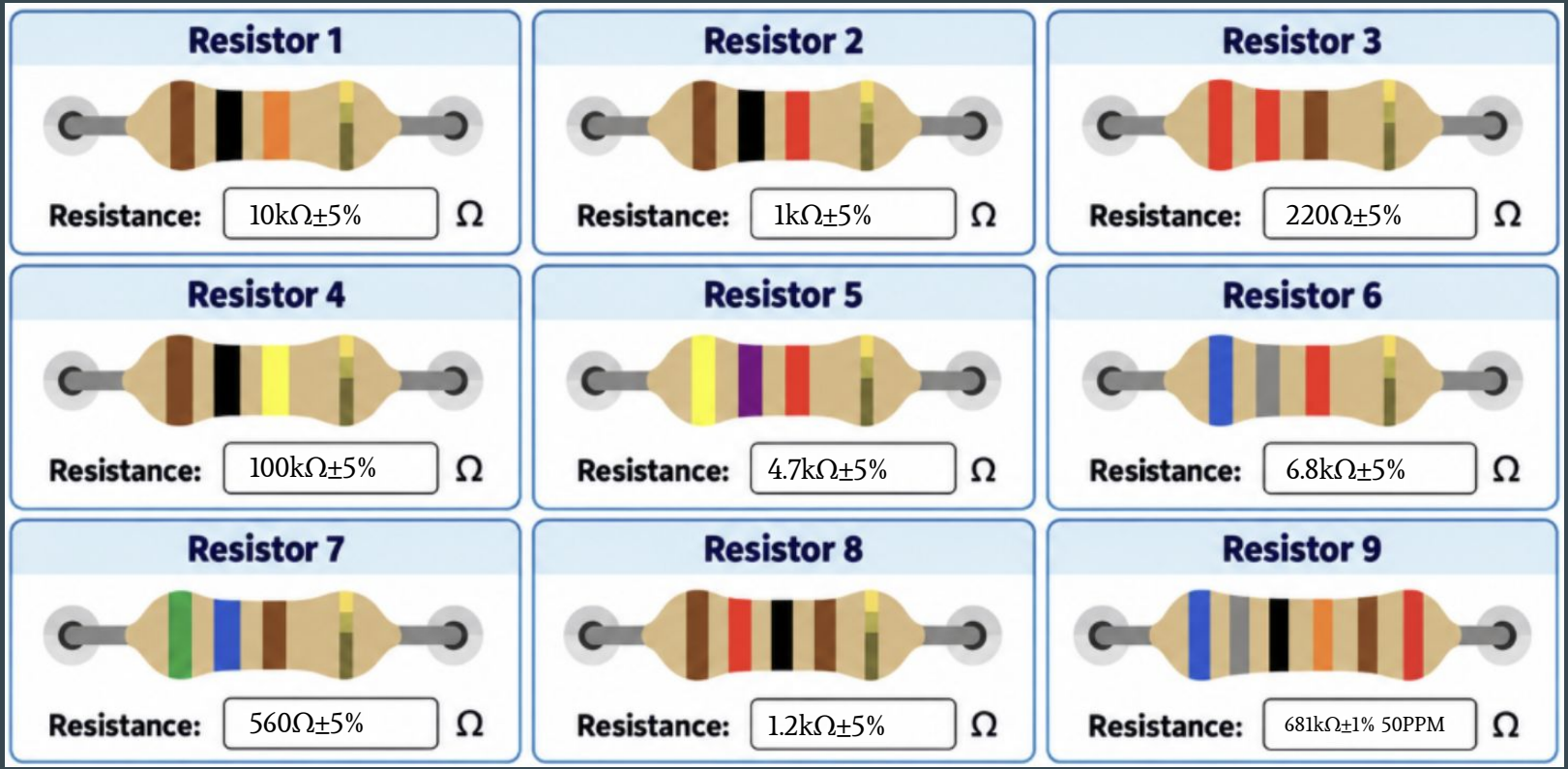
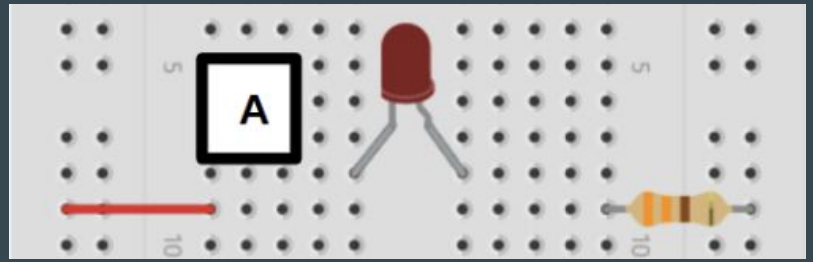
First Circuit Foundations

