Pumpkin Project

Day #1: Set up and Wiring!

Motivation

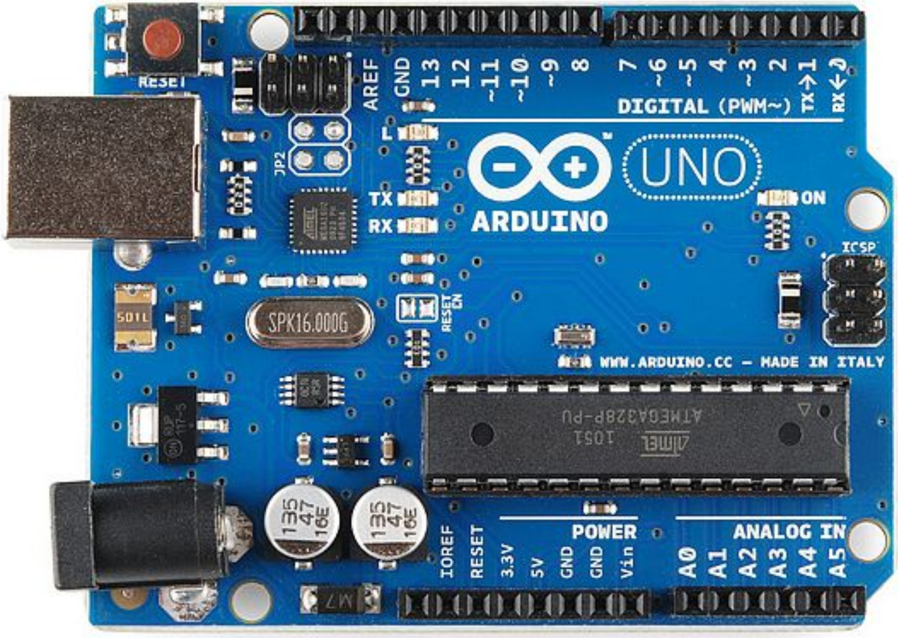
In this project we are going to learn how we can combine the same basic programming skills we learned in Snap! along with hardware components to make spooky Halloween decorations.

At the end of the project, we will do a trick-or-treat gallery walk to share our creations.

Arduino

We will be using the **Arduino Uno** microprocessor for these projects

We will be using the Arduino language instead of Snap! but we will be using the same basic constructs: variables, loops, branches, and functions. As we build this project think about how Arduino and Snap! are similar and how they are different.



Build Day #1

Introduction to Arduino

Step 1: Installing the Arduino Software

We will need to set-up our computers with the Arduino IDE

You won’t need the IDE until day #2 of this project, so you can do this as homework. You have two options:

- Downloading and installing the IDE on your computer
- Using a web-based IDE that will store your work in the cloud

What do you think are some of the benefits/drawbacks of each of these options?

Step 1: ASSIGNMENT

The link below is provided on your lab assignment sheet

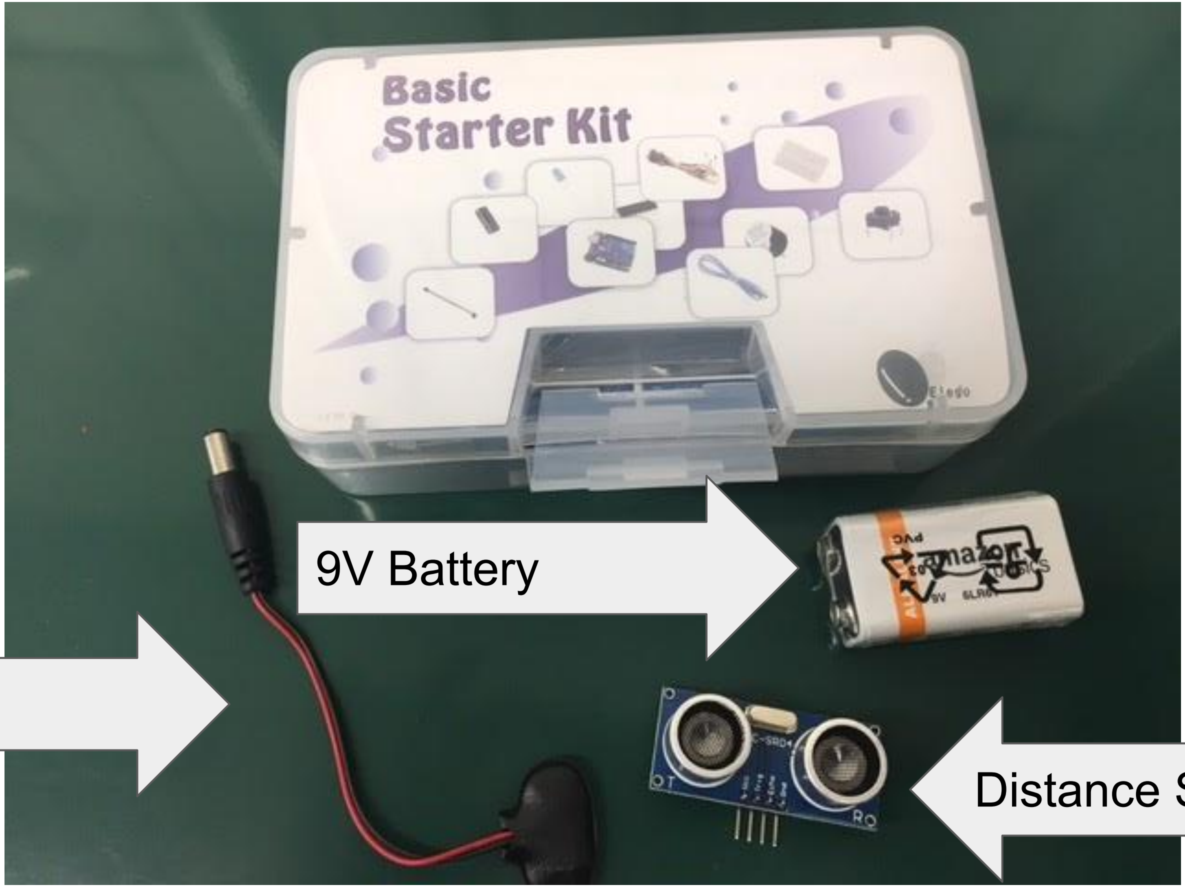
https://www.arduino.cc/en/Guide/HomePage

