



Armstrong

School Program 2023-2024

Lesson 2



Armstrong

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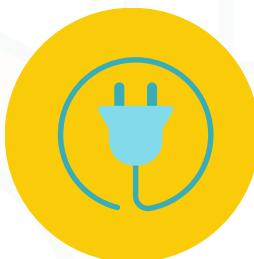
<https://armstrongedu.com/>



Lesson Content



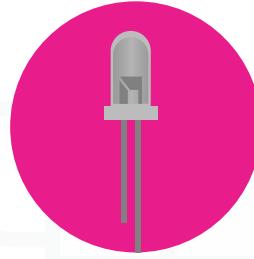
Revising previous lesson



Electrical circuit basics



Getting started with Tinkercad



Blinking LEDs



Remember

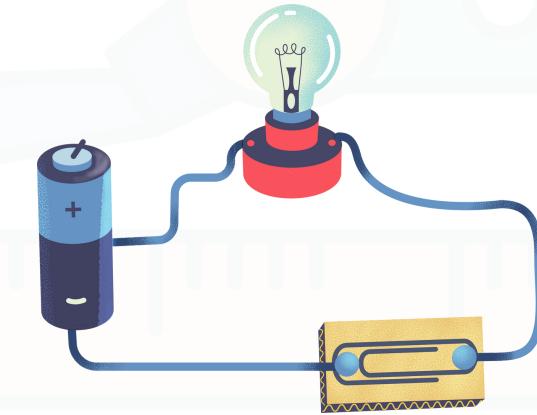
HIGH= on, LOW=off

In programming a pin is **HIGH** when it outputs electricity (led on) and **LOW** when it doesn't output electricity.



Electronic circuits

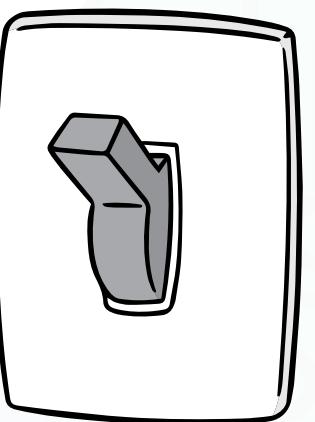
How does a flashlight work?



A flashlight is a device that produces light when you press a button.

what parts are inside a flashlight?

The batteries, the switch, the lamp.



Electronic circuits

Batteries

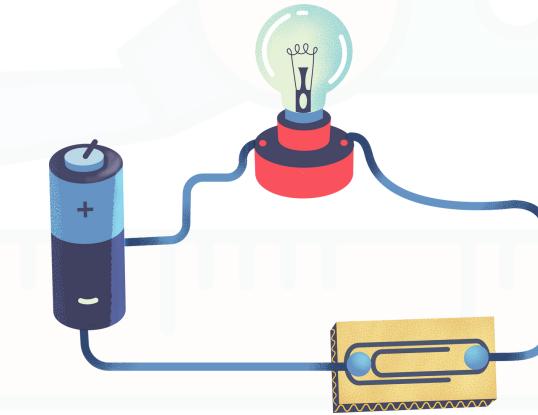
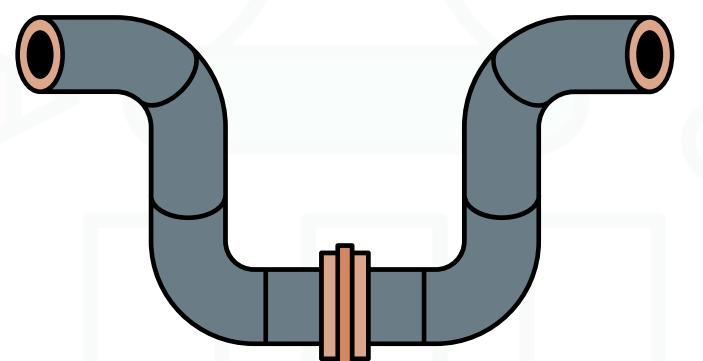


Batteries are like tiny boxes that store electricity.

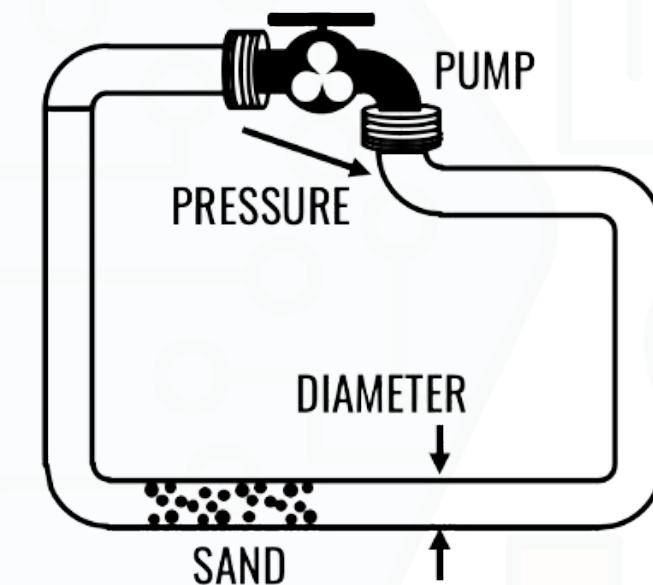
what is electricity?



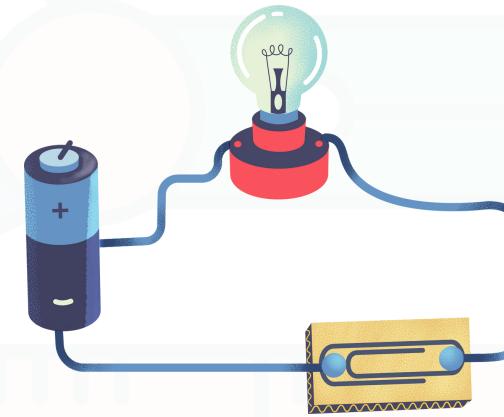
Electricity is a form of energy that can make things move or glow.
Electricity flows like water in a pipe, but it needs a path to follow.



Water



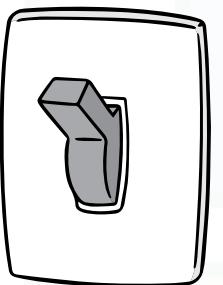
Electronic circuits



What is a circuit?

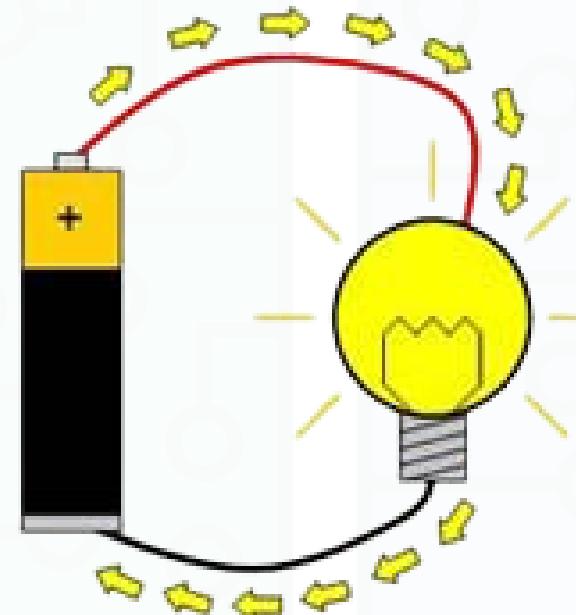
A circuit is like a circle. When a circuit is closed, the electric current can move from the power source, such as a battery, to the device, such as a light bulb, and back to the power source. This makes the device work.

Switch

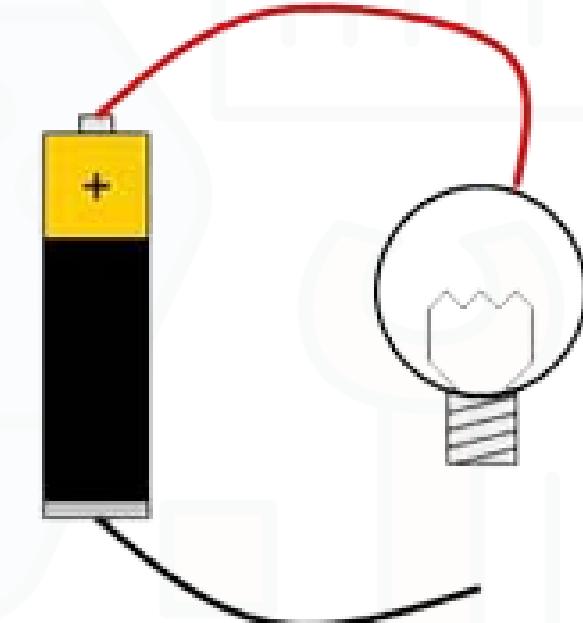


A switch is like a gate that controls the flow of electricity.

