Become an Arduino Wizard!

Kim Brand, 1st Maker Space

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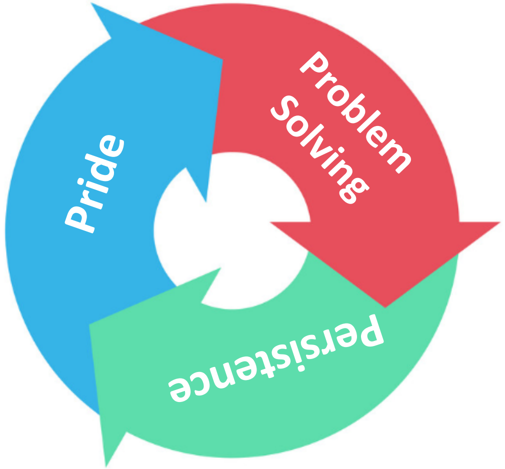
Build.
Sustain.

Why Arduino? Why Code?

- ***The Arduino is***
  - Open-source: Hundreds of manufacturers, millions of users, widely supported
  - Economical: Get started for under $10
  - Powerful enough
  - Evolving: Embedded, Wearable, IoT, Industrial PLC, etc.
  - Safe!



- ***Coding is***
  - Control
  - Confidence
  - Nearly perfect ‘Zone of Proximal Development’ challenges
  - Workforce-ready (New Arduino Certification)

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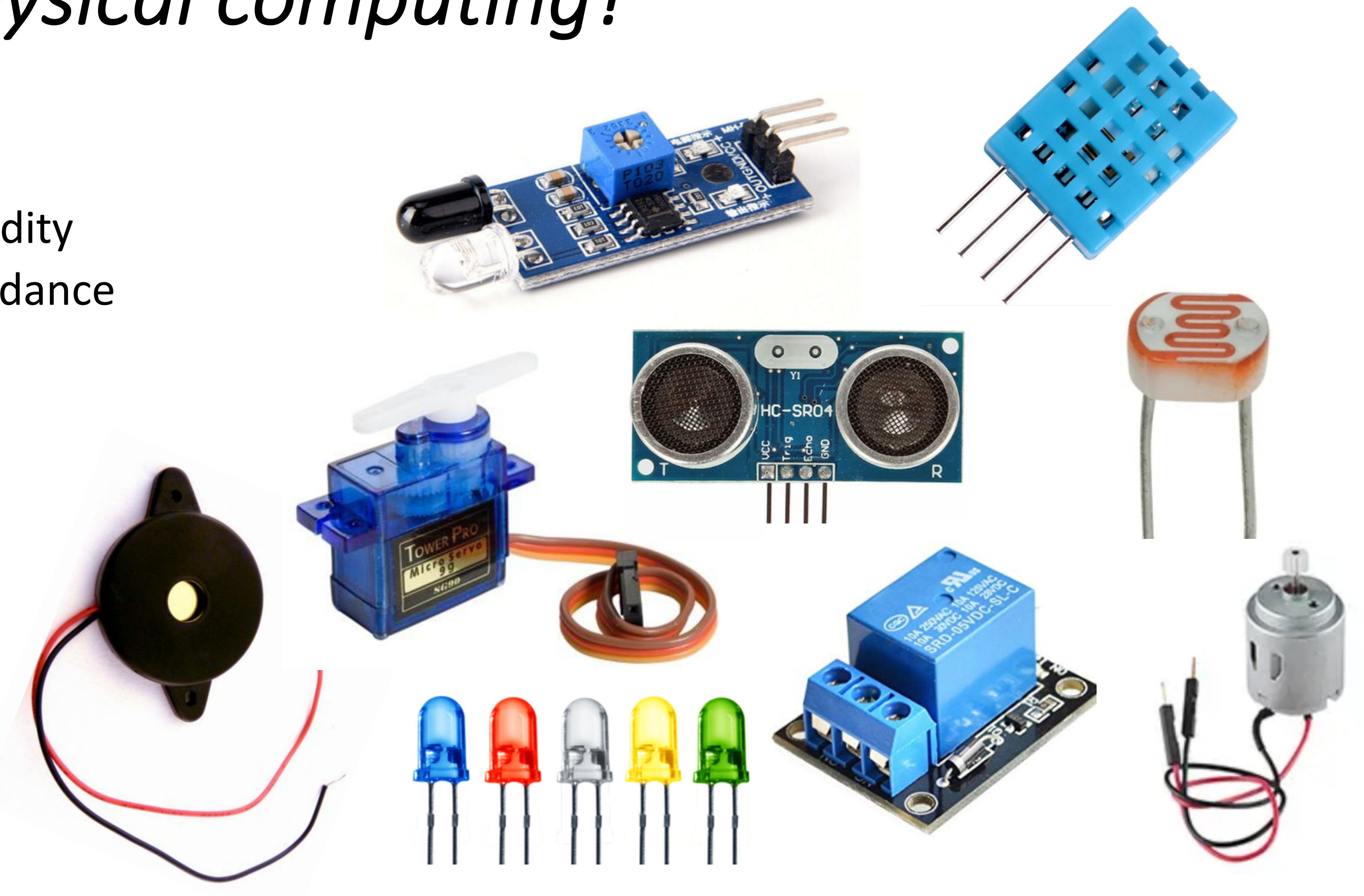
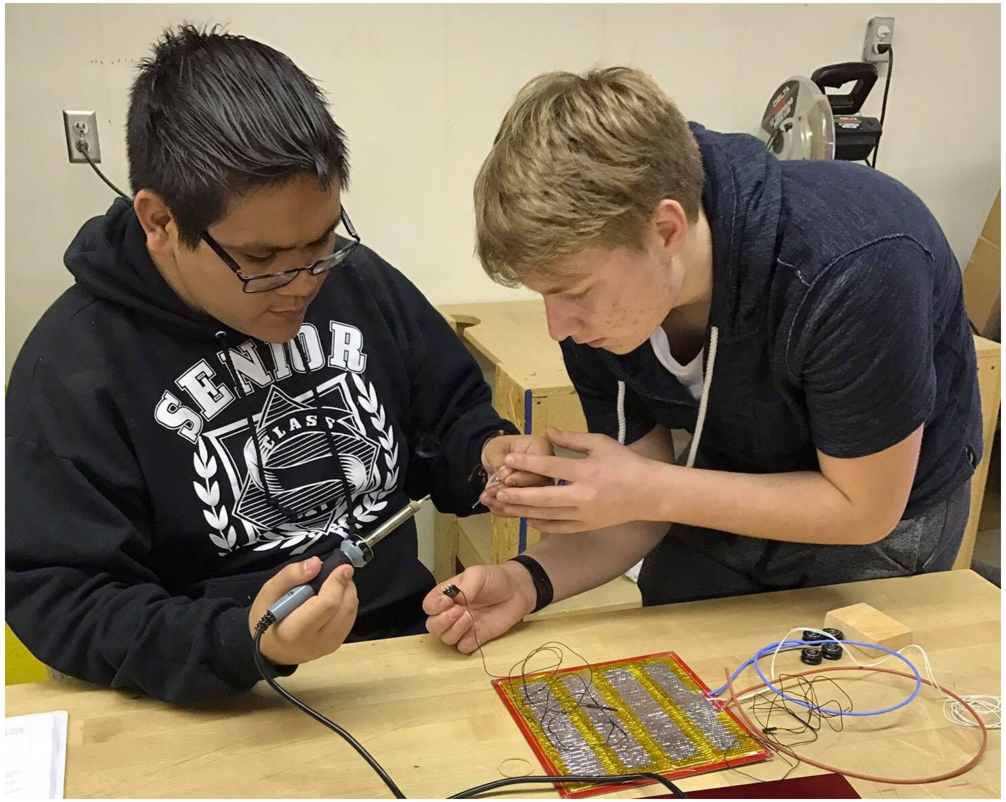
What is physical computing?

- Sensors
  - Temp & Humidity
  - Obstacle Avoidance
  - Sonar
  - Light
- Actuators
  - Servos
  - Relays
  - Motors
- Light & Sound



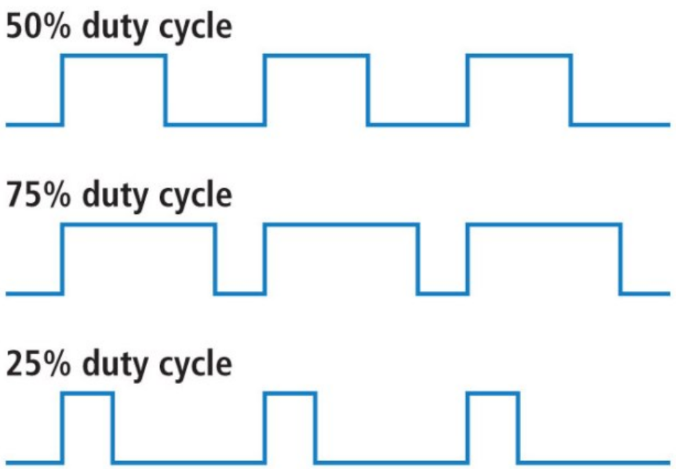
Why is physical computing so important?