This page steps you through the two options for setting up the Arduino IDE on your computer

Please come to class next time with your IDE ready to go. Stop by during office hours or after class if you have trouble with the set-up

STEP 2: The Kit of Parts

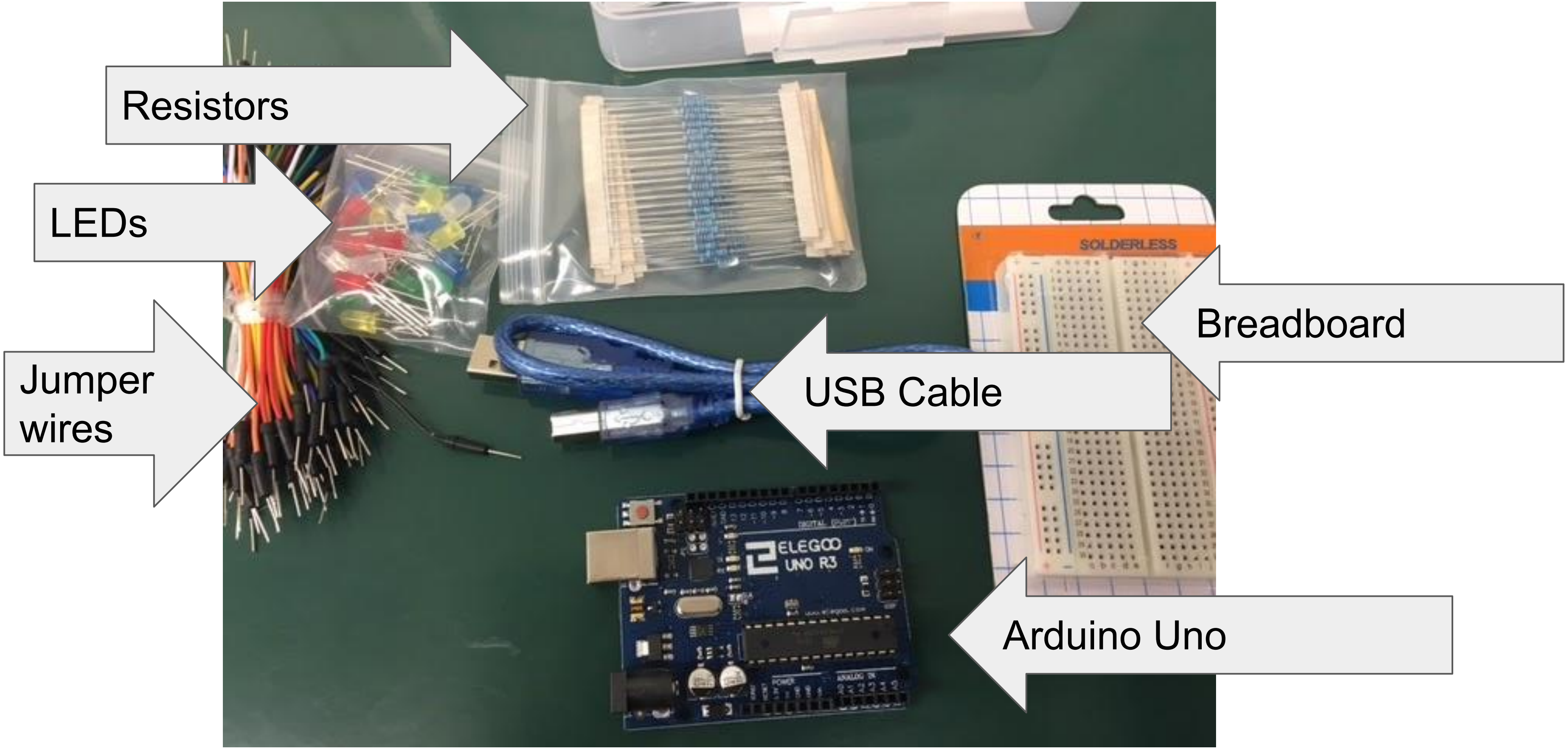
The next step is to check out a kit of parts and to pick up a pumpkin. We will go over each part and its role in the project. When you get your kit please do a quick inventory to ensure you have all the necessary components.



