

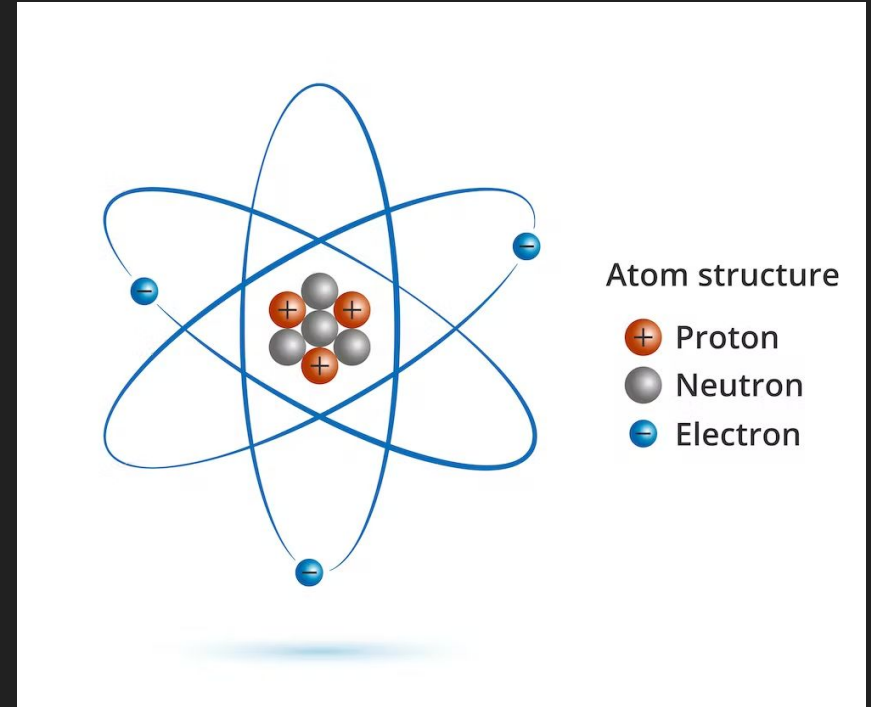
STEM Workshop: Arduino

Lesson 4: Introduction to Arduino Programming

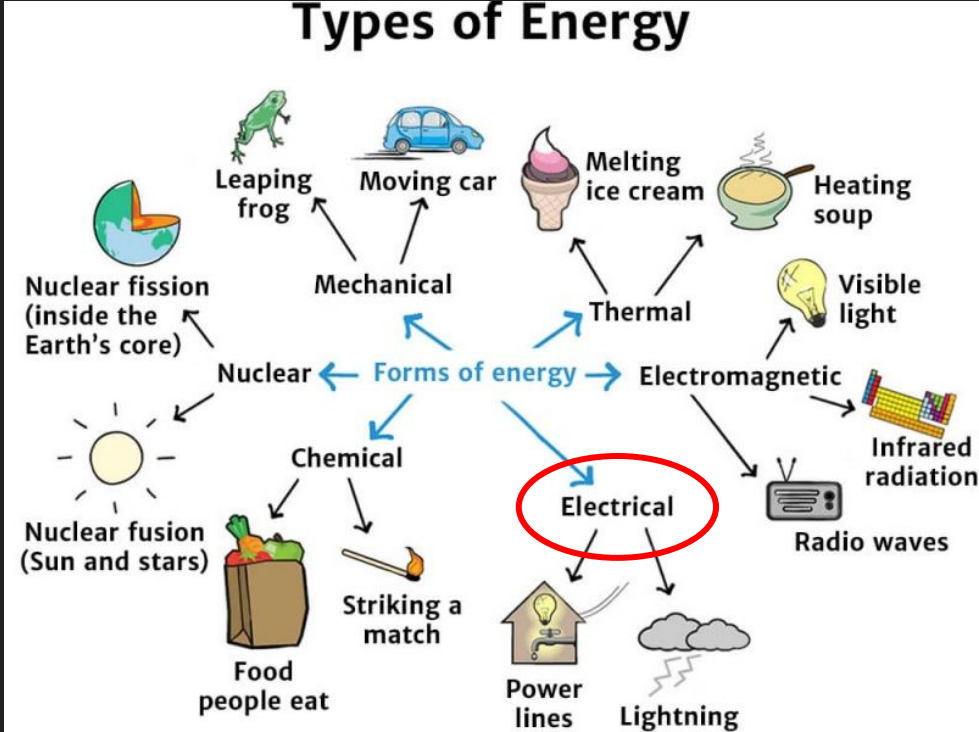
Brought to you by the University of Maryland Balloon
Payload Program!

Electricity isn't magic!

- The universe is made of tiny particles called atoms
- Atoms have even smaller, negatively charged particles flying around them, called **electrons**

