

Introduction to Electronics

April 18, 2023

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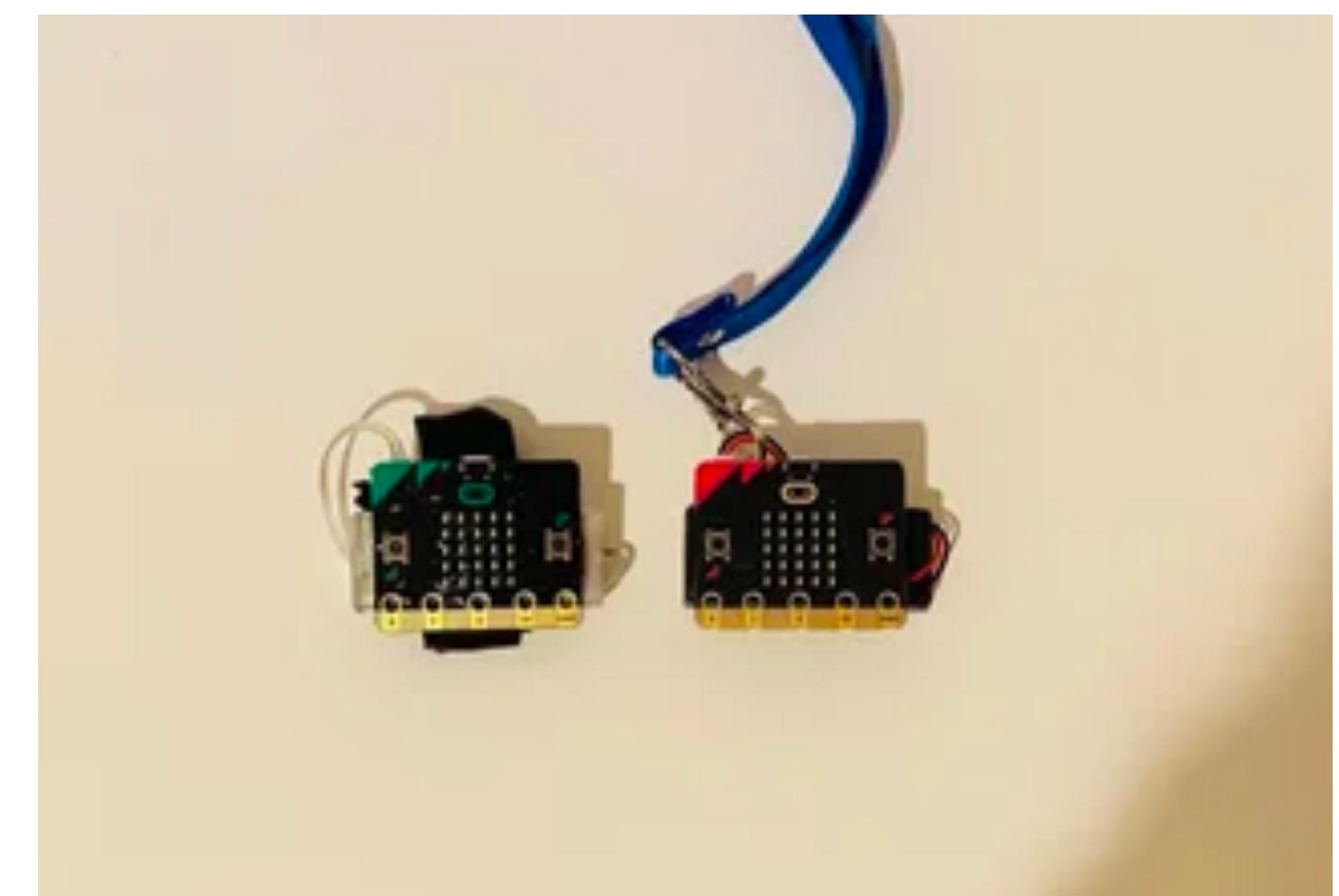
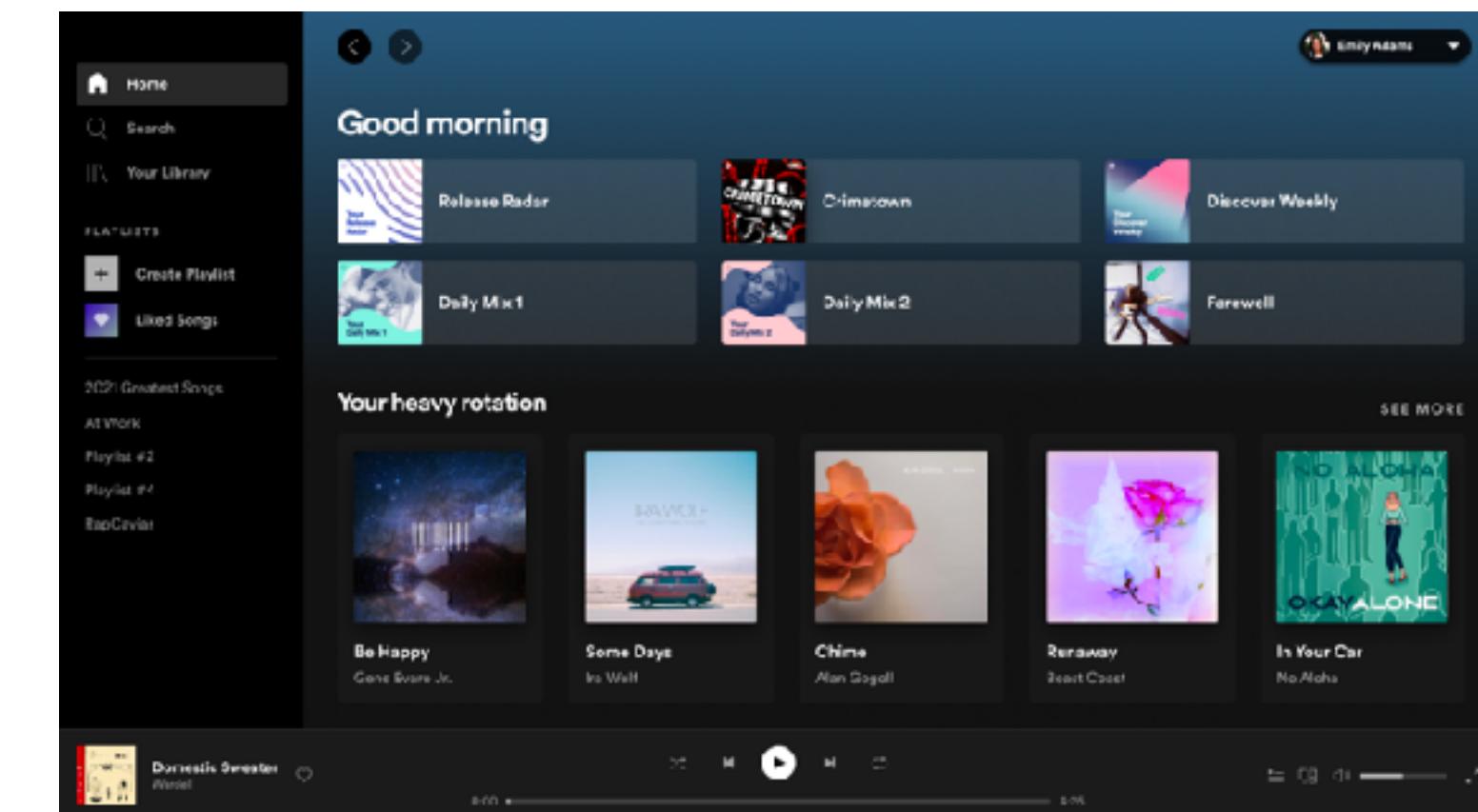