9V Battery

Battery clip

Distance Sensor



Resistors

LEDs

Jumper wires

Breadboard

USB Cable

Arduino Uno

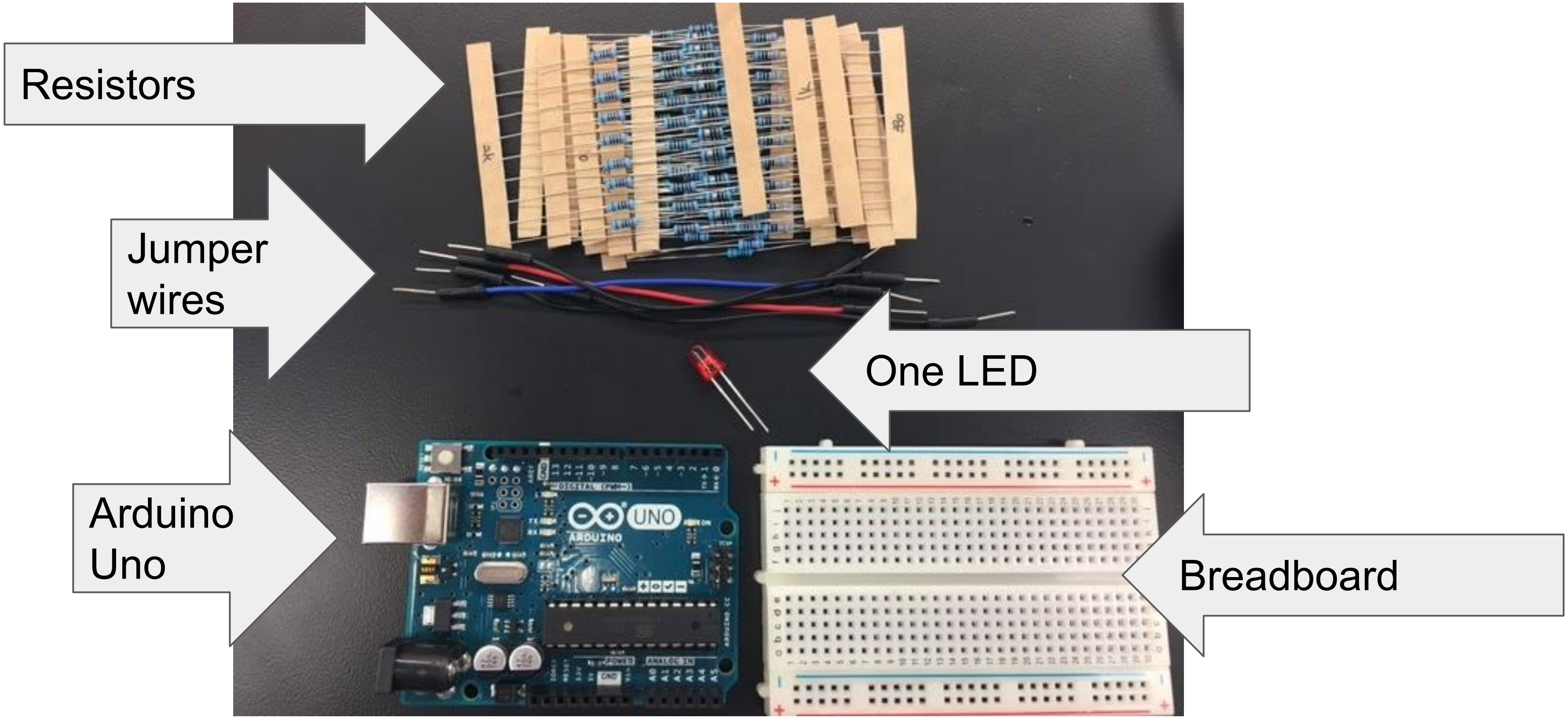
STEP 3: Wiring an LED

Now that we've gathered all of our supplies, we will look at how to build a simple circuit that lights up an LED. The objectives of this exercise are:

- Learn to build a circuit using a breadboard
- Understand how an LED works
- Familiarize yourself with the hardware you will be using in lab

We will work through this exercise together.

Parts you will need



Resistors

Jumper wires

One LED

Arduino Uno

Breadboard

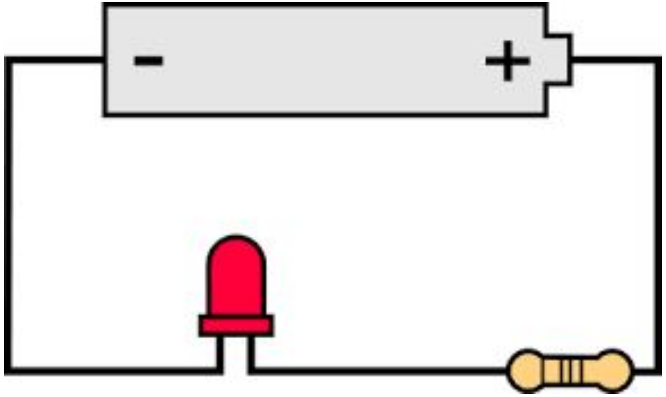
A simple circuit

In this part of the lab we will be creating a simple circuit

A circuit is a closed loop through which electrons can flow

The simplest circuit contains (a) a power source (b) a conductive path through which current can flow and (c) a load

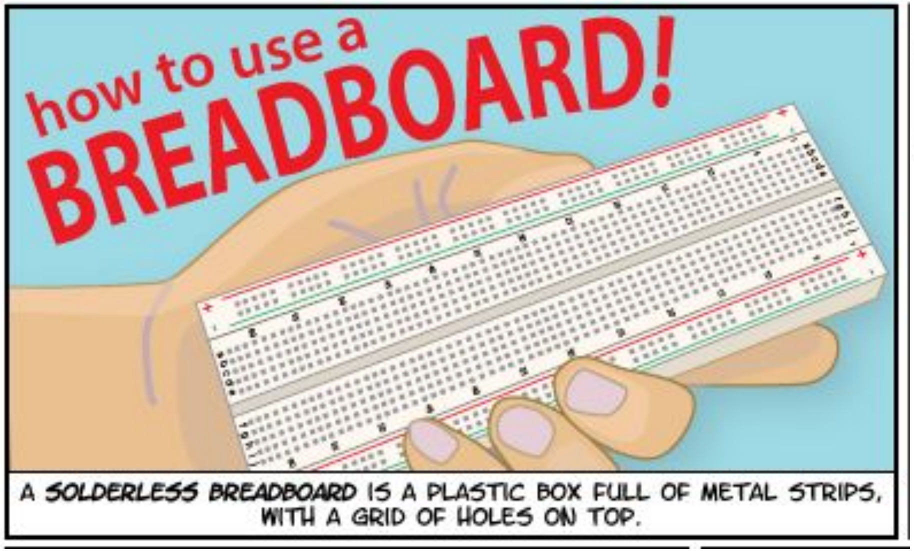
The load is the part of the circuit that does work. What part of our circuit is the load?



