What size resistors will allow 1mA through each color LED?

Blue

Voltages are relative, so we need to pick a reference point. Let's call point **3** zero volts. The battery in the flashlight provides three volts, so point **1** must be 3 volts. Since the blue LED needs 2.5 volts to turn on, point **2** must be 2.5 volts. The difference in point **1** and point **2** is 3-2.5 = 0.5 volts.
If $V=IR$, then divide by I to find $R=V/I$.
Now to find R:

$$\frac{V}{I}=R;\frac{0.5\,volts}{0.001\,amps}=500\,ohms$$

Red & Green

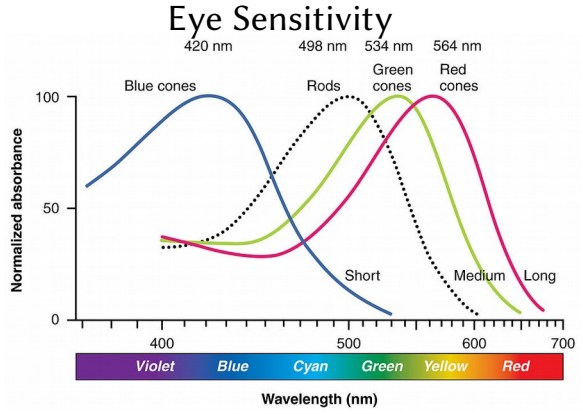
Try to find the resistance yourself. Try out different resistances and write what you notice.
Do bigger resistors make the LED brighter or darker?
What colors can you make?
What happens when you turn individual colors on and off?

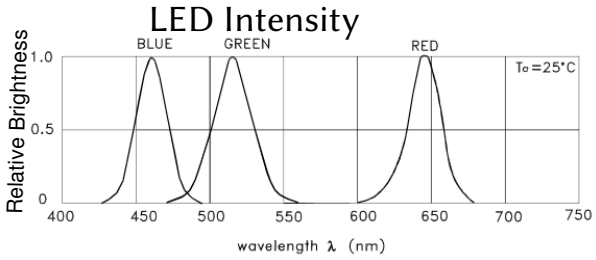
Colors

Your eyes have three types of light sensors, called cones. To match your eye, the LED can has three colored lights inside: red, green, and blue.
Scientists measure color using wavelength. Visible light has a wavelength of between 40 and 700 nm (nanometers). A nanometer is one-billionth of a meter.
The **Eye Sensitivity** chart shows how sensitive the red, green, and blue cones in your eyes are to different colors of light. The **LED Intensity** chart shows how bright the red, green, and blue lights on the LED are.

What wavelengths do your cones absorb best? What wavelengths are the LED's three lights brightest at?

	Red	Green	Blue
Eyes			
LED			



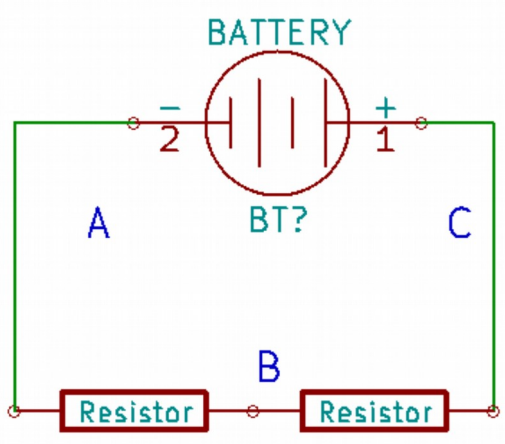


Sources:
Human Rods & Cones: http://cnx.org/content/col11496/1.6/
LED Datasheet: http://www.kingbrightusa.com/images/catalog/SPEC/WP154A4SUREQBFZGC.pdf

Circuits

Circuits make the world go. Complicated circuits form computers, manage stoplights, and run appliances. Fundamentally, circuits are simple. They are made of parts connected with wires. Common parts include batteries, resistors, transistors, and capacitors.

Each wire in a circuit has a specific voltage relative to all of the others. If the battery in the picture produces three volts, then point **C** must be three volts higher than point **A**.



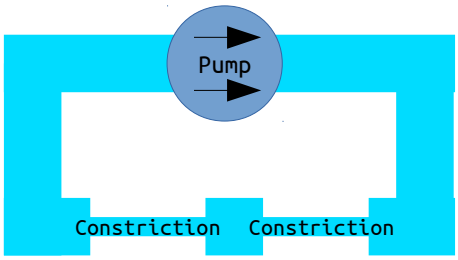
Voltage and Current

All circuits (even computers) work by manipulating voltage and current. Voltage and current are similar to pressure and flow rate in water. Imagine you have a garden hose turned on. The water coming out of the hose is like a current. If you block up the hose with your thumb, the pressure in the hose rises. That pressure is voltage.

The most basic electrical component is the resistor. It behaves a little bit like a constriction in a flow of water. A resistor limits the flow of current by creating a voltage difference. In water, a resistor creates a pressure drop based on the amount of water moving through it.

Resistors are measured in ohms. Ohm's law says that a one ohm resistor will create a one volt difference for each amp it lets through: R = V/I

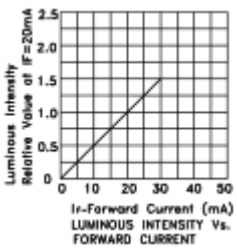
Try to complete the table below.



Voltage	Current	Resistance
10 volts		500 ohms
4 volts	0.1amps	
	0.15 amps	15 ohms

LEDs

An diode acts like a one-way valve for current. In one direction, a diode subtracts a small voltage and lets the rest through. In the other direction, a diode entirely blocks current. A light emitting diode, or LED, is a special kind of diode. As the name suggests, it creates light when current passes through it. An LED's brightness is proportional to current.



The LED you have has three separate lights in it. Each turns on at a different voltage. Red needs 1.7 volts, green needs 2.6 volts, and blue needs 2.5 volts. Differently-sized resistors can control brightness by limiting current through the LED.