- Problems that inspire not discourage!
- Surprises
- Collaboration
- Competition
- Engagement
- Relevance
- Exhibit potential

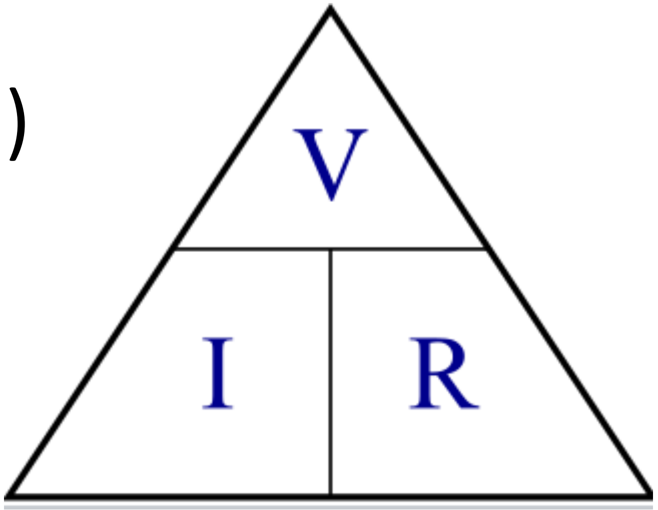


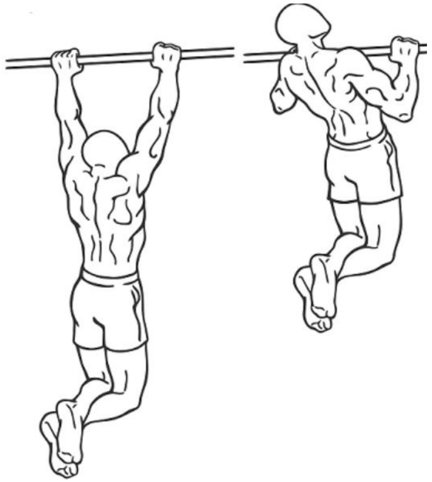
Arduino Video: Massimo Banzi, co-founder

Essential Arduino Vocabulary



- GPIO & PWM
- Github.com
- Ohms Law
- JSON Files (Arduino IDE Config)
- IoT – Internet of Things (ESP8266, ESP32)
- ADC – DAC (Analog – Digital Conversion)
- Pull-Up Resistors
- IDE – Integrated
  Development
  Environment





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Microcontroller / Electronics Concepts

- On – Off, Yes – No, High – Low, True – False, One and zero . . . **Logic**!
- **Voltage** –
  - 5v is On/Yes/High/True/One –
  - 0 v is Off/No/Low/False/Zero
- The playground of a computer is measured in **bits**
- **Circuits** – like plumbing with bits (I call it bit plumbing)
- **Input and output** – working in either the real or virtual worlds
- **Programming** is power to tell the computer what to do
- **Data** can be numbers, colors, sound, words, graphics
- **Memory** stores programs & data – even when the power if off!

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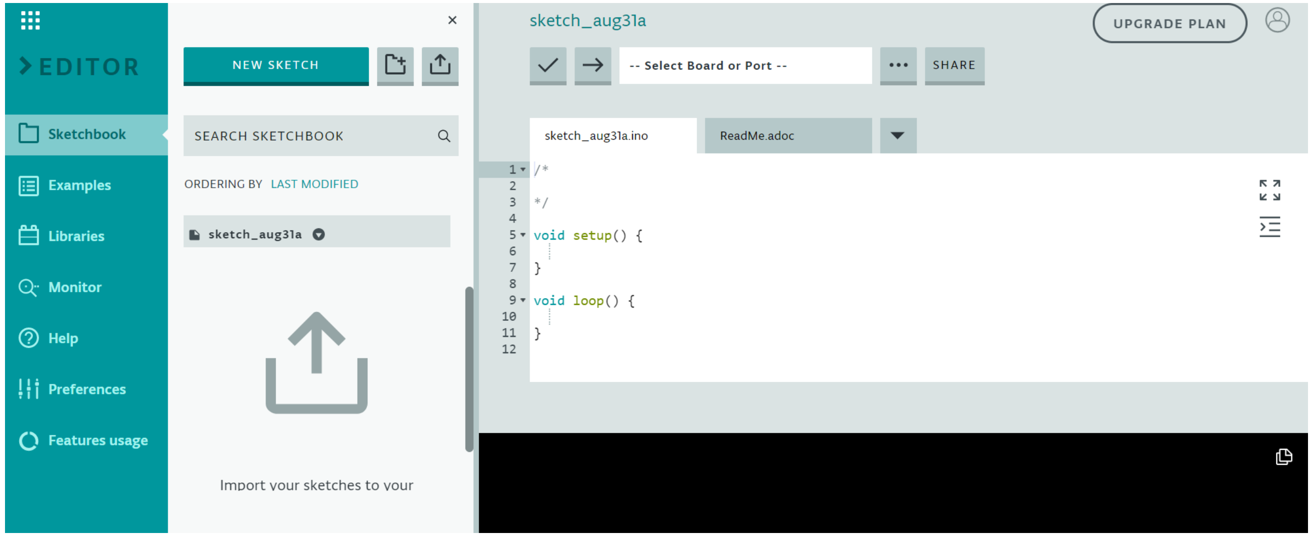
Arduino Create for Chromebooks

- Cloud based IDE
- Web editor & USB device connector
- Project Hub
- Subscription:

  $0.30 - $0.99/student/month (based on # subscriptions)
- Drama



```
/*

*/

void setup() {

}

void loop() {

}

```

Import your sketches to your

Top 6 Free Arduino Wizard Guides

- Instructables: A Beginner's Guide to Arduino
- Arduino.cc: Foundations & Language Guide
- Adafruit.com: Ladyada's Learn Arduino
- By students: Programming in Arduino
- Brian Evans: Arduino Programming Notebook
- Makerspaces.com: Simple Arduino Projects