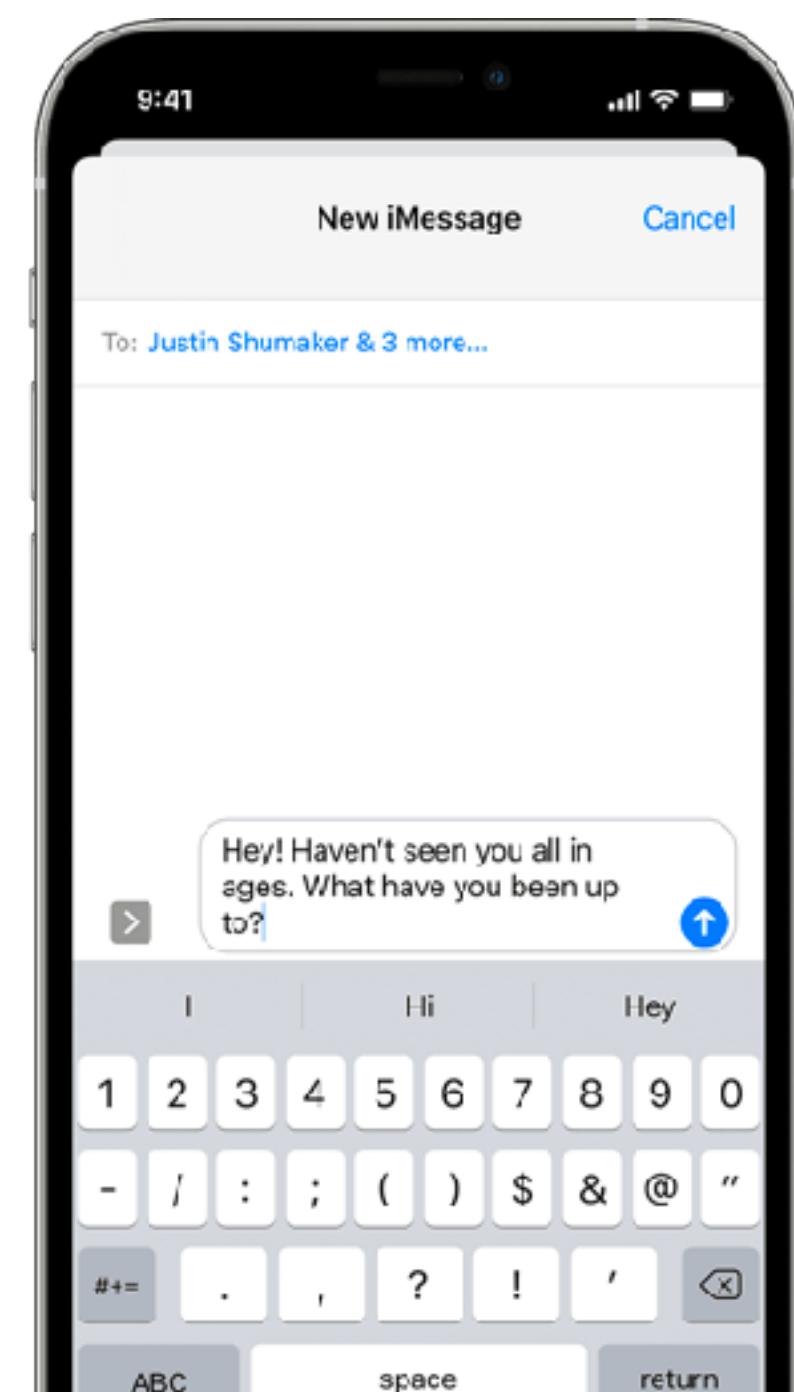
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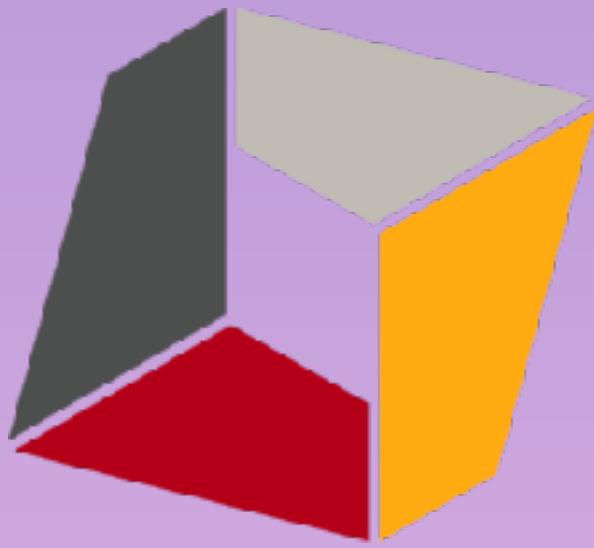
We can build physical stuff!!

