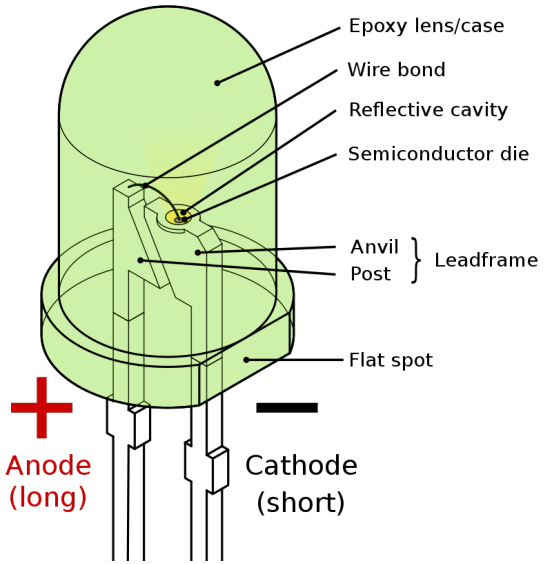
Creating an electrical circuit with 2-LEDs and a switch



LED – Light Emitting Diode - Illuminate

Switch – Control - Open Circuit/Closed Circuit



Making a Simple LED Circuit

Goal: To illuminate two light-emitting diodes using LEDs, conductive wires, a coin battery, and a switch made from paper fasteners(brads) and a paper clip. To complete this task, follow these step-by-step technical/procedural directions:

Materials:

2 LEDs

A coin battery (e.g., a 3V coin cell battery, like a CR2032)

A switch (2 paper fasteners or brads, and a paper clip)

2 – cardboard sheets

Masking tape

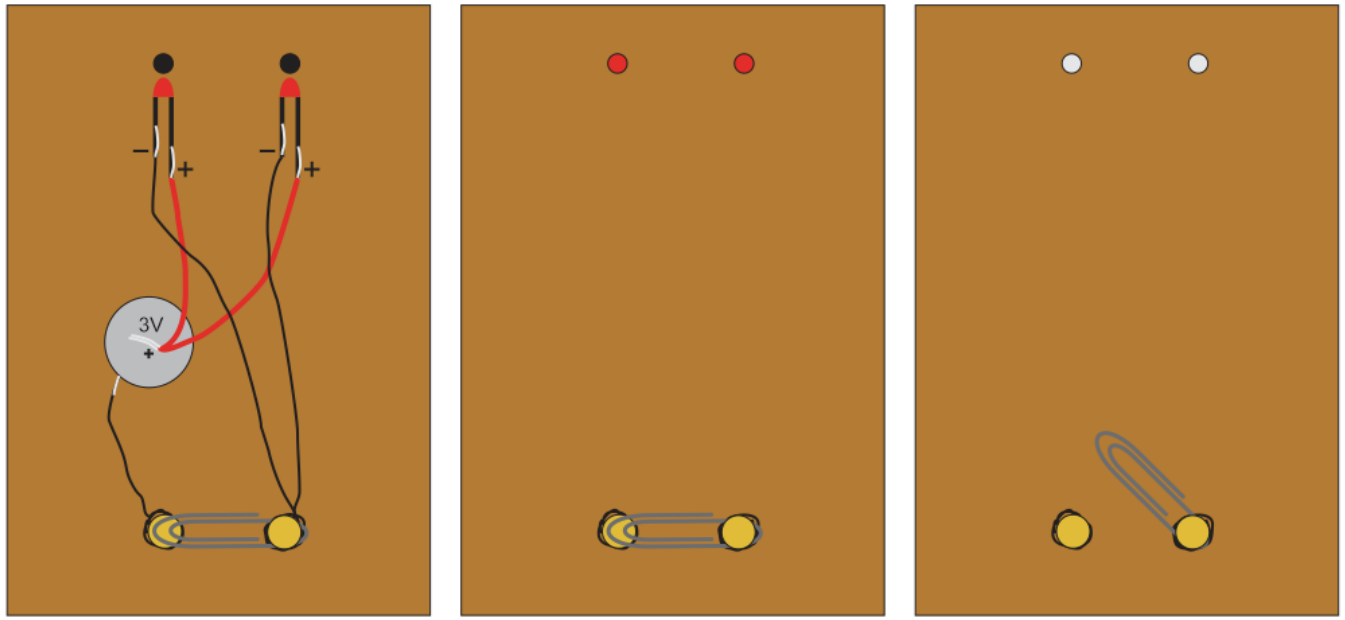
Tools:

Wire stripper

Pencil

Ruler

Soldering iron and solder



Wire Preparation

Black wires

2 - 7” black wires (strip the insulator from one end of the wire ½” and the opposite side of the wire ¾” – 1”)

1 - 3” black wire (strip the insulator from each end of the wire ½”)

Red wires

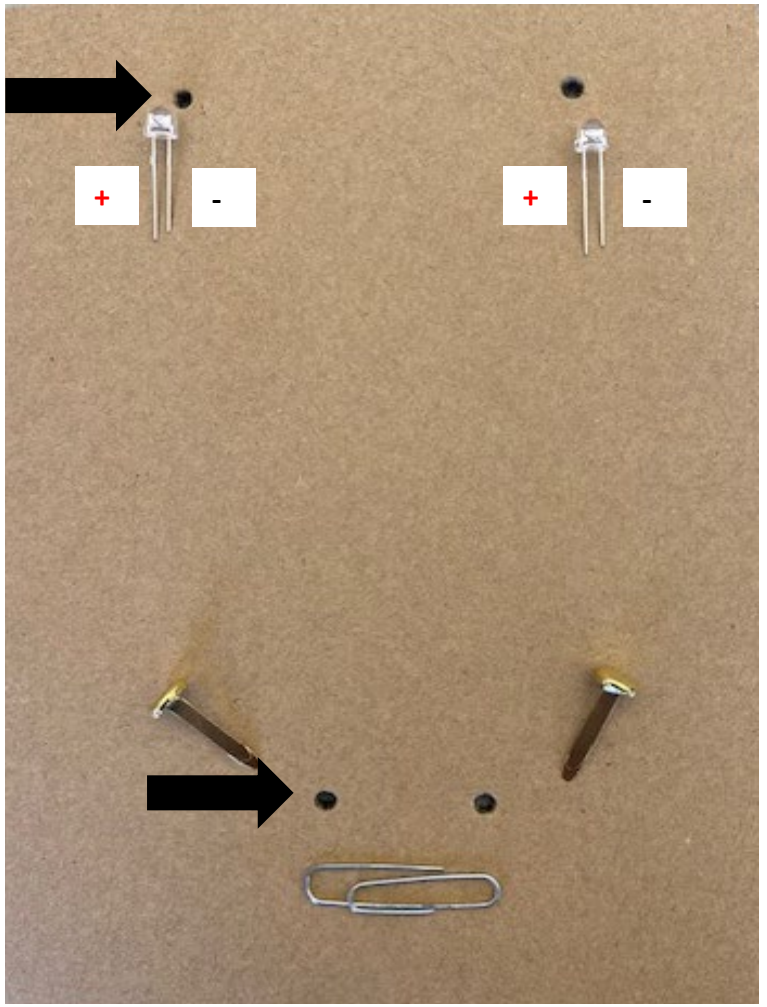
2 - 5” red wires (strip the insulator from each end of the wire ½”)

The metal core of each wire is a conductor, allowing electric current to flow through the circuit. The plastic coating surrounding the wire is an insulator that prevents unintended electrical connections. Use the wire stripper to carefully remove the specified amount of insulation from each end without damaging the metal conductor.

Step 1:

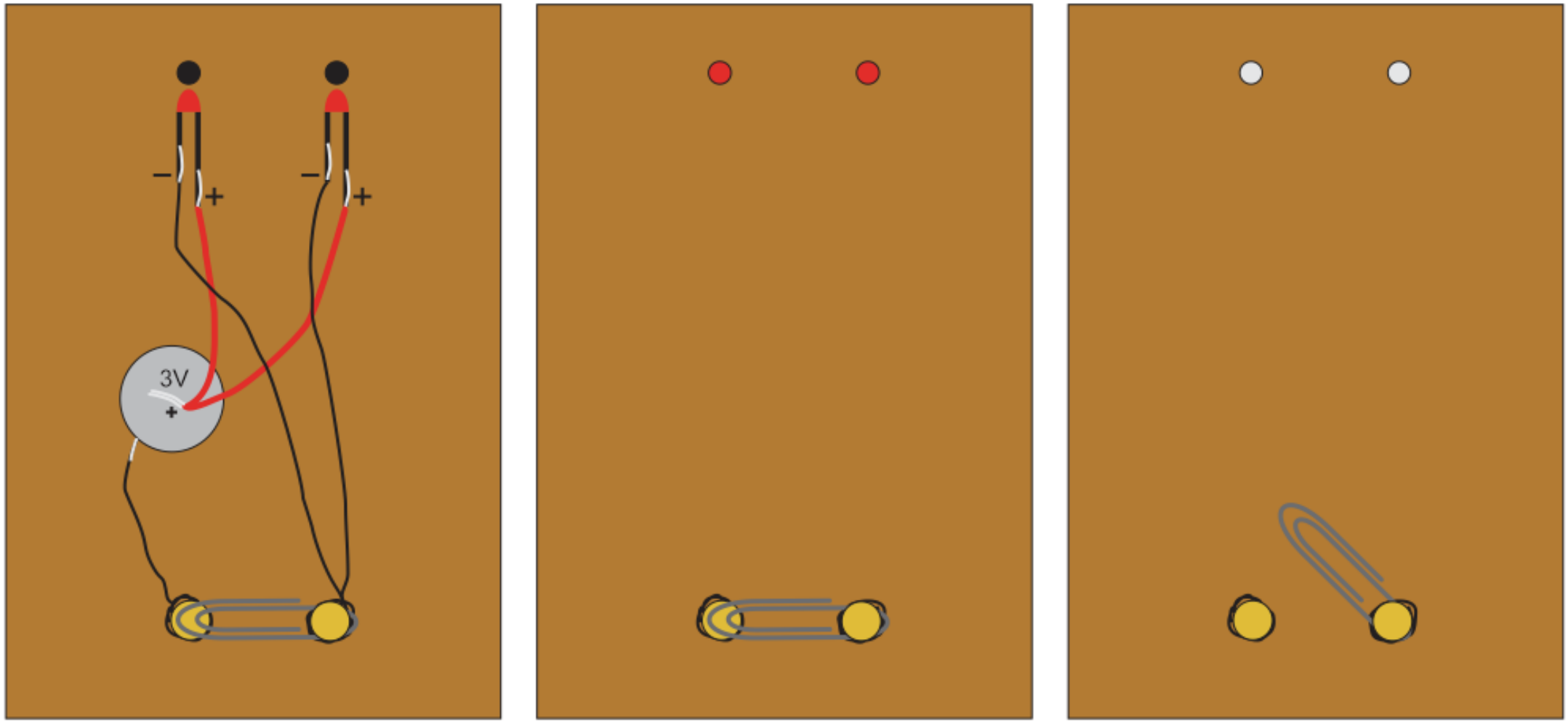
Prepare your base by laying each of the basic components out as seen here.

The cardboard base serves as an insulator, supporting the electrical components while helping prevent unintended contact between conductive materials. Carefully measure and mark the locations of the LEDs and switch before creating the holes.



Using a sharpened pencil, punch 2 holes at the top (3/4” down and 2-1/2” apart) from your cardboard base for the LEDs.

Using a sharpened pencil, punch 2 holes from the bottom (1-1/2” from the bottom) and no further apart than the length of your paper clip.


3V
+

Step 2: Preparing the LEDs

An LED, or light-emitting diode, converts electrical energy into light and thermal energy. Each LED has two terminals: the anode (positive), typically identified by the longer leg, and the cathode (negative), typically identified by the shorter leg. LEDs are polarized components, meaning they must be connected in the correct direction for current to flow and the LED to illuminate.



Using your red wire, twist one end to the positive (longer) anode of the LED and secure it in place (e.g., with tape or a twist-on connector). For this example, we will solder our wires to the LEDs.

Using your black wire, twist one end to the negative (shorter) cathode of the other LED and secure it in place with solder.

