**⚡ Station 2: Power Up! Potential Energy in Batteries**

**NGSS Standard:** *MS-PS3-2 – Energy Transfer and Conservation*
**Focus Question:** *How does a battery store and release energy to power devices?*

**🎯 Your Mission:**

Batteries store chemical potential energy. Your job is to measure and compare how much energy is stored in different batteries and observe how it powers a light.

**🎯 FOCUS:**

Energy Storage and Transfer – How Batteries Release Potential Energy to Power a Circuit

**🛠️ Materials at Your Station:**

* 1 AA battery (1.5V)
* 1 9V battery
* Multimeter or voltage tester
* Battery holders (for each battery type)
* LED (with resistor to prevent burn-out)
* Breadboard or jumper wires (optional, for easy setup)

**Student Directions:**

 **STEP 1: Measure Voltage**

* Use the **multimeter or voltage tester** to read the voltage of each battery.
* Place the red probe on the **positive (+)** side and the black probe on the **negative (–)** side.
* **Record** the reading for each battery in volts (V).

**STEP 2: Build a Simple Circuit**

* Insert the **AA battery** into its holder.
* Connect the **positive and negative wires** from the battery holder to the LED circuit (use a breadboard or clip wires).
* Observe the **brightness** of the LED and describe it as **Low**, **Medium**, or **High**.
* Repeat the same setup with the **9V battery**.

💡 *Hint: Make sure to use the same LED each time for a fair comparison!*

**STEP 3: Fill in the Data Table**

| **Battery Type** | **Voltage Reading (V)** | **Brightness of LED (Low, Med, High)** |
| --- | --- | --- |
| AA | \_\_\_\_\_\_\_ V | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| 9V | \_\_\_\_\_\_\_ V | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

 **Think & Record:**

**Which battery stored more energy, and how can you tell?**
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**How does the voltage relate to how much energy is available to power the LED?**
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**In real life, why might someone choose a higher-voltage battery?**
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Station 2: "Power Up! Potential Energy in Batteries"** activity:

🔋 **NGSS Standard:**
**MS-PS3-2** – *Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.*

✅ **ITEEA STEL Standards – Middle School**

**STEL 1E** – Technological systems use inputs, processes, outputs, and feedback to solve problems.
→ Students explore how batteries (input) release energy (process) to power an LED (output) and observe performance (feedback).

**STEL 4D** – Requirements for a design include desired elements and constraints.
→ Students compare battery options based on voltage output to determine which meets specific energy needs in a circuit.

**STEL 7E** – The selection of materials involves trade-offs between competing values.
→ Students evaluate AA vs. 9V batteries and discuss trade-offs like energy output, cost, or safety in real-life applications.

**STEL 8D** – Energy and power technologies are used to provide light, heat, and power.
→ This activity directly connects to powering an LED and measuring energy transfer from a chemical source (battery) to electrical output.

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

**CCSS.MATH.CONTENT.6.SP.B.5** – Summarize numerical data sets in relation to their context.
→ Students collect and analyze voltage readings and brightness levels, then summarize their findings based on performance.

**CCSS.MATH.CONTENT.6.EE.B.6** – Use variables to represent numbers and write expressions to solve problems.
→ Students can model energy relationships or make comparisons using variables like V (voltage), I (current), and brightness level.

**CCSS.MATH.CONTENT.7.EE.B.3** – Solve real-life problems using numerical and algebraic expressions and equations.
→ Students may apply formulas (e.g., Ohm’s Law if extended) to calculate relationships and interpret data from their circuits.

💡 **Summary:**
This station-based activity blends science, math, and engineering by guiding students to measure, compare, and interpret energy stored in batteries. It promotes hands-on understanding of energy systems, reinforces data collection and analysis skills, and introduces trade-offs in real-world design decisions.