Student example

Resistor Identification

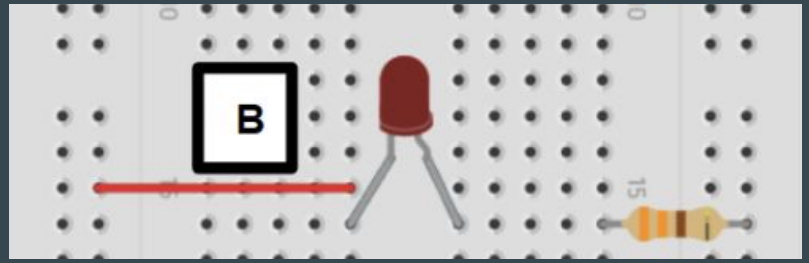


Circuit Analysis A



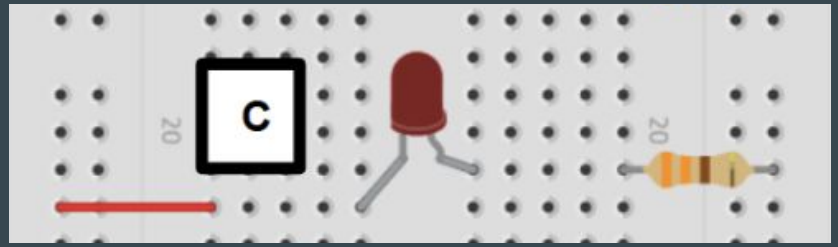
This circuit is incomplete. The LED is a **node** too high, which makes it an **incomplete circuit**, and the **polarity** is wrong. To fix it, I would lower it by 1 node, and change the **orientation** of the LED so that the **anode** is on the right and the **cathode** is on the left.

Circuit Analysis B



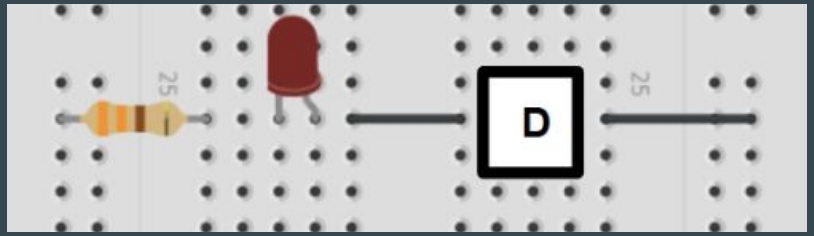
This circuit is incomplete. The **resistor** is connecting the anode to ground, and the wire is one node too high. To fix it, I would move the resistor so that it connects the anode to the positive rail, and I would move the wire to the same node as the cathode.

Circuit Analysis C



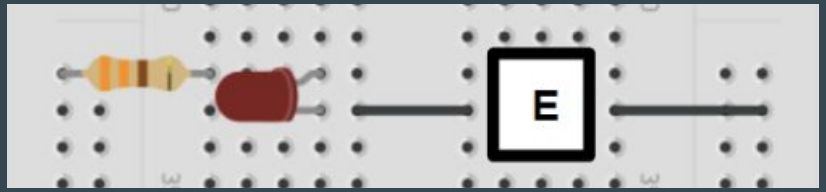
This circuit is incomplete. The LED has the wrong polarity. To fix it, I would change the orientation of the LED by putting the anode where the cathode is, and the cathode where the anode is.

Circuit Analysis D



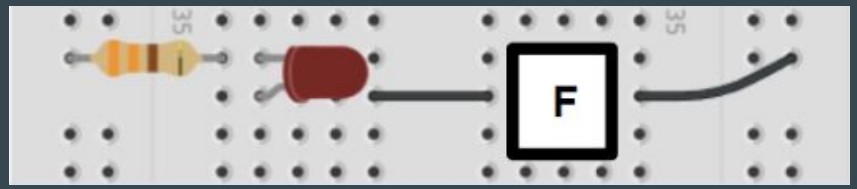
This circuit is incomplete. The polarity of the LED is not right. To fix it, I would change the orientation of the LED by turning it 180°.

