15 Electrodynamics

Name_____

Lab E: PARALLEL CIRCUITS

Inquiry Physics

We will now discover how current, voltage, and resistance operate in any parallel circuit. Set the power supply at 1.5 V for this lab. **DO NOT EXCEED 1.5 V.**

Step 1: Set up a circuit with a power supply **set at 1.5 V** and two resistors as shown in diagram **A**. The ammeter is positioned to measure the current entering resistor one (R_1), while the voltmeter measures its voltage drop. Enter the readings in the "R_1" row of the table for the "Two-Resistor Circuit".

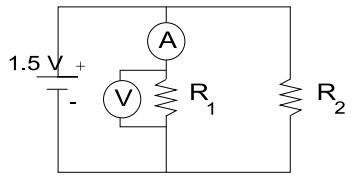

Diagram A

Step 2: Move the ammeter and voltmeter to measure the current entering R_2 and its voltage drop (diagram **B**). Enter the readings in the "R_2" row of the table.

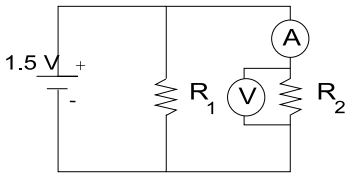

Diagram B

Step 3: Move the ammeter and voltmeter to measure the total current entering the power supply and the total voltage supplied by the power supply (diagram **C**). Enter those readings in the "Total" row.

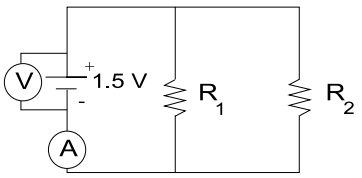

Diagram C

Circuit	Resistor	Voltage (V)	Current (A)	Theoretical Resistance (Ω)	Actual Resistance (Ω)
Two-Resistor Circuit	R_1				
	R_2				
	Total				
Three-Resistor Circuit	R_1				
	R_2				
	R_3				
	Total				

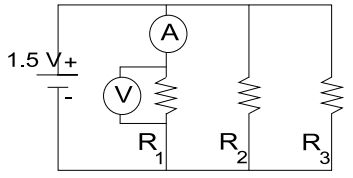

Diagram D

Step 4: Now set up the three-resistor circuit shown in Diagram **D**. The ammeter and voltmeter are initially positioned to measure the current entering and the voltage drop across R_1. Enter those readings in the "R_1" row of the table for the "Three-Resistor Circuit".

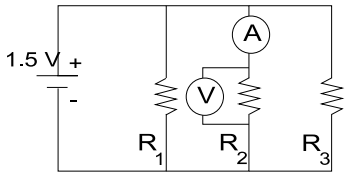

Diagram E

Step 5: Move the ammeter and voltmeter to measure the current entering R_2 and its voltage drop (diagram **E**). Enter the readings in the "R_2" row of the table.

Step 6: Move the ammeter and voltmeter to measure the current entering R_3 and its voltage drop (diagram **F**). Enter the readings in the "R_3" row of the table.

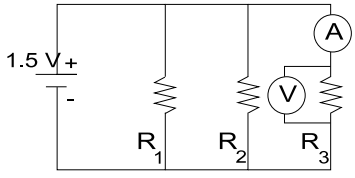

Diagram F

Step 7: Move the ammeter and voltmeter to measure the total current entering the power supply and the total voltage supplied by the power supply (diagram **G**). Enter those readings in the "Total" row.

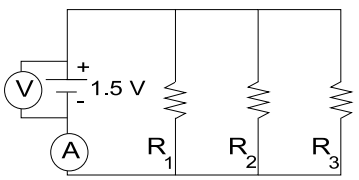

Diagram G

ANSWER ALL QUESTIONS IN COMPLETE SENTENCES

1. In either circuit you constructed, how do the voltage drops across the individual resistors compare with the voltage for the power supply? Contrast this to the behavior in a series circuit.

2. Your data shows how current flows through parallel circuits. Contrast this to the behavior in a series circuit.

3. How are resistance and current related in the different parts of a parallel circuit? (Does higher resistance result in higher or lower current, or does it have no effect?)

Determine the theoretical resistance of each resistor in the circuits, and then calculate the actual resistances using Ohm's Law. Record those values in the table. Using Ohm's Law, you can also calculate the actual total resistance of the circuits, using the readings for total voltage and total resistance. Record those values in the table.

4. Adding a resistor to a series circuit increases the total resistance. Parallel circuits behave differently: compare the two total resistance values in the table. How did the total resistance change when a third resistor was added?

5. How do the total resistances compare with the individual resistances in parallel circuits?

There is a formula for computing the total resistance of a parallel circuit for **any number** of resistors. We will derive this formula together later.

PROPERTIES OF PARALLEL CIRCUITS

6. You can now formulate the relationships between the ***total*** and ***individual*** values for current, voltage, and resistance in any parallel circuit. Use your answers to questions 1-5 to guide you.

The current: _____

_____

The voltage: _____

_____

The resistance: _____

_____