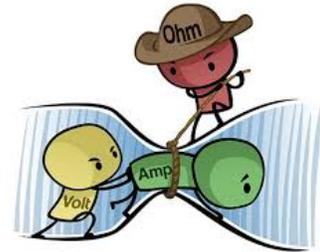


Phys. B. M6 Circuits Lab:

Name: Austin HORNER

Objectives:

- You will be able to design and build models and distinguish between series and parallel circuits.
- Use Ohm's Law to calculate resistance, current, and voltage in circuits.



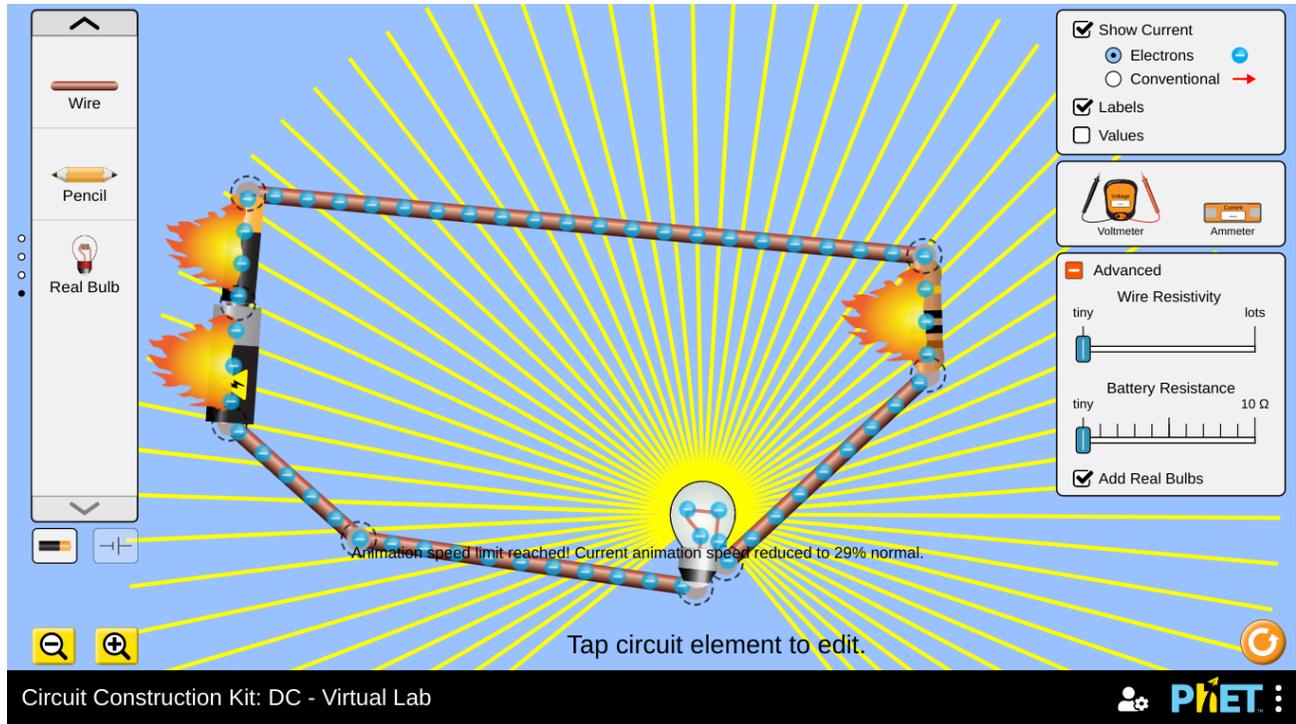
***Please use the following simulation for this lab: [PhET Circuit Construction](#)*

Part 1: Explore

Objective: *Explore and experiment! Learn how to build on the PhET simulation. Click on everything. Have fun!! :)*