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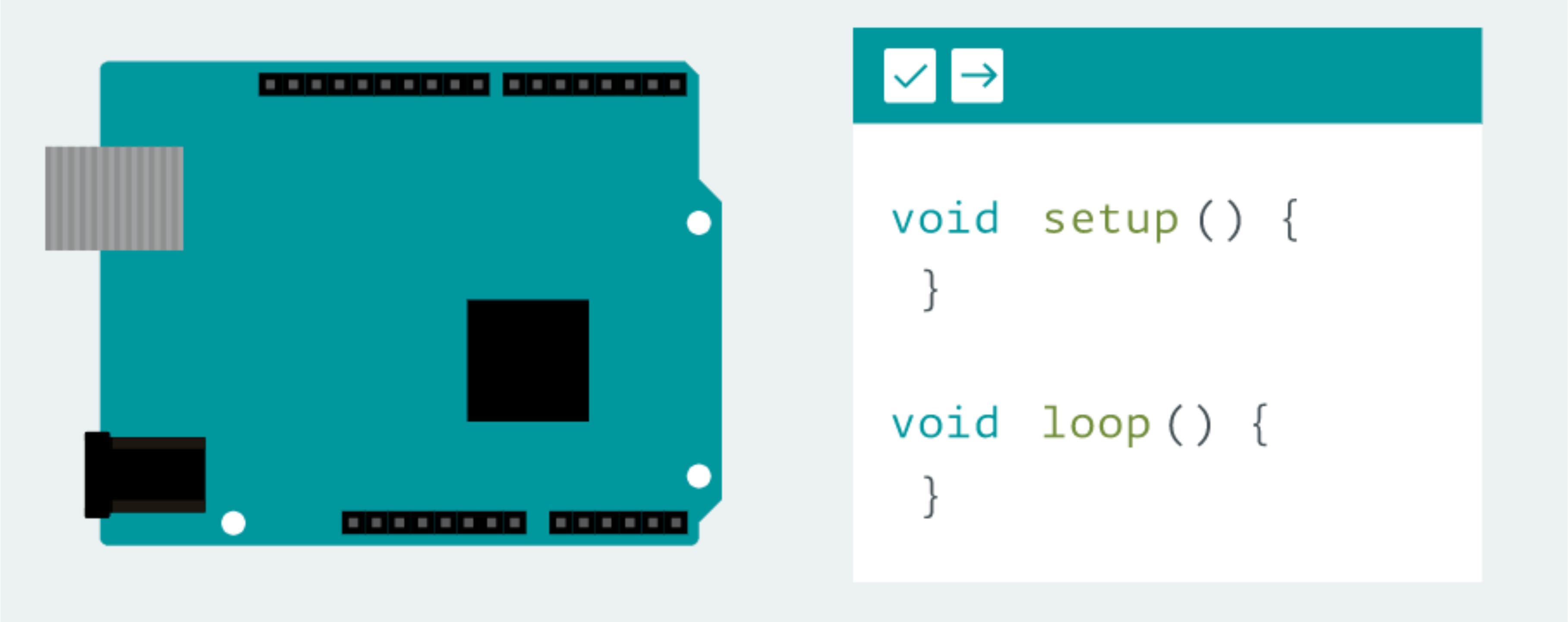
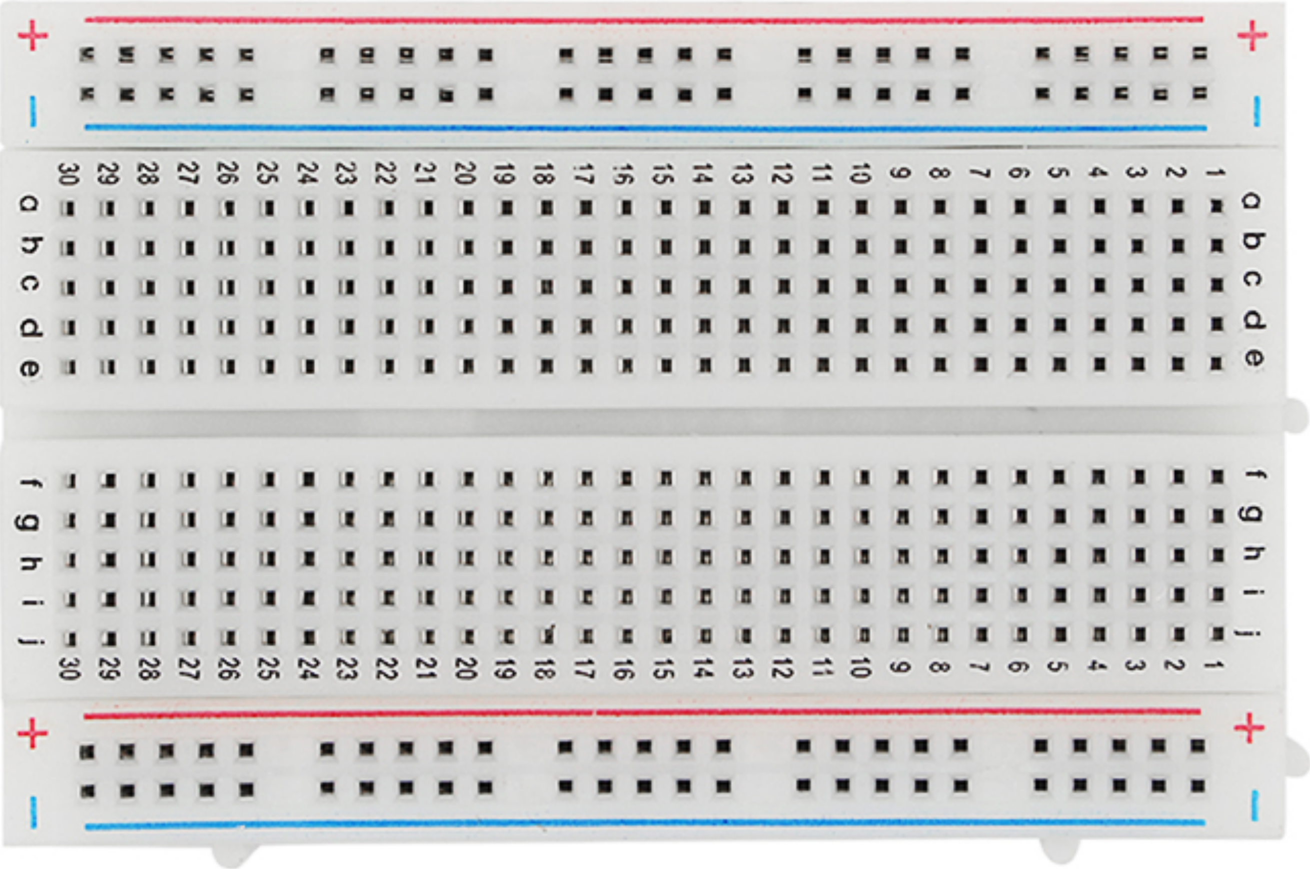
Arduino Physical vs Virtual



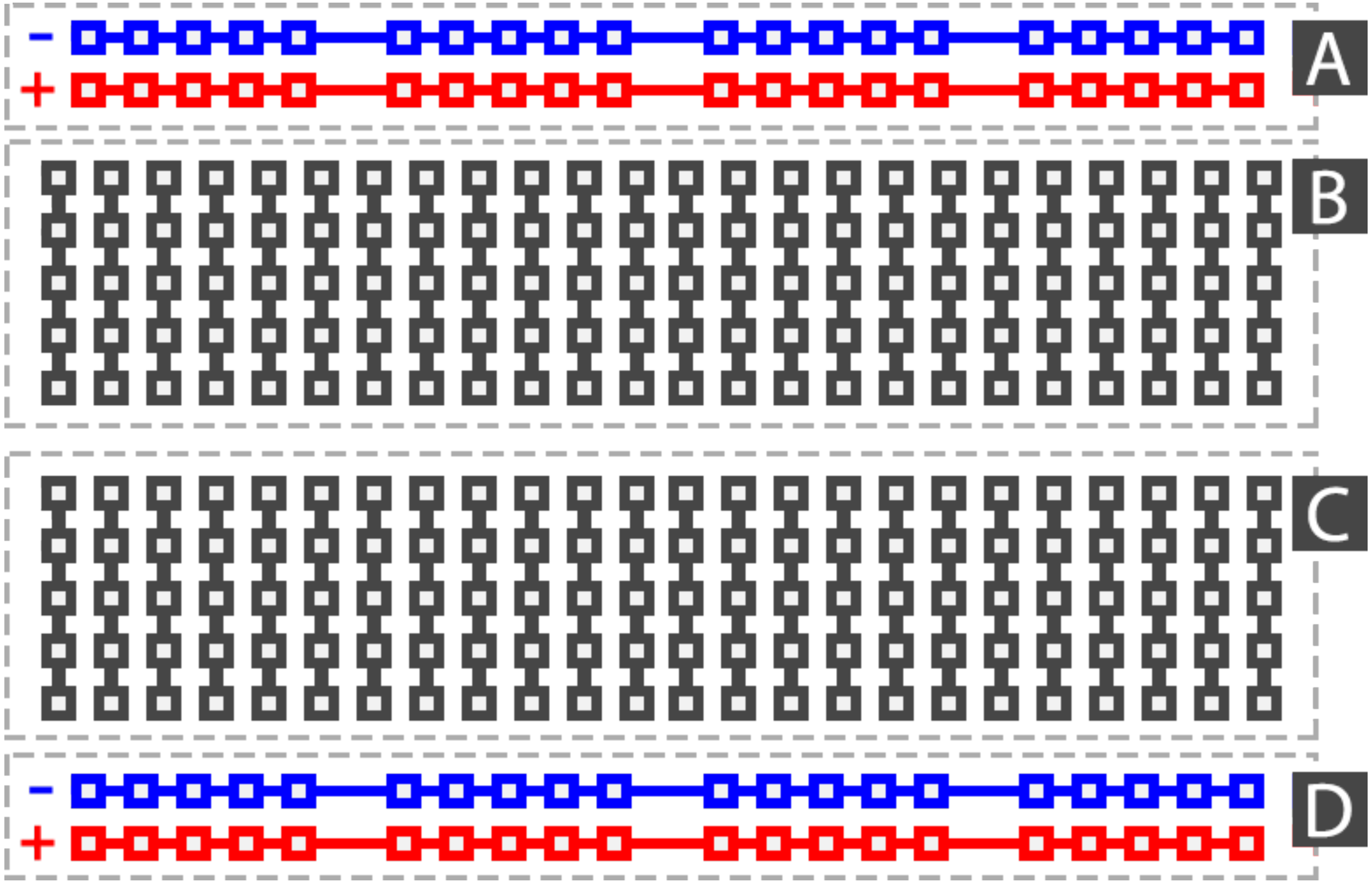
```
void  setup() {
 }

void  loop() {
 }
```

Assembling your first Arduino circuit!

- Solderless breadboards make it easy!



