**NGSS ES Harley Kit Activity**

**Harley’s Circuit Safari: Jungle Rescue Mission"**

**Name:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  **Date:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
**Partner(s):** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**🎯 Your Mission:**

You’re part of the Harley-Davidson Jungle Rescue Team! Your solar-powered adventure bike is traveling through a dense jungle. Your job is to create a rescue alert system using circuits that can send signals with light, sound, and movement to help stranded animals or explorers.

You’ll build creative circuits to help your team **send a signal, scare off wild animals, and guide your team to safety.**

**📍 Station 1: Solar Signal Shield**

**NGSS: 4-PS3-2**  
**Objective:** Build a "sun-activated" signal system using reflected light and a circuit.

**Materials:**

 1 **LED**

 1 **battery** + **battery holder**

 2 **wires** or **foil strips** (to complete your circuit)

 1 **small mirror** or piece of **aluminum foil**

 1 **paper cup** or **cardboard dome** (to act as your “signal shield”)

 **Flashlight** (if sunlight isn’t available)

**Student Directions:**

**Build the Circuit**

* Connect the **positive wire** from the battery to the **positive leg** of the LED.
* Connect the **negative wire** from the battery to the **negative leg** of the LED.
* Make sure everything is securely connected using the battery holder.

**Step 1: Mount the LED in the Shield**

* Place the LED inside the **paper cup** or **cardboard dome** to act like a signal lamp.
* Cut a small hole if needed to let the LED poke through the top of the dome.

**Step 2: Use Reflected Light to Signal**

* Hold the **mirror or foil** to reflect **sunlight** (or flashlight beam) onto the dome.
* **Aim the beam** at the LED shield.
* Try tilting the mirror or foil to create a **flashing effect**, like an **SOS signal**.

**Observe & Record:**

**What do you notice when light hits the reflective surface?**  
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**What happens when you move or tilt the reflective surface?**  
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Real-World Connection:**

**Why would a light-based signal be helpful in a jungle rescue situation?**  
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**What energy transformations happen in your design?**  
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

🔍 What do you notice when light hits the reflective surface?  
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

💡 Why would this be useful in a jungle rescue?  
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**📍 Station 2: Monkey-Repelling Motor Trap**

**NGSS: 4-PS3-4**  
**Objective:** Build a working **motor-powered scare trap** to protect your jungle base from sneaky monkeys using a spinning fan!

**Materials:**

 1 **small motor**

 1 **battery** + **battery holder**

 **Wire leads** (or foil strips)

 **Paper fan or pinwheel**

 **Straw** (for fan support or motor mount)

 **Tape**

 **Paper cup** or **cardboard base**

**Student Directions:**

**Step 1: Test Your Motor**

* Connect one wire from the **positive battery terminal** to one motor terminal.
* Connect another wire from the **negative terminal** to the other side of the motor.
* ✅ **Does the motor spin?** If not, double-check your connections or try switching wires.

**Step 2: Build the Spinner**

* Tape a **paper pinwheel** or **cut paper blades** to the motor shaft (the part that spins).
* Make sure the fan is **balanced** and can spin freely. You may need to adjust where you place it.

**Step 3: Create Your Trap Setup**

* Tape the motor securely to your **cardboard base** or inside a **paper cup**.
* Angle it so the fan is visible and facing outward like a real scare device.
* Test it again by connecting the circuit — does the **fan spin rapidly**?

**Observe & Record:**

**What kind of energy is being created (from → to)?**  
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
→ (Hint: Is it going from battery power to motion?)

**What happens when the wires are connected and disconnected?**  
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**🐒 Jungle Survival Connection:**

**How could this “spinning scare trap” help the rescue mission?**  
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
→ (Hint: Think about motion, noise, or flashing movement.)

**How could you improve your monkey-repelling fan trap?**  
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**📍 Station 3: Jungle Sound Beacon**

**NGSS: 4-PS3-2**  
**Objective:** Create a hidden sound beacon that activates when someone steps on a pressure plate.

**Materials:**

 2 **foil squares**

 1 **small sponge** or **thin soft cardboard**

 1 **buzzer**

 **Battery + holder**

 **Alligator clip wires** (or foil strips)

 **Tape**

 **Paper labeled “LEAVES”** to hide the trap

**Student Directions:**

**Step 1: Build the Pressure Plate**

* Tape **one foil square** to the top of the sponge.
* Tape the **second foil square** to the bottom of the sponge (or soft surface).
* The goal: when someone steps on it, the sponge compresses and the foil squares **touch**!