Circuit Analysis E



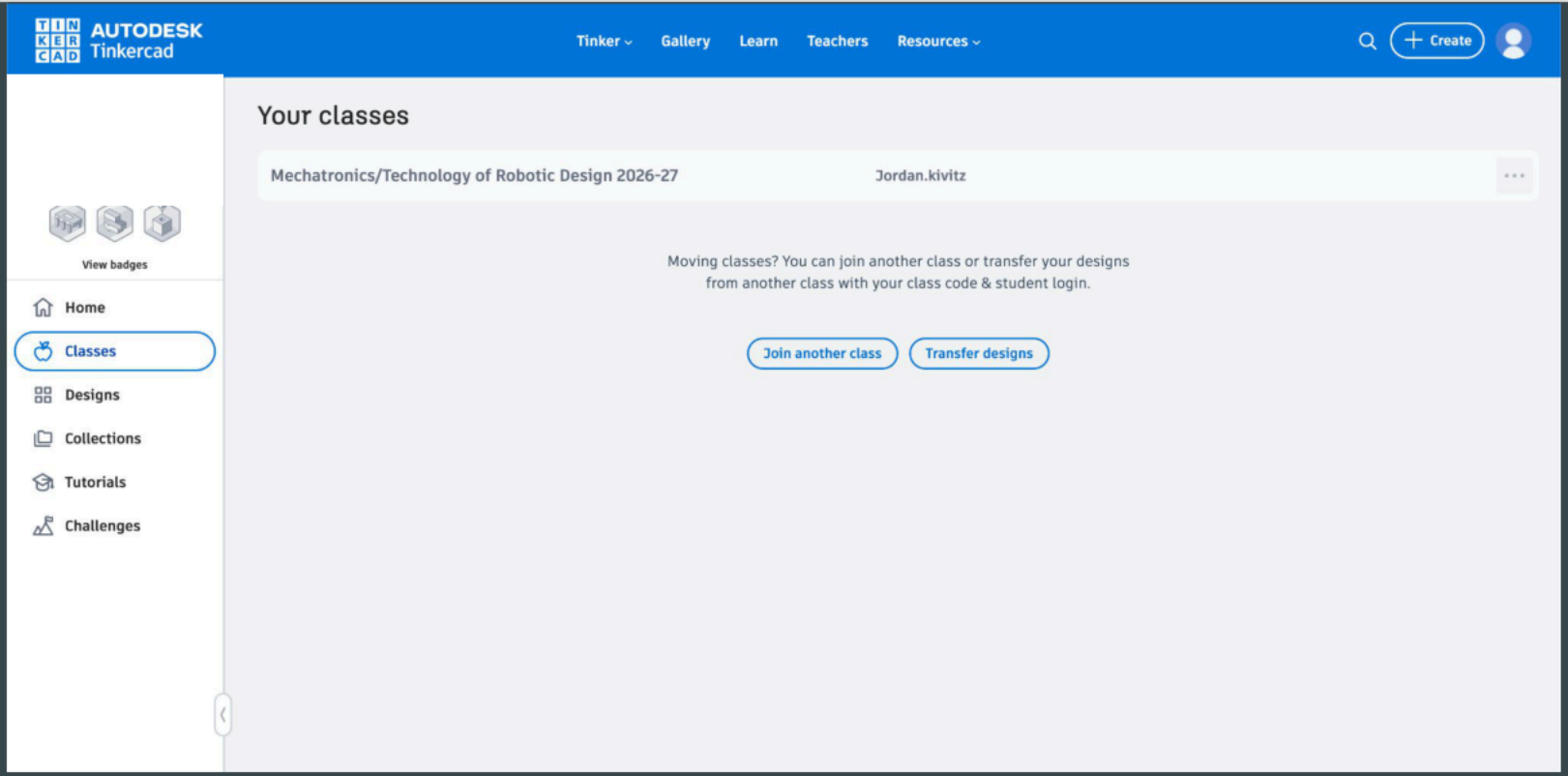
This circuit is complete. The resistor is connected to the positive rail, then to the same node as the LED's anode, then the cathode is connected to the same node as a wire, which is then connected to another wire on the same node, and lastly to the ground rail. This creates a **complete circuit**, and allows the **current** to flow freely.