Closed circuit



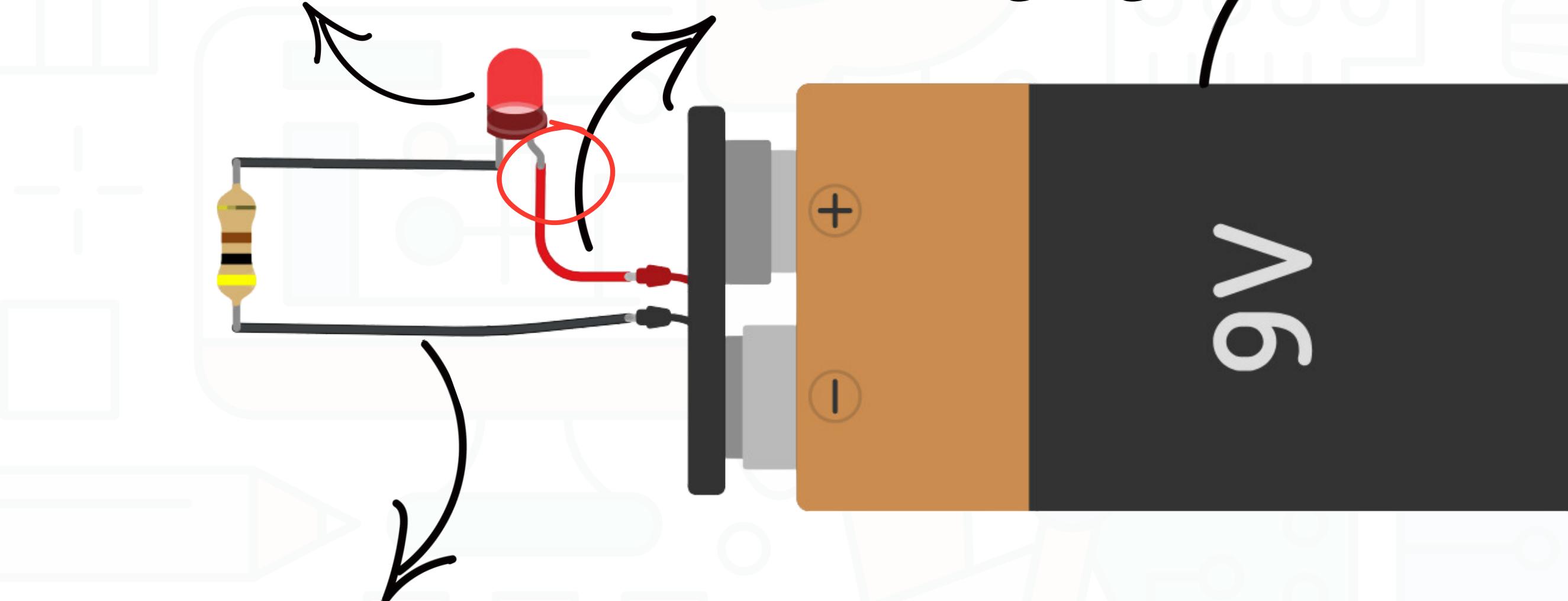
Open circuit



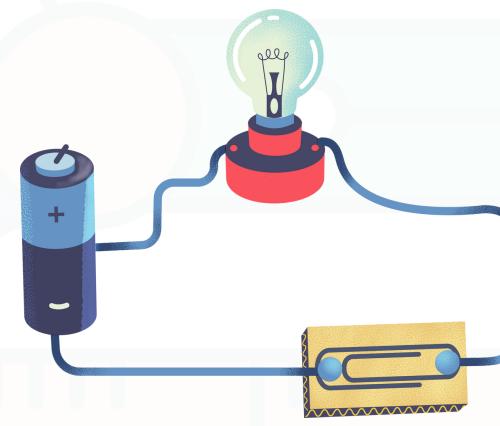
Electronic circuits

Example of a closed circuit

LED + connected to long leg



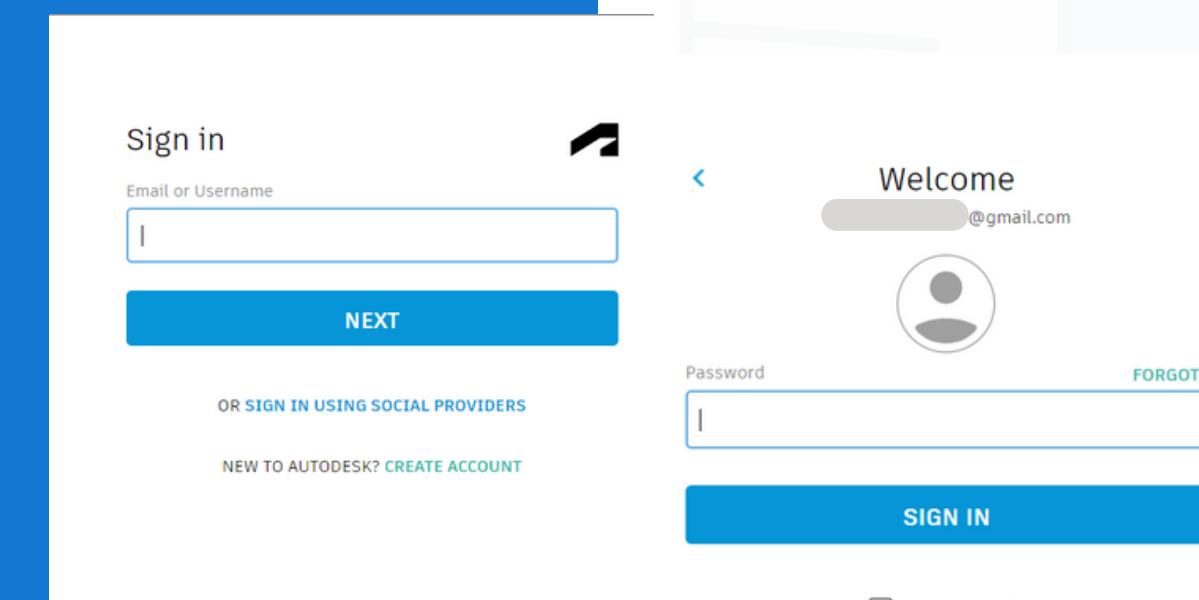
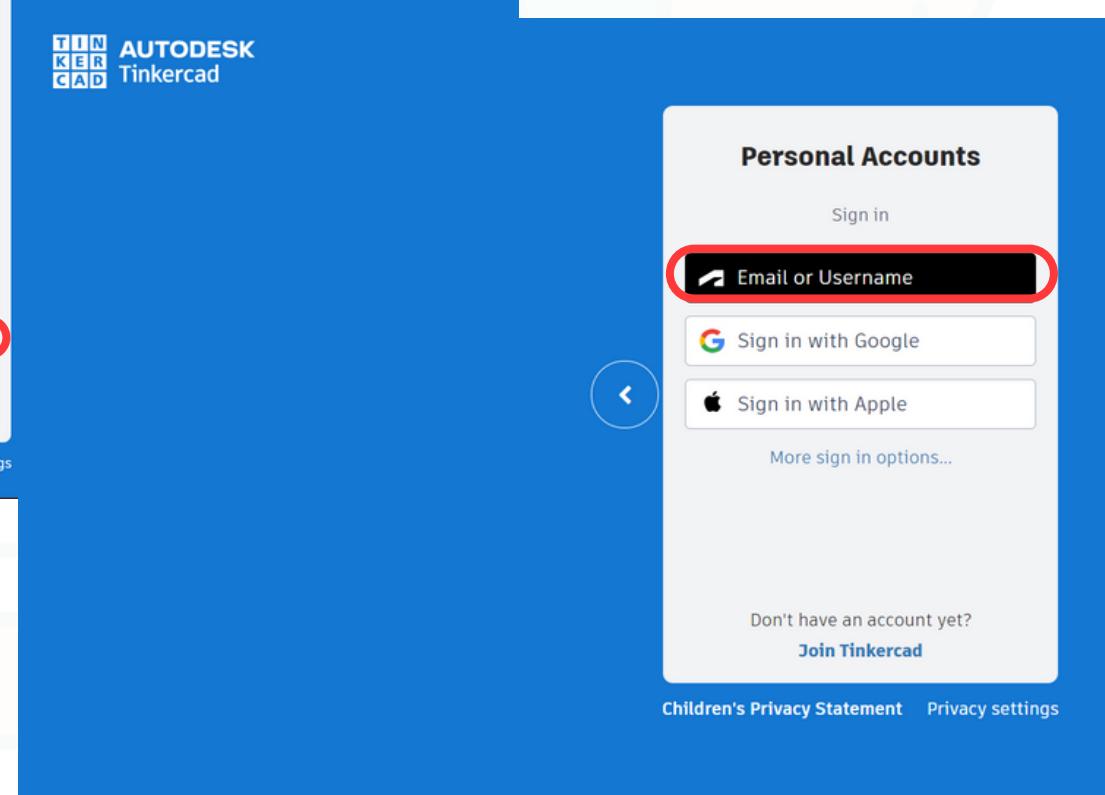
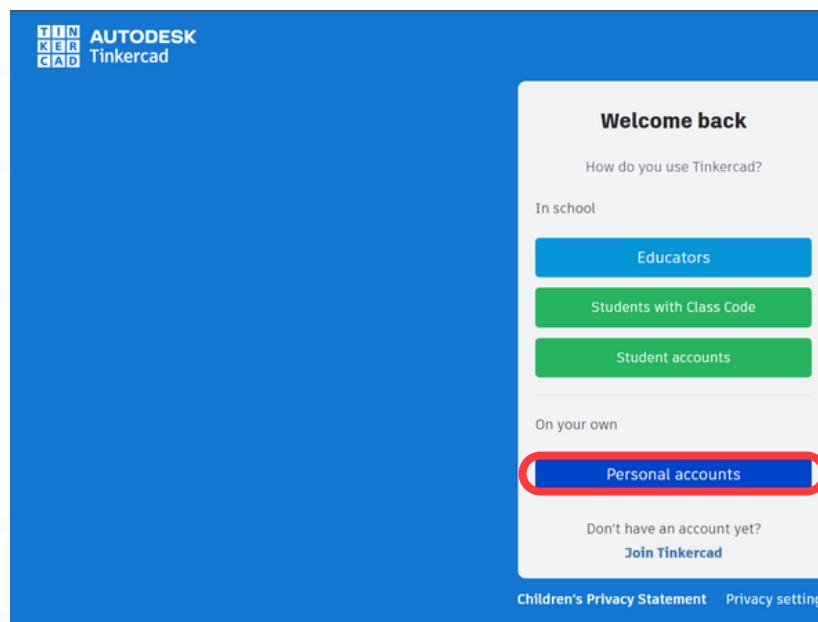
- connected to short LED's leg



battery

Getting started with Tinkercad

Step 1: sign in.



AUTODESK
Tinkercad

Your account for everything Autodesk
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Getting started with

Step 2: create new circuit.

The screenshot shows the Tinkercad interface for creating a new circuit. On the left, the sidebar includes options for 3D Design, Circuit (which is selected), and Codeblocks. The main workspace shows an Arduino Uno connected to a breadboard with various components like resistors, capacitors, and a motor. A red arrow points from the 'Components Basic' dropdown menu to a yellow box labeled 'Select "All" to get all components'. Another red box highlights the 'All' option in the dropdown. A red box also highlights the component library itself. A yellow arrow points from the 'Basic' label to the 'All' label. The top bar shows the user 'Swanky Tumelo' and a 'Rename your circuit' field. A blue box on the left says 'Time is running out to enter the Throwables Challenge and see your design added to the Sim Lab editor!». The right sidebar lists categories like Starters, Basic, Arduino, Micro:Bit, Circuit Assemblies, and All, with specific components like 9V Battery, Coin Cell 3V Battery, and 1.5V Battery listed at the bottom.

