Physics Name:

Lab – Series and Parallel Circuits

Materials:

3V battery or power supply	2-Switches	
1-multimeter	8 insulated hookup wires	2 lamps with bulbs

Background: A multimeter can be used to measure voltage and current. It has various functions and ranges within functions. In order to measure current, it must be placed INTO the circuit in a series fashion. In order to measure voltage it must be used from OUTSIDE the circuit in a parallel fashion.

Procedure:

IMPORTANT NOTES

- In place of the battery, students can use the power supplies at their lab stations. Be sure not to set them over 3V so that the bulbs don't blow.
- When using the multimeters, always start out with the highest range of each function and work your way down.
- Always use the 10A port when measuring current with your multimeters.
- Distinguishing between the voltage under load" and the "no load voltage" may be harder with a power supply in place of a battery

A

1. Set the multimeter to DC voltage. Measure the voltage across the battery terminals. Record this as the "no load voltage."
2. Connect one bulb with the battery and multimeter as shown in Figure A. Turn the power on. Set your multimeter to DC Current. Record the current reading and your observations. Set the multimeter to DC voltage. Measure the voltage across the bulb and across the battery. Record. The voltage across the battery when the lights are on is called the "voltage under load."
3. Place the second bulb in the circuit as shown in figure B below. Again record the voltages across each load and the current in each branch, and your observations.
4. Unscrew one of the bulbs from its socket. **CAUTION:** *The bulb may be hot.* Record voltage and current readings and your observations.
5. Change the circuit to that shown in figure C below. Measure and record the voltages across each load and the currents in each branch, and your observations.

B

6. Unscrew one of the bulbs from its socket. **CAUTION:** *The bulb may be hot.* Record voltage and current readings and your observations.
7. In your circuit like that in figure C, add switches that control *each bulb separately*. Record voltage and current readings and observations with both switches open, then with only bulb one switch open, then with bulb 2 switch only open.

C

DATA: "No Load" Voltage: _____ V Voltage under load: _____ V

Step	Current(s)	Voltage(s)	Observations
2			
3			
4			
5			
6			
7	**Both** **Bulb 1 only** **Bulb 2 only**	**Both** **Bulb 1 only** **Bulb 2 only**	**Both** **Bulb 1 only** **Bulb 2 only**

Analysis:

1. Describe the flow of current in Step 2. Be sure to give direction and what the current flows through as it moves from the source around the circuit.

2. Explain what happened in Step 4.

3. Describe the flow of current in Step 5.

4. Explain what happened in Step 6.

5. In which circuits were the bulbs brightest? In which were they dimmest?

6. Use Ohm's law together with the voltage of the battery and your current readings to calculate the resistance of each circuit.

7. Form a hypothesis to explain the difference between "voltage under load" and "no load voltage"

8. In which step(s) is the combination of bulbs in a series circuit? A parallel circuit? How do series and parallel circuits differ?

9. What do you notice about the total current going into any junction and the total current going out? Show your findings numerically.

10. What do you notice about the sum of the voltage drops across all the loads in any closed loop compared to the total voltage of the source? Show your findings numerically.

11. Make a *schematic diagram* of each of the circuits.

Conclusions: