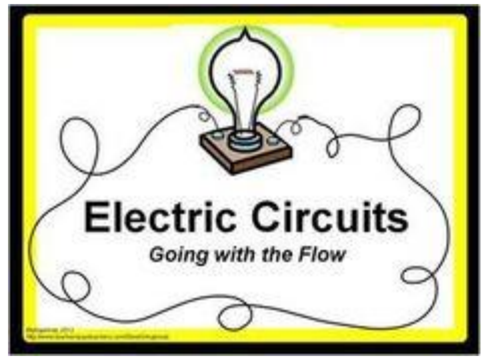
Circuit Lab Name: ___________________________

Series and Parallel Circuits

During the past 100 years we have come to rely on the movement of extremely small particles carrying charge— electrons— to do work for us in a variety of ways. For example, connecting a light bulb to a voltage source using wires allows that source to push electrons through the bulb's filament… and that skinny wire glows, giving us light. Inside the filament electrons in motion are colliding with the atoms of the filament. The energy in motion of the electrons is transferred to the atoms, causing them to emit light.



How do the voltage drops across the three resistors of a series circuit compare to each other? Are these voltage drops different for different resistors? How do the voltage drops compare to the voltage gain in the battery? How do the current values in the individual resistors compare to each other? Are these currents affected by the resistance of the resistors? How do the current values compare to the current at the battery location? For any individual resistor, how is the voltage drop, current and resistance related? How can all these comparisons be expressed using mathematical equations?

Formula's:

Ohm's Law: $V = IR$

Series Circuits:

$V_T = V_1 + V_2 + V_3 + \ldots\ldots\ldots\ldots$

$I_T = I_1 = I_2 = I_3 = \ldots\ldots\ldots\ldots$

$R_T = R_1 + R_2 + R_3 + \ldots\ldots\ldots$

Parallel:

$V_T = V_1 = V_2 = V_3 = \ldots\ldots\ldots\ldots$

$I_T = I_1 + I_2 + I_3 + \ldots\ldots\ldots\ldots$

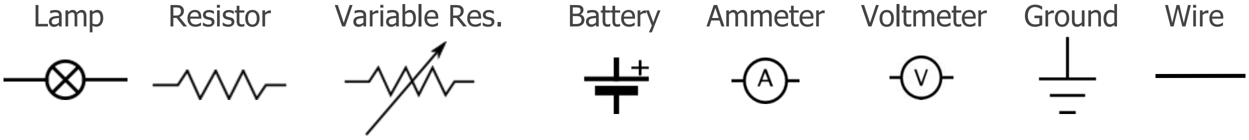
$1/R_T = 1/R_1 + 1/R_2 + 1/R_3 + \ldots\ldots\ldots$

Materials:

Power supply
Lead wires from power supply
Supplemental wires with alligator clips
Light board or individual light sockets
Multi-meter
Metal washers
Variable resistor

Symbols:

Lamp Resistor Variable Res. Battery Ammeter Voltmeter Ground Wire



Switch

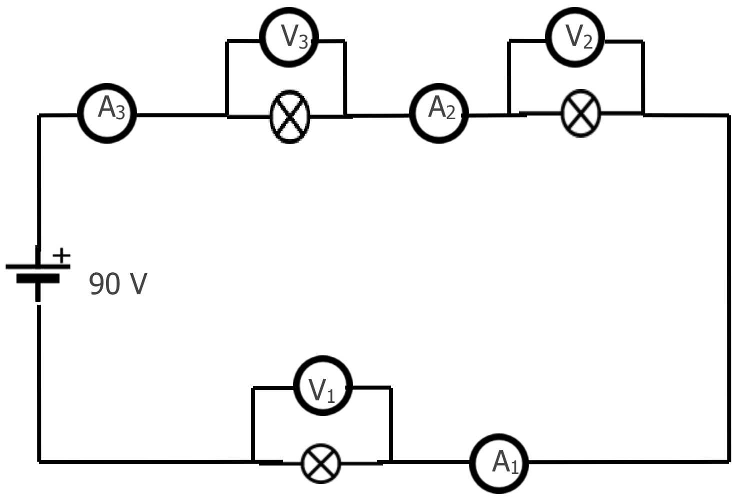
Warning!!

Handle with care. Electricity can be dangerous if you don't respect its power. Follow all directions don't "experiment" with connections not outlined in this lab. Failure to follow these directions may result in damage to lab equipment and or serious injury to those handling the equipment.

