Circuit Lab **Name/Hour:**

Purpose: To investigate the properties of series, parallel, and complex circuits.

Materials: 1 9-Volt battery
3 small Christmas light bulbs, cut and stripped
1 multi-meter

Relationships: V=IR
P=IV
series: total resistance = $R_T = R_1+R_2+R_3\ldots$

parallel: total resistance = $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \ldots$

SHOW ALL OF YOUR WORK FOR ALL CALCULATIONS **USE COMPLETE SENTENCES FOR ALL VERBAL ANSWERS**

1. Measure and record the voltage of your battery and the resistance of one light bulb below. Arrange the battery and the light bulb so that it will light, determine the current through the circuit algebraically, and draw a schematic diagram of the circuit.

V =_____ R = _____ I = _____

2. Measure the individual resistance of two light bulbs and record. Compute the total resistance of the two bulbs in **series** and verify with the multi-meter. Arrange two bulbs in series so that they will light with the battery. Determine the total current through the circuit algebraically, and draw a schematic diagram of the circuit.

R_1 = _____ R_2 = _____ R_T = _____ I =_____

3. Measure the individual resistance of three light bulbs and record. Compute the total resistance of the three bulbs in **series** and verify with the multi-meter. Arrange the three bulbs in series so that they will light with the battery. Determine the total current through the circuit algebraically, and draw a schematic diagram of the circuit

R_1 = _____ R_2 = _____ R_3 = _____ R_T = _____ I =_____

4. Measure the individual resistance of two light bulbs and record. Compute the total resistance of the two bulbs in **parallel** and verify with the multi-meter. Arrange the two bulbs in parallel so that they will light with the battery. Determine the total current through the circuit algebraically, and draw a schematic diagram of the circuit

$R_1 =$ _____ $R_2 =$ _____ $R_T =$ _____ $I =$_____

5. Measure the individual resistance of three light bulbs and record. Compute the total resistance of the three bulbs in **parallel** and verify with the multi-meter. Arrange the three bulbs in parallel so that they will light with the battery. Determine the total current through the circuit algebraically, and draw a schematic diagram of the circuit.

$R_1 =$ _____ $R_2 =$ _____ $R_3 =$ _____ $R_T =$ _____ $I =$_____

6. Measure the individual resistance of three light bulbs and record. Arrange two bulbs in **parallel** with each other, and then place this set of lights in **series** with the third bulb. Compute the total resistance of this **set** of resistors and verify with the multi-meter. Arrange the set so it will light with the battery. Oooohh! ☺ Determine the total current through the circuit algebraically, and draw a schematic diagram of the circuit.

$R_1 =$ _____ $R_2 =$ _____ $R_3 =$ _____ $R_T =$ _____ $I =$_____

Compile your data into the following tables:

Series Circuits

Arrangement	Number of Resistors	R_T (total Resistance)	I (total current)
#1			
#2			
#3			

Parallel Circuits

Arrangement	Number of Resistors	R_T (total Resistance)	I (total current)
#1			
#4			
#5			

7. Based on your observations and data, what happens to the total **resistance** through a **series** circuit when individual resistors are added to the circuit? (look at your data table for series circuits)

8. Based on your observations and data, what happens to the total **current** through a **series** circuit when resistors are added to the circuit?

9. Based on your observations and data, what happens to the total **resistance** through a **parallel** circuit when individual resistors are added to the circuit? (look at your data table for parallel circuits)

10. Based on your observations and data, what happens to the total **current** through a **parallel** circuit when resistors are added to the circuit?

11. What is the nature of the relationship (inverse or direct) between individual resistance and total resistance for a series circuit? What about a parallel circuit?

12. What is the nature of the relationship (inverse or direct) between total resistance and current for series and parallel circuits? Is there a difference between the two or is the relationship the same for both?

13. Which arrangement (#1-#6) drew the most power and *why*?

14. Explain the reason for the difference in bulb brightness seen in # 6.