



### Science Objectives

- Students will describe electric current, voltage, and resistance and the units of measurements for these physical quantities.
- Student will construct a simple circuit with an on/off switch.
- Students will construct a simple circuit with multiple bulbs.

### Vocabulary

- |                    |              |
|--------------------|--------------|
| • ampere           | • resistance |
| • battery          | • resistor   |
| • circuit diagram  | • switch     |
| • electric circuit | • volt       |
| • electric current | • voltage    |
| • ohm              | • voltmeter  |
| • ammeter          | • schematic  |

### About the Lesson

- This lesson uses a simulation environment for constructing electric circuits. Students construct simple series circuits and measure voltage and current. They also work with equations relating voltage, current, and resistance.
- As a result, students will:
  - Describe an electric circuit.
  - Use formulas to calculate resistance, voltage and current.
  - Construct series circuits.

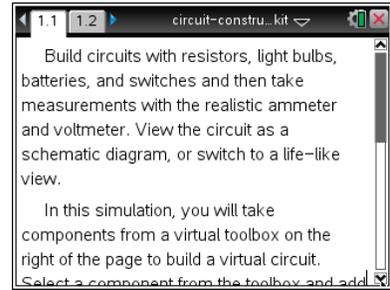


### TI-Nspire™ Navigator™

- Send out the *Circuit Construction Kit.tns* file.
- Monitor student progress using Class Capture.
- Use Live Presenter to allow students to show the class how to build circuits and use the meters.

### Activity Materials

- Compatible TI Technologies:  TI-Nspire™ CX Handhelds,  TI-Nspire™ Apps for iPad®,  TI-Nspire™ Software



### Tech Tips:

- This activity includes screen captures taken from the TI-Nspire CX handheld. It is also appropriate for use with the TI-Nspire family of products including TI-Nspire software and TI-Nspire App. Slight variations to these directions may be required if using other technologies besides the handheld.
- Watch for additional Tech Tips throughout the activity for the specific technology you are using.
- Access free tutorials at <http://education.ti.com/calculators/pd/US/Online-Learning/Tutorials>

### Lesson Files:

#### Student Activity

- Circuit\_Construction\_Kit\_Student\_MG.doc
- Circuit\_Construction\_Kit\_Student\_MG.pdf
- Circuit\_Construction\_Kit.tns

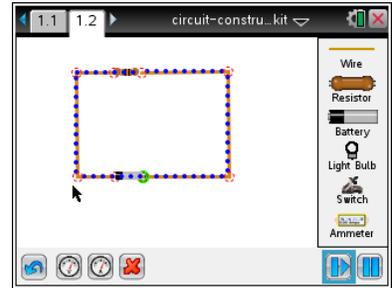


### Discussion Points and Possible Answers

Allow students to read page 1.1 and the information on the activity sheet.

**Move to page 1.2.**

Students are to place six pieces of wire on the screen and arrange them as a rectangle with two horizontal gaps. These gaps are for the resistor and the battery. The current will begin to flow when the circuit is connected. Students can select the Pause button to pause the current flow.



**Tech Tip:** If students accidentally connect two wires, they can undo the connection. Select the red circle connecting the wires and select . To delete a wire segment, select the middle of a segment and the wire is highlighted in green. Then select .

Q1. Describe what happens.

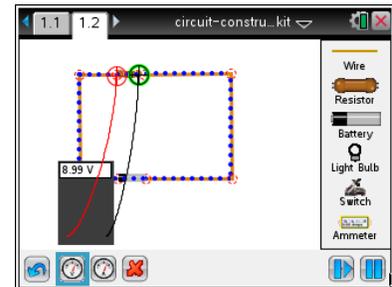
**Answer:** Current starts flowing.

### Part 1: Exploring Electric Circuits

In this part of the lesson students construct a simple electric circuit with a resistor. They also measure current and voltage and add a switch to the circuit.

1. Measuring the voltage and current means placing the probes on the circuit itself. In particular, the two leads for the volt meter should be placed on either side of the resistor, in such a way that the readout is positive.

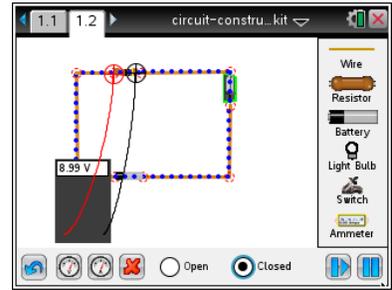
Q2. What are the measurements for voltage and current?



