Name: _____ Date: _____ Block: _____

Series and Parallel Circuits Lab

PURPOSE: Describe the relationship between potential difference, current, and resistance for series and parallel circuits.

INSTRUCTIONS:

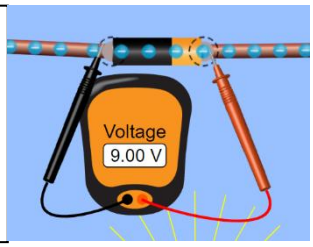
Step 1) Go to "Phet - Circuit Construction Kit: DC" simulation https://phet.colorado.edu/en/simulations/circuit-construction-kit-dc. Press play and select "Lab".

Step 2) Play around and try to learn how to use the simulation (how to connect, disconnect, change values of a circuit element, how to use voltmeter and ammeters) for 5 minutes.

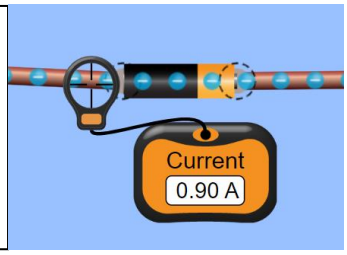
PART 1: AMMETER AND VOLTMETER TUTORIAL

Step 3) Make a simple circuit with a default 9.00V battery and one default light bulb (10 ohms). Make the following measurements using an ammeter and a voltmeter. Your measurements should match what is shown in the diagrams.

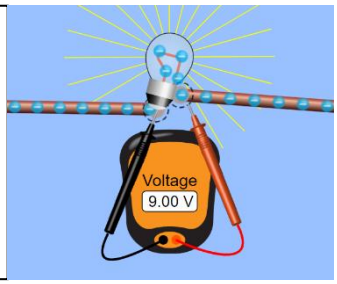
To measure **total potential difference across the circuit** (V_{tot}), place the black probe on one end of the battery and the red probe on the other end of the battery.



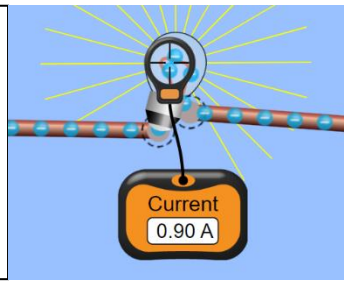
To measure the **total current through the circuit** (I_{tot}), place the center of the circular probe on the wire right after the battery.



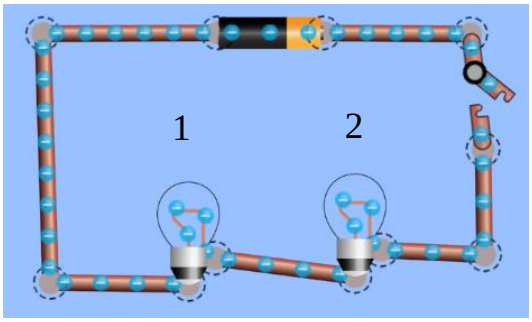
To measure **potential difference across a single lightbulb** (e.g. V_1, V_2, V_3), place the black probe to one end and place the red probe to the other end of the lightbulb.



To measure the **current through a lightbulb** (e.g. I_1, I_2, I_3), place the center of the circular probe on the wire inside the lightbulb.



PART 2: SERIES CIRCUITS



Step 4) Construct the circuit on the right. It has two light bulbs in series. Set the battery to **60V** and resistance of the lightbulbs to **10 ohms** each.

Step 5) Use the voltmeter and ammeter to measure the voltage and current across each light bulb. Record your results in Table 1.
(V_1 = voltage of first light bulb; I_1 = current of first light bulb;
V_2 = voltage of second light bulb; I_2 = current of second light bulb; etc.)