Procedure:

Assemble the lab equipment to resemble the below schematic diagram. As we use a Multi-meter to measure the voltage and amperes, only assemble the power supply with wires and lamps.

A. Use the Multi-meter to determine the unknown values.



B. Use the Multi-meter to get the actual Volts and Amperes in the above circuit. 4 pts.

V_T = 90 V V_1 = ______ V_2 = ______ V_3 = ______

A_T = ______ A_1 = ______ A_2 = ______ A_3 = ______

Do the Series formulas prove the results right or wrong? Why? 3 pts.

____

____

____

____

C. Calculate the value of each Lamp (resistor) in the circuit. Show your work below. 3 pts.

R_1 = ______

R_2 = ______

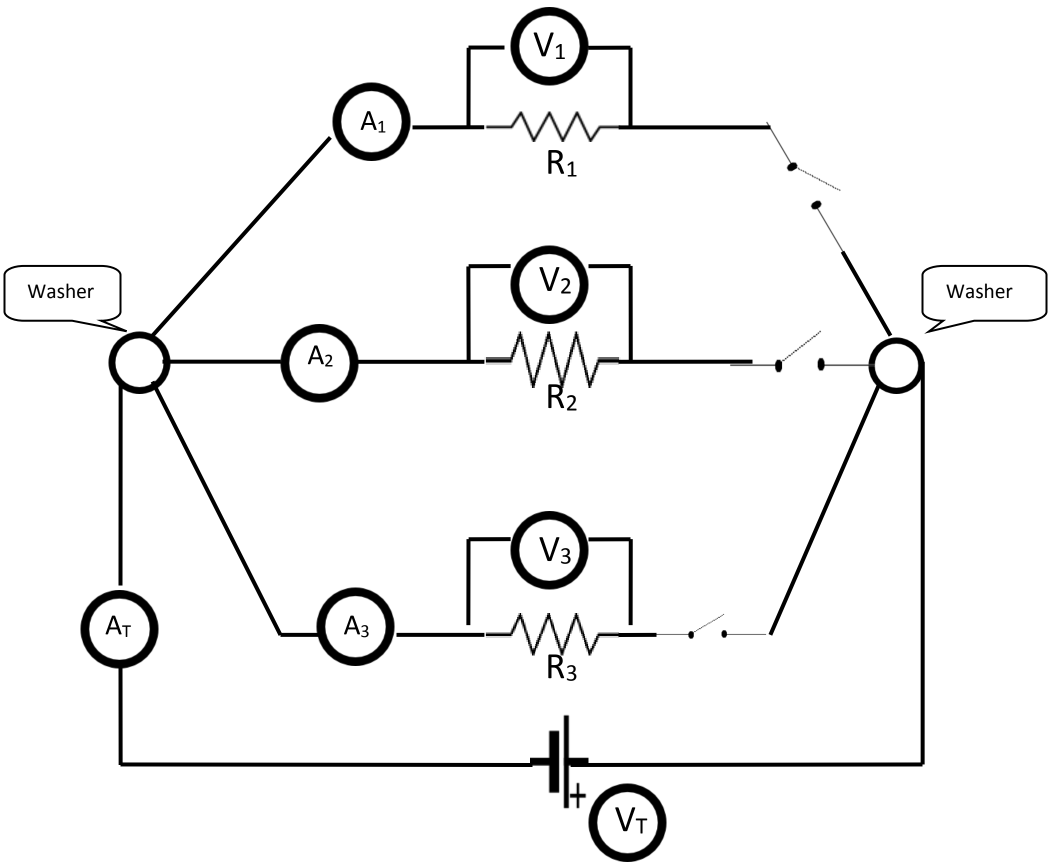
R_3 = ______

D. Use the Multi-meter to measure the <u>actual</u> resistor value of the lamps. 1.5 pts.

R_1 = _____ R_2 = _____ R_3 = _____

E. Do the Actual Measurements equal the Calculated measurements? Explain any differences, large or small. 3 pts.

F. Examine the below schematic drawing. Create the same with the use of light board(s) or single light bulbs or resistors. We will use a Multi-meter to measure the Voltage and Amps, so leave this out of the construction of this circuit.



