

# Arduino & Electricity

# Arduino

A screenshot of the Arduino IDE interface. The window title is "Blink | Arduino 1.0". The menu bar includes "File", "Edit", "Sketch", "Tools", and "Help". Below the menu bar is a toolbar with icons for saving, opening, and other functions. The main text area contains the following code:

```
/*  
 * Blink  
 * Turns on an LED on for one second, then off for one second, repeats  
 *  
 * This example code is in the public domain.  
 */  
  
void setup() {  
  // initialize the digital pin as an output.  
  // Pin 13 has an LED connected on most Arduino boards:  
  pinMode(13, OUTPUT);  
}  
  
void loop() {  
  digitalWrite(13, HIGH);   // set the LED on  
  delay(1000);             // wait for a second  
  digitalWrite(13, LOW);   // set the LED off  
  delay(1000);             // wait for a second  
}
```

The status bar at the bottom shows "Done uploading." and "Binary sketch size: 1556 bytes (of a 250040 byte maximum)". The bottom right corner indicates the board is "Arduino Mega 2560 or Mega ADK on /dev/ttyACM0".

- Open-source computer hardware and software company, project and user community

- Designs and manufactures kits for building digital devices and interactive objects that can sense and control the physical world.

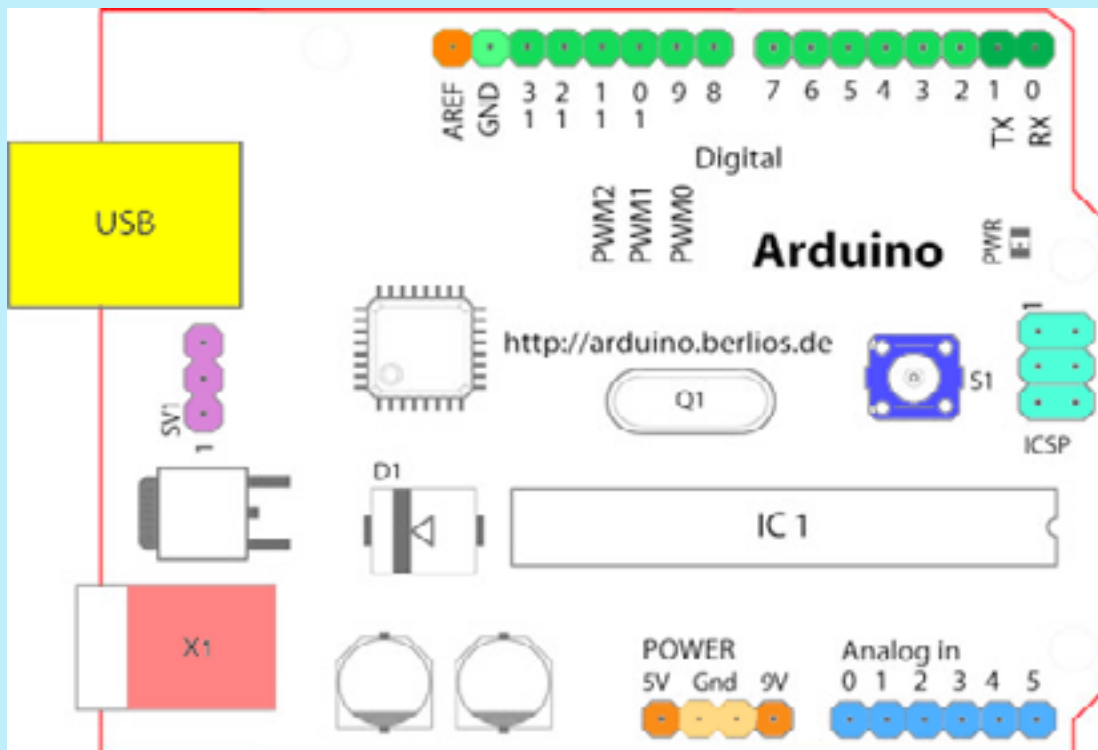
- Uses an IDE similar to Processing

- Plays nice with Processing, web languages

- simplified version of the C++ language

[www.arduino.cc](http://www.arduino.cc)

# Arduino con't



- Uses pins to connect to sensors, motors and various other electronic devices.