How the holes are connected



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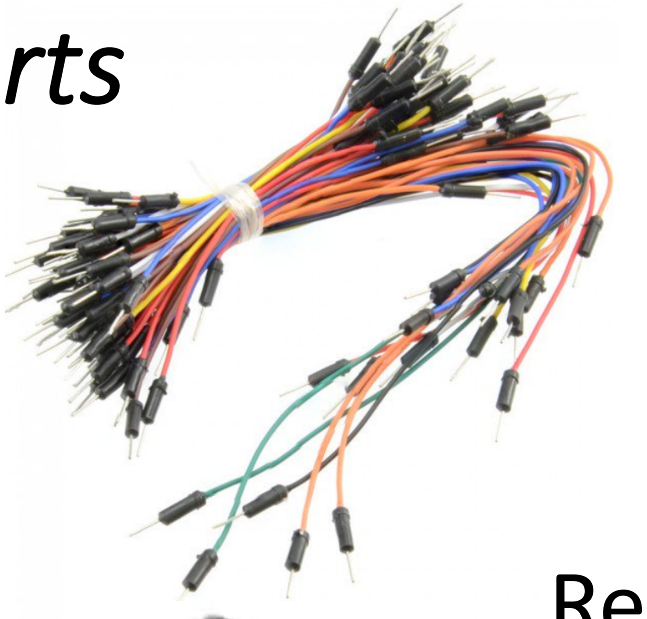
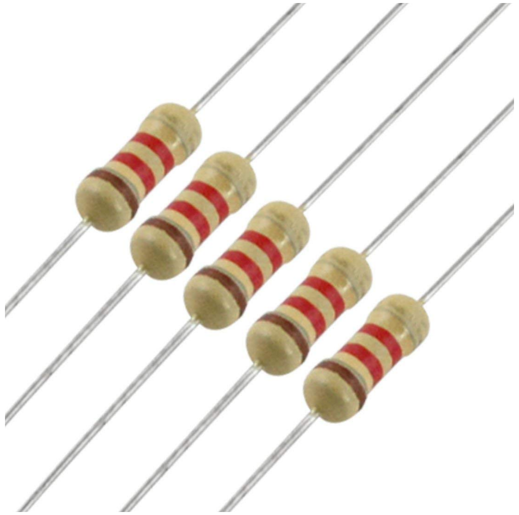
Electronic parts

Connector Wires



Switches

Resistors

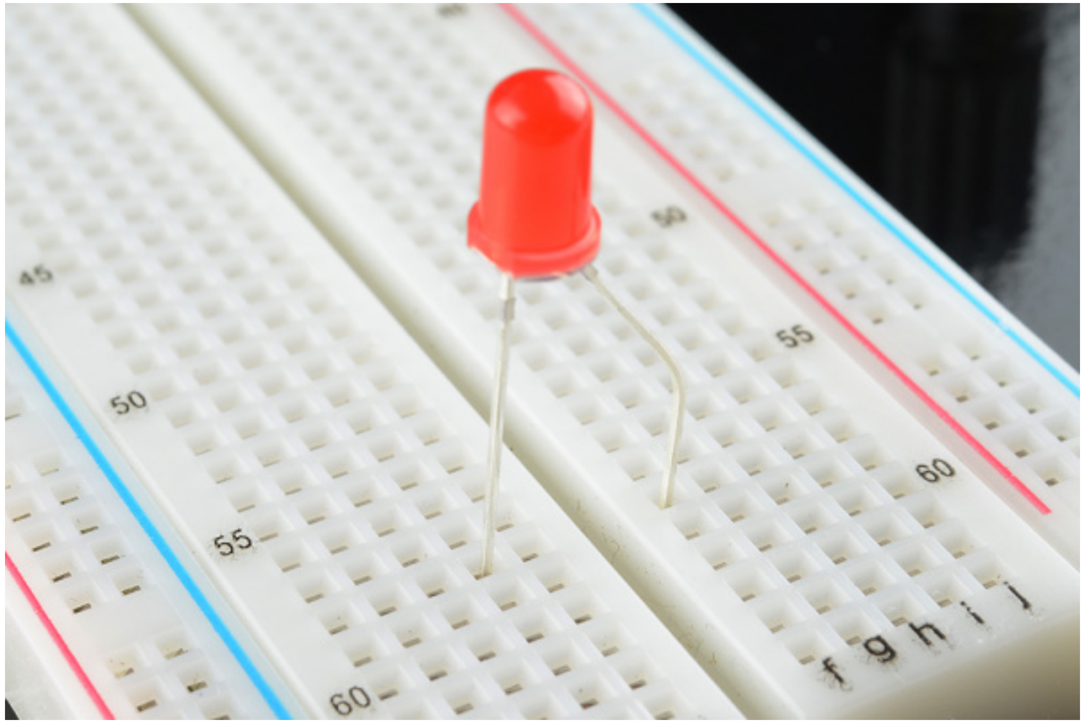


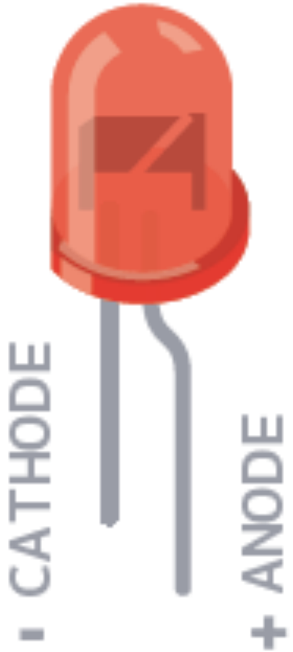
LEDs

How parts are inserted

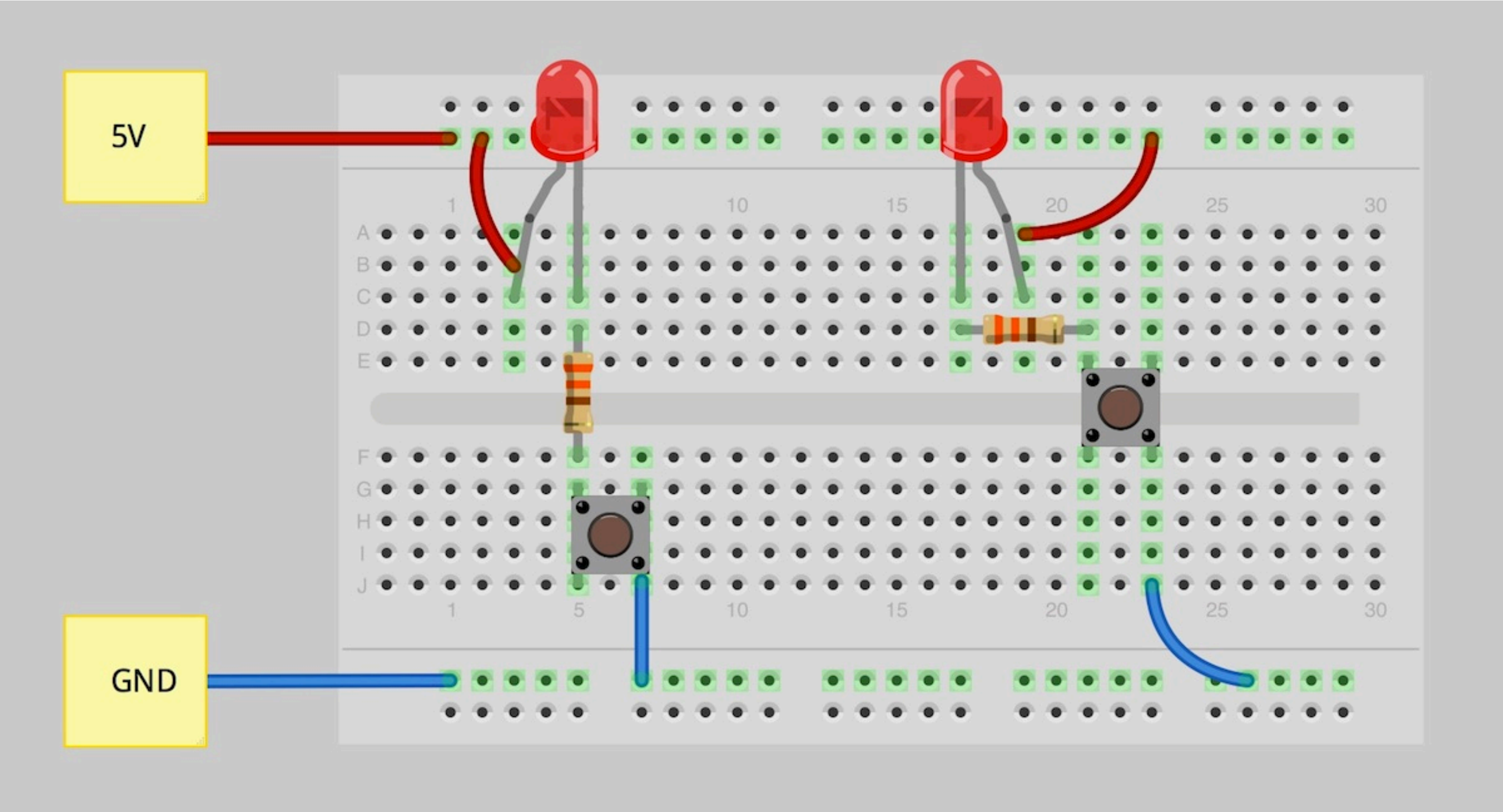
Note: LEDs have a positive and negative (+ / -) Polarity

The longer leg is positive: '+'