Step 3: Building the Switch

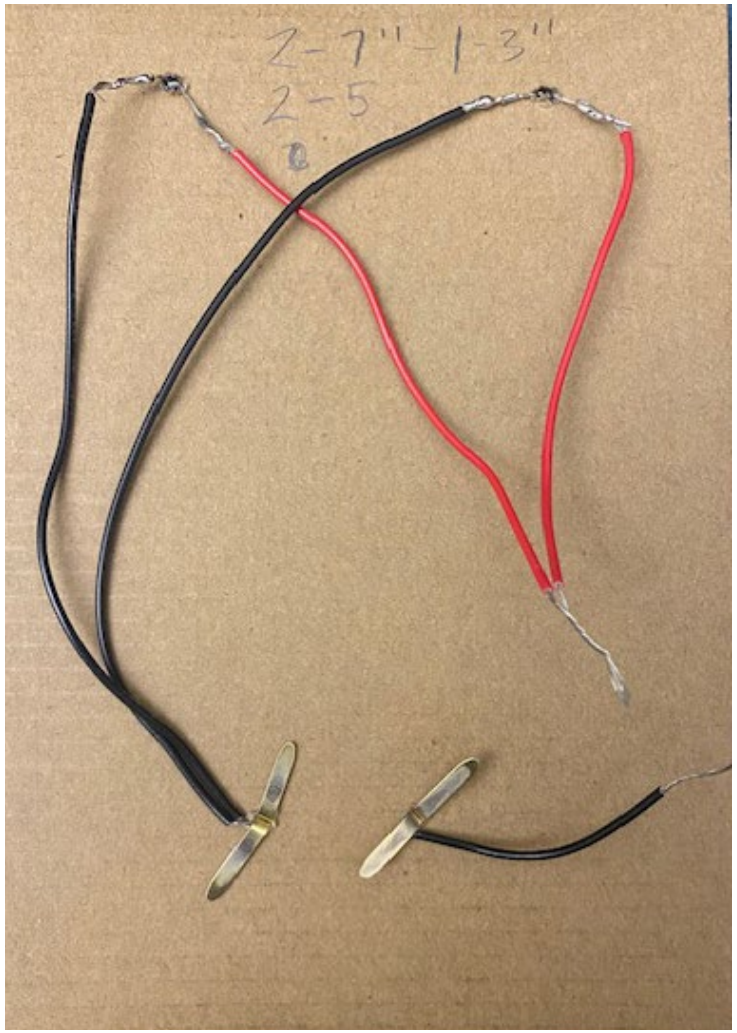
-Push the black wires to the front of the cardboard base as seen to the right.

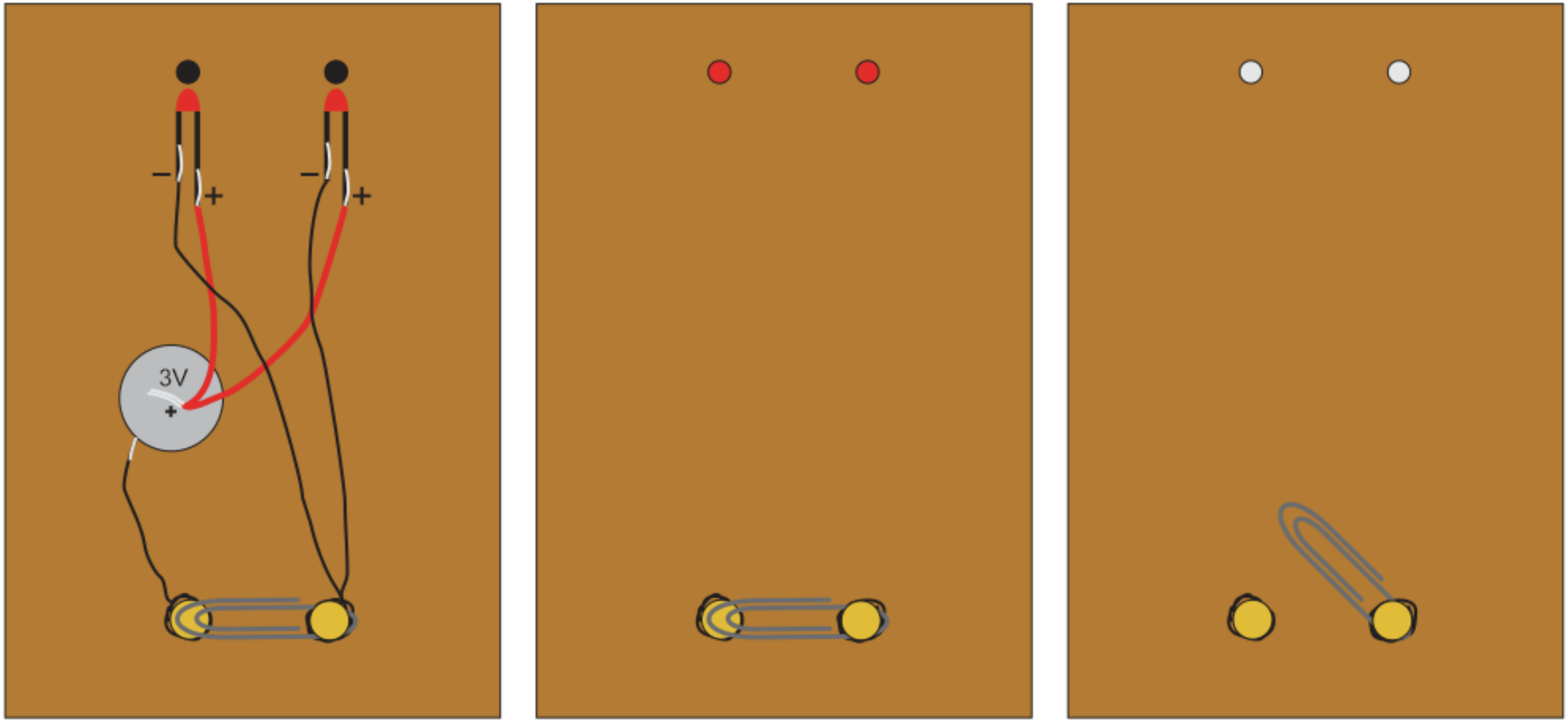
-Push the two paper fasteners (or brads) through the two holes in the cardboard below the LEDs.

