UNIT: CIRCUITRY GAME

ACT-Based Math: Voltage Drop Experiment

### Here are ACT-aligned math activities for the Build Your Own Circuitry Game that help students apply real-world skills in electrical measurement, formula application, and data interpretation relevant to voltage, current, and resistance in circuit design.

### Objective:

Students analyze voltage drops across different components.

MATERIALS NEEDED:

* Multimeter
* Resistors
* Wires
* Worksheet

Student Directions:

**Goals:**  
You will explore **voltage drops** across resistors in a **series circuit** by measuring real values and comparing them with theoretical calculations using Ohm’s Law. This hands-on activity builds your math and STEM reasoning skills.

**STEP 1: Build a Series Circuit**

* Gather the following components from your Circuitry Game Kit:
  + At least **two resistors** with different resistance values
  + A **power source** (battery)
  + **Wires** to make connections
  + A **multimeter**
* Assemble a **series circuit**, meaning all components are connected end-to-end in one continuous loop.

Tip: Label or note the resistance value of each resistor (e.g., 100Ω and 200Ω).

**STEP 2: Measure Total Voltage**

* Use the **multimeter** to measure the **total voltage** supplied by the battery (place the probes across the battery terminals).
* Record the voltage on your worksheet. This is your **V\_total**.

**STEP 3: Measure Voltage Drops Across Each Resistor**

* Measure the **voltage drop** across each individual resistor by placing the multimeter probes on either side of the resistor.
* Record the voltage drops as **V₁** and **V₂**.

Reminder: In a series circuit, the sum of the individual voltage drops should equal the total voltage from the battery (V\_total = V₁ + V₂).

**STEP 4: Theoretical Calculations**

* Use the voltage division rule to calculate the **theoretical voltage drop** across each resistor:

**V₁ = (R₁ / R\_total) × V\_total**  
**V₂ = (R₂ / R\_total) × V\_total**

* Where:
  + **R₁** and **R₂** are the resistor values
  + **R\_total = R₁ + R₂**
* Compare these calculated values with your measured voltage drops. Are they close? Why or why not?

**STEP 5: Analyze and Reflect**

Answer the following questions on your worksheet:

* Are your measured and calculated voltage drops similar?
* What factors might cause small differences?
* Why is understanding voltage drop important when designing circuits?

Extension: Try this again using **three** resistors or with a **parallel circuit** and observe how the voltage behaves differently.

## ACT-Style Question:

## If a **12V battery** powers a circuit with two **equal resistors**, what is the voltage drop across each?

## 3V

## 6V

## 12V

## 24V

## **⚡ Why These Activities and Questions Matter**

By engaging in math-based activities connected to the **Build Your Own Circuitry Game**, students:

✅ Practice organizing electrical concepts into clear, structured calculations and formulas.  
✅ Strengthen their ability to explain circuit design, Ohm’s Law, and electrical efficiency in mathematical terms.  
✅ Develop problem-solving and analytical reasoning skills using real-world topics like voltage, current, and resistance.

These skills mirror the **ACT Math** requirements—helping students become confident, effective problem-solvers, prepared for college-level math and careers in STEM fields.