Circuit Analysis F



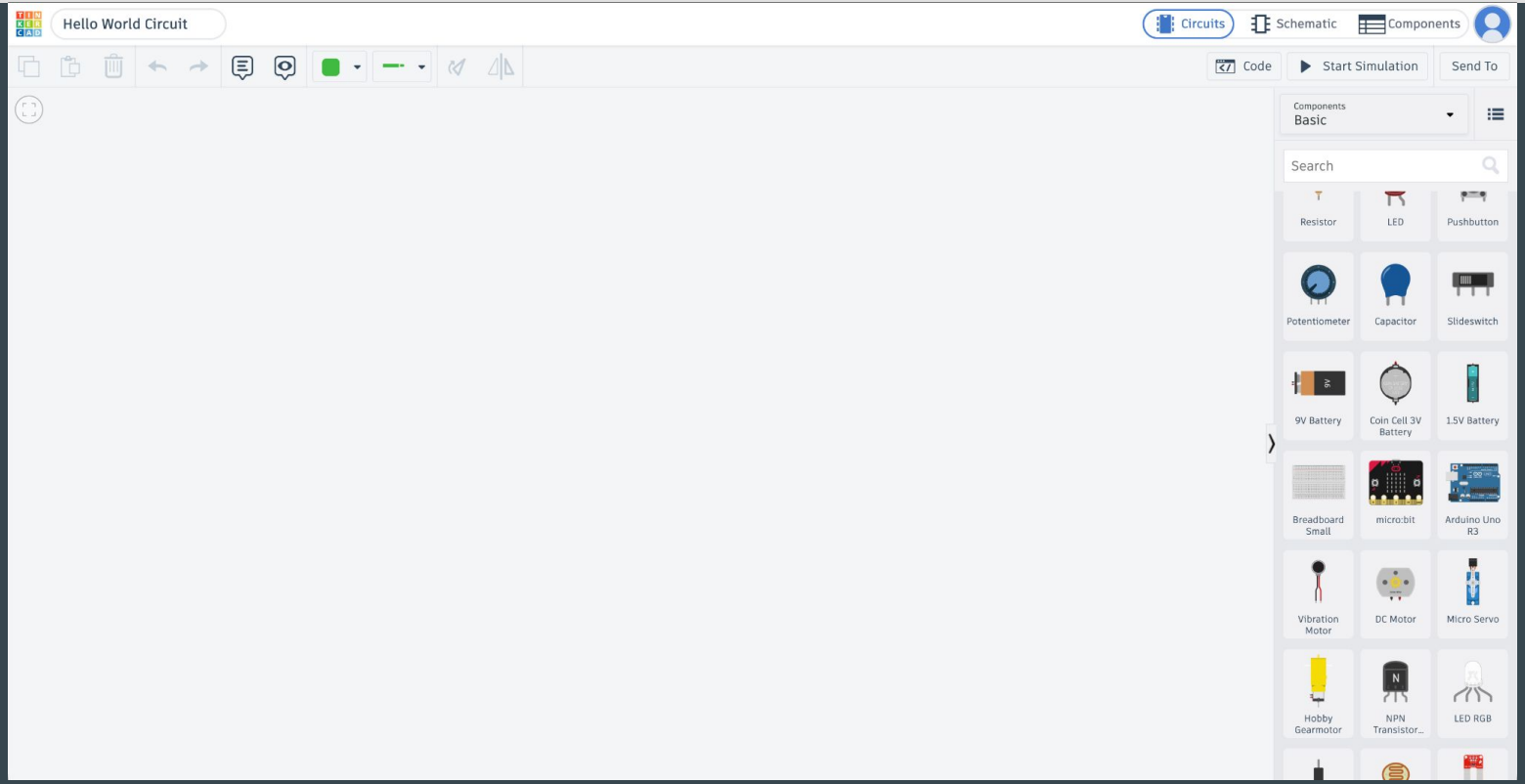
This is an incomplete circuit. This is because the LEDs polarity is wrong. To fix it, I would rotate The LED 180°, so that the anode is connected to the positive node and the cathode is connected to the negative node.