**Step 2: Make the Circuit**

* Connect one foil square to one side of your buzzer using a wire.
* Connect the other foil square to the other side of the buzzer.
* Complete the circuit by attaching the buzzer to the **battery holder** with wires.
* **Test it!** The buzzer should only sound **when the foil pieces press together.**

**Step 3: Disguise Your Beacon**

* Place the sponge + foil sandwich under a piece of paper labeled **“LEAVES”**.
* Try stepping on it gently—**can you hear the alarm?**

**Record & Reflect:**

**🎧 What causes the buzzer to sound?**  
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
(Hint: Think about what closes the circuit.)

**🔊 Why would this be helpful in an emergency or jungle rescue?**  
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
(Hint: Could rescuers find someone who stepped on it?)

**💡 Optional Challenge:**  
Can you design your beacon to only work **at night** or when the person is **really heavy**? Brainstorm an upgrade!  
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**📍 Station 4: Leaf Trail Light Path**

**NGSS: 4-PS3-4**  
**Objective:** Use a circuit with “leaf-shaped” LEDs to light a path out of the jungle.

**Materials:**

 Green **LED lights**

 **Battery + holder** (2 AA or 9V)

 **Green construction paper** (cut into “leaves”)

 **Wire or foil strips** (to connect the circuit)

 **Tape**

 Optional: Paper map or cardboard path base

**Student Directions:**

**Step 1: Make Your Glowing Leaves**

* Take a piece of green paper and cut it into leaf shapes.
* Tape **one LED** to each paper leaf. Make sure the **metal legs of the LED stick out** so you can connect them later.

**Step 2: Plan Your Jungle Trail**

* Lay out the leaves in a **path or winding trail**—this could be across your desk, on the floor, or over a paper jungle map.
* Decide where your path starts (rescue base) and ends (safe zone).

**Step 3: Build the Light Circuit**

* Connect your battery holder to the first leaf using **foil strips or wire**—one strip to the longer leg of the LED (positive) and one to the shorter leg (negative).
* Keep connecting the leaves one after the other, forming a **series or parallel circuit**.
* Tape everything in place so the connections stay secure.

**Step 4: Test the Path!**

* Turn on the battery power (or plug in the holder). Watch as your “leaves” glow!
* Use your finger to “walk” through the jungle and follow the glowing path.

**Record & Reflect:**

**What’s happening to the energy in this circuit?**  
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
(Hint: How does electrical energy become light?)

**🚶 How does light help in dark, wild areas like a jungle?**  
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
(Hint: What could rescuers, animals, or explorers use the lights for?)

**Optional Challenge:**  
Can you make the lights blink or turn on **only when someone steps on the trail**? Add a switch or foil pressure plate to make it interactive!

What’s happening to the energy in this circuit?  
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

How does light help in dark, wild areas?  
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**🚨 Final Challenge: Build Your Rescue Base System!**

**NGSS Standard:** 4-PS3-2, 4-PS3-4 – Energy transfer & conversion in designed systems  
**🎯 Objective:** Design and build a **rescue system** that uses **at least two types of energy** (light, sound, or motion) to keep people or animals safe in the jungle!

**Materials Needed:**

** LED lights**

** Buzzers or motors**

** Battery packs**

** Alligator clips, wire, foil strips**

** Switches, mirrors, pressure plates, fans, or paper sensors**

** Green paper, cardboard, foam, tape**

**Student Directions:**

**Step 1: Plan It Out**

* Think about what you learned from the other stations:
  + Lights can signal or light a path.
  + Buzzers can alert or warn others.
  + Motors or fans can cause motion to scare or signal.
* Decide what your rescue base will do:
  + Help people find their way?
  + Warn animals to stay away?
  + Send a sound or light signal when someone arrives?