-Wrap each end of the black wires around the one of the paper fasteners (or brads)

-Attach the shorter black wire to the opposite, unconnected fastener.





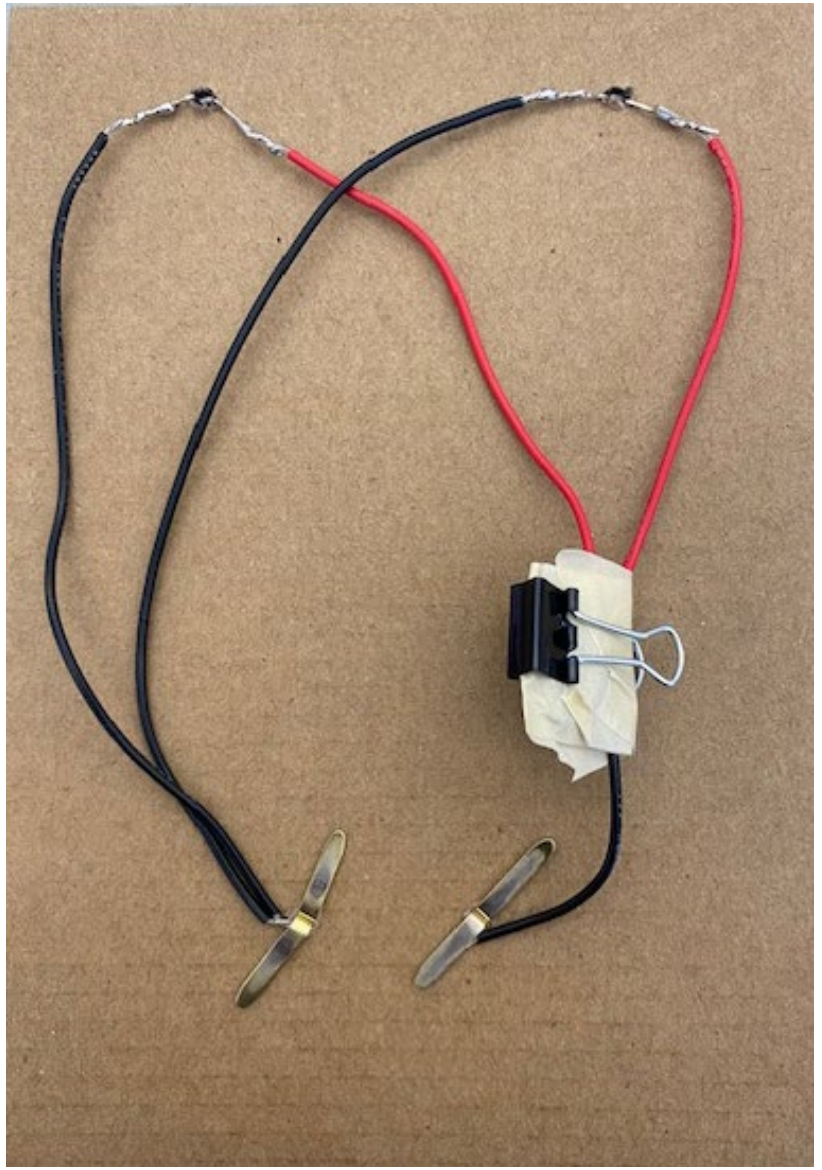


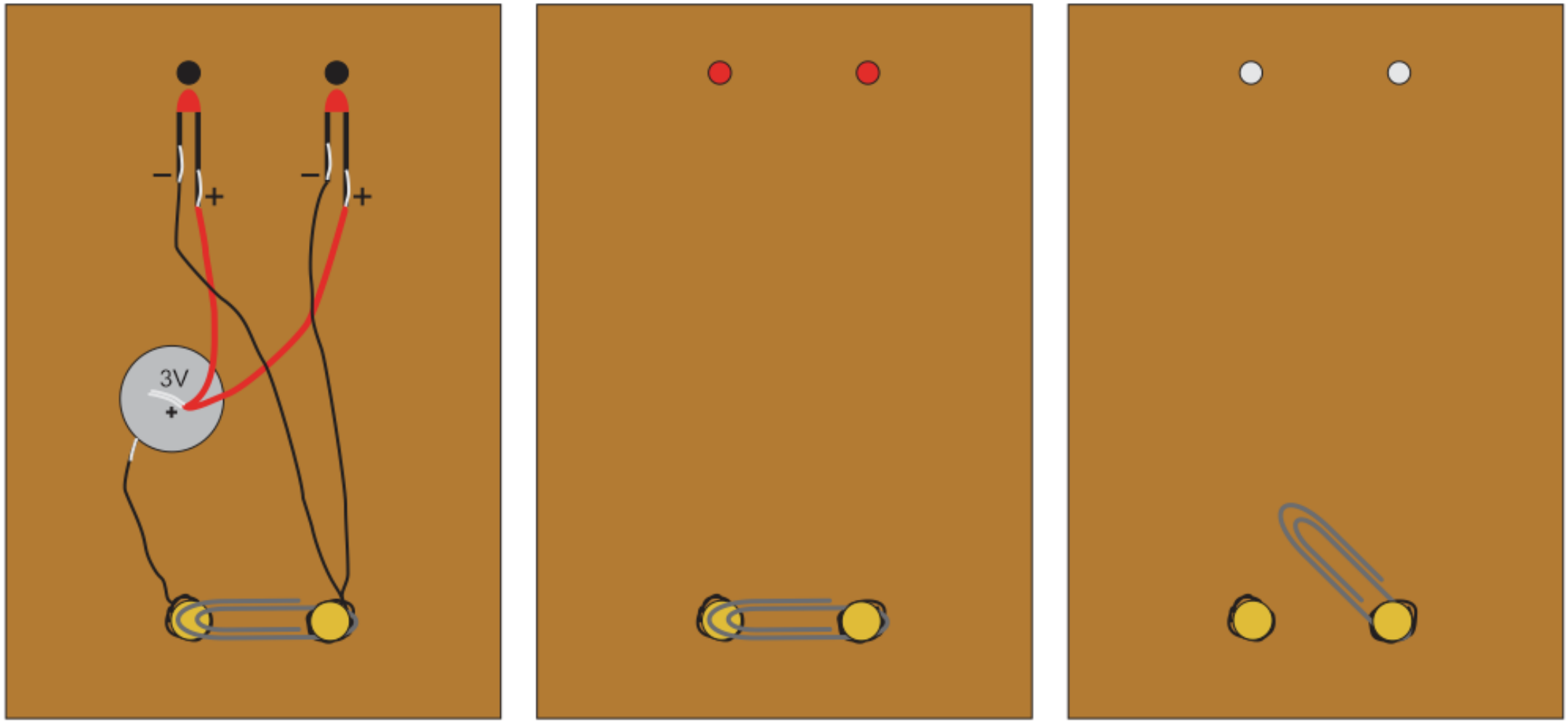
The metal paper fasteners and paper clip are conductors that will form a mechanical switch. When the paper clip is not touching the opposite fastener, the switch creates an open circuit, interrupting the pathway for current. When the paper clip touches both conductive contacts, it creates a closed circuit, completing the pathway for current to flow.

Step 4: Connecting the LEDs and Switch to the Battery

The 3-volt coin battery provides the voltage, or electrical potential difference, needed to drive current through the circuit. The battery's chemical energy is converted into electrical energy, which is transferred to the LEDs.

Connect the positive battery terminal to the LED anodes and the negative battery terminal to the appropriate return wires. Use insulating tape to secure the connections and prevent exposed conductors from accidentally touching.




3V
+

Step 5: Complete the Switch

Gently press the paper clip to close the switch. Observe how the LEDs illuminate when the circuit is closed. The battery supplies energy that is transferred electrically to the LEDs, where some of that energy is converted into visible light. Release the paper clip to create an open circuit and observe what happens.