-Analog and digital pins: Digital can only be on/off, 0 or 1 while analog can be a range of values. Digital can be input and output.

- Interfaces with Processing through serial communication

- Various models are available, depending on needs

- Various shields and sensors are able to interface with the Arduino

# Electricity

**Electricity is the movement of electrons**

**Three basic principles:**

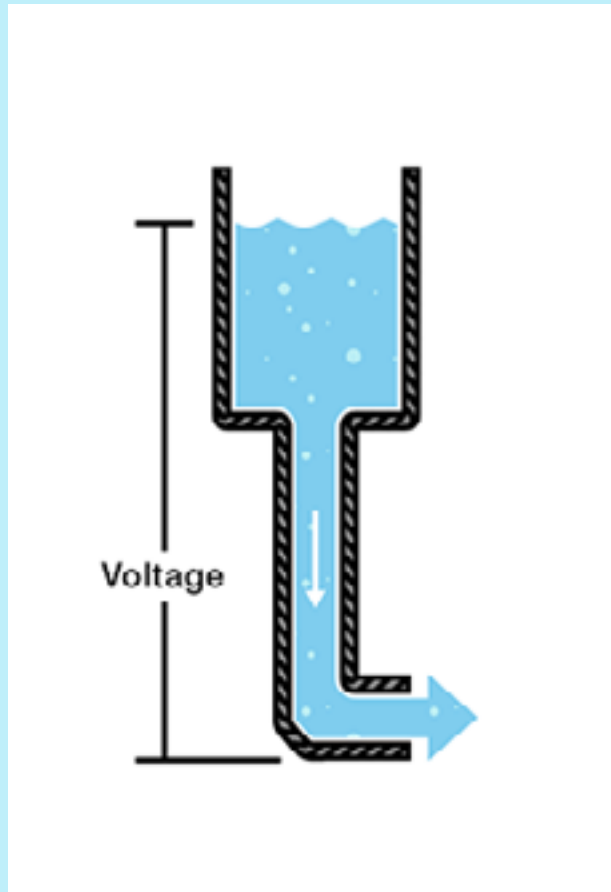
**1) Voltage is the difference in charge between two points.**

**2) Current is the rate at which charge is flowing.**

**3) Resistance is a material's tendency to resist the flow of charge (current).**

# Electricity con't

## Voltage



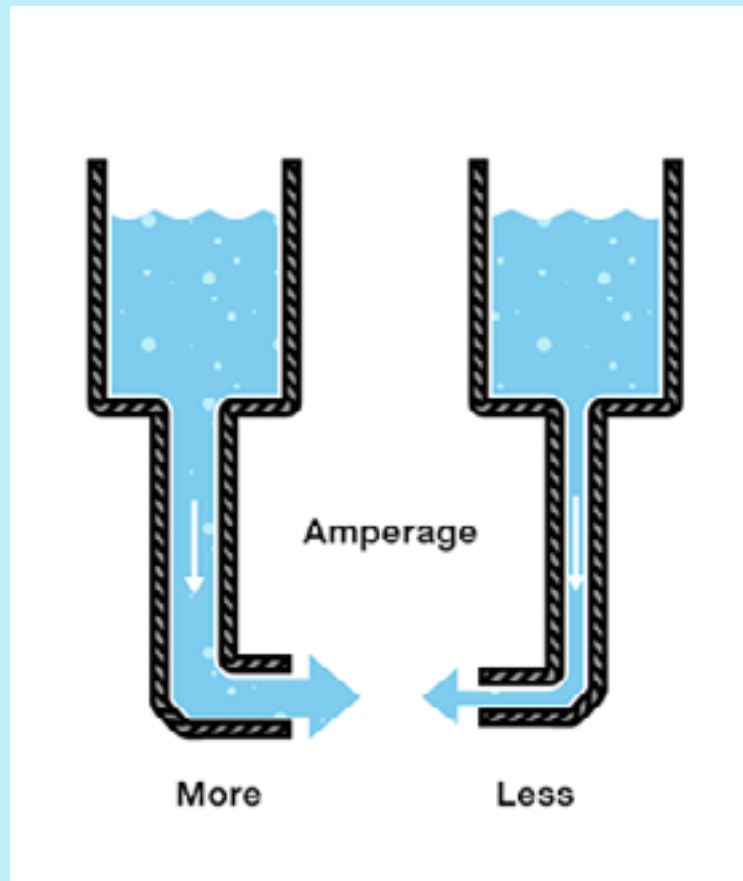
**Amount of potential energy between two points on a circuit.**