Getting started with



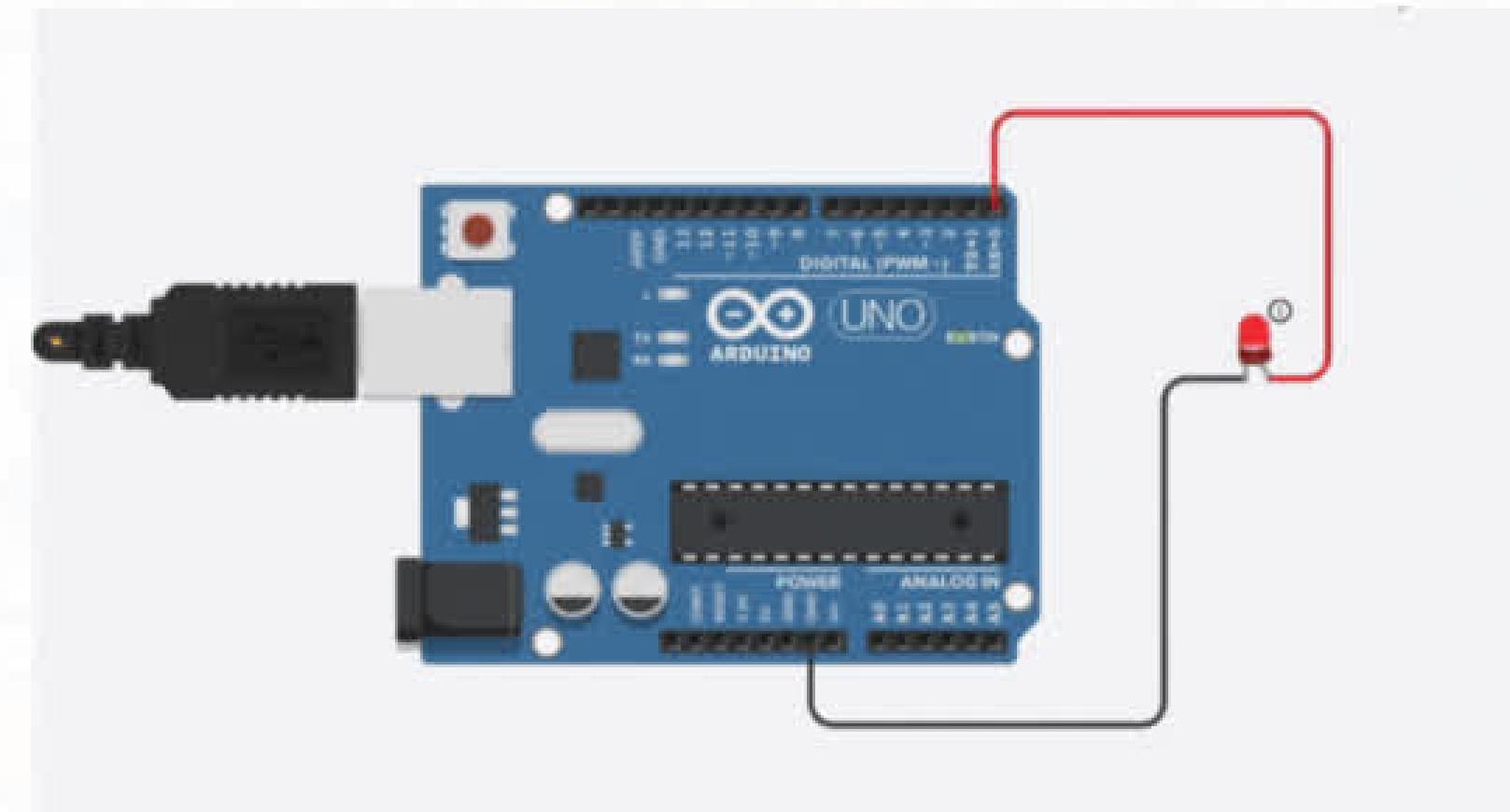
Step 3: connect and simulate.

To change the wire color

The screenshot shows the Tinkercad interface with the following details:

- Toolbar:** Includes standard icons for file operations, selection, and tools, along with a wire color dropdown set to green.
- Project Title:** Push Button Arduino Led
- Breadboard:** A breadboard with a blue Arduino Uno connected. A push button is connected between digital pin 13 and ground. A green wire connects digital pin 13 to the breadboard power rail. A red wire connects the breadboard power rail to the Arduino's 5V pin.
- Components Panel:** Shows categories like Basic, Potentiometer, Capacitor, Slideswitch, 9V Battery, Coin Cell 3V Battery, 1.5V Battery, Breadboard Small, micro:bit, Arduino Uno R3, Vibration Motor, DC Motor, Micro Servo, Hhvhv, NPN, and ILED RGB.
- Wire Color Legend:** A sidebar titled "WIRE COLOR" lists ten options: Black, Red, Orange, Yellow, Green, Turquoise, Blue, Purple, Pink, Brown, Grey, and White. The "Green" option is highlighted.

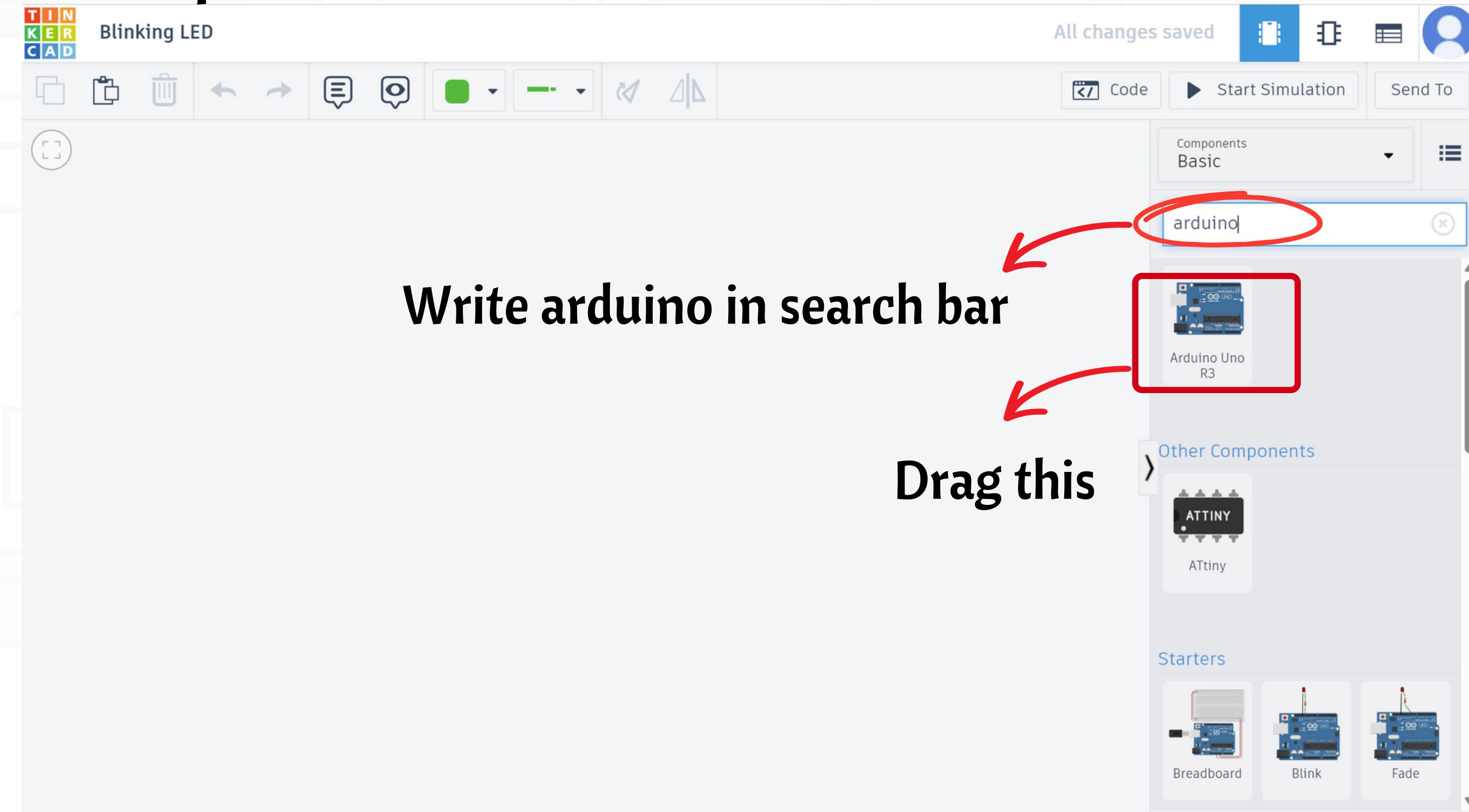
Let's start our first simulation



Blinking LEDs



Step 1: components



The screenshot shows the TINKER CAD interface. At the top left, it says "TINKER CAD" and "Blinking LED". The top right shows "All changes saved" and icons for Code, Start Simulation, and Send To. Below the toolbar is a search bar with "arduino" typed in, circled in red with a red arrow pointing to it from the text "Write arduino in search bar". The main area is a component library with sections for "Components Basic", "Other Components", and "Starters". Under "Components Basic", there is a highlighted "Arduino Uno R3" component, also circled in red with a red arrow pointing to it from the text "Drag this". Other components shown include ATTINY and various starters like Breadboard, Blink, and Fade.

Write arduino in search bar

Drag this

Blinking LEDs



Step 1: components

TINKERCAD Blinking LED All changes saved Code Start Simulation Send To

Components Basic

led

LED LED RGB

Other Components

NeoPixel NeoPixel Jewel NeoPixel Ring 12

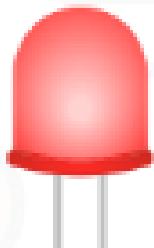
NeoPixel Ring 16 NeoPixel Ring 24 NeoPixel Strip 4