Tinkercad Setup



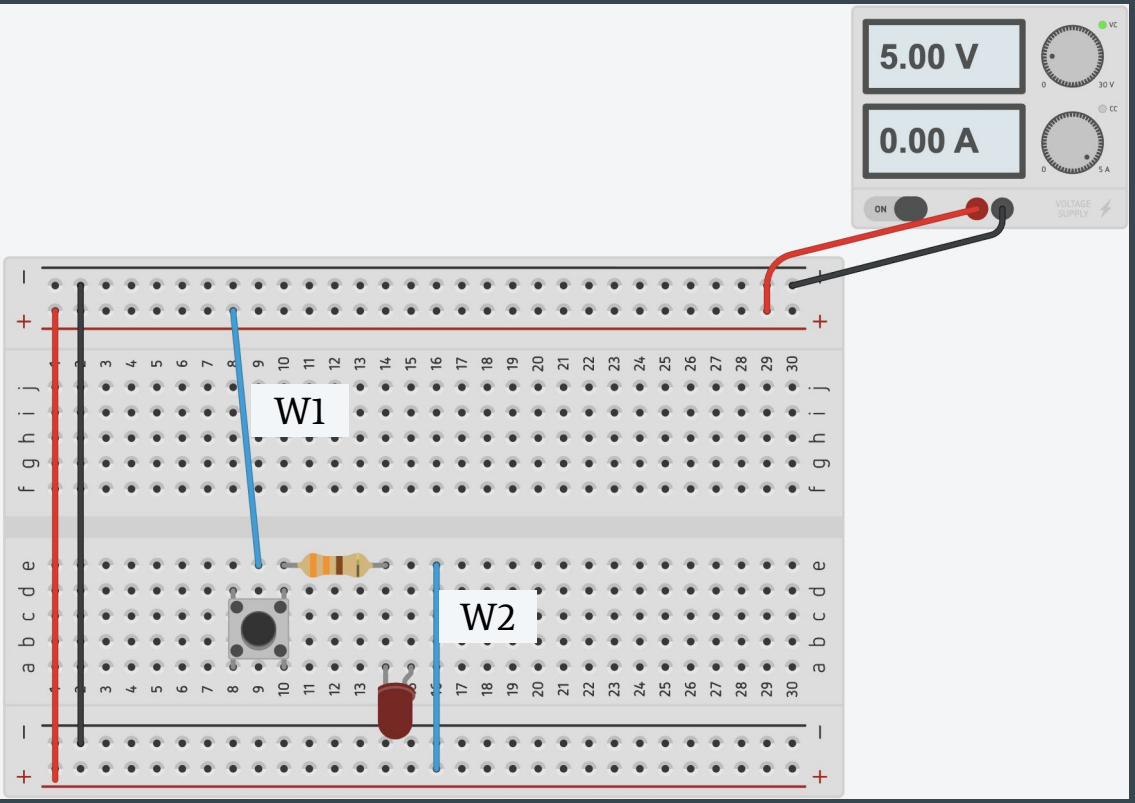
I successfully signed into Tinkercad and joined our class.