Assignment 2

- augment.py



Where can you make circuits?



STANFORD PRODUCT
REALIZATION LAB



Electronics Basics

There are 3 main properties of a circuit

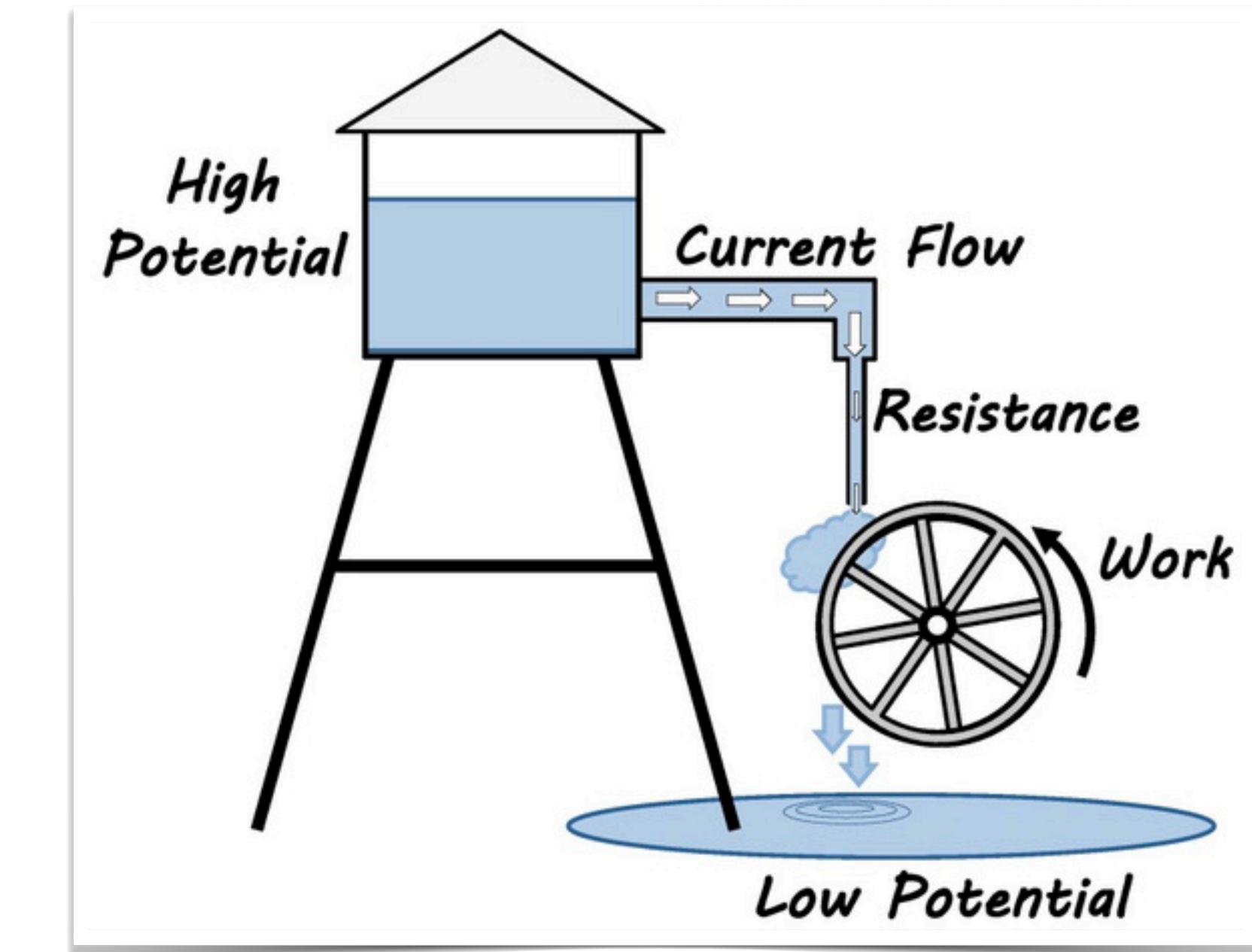
Voltage

Current

Resistance

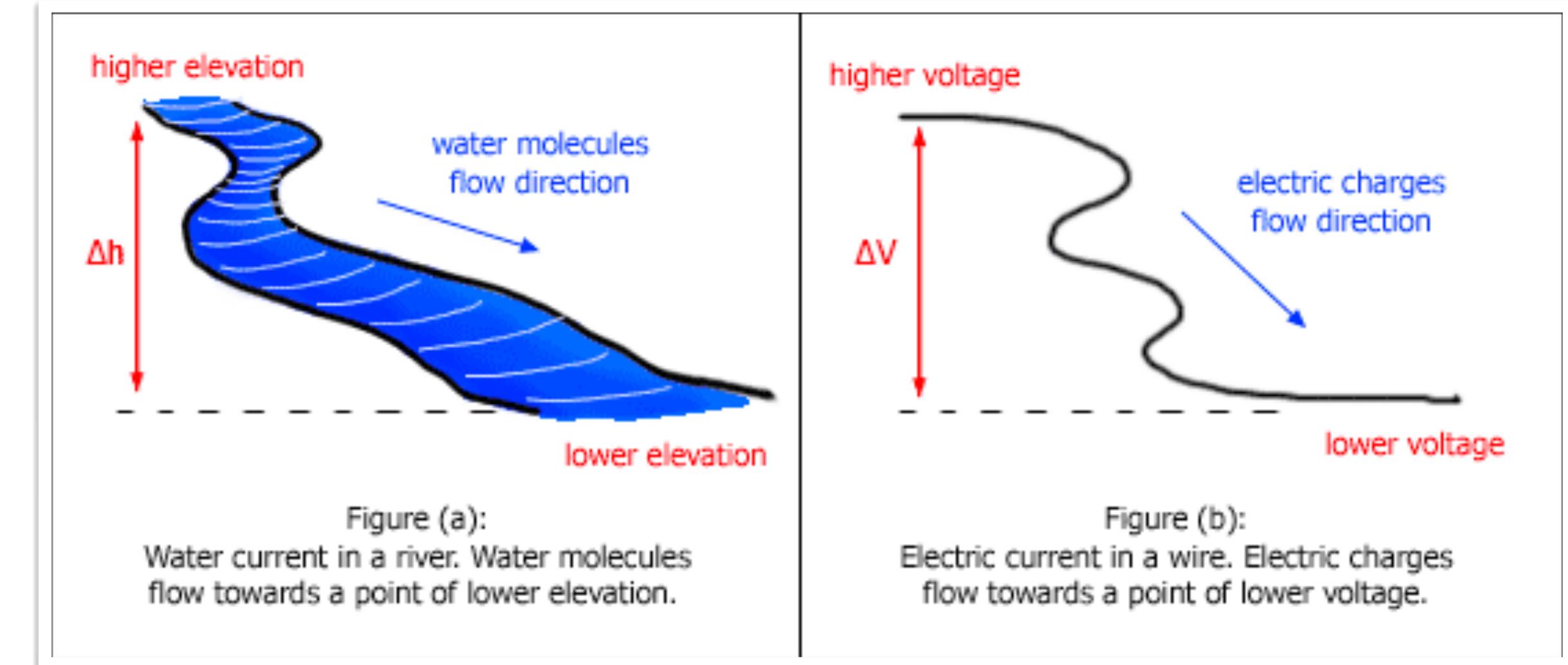
Current

- **Current is the flow of electrons** (measured in amperes or amps) in a circuit.
- Current is like water flowing through a pipe. Just as water needs a pipe to flow, current needs a wire to flow through.



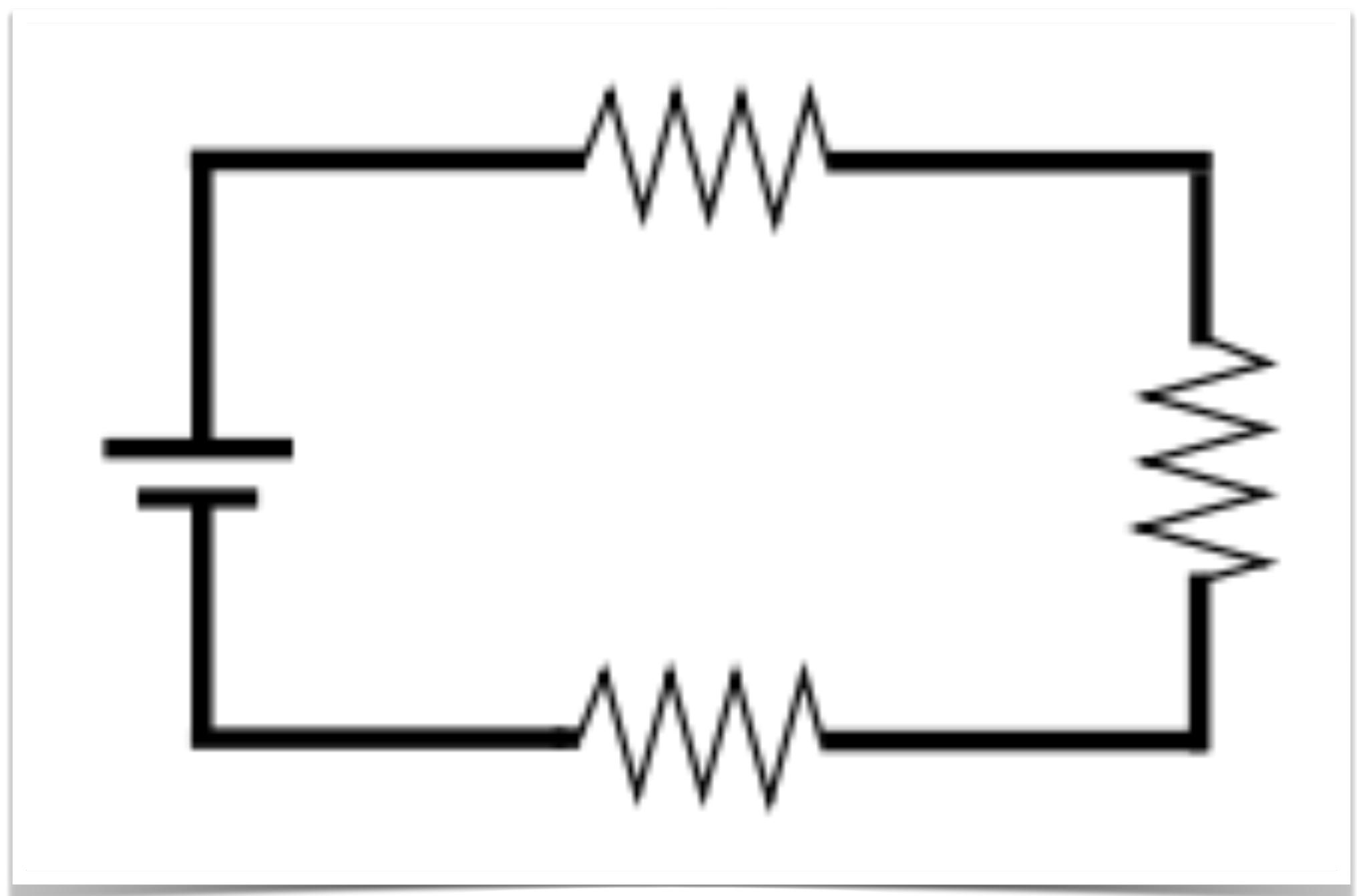
Voltage

- **Voltage is the electric potential difference** (measured in volts) between two points in a circuit, which determines the flow of current.
- It is basically the "push" that makes electricity flow through a circuit. Just as water flows through a pipe when there is pressure behind it, current flows through a wire when there is voltage across it.



