

# PhyzLab: Current Events IV

a quantitative investigation of circuits  
with unequal resistors

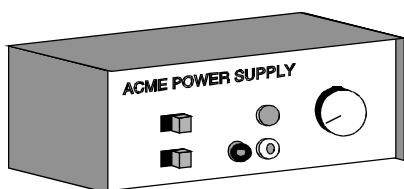
PERIOD	1.		
	2.		
GROUP	3.		
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## • Purpose •

In this activity, you will measure current and voltage at various points in a parallel circuit to see how the flow of charge and the energy of that charge are distributed in the circuit.

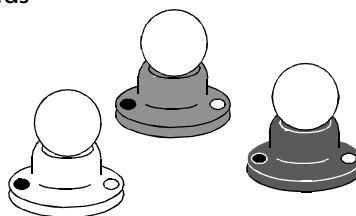
## • Apparatus •

- \_\_\_ variable DC power supply (or 6 V lantern battery)
- \_\_\_ 2.5 V miniature light bulb in socket
- \_\_\_ 6.3 V miniature light bulb in socket
- \_\_\_ 14.4 V miniature light bulb in socket
- \_\_\_ connecting wires
- \_\_\_ DC ammeter (0-1 A range)
- \_\_\_ DC voltmeter (0-10 V range) with test leads



*DC power supply*

*NOTE: black terminal is negative*

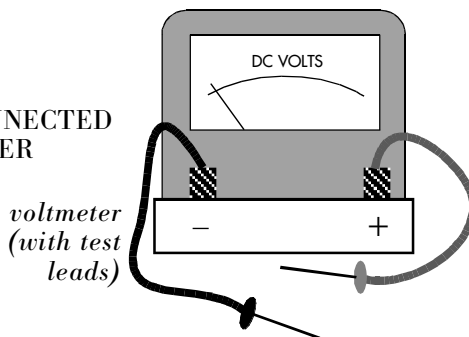


*bulbs in sockets*

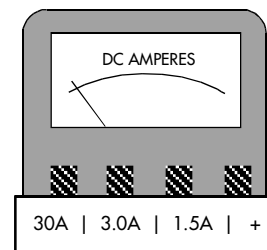


*connecting wires*

THE TEST LEADS ARE ALWAYS CONNECTED TO THE VOLTMETER AND ARE NEVER CONNECTED TO THE AMMETER



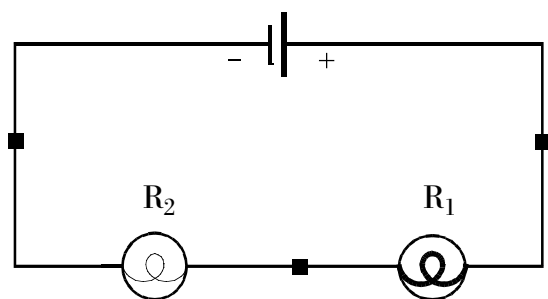
*voltmeter  
(with test leads)*



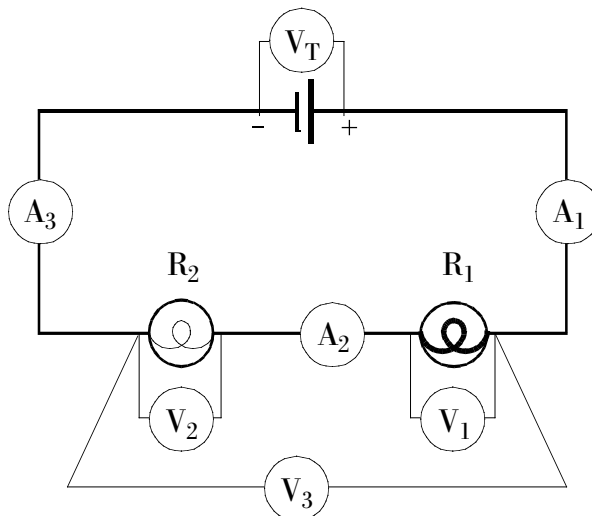
*ammeter*

### 1. TWO UNEQUAL BULBS IN SERIES

a. **Construct** a circuit with two unequal bulbs in series as shown below. Notice that  $R_1$  represents the **lower** resistance bulb. Use the 2.5 V bulb for  $R_1$  and a 6.3 V bulb for  $R_2$ .