**Step 2: Choose Your Energy Types**

Pick at least TWO types of energy for your system:

* 💡 Light (LEDs or reflected mirrors)
* 🔊 Sound (buzzers or alarms)
* 🔄 Motion (motors, fans, moving parts)

**Step 3: Build It**

* Sketch your system first on the template below. Label each part.
* Then, using your materials, connect your components with batteries and switches.
* Test each part. Does it light up, buzz, or move when activated?

**Step 4: Test & Improve**

* Does everything turn on at the right time?
* Can you combine switches (like a pressure plate + button)?
* Is the system clear and safe?

**Draw Your Jungle Rescue Base System Below:**

Label where energy moves (example: “Battery → Wire → LED = Light!”) **✏️ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
✏️ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Answer These Reflection Prompts:**

How does your system help keep people or animals safe?  
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What did you learn about energy and circuits today?  
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

If you could add one more feature to your jungle system, what would it be?  
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**NGSS MS HARLEY KIT ACTIVITY**

# 🏍️ **Harley’s Tech Trek: Jungle Rescue Circuit Mission**

**Name:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  **Date:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
**Partner(s):** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### 🌟 Mission Overview:

As part of the **Harley-Davidson Jungle Rescue Team**, you must build life-saving tech to help explorers trapped deep in the rainforest! Use your circuit design and physical science skills to create systems that **light paths**, **send signals**, and **scare away wild animals** using **light**, **sound**, and **motion**.

## 📍 **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!)

Let me know if you'd like this in printable worksheet format or want me to continue detailing the next station!

## 📍 **Station 2: Motion Defense Spinner**

**NGSS: MS-PS3-5** – Show how kinetic energy transfers through circuits  
🎯 **Goal**: Use electrical energy to create movement and defend your base!

### **Materials:**

 Small DC motor

 Battery + holder (AA or 9V)

 Paper fan blades or spinner

 Cardboard or jungle platform (your mount)

 Tape, straw, and scissors

 Jumper wires or foil strips

 Optional: different battery sizes or weights

### **Student Directions:**

#### **Step 1: Assemble the Power Core**

* Connect your **motor terminals** to the battery using **jumper wires or foil strips**.
* Make sure your connections are secure and wires aren’t crossing.

#### **Step 2: Build the Jungle Fan**

* Cut out a paper fan or spinner with large “blades.”
* Use tape to attach it **firmly** to the shaft of the motor (centered!).
* Add a straw if needed to elevate or extend your motor mount.

#### **Step 3: Construct the Mount**

* Mount the motor to cardboard (this is your **Base Defense Platform**).
* Tilt it slightly, or make it upright, depending on your defense style.

#### **Step 4: Test + Troubleshoot**

* Power it up!
* What happens when you **reverse the wires**? What direction does it spin now?
* Try **tilting the fan**, or making the blades bigger. Does the speed change?
* Add more **weight** or try a **different battery**. What happens?

### **Test & Record:**

| **Test Variable** | **What You Changed** | **What Happened?** |
| --- | --- | --- |
| Default Setup | — | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Reversed Wires | Changed polarity | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Increased Fan Size | Larger blades | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Battery Type | Swapped voltage | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Tilted Base | Changed angle | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

### **Mission Reflection:**

* **What type of energy is stored in your battery?**  
  → \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* **What kind of energy did it turn into?**  
  → \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* **What helped your fan spin faster or better? Why?**  
  → \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* **If you added one more feature to improve defense, what would it be?**  
  → \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Bonus Mission (Optional):

**Design a Jungle Alert System** — Add a **light or buzzer** that activates when the motor is running! You’ll combine **motion + sound/light** for ultimate base defense.

## **Station 3: Sound Trap Alert**

**NGSS: MS-PS2-3 & MS-PS3-2** – Investigate forces and energy in circuits  
**Goal**: Build a buzzer-based alarm triggered by pressure!

### Materials:

 1 Buzzer

 1 Battery + holder

 2 foil squares or strips

 Sponge or soft cardboard piece

 Tape

 Jungle-themed “leaf” cover paper (or green paper)

### **Student Directions:**

**Step 1: Build the Pressure Plate**

* Place the **sponge** between the two **foil pieces** like a sandwich.
* Tape it so the foil is on the top and bottom—**not touching each other** unless pressed.

