



### Science Objectives

- Students will describe electric current, voltage, and resistance and the units of measurements for these physical quantities.
- Students will construct series and parallel circuits.
- Students will solve current-voltage-resistance equations for series and parallel circuits.

### Vocabulary

- |                    |                  |
|--------------------|------------------|
| • ampere           | • resistance     |
| • battery          | • resistor       |
| • circuit diagram  | • series circuit |
| • electric current | • switch         |
| • ohm              | • volt           |
| • parallel circuit | • voltage        |

### About the Lesson




- This lesson uses a simulation environment for constructing electric circuits. Students construct series and parallel circuits. 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 and parallel circuits.

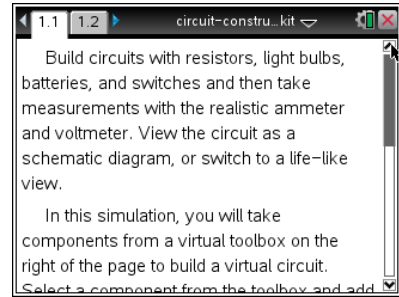


### TI-Nspire™ Navigator™

- Send out the *Circuit Construction Kit.tns* file.
- Monitor student progress using Class Capture.
- Use Live Presenter to allow students to show how they manipulate variables that effect results.

### 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\_HS.doc
- Circuit\_Construction\_Kit\_Student\_HS.pdf
- Circuit\_Construction\_Kit.tns

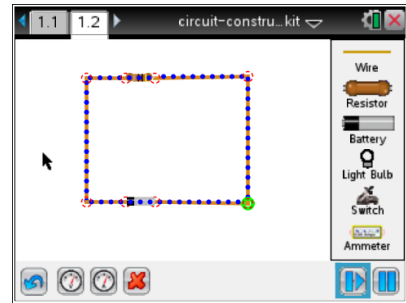






### Discussion Points and Possible Answers

Allow students to read page 1.1..

**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. Students should select the Play button  after they have connected all the components of the circuit.



 **Tech Tip:** Students can use  to undo a move or delete a circuit element. For example, if you accidentally connect two wires, you can undo the connection. Select the red circle connecting the wires and select . To delete a wire segment, select the middle of a segment until the wire is highlighted in green. Then select .

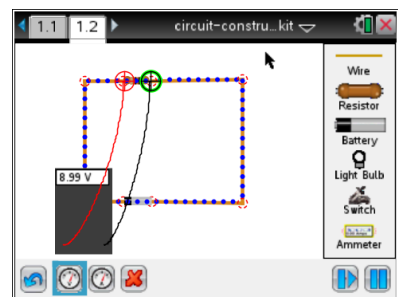
Q1. Describe what happens.

**Answer:** Current starts flowing.


### Part 1: Exploring Electric Circuits

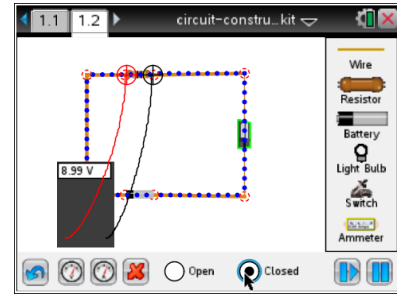
In this part of the lesson students construct a simple electric circuit with a resistor. They also measure current and voltage and add a switch to the circuit.


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





- Adding a switch to the circuit involves disconnecting one of the wires. To do so, select on the point where two wires intersect (only the point is highlighted green). Select  to disconnect the wires. Then place the switch between these wires.



**Tech Tip:** To disconnect two wires, students should 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:** When the circuit is open, the current does not flow. When the circuit is closed, the current flow.

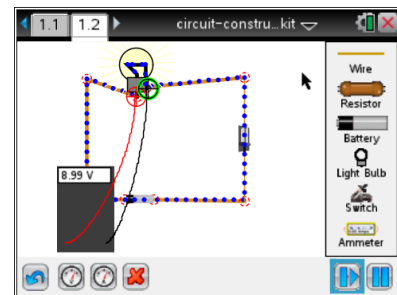
- Calculate the resistance in the circuit.

**Answer:** 10 ohms

### Part 2: Creating a Series Circuit

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  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.



**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.

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

**Answer:** When the switch is on, current flows. When the current is off, current stops flowing.



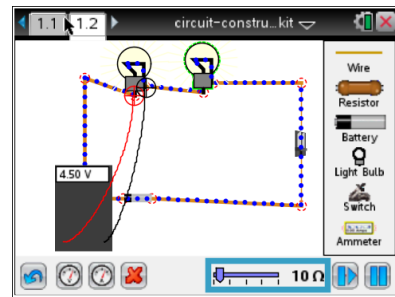
Q5. How much current is flowing through the bulb? What is the voltage?

**Answer:** Current = 0.9 amps; Voltage = 9.00 volts

Q6. Calculate the resistance.

**Answer:** 10 ohms

4. Next, students connect a second bulb to the circuit. This involves disconnecting the first bulb, adding more wire, and adding the second bulb.



Q7. Use the previous values for voltage and the calculated value for resistance to calculate the current.

**Answer:** 0.45 amperes

Q8. Run the simulation to check the calculated value for the current.

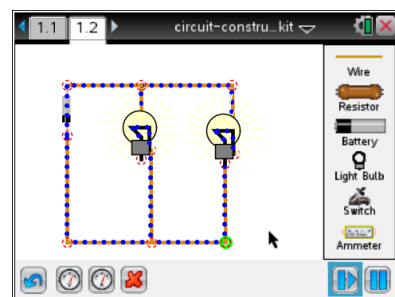
**Answer:** Check students' work.

Q9. Suppose the circuit now had 10 bulbs. What would be the current?

**Answer:** 0.09 amperes

### Part 3: Creating a Parallel Circuit

Having created a series circuit with two bulbs, students should be aware of the fact that switching off this type of circuit will switch off both bulbs. However, there is a different type of circuit that allows you to turn off one bulb, while the other is still on. Students construct a parallel circuit with two bulbs and measure the current.





Q10. What happens to the current the more electrical devices are added to a series circuit?

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

Q11. Use the previous values for voltage and the calculated value for resistance to calculate the separate currents  $I_1$  and  $I_2$ .

**Answer:** Each is 0.9 amperes.

Q12. Run the simulation to check the calculated values for the currents.

**Answer:** Check students' work.

Q13. What happens when all switches are closed?

**Answer:** Both bulbs are off.

Q14. What happens when one of the switches next to a bulb is off? How is this different from the series circuit?

**Answer:** A bulb is off when the switch next to it is off. Unlike a series circuit, it is possible to have one bulb on and one bulb off with a parallel circuit.



### 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.