Resistance

- Resistance is a property that measures how much an object resists or opposes the flow of electricity through it. Think of it like a roadblock that slows down traffic.
- Just as a narrow or rough section in a pipe can make it more difficult for water to flow, a higher resistance in a circuit can make it more difficult for current to flow.



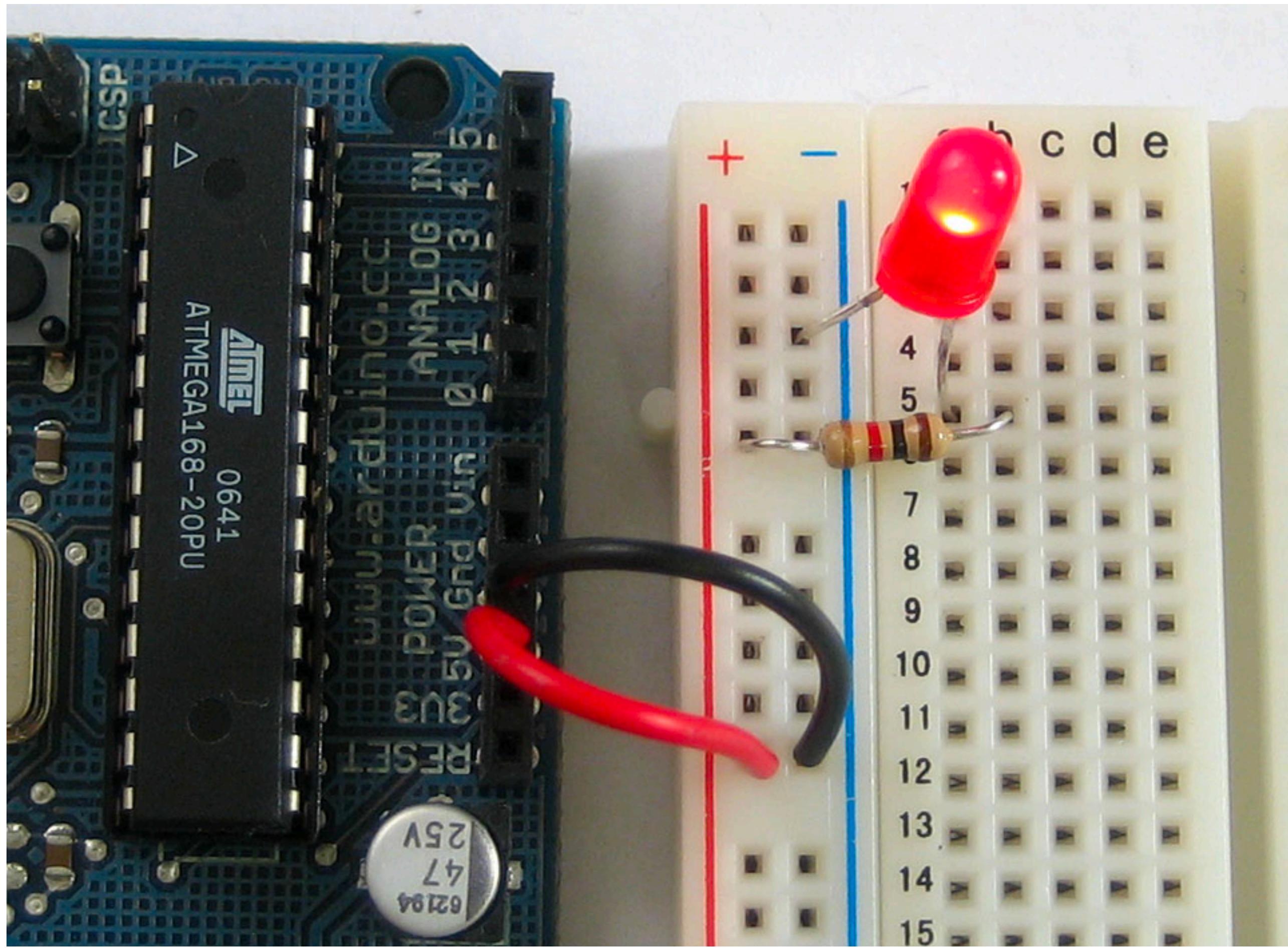
These three factors come together in Ohm's Law