**Step 2: Connect the Circuit**

* Connect one foil piece to the **positive side** of the battery holder.
* Connect the other foil piece to **one terminal of the buzzer**.
* Complete the circuit by connecting the buzzer’s other terminal back to the battery's negative side.
* Test it! Push gently on the sponge—**does the buzzer sound?**

**Step 3: Disguise It Like a Jungle Pro**

* Place jungle “leaf” paper over your pressure plate.
* Try placing it under a path or entry point.
* Now **test it** by stepping, tapping, or pressing your trap.

**Test & Record:**

| **Test Action** | **What You Did** | **What Happened?** |
| --- | --- | --- |
| Light Press | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Firm Step | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Jump On It | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Cover with Leaves | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

**Reflection Questions:**

* **How does the circuit close and send energy to the buzzer?**  
  → \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
  → \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* **What type of force activates the trap?**  
  → \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* **How could you make your trap more sensitive or louder?**  
  → \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Bonus Challenge:**

Can you add a **second buzzer** or a **blinking light** to your trap? Defend your jungle base with style and science!

Would you like a printable worksheet version of this next?

**Test & Record:**

* What happens when pressure is applied?
* How sensitive is your trap?

**Reflection:**  
→ How does the circuit close and send energy to the buzzer?  
→ What type of force causes this?

## **Station 4: Circuit Puzzle Challenge**

**NGSS: MS-PS3-5** – Apply knowledge of energy systems  
🎯 **Goal**: Create a circuit puzzle that only works when **all** paths are connected correctly.

### Materials:

 LEDs

 Buzzer

 Battery + holder

 Aluminum foil strips (or tape)

 Cardboard base

 Puzzle-shaped paper or cardboard pieces

 Wires or alligator clips

 Tape, scissors

### Student Directions:

#### 🗺️ Step 1: Create the Circuit Base

* Lay **foil strips** on cardboard to form your “hidden path.”
* Think like a game designer—**leave gaps** in the foil path where **puzzle pieces** will go!

#### 🧩 Step 2: Make Puzzle Connectors

* Cut paper or cardboard into puzzle pieces that will **bridge the gaps** in your foil path.
* Tape **foil to the bottom** of each piece so it **conducts electricity** when placed correctly.

#### ⚡ Step 3: Add LEDs and Buzzer

* Connect your circuit using the foil paths, puzzle bridges, battery, LED(s), and buzzer.
* Arrange the pieces so that the circuit is only complete—and works—when **ALL puzzle pieces are in the right spot**.

#### 🔄 Step 4: Test It!

* Try placing puzzle pieces one at a time.
* Does the LED light up? Does the buzzer buzz?
* What happens if a piece is missing or upside down?

### 🧪 **Test & Record**

| **Challenge Attempt** | **Did It Work?** | **What Went Wrong (If Anything)?** |
| --- | --- | --- |
| First Try | ☐ Yes ☐ No | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Wrong Piece Used | ☐ Yes ☐ No | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| All Correct Pieces | ☐ Yes ☐ No | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

What was the **trickiest part** of the puzzle to get working?  
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Can you design a **second puzzle** for another team to solve?  
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### **Reflection:**

* **How does your puzzle model real-world circuit design challenges (like in electronics or machines)?**  
  → \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* **What does this puzzle teach about open vs. closed circuits?**  
  → \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## **Wrap-Up Challenge: Rescue Base Blueprint**

You’re now ready to design a **complete jungle rescue system** using everything you’ve learned.

### **Materials Needed:**

* Use at least **2 types of energy transfer**:
  + 💡 Light (LED)
  + 🔊 Sound (buzzer)
  + 🔄 Motion (motor/spinner)

### **Sketch Your Rescue Base:**

Draw your system and **label where energy starts and what it turns into**.  
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**NGSS HS HARLEY KIT ACTIVITY**

## 🏍️ Harley’s Circuit Speedway: High Voltage Engineering Mission

**Name:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  **Date:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
**Partner(s):** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### 🌟 Mission Overview:

Welcome to the Harley-Davidson Circuit Speedway Team! You're the lead electrical engineer responsible for building, testing, and optimizing high-performance electrical systems used in race bikes and garage tech. At each station, you’ll take on challenges that bring NGSS Physical Science and Engineering stsandards to life.