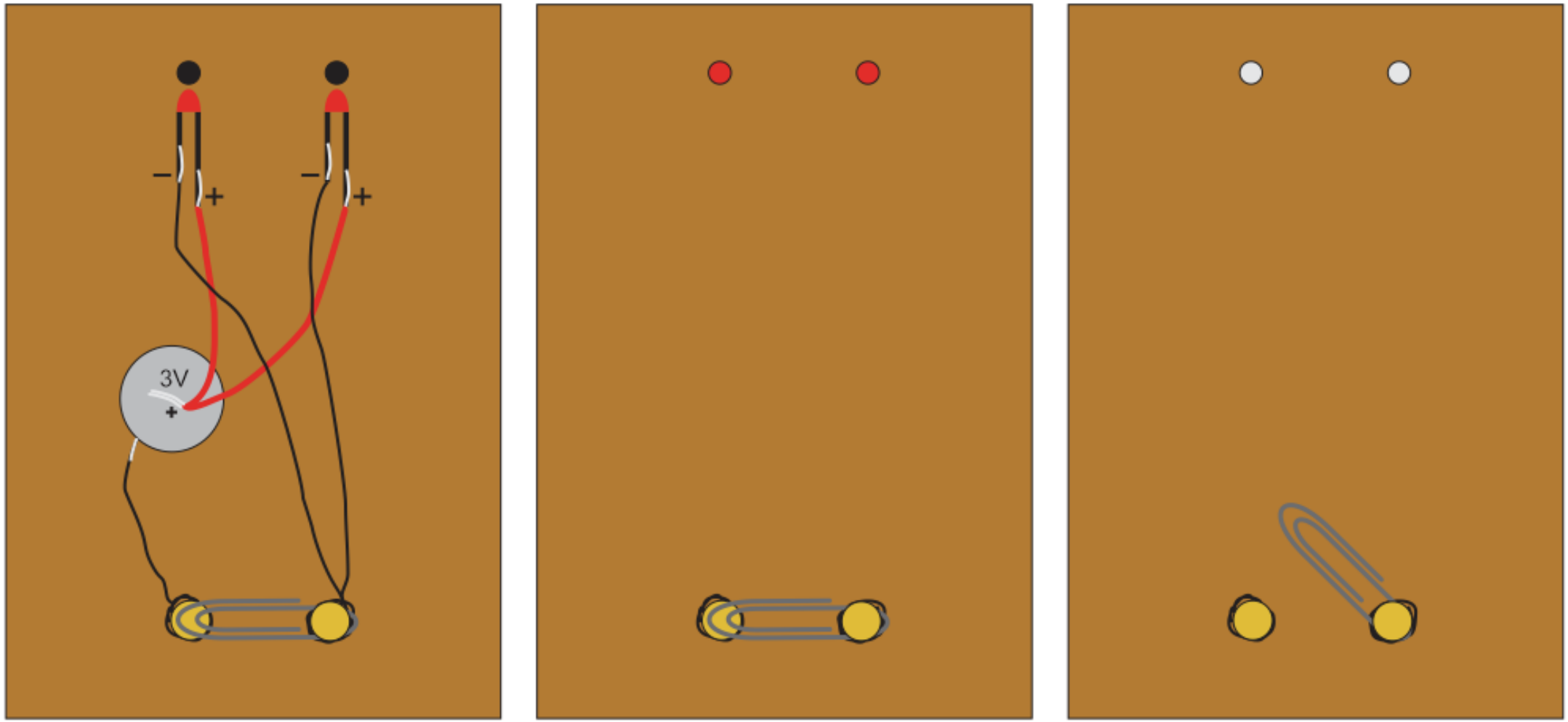


Step 6: Testing the Circuit

To test your circuit, gently press down on the paper clip arms. This should close the switch, allowing current to flow from the battery to the LEDs, illuminating them.

