UNIT: circuitry game

THE POWER PUZZLE

Your Mission:

You’re the circuit designer for a high-tech LED lighting system! Your job is to figure out the **correct resistance** needed to safely power your LED—too much current, and it could burn out!

Focus: Energy Transfer, Resistance, and Current Control in Electrical Circuits

Materials:

* Copper foil or wire strips (short and long pieces)
* LED light
* Battery (e.g., coin cell or 9V)
* Multimeter (to measure voltage or current)
* Optional: Resistors of various values
* Tape and scissors

STUDENT DIRECTIONS:

**STEP 1: Build a Simple LED Circuit**

* Connect your LED to the battery using short copper tape strips or wires first.
* Observe the brightness of the LED. Is it too bright? Dim? Just right?

**STEP 2: Try a Longer Copper Tape Path**

* Replace one of the short strips with a longer path of copper tape.
* Observe again: Has the brightness changed?

**STEP 3: Estimate or Measure Values**

* Use the multimeter to measure:
	+ Voltage (V) across the LED
	+ Current (I) flowing in the circuit
	*OR* use the LED packaging to estimate how much voltage/current it needs (most LEDs use ~2V and 20mA).

 **Calculate Resistance**

* **Use Ohm’s Law:**

****

* Use your measurements or estimates to solve for R (resistance needed in ohms, Ω).

DATA TABLE TEMPLATE:

| **Setup Type** |  **Voltage (V)** |  **Current (A)** |  **Resistance (Ω)** |
| --- | --- | --- | --- |
| Short copper strip |  |  |  |
| Long copper strip |  |  |  |
| (Optional) with resistor |  |  |  |

**Analysis & Challenge:**

* Voltage used: \_\_\_\_\_\_\_\_\_\_\_
* Resistance calculated: \_\_\_\_\_\_\_\_\_\_\_
* What happened when resistance was too low?
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Discussion Prompt:**

* How does resistance affect how much energy your LED receives?
* What might happen to a real-world device if resistance isn’t controlled properly?
* Why do you think engineers carefully calculate resistance in every circuit?

Standards Alignment

NGSS: HS-PS3-1, HS-PS3-2 STEL: STEL 1H, STEL 4J, STEL 5F, STEL 7G, STEL 8H STEL 11G CCSS: CCSS.MATH.CONTENT.HSN.Q.A.1, CCSS.MATH.CONTENT.HSN-Q.A.2, CCSS.MATH.CONTENT. HSN-Q.A.3, CCSS.MATH.CONTENT. HSF-IF.C.7, CCSS.MATH.CONTENT. HSA-CED.A.4