Current Electricity Lab Teacher's Notes

Main Topic	Electricity
Subtopic	Current Electricity
Learning Level	High
Technology Level	Low
Activity Type	Student

Description: Students build and draw parallel and series circuits, observe voltage and current, and then calculate and measure the total resistance of each.

Required Equipment	Alligator leads (pk 10), Mini bulb bases (3), Mini bulbs (3), D battery, Battery holder, DC Power Supply, Resistors (2 different), Digital Multimeter
Optional Equipment	

Educational Objectives

- Build parallel and series circuits.
- Calculate the effective resistance of different circuits.
- Measure the effective resistance of different circuits.

Concept Overview

Students will construct series and parallel circuits with both bulbs and resistors.

The lab begins with bulbs, but since taking measurements with bulbs can often be imprecise, the measurement portion of the lab uses resistors and a DC power supply.

Students will observe these properties of series circuits:

1. The voltage across each resistor can be added to find the voltage across the power supply.
2. The current is the same through each resistor.
3. The total resistance of the circuit is found by adding the resistor values together.

Students will observe these properties of parallel circuits:

1. The voltage is the same across each resistor and across the power supply.
2. The current through each resistor can be added to find the total current coming from the power supply.
3. The total resistance of the circuit can be found using the following equation:

$$\frac{1}{R_t} = \frac{1}{R_1} + \frac{1}{R_2}$$

Lab Tips

Students must have experience with a digital multimeter and know how to use it to measure voltage, current, and resistance.

Acknowledgement

Thank you to Dwight "Buzz" Putnam for developing and contributing this lab.

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Class: _____

Materials:

Alligator leads (pk 10), Mini bulb bases (3), Mini bulbs (3), D battery, Battery holder, DC Power Supply, Resistors (2 different), Digital Multimeter

Safety and Equipment Precautions!

- In creating your circuits, DO NOT leave the wires connected to the battery for long periods of time. We want the batteries to last!
- DO NOT remove the bulbs from their sockets.
- DO NOT connect the bulbs to the power supplies; they will burn out!

Part 1 – "Creating Circuits"

Using the **SMALL** wires, **BULBS**, and **BATTERY**, you and your electrician partner will build the following...

1. A circuit with **two** bulbs wired in **Series**.
2. A circuit with **three** bulbs wired in **Series**.

Draw the circuits below that you have built making certain to use proper circuit symbols and labels.

Series with 2 bulbs	**Series with 3 bulbs**

Using the **SMALL** wires, **BULBS**, and **BATTERY**, build the following...

1. A circuit with **two** bulbs wired in **Parallel**.
2. A circuit with **three** bulbs wired in **Parallel.**

Draw the circuits below that you have built making certain to use proper circuit symbols and labels.

Parallel with 2 bulbs	**Parallel with 3 bulbs**

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Part 2 – "Using Ohm's Law in Series and Parallel Circuits"

IMPORTANT!

- When making connections, the power supply **MUST** be UNPLUGGED!
- **DO NOT** touch wires together when the power supply is on.
- Use **ONLY** the D.C. terminals of the power source, **NOT** the A. C. terminals.
- **DO NOT** leave the circuit with the power supply on for long periods of time! The **resistors** get VERY hot and may ***fry***!
- The Total Voltage ["Power Supply"] for both circuits must be set between 3 & 5 Volts. [Be certain to enter the **ACTUAL** voltage in the table.]
- YOU MUST UNPLUG POWER SUPPLY when you are NOT taking measurements!
- You must disconnect the circuit **BEFORE** you measure the Resistances of the resistors!
- Have your teacher check your circuit before you measure your values.

SERIES CIRCUIT

Create a SERIES circuit with two DIFFERENT resistors. Check the power supply to be certain it is set between 3 & 5 Volts. Fill out the table below.

Voltage Table-Series Circuit

Measure the Voltage across…	Voltage [V]
Resistor #1	
Resistor #2	
Total Voltage [Power supply]	

Current Table-Series Circuit

Measure the Current…	Current [I]
BEFORE Resistor #1	
AFTER Resistor #2	
BETWEEN Resistor #1 and #2	

Using your values from the tables above, **Calculate** the **TOTAL resistance** of the circuit using **Ohm's Law.**

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WITH THE POWER SUPPLY UNPLUGGED...

Measure with the Digital Multimeter... The Resistance of…	**Resistance [Ohms]**
Resistor #1	
Resistor #2	
CALCULATED Total Resistance of Circuit [Using Ohm's Law above]	
MEASURED Total Resistance of Circuit [Using R1 + R2 = Rt]	
PERCENT ERROR between the two Total Resistance values.	

PARALLEL CIRCUIT

Create a **PARALLEL** circuit with two DIFFERENT resistors. Check the power supply to be certain it is set between 3 & 5 Volts. Fill out the table below.

Voltage Table-Parallel Circuit

Measure the Voltage across…	Voltage [V]
Resistor #1	
Resistor #2	
Total Voltage [Power supply]	

Current Table-Parallel Circuit

Measure the Current through…	Current [I]
Resistor #1 branch	
Resistor #2 branch	
Total Current	

Using your values from the tables above, **Calculate** the **TOTAL resistance** of the circuit using Ohm's Law.

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WITH THE POWER SUPPLY UNPLUGGED...

Measure with the Digital Multimeter... The Resistance of…	**Resistance [Ohms]**
Resistor #1	
Resistor #2	
CALCULATED Total Resistance of Circuit [Using Ohm's Law above]	
MEASURED Total Resistance of Circuit [Using 1/R1 + 1/R2 = 1/Rt]	
PERCENT ERROR between the two CALCULATED Total Resistance values.	

Conclusions

Using your knowledge of electric circuits, answer the following…

For SERIES circuits…

1. A. What would happen to the **Total Current of your circuit** if you change from a two-bulb circuit to a three-bulb circuit?

   B. How could you tell from **JUST LOOKING** at the bulbs?

2. What happens to the **Voltage across EACH bulb** when you change from a two-bulb circuit to a three-bulb circuit?

3. What happens to the **Total Resistance of your circuit** when you change from a two-bulb circuit to a three-bulb circuit?

For PARALLEL circuits…

1. What happens to the **TOTAL Current** of your circuit when you change from a two-bulb circuit to a three-bulb circuit?

2. What can you say about the **Voltage** across **EACH** bulb in the two-bulb circuit and in the three-bulb circuit?

3. Should you wire your entire home ONLY in parallel? What would happen to the current throughout the home? What would happen to the fuses or circuit breakers in your home?