## 📍 Station 1: Pit Crew Voltage Check – Ohm’s Law in Action

**NGSS: HS-PS3-1** – Create a computational model to calculate the energy in a system component

### 🎯 Goal: Use Ohm’s Law to calculate current and resistance in a functioning circuit.

**Materials:**

* Breadboard or circuit tray
* 9V battery + holder
* Assorted resistors (100Ω, 330Ω, 470Ω, 1kΩ)
* 2 LEDs
* Multimeter
* Jumper wires

### 🛠️ Student Directions:

🔌 **Step 1: Build Your Test Circuit**

1. Connect the 9V battery to your breadboard.
2. Place two LEDs in series with one resistor.
3. Use jumper wires to connect the complete circuit.

🔎 **Step 2: Measure Current and Voltage**

1. Use the multimeter to measure voltage across the resistor.
2. Use the multimeter to measure current flowing through the circuit.
3. Record your results.

🧮 **Step 3: Use Ohm’s Law**  
Use **V = IR** to calculate the unknown value in your circuit:

* If you know V and R, solve for I.
* If you know V and I, solve for R.

📓 **Record Your Data:**

| **Voltage (V)** | **Resistance (Ω)** | **Current (A)** |
| --- | --- | --- |
|  |  |  |

### 💬 Reflection Prompts:

1. What happens to current if you increase the resistance?  
   → \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. How does this relate to energy flow in a real race bike’s system?  
   → \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## 📍 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?  
   → \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## 📍 Station 3: Circuit Layout Garage – Series vs. Parallel Design

**NGSS: HS-PS3-5** – Model how layout affects energy and force in a circuit

### 🎯 Goal: Build and compare series vs. parallel circuits.

**Materials:**

* Breadboard or cardboard
* 2-3 LEDs
* Battery + holder
* Jumper wires
* Switch
* Resistors

### 🛠️ Student Directions:

🔄 **Step 1: Build a Series Circuit**

1. Connect LEDs in a single path with resistors.
2. Test brightness and functionality.

🔄 **Step 2: Build a Parallel Circuit**

1. Wire each LED on its own branch to the power source.
2. Observe and record differences.

📓 **Compare:**

| **Configuration** | **LED Brightness** | **What Happens If 1 LED Fails?** |
| --- | --- | --- |
| Series |  |  |
| Parallel |  |  |

### 💬 Reflection Prompts:

1. Which layout is more energy-efficient? Why?  
   → \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. How do real homes use parallel circuits for safety and efficiency?  
   → \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## 📍 Station 4: Engineering Optimization Challenge

**NGSS: HS-ETS1-3** – Evaluate solutions based on constraints

### 🎯 Goal: Improve one of your circuits to reduce energy loss and increase performance.

**Materials:**

* Any previously used circuit
* Optional: buzzer, motor, second battery
* Multimeter
* Stopwatch (for timing response)

### 🛠️ Student Directions:

🧠 **Step 1: Choose a Circuit to Improve**

1. Pick one of your designs from another station.
2. Identify problems like dim lights, overheating, or low power.

🔧 **Step 2: Make Modifications**  
Try one or more of the following:

* Reduce resistance
* Use parallel layout
* Add a more powerful battery
* Add a motor or buzzer for multifunctional output

📓 **Test & Record Results:**

| **Change Made** | **Outcome** | **Better/Worse?** |
| --- | --- | --- |
|  |  |  |

### 💬 Reflection Prompts:

1. How did your design change improve circuit performance?  
   → \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. What trade-offs did you have to consider (e.g., cost, heat)?  
   → \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## 🏁 Wrap-Up Challenge: Circuit Speedway Blueprint

Create a blueprint for a racing garage system that uses at least **two energy conversions**.

* Label input energy, output energy, components used.
* Optional: Add switches, sensors, or safety features.

**Sketch & Describe Below:**  
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
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