Tinkercad Setup



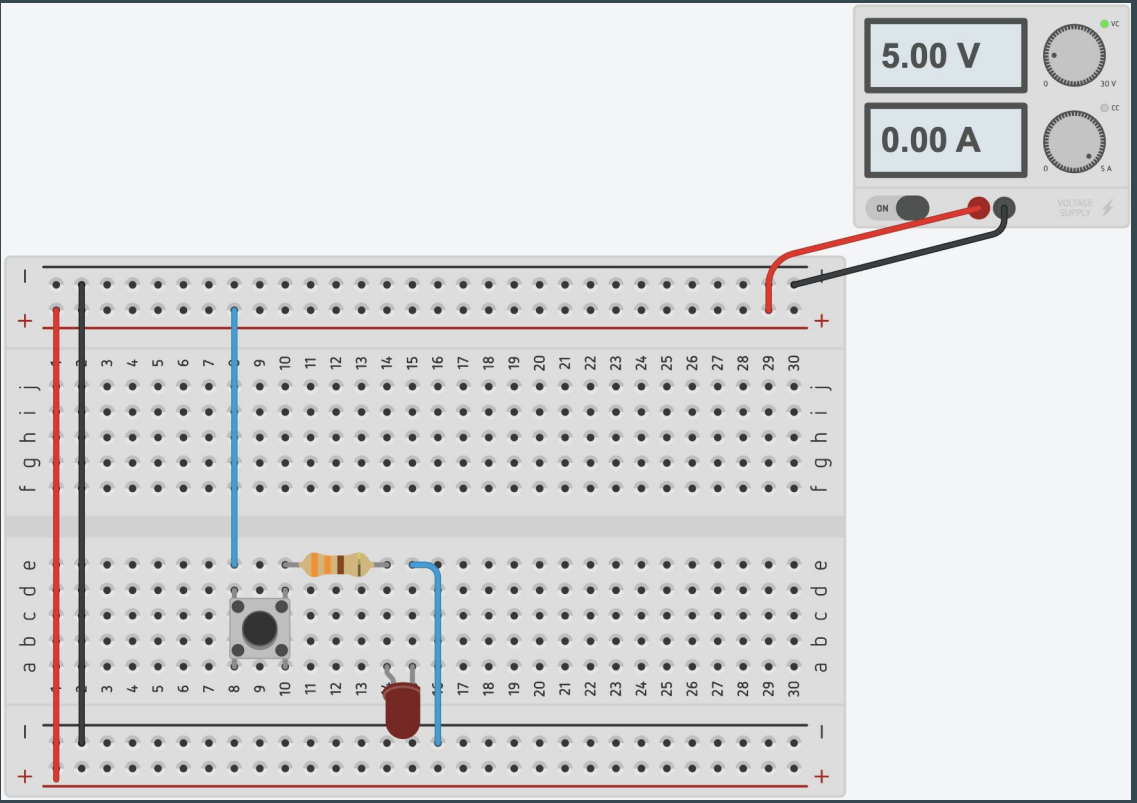
*I created a new circuit and named it **Hello World Circuit**. It is ready for the next step.*

Tinkercad Circuit + Troubleshooting – Broken Circuit



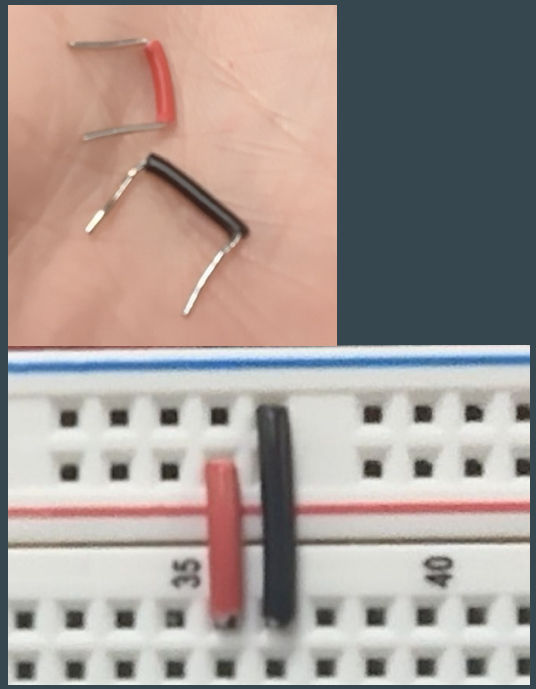
The 1st change I made was moving wire 1 to the node to the right of the button. This means that the button is no longer connected to the positive rail, and energy can't flow to the button and on. The 2nd change I made was moving wire 2 to the node to the right of the LED. This means that the energy exiting the LED can't flow to **ground**. The 3rd change I made was moving wire 2 to the positive rail from the ground rail, meaning that the energy exiting the wire can't return to ground. Last, I reversed the polarity of the LED, meaning the current can't flow. To be sure that each of these changes made an incomplete circuit, I tested it using the **simulation** each time.

Tinkercad Circuit + Troubleshooting – Working Circuit



My circuit matches the **schematic** because they follow the same path. They both start at a **VCC** with a **voltage** of 5, then the current flows through a **series** of components, starting with a button, then to a resistor with a **resistance** of 330Ω, next to the LED, and last back to ground. To restore the circuit from the broken one, I **troubleshoot** ed by changing each component one by one to make sure that the current can flow from one to the next.