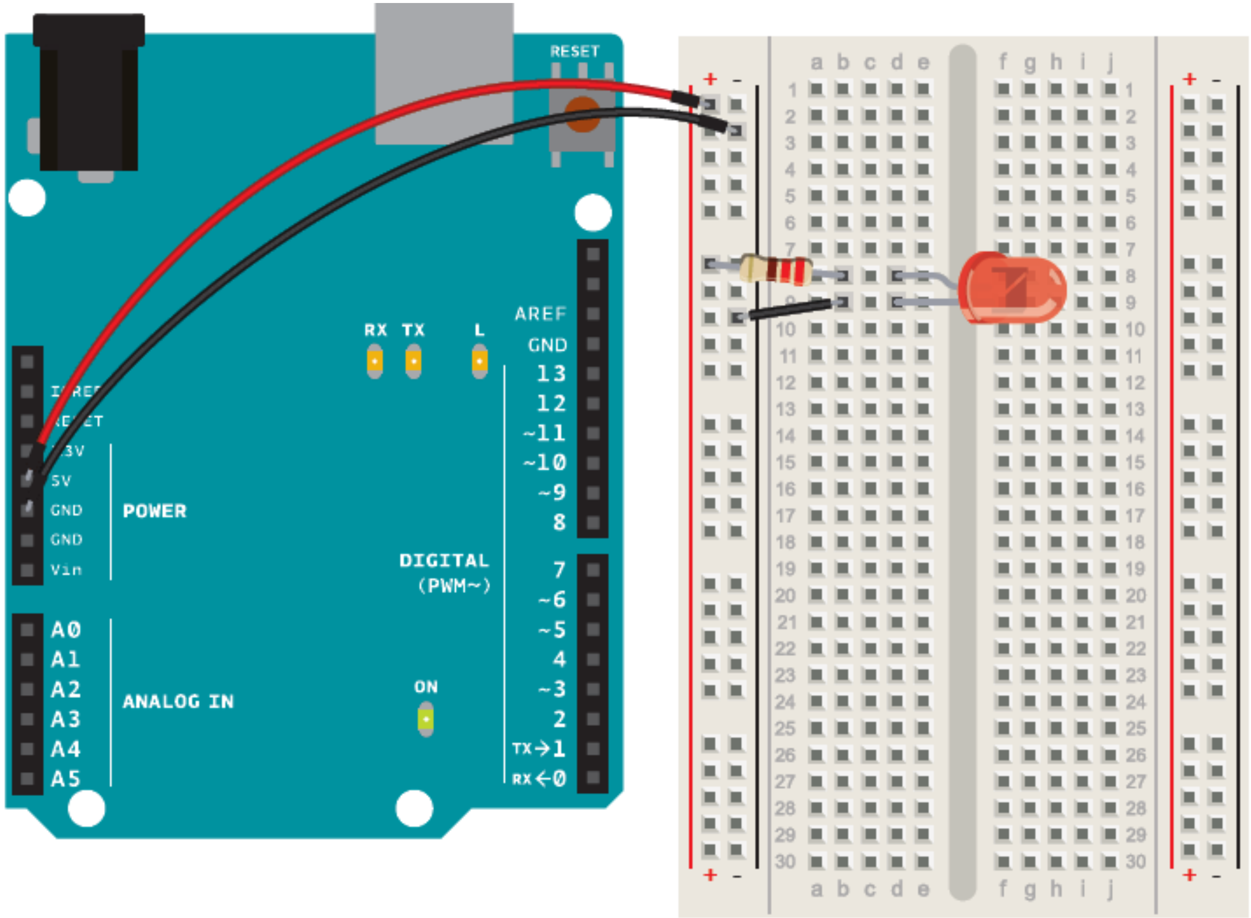


How parts are connected:



Sometimes Ground (GND) is labeled negative '– ' or 0 volts

Wiring power to the breadboard from the Arduino



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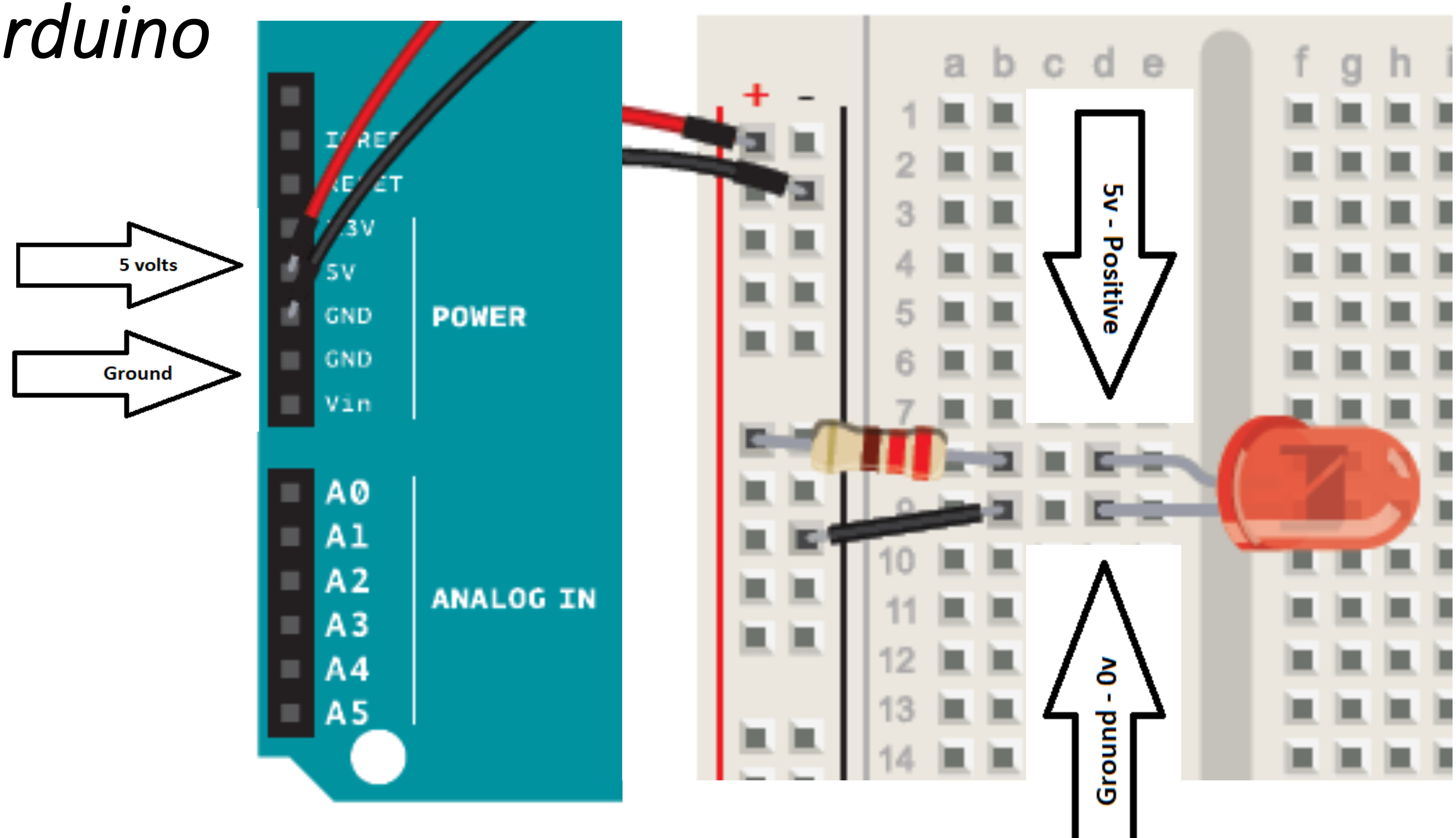
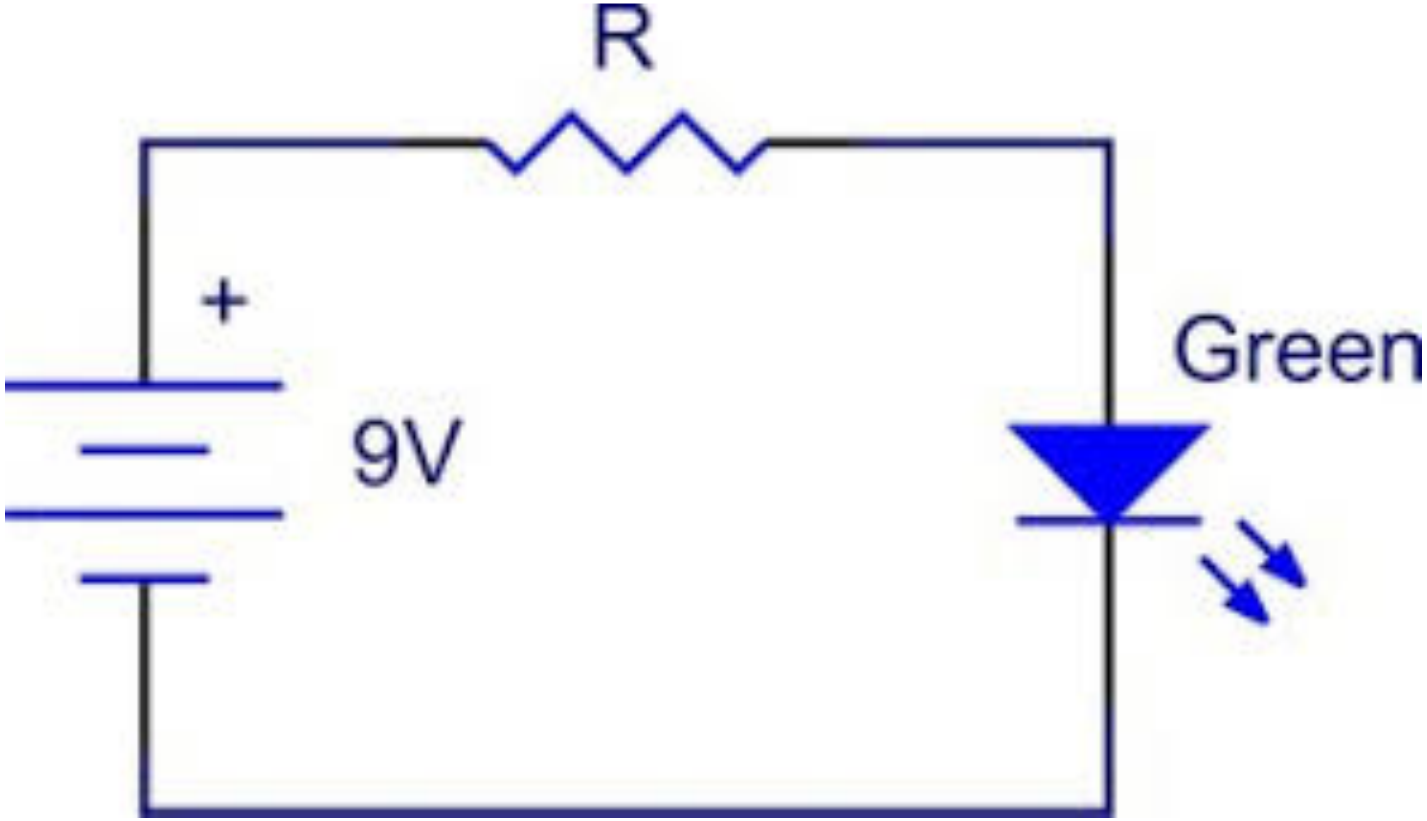
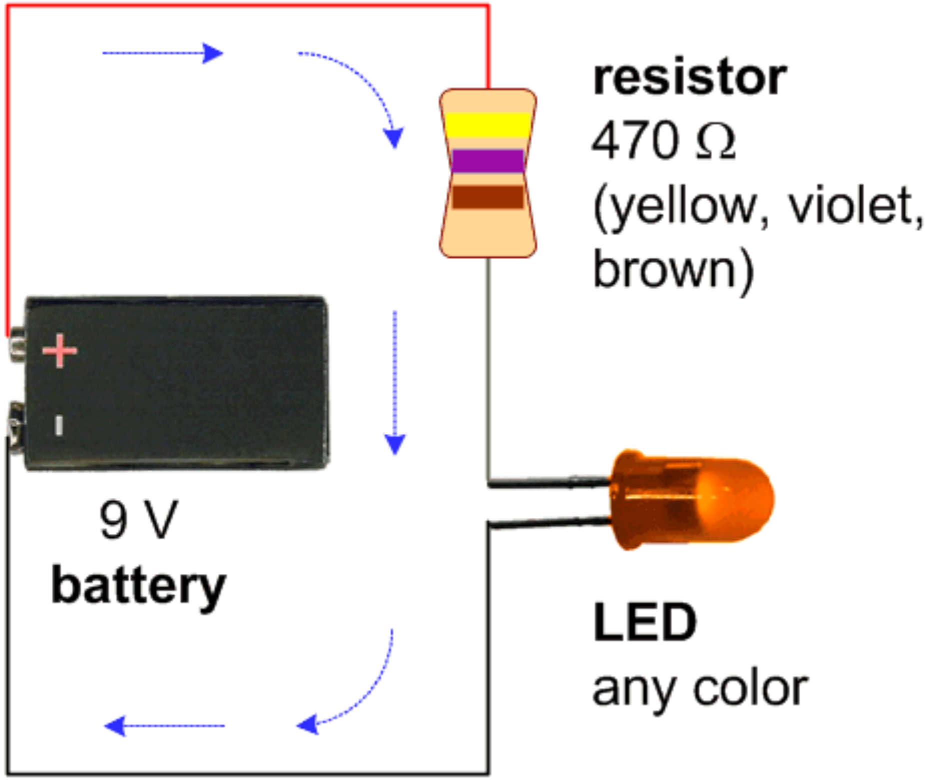
Wiring power to the breadboard from the Arduino

