PS Physics Name_____Period_____

Building Electric Circuits

Background Information: An electric circuit allows the flow of electrons from a power source to make a complete round trip back to the power source. Most electric circuits contain several elements such as light, transformers, and switches. In a series electric circuit, only one path is available for the electrons to flow through. In a parallel circuit, two or more paths are available for the electron flow.

Purpose: In this investigation you will construct series and parallel circuits and measure their current and voltage.

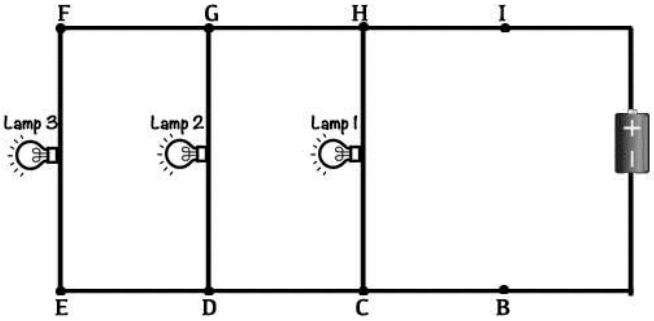
Pre-lab Question: How are the current and voltage of an electric circuit determined?

Materials:

- 3 Christmas lights
- dry cell battery
- 21 connecting wires
- ammeter
- voltmeter
- tape
- large piece of paper
- scissors
- alligator clips

Lab Safety: Use caution when handling the scissors

Procedure: Part A: Parallel Circuit

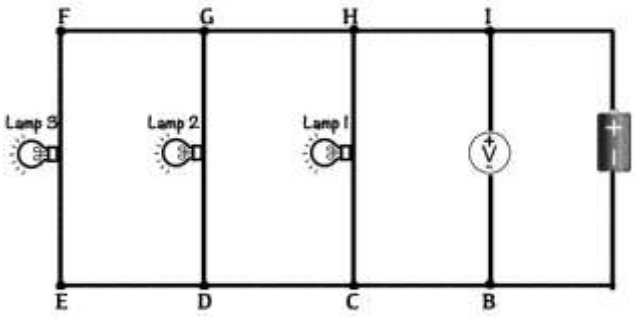


1. Use the dry cell and connecting wires to connect the three lamps in parallel. See Figure 1. Tape the circuit to a piece of paper and label the connections as shown. Tape the wires not the connections.

2. Complete the circuit by connecting the wires to the dry cell battery and record your observations of the lamps.

3. Pull, don't twist, out the middle bulb. Record your observations.

4. Push in the middle bulb. Open the circuit. Measure the total voltage of the circuit by placing the voltmeter as indicated in Figure 2. The positive terminal of the voltmeter must be connected to the positive post, and the negative terminal of the voltmeter must be connected to the negative post. Close the circuit to see if the needle of the voltmeter deflects to the right. If the needle deflects to the left, reverse the leads of the voltmeter. Record the total voltage (V_T) in the Data Table. Open the circuit.



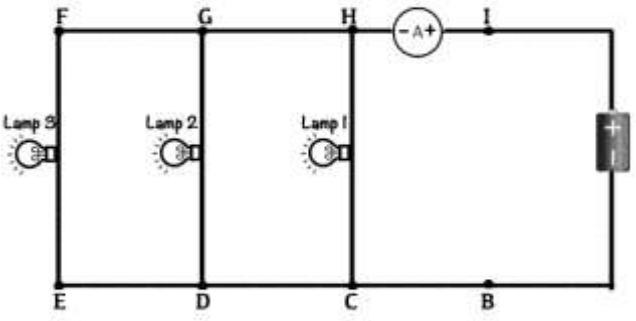
Part A: Parallel Circuit *con't*

5. Measure the voltage across lamp 1 by connecting the positive lead of the voltmeter to post H and the negative lead to post C. Close the circuit and record the voltage (V_1) in the Data Table. Open the circuit.

6. Measure the voltage across lamp 2 by connecting the positive lead of the voltmeter to post G and the negative lead to post D. Close the circuit and record the voltage (V_2) in the Data Table. Open the circuit.

