**Setup**

Kirchhoff's Laws provide a general set of rules for measuring current, voltage, and resistance in any circuit. These circuits may be composed of:

* Both equal and unequal loads (e.g. resistors, light bulbs, etc.)
* Combinations of series, parallel, and mixed connections

Use the following ExploreLearning computer gizmo to explore Kirchhoff's Laws as follows:

1. Go to [www.explorelearning.com](file:///C:\Users\Greg\Teaching\Science\SPH3U0\SPH3U0_1112Fall\5-Electricity\www.explorelearning.com) and click on "Enroll in a Class" at the top right corner.
2. Enter class code : **XLUBZCHS5M**  **and click continue.**
3. **Follow instructions and create a temporary account as follows:**
   * **user id: ST + your student number**
   * **password: PW + your student number**
   * **DO NOT provide your name or email address**
4. **Select the "Circuits" activity and launch the gizmo.**

**Series Circuits**

1. Use the Gizmo application to build a series circuit with one battery and three unequal resistors.
2. Kirchhoff's rules for measuring current and resistance in a series circuit predict that:
   * Itotal = I1 = I2 = I3 = ...
   * Rtotal = R1 + R2 + R3 + ...
3. Use the ammeter and ohmmeter tools to verify these rules by measuring current and resistance at different points in the circuit. Record your observations and calculations.
4. Ohm's Law predicts that V = IR.
5. Kirchhoff's rules for measuring voltage in a series circuit predict that:

* Vtotal = V1 + V2 + V3 + ...

1. Use Ohm's Law to predict values of voltage at different points in the circuit. Record your observations and calculations.
2. Use the voltmeter tool to verify your predictions.

**Parallel Circuits**

1. Use the Gizmo application to build a parallel circuit with one battery and three unequal resistors.
2. Kirchhoff's rules for measuring voltage and resistance in a parallel circuit predict that:
   * Vtotal = V1 = V2 = V3 = ....
   * 1/Rtotal = 1/R1 + 1/R2 + 1/R3 + ...
3. Use the volt meter and ohmmeter tools to verify these rules by measuring voltage and resistance at different points in the circuit. Record your observations and calculations.
4. Ohm's Law predicts that V = IR.
5. Kirchhoff's rules for measuring current in a parallel circuit predict that:
   * Itotal = I1 + I2 + I3 + ...
6. Use Ohm's Law to predict values of current at different points in the circuit. Record your observations and calculations.
7. Use the ammeter tool to verify your predictions.

**Mixed Circuits**

Mixed circuits contain sections in which components are connected in parallel and sections in which components are connected in series. To analyze a mixed circuit:

1. First divide the circuit into sections that are connected in parallel and sections that are connected in series.
2. Then simplify each section separately to find the equivalent resistance of a simpler circuit
3. Use Ohm's Law to find the equivalent voltage and current for the simplified circuit.
4. Expand and solve each simplified section to find the final values.

For each of the circuits below, the source has a voltage of 6.0 V and each resistor has a value of 10 Ω. Find all the other values of current, voltage, and resistance and use the computer gizmo to check your answers.