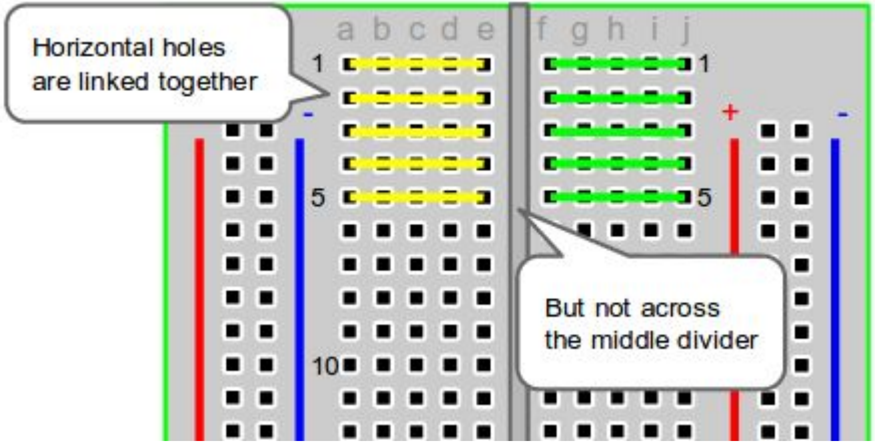
What is a breadboard

A breadboard allows us to build prototype circuits without soldering

It will help us connect the different parts of our circuit



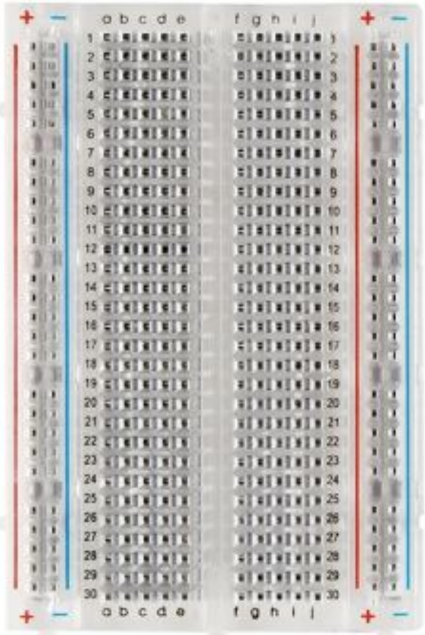
A *SOLDERLESS BREADBOARD* IS A PLASTIC BOX FULL OF METAL STRIPS, WITH A GRID OF HOLES ON TOP.

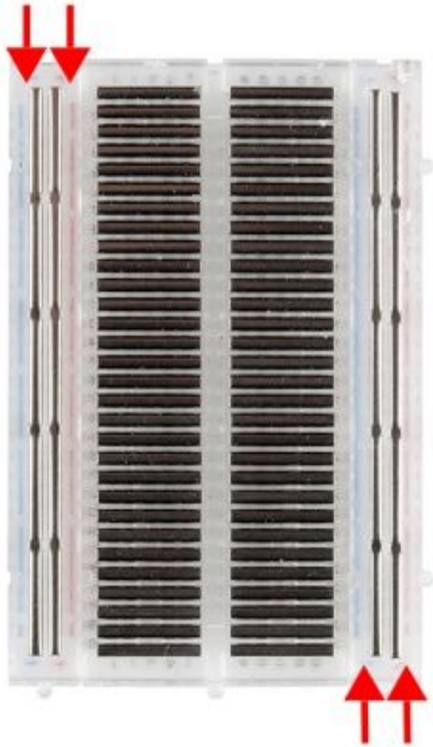


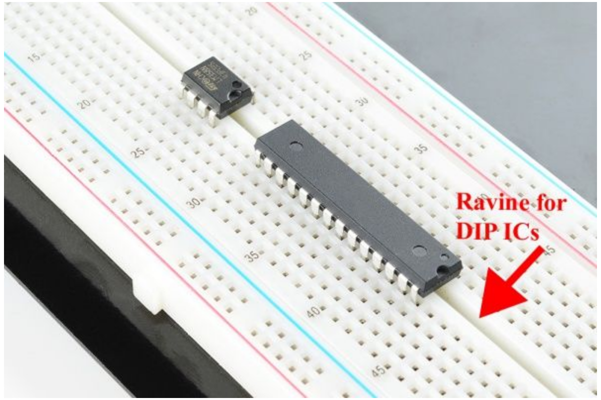
Horizontal holes are linked together

But not across the middle divider

How a breadboard works







Row numbers and column letters are just for reference

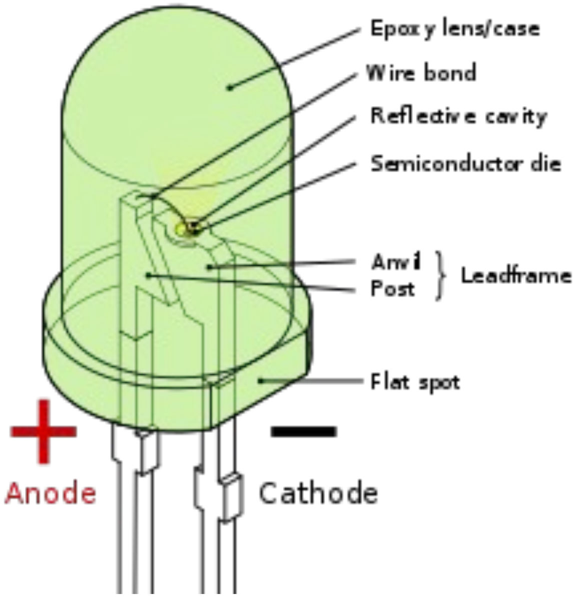
The LED: our load

LED stands for Light Emitting Diode

In a circuit, a **diode** is directional meaning that it only works if current flows the correct direction

