**🔧 Station 1: Conductor vs. Insulator Showdown**

**NGSS Standard:** *MS-PS2-3 – Electric and Magnetic Forces*  
**Focus Question:** *How do different materials affect the flow of electric current?*

**🎯 Your Mission:**

You are testing mystery materials to find out which ones allow electricity to pass through (conductors) and which ones block it (insulators). This helps engineers choose the right materials for wiring and safety!

**FOCUS:**

Material Properties & Electric Current – How Conductors and Insulators Affect Circuit Flow

**🛠️ Materials at Your Station:**

* Battery pack (AA or 9V)
* Light bulb holder + bulb **OR** LED with resistor
* Alligator clip wires (at least 3)
* Test items:
  + Metal paper clip
  + Plastic straw
  + Cardboard
  + Aluminum foil
  + Rubber band
  + Wooden stick or craft stick

**👣 Student Directions:**

**STEP 1: Build Your Circuit**

* Connect one end of a wire to the **positive (+)** side of the battery.
* Connect the other end of that wire to the **first leg** of the light bulb or LED.
* Connect another wire to the **second leg** of the light.
* Leave the end of that wire **open**—this is where you’ll test your materials.
* Finally, connect the **third wire** from the **negative (–)** side of the battery. This wire also remains open for testing.

**STEP 2: Test Each Material**

* Touch or clip one end of your **test material** to the open end of the wire from the **bulb**.
* Touch or clip the other end of the material to the open end from the **battery**.
* **Watch the light!** If it turns on, the material conducts electricity.
* If it stays dark, the material is an insulator.

**STEP 3: Complete the Data Table**

| **Material** | **Did the Light Turn On?** | **Conductor or Insulator?** |
| --- | --- | --- |
| Aluminum foil | ☐ Yes ☐ No | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Plastic straw | ☐ Yes ☐ No | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Rubber band | ☐ Yes ☐ No | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Metal paper clip | ☐ Yes ☐ No | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Wood stick | ☐ Yes ☐ No | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Cardboard | ☐ Yes ☐ No | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

**🧠 Reflect and Explain:**

**What do all the conductors have in common (look at color, feel, material type)?**  
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Why is it important to know which materials are conductors or insulators in real life?**  
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

🔧 **Station 1: Conductor vs. Insulator Showdown**  
🔌 **NGSS Standard:** MS-PS2-3 – *Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.*

✅ **ITEEA STEL Standards – Middle School**

**STEL 1E** – Technological systems use inputs, processes, outputs, and feedback to solve problems.  
→ Students build a working electrical system and test the effect of inserting different materials (inputs) to evaluate outcomes (outputs).

**STEL 4D** – Requirements for a design include desired elements and constraints.  
→ Students define the desired element (conductivity) and test different materials against that constraint to find effective designs.

**STEL 5E** – Troubleshooting is a problem-solving method used to identify the cause of a malfunction in a technological system.  
→ Students troubleshoot their circuits if the bulb doesn’t light up, learning to isolate problems related to materials or connections.

**STEL 7D** – Materials have different properties that make them useful in different ways.  
→ Students directly test and classify materials based on electrical properties (conductive or insulating).

**STEL 8E** – Technological systems often interact with one another.  
→ Students see how energy (electric current) moves through materials and affects system behavior.

✅ **Common Core Math Standards – Middle School**

**CCSS.MATH.CONTENT.6.SP.B.4** – Display numerical data in plots on a number line, including dot plots, histograms, and box plots.  
→ Students can display how many materials were conductors vs. insulators in a graph or tally chart.

**CCSS.MATH.CONTENT.7.SP.C.7** – Develop a probability model and use it to find probabilities of events.  
→ Students could predict the likelihood of a material being a conductor based on previous results, reinforcing statistical thinking.

**CCSS.MATH.CONTENT.6.EE.C.9** – Use variables to represent two quantities in a real-world problem and analyze the relationship.  
→ Students relate material type to whether a bulb lights up, forming logical relationships that support early algebraic thinking.

💡 **Summary:**  
This activity strengthens students' understanding of materials science and basic circuitry by integrating hands-on engineering exploration with data collection and classification. It builds foundational skills in scientific reasoning, technological literacy, and applied math.