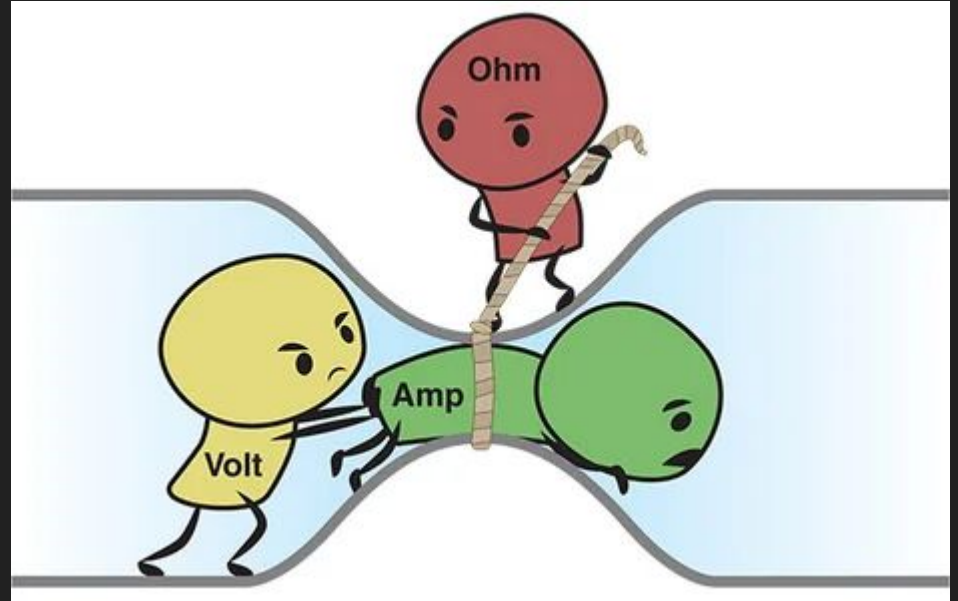


Electrons can do things for us

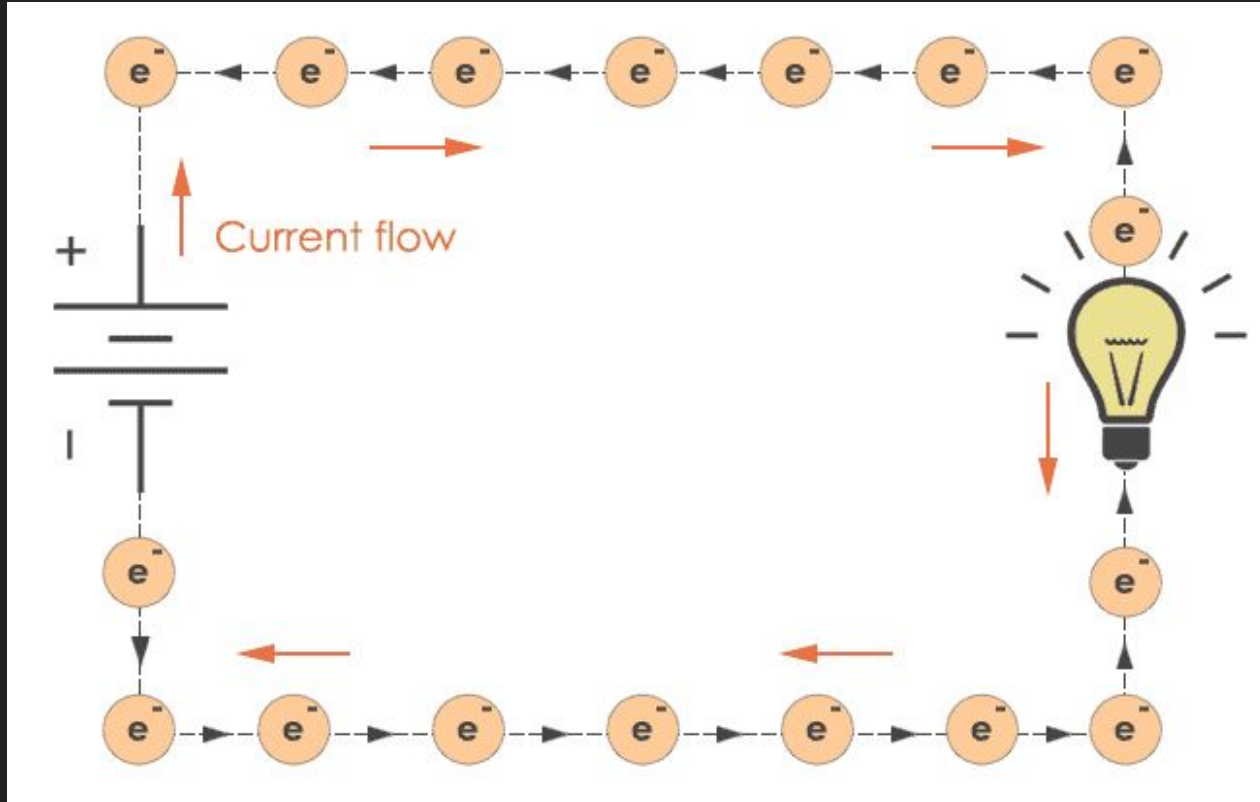


Can we describe electron behavior?

- **Voltage** - the amount of force electrons are being pushed with
- **Current** - the amount of energy going through the circuit
- **Resistance** - how hard it is to push electricity along



How do electrons work in circuits?

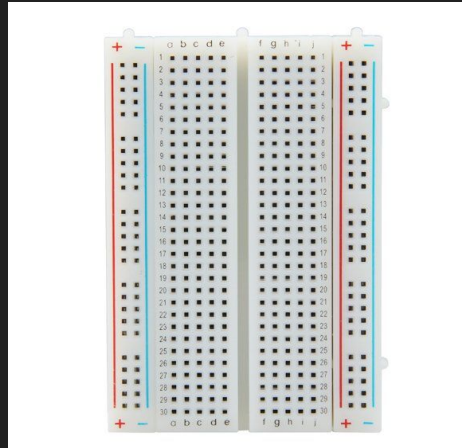


How to make circuits

Power Supply



Breadboard

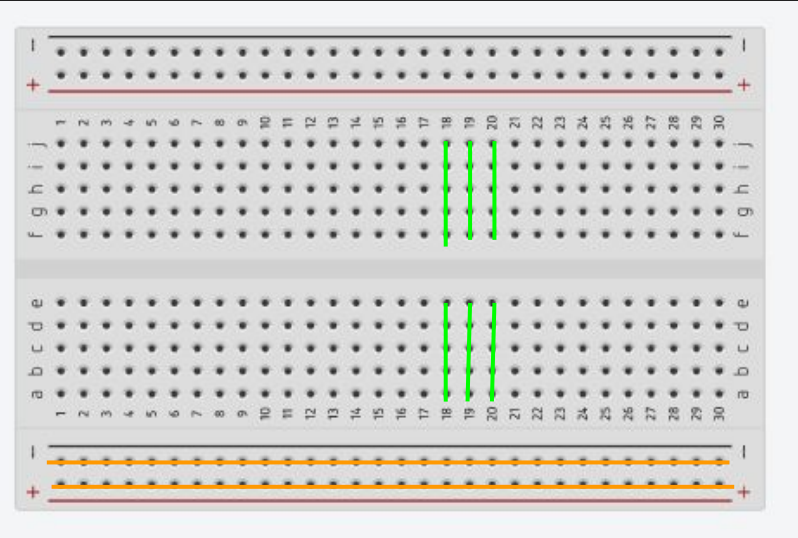


Connections



And any other components you would like to add!

How to use a breadboard



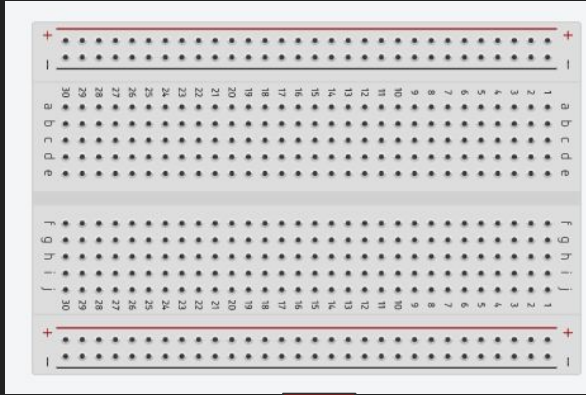
- Split in two halves (no electrical connection across the two halves)

Numbered Rows- electrical connection across each row

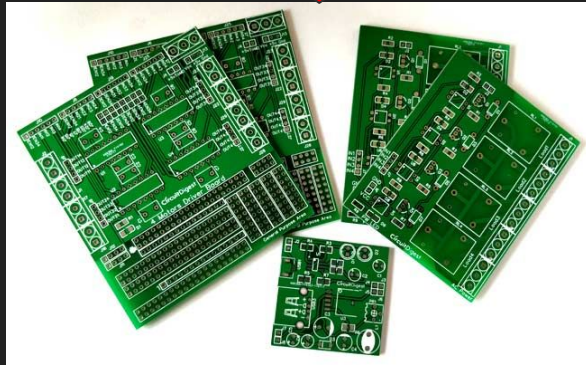
+/- Columns- used for power supply
+ = plus side of battery
- = minus side of battery (ground)

Why use a breadboard?