If you accidentally put an LED in a circuit backwards, it won’t explode, it just won’t light up

Debugging tip: if your LED isn’t lighting up, double check that it is oriented correctly! We will see how to orient the LED in the next slide

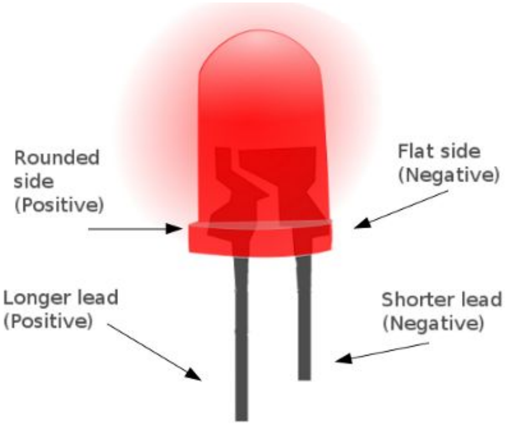


LED

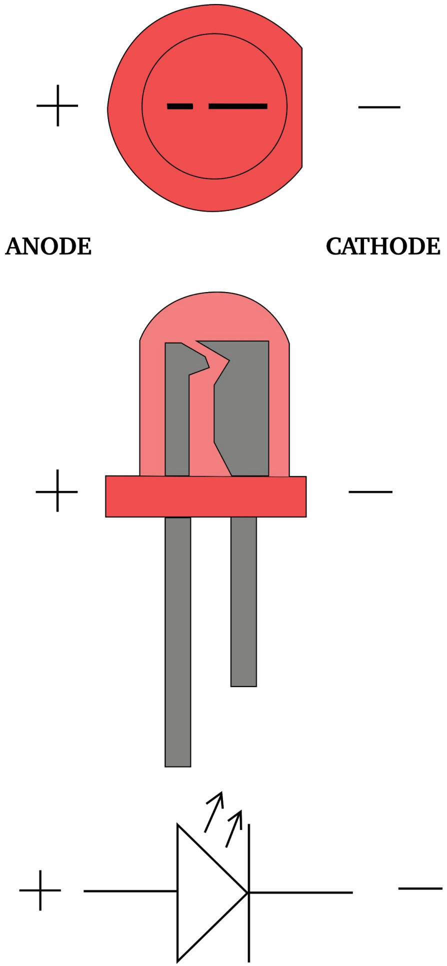
Note that one of the leads on the LED is slightly longer than the other

Also, one side of the LED is flat

The longer, rounded side is the **anode** or positive side



The shorter flat side is the **cathode** or negative side



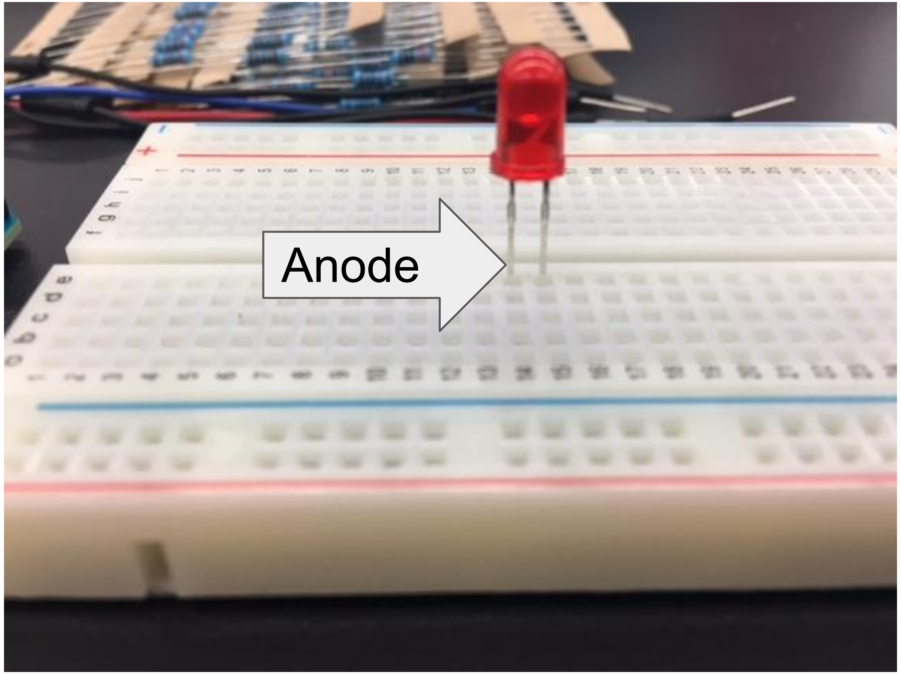
Place the LED on the breadboard

Put the LED on the breadboard so that the leads are in different rows

> Why do we put the leads in different rows?