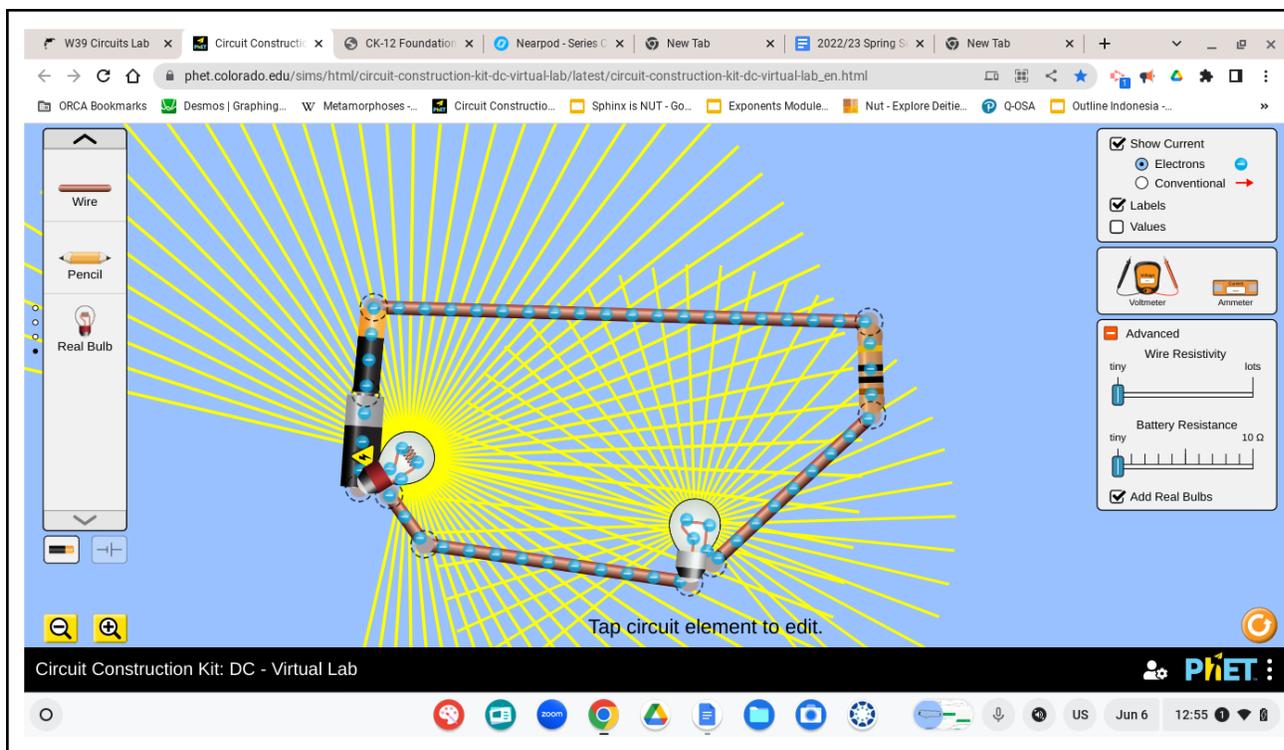
Procedure:

- Drag items out from the left hand options. Use the top and bottom arrows to see more items.
- Observe what happens when you click on “Show currents-electrons, conventional”, “Labels”, “values”.
- Click on “Advanced”, to view both Wire and Battery Resistance.
- **Challenges:**
 - a. Get a light bulb to light up
 - b. Click on parts of your circuit
 - c. Start a fire in the simulation-
 - What needs to happen for you to control the circuit so a fire doesn't happen?



- d. Play with the following to observe what happens:
Insulators, conductor, switches, resistors, fuses, batteries.

Paste a screenshot of your favorite circuit you built.