7. Measure the voltage across lamp 3 by connecting the positive lead of the voltmeter to post F and the negative lead to post E. Close the circuit and record the voltage (V_3) in the Data Table. Open the circuit and remove the voltmeter.

8. Measure the total current by removing the connecting wire between posts H and I and attaching the positive lead of the ammeter to post I and the negative lead of the ammeter to post H. See Figure 3. Momentarily close the circuit. If the needle deflects to the left, open the switch and reverse the leads of the ammeter. Close the circuit and record the total current (I_T) in the Data Table. Open the circuit.



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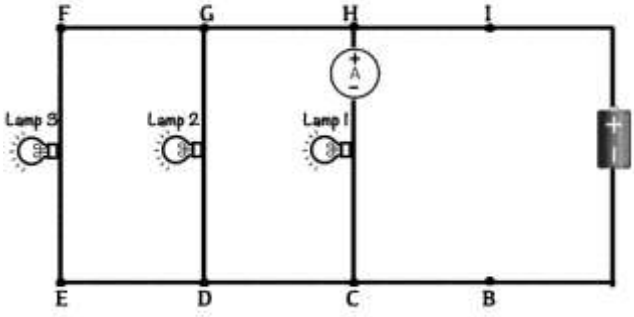
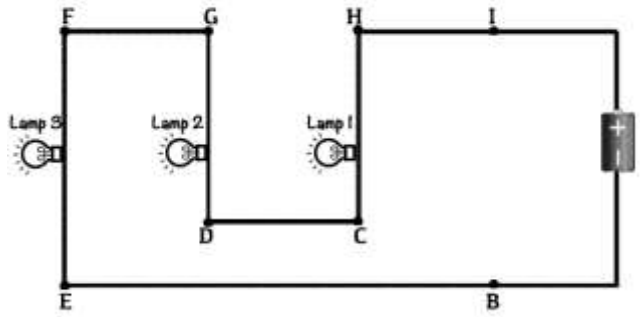
9. Disconnect the ammeter and replace the connecting wire between posts H and I. Disconnect the wire at post H that leads to lamp 1. Do not disconnect the wire at the lamp. Connect the negative lead of the ammeter to the wire that is connected to the lamp. Connect the positive lead of the ammeter to post H. See Figure 4. Close the circuit and record the current (I_1) through lamp 1 in the Data Table. Open the circuit, disconnect the ammeter, and reconnect the lamp wire to post H.



10. Disconnect the lamp wire from lamp 2 at post G. Do not disconnect it at the lamp. Connect the negative terminal of the ammeter to the lamp wire and the positive lead to post G. Close the circuit and record the current (I_2) through lamp 2 in the Data Table. Open the circuit, disconnect the ammeter, and reconnect the wire back to post G.

11. Disconnect the lamp wire from lamp 3 at post F. Do not disconnect it at the lamp. Connect the negative terminal of the ammeter to the lamp wire and the positive lead to post F. Close the circuit and record the current (I_3) through lamp 2 in the Data Table. Open the circuit, disconnect the ammeter, and reconnect the wire back to post F.

Part B: A Series Circuit

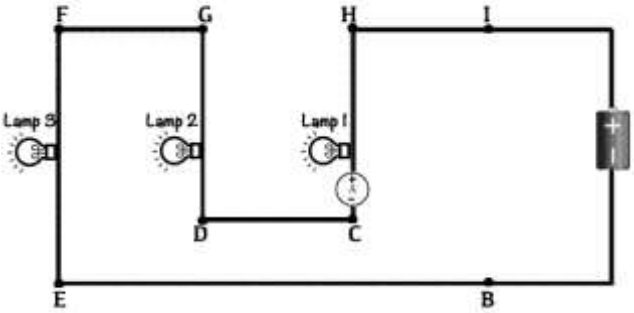


1. Use the dry cell and the connecting wires to connect the three lamps in series. See Figure 5. Tape the circuit to a piece of paper and label the connections as shown. Tape the wires not the connections. Complete the circuit by connecting the wires to the dry cell battery and record your observations of the lamps.