Make sure you pay attention to which is the anode (the longer lead)

Next we will add the resistor - *if you don’t use a resistor you can destroy your LED*



Resistors

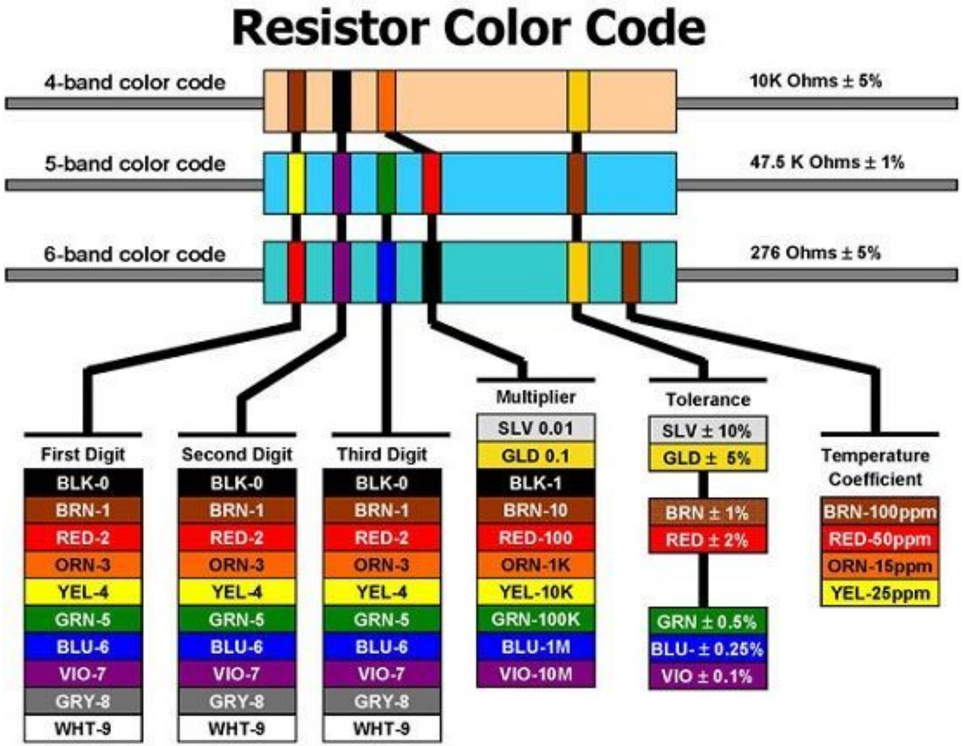
Resists the flow of electricity. The higher the resistance, the lower the current

We will use a resistor to control how much electricity flows through the LED and therefore how brightly it shines

The unit of resistance is the **ohm**

Resistors

The color coding on the resistor can be used to tell you its strength



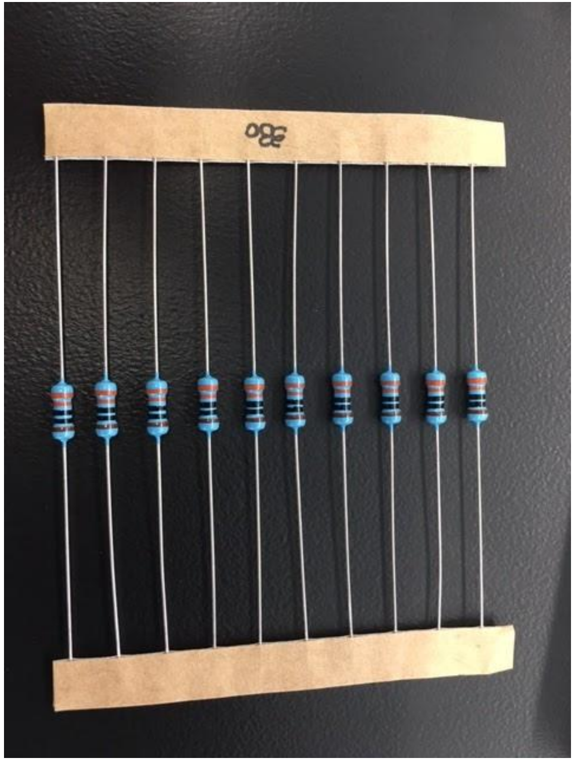
First Digit	Second Digit	Third Digit	Multiplier	Tolerance	Temperature Coefficient
			SLV 0.01	SLV ± 10%	
			GLD 0.1	GLD ± 5%	
BLK-0	BLK-0	BLK-0	BLK-1		
BRN-1	BRN-1	BRN-1	BRN-10	BRN ± 1%	BRN-100ppm
RED-2	RED-2	RED-2	RED-100	RED ± 2%	RED-50ppm
ORN-3	ORN-3	ORN-3	ORN-1K		ORN-15ppm
YEL-4	YEL-4	YEL-4	YEL-10K		YEL-25ppm
GRN-5	GRN-5	GRN-5	GRN-100K	GRN ± 0.5%	
BLU-6	BLU-6	BLU-6	BLU-1M	BLU- ± 0.25%	
VIO-7	VIO-7	VIO-7	VIO-10M	VIO ± 0.1%	
GRY-8	GRY-8	GRY-8			
WHT-9	WHT-9	WHT-9			

Choose your resistor

The bigger the resistance, the lower the voltage that will flow through the LED and the dimmer the light will be

