Follow-up Activity: For Students

Physics 18: Ohm's Law

This activity is intended for children ages 12 to 14 years and should be completed only under the supervision of a parent or guardian.

Introduction:

In class we learned how to build circuits on a breadboard. We also learned that resistors are devices that can be wired into a circuit in order to control the voltage or current supplied to different circuit elements. We then investigated what happens when resistors are added to a circuit in series vs. in parallel. We learned that resistors in series are additive, so two 100**Ω** resistors in series is equivalent to one 200**Ω** resistor. In contrast, two 100**Ω** resistors in parallel have an equivalent resistance of only 50**Ω**. This is because the parallel circuit provides two paths for the current to follow, so total resistance is of the system is reduced when resistors are added in parallel.

Activity: Make A Resistor

In the following activity, you will make a variable resistor using paper and a pencil. The "lead" in a #2 pencil is actually graphite, and as you might have learned before, graphite is a poor conductor of electricity. But now that you have learned about Ohm's Law and resistance, you know that another word for "poor conductor of electricity" is "resistor."

Materials:

- #2 Pencil
- Paper
- Ruler
- Red LED (available at Radioshack or similar retail for ~$2)
- 9V battery
- Multimeter (optional)

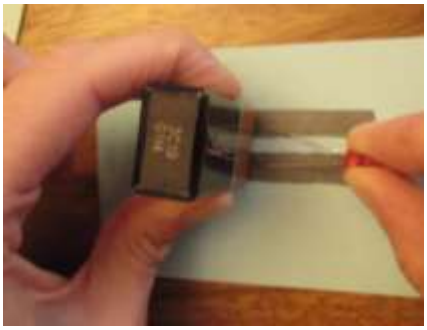
Procedure:

1. Use the pencil to draw two rectangles on the paper. The rectangles should be approximately 2 inches long and 0.5 inches wide, and there should be a space between them about 0.25 inches wide.

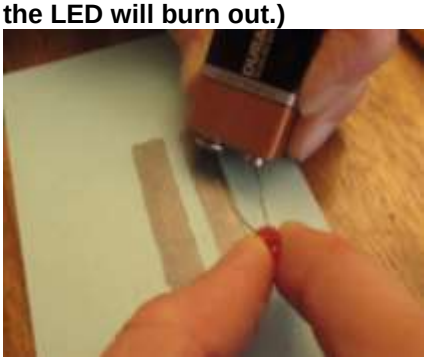
2. Using the pencil to make strokes along the long axis of the rectangles, color in the rectangles. You should color them in very darkly; when you are finished, the rectangles should be shiny when you angle the paper in the light (see the picture below). These are your pencil resistors.

3. Place the battery on the two pencil resistors so that one battery terminal is on each resistor. Pay attention to which rectangle is touching the positive terminal and which is the negative. (The positive terminal is marked with a "+" on the side of the battery.)

4. Touch the negative (short) lead of the LED to the resistor connected to the negative battery terminal; touch the positive (long) lead to the other resistor. Slide the LED back and forth along the pencil resistors, moving it closer to and farther away from the battery, and observe what happens.



5. Try using only one pencil resistor and connecting the other LED terminal directly to the battery. See if you can slide the LED terminal back and forth along the resistor. **(Warning: Do not connect the LED to the battery without a resistor – at least one lead of the LED must be connected to the pencil resistor at all times or the LED will burn out.)**



6. If you have a multimeter, you can use it to measure the resistance along the resistor. Follow the instructions that came with your meter and see how the resistance is related to the length of the resistor.

Additional Resources:

- Variable pencil resistor (video, 0:48): https://www.youtube.com/watch?v=aElHVTv-75M
- How to use a multimeter: http://www.sciencebuddies.org/science-fair-projects/multimeters-tutorial.shtml