## 📍 **Station 1: Light Tracker Beacon**

**NGSS: MS-PS3-2** – Model energy transfer in electrical circuits  
🎯 **Goal**: Build a working LED circuit that lights the way for your jungle rescue team at night! You’ll model how electrical energy from a battery is transferred to light energy—and even reflect it across the terrain.

### Materials:

 Breadboard or small cardboard base

 2 LED lights (any color)

 1 battery (AA or 9V) + holder

 2 resistors (330Ω or 100Ω)

 Jumper wires or foil strips

 Switch (or a homemade pressure switch using foil)

 Small mirror or aluminum foil sheet

### **Student Directions:**

**🔌 Step 1: Understand the Flow**

Look at your battery. It stores chemical potential energy. When you connect it to a circuit, that energy turns into electrical energy, which powers your LED (which emits light energy).

**🔋 Step 2: Set Up Your Power**

1. Place your battery into the holder.
2. Connect a red wire from the positive terminal of the battery holder to your breadboard or foil path.
3. Connect a black wire from the negative terminal to a different area on your board (or second foil strip). This sets your circuit's main power path.

**Step 3: Place the LEDs**

1. Look at each LED. One leg is longer (positive or anode), and one is shorter (negative or cathode).
2. Place the LEDs into the breadboard (or tape them onto cardboard with foil). Make sure:
   * The positive leg connects toward the red wire/power.
   * The negative leg connects toward the black wire/ground**.**

**Step 4: Add the Resistors**

1. Connect a resistor in front of each LED to prevent it from burning out.
2. Resistors can go between the power wire and the LED’s positive leg, or between the LED’s negative leg and the ground wire.
   * Example: Battery (+) → Resistor → LED → Wire → Battery (–)

**Step 5: Add a Switch**

1. You can use a push-button switch or make your own with two foil pieces and a sponge.
2. Put the switch between the battery and the rest of the circuit. This way, when the switch is pressed or touched, the circuit closes and turns on the LEDs.

**Step 6: Aim and Reflect**

1. Use a mirror or piece of foil to reflect the LED light across your “rescue zone.”
2. Try angling the mirror to flash light in specific directions—like an SOS signal.

**Test & Record:**

1. Do both LEDs light up?
2. What happens when you cover one LED?
3. Try using a stronger resistor (like 1,000Ω). What changes about the brightness?

**Write your answers below:  
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**💬 Reflection Prompts:**

1. How does energy travel from the battery to the light?  
→ Think about each part the energy flows through.  
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. Why is resistance important in a circuit?  
→ What would happen without a resistor?  
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3. In a real jungle rescue, how would a system like this help your team?  
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ **→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**🌟 Optional Challenge:**

Can you modify your circuit to make only one LED light at a time? (Hint: Try adding a second switch!)

📍 **Station 1: Light Tracker Beacon** (NGSS: MS-PS3-2)

### ✅ **ITEEA STEL Standards – Middle School Alignment**

**STEL 1B** – Technology helps to shape the natural world and can address problems and needs.  
→ This station demonstrates how electrical circuits can be used to solve real-world problems like nighttime signaling in a jungle rescue.

**STEL 2B** – Technological decisions should reflect thoughtful consideration of factors like sustainability, effectiveness, and safety.  
→ Students must consider the brightness, placement, and safety of LEDs, mirrors, and circuits.

**STEL 3B** – Systems thinking involves understanding how different parts interact in a technological system.  
→ Students build and analyze a complete LED signaling circuit, considering how power, resistors, and switches affect the outcome.

**STEL 4B** – Technological systems include inputs, processes, outputs, and feedback.  
→ This circuit has a clear input (battery), process (energy transfer through components), and output (light), with feedback when testing and adjusting LED brightness.

**STEL 6B** – Creativity in design is necessary to meet users' needs and constraints.  
→ Students creatively use materials (foil, mirrors, cardboard) to engineer a solution for light signaling in the wild.

**STEL 7B** – The engineering design process is iterative: it includes defining problems, designing solutions, testing, and refining.  
→ Students go through planning, building, testing, and improving their circuits in response to reflection questions and challenge prompts.

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

**CCSS.MATH.CONTENT.6.EE.A.2** – Write, read, and evaluate expressions in which letters stand for numbers.  
→ Students analyze relationships between voltage, resistance, and current conceptually, possibly discussing Ohm’s Law (V = IR) informally.

**CCSS.MATH.CONTENT.6.RP.A.1** – Understand ratio concepts and use ratio reasoning to solve problems.  
→ Students reason proportionally when comparing LED brightness with different resistor values.

**CCSS.MATH.CONTENT.7.EE.B.3** – Solve real-life problems using numerical and algebraic expressions and equations.  
→ As part of deeper extension tasks, students can calculate voltage drops or predict outcomes based on circuit changes.

**CCSS.MATH.CONTENT.6.SP.B.5** – Summarize numerical data sets in relation to context.  
→ Students record and compare data from testing different resistors or light reflections, and describe trends.

**CCSS.MATH.PRACTICE.MP2** – Reason abstractly and quantitatively.  
→ Understanding current flow, resistance, and voltage requires translating physical setups into conceptual models.

**CCSS.MATH.PRACTICE.MP4** – Model with mathematics.  
→ Students model circuits and energy flows, potentially diagramming their setups to explain their reasoning.

**CCSS.MATH.PRACTICE.MP5** – Use appropriate tools strategically.  
→ Selecting components like resistors or switches requires thoughtful consideration of their function in the circuit.

### ✅ Summary

The **Light Tracker Beacon** station effectively combines **NGSS energy transfer concepts** with **engineering design thinking (ITEEA)** and **middle school mathematical modeling and reasoning (Common Core)**. It’s a well-rounded hands-on STEM task ideal for building deeper understanding of **real-world energy applications** in a collaborative, exploratory format.