**Voltage is represented in equations and schematics by the letter "V"**

**Water = Charge  
Pressure = Voltage  
Flow = Current**

# Electricity con't

## Current



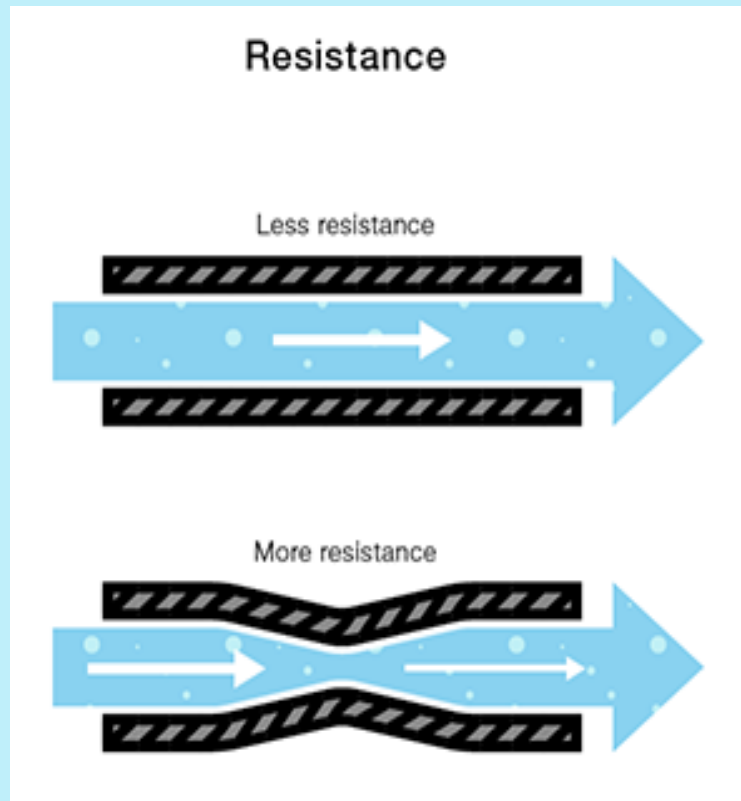
Amount of water running through the hose.

measured in Amperes (Amps)

Current is represented in equations and schematics by the letter "I"

# Electricity con't

## Resistance



Limiting current through a circuit

The circuit with the higher resistance will allow less charge to flow, meaning the circuit with higher resistance has less current flowing through it.

measured in Ohms

Resistance is represented in equations and schematics by the letter "R"

# Electricity con't

## Ohm's Law

$$V=I*R$$

**V = Voltage in volts**

**I = Current in amps**

**R = Resistance in ohms**



# Electricity con't

## Calculating Resistance

Red LED can handle 20 mA or .020 amps, although datasheet says 18 mA is safe.