G. Use the Multi-meter to get the volts and Amperes only. 4 pts.

V_T = <u>90 V</u> V_1 = ______ V_2 = ______ V_3 = ______

A_T = ______ A_1 = _____ A_2 = _____ A_3 = _____

Do the Parallel formulas prove the results right or wrong? Why? 4 pts.

____

____

____

____

H. Calculate the value of each Lamp (resistor) in the circuit. Show your work below. 3 pts.

R_1 = ______

R_2 = ______

R_3 = ______

I. Use the Multi-meter to measure the actual resistor value. 1.5 pts.

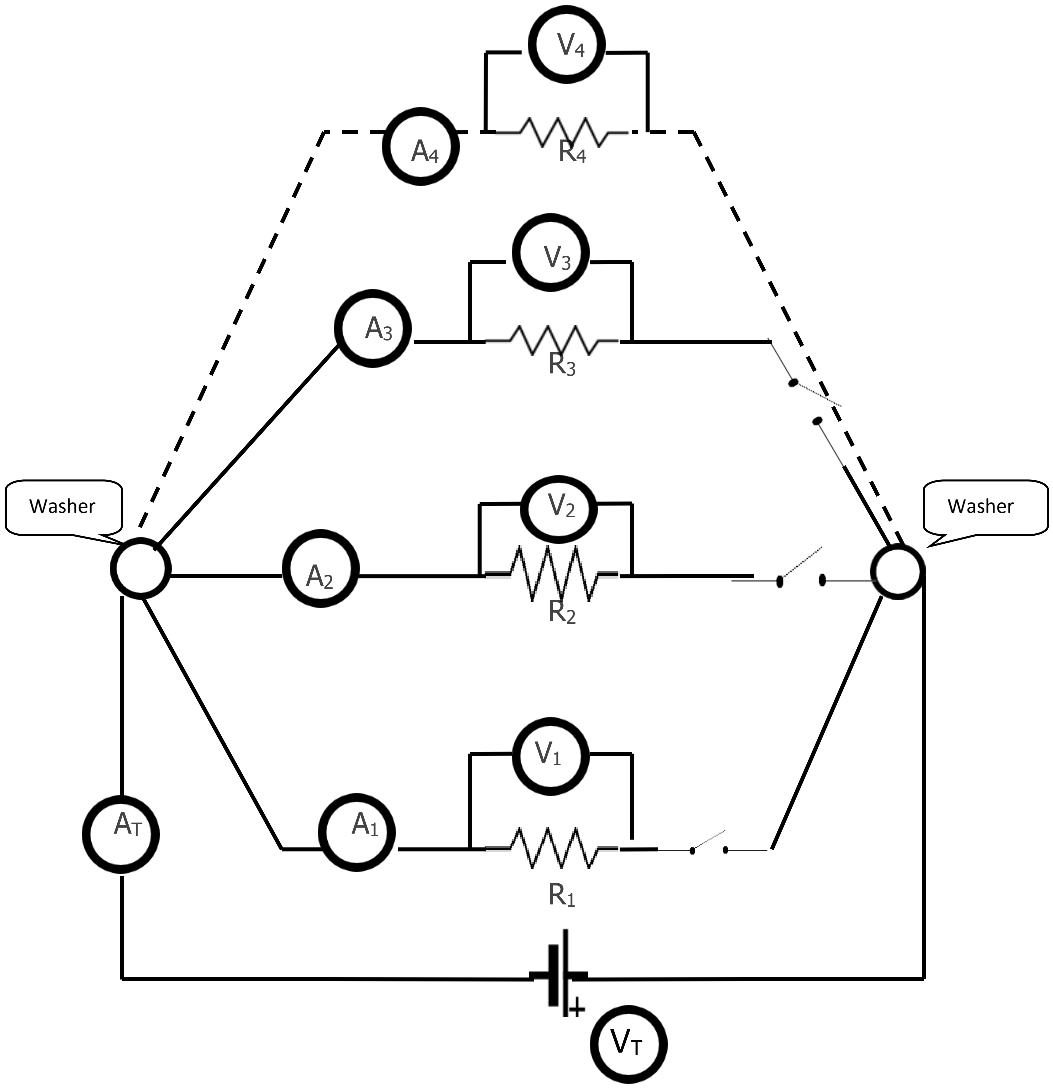
R_1 = ______ R_2 = ______ R_3 = _____

J. Add another branch to the previous circuit so that it resembles the next diagram.

K. Before measuring the values with the Multi-meter. Predict the value of the current in each of the branches by circling your best guess in the following choices. 1 pt.

a. Current decreases in the branches after adding another branch
b. The current increases in each of the branches after adding another branch
c. No change in the current, each branch will continue receive the same but the total current will increase.
d. No change in the current, four branches will have the same current as three branches, and the total current will stay the same as with three branches.