Breadboard



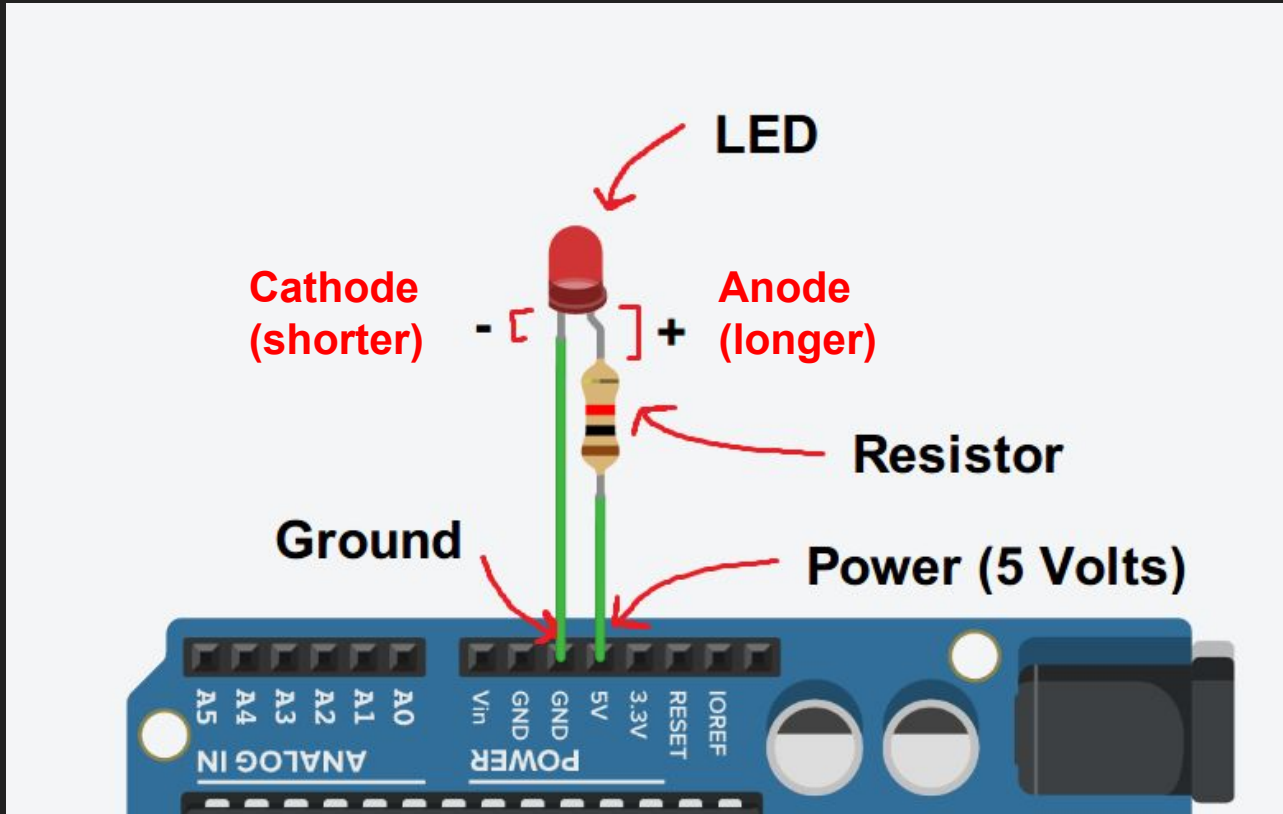
PCB



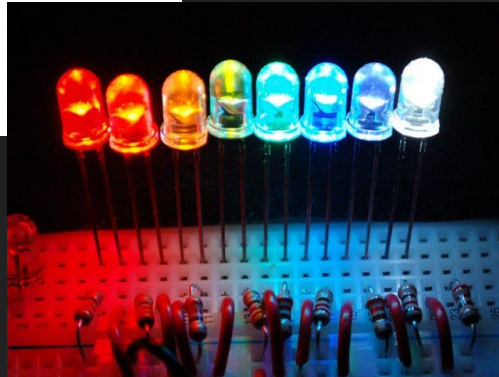
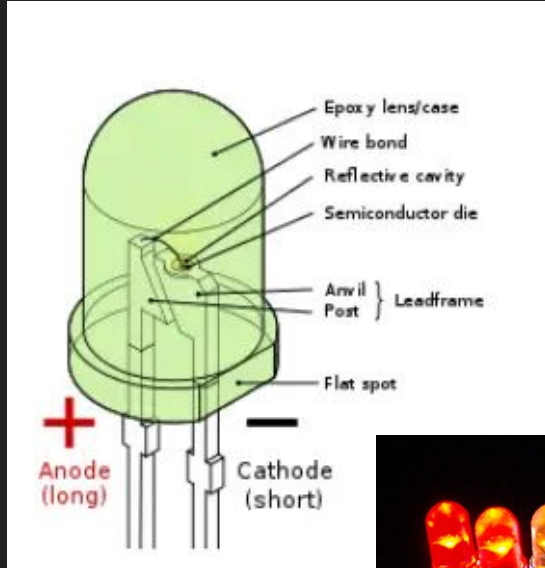
Used to prototype (“rough draft”) circuits

- Easy to unplug and plug things in (instead of soldering)
- Cheaper and easier than making a printed circuit board (PCB)

Simple LED circuit explained



What is an LED?



LED stands for Light-Emitting Diode

A **diodes** can only let current through one way, which is why an LED has a side that must be connected to + (long) or - (short)

SAFETY: Should be connected to a 220 Ohm resistor or it will get really hot, burn out, and stop working :(