Jumper Wires + Breadboard Connections



To determine the right length of the **jumper wire** s, I first connected the stripped and bent end to a **rail**, and used the wire strippers to mark where the other end should be stripped and bent. The red wire which is connected to the **power rail**, carries the power on an **electrical path** to the **terminal strip**. The black jumper wire provides a **return path** for the current to the **ground terminal**. The two jumper wires are connected to two different nodes so that they don't have the same **connection point**, and another component like and LED or resistor can be added. I checked that the metal ends make a reliable connection because there was resistance when putting them in and taking them out, and I checked them to the side of the breadboard. I could also check by adding and LED, resistor, and connecting it to power.

Physical Breadboard Prototype

WIRE PREP

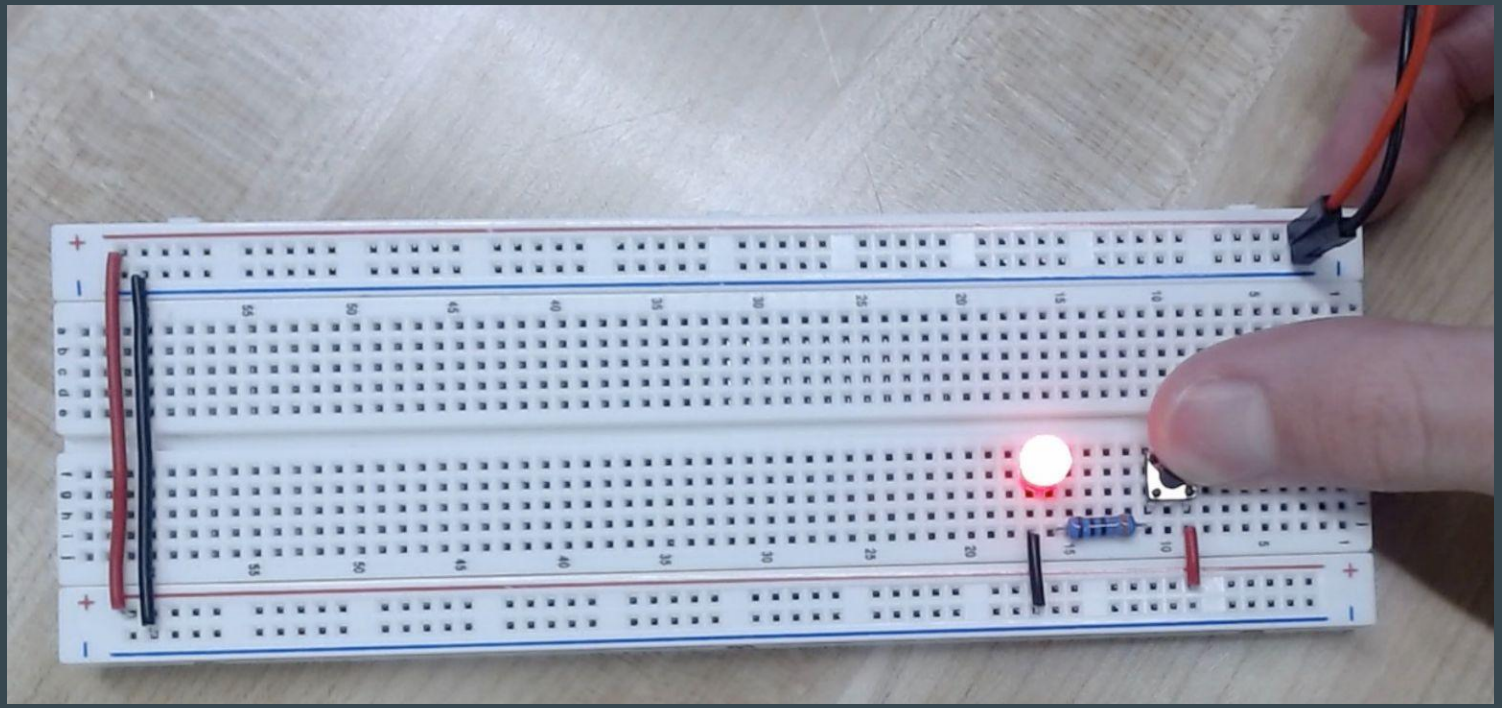
I prepared the wire to make a reliable **electrical contact** by first stripping one end and making sure the exposed wire was the right length by checking it to the side of the breadboard. Next I measure, cut stripped, and bent the wire at the correct node so that it would take the path that I wanted it to. To strip it, I first used a stripper to cut the **insulation** off and reveal the **conductor** of the **solid-core wire**.