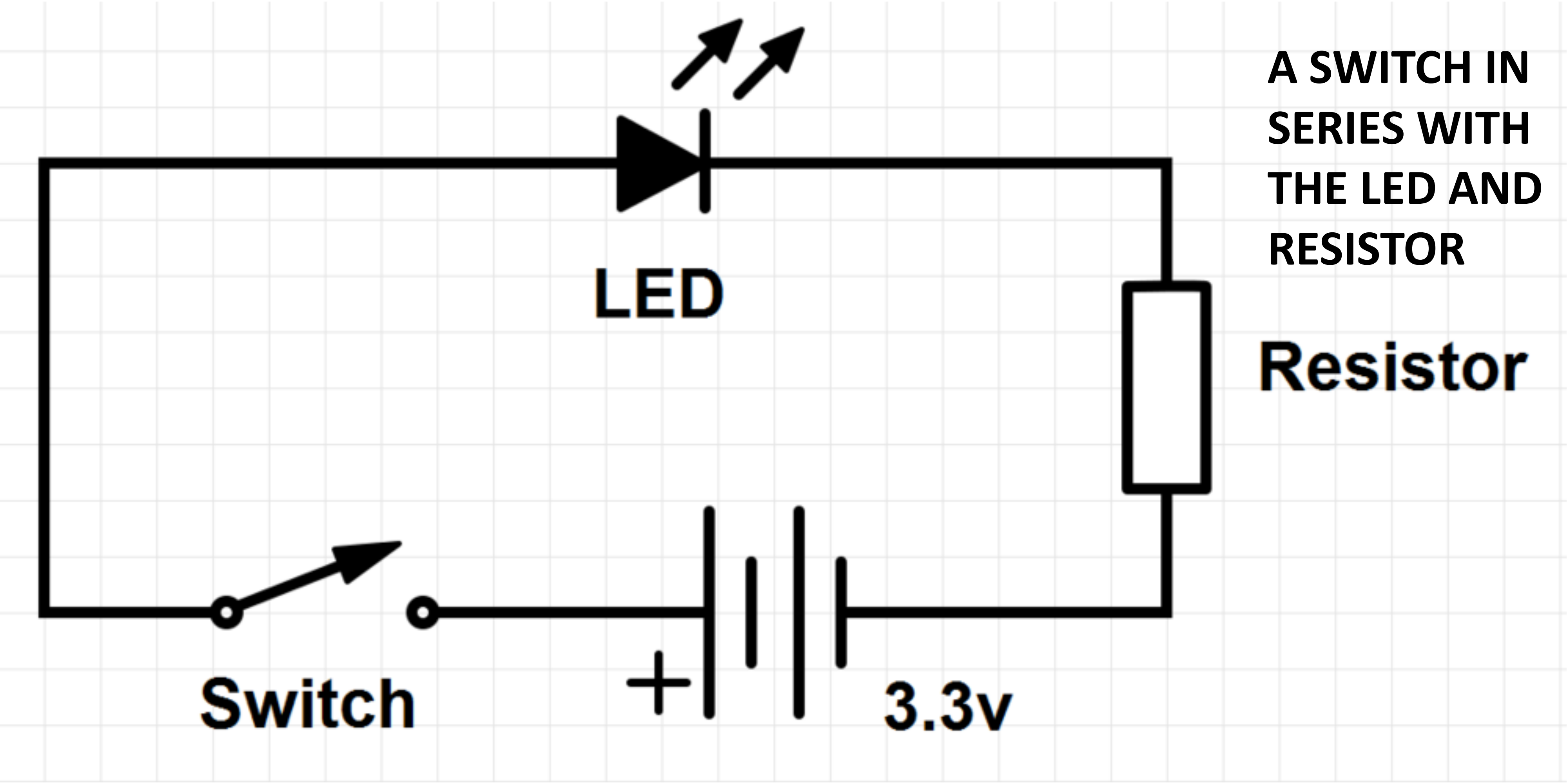


Circuits need to connect to both sides of the power source and with the right polarity: + and –