9 volt battery

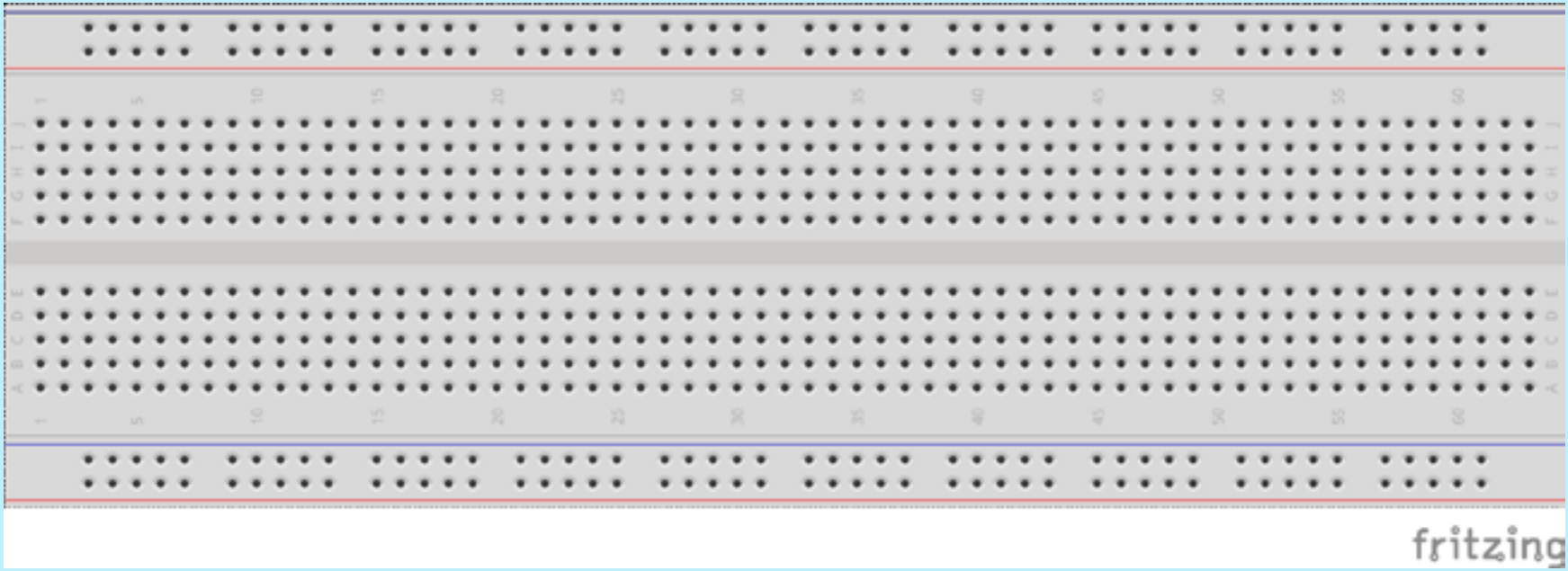
$$V=I*R...R=V/I$$

With our values:  $R=9/.018$

$$R = 500$$

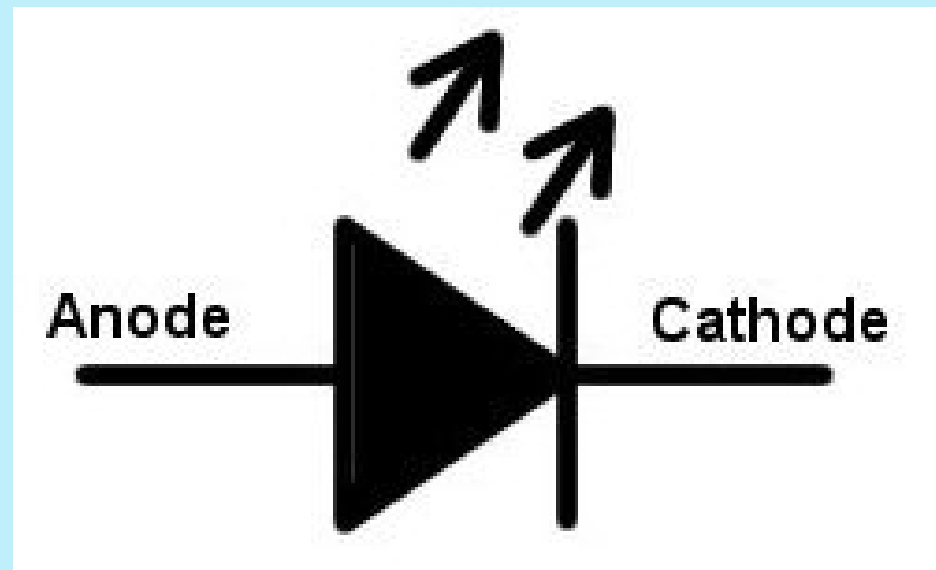
