**📍 Station 4: Material Detective**

**Focus:** Properties of Materials
**NGSS:** MS-PS1-2, 2-PS1-1

### **Goal:**

Use tools and tests to investigate **thickness**, **magnetism**, and **electrical conductivity** of different materials. Learn how physical properties help us choose the right material for a job!

**Materials needed:**
 Ruler or caliper

 Samples: metal, plastic, wood, paper (labeled or numbered)

 Magnet

 Multimeter (set to continuity or resistance mode)

**Student Directions:**

#### Step 1: Measure the Thickness

1. Use a **ruler or caliper** to measure how thick each material sample is (in **mm or cm**).
2. Record it in your chart.

#### 🧲 Step 2: Test Magnetism

1. Gently touch the **magnet** to each material sample.
2. Does the sample **stick to the magnet**?
	* Check the box: ☐ Yes or ☐ No

#### ⚡ Step 3: Test Electrical Conductivity

1. Turn the **multimeter** to continuity mode (or resistance, if instructed).
2. Touch the two probes to opposite sides of the sample.
3. Watch the screen or listen for a beep:
	* Beep or low number? ✅ It **conducts electricity**
	* No beep or high number? ❌ It **does NOT conduct**

### 📊 Record Your Findings:

| **Material** | **Thickness (cm or mm)** | **Magnetic?** | **Conducts Electricity?** |
| --- | --- | --- | --- |
| Metal |  | ☐ Yes ☐ No | ☐ Yes ☐ No |
| Plastic |  | ☐ Yes ☐ No | ☐ Yes ☐ No |
| Wood |  | ☐ Yes ☐ No | ☐ Yes ☐ No |
| Paper |  | ☐ Yes ☐ No | ☐ Yes ☐ No |

### 💬 Think & Reflect:

📝 **Which materials might be most useful in building a circuit or structure? Why?**
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

🧠 **How does knowing the physical properties of a material help engineers?**
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**🧠 Challenge Question (Wrap-Up):**

**Imagine you're designing a race track or a robotic arm. How would accurate measurement help you? How does energy or mass affect how it works?**
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
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### 📍 **Station 4: Material Detective**

**Focus:** Properties of Materials
**NGSS Standards:**

* **MS-PS1-2** – Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.
* **2-PS1-1** – Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.

### ✅ ITEEA STEL Standards – Middle School

**STEL 3E** – The study of technology uses measurement.
→ Students use rulers and calipers to measure material thickness, learning how precision impacts engineering design and decision-making.

**STEL 4E** – Materials have many different properties.
→ Students explore magnetism, conductivity, and thickness to classify materials and understand their usefulness in real-world systems.

**STEL 5F** – Elements of the design process include identifying criteria and constraints, and refining solutions.
→ Students use property data to assess which materials meet design needs (e.g., for conductivity, strength, or weight).

**STEL 6E** – Energy is the capacity to do work.
→ By testing conductivity, students explore how materials affect the flow of electrical energy in systems.

**STEL 7F** – Technological products and systems can be used to apply energy in a variety of ways.
→ This includes choosing materials that enable (or block) energy transfer in electronic or magnetic systems.

### ✅ 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 organize and visualize their thickness, conductivity, and magnetism data.

**CCSS.MATH.CONTENT.6.RP.A.3** – Use ratio and rate reasoning to solve real-world and mathematical problems.
→ Students may reason about how thickness or material quantity affects performance (e.g., conductivity vs. size).

**CCSS.MATH.CONTENT.7.EE.B.3** – Solve real-life and mathematical problems using numerical and algebraic expressions and equations.
→ Students calculate and interpret electrical resistance or compare measurement-based results.

**CCSS.MATH.PRACTICE.MP5** – Use appropriate tools strategically.
→ Students apply tools like calipers, magnets, and multimeters to collect and interpret data effectively.

**CCSS.MATH.PRACTICE.MP6** – Attend to precision.
→ Precision in thickness and electrical testing is crucial for accurate conclusions and recommendations.

### ✅ Summary:

This station strengthens students’ understanding of **material properties**, **measurement tools**, and **energy systems**. It reinforces **STEL standards** through hands-on analysis and aligns with **Common Core Math** through data collection, reasoning, and tool-based measurement—all key skills for engineers and designers.