6 8 10

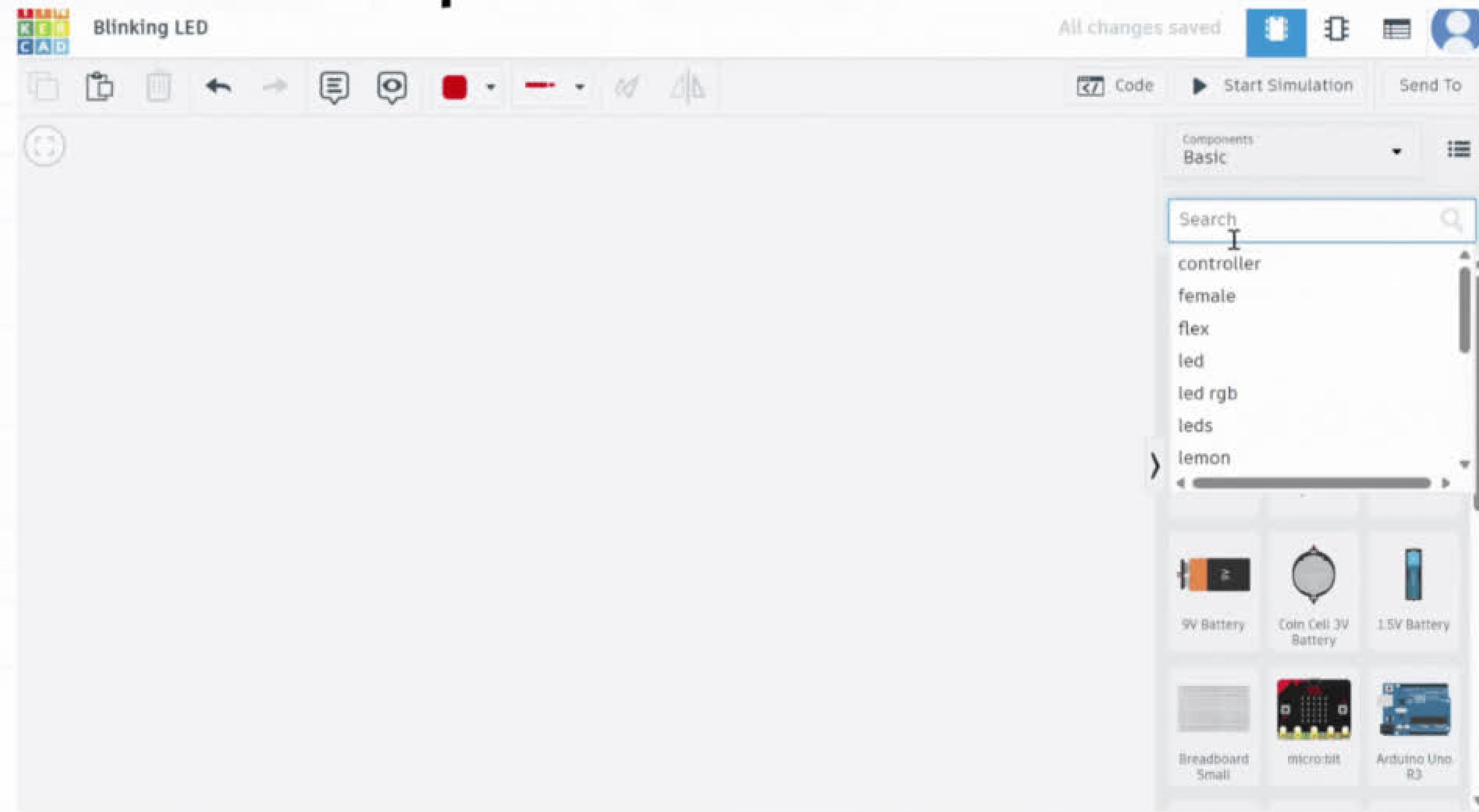
Write led in search bar

Drag this

Blinking LEDs



Step 2: Connect components

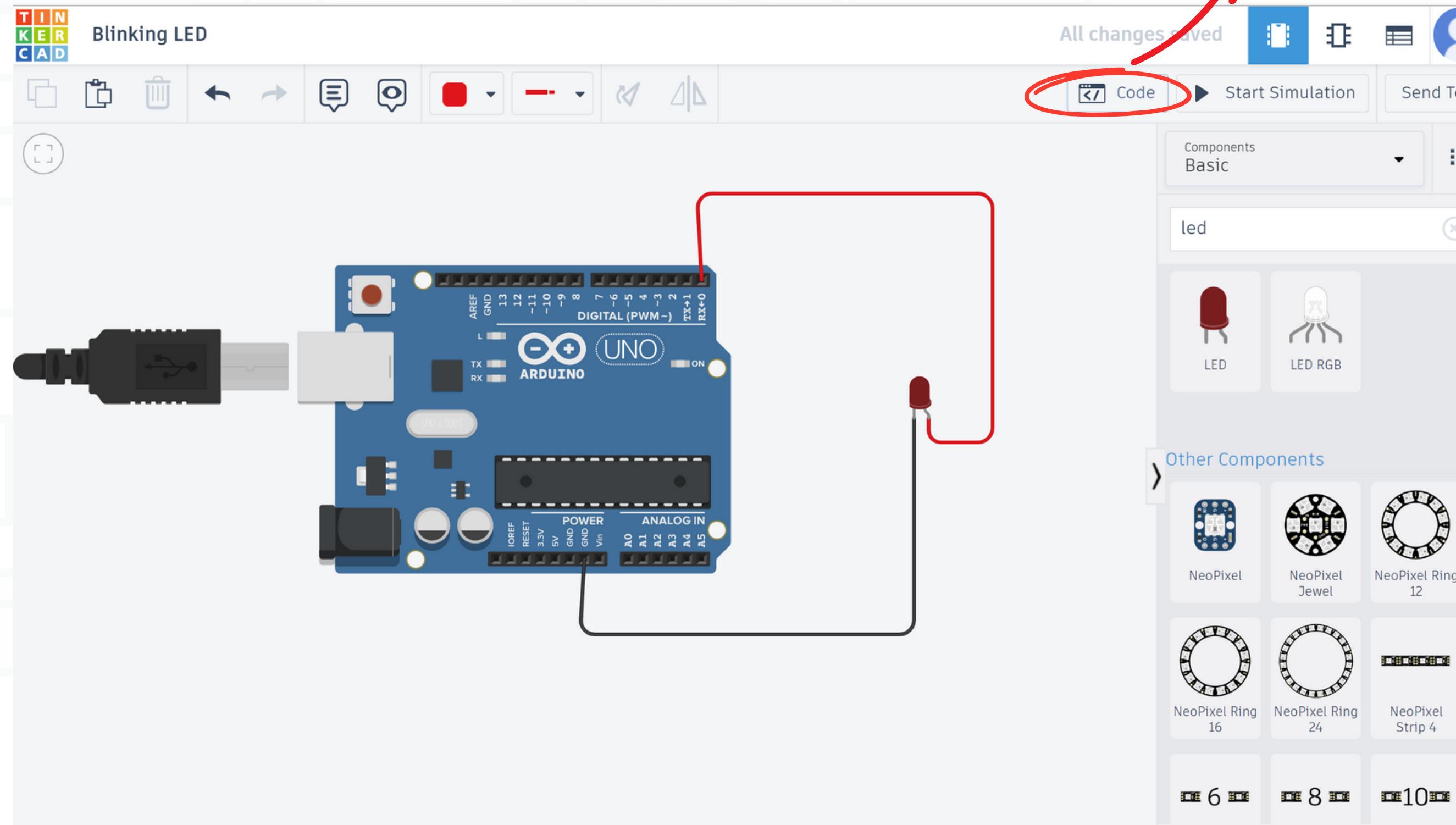


The screenshot shows the KEEPCAD software interface. The title bar says "Blinking LED". The top menu includes "File", "Edit", "Design", "Tools", "Help", "Code", "Start Simulation", and "Send To". A search bar at the top right contains the text "All changes saved". On the left, there's a toolbar with icons for file operations like Open, Save, Print, and a breadboard. The main workspace is currently empty. On the right, a component library is open under "Components Basic". A search bar here also contains "I". Below it is a list of components starting with "controller", followed by "female", "flex", "led", "led rgb", "leds", and "lemon". At the bottom of the library are icons for "9V Battery", "Coin Cell 3V Battery", "1.5V Battery", "Breadboard Small", "micro:bit", and "Arduino Uno R3".

