Name: _____ Date: _____ Block: _____

# Series and Parallel Circuits Lab

**Purpose:**

- Describe the relationship in between, potential difference, current and resistance for series and parallel circuits

**Instructions:**

- Go to "Phet - Circuit Construction Kit: DC" simulation from https://phet.colorado.edu/sims/html/circuit-construction-kit-dc/latest/circuit-construction-kit-dc_en.html and select "Lab"



- 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.
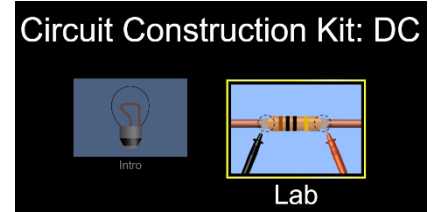
**Part 1: Series Circuits**

- Construct the circuit on the right.

- Set the voltage to 60V and resistance of the lightbulbs to 10 ohms.
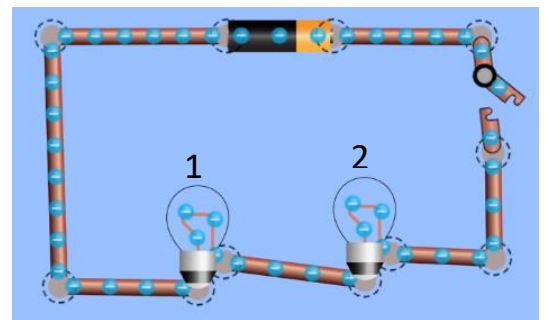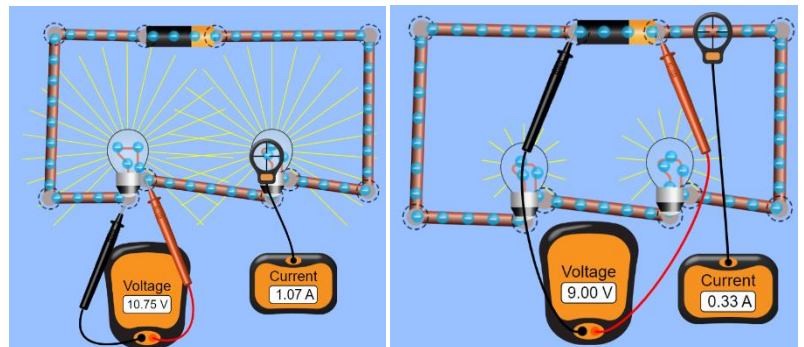


1. *Predict: What potential difference will you find across the first lightbulb? The second lightbulb?*

2. *Predict: What current will you find through the first lightbulb? The second lightbulb?*

- Use the voltmeter and ammeter to measure the voltage and current across each light bulb. Record your results on Table 1.

- Next add one more lightbulb (#3) 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.

- Lastly, add one more lightbulb (#4) with **30 ohms** of resistance in series and record the measurements.

❖ To measure potential difference across the lightbulb, 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, place the center of the circular probe on the wire inside the lightbulb.

❖ To measure total potential difference across the circuit, place the black probe to one end and place the red probe to the other end of the battery.



❖ To measure the total current through the circuit, place the center of the circular probe on the wire right after the battery.

**Table 1:**

| Series | $V_{tot}$ (V) | $I_{tot}$ (A) | $V_1$ (V) | $I_1$ (A) | $V_2$ (V) | $I_2$ (A) | $V_3$ (V) | $I_3$ (A) | $V_4$ (V) | $I_4$ (A) |
|---|---|---|---|---|---|---|---|---|---|---|
| 2 bulbs | 60 V | | | | | | X | X | X | X |
| 3 bulbs | 60 V | | | | | | | | X | X |
| 4 bulbs | 60 V | | | | | | | | | |

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 2: Parallel Circuits**

- Once you are ready, construct the circuit on the right.

- Set the voltage to **60V** and resistance of the lightbulbs to **10 ohms**.

- Once you set up the circuit, measure the potential difference and current of each lightbulb and the circuit.

- 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.

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

- 

**Table 2:**

| Parallel | $V_{tot}$ (V) | $I_{tot}$ (A) | $V_1$ (V) | $I_1$ (A) | $V_2$ (V) | $I_2$ (A) | $V_3$ (V) | $I_3$ (A) | $V_4$ (V) | $I_4$ (A) |
|---|---|---|---|---|---|---|---|---|---|---|
| 2 bulbs | 60 V | | | | | | X | X | X | X |
| 3 bulbs | 60 V | | | | | | | | X | X |
| 4 bulbs | 60 V | | | | | | | | | |

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 houses? 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 |  |