

Introduction to Circuits Activity

Physical Science and Technology

In this activity you will explore with virtual circuits using the PhET “Circuit Construction Kit (DC Only)”. You will need to use a laptop or desktop computer. The app is located at <http://phet.colorado.edu/en/simulation/legacy/circuit-construction-kit-dc>.

In order to understand circuits, we need to understand the three basic properties that affect them; Voltage, Current, and Resistance. Voltage tells you how hard electricity is being “pushed” through an electrical circuit; current and resistance will be investigated in this activity.

You may work with a partner to use the applet, but each of you should answer the lettered questions individually (hand-write on paper and turn into the silver bin).

Part 1

1. Open up the applet and experiment with dragging different components into the work space. To delete a component, just click on it and hit delete. Once you feel comfortable with how the app works, build a circuit using any of the components that you would like. For now, limit your circuit to only one loop. Keep the “Lifelike” box checked in Visual Settings and make sure that the blue circles are moving in your circuit. Your circuit will need to have at least one power source (battery). You’ll also find that you need at least one other component in your circuit to keep it from igniting!
 - a. **Draw the circuit that you created as it appears in the lifelike setting. You do not need to draw all of the blue circles, but indicate which direction they are going.**
 - b. **What do the moving blue circles represent?**
2. Use the internet to find brief, formal definitions of current and resistance.
 - c. **In your own words, what is current?**
 - d. **What is the common unit used to quantify current, and what does this unit mean?**
 - e. **What is resistance, and what are the units of resistance?**
3. Ammeters measure current. Under the tools option, select Non-Contact Ammeter and move the crosshairs over your circuit. You will use this tool during the rest of the activity to measure current.
 - f. **Move the Ammeter around the loop of your circuit while current is flowing. What do you notice regarding the value of current as you move around the loop?**

4. Now that you understand what current is, we need to investigate resistance. Edit your circuit, if necessary, to make sure that it has at least one light bulb that is emitting light.
 - g. **Now that you have added the light bulb, under the “Advanced” option, click the “Show >>” box. Move the Wire Resistivity bar from the left to the right. How does this affect the light bulb and the current in the circuit?**
 - h. **Based on your observation, define resistance in your own words.**
5. There is a simple mathematical equation that relates voltage, current, and resistance in a closed circuit (a loop). To determine this relationship, we’ll start by looking at how voltage and current affect each other.
 - i. **With your light bulb still illuminated and your ammeter still reading current, right click on the battery and slide the voltage bar right, increasing the voltage. How does this affect current?**
6. Next you’ll make some measurements of voltage, current, and resistance to see how they are all interrelated. For this, you’ll need to use the “Voltmeter” tool.
 - j. **Move the probes over the two connections of the light bulb. Right click on the bulb and select “show value”. Once you have done this, record the values for resistance, current, and voltage for the light bulb. (Use the ammeter to find the current right before or after the light bulb.) Change the values by adjusting either the resistance value for the light or wire, or by adjusting the value of voltage for the battery. Record two more sets of data based on these changes.**

	Test 1	Test 2	Test 3
Voltage			
Current			
Resistance			

- k. **Do a quick internet search to find the mathematical equation called Ohm’s Law that relates voltage, current, and resistance.**
- l. **Showing all your work, use Ohm’s Law to investigate each of the tests you performed in the table above and explain how the measurements you made are consistent with Ohm’s Law.**

Part 4

At this point in the lab you should understand some of the basics of electrical circuits. Now you need to learn the conventional symbols for the components in a circuit and we will be ready to continue through the rest of the unit. Edit your circuit (or create a new one) so it contains at least one battery, resistor, light bulb, and switch.

- m. In the app, change the Visual option from Lifelike to Schematic. For a clearer view, under the Advanced menu, click the Hide Electrons box. Now draw the circuit that you are looking at in using the schematic symbols.**
- n. On your drawing, label your circuit components (you don't need to label wires, but you should label each of the following: resistor, switch, and battery). For the battery, show which side has the higher electrical potential.**