Blinking LEDs

Step 3: Write code to blink one LED

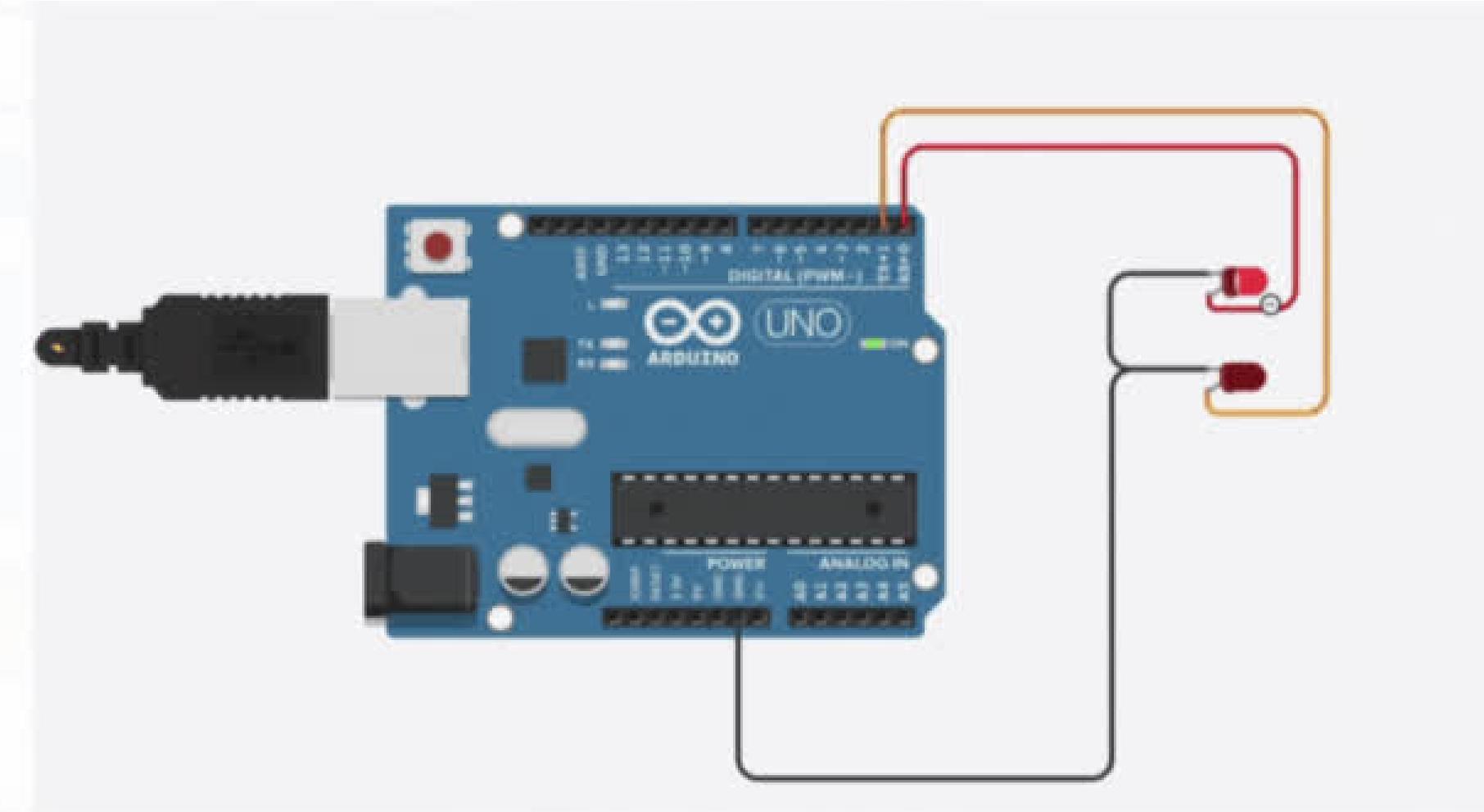
Click here to write code



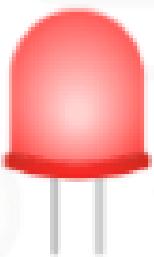
Blinking LEDs



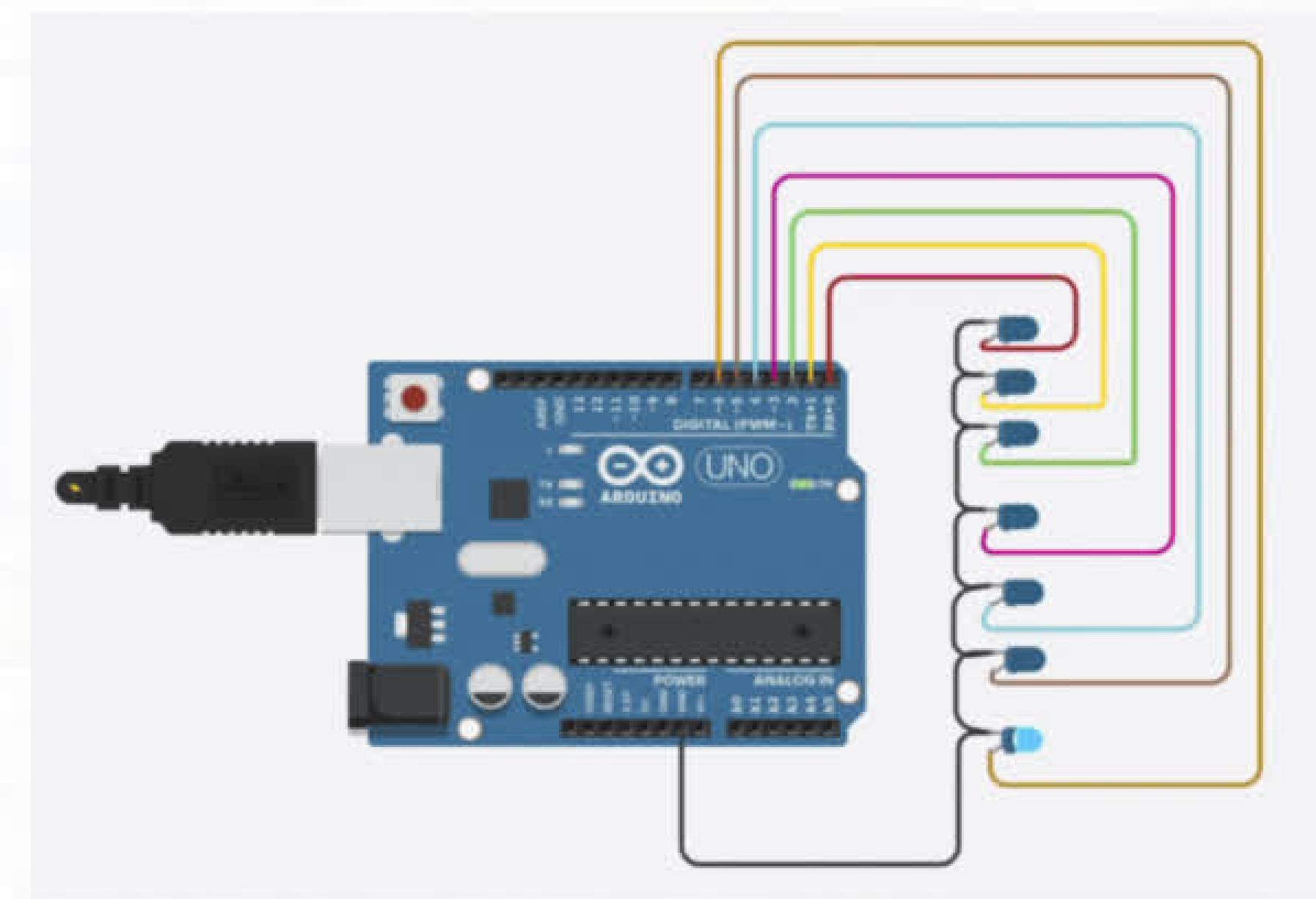
Mission 1: Blink 2 LEDs



Blinking LEDs



Mission 2: Blink 7 LEDs



Code

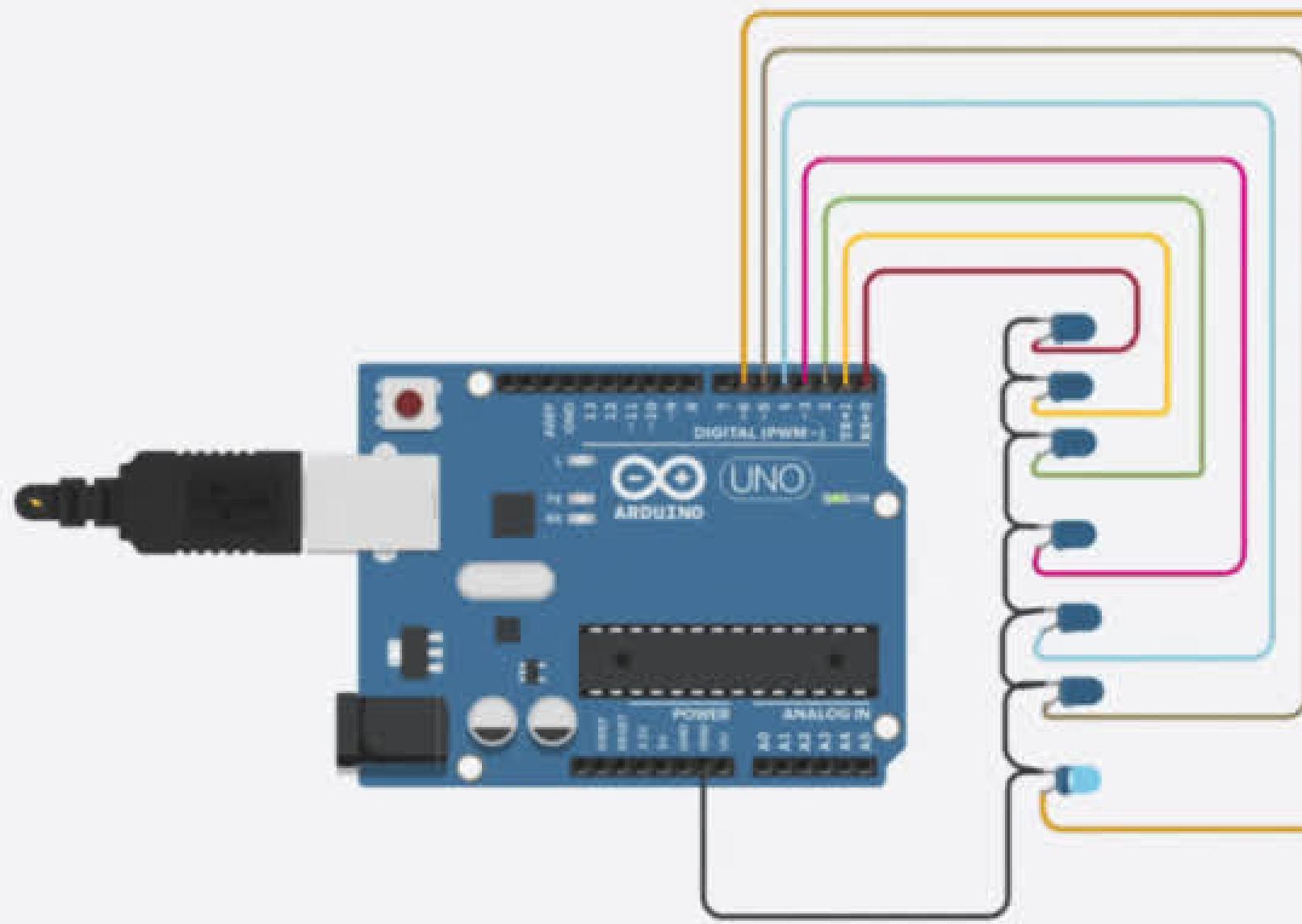


```
void setup() {  
    pinMode(0, OUTPUT);  
    pinMode(1, OUTPUT);  
    pinMode(2, OUTPUT);  
    pinMode(3, OUTPUT);  
    pinMode(4, OUTPUT);  
    pinMode(5, OUTPUT);  
    pinMode(6, OUTPUT);  
}
```

Code



Mission 2: Blink 7 LEDs



```
void loop() {
    //blink led 0
    digitalWrite(0, HIGH);
    delay(1000);
    digitalWrite(0, LOW);
    delay(1000);

    //blink led 1
    digitalWrite(1, HIGH);
    delay(1000);
    digitalWrite(1, LOW);
    delay(1000);

    //blink led 2
    digitalWrite(2, HIGH);
    delay(1000);
    digitalWrite(2, LOW);
    delay(1000);
```

```
digitalWrite(3, HIGH);
delay(1000);
digitalWrite(3, LOW);
delay(1000);

//blink led 4
digitalWrite(4, HIGH);
delay(1000);
digitalWrite(4, LOW);
delay(1000);

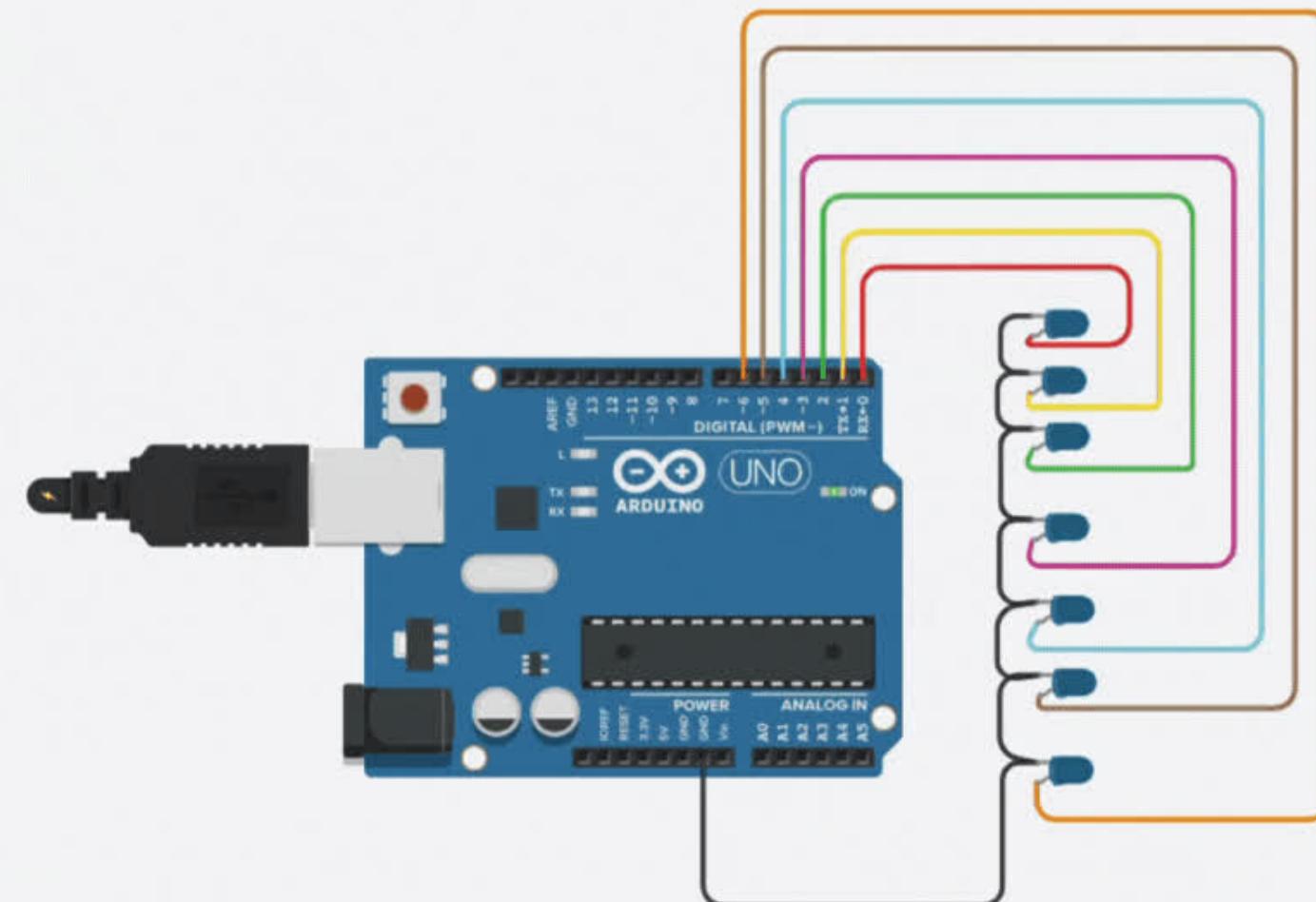
//blink led 5
digitalWrite(5, HIGH);
delay(1000);
digitalWrite(5, LOW);
delay(1000);
```