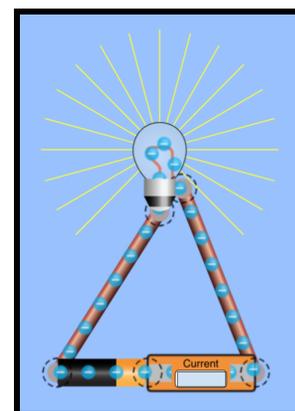


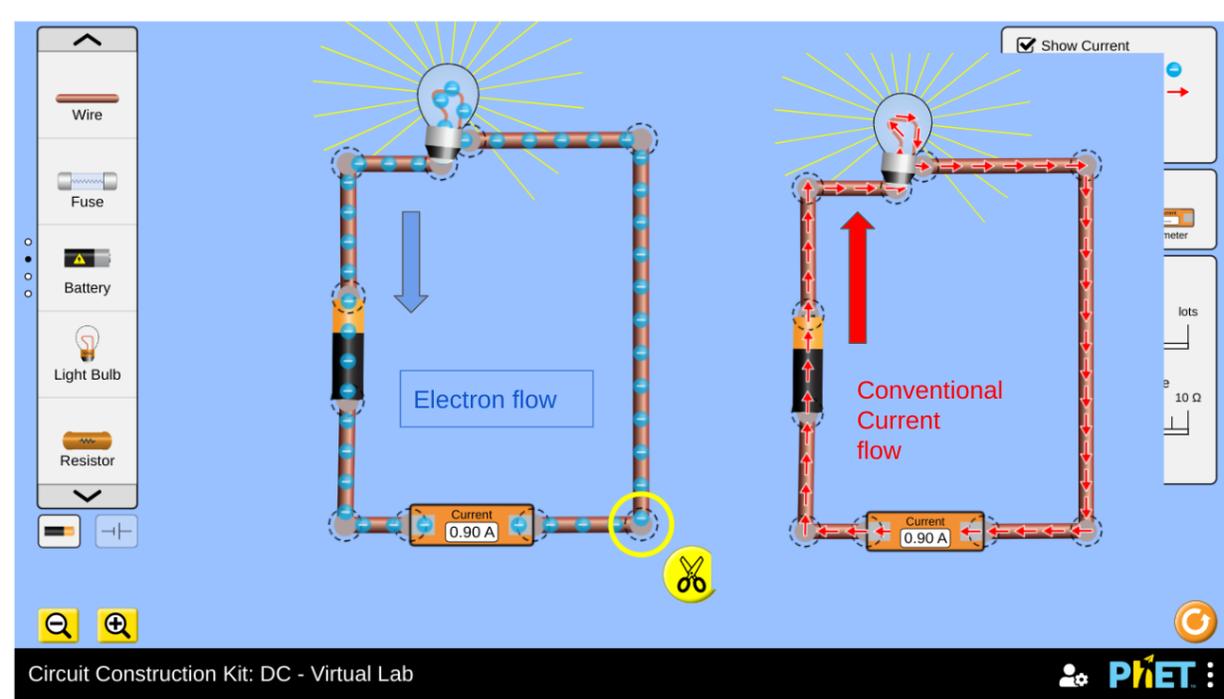
Part 2: Complete Reference Circuit-

Objective: Collect data below as a reference point for changes in the next experiments.

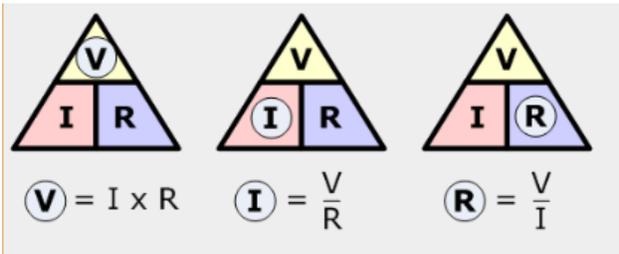
Procedure:

- Drag 1 battery, 1 lightbulb, and 1 ammeter (ammeter measures electric current) and two wires out onto the blue field.
- Use the wires to connect each side of the lightbulb to the battery and ammeter **like the picture on the right**. The bulb should light up. **If** (Hint: You must connect on the right spot on the bulb for this to work). If there is a fire, call the fire department! Just kidding! Carefully re-attach the wires on **each side** of the bulb.
- To remove a component of your circuit, click on it to highlight in yellow. Then delete on the bottom of the page.
- Select the box in the upper right of the simulation to show “Values”
- Record the voltage from the battery, and current on the ammeter in the data table below.





- Keep this model to compare with the other models you build later.



Reference Circuit Data Table:

	V = Voltage (Volts)	I = Current (Amps)
Reference Circuit	Example: 9V battery	.90A

Below calculate resistance using Ohm's Law. Remember $V = I * R$ so rearrange the equation to solve for R. $R = V/I$

Please show your work: $R = 9V/0.9A = 10 \Omega$
 Ex. $9/.9=R$

Part 3: Complete Series Circuit-

Hypothesis: How do you think adding an additional bulb in the series will affect the brightness of each bulb? Use the **if.....then....** Format.

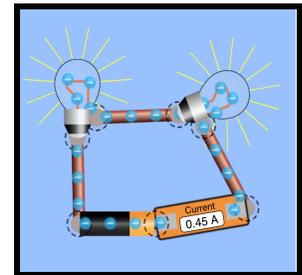
Example: If the number of bulbs are increased then the brightness will _____.

What is YOUR hypothesis?

If the number of bulbs are increased, the brightness will decrease

Procedure:

- Build your series model.
- **Note:** Series circuits only have 1 path for the current to flow through, so the bulbs should be in a line. Your model should look similar to the **sample picture on the right.**



Tap circuit element to edit.

Circuit Construction Kit: DC - Virtual Lab

- Record the voltage and current in the circuit in the data table below.

Series Circuit Data Table:

	V = Voltage (Volts)	I = Current (Amps)
Series	9	0.45
Below calculate resistance using Ohm's Law. Remember $V = I * R$		
Please show your work: $V/R = A$ $R=V/I$ $R = 9V/0.45A = 20\Omega$		

Analysis:

1. Did your data support your hypothesis? (what is the resistance on your circuit above) Feel free to use this sentence example to help you.

Example: Yes the data supports my hypothesis. My hypothesis was If the number of bulbs are increased then the brightness will increase. When I added more light bulbs to my circuit the resistance went up because _____ . (or whatever your hypothesis was)

Yes the data supports my hypothesis that adding another bulb would decrease the brightness.. When a second bulb was added, brightness went down because the current was cut in half from 0.90 A to 0.45A. Each bulb has a resistance of 10Ω which adds to the resistance of the circuit.