So we'll need a 500 ohm resistor, or something close, like 560 ohm.

# Breadboard

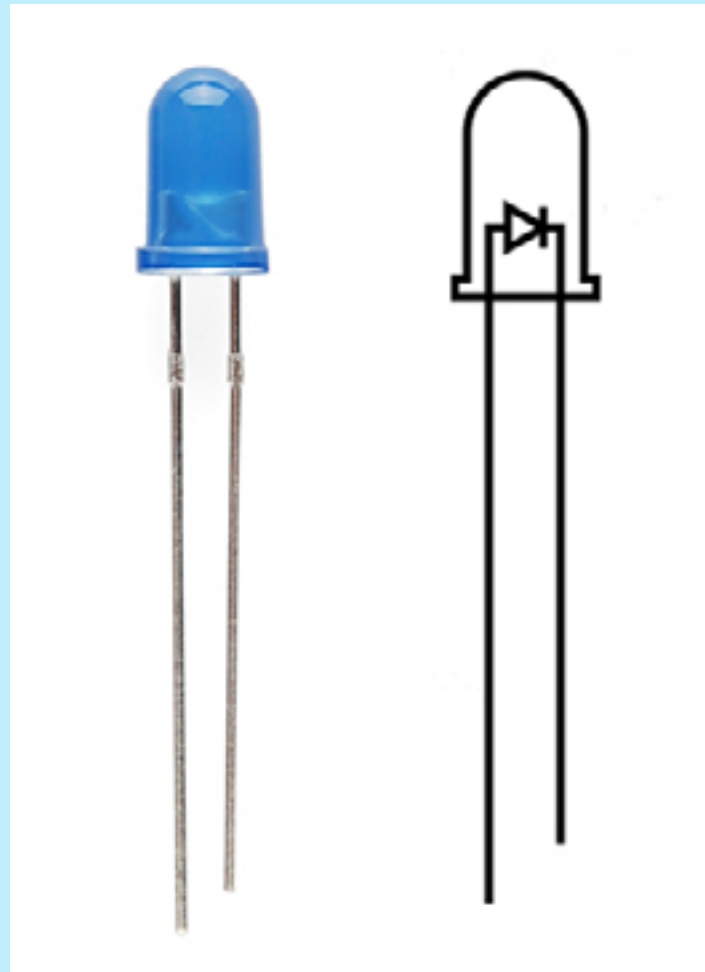


# LED (Light Emmiting Diode)

Current can only pass through one direction in a diode.