Same Goes for LED 6

Blinking LEDs



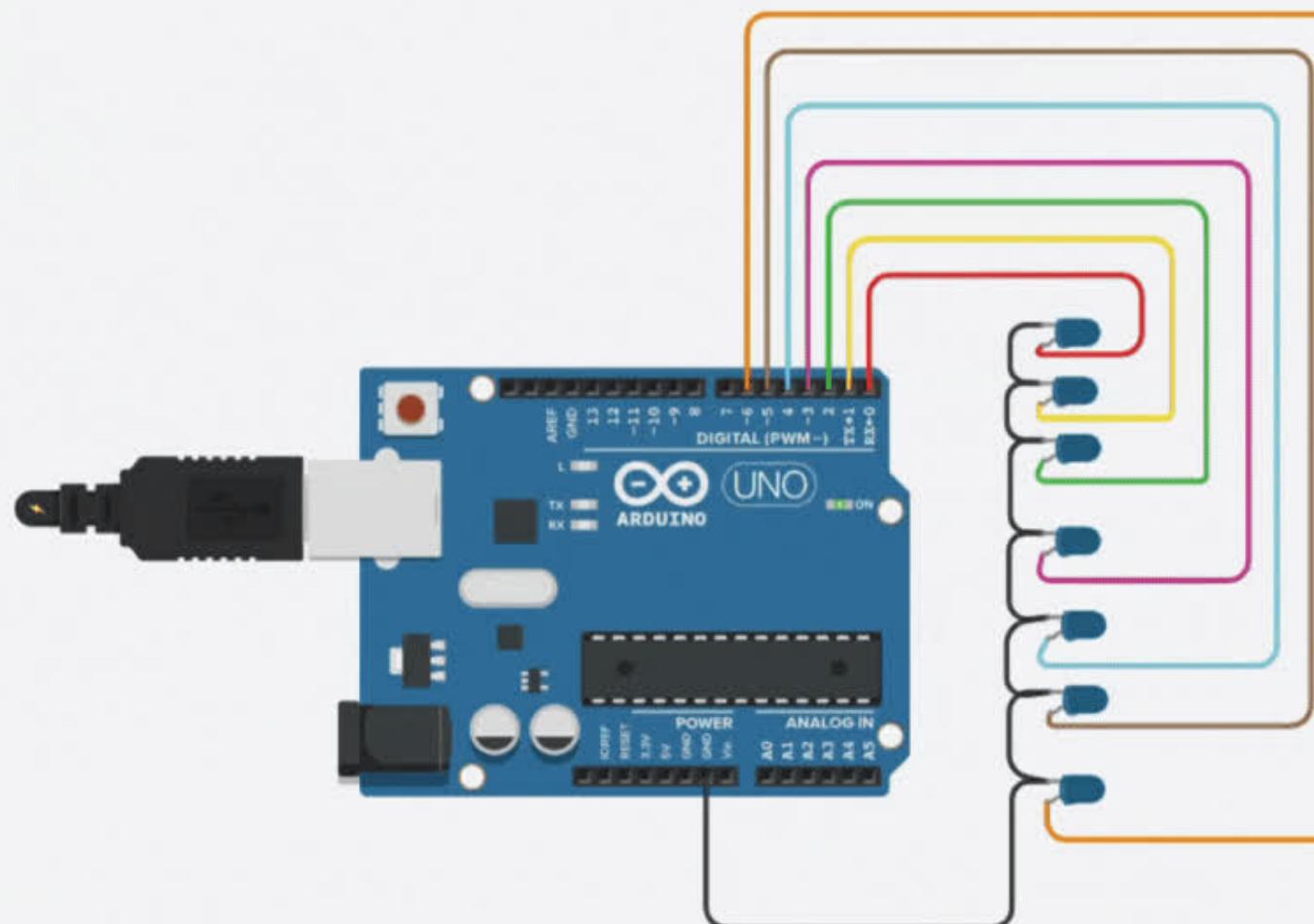
Mission 3: Blink 7 LEDs with pattern #1



Code



Mission 3: Blink 7 LEDs with pattern #1



HIGH

```
void loop() {
    //light led 0
    digitalWrite(0, HIGH);
    delay(1000);

    //light led 1
    digitalWrite(1, HIGH);
    delay(1000);

    //light led 2
    digitalWrite(2, HIGH);
    delay(1000);

    //light led 3
    digitalWrite(3, HIGH);
    delay(1000);

    //light led 4
    digitalWrite(4, HIGH);
    delay(1000);

    //light led 5
    digitalWrite(5, HIGH);
    delay(1000);

    //light led 6
    digitalWrite(6, HIGH);
    delay(1000);
}
```

LOW

```
//turn off led 6
digitalWrite(6, LOW);
delay(1000);

//turn off led 5
digitalWrite(5, LOW);
delay(1000);

//turn off led 4
digitalWrite(4, LOW);
delay(1000);

//turn off led 3
digitalWrite(3, LOW);
delay(1000);

//turn off led 2
digitalWrite(2, LOW);
delay(1000);

//turn off led 1
digitalWrite(1, LOW);
delay(1000);

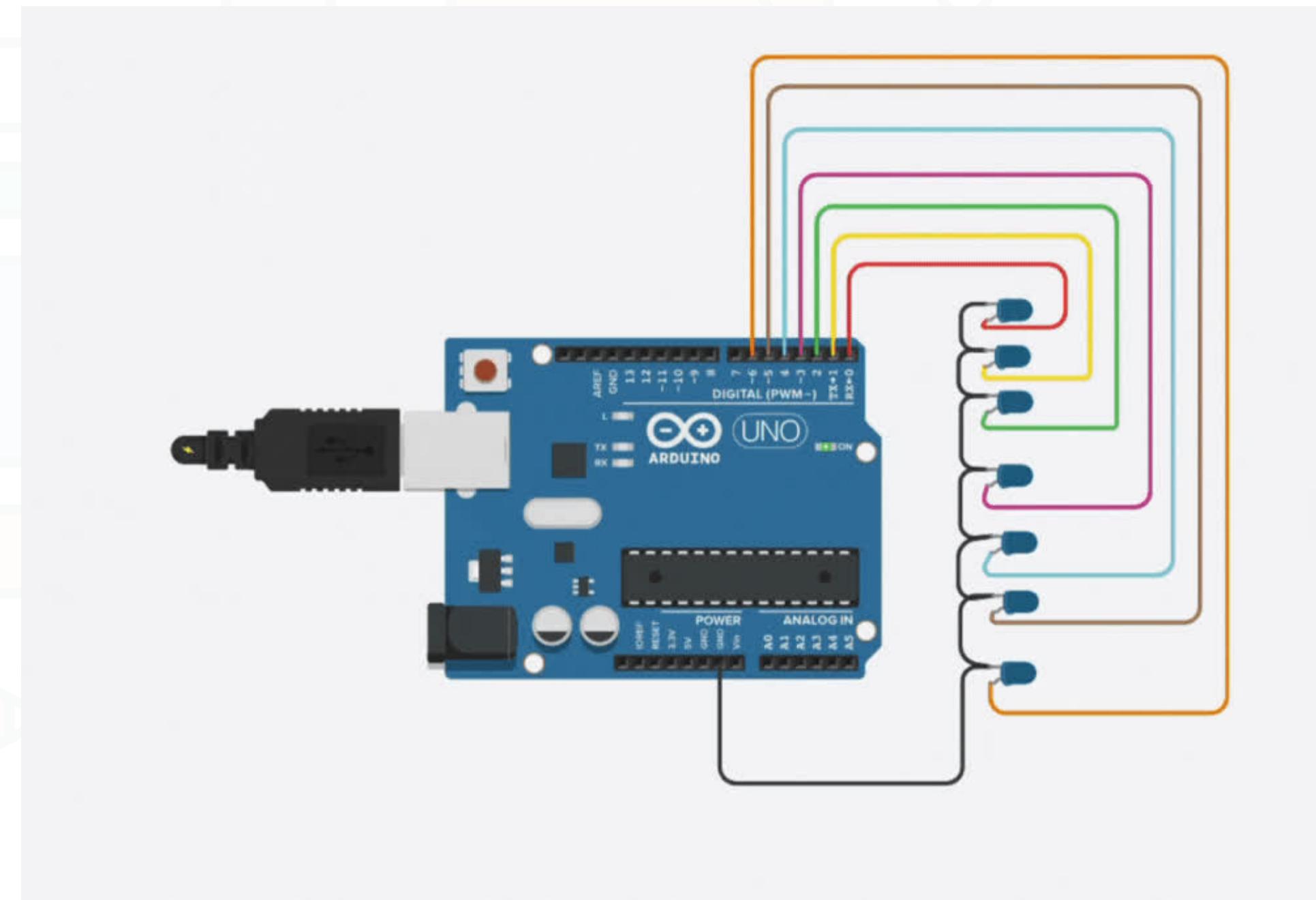
//turn off led 0
digitalWrite(0, LOW);
delay(1000);

}
```