Try the 330Ω resistor

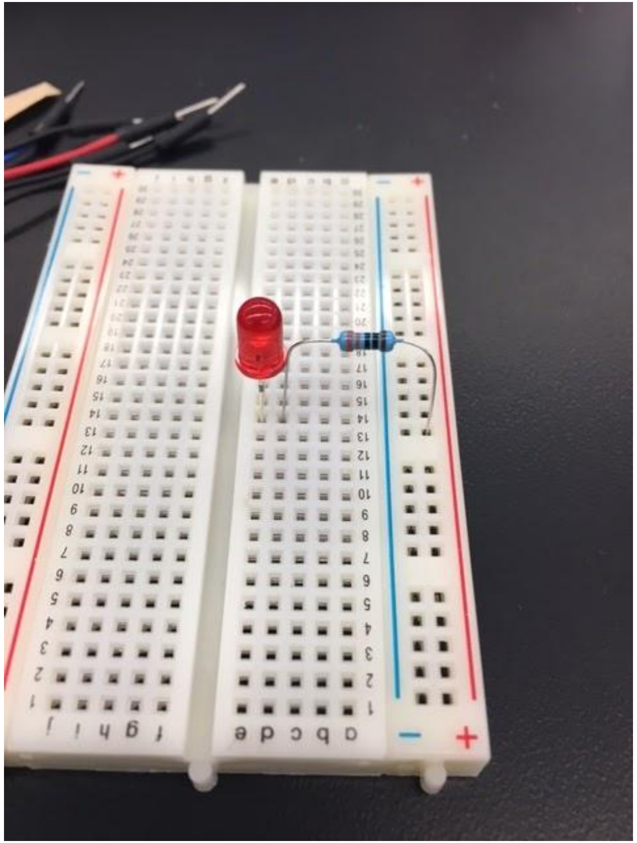
It does not matter which direction you place the resistor



Add a resistor

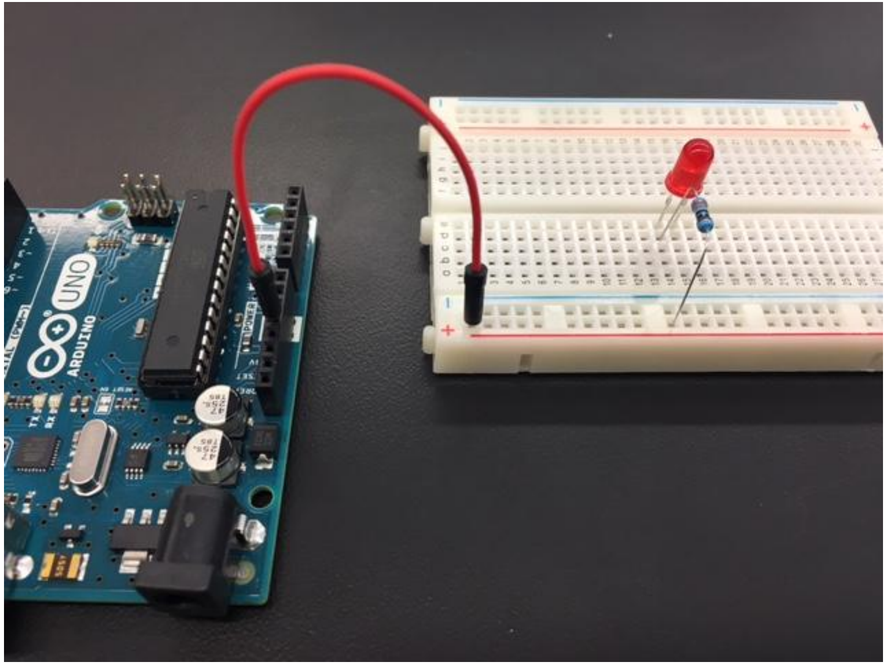
Add a resistor with one end in the same row as the anode on the LED (the longer lead). The other end of the resistor should go in the + rail on the edge of the breadboard (you will connect power from the Arduino to this column)

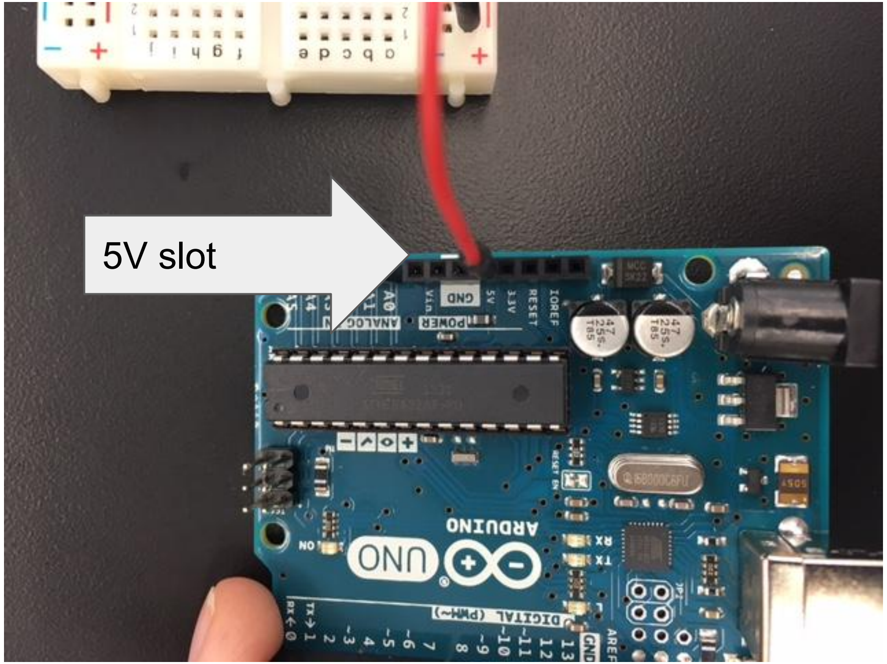
We are positioning the resistor so it is between the power source and our LED



Connect to Power

Use a jumper cable to connect from the + column of the breadboard to the 5V slot on your Arduino