SCHEMATIC WITH METERS



b. **Predict** the values *before* taking measurements (use  $V_T = 6.0\text{ V}$ ):

$$V_T = \underline{6.0\text{ V}}$$

$$V_1 = \underline{\hspace{2cm}}$$

$$I_1 = \underline{\hspace{2cm}}$$

$$V_2 = \underline{\hspace{2cm}}$$

$$I_2 = \underline{\hspace{2cm}}$$

$$V_3 = \underline{\hspace{2cm}}$$

$$I_3 = \underline{\hspace{2cm}}$$

c. **Measure** all quantities listed above and record the values below.

$$V_T = \underline{6.0\text{ V}}$$

$$V_1 = \underline{\hspace{2cm}}$$

$$I_1 = \underline{\hspace{2cm}}$$

$$V_2 = \underline{\hspace{2cm}}$$

$$I_2 = \underline{\hspace{2cm}}$$

$$V_3 = \underline{\hspace{2cm}}$$

$$I_3 = \underline{\hspace{2cm}}$$

d. **Switch** the order of the bulbs so that current flows through  $R_2$  before flowing through  $R_1$ . Note that  $V_1$  still measures the voltage across  $R_1$ , etc.  $A_1$  still measures the current before the bulbs,  $A_2$  measures current between bulbs, and  $A_3$  measures current returning to the power supply.

e. **Predict** the values *before* taking measurements (use  $V_T = 6.0\text{ V}$ ):

$$V_T = \underline{6.0\text{ V}}$$

$$V_2 = \underline{\hspace{2cm}}$$

$$I_1 = \underline{\hspace{2cm}}$$

$$V_1 = \underline{\hspace{2cm}}$$

$$I_2 = \underline{\hspace{2cm}}$$

$$V_3 = \underline{\hspace{2cm}}$$

$$I_3 = \underline{\hspace{2cm}}$$

f. **Measure** all quantities listed above and record the values below.

$$V_T = \underline{6.0\text{ V}}$$

$$V_2 = \underline{\hspace{2cm}}$$

$$I_1 = \underline{\hspace{2cm}}$$

$$V_1 = \underline{\hspace{2cm}}$$

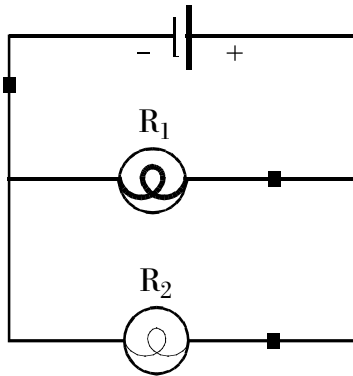
$$I_2 = \underline{\hspace{2cm}}$$

$$V_3 = \underline{\hspace{2cm}}$$

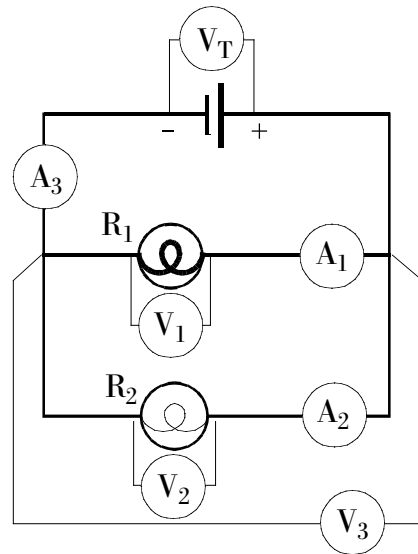
$$I_3 = \underline{\hspace{2cm}}$$

## 2. TWO UNEQUAL BULBS IN PARALLEL

a. **Construct** a circuit with two unequal bulbs in parallel as shown below. Notice that  $R_1$  represents the **lower** resistance bulb. Use a 6.3 V bulb for  $R_1$  and a 14.4 V bulb for  $R_2$ .



