## 📍 Station 2: Energy Conversion Pit Stop – Powering LEDs

**NGSS: HS-PS3-3** – Design a system to convert one form of energy into another

### 🎯 Goal: Construct a system where chemical energy from a battery converts into light energy.

**Materials:**

* Battery + holder
* Breadboard or cardboard
* 2 LEDs
* Resistors
* Aluminum foil (optional)
* Switch

### 🛠️ Student Directions:

🔋 **Step 1: Design Your Circuit**

1. Place the battery in the holder.
2. Connect the battery to a breadboard circuit with LEDs and resistors.
3. Add a switch to control the circuit.

🌟 **Step 2: Test for Brightness and Resistance**

1. Try using different resistor values (330Ω, 1kΩ, etc.).
2. Note how the brightness changes.

📓 **Record:**

| **Resistor Used** | **Brightness (Low/Med/High)** |
| --- | --- |
|  |  |

### 💬 Reflection Prompts:

1. How does the resistor affect the energy conversion into light?  
   → \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Why is managing energy important in real-world devices?  
   → \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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### ✅ **ITEEA STEL Standards – High School**

**STEL 1E** – Technological systems use energy, information, and physical and biological resources to achieve goals.  
→ Students directly explore how **chemical energy** (battery) is converted into **light energy** (LEDs) through a designed system.

**STEL 2E** – Technological decisions should consider efficiency, safety, and sustainability.  
→ By comparing resistor values, students examine how controlling current can manage energy efficiency and device longevity.

**STEL 3E** – Systems thinking involves understanding how parts interact within a system.  
→ Students analyze how each component (battery, resistor, LED, switch) affects the entire circuit's function.

**STEL 4E** – Troubleshooting requires interpreting data and evaluating performance.  
→ Students observe and measure LED brightness as a performance output based on input changes (resistor values).

**STEL 5E** – Design involves generating and testing solutions to meet specific needs.  
→ Students design, test, and refine a working energy conversion system in line with performance expectations (brightness control, switch functionality).

**STEL 6E** – Modeling, simulation, and prototyping help assess performance of designed systems.  
→ Students prototype circuits and observe how energy behaves under different configurations, simulating design processes used in electronics.

**STEL 7E** – Design constraints (like materials, efficiency, or user needs) shape technology outcomes.  
→ The use of different resistors models real-world decisions about **power management** and **component protection**.

### ✅ **Common Core Math Standards – High School**

**CCSS.MATH.CONTENT.HSN.Q.A.1–3** – Use units, define quantities, and choose levels of precision when modeling and solving problems.  
→ Students deal with **ohms, volts, and brightness**—practicing real measurement language and approximations used in electrical engineering.

**CCSS.MATH.CONTENT.HSA.CED.A.1** – Create equations to describe relationships.  
→ Students relate resistor values to brightness, which can be quantified using **V = IR** and interpreted in data tables.

**CCSS.MATH.CONTENT.HSA.REI.B.3** – Solve simple linear equations in one variable.  
→ Ohm’s Law and energy equations are applied when evaluating how resistance changes current and affects light output.

**CCSS.MATH.PRACTICE.MP2** – Reason abstractly and quantitatively.  
→ Students interpret how numerical resistance values correspond to brightness changes in a physical circuit.

**CCSS.MATH.PRACTICE.MP4** – Model with mathematics.  
→ Students use math concepts like proportionality and inverse relationships (more resistance = less current = lower brightness).

**CCSS.MATH.PRACTICE.MP5** – Use appropriate tools strategically.  
→ Tools like breadboards and switches are used to visualize and test real applications of energy conversion.

### ✅ Summary

This station integrates **physics, engineering design, and mathematical modeling** by having students **construct a working energy conversion circuit**, test variables like resistance, and observe system outputs. It supports **NGSS engineering practice**, **ITEEA systems thinking and troubleshooting**, and **Common Core mathematical reasoning**.