Coding and designing circuits

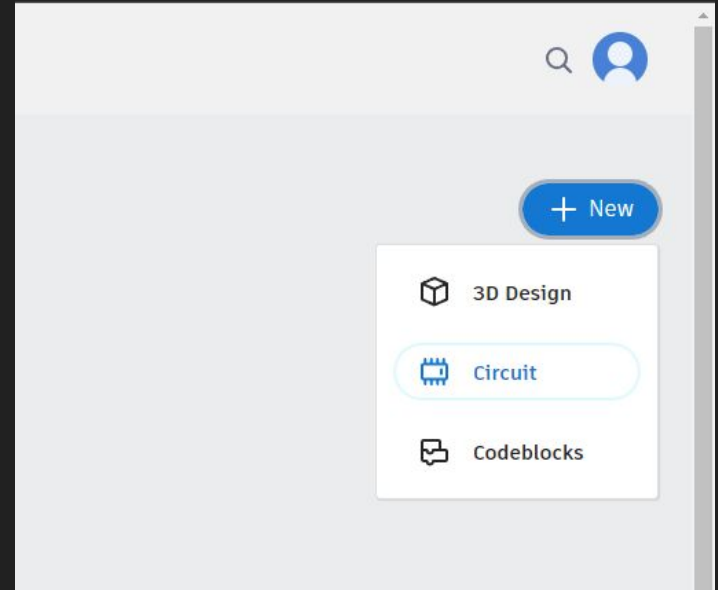
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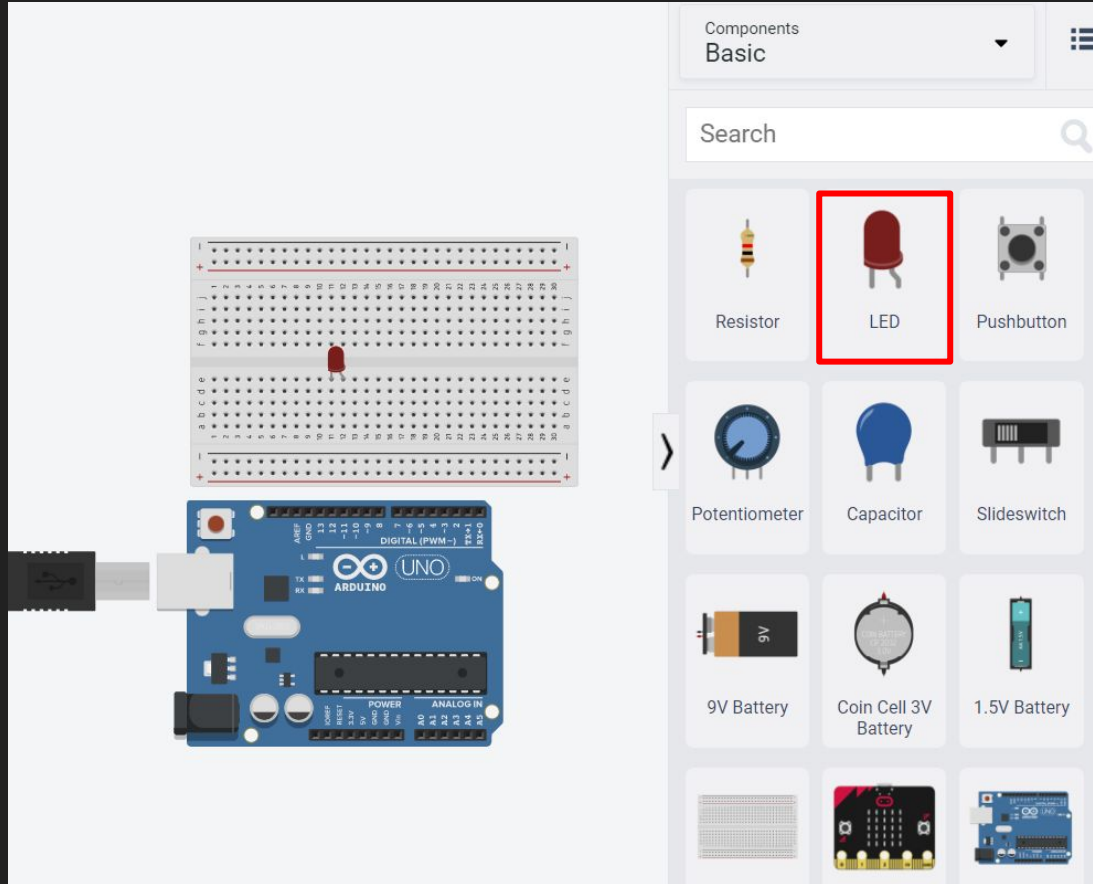
Username:

umdstemworkshop@gmail.com

Password:

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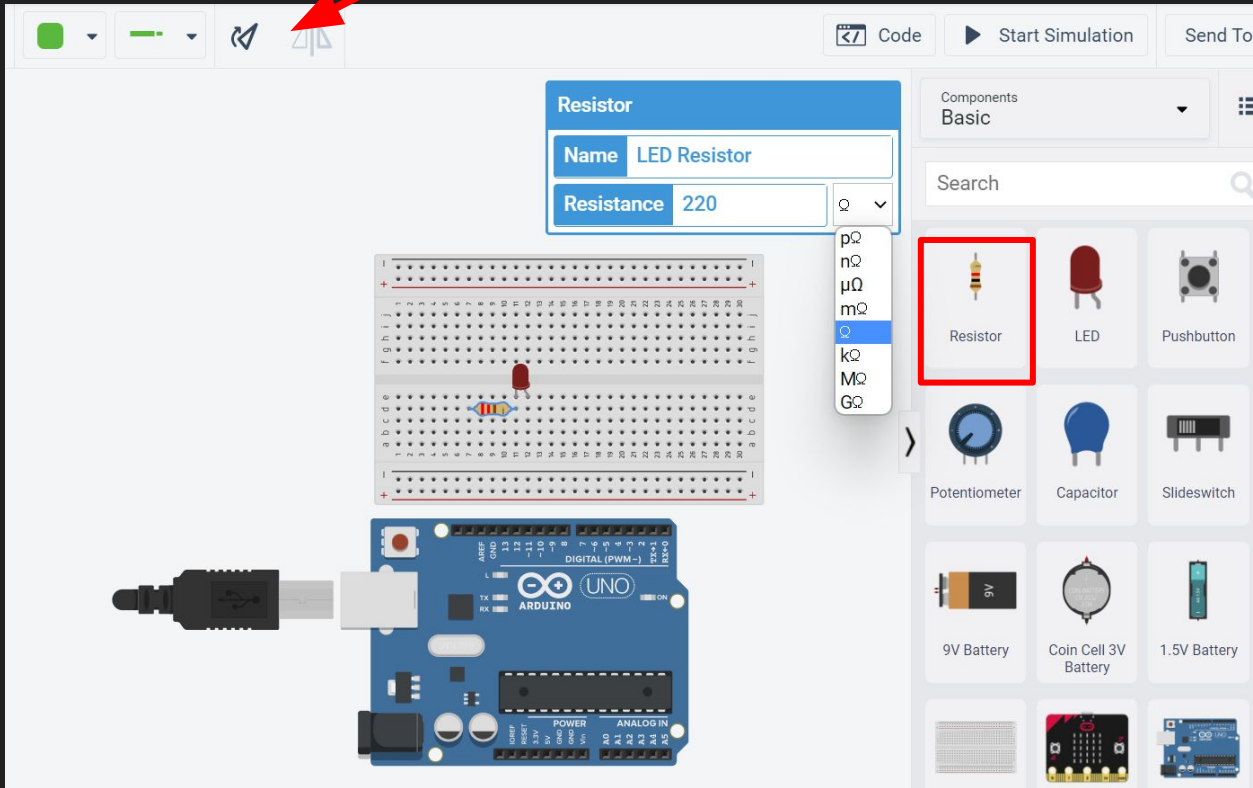