Ohm's
Law

$$I = \frac{V}{R}$$

Electric current = Voltage / Resistance

These concepts are the foundation of EE

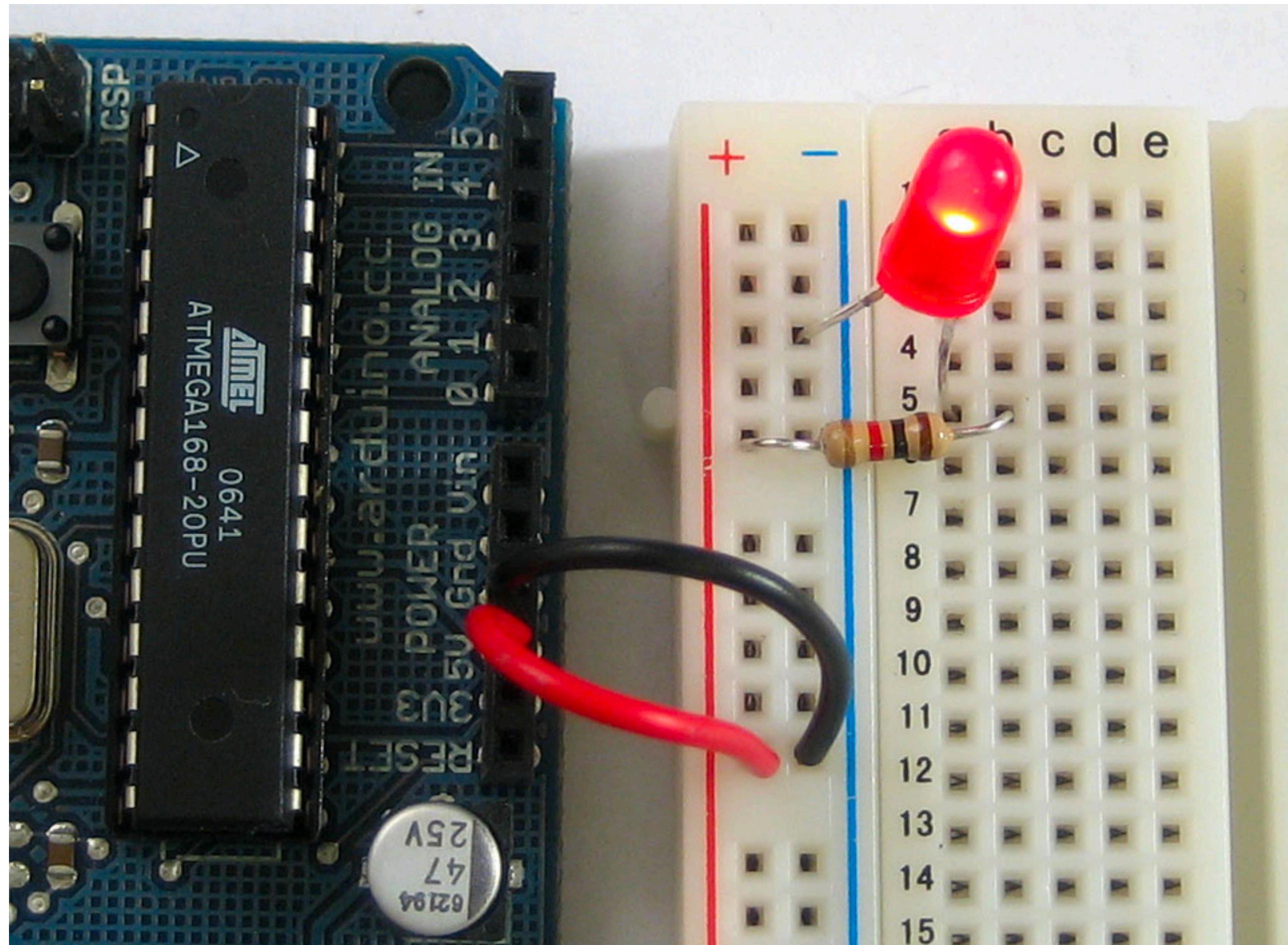


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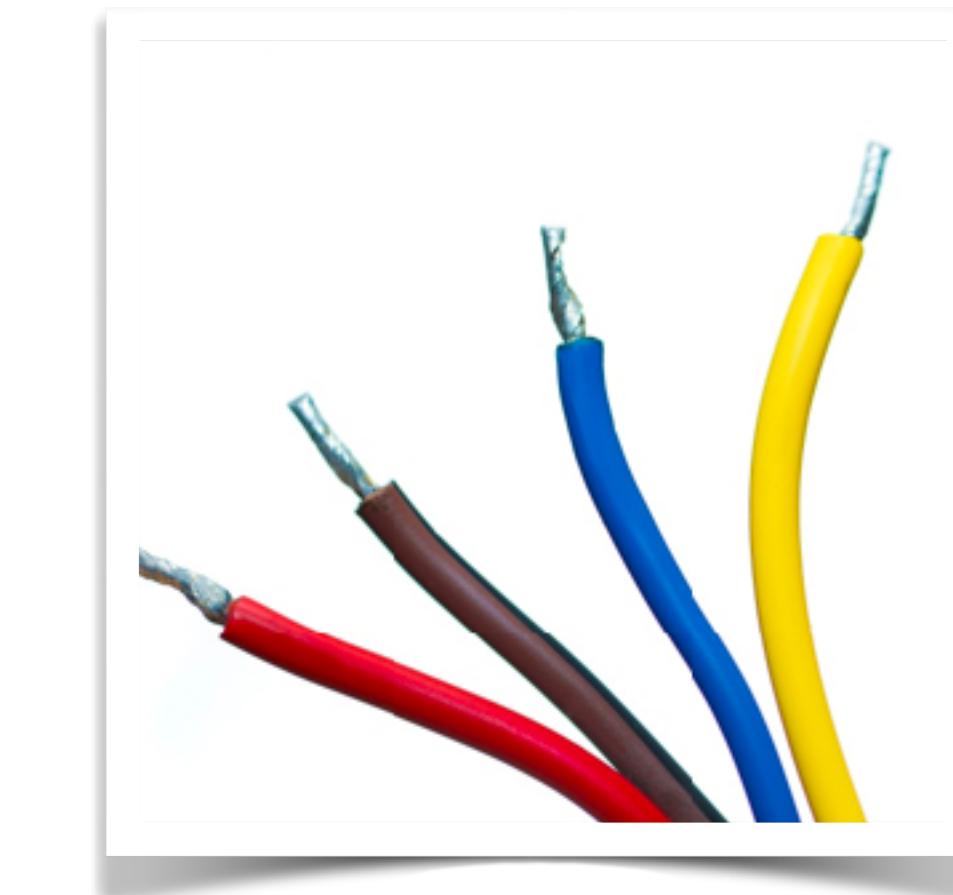
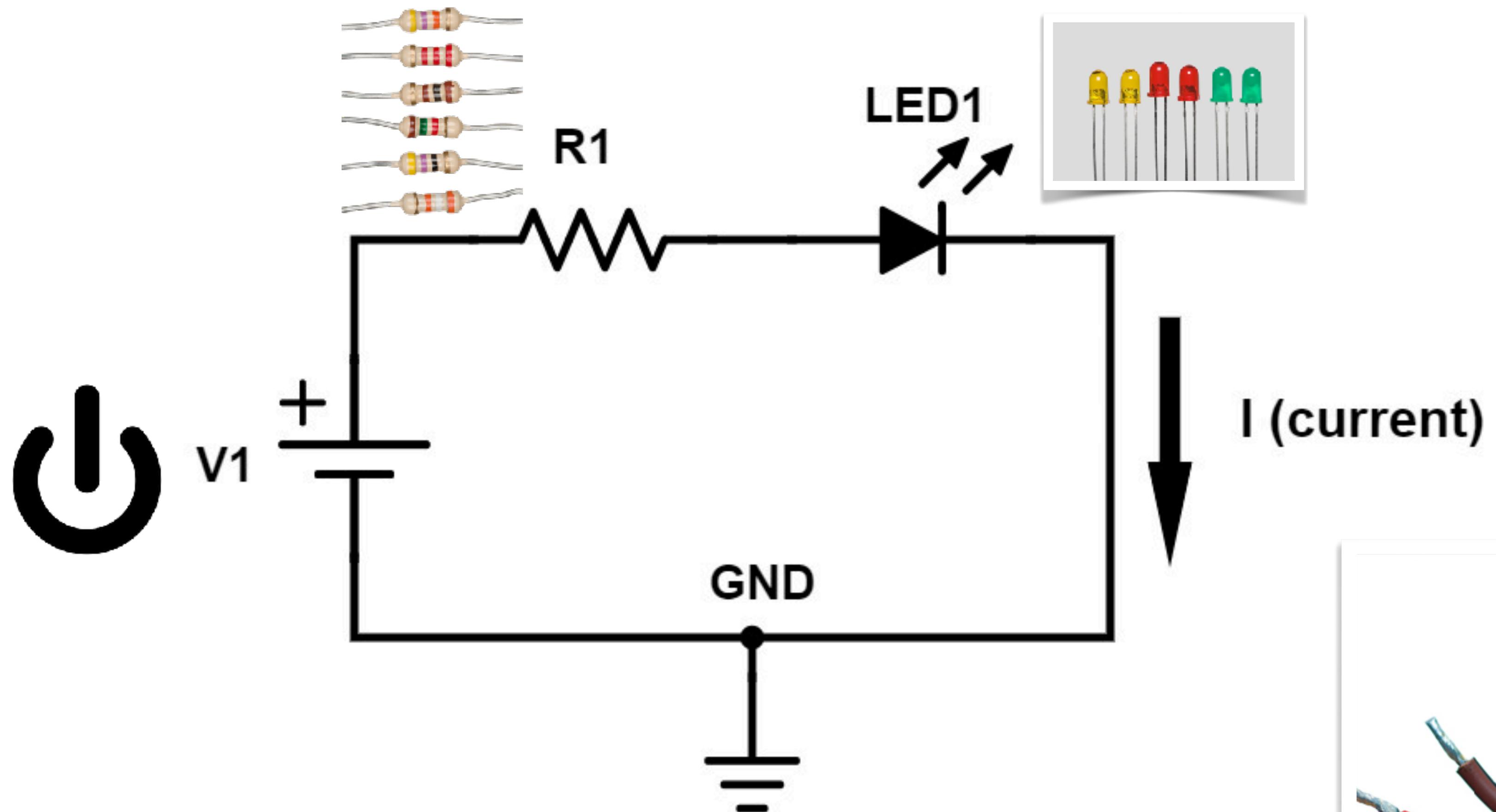
Voltage

