Worksheet: Ohm's Law

Name: _____ Group name: _____

A multimeter includes a resistance setting (Ω), which works by measuring the voltage across the leads for a fixed current using Ohm's law $V = IR$. Be sure to notice the **prefix**: the measurement may be in Ω (ohm), kΩ (kilo-ohm) or MΩ (mega-ohm).

1. Observe the superconductor demo in front of class.

   - Try to reproduce the diagram resistance over temperature you observed:

   - Split the diagram into two regions: "boring" and "surprising". Explain what's going on in each of the two regions and why they are boring and surprising, respectively.

2. Use the attached resister sheet and consider the strips along the paper to be "wires".

   - Measure the resistance of the two single strip shading regions **before** applying graphite.

     R_{thin} = _____ ___, R_{thick} = _____ ____

   - Shade in the single-strip regions with a **thick** layer of graphite and measure:

     R_{thin} = _____ ___, R_{thick} = _____ ____

   - Assuming your two layers of graphite have the same thickness, how does R depend on the width of the strip?

3. Shade in the **parallel path** region with a nice thick layer of graphite

   - Recall the water-pipe analogy for electric current. Predict whether the parallel path resistor has **greater** or **less** resistance than a single path. By about what factor?

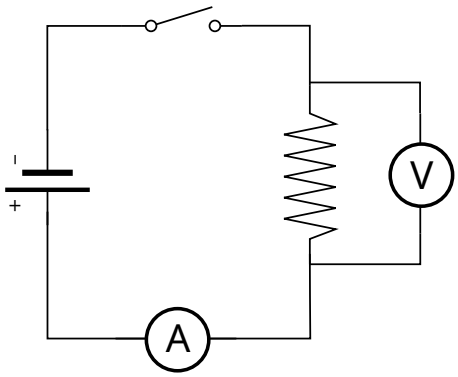
   - Measure the resistance: R = _____ _____

4. Shade in the **series path** region (winding) with a nice thick layer of graphite

   - Recall the water-pipe analogy for electric current. Predict whether a series path resistor has **greater** or **less** resistance than a single path? By about what factor?

   - Measure the resistance: R = _____ _____

5. Build the circuit shown on the right. Set up the batteries so that you can easily switch between a nominal voltage of 1.5 V, 3 V, 4.5 V and 6 V.



   - Measure voltage and current of the circuit for the 4 different voltages. Make an I–V diagram, where you graph current over voltage.

   - Is a resistor an “ohmic” device? Why or why not?

   - Determine the resitance from your graph: R = _____ _____

6. Change your resistor with a light bulb.

   - Measure the I–V curve and plot your data on the back. Label the graph “light bulb.”

   - Note that the slope of the curve decreases with increasing voltage. What does this mean for the resistance?

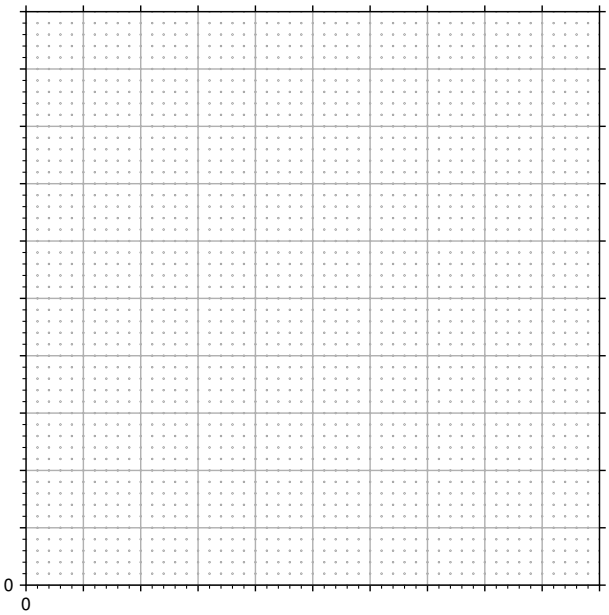
   - We can assume that voltage is connected to the temperature of the wire in the light bulb. What does that mean for the dependence of resistance on temperature?

7. Change your light bulb for a LED. Make sure you use pins A and B.

   - Measure the I–V curve and plot your data on the back. Label the graph “LED”.

   - Discuss the features of this curve.

   - Is a LED an “ohmic” device? Why or why not?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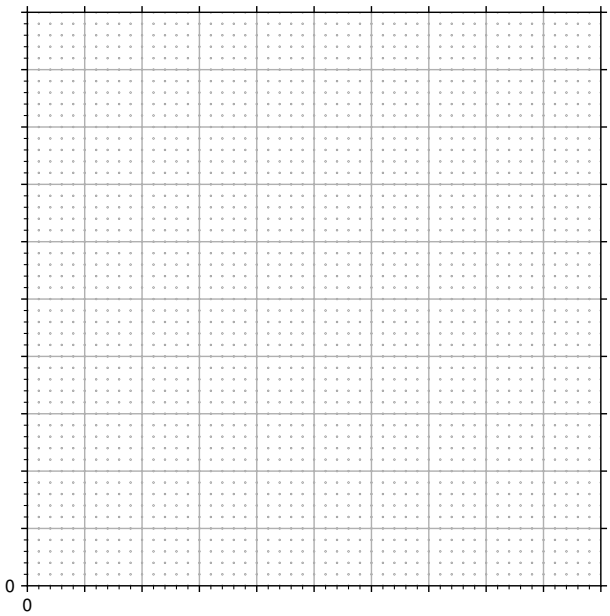
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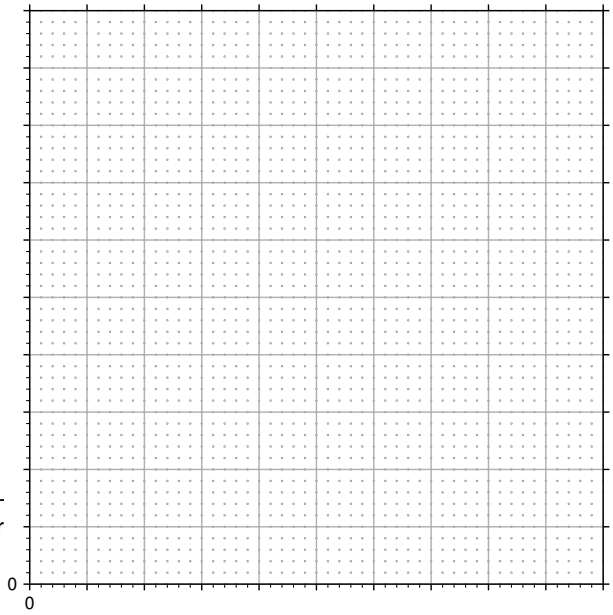
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