Drag a LED to the breadboard

Make sure that the LED connectors are in different rows

Rotation Button

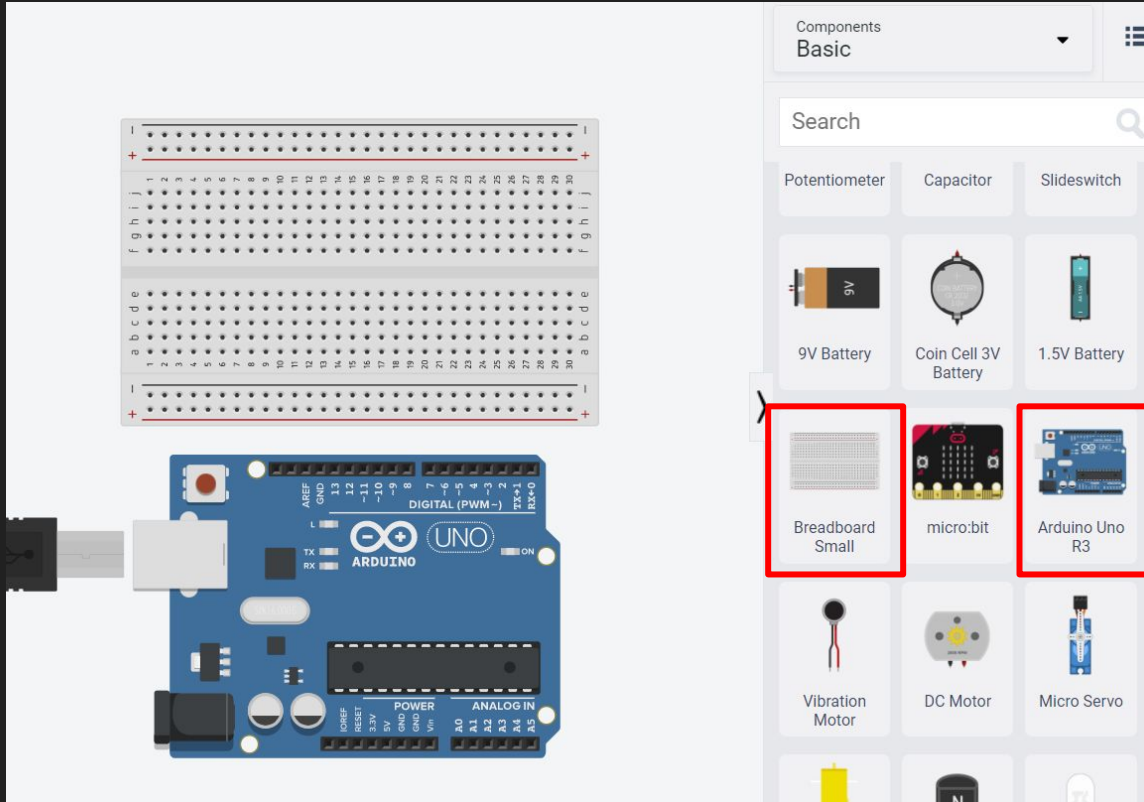


Change the resistor to 220 Ω (NOT k Ω)

Rotation: use the rotation button or select the component and press the R key

Notice how the resistor also connects to a column other than where the LED is

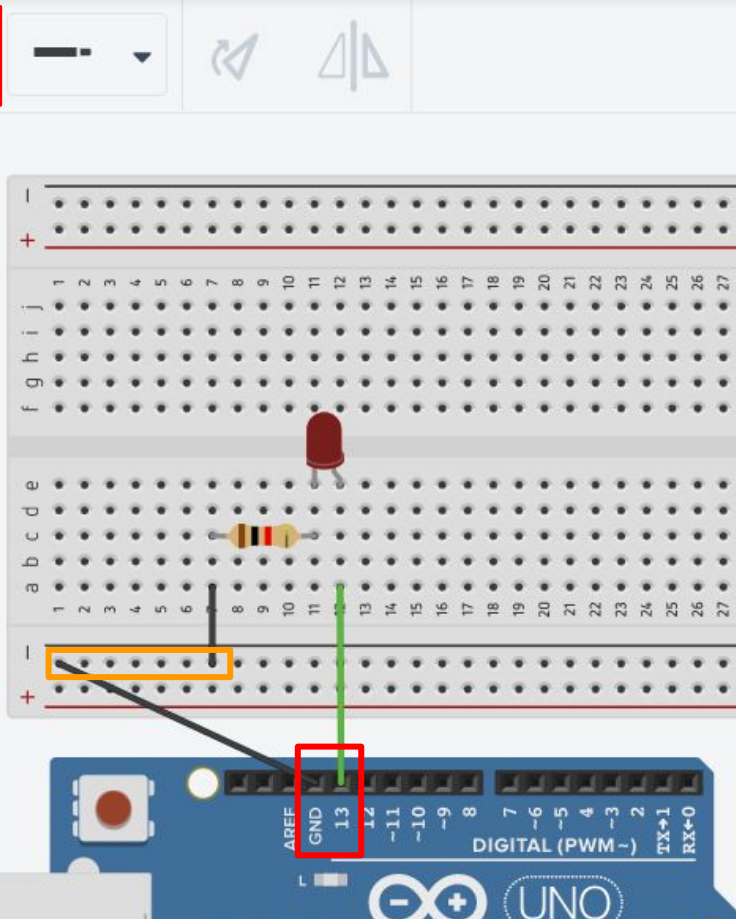
Let's get started! (Blinking LED)



Drag out an
Arduino Uno and a
breadboard to your
workspace



You can change colors

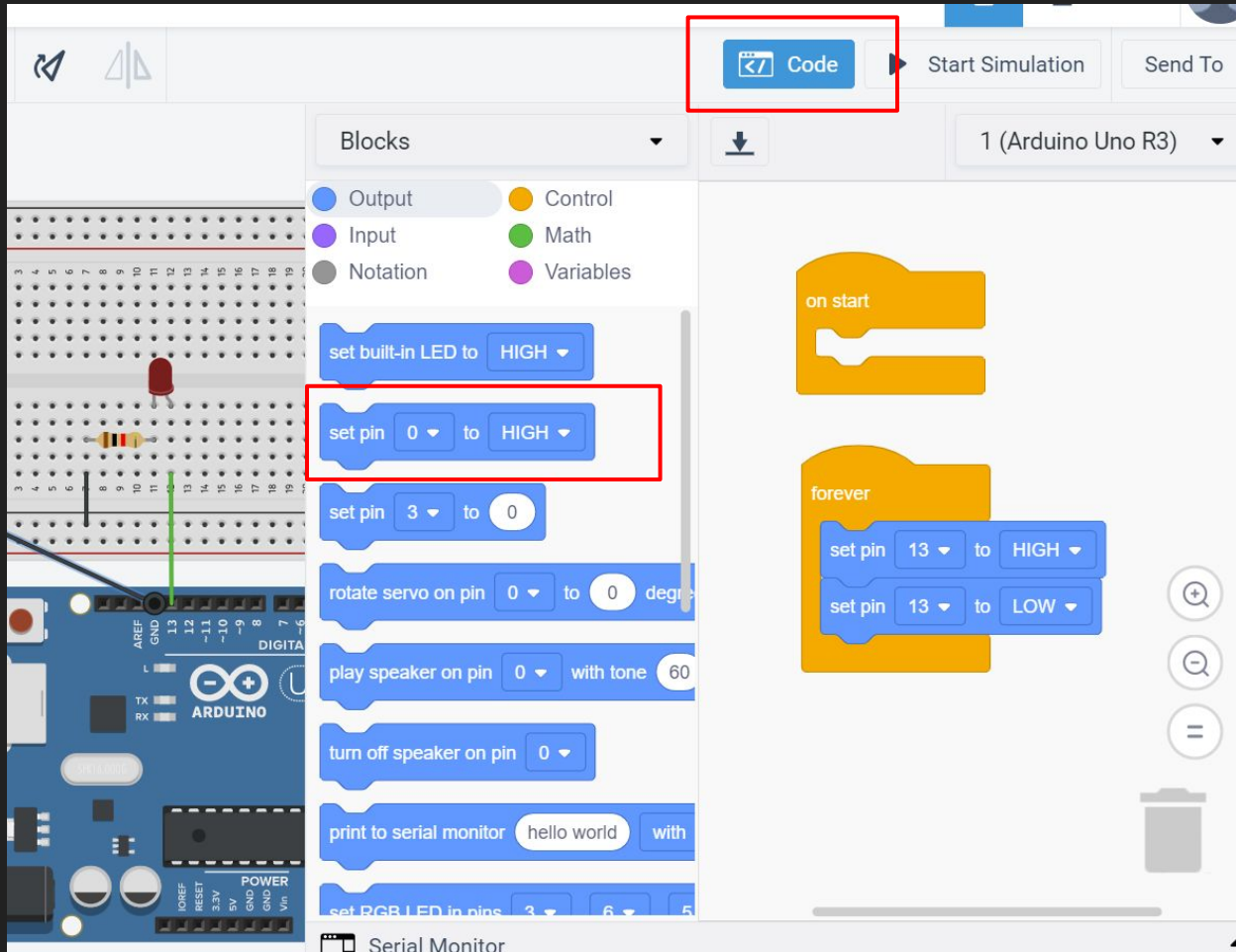


Click the hole to make a wire

Connect:

1. Curved LED connector to PIN 13 on the Arduino
2. Left end of the resistor to the ground (-) column
3. Ground column to GND on the Arduino

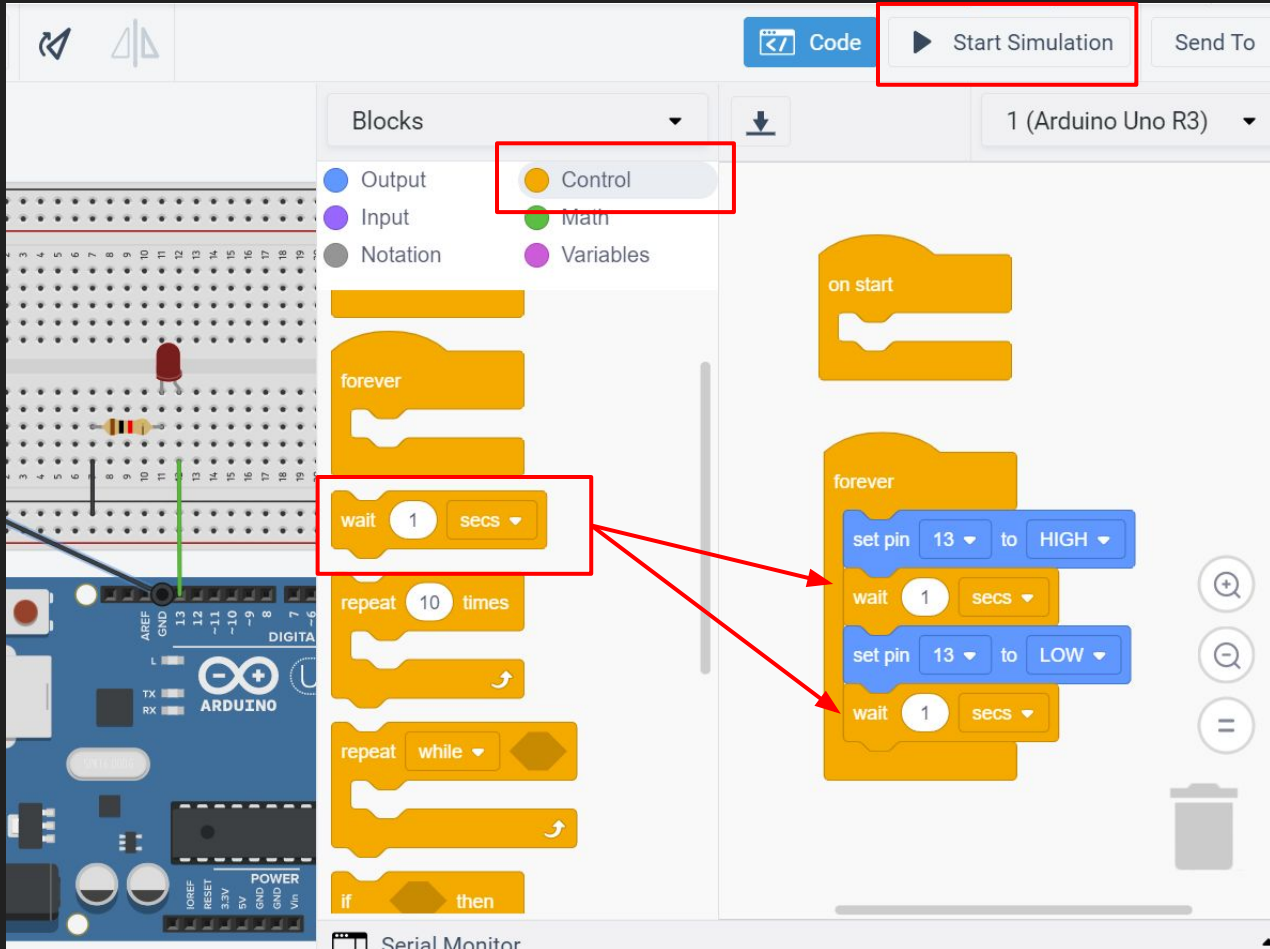
To change the color click the change color button



Click the code button

We want the LED to turn on and off so drag the second block and change:

1. Pin from 0 to 13
2. First command block is set to HIGH (on)
3. Second command block to LOW (off)



Click the control button

We need the led to wait a little before it turns on and off:

Drag the “Wait” command and put them after both of the on and off commands

Click start simulation and your LED should blink!

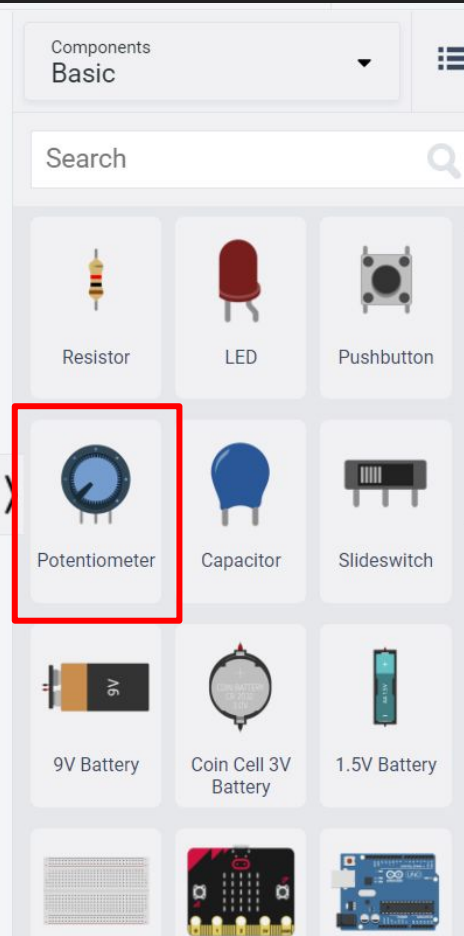
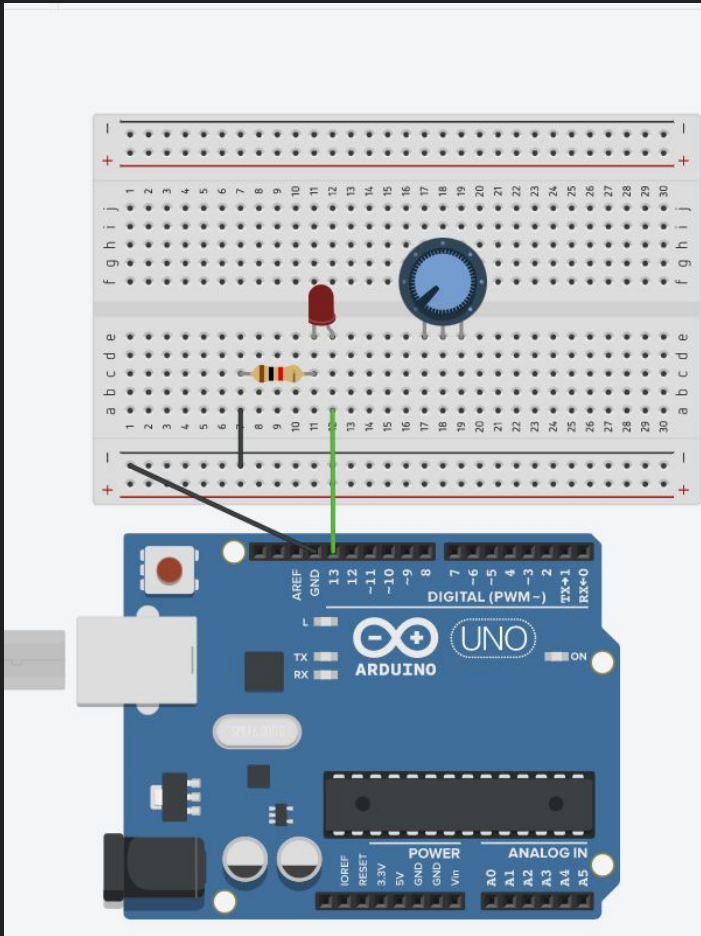
What is a potentiometer?