# LED (Light Emmiting Diode)



# Switch

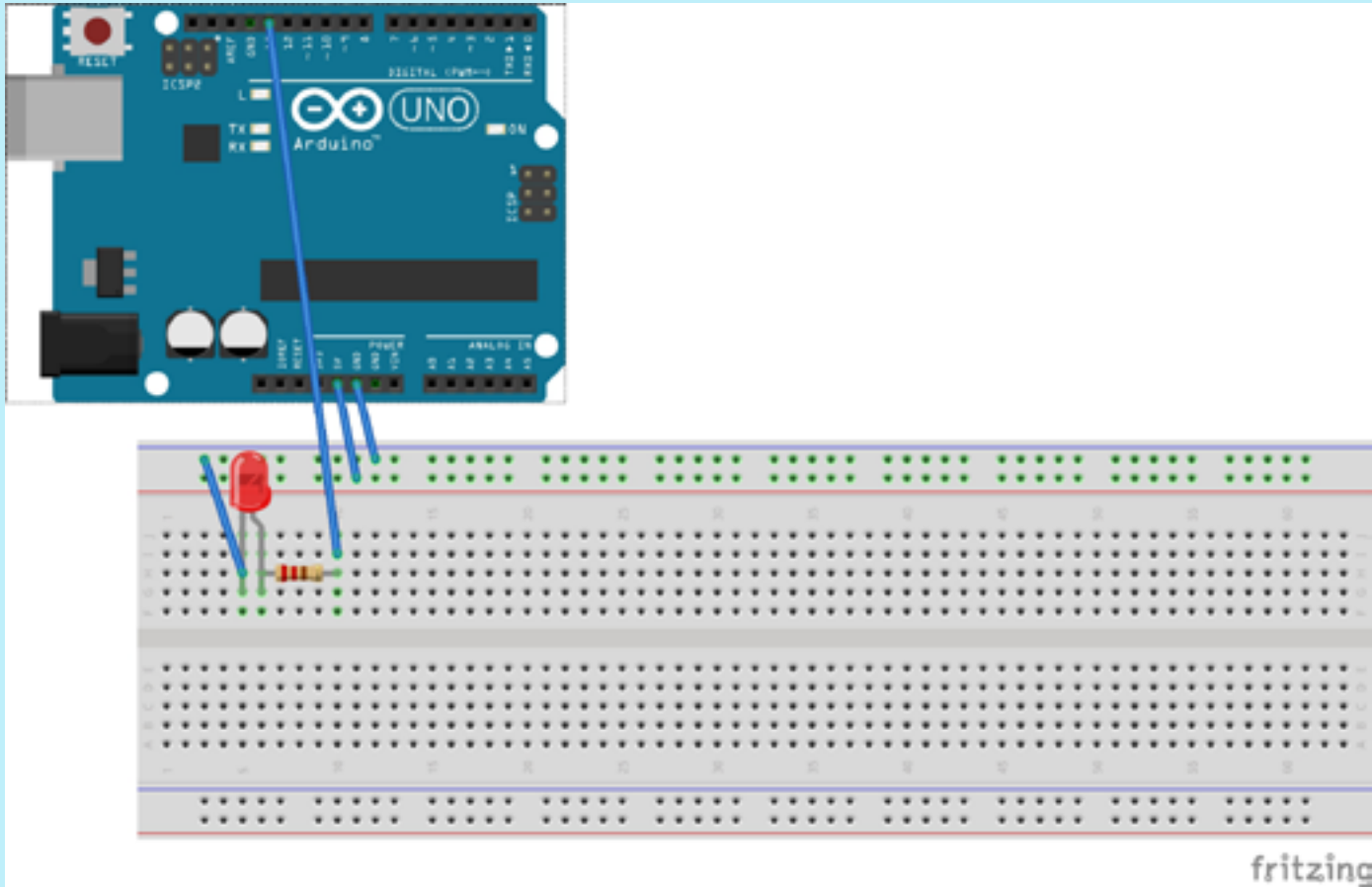


# Potentiometer



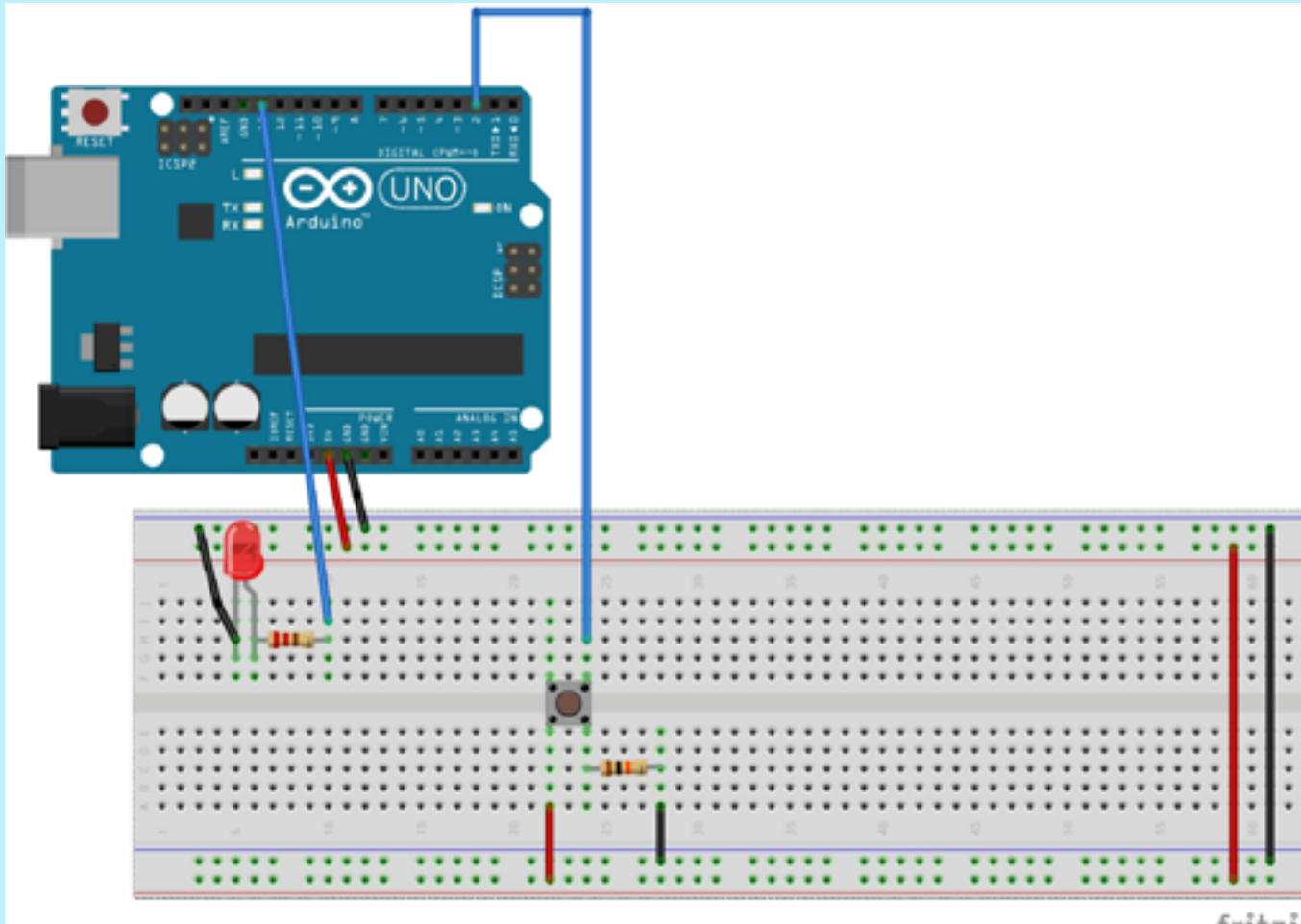
**A simple knob that provides a variable resistance, which we can read into the Arduino board as an analog value**