**Answer:** Voltage = 9.00 V; current = 0.9 Amps



- Adding a switch to the circuit involves disconnecting one of the wires. To do so, select a wire. It will be highlighted green. Select Delete to disconnect the wire. Then place the switch between these wires.



**Tech Tip:** To disconnect two wires, students will select the red circle connecting the wires and select . After the switch is inserted into the circuit, select the switch to bring up the buttons to open or close it.

- How can you tell that the circuit is open or closed other than the change in the icon?

**Answer:** Current stops when the switch is off and the circuit is open. Current flows when the switch is on and the circuit is closed.

- To calculate the resistance in the circuit, first solve the formula for  $R$ .

**Answer:**  $R = \frac{V}{I}$

- What are the values of  $V$  and  $I$ ?

**Answer:**  $V = 9.00$  volts,  $I = 0.90$  Amps

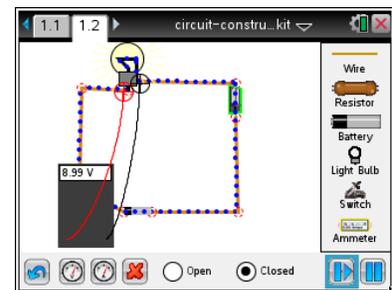
- Substitute the values of  $V$  and  $I$  into the formula from Question 4. What is the resistance in the circuit?

**Answer:** 10 ohms

### Part 2: Creating a Circuit with a Light Bulb

Having seen how a basic circuit works, students can now build a circuit with a single light bulb.

- Have students replace the resistor with a light bulb. This involves highlighting the entire resistor (so that the whole thing is green) and selecting Delete to remove it. Then select the light bulb button and connect the bulb to the circuit. Remind students that a light bulb is itself a source of resistance. Share with the kids the





difference between a joint/connection being selected and the complete item (light, battery, etc.).



**Tech Tip:** Students may need to move the leads of the voltmeter away from the circuit in order to connect the light bulb to the wires.

Q7. Describe what happens when you turn the switch on and off.

**Answer:** When the switch is on, the current flows. When the switch is off, the current is no longer flowing.

Q8. How much current is flowing through the bulb? What is the voltage?

**Answer:** Voltage = 9.00 V; current = 0.9 amperes

Q9. What are the values of  $V$  and  $I$ ?

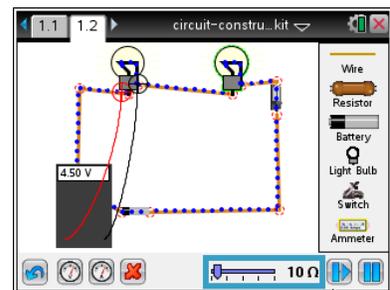
**Answer:**  $V = 9.00$  volts;  $I = 0.9$  Amps

Q10. What is the amount of resistance, or value of  $R$ ? Substitute the values of  $V$  and  $I$  into the formula from Question 4 and simplify.

**Answer:** 10 ohms

### Part 3: Creating a Circuit with Several Light Bulbs

Adding a second bulb allows you to explore the impact on the current when a second source of resistance (a second light bulb) is added.



Q11. Calculate the current,  $I$ , using the formula in Step 4. Use the previous values for voltage,  $V$ , and the calculated value for resistance,  $R$ .

**Answer:** 0.45 amperes



Q12. Run the simulation to check the calculated value for the current.

**Answer:** Check students' work.

Q13. Suppose the circuit now had 10 bulbs. What would be the current?

**Answer:** 0.09 amperes

Q14. What happens to the current as more electrical devices, such as light bulbs, are added to a circuit?

**Answer:** The more devices are added, the more the current decreases.



#### TI-Nspire Navigator Opportunities

Allow students to volunteer to be the Live Presenter and demonstrate how to adjust/add and remove the components of the circuit. Use Quick Poll to check for understanding during the course of the activity.

### Wrap Up

When students are finished with activity, collect students' worksheets.

### Assessment

- Formative assessment will consist of questions embedded in the student worksheet. Analyze questions in the student worksheet with the students.
- Summative assessment will consist of questions/problems on the chapter test.