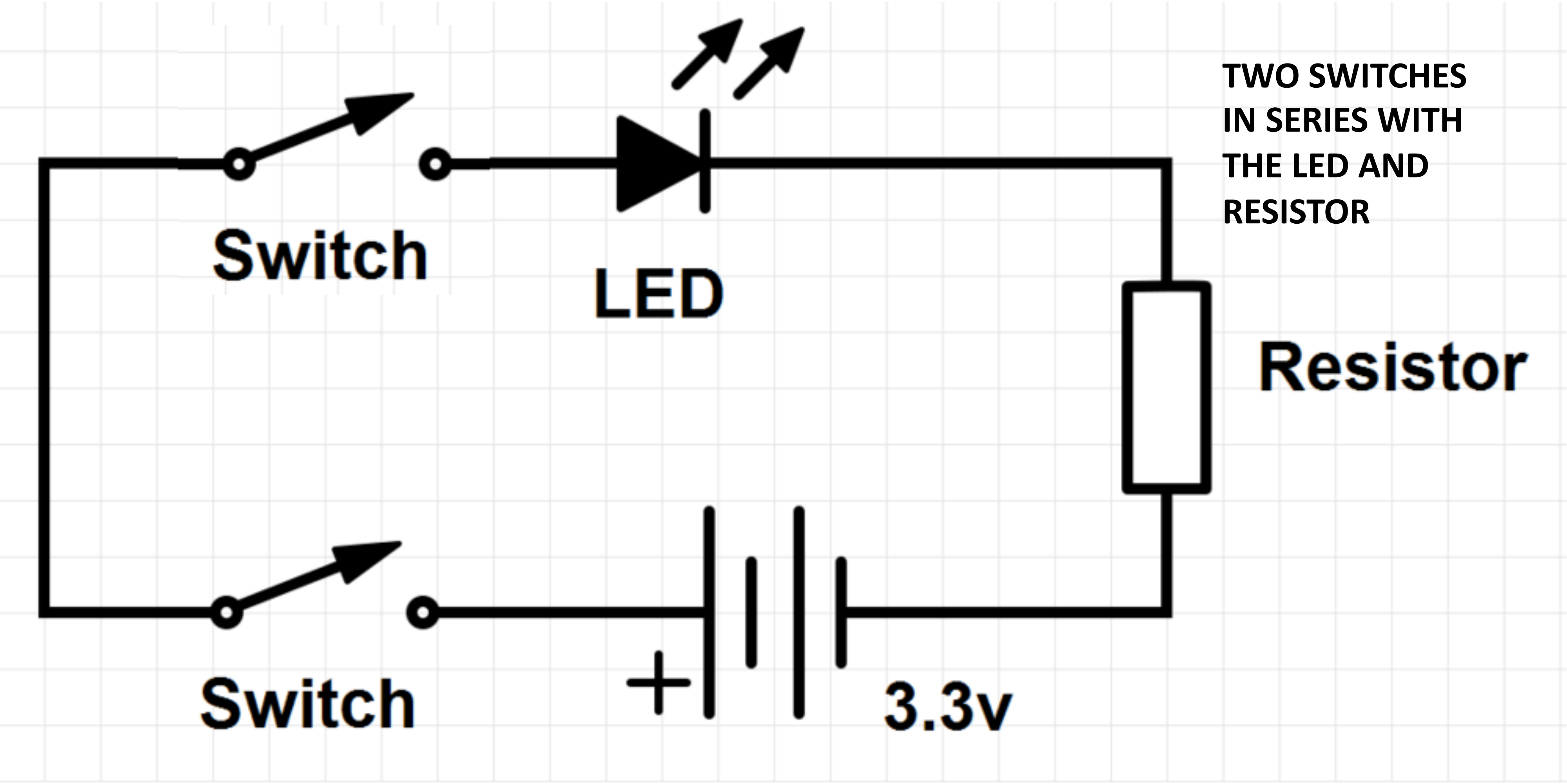


Circuits need to connect to both sides of the battery and with the right polarity: + and –



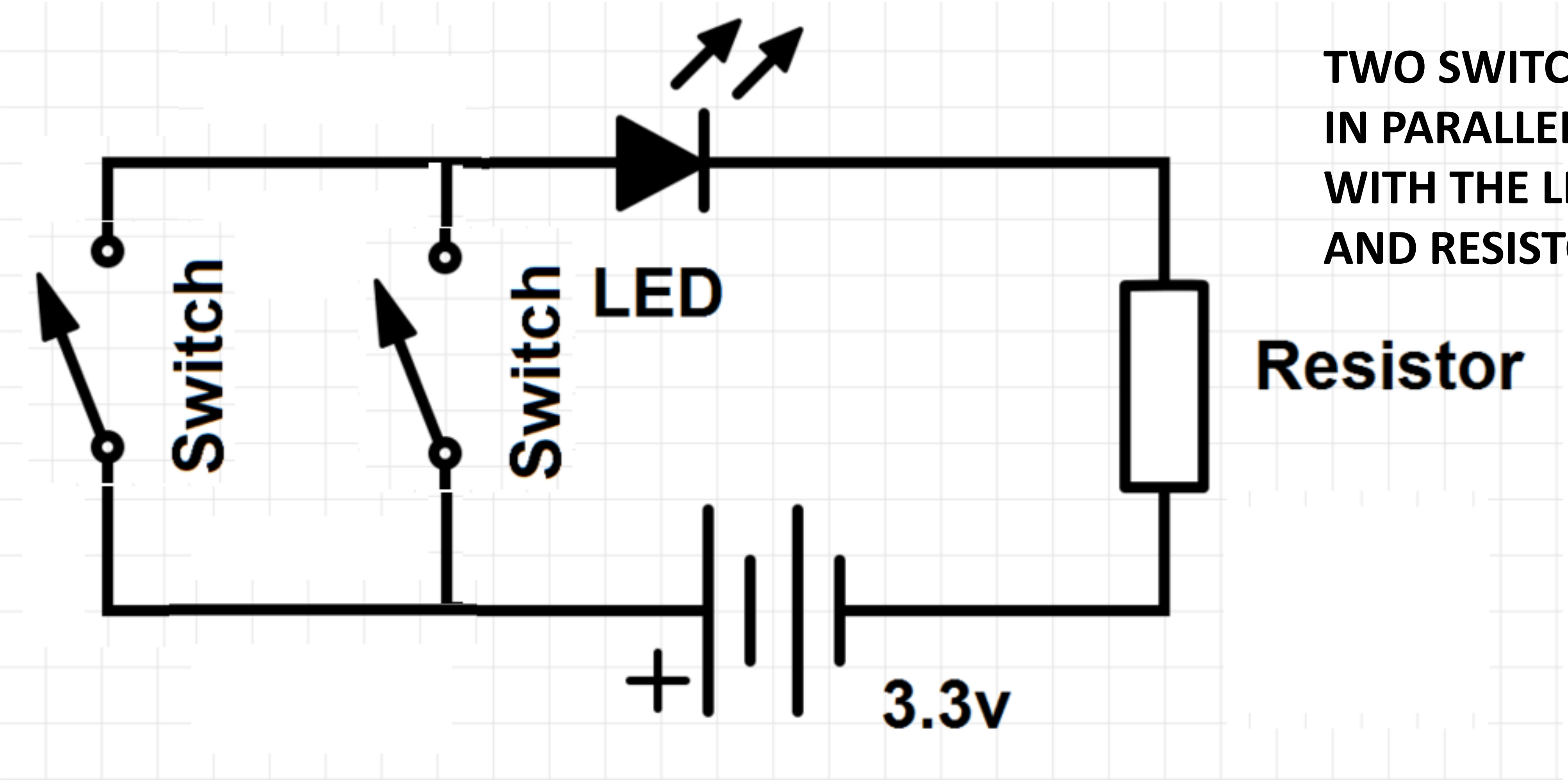
A SWITCH IN SERIES WITH THE LED AND RESISTOR

Circuits need to connect to both sides of the battery and with the right polarity: + and –



TWO SWITCHES IN SERIES WITH THE LED AND RESISTOR

Circuits need to connect to both sides of the battery and with the right polarity: + and –



TWO SWITCHES
IN PARALLEL
WITH THE LED
AND RESISTOR

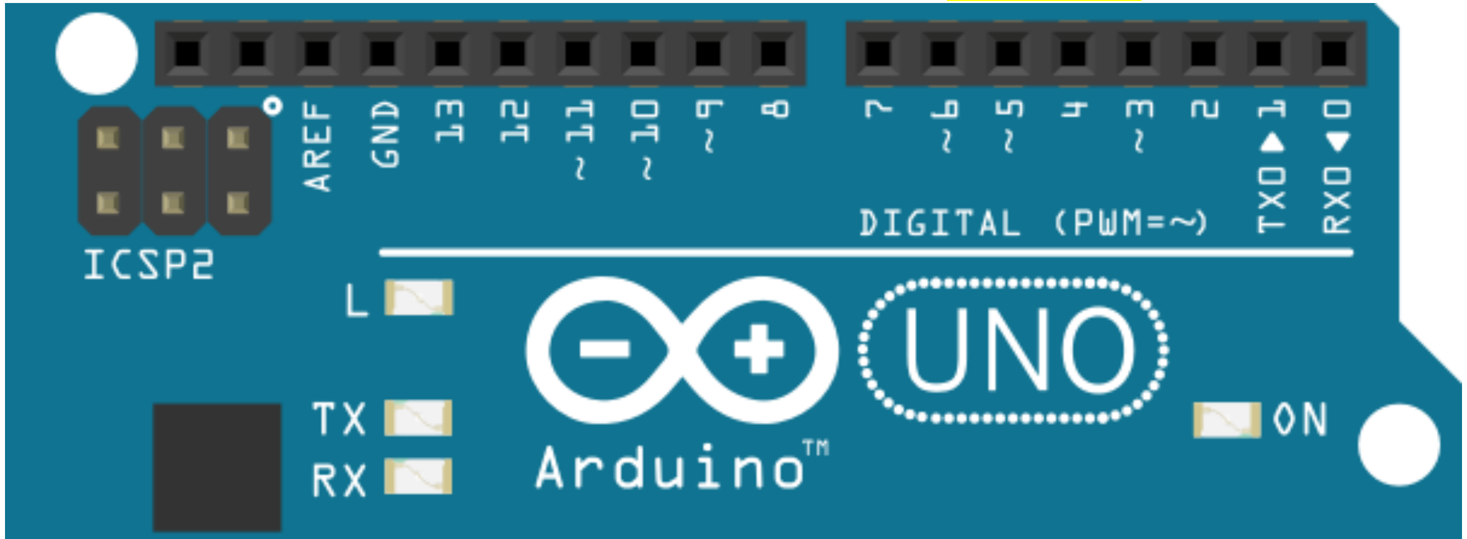
Programming the Arduino – commands

setup()	Initialize the Arduino
loop()	Do over and over – the ‘program’
pinMode(pin,mode)	pin = PIN #, mode = INPUT or OUTPUT
digitalWrite(pin,value)	pin = PIN #, value = HIGH or LOW