# Fade/Blink



LED, 220 ohm resistor

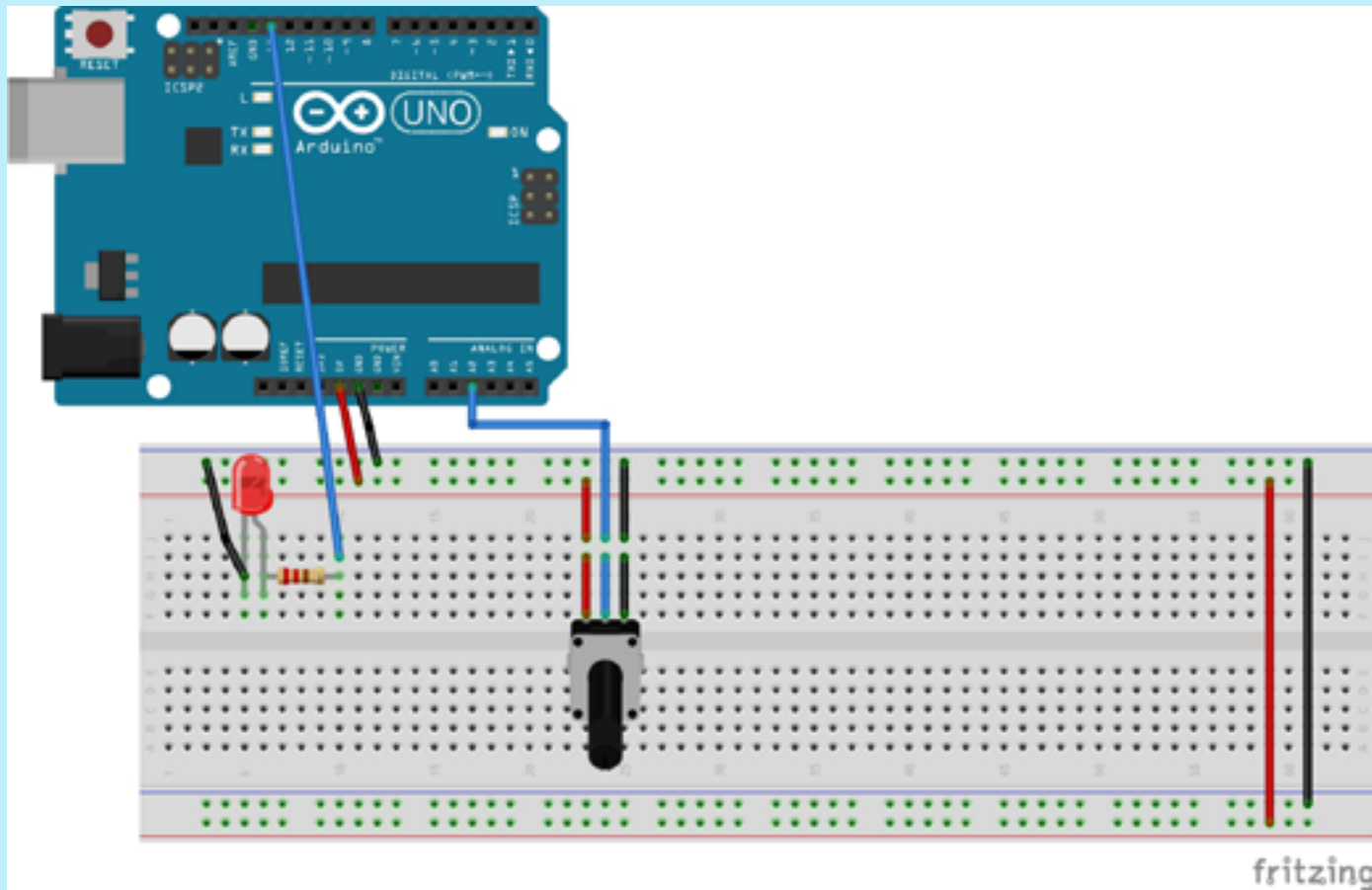
# Button



LED, 220 and 10k ohm resistor, button



# Potentiometer



LED, 220 ohm resistor, potentiometer