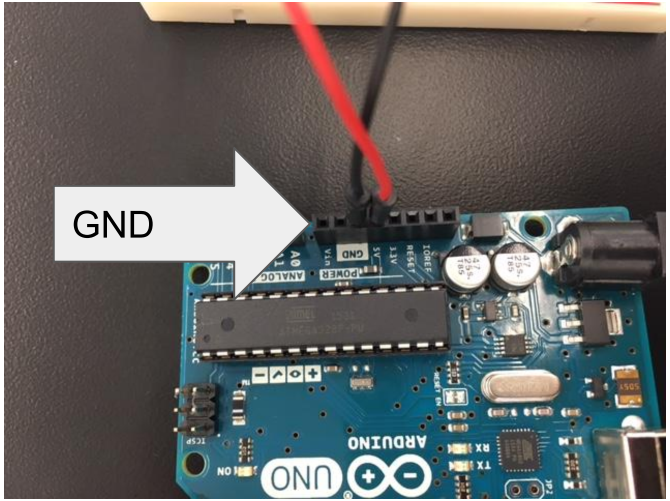




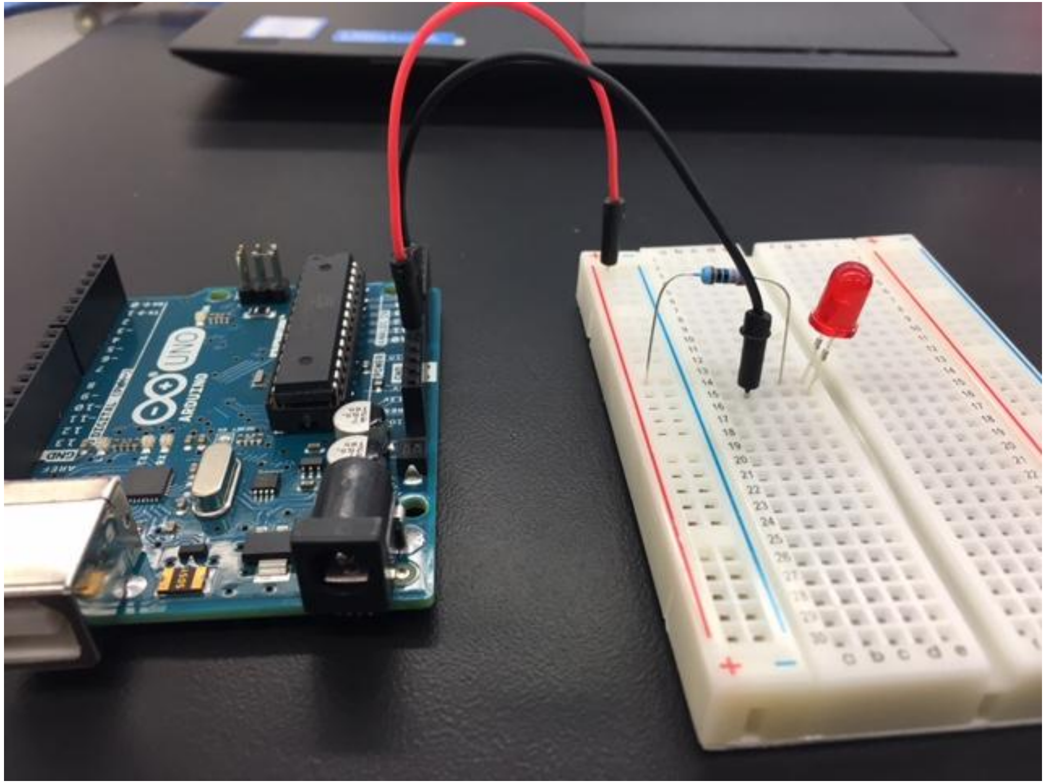
5V slot

Connect to Ground

Now use another jumper to connect from the **cathode** end of the LED to the GND slot on your Arduino



GND

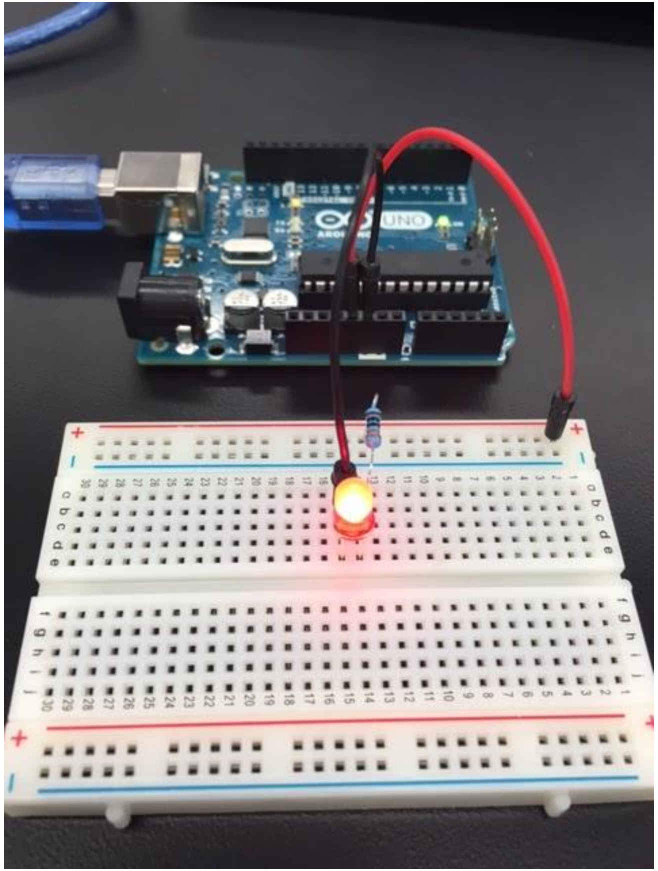


Light the LED!

Now connect your Arduino to your computer using the USB cable

The LED should light up!

Note: we haven’t actually written a program yet, we’re just using the computer as a power source



STEP 4: Add an LED

Can you add a second LED to your circuit and light both LEDs at the same time?