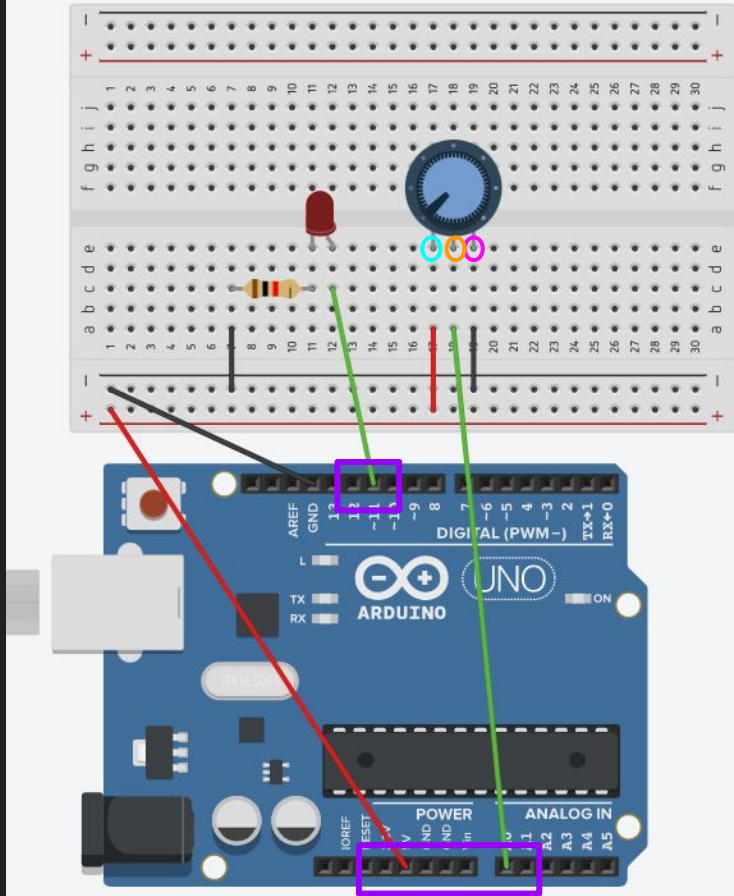
A potentiometer is a variable resistor (a resistor that changes values) based on how much it is twisted



Think of a volume dial or an adjustable light!

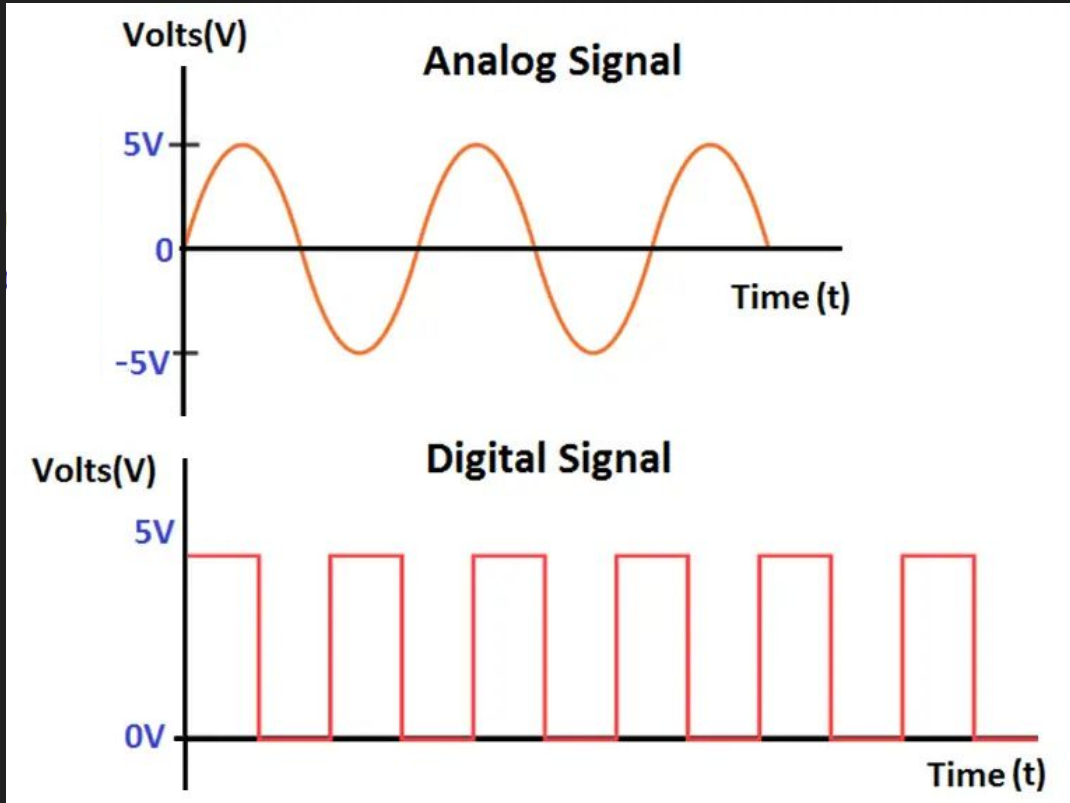


Drag out a potentiometer and put it on your breadboard



- Connect the potentiometer
1. **Left** pin to the power column
 2. Power column to 5V on Arduino
 3. **Middle** pin to A0 on arduino
 4. **Right** pin to ground column on Arduino
 5. Change the LED pin to 11

Two kinds of signals: digital and analog



Analog: can give many different values

- Think of decimals or fractions between 1 and 0

Digital: Only two values (HIGH = on LOW = off)

- Think of only 1 and 0

Blocks ▼ ↓ 1 (Arduino Uno R3)