Blinking LEDs



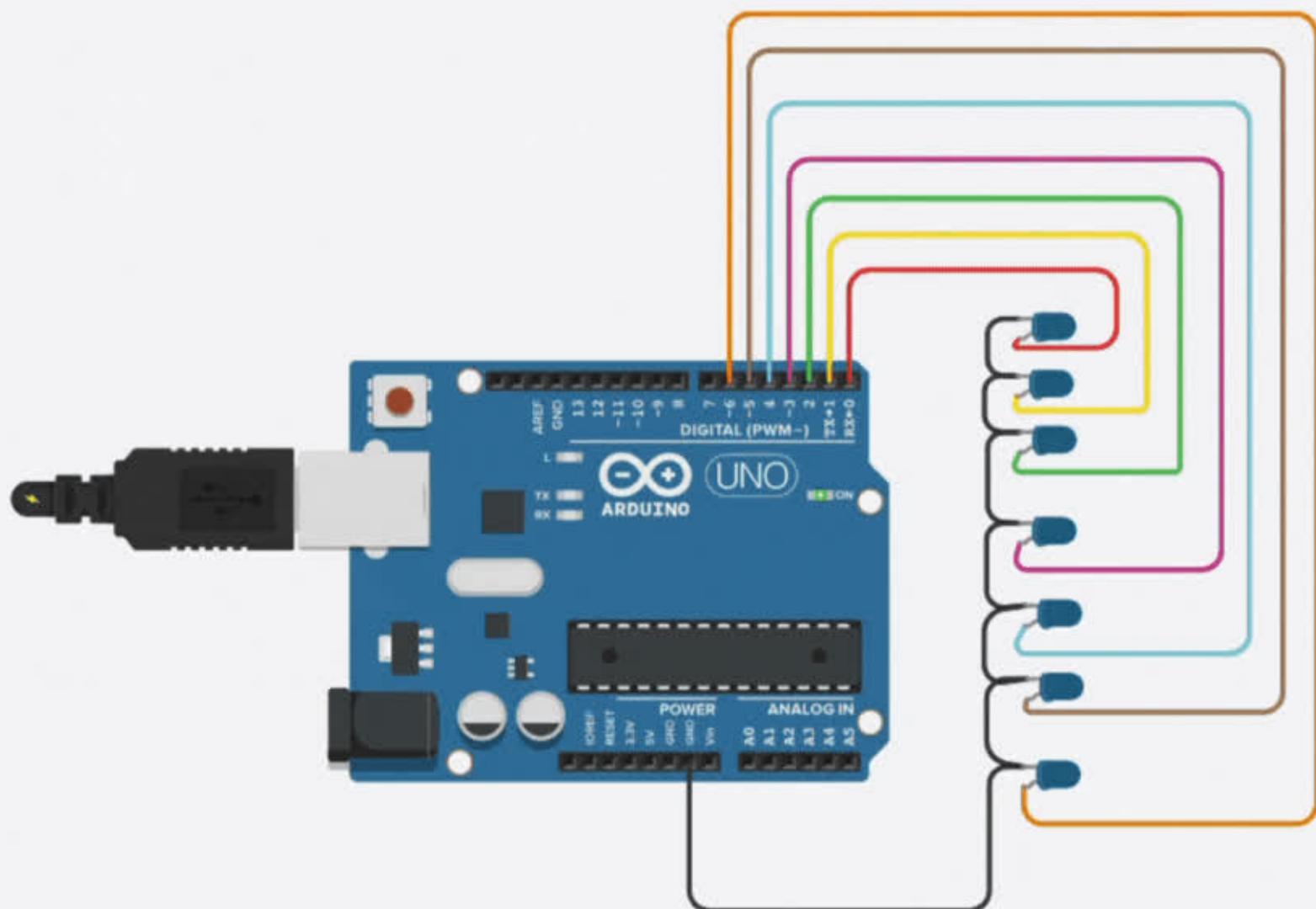
Mission 4: Blink 7 LEDs with pattern #2



Code



Mission 4: Blink 7 LEDs with pattern #2



```
void loop() {
    digitalWrite(0, HIGH);
    digitalWrite(1, HIGH);
    delay(1000);

    //turn off the back
    digitalWrite(0, LOW);
    //turn on the front
    digitalWrite(2, HIGH);
    delay(1000);

    //turn off the back
    digitalWrite(1, LOW);
    //turn on the front
    digitalWrite(3, HIGH);
    delay(1000);

    //turn off the back
    digitalWrite(2, LOW);
    //turn on the front
    digitalWrite(4, HIGH);
    delay(1000);

    //turn off last 2 LEDs
    digitalWrite(5, LOW);
    digitalWrite(6, LOW);
    delay(1000);
}
```

```
//turn off the back
digitalWrite(3, LOW);
//turn on the front
digitalWrite(5, HIGH);
delay(1000);

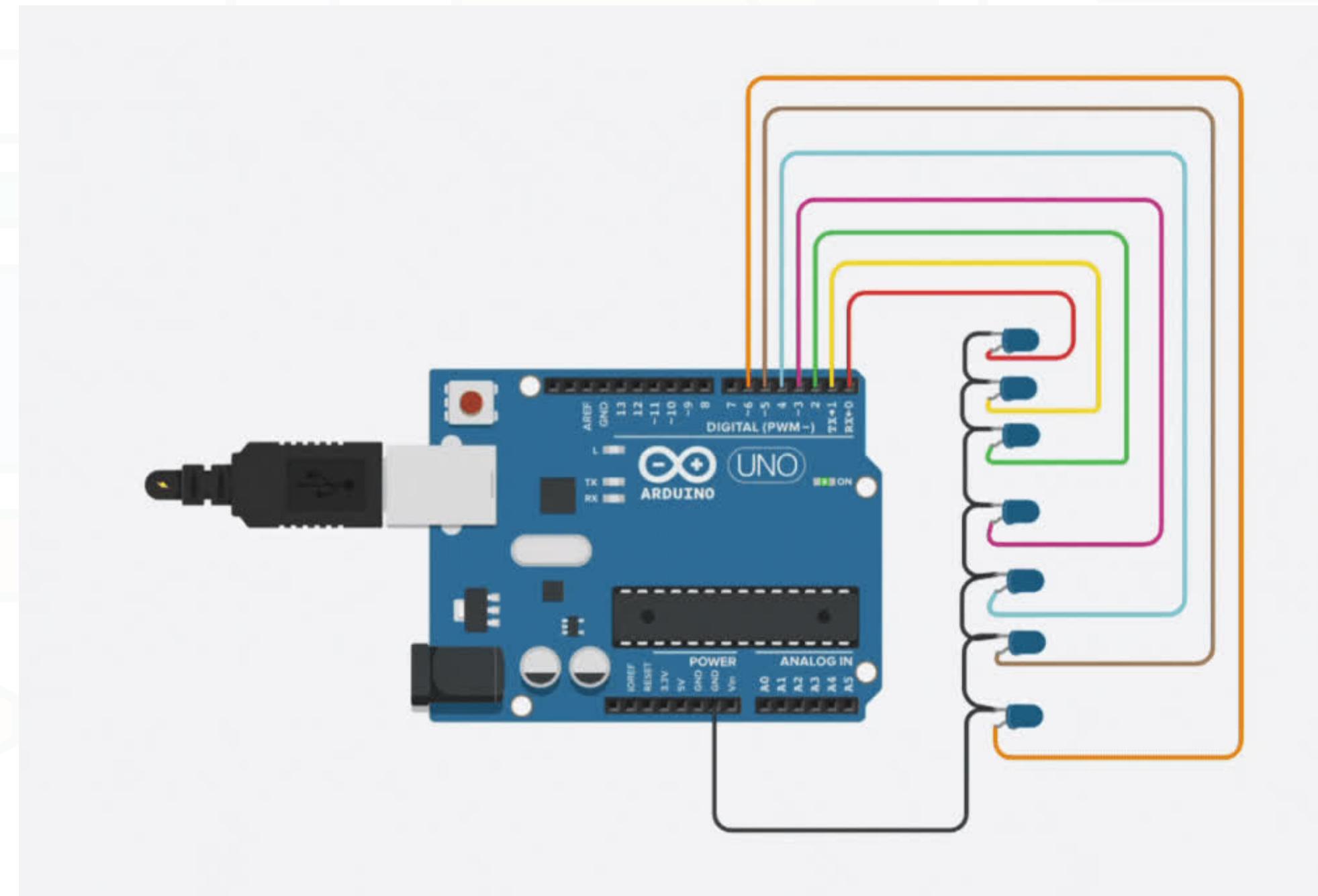
//turn off the back
digitalWrite(4, LOW);
//turn on the front
digitalWrite(6, HIGH);
delay(1000);

//turn off last 2 LEDs
digitalWrite(5, LOW);
digitalWrite(6, LOW);
delay(1000);
```