L. Use the Multi-meter to get the volts and Amperes only. 5 pts.



Check with instructor to the actual total voltage setting. ____________.

V_T = _______ V_1 = _______ V_2 = _______ V_3 = _______ V_4 = _______

A_T = _______ A_1 = ______ A_2 = ______ A_3 = _______ A_4 = _______

M. <u>Calculate</u> the value of each Lamp (resistor) in the circuit. Show your work below. 2 pts.

R_1 = ______

R_2 = ______

R_3 = ______

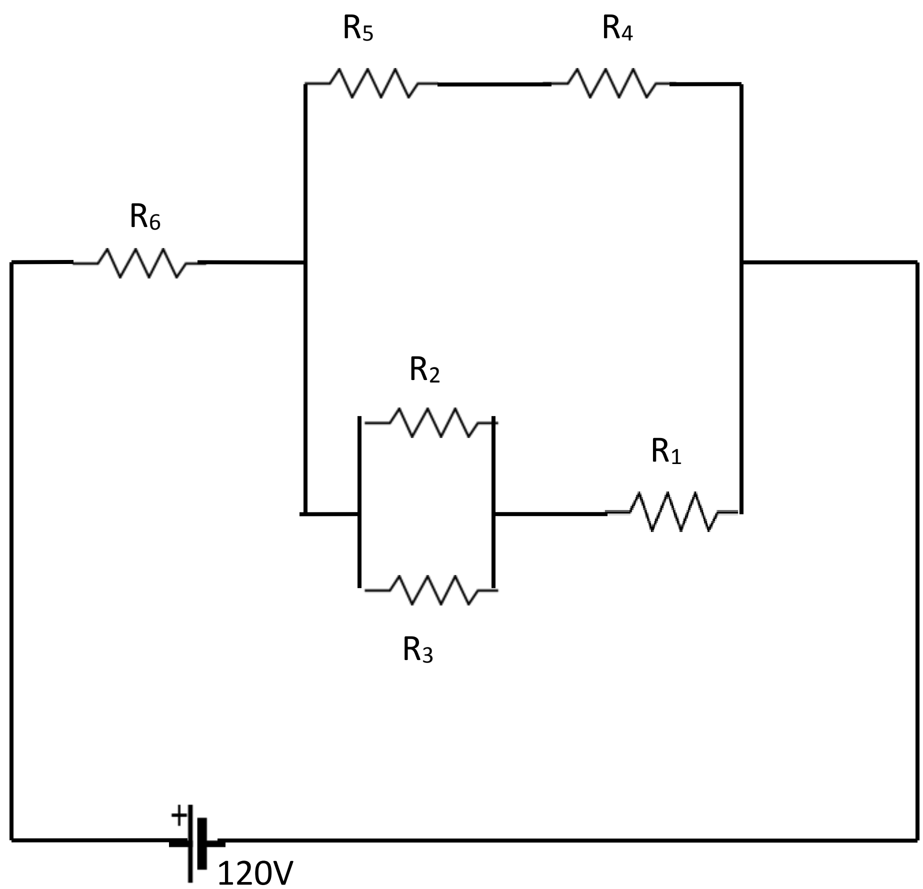
R_4 = ______

N. Now use the Multi-meter to measure the actual resistor value. 2 pts.

R_1 = ______ R_2 = ______ R_3 = ______ R_4 = ________

O. Use the space below to explain why adding more appliances to one outlet is potentially dangerous.

P. Solve the following Electrical Circuit for all unknown values listed below, answers may not be whole numbers, but may be fractions or decimal values. **Attach paper showing work**.



V_T = 120 V V_1 = ______ V_2 = ______ V_3 = ______ V_4 = ______ V_5 = ______ V_6 = ____

A_T = 6 A A_1 = ______ A_2 = ______ A_3 = ______ A_4 = ______ A_5 = ______ A_6 = ____

R_T = ______ R_1 = ______ R_2 = 12 Ω R_3 = 24 Ω R_4 = 10 Ω R_5 = 20 Ω R_6 = 10 Ω