Physical Breadboard Prototype

TOP VIEW

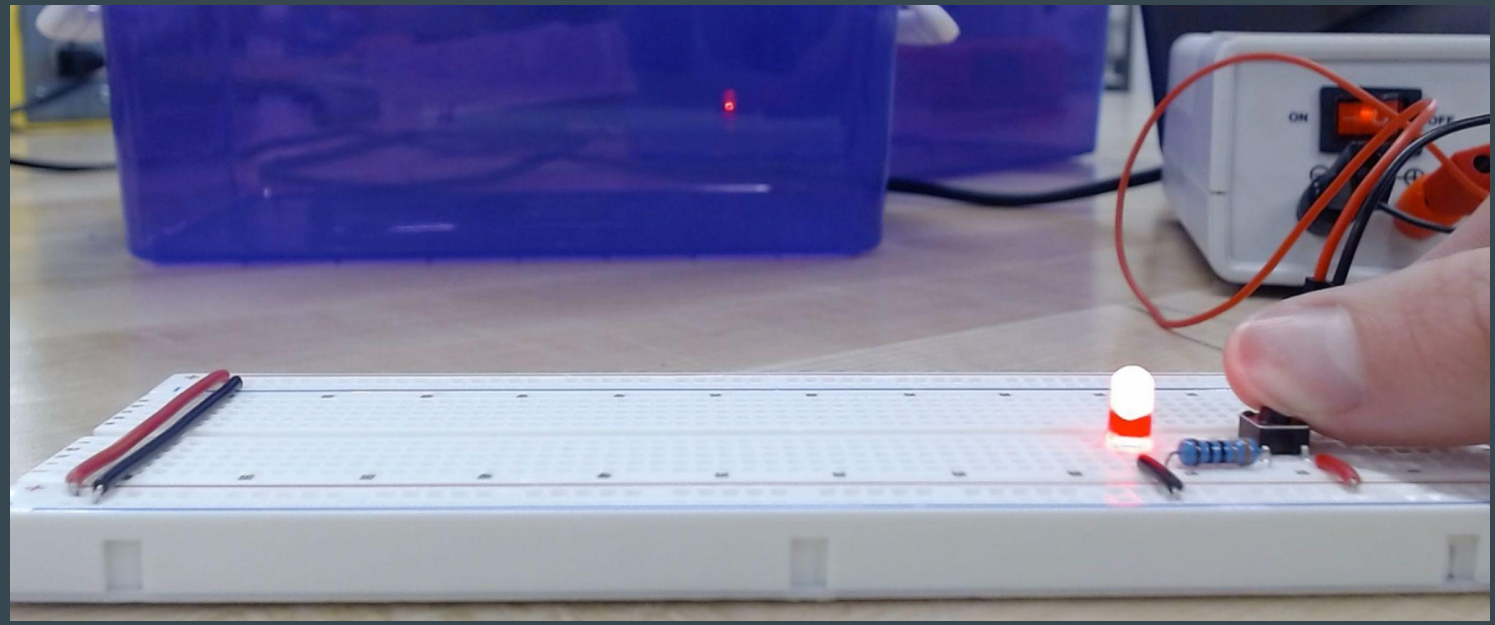
One challenge I encountered when the Tinkercad simulation to a **prototype** in real life was ensuring **continuity** and that the power exiting the **power supply** made its way through the circuit and back to ground without any breaks.



Physical Breadboard Prototype

SIDE VIEW

To ensure the physical circuit was working correctly, I traced the path from power to ground to ensure that it made a complete circuit. I also trimmed as much conductive material as possible to ensure that no **short circuits** were possible.



Physical Breadboard Prototype

ISOMETRIC VIEW