pin may be LED_BUILTIN

or a number: 2 through 7

← PIN # →



Programming the Arduino – flashing the LED

```
// LED_BUILTIN = PORT #13

void setup() {                                  // the setup function only runs once
        pinMode(LED_BUILTIN, OUTPUT);           // initialize digital pin LED_BUILTIN as an
output.
}

void loop() {                                   // the loop function runs over and over again forever
        digitalWrite(LED_BUILTIN, HIGH);        // turn the LED on (HIGH is the voltage level)
        delay(1000);                            // wait for 1000 milliseconds
        digitalWrite(LED_BUILTIN, LOW);         // turn the LED off by making the voltage
LOW
        delay(1000);                            // wait for 1000 milliseconds
}
```

Programming the Arduino – Flashing Port #2

```
// Change LED_BUILTIN to 2 to flash the LED connected to PIN #2

void setup() {                          // the setup function only runs once
        pinMode(2, OUTPUT);             // initialize digital pin 2 as an output.
}

void loop() {                           // the loop function runs over and over again
        digitalWrite(2, HIGH);          // turn the LED on (HIGH is the voltage level)
        delay(1000);                    // wait for 1000 milliseconds
        digitalWrite(2, LOW);                   // turn the LED off by making the
voltage LOW
        delay(1000);                    // wait for 1000 milliseconds
}
```

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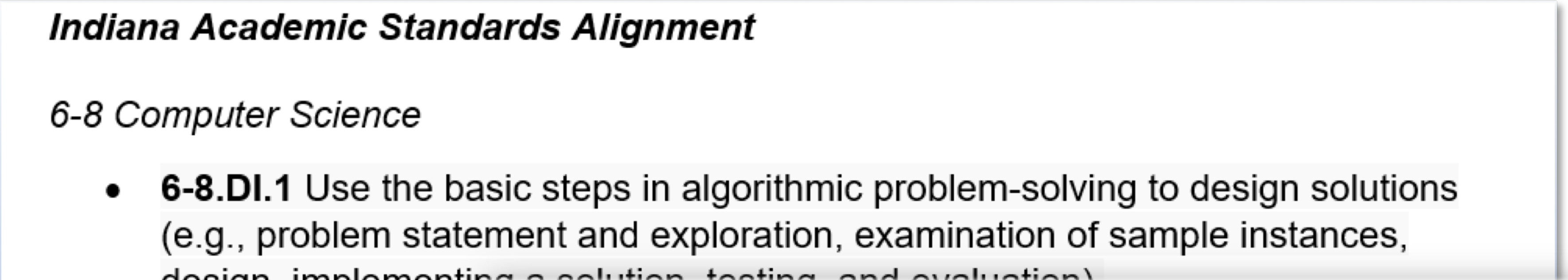
Programming the Arduino – Flashing Port #2 & 3

```
void setup() {                                      // the setup function only runs once
        pinMode(2, OUTPUT);                         // initialize digital pin 2 as an output.
        pinMode(3, OUTPUT);                         // and pin 3
}

void loop() {                              // 'toggle' the LEDs on and off – like a railroad crossing
        digitalWrite(2, HIGH);             // turn on the LED on PIN #2 (HIGH = 5v)
        digitalWrite(3, LOW);              // turn off the LED on PIN #3 (LOW = 0v)
        delay(1000);                       // wait for 1000 milliseconds
        digitalWrite(2, LOW);              // turn off the LED on PIN #2 (LOW = 0v)
        digitalWrite(3, HIGH);             // turn on the LED on PIN #3 (HIGH = 5v)
        delay(1000);                       // wait for 1000 millisecond
}
```

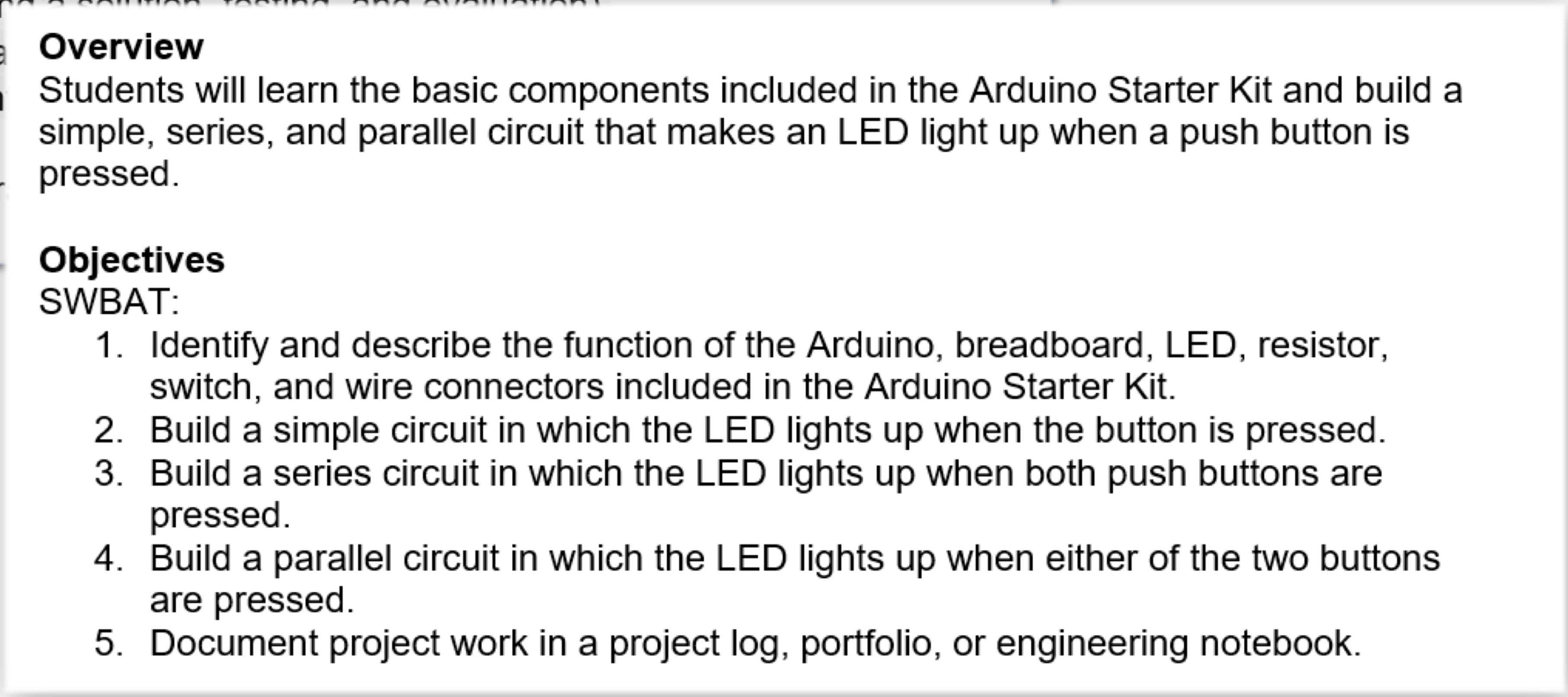
@MakerspaceMary's Arduino Lesson Plans



Indiana Academic Standards Alignment

6-8 Computer Science

- **6-8.DI.1** Use the basic steps in algorithmic problem-solving to design solutions (e.g., problem statement and exploration, examination of sample instances, design, implementing a solution, testing, and evaluation).
- **6-8.DI.5** Demonstra
interact with conten
research.
- **6-8.CD.1** Demonstr
and software.



Overview
Students will learn the basic components included in the Arduino Starter Kit and build a simple, series, and parallel circuit that makes an LED light up when a push button is pressed.

Objectives
SWBAT:

1. Identify and describe the function of the Arduino, breadboard, LED, resistor, switch, and wire connectors included in the Arduino Starter Kit.
2. Build a simple circuit in which the LED lights up when the button is pressed.
3. Build a series circuit in which the LED lights up when both push buttons are pressed.
4. Build a parallel circuit in which the LED lights up when either of the two buttons are pressed.
5. Document project work in a project log, portfolio, or engineering notebook.

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