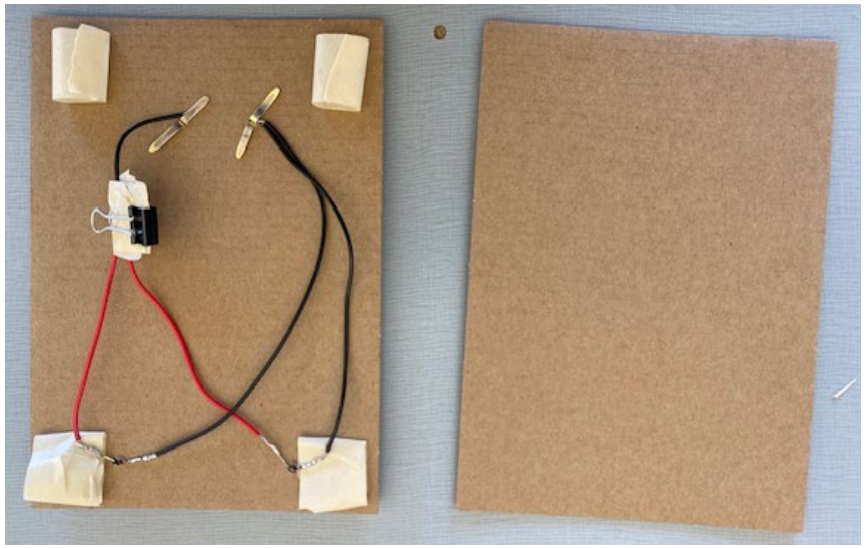
Step 7: Troubleshooting

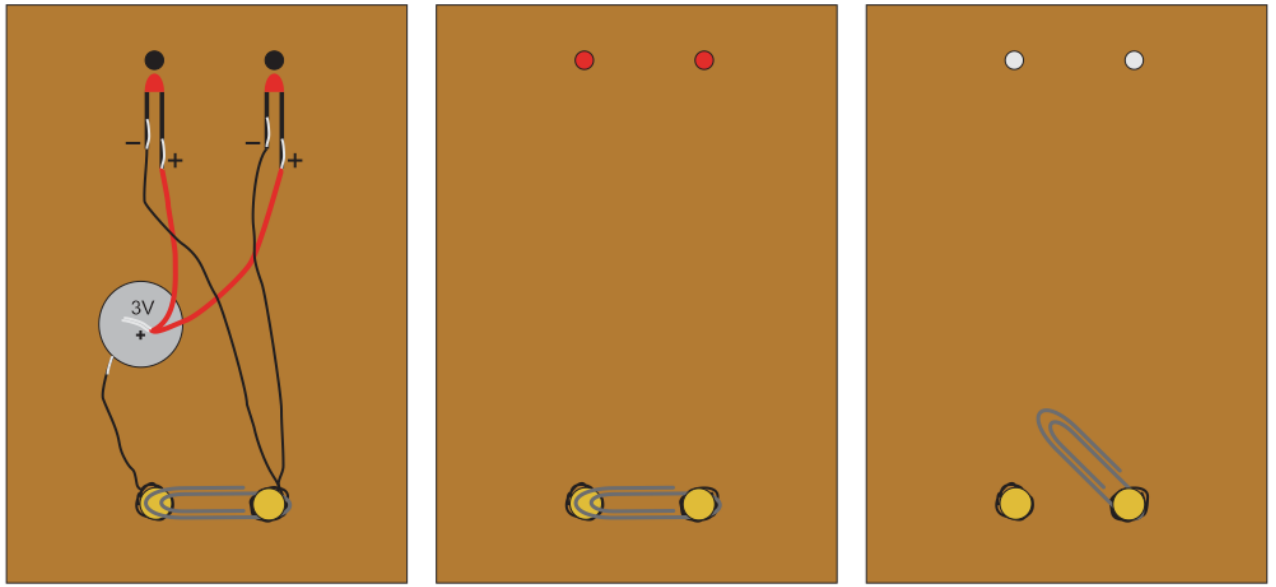
If the LEDs do not illuminate, inspect the circuit for loose connections, incorrect LED polarity, or an incomplete electrical pathway. Check that the conductive surfaces of the switch make contact. Look for unintended connections that might create a short circuit, allowing current to bypass the LEDs. Poor connections can also increase resistance, reducing the current flowing through the circuit.


3V
+

Step 8: Finalize the Setup

After confirming that both LEDs illuminate when the switch is closed and turn off when the switch is opened, secure the cardboard backing. The backing provides an additional insulating barrier that helps protect the circuit components and prevents accidental contact with exposed conductors.





Reflection Questions

- Why are copper wires and metal paper clips appropriate materials for constructing an electrical circuit, while cardboard and plastic are not?
- How does the switch control the flow of electric current through the circuit?
- Describe how energy is transferred and transformed when the LEDs illuminate.
- Why is it important to follow technical/procedural directions carefully when constructing an electrical circuit?