Blinking LEDs



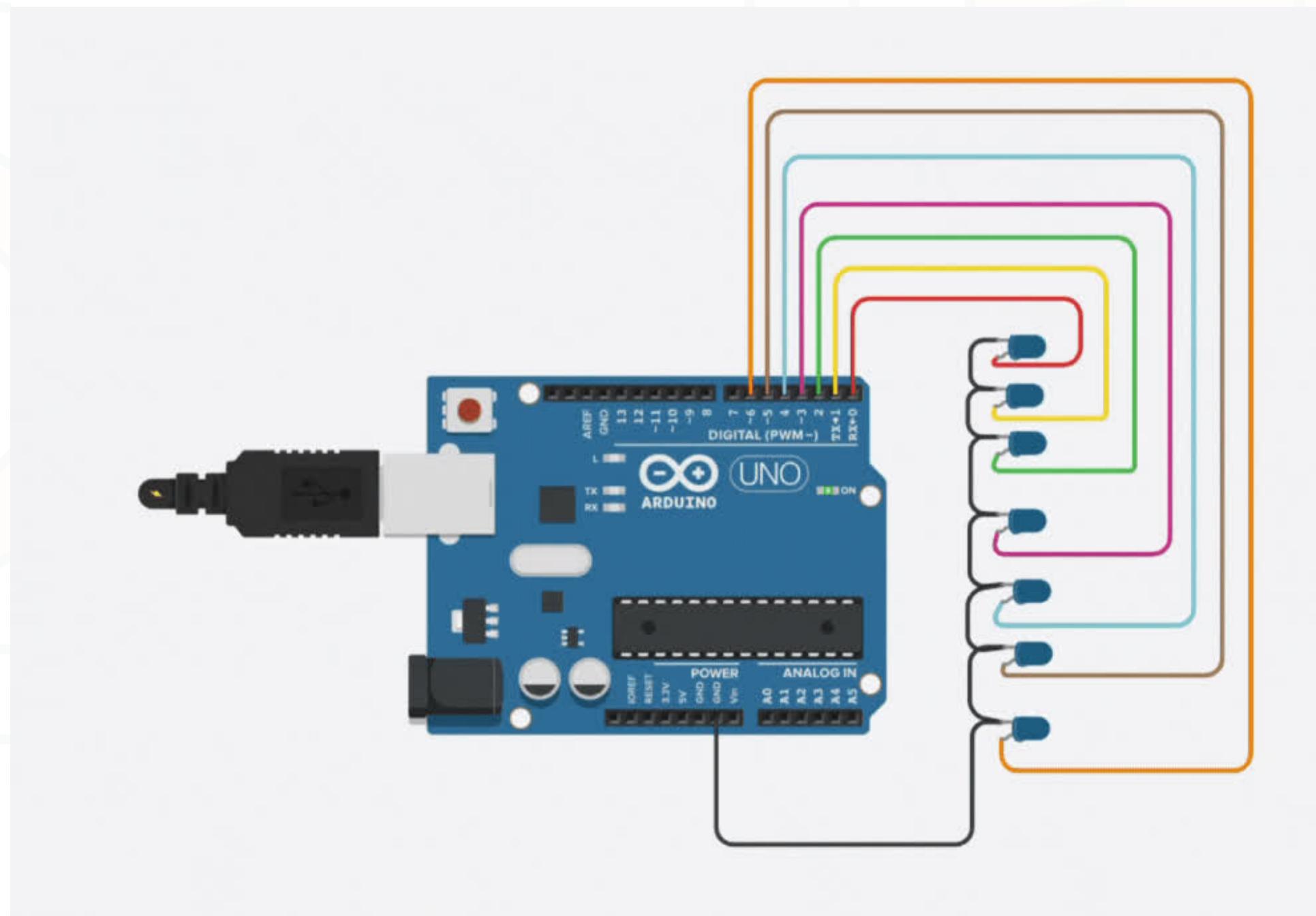
Mission 5: Blink 7 LEDs with pattern #3



Code



Mission 5: Blink 7 LEDs with pattern #3



```
void loop() {
    digitalWrite(0, HIGH);
    digitalWrite(6, HIGH);
    delay(1000);

    digitalWrite(0, LOW);
    digitalWrite(1, HIGH);
    digitalWrite(5, HIGH);
    digitalWrite(6, LOW);
    delay(1000);

    digitalWrite(1, LOW);
    digitalWrite(2, HIGH);
    digitalWrite(4, HIGH);
    digitalWrite(5, LOW);
    delay(1000);

    digitalWrite(2, LOW);
    digitalWrite(3, HIGH);
    digitalWrite(4, LOW);
    delay(1000);
}
```

```
//time to reverse
digitalWrite(2, HIGH);
digitalWrite(3, LOW);
digitalWrite(4, HIGH);
delay(1000);

digitalWrite(1, HIGH);
digitalWrite(2, LOW);
digitalWrite(4, LOW);
digitalWrite(5, HIGH);
delay(1000);

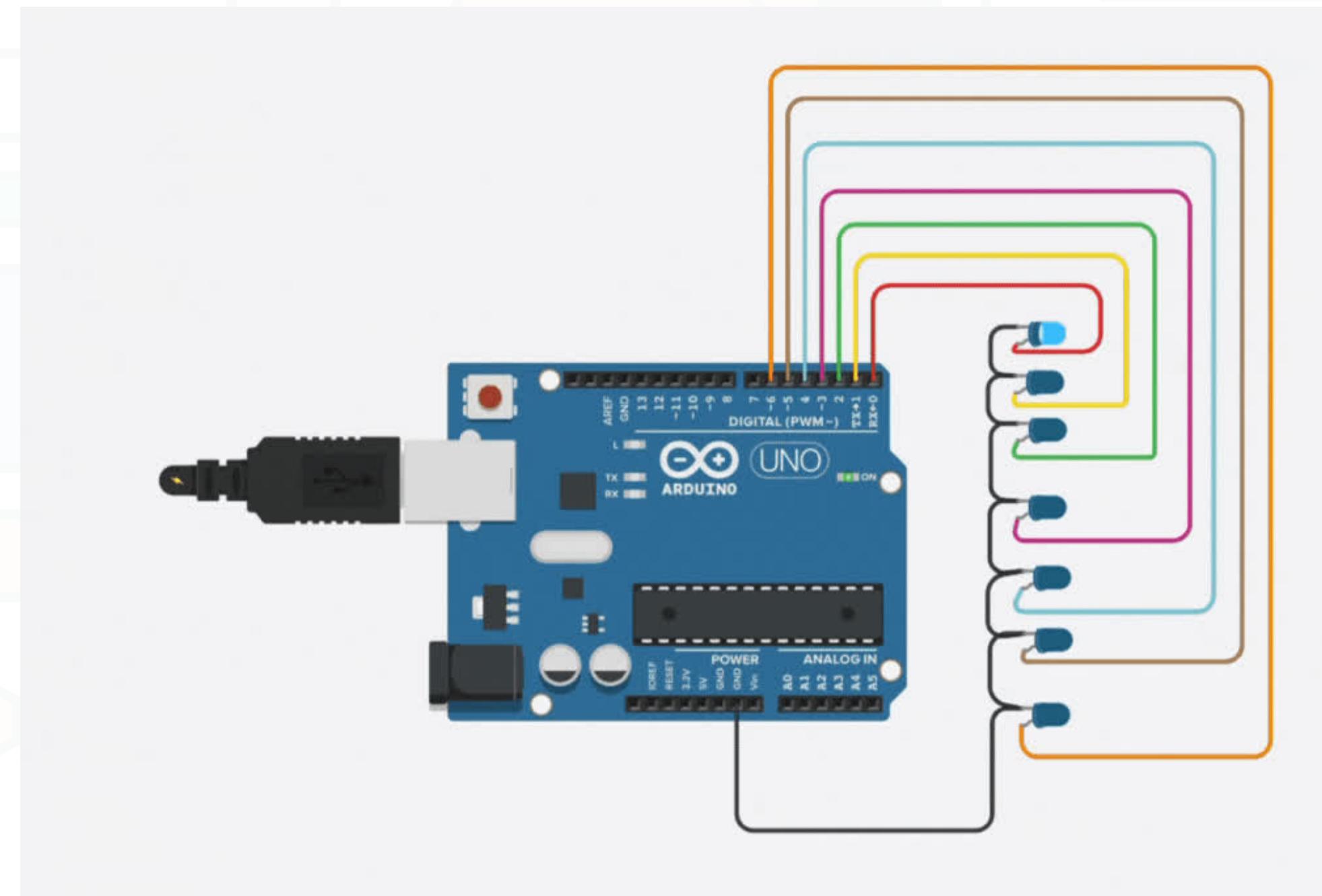
digitalWrite(0, HIGH);
digitalWrite(1, LOW);
digitalWrite(5, LOW);
digitalWrite(6, HIGH);
delay(1000);

digitalWrite(0, LOW);
digitalWrite(6, LOW);
delay(1000);}
```

Blinking LEDs



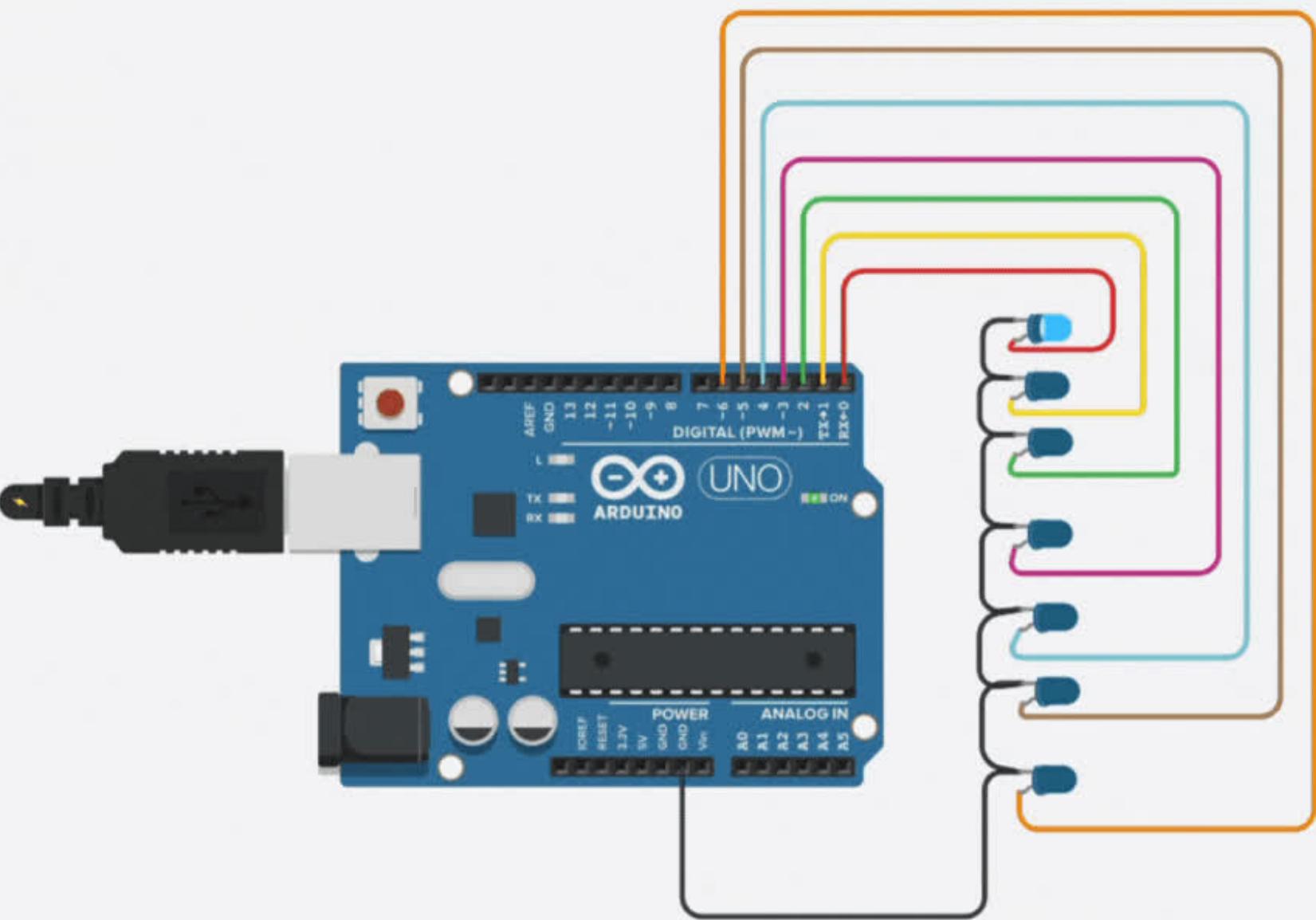
Mission 6: Blink 7 LEDs with pattern #4



Code



Mission 6: Blink 7 LEDs with pattern #4



```
void loop() {
    digitalWrite(0, HIGH);
    delay(1000);

    digitalWrite(0, LOW);
    digitalWrite(2, HIGH);
    delay(1000);

    digitalWrite(2, LOW);
    digitalWrite(4, HIGH);
    delay(1000);

    digitalWrite(4, LOW);
    digitalWrite(6, HIGH);
    delay(1000);
}
```



```
//time to reverse

digitalWrite(4, HIGH);
digitalWrite(6, LOW);
delay(1000);

digitalWrite(2, HIGH);
digitalWrite(4, LOW);
delay(1000);

digitalWrite(2, LOW);
digitalWrite(6, HIGH);
delay(1000);
```