen or cell phone flashlight), and again in the dark. The manufacturer's resistance vs. illumination curve is shown in Figure. For reference, sunrise is ~300 lux, ~1000 lux is an overcast day, and ~10000 lux is a sunny day.
3. Try shining a bright light, such as a laser pointer, or cell phone flash light on the photoresistor. Does the LED look bright or dark? Now try again, but turn off the laser pen or phone light so that the photoresistor sees "dark". What happens to the LED brightness?
4. How is this circuit useful? Describe a few applications for photoresistor (aka photocell) in a device you might find in everyday life? [As one suggestion: think about communicating between 2 people]

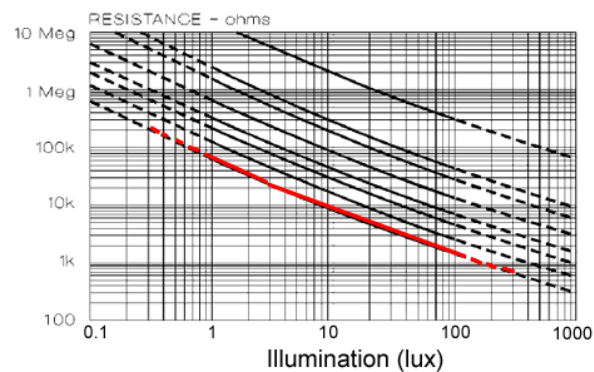


Figure 3. CdS photocell resistance vs. illumination intensity. The different curves represent the typical spread in performance – each CdS photocell has its own 'personality'; it's difficult to make them all exactly the same (for cheap).

Light Sensing System—a “mini-computer” (Arduino) reacts to different light levels

(Time permitting)

Let's try to make a garden-light system---the garden lights should turn on when it is dark outside; they should turn off when it is bright outside. So far, we've seen how to sense light. And we've seen how to turn on a LED. Now let's combine these two functions using an Arduino microcontroller (a 'mini-computer' programmed to do just one thing).

1. First build the circuit shown below. Measure the voltage V_{out} in the bright light vs. no light condition. Write down the voltage you measure for bright vs. dark. You'll need to use this number in a minute. [V_{out} should read a relatively high value in the dark; and relatively low value with lots of light shining on the photocell].
2. The Arduino will read the voltage V_{out} . Based on this reading, it will illuminate a LED (or not). The Arduino will then react to this by turning the LED on (if dark outside) or off (if bright outside).
3. Upload the Arduino code provided. Then try out your system!
4. What else could you imagine doing if you sense bright vs. dark? Think about motors, other things that turn on and off.

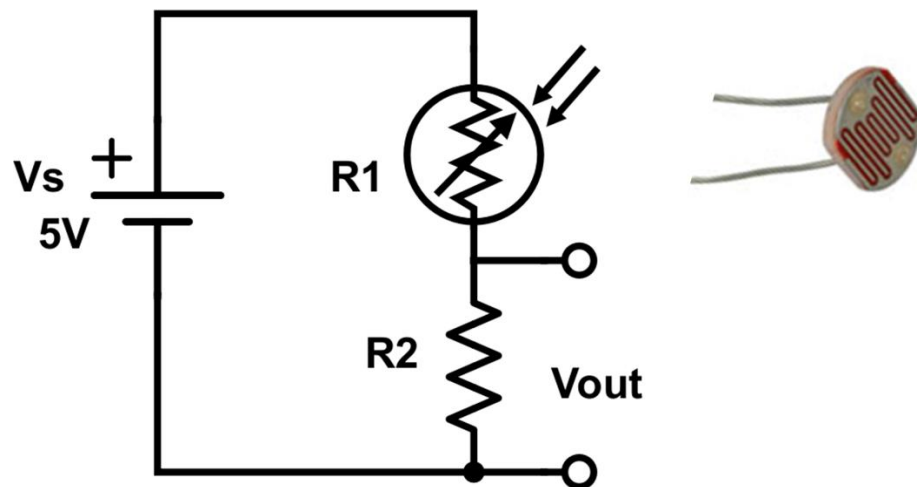


Figure 4. Voltage divider circuit. Changing light levels change the output voltage V_{out} . The arduino will read V_{out} and react by turning a LED on/off accordingly.