SCHEMATIC WITH METERS



b. **Predict** the values *before* taking measurements (use  $V_T = 6.0V$ ):

$$V_T = \underline{6.0V}$$

$$V_1 = \underline{\hspace{2cm}}$$

$$I_1 = \underline{\hspace{2cm}}$$

$$V_2 = \underline{\hspace{2cm}}$$

$$I_2 = \underline{\hspace{2cm}}$$

$$V_3 = \underline{\hspace{2cm}}$$

$$I_3 = \underline{\hspace{2cm}}$$

c. **Measure** all quantities listed above and record the values below.

$$V_T = \underline{\hspace{2cm}}$$

$$V_1 = \underline{\hspace{2cm}}$$

$$I_1 = \underline{\hspace{2cm}}$$

$$V_2 = \underline{\hspace{2cm}}$$

$$I_2 = \underline{\hspace{2cm}}$$

$$V_3 = \underline{\hspace{2cm}}$$

$$I_3 = \underline{\hspace{2cm}}$$

d. **Switch** the order of the bulbs so that  $R_2$  is closer to the power supply than  $R_1$ . Note that  $V_1$  still measures the voltage across  $R_1$ , etc.  $A_1$  still measures the current passing through  $R_1$ ,  $A_2$  measures current passing through  $R_2$ , and  $A_3$  measures current returning to the power supply.

e. **Predict** the values *before* taking measurements (use  $V_T = 6.0V$ ):

$$V_T = \underline{6.0V}$$

$$V_2 = \underline{\hspace{2cm}}$$

$$I_2 = \underline{\hspace{2cm}}$$

$$V_1 = \underline{\hspace{2cm}}$$

$$I_1 = \underline{\hspace{2cm}}$$

$$V_3 = \underline{\hspace{2cm}}$$

$$I_3 = \underline{\hspace{2cm}}$$

f. **Measure** all quantities listed above and record the values below.

$$V_T = \underline{\hspace{2cm}}$$

$$V_2 = \underline{\hspace{2cm}}$$

$$I_2 = \underline{\hspace{2cm}}$$

This is the terminal voltage when the circuit is up and running! If possible, set it to 6.0 V

$$V_1 = \underline{\hspace{2cm}}$$

$$I_1 = \underline{\hspace{2cm}}$$

$$V_3 = \underline{\hspace{2cm}}$$

$$I_3 = \underline{\hspace{2cm}}$$

• **Data and Calculations** •

**1. TWO UNEQUAL BULBS IN SERIES.**  $V_T =$  \_\_\_\_\_

	Voltage (V)	Current (A)	Resistance ( $\Omega$ )	Power (W)
B <sub>1</sub>				
B <sub>2</sub>				
Tot				

^ Use  $V_3$

^ Use  $I_3$

Power sum ( $P_1 + P_2$ ): \_\_\_\_\_

**2. TWO UNEQUAL BULBS IN PARALLEL.**  $V_T =$  \_\_\_\_\_

	Voltage (V)	Current (A)	Resistance ( $\Omega$ )	Power (W)
B <sub>1</sub>				
B <sub>2</sub>				
Tot				

^ Use  $V_3$

^ Use  $I_3$

Power sum ( $P_1 + P_2$ ): \_\_\_\_\_

• **Analysis** •

**1. Calculations of Resistance and Power**

Calculate the resistance and power of each bulb and for each circuit in the lab. Record the values in the data table.

**2. Unequal Bulbs in Series**

- Which bulb uses more power, \_\_\_the high-resistance bulb or \_\_\_the low-resistance bulb?
- Does that bulb use more power because \_\_\_it gets more current, \_\_\_more voltage, or \_\_\_both?
- Does changing the order of the bulbs change the amount of power each one uses? (Does the first bulb to get the current use more power than the second bulb?)

**3. Unequal Bulbs in Parallel**

- Which bulb uses more power, \_\_\_the high-resistance bulb or \_\_\_the low-resistance bulb?
- Does that bulb use more power because \_\_\_it gets more current, \_\_\_more voltage, or \_\_\_both?
- Does changing the order of the bulbs change the amount of power each one uses? (Does the bulb closer to the battery get more power?)