Current

Resistance



These concepts allow us to get here



Ground

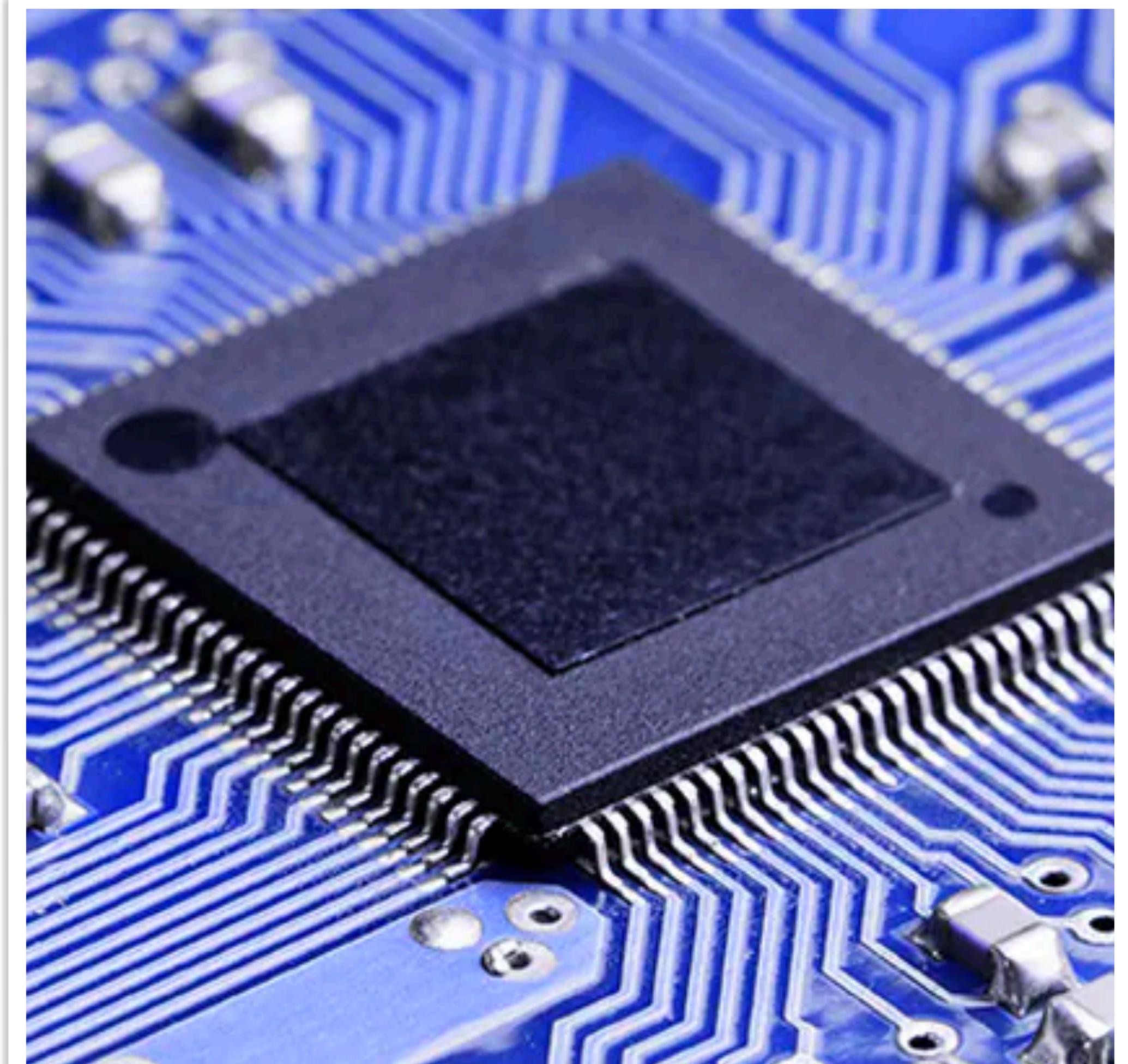
- In an electrical circuit, the ground serves as a reference point or a "zero voltage" point.
- Ground acts as the return path for the electric current to flow back to the power source, completing the electrical circuit.

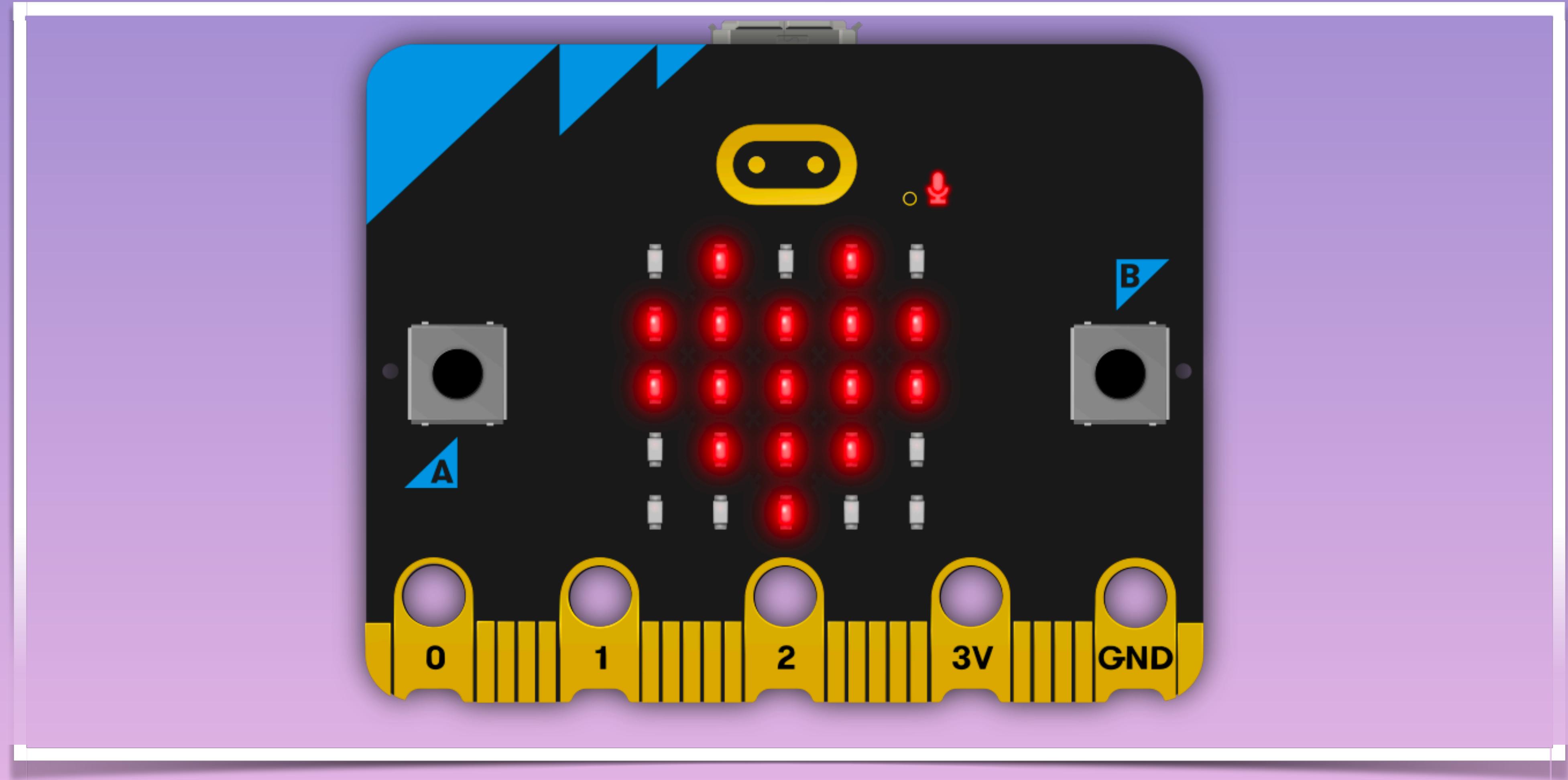


Any questions?

Microcontroller

- A **microcontroller** is an integrated circuit that contains a microprocessor, memory, and input/output peripherals, capable of executing instructions and controlling external devices or systems

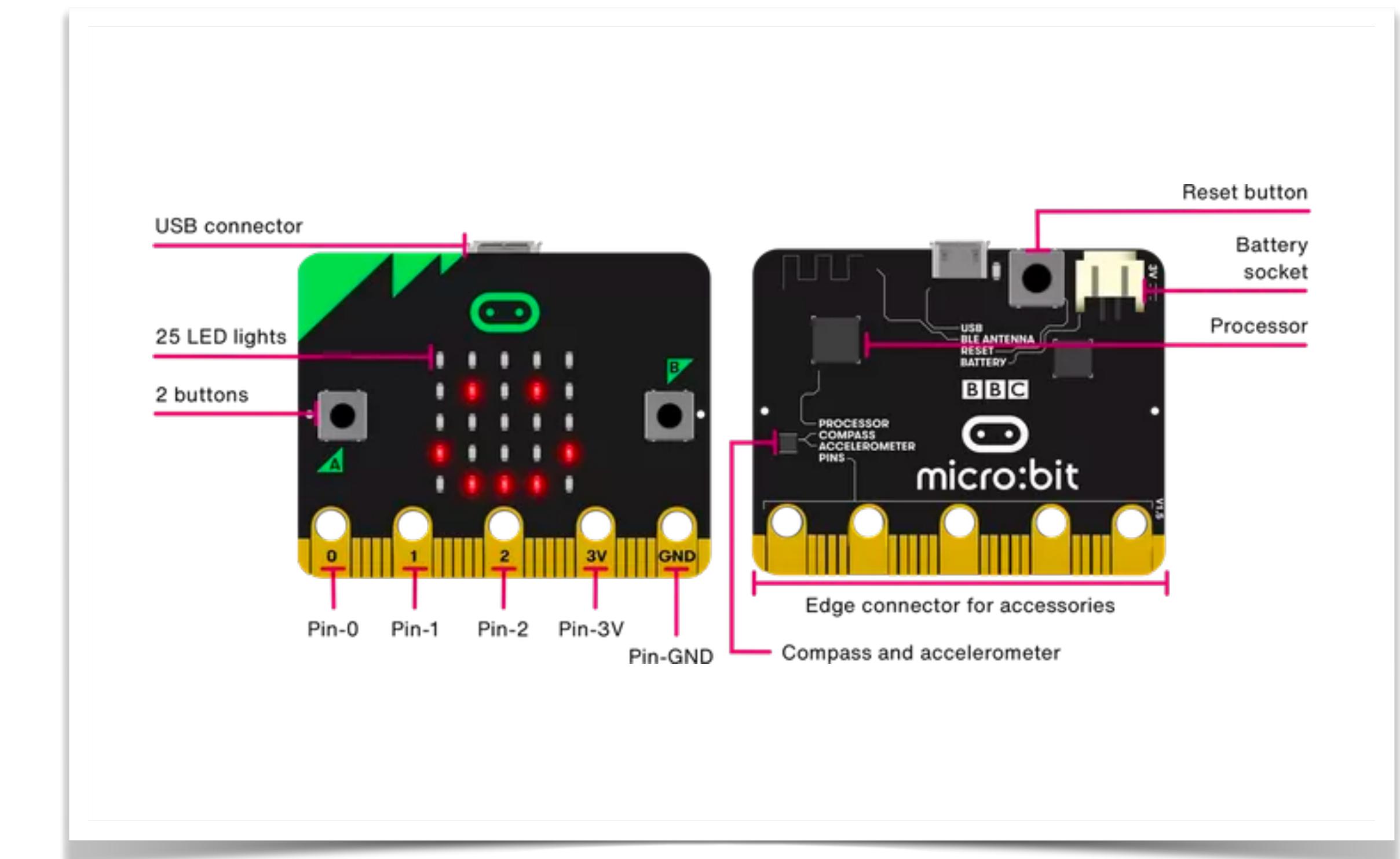




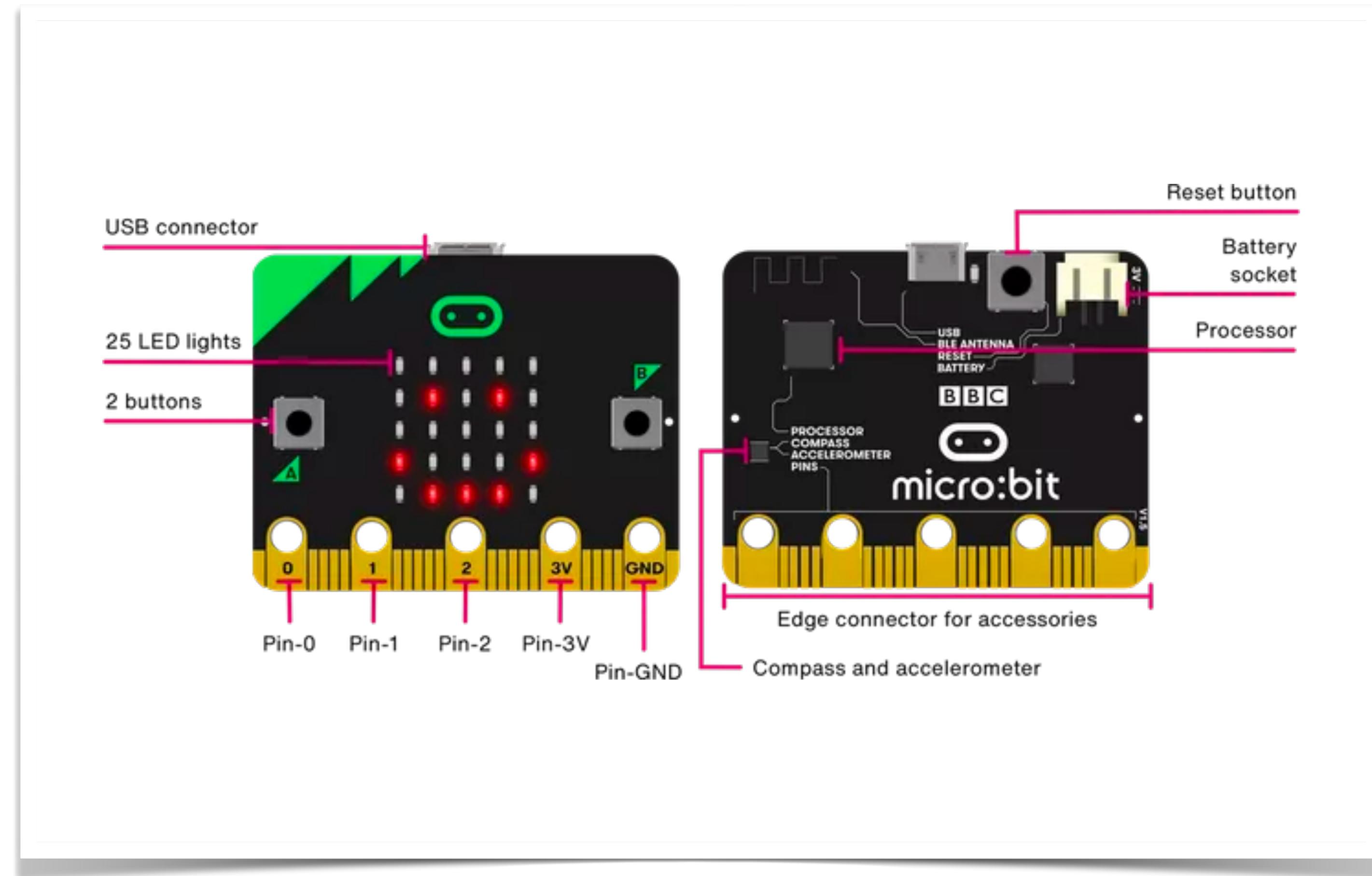
And that brings us to our microcontroller of choice

Meet the microbit

- The microbit v2 is a small, pocket-sized computer that is designed to help students learn programming and electronics.