Output Control
Input Math
Notation Variables

set built-in LED to HIGH ▼

set pin 0 ▼ to HIGH ▼

set pin 3 ▼ to 0

rotate servo on pin 0 ▼ to 0 degrees

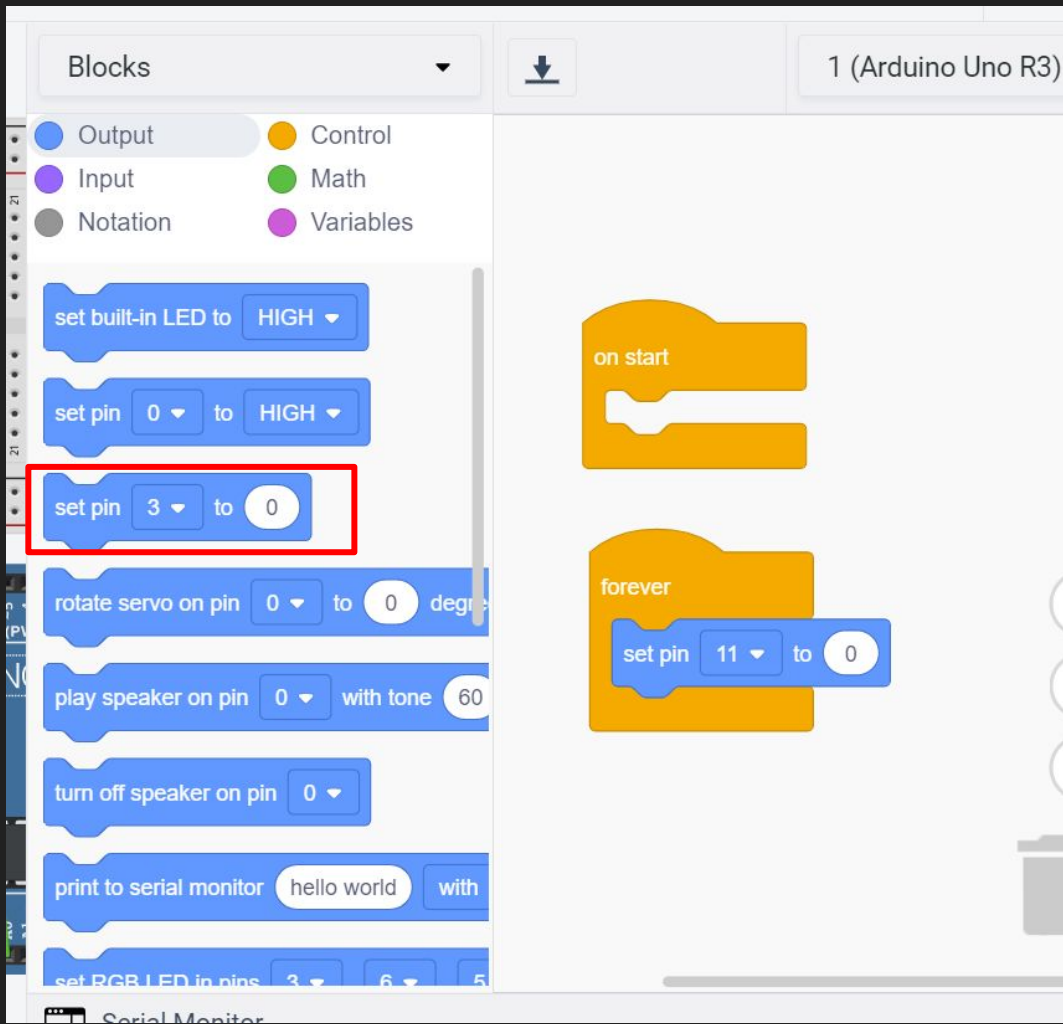
play speaker on pin 0 ▼ with tone 60

turn off speaker on pin 0 ▼

print to serial monitor hello world with

set RGB LED in pins 3 ▼ 6 ▼ 5 ▼

Serial Monitor



We want the potentiometer to control the LED so open up the code:

Delete everything

Set pin command (3rd one on the list) and change it to pin 11

Blocks



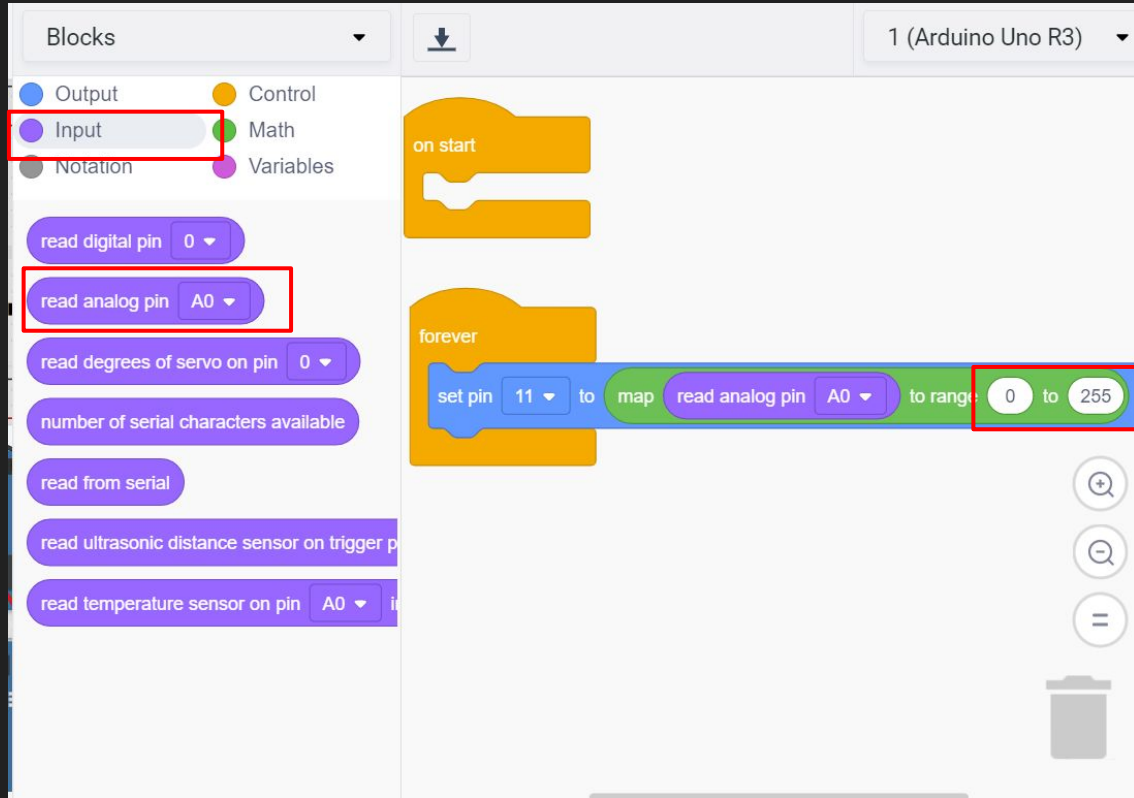
1 (Arduino Un

- Output
- Input
- Notation
- Control
- Math
- Variables



Go to math

Drag the map
command inside the
set pin command



Go to input and drag the read analog pin command inside the map command

Change the value of the range to “0 to 255”

Run the simulation and twist the potentiometer around and see what happens!

Raise your hand once you've finished!
We'll come around and upload your code