UNIT: ELECTRICAL CIRCUITS

ACT-Based Science: Ohm’s Law Investigation (Data Analysis & Graphing)

These **hands-on science activities** align with **ACT Science College and Career Readiness Standards (CCRS)** and reinforce key skills like **data interpretation, experimental design, and scientific reasoning**—all while deepening students’ understanding of **electric circuits**.

**ACT Skills Practiced:**

* Interpreting data tables & graphs
* Identifying patterns & relationships
* Applying scientific formulas

**Objective:**

Students will collect and analyze data to determine the relationship between **voltage, current, and resistance** using Ohm’s Law (V=IR).

**Materials:**

* Batteries (9V)
* Resistors (various ohm values)
* Wires & alligator clips
* Multimeters (to measure voltage & current)
* Data table worksheet

**STUDENT DIRECTIONS:**

**Goal:** Determine the mathematical relationship between voltage, current, and resistance using Ohm’s

**STEP 1: Build a Simple Circuit**

1. Gather your battery, one resistor (start with 10Ω), wires, and multimeter.
2. Connect the resistor in series with the battery using alligator clips.
3. Attach the multimeter **in series** to measure **current (I)** in **amperes (A)**.
4. Switch the multimeter mode to **voltage (V)** and connect it **in parallel** with the resistor to measure voltage across it.
5. Double-check your connections with your teacher before turning on the circuit.

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#### **STEP 2: Collect and Record Data**

1. Once your circuit is complete and safe, measure:
	* The voltage across the resistor (should be ~9V).
	* The current flowing through the circuit.
2. Record the data in the table below.
3. Repeat steps using **different resistor values** (50Ω and 100Ω).

**Hint:** Use the Ohm’s Law equation to calculate resistance if needed: **R = V / I**

**STEP 3: Graph Your Data**

* On graph paper or using a digital tool:
	+ **X-axis** = Current (I)
	+ **Y-axis** = Voltage (V)
* Plot all three data points from your table.
* Draw a best-fit line.
* Label your axes and add a title: “Voltage vs. Current in a Simple Circuit”

**STEP 4: Analyze Your Results**

Answer these questions in complete sentences:

1. What pattern do you notice between voltage and current in your graph?
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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1. What happens to current when resistance increases?
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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1. Does your data follow Ohm’s Law? Why or why not?
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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1. What could explain any errors or differences in your measurements?
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**ACT-Style Data Table:**

|  |  |  |  |
| --- | --- | --- | --- |
| Resistor (Ω) | Voltage (V) | Current (A) | Calculated Resistance (Ω) |
| 10Ω | 9V | 0.9A | ? |
| 50Ω | 9V | 0.18A | ? |
| 100Ω | 9V | 0.09A | ? |

**Discussion Questions:**

* Based on your graph, what relationship do you observe between voltage and current?
* How does increasing resistance affect current flow?
* Does your data support Ohm’s Law? Why or why not?

**ACT-Style Multiple Choice Question:**

* Which of the following best describes the relationship between **voltage and current** in a circuit with a fixed resistance?
1. Exponential
2. Quadratic
3. Linear
4. Random

## **🌟** Why These ACT-Based Science Activities Matter

* **Prepares students for ACT Science** by reinforcing **data analysis, graph interpretation, and experimental design**.
* **Develops STEM inquiry skills**—helping students **think like scientists and engineers**.
* **Connects electrical circuits to real-world applications**, from home wiring to **renewable energy technologies**.