2. Pull out bulb 2 and record your observations. Push the bulb back into the socket. Open the circuit.

3. Connect the positive lead of the voltmeter to post I and the negative lead to post B. Close the circuit. If the voltmeter deflects to the left, reverse the leads. Record the total voltage (V_T) in the Data Table. Open the circuit.

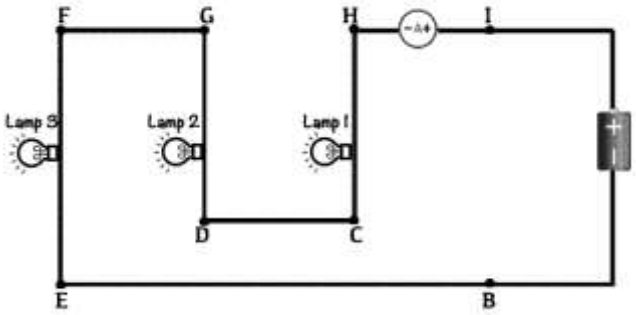
4. Connect the positive lead of the voltmeter to post H and the negative lead to post C. Close the circuit and record the voltage (V_1) across lamp 1 in the Data Table. Open the circuit.



5. Connect the positive lead of the voltmeter to post D and the negative lead to post G. Close the circuit and record the voltage (V_2) across lamp 1 in the Data Table. Open the circuit.

6. Connect the positive lead of the voltmeter to post F and the negative lead to post E. Close the circuit and record the voltage (V_3) across lamp 1 in the Data Table. Open the circuit and remove the voltmeter.

7. Measure the total current by removing the connecting wire between posts H and I and connecting the positive lead of the ammeter to post I and the negative lead of the ammeter to post H. Close the circuit. If the needle deflects to the left, reverse the leads. Record the total current (I_T) in the Data Table. Open the circuit, remove the ammeter, and replace the connecting wire between posts H and I.



8. Disconnect the wire from lamp 1 at post C. Do not disconnect this wire at the lamp. Connect the positive lead of the ammeter to the lamp wire and the negative lead to post C. Close the switch and record the current (I_1) through lamp 1 in the Data Table. Open the circuit, disconnect the ammeter, and reconnect the lamp wire to post C.

9. Disconnect the wire from lamp 2 at post G. Do not disconnect this wire at the lamp. Connect the positive lead of the ammeter to the lamp wire and the negative lead to post G. Close the switch and record the current (I_2) through lamp 2 in the Data Table. Open the circuit, disconnect the ammeter, and reconnect the lamp wire to post G.

10. Disconnect the wire from lamp 3 at post E. Do not disconnect this wire at the lamp. Connect the positive lead of the ammeter to the lamp wire and the negative lead to post E. Close the switch and record the current (I_3) through lamp 1 in the Data Table. Open the circuit, disconnect the ammeter, and reconnect the lamp wire to post E.

Data:

	Voltage (volts)					Current (amps)			
Circuit	V_T	V_1	V_2	V_3		I_T	I_1	I_2	I_3
Parallel									
Series									

Analysis and Conclusions:

1. Add the currents I_1, I_2, and I_3 in the parallel circuit. Is the total current (I_T) approximately equal to the sum of the three individual currents in a parallel circuit?

2. Add the voltages V_1, V_2, and V_3 in the parallel circuit. Is the total voltage equal to the sum of the individual voltages in a parallel circuit?

3. In a parallel circuit, is the total voltage equal to the individual voltages?

4. Add the currents I_1, I_2, and I_3 in the series circuit. Does the total current equal the sum of the individual currents in a series circuit?

5. Is the total current approximately equal to the individual currents in a series circuit?

6. Add the voltages V_1, V_2, and V_3 in the series circuit. Is the total voltage approximately equal to the sum of the individual voltages in a series circuit?

7. In which circuit would a burned-out bulb cause all the other bulbs to go out? Explain why.

8. Voltage is the energy that the electrons carry. Based on the data, explain why the bulbs in a series circuit burn dimmer than the bulbs in a parallel circuit.

9. What would happen to the current in a parallel circuit if all the bulbs were not the same size?

10. How are the lamps in a house connected? Why?