Table 1: Voltage and Current in a Series Circuit with up to Four Lightbulbs										
	Entire Circuit		**Lightbulb #1**		**Lightbulb #2**		**Lightbulb #3**		**Lightbulb #4**	
	V_{tot}	I_{tot}	V_1	I_1	V_2	I_2	V_3	I_3	V_4	I_4
Step 4 (2 bulbs)	60 V	____ A	____V	____ A	____V	____ A	N/A	N/A	N/A	N/A
Step 5 (3 bulbs)	60 V	____ A	____V	____ A	____V	____ A	____V	____ A	N/A	N/A
Step 6 (4 bulbs)	60 V	____ A	____V	____ A	____V	____ A	____V	____ A	____V	____ A

Step 5) Next, add one more lightbulb with **10 ohms** of resistance in **series** to the circuit. Measure the voltage and current across each light bulb. Record your results in Table 1.

Step 6) Lastly, add one more lightbulb with **30 ohms** of resistance in **series** and record the measurements in Table 1.

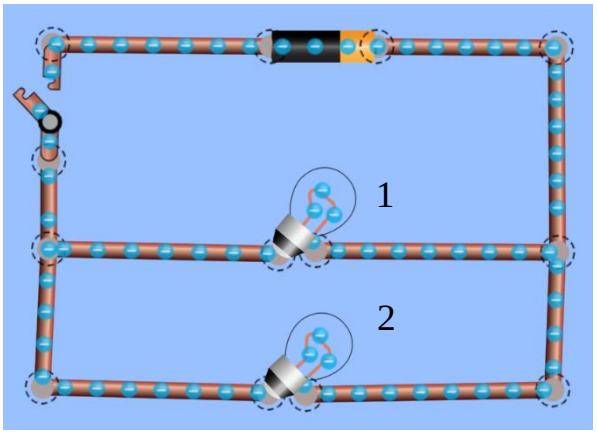
3. *How does the speed of electron movement change when more lightbulbs are added in series?*

4. *How does lightbulb brightness change when more lightbulbs are added in series?*

5. *What is the relationship between the total current of the circuit and individual lightbulb currents in series?*

6. *What is the relationship between the total voltage of the circuit and individual lightbulb voltages in series?*

PART 3: PARALLEL CIRCUITS



Step 7) Once you are ready, construct the circuit on the right. It has two lightbulbs in parallel. Set the battery to **60V** and the resistance of the lightbulbs to **10 ohms** each.

Step 8) Measure the potential difference and current of each lightbulb and the circuit. Record your results in Table 2.

Step 9) Add one more lightbulb with **10 ohms** of resistance in **parallel** to the circuits and measure the voltage and current on each bulb then record them in Table 2.

Step 10) Lastly, add one more lightbulb with **30 ohms** of resistance in parallel and record the measurements.

Table 2: Voltage and Current in a Parallel Circuit with up to Four Lightbulbs

	Entire Circuit		Lightbulb #1		Lightbulb #2		Lightbulb #3		Lightbulb #4	
	V_{tot}	I_{tot}	V_1	I_1	V_2	I_2	V_3	I_3	V_4	I_4
Step 4 (2 bulbs)	60 V	____ A	____V	____ A	____V	____ A	N/A	N/A	N/A	N/A
Step 5 (3 bulbs)	60 V	____ A	____V	____ A	____V	____ A	____V	____ A	N/A	N/A
Step 6 (4 bulbs)	60 V	____ A	____V	____ A	____V	____ A	____V	____ A	____V	____ A

7. *How does the speed of electron movement change when more lightbulbs are added in parallel?*

8. *How does lightbulb brightness change when more lightbulbs are added in parallel?*

9. *What is the relationship between the total current of the circuit and individual lightbulb currents in parallel?*

10. *What is the relationship between the total voltage of the circuit and individual lightbulb voltages in parallel?*

11. *How do you suppose electrical appliances are connected in our homes? In parallel or in series? Why?(Hint: What happens to other appliances when one appliance is turned off?)*

12. A student is recording the following measurements on the table. ***Fill in the rest of the table*** *and construct a circuit that is going to be aligned with the numbers on the table below. Then* ***draw that circuit*** *below.*

V_{tot} (V)	I_{tot} (A)	R_1 (Ω)	V_1 (V)	I_1 (A)	R_2 (Ω)	V_2 (V)	I_2 (A)
	3 A		12 V	1 A		12 V	