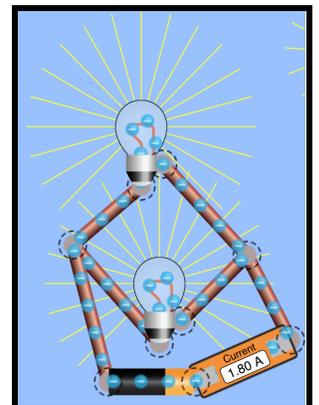
2. How did the number of bulbs affect the brightness and why?

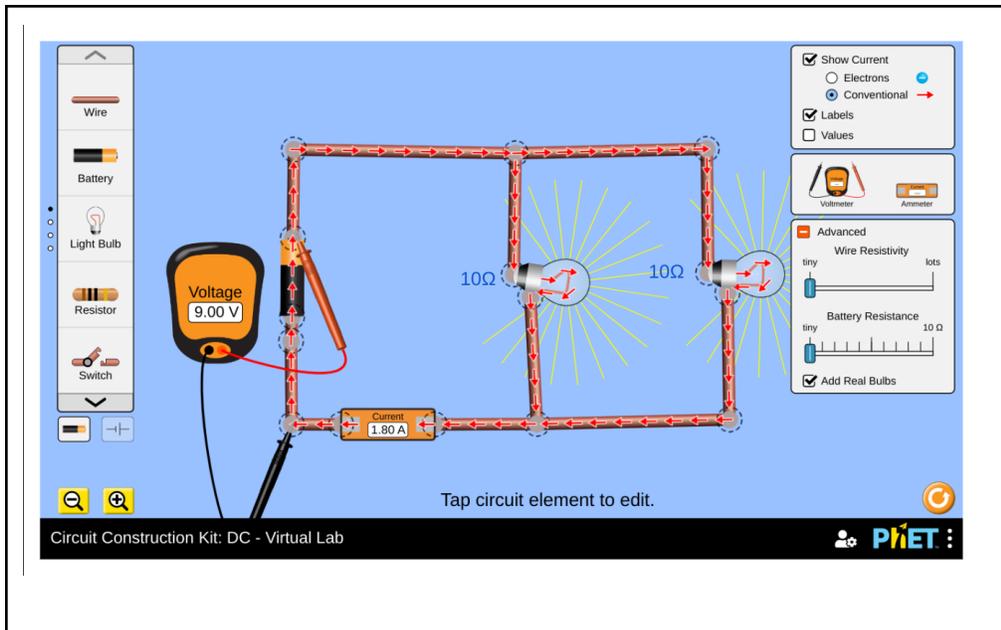
Each bulb adds 10Ω of resistance to the circuit. Voltage/ resistance = current. Increasing resistance decreases current and therefore the brightness of the bulb which is proportional to the current or power, which is voltage times current. $P = VA$

Part 4: Complete Parallel Circuit

Hypothesis: How will adding another bulb in parallel affect the brightness of each bulb? Write your prediction below.

Adding a 10 ohm bulb in parallel should **increase the brightness** because it decreases the resistance of the circuit.





Procedure:

- Build a parallel circuit with 2 light bulbs. It should look similar to the model to the right.
- Record the voltage and current in the circuit in the data table below.

Parallel Circuit Data Table

	V = Voltage (Volts)	I = Current (Amps)
Parallel	9 V	1.8 A
Below calculate resistance using Ohm's Law. Remember $V = I * R$		
Please show your work:		

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$\frac{1}{R} = \frac{1}{10} + \frac{1}{10} = \frac{2}{10} = \frac{1}{5}$$

$$R = 5\Omega$$

$$\frac{V}{R} = A$$

$$\frac{9 \text{ volts}}{5\Omega} = 1.8A$$

Analysis:

3. Did your data support your hypothesis? Explain your answer. Feel free to use this sentence example to help you.

Example: Yes the data supports my hypothesis. My hypothesis was If the number of bulbs are increased then the brightness will increase. When I added more light bulbs to my circuit the resistance went ___ because_____.

Yes the data supported my hypothesis that that the bulbs would be brighter because the current was increased by lowering resistance.

4. How did the number of bulbs affect the brightness and why?

The bulbs in parallel increased the brightness because two bulbs in parallel have less resistance than two bulbs in series.

Conclusion:

What is one benefit of using a parallel circuit?

The benefit of a parallel circuit is that if one bulb burns out, the circuit can still work.

On a scale of 1-4, how confident are you that you can apply Ohm's Law to calculate resistance, current, and voltage? (1= not so sure...4=I've totally got this).

I am very confident about using the Ohm's Law equation. Calculating the resistance in parallel was new information for me. 4