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

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### ✅ **ITEEA STEL Standards – High School**

**STEL 1E** – Technological systems use energy, information, and physical and biological resources to achieve goals.  
→ Students investigate how voltage, current, and resistance interact in real systems, mirroring energy control in complex technologies like vehicles.

**STEL 2E** – Technological decisions should consider safety, efficiency, and impact.  
→ Measuring and calculating circuit values reinforces why accurate system design is critical for safe and efficient energy use in real-life applications.

**STEL 3E** – Systems thinking involves understanding interactions within and between systems.  
→ This activity requires analyzing how changing one circuit component affects the entire system’s behavior (e.g., resistance affects current flow).

**STEL 4E** – Understanding and troubleshooting systems requires interpreting feedback from sensors, meters, or indicators.  
→ Students use a multimeter to gather feedback (voltage and current), simulating diagnostic tools in professional technical fields.

**STEL 5E** – Design involves identifying problems, proposing solutions, testing, and refining designs.  
→ Students iterate between measurement and redesign based on calculated outcomes from Ohm’s Law, refining their circuits to meet performance goals.

**STEL 6E** – Modeling and simulation help evaluate the feasibility and effectiveness of designs.  
→ Applying **V = IR** is computational modeling in action—students simulate and predict how a circuit should behave before testing it physically.

**STEL 7E** – Design constraints influence final products.  
→ Students must work within real-world constraints like battery output, resistor limits, and component tolerances when designing their circuits.

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

**CCSS.MATH.CONTENT.HSN.Q.A.1** – Use units to understand problems and guide the solution of multi-step problems.  
→ Students must interpret volts, ohms, and amperes in real-world context while solving with correct units.

**CCSS.MATH.CONTENT.HSN.Q.A.2–3** – Define quantities appropriately and choose/interpret appropriate units and accuracy.  
→ Measurement and calculation of resistance and current require proper precision and interpretation of real sensor data.

**CCSS.MATH.CONTENT.HSA.CED.A.1** – Create equations that describe numbers or relationships.  
→ Students use **V = IR** to model the relationship between voltage, current, and resistance.

**CCSS.MATH.CONTENT.HSA.REI.B.3** – Solve linear equations in one variable.  
→ Students rearrange Ohm’s Law to isolate unknowns like I or R in their circuit analysis.

**CCSS.MATH.PRACTICE.MP4** – Model with mathematics.  
→ Ohm’s Law is applied as a mathematical model to represent energy flow through a circuit.

**CCSS.MATH.PRACTICE.MP5** – Use appropriate tools strategically.  
→ Students use multimeters and circuit components as tools to generate and verify real data against their calculations.

### ✅ Summary

This station challenges students to **build, measure, and model** a real electrical circuit using **Ohm’s Law**, which integrates **NGSS physics**, **ITEEA system design standards**, and **high school math practices** in algebra, precision, and modeling. It reinforces engineering thinking, diagnostic tools, and energy literacy essential to advanced technical pathways.