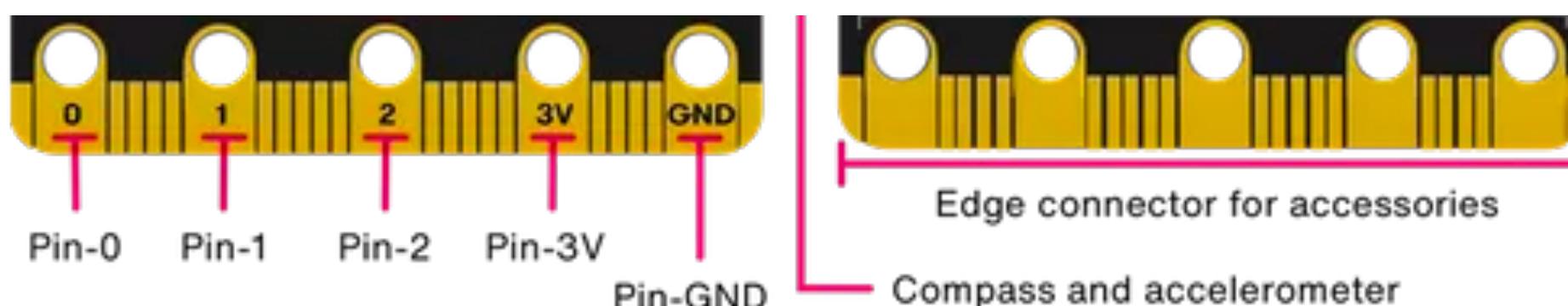
Features of the microbit V2



- **LED display:** A 5x5 LED matrix that can be used to display text, images, and animations.
- **Buttons:** Two programmable buttons that can be used as inputs for your programs.
- **Accelerometer:** A sensor that can detect changes in motion and orientation.
- **Compass:** A sensor that can detect the direction of magnetic fields.
- **Temperature sensor:** A sensor that can measure the temperature of the surrounding environment.
- **Pins:** A set of pins that can be used to connect the Microbit to external sensors, actuators, and other components.

The pins are GPIO pins

- GPIO stands for "General Purpose Input/Output". A GPIO pin is a digital pin on a microcontroller or computer that can be used for both input and output operations
- These pins can make use of output and input voltage input that we can handle with code.



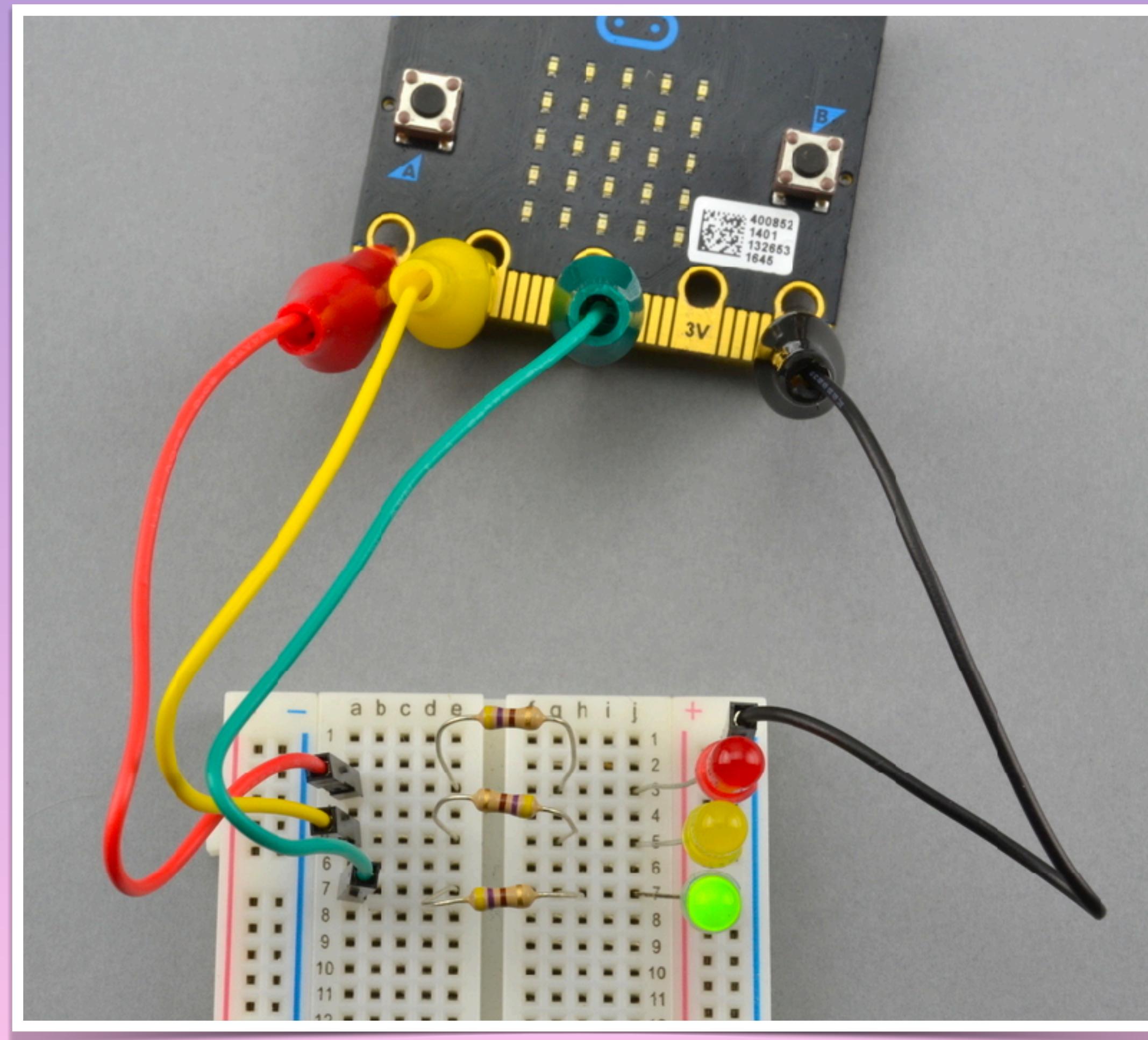
These pins can help us build circuits

```
if pin0.is_touched():
    display.show(0)
```

```
#see if electrons flowing
pin1.read_digital()

#make electrons flow
pin1.write_digital(1)
```

They can be used to interface with more traditional circuits



Code Demo

Now, a circuit using a secret spooky conductor

- Any guesses??



WARNING

this is dangerous

Only safe at super low CURRENT and VOLTAGE

How are YOU a conductor??

- Water is conductive because it contains charged particles, or ions, that can move through the water and carry an electric current.

How are YOU a conductor??

- Water is conductive because it contains charged particles, or ions, that can move through the water and carry an electric current.
- You are ~60% water!

Human Connection!!