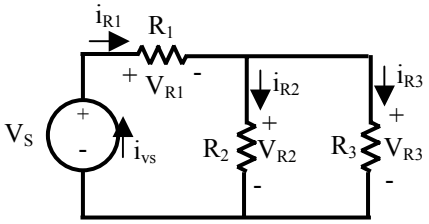
Name _____

Lab Partner _____

EE301L – Spring 2009

Laboratory Project 2: KVL, KCL, Ohm's Law



Given:
$V_S = 20$ V
$R_1 = 470\ \Omega$
$R_2 = 470\ \Omega$
$R_3 = 470\ \Omega$

Figure 1: Circuit for Lab 2

Preliminary (must be completed before the lab or points are deducted)

1. Write KVL equations for all three loops.

2. Write KCL equations for all three nodes.

3. Write Ohm's Law equations for all of the resistive elements.

4. For the series circuit, calculate the following:

Table 1: Preliminary Calculations

	Calculated Value	**Units**
V_{R1} (voltage drop across R_1)		
V_{R2} (voltage drop across R_2)		
V_{R3} (voltage drop across R_3)		
i_{R1} (current through R_1)		
i_{R2} (current through R_2)		
i_{R3} (current through R_3)		
i_{Vs} (current through the source)		

Hint: Express two of the KVL equations in terms of currents using Ohm's Law. Use these with a KCL equation that includes currents through i_{R2} and i_{R3} to solve three simultaneous equations for currents. Once the currents are known, the Ohm's law equations can be used to find the voltages.

Experimental

Note: See the last two pages on how to measure currents. The fuse in the mulitmeters will blow if you measure current incorrectly. Never measure current "across" a resistor.

1. Construct the circuit on the pegboard.
2. Using a multimeter, set the voltage source before connecting to the circuit.
3. **Before connecting the resistors to anything**, measure and record the actual resistance of each resistor in Table 2.
4. Connect the power source and take voltage and current measurements using multimeter and record the measurements in Table 3.
5. Measure the source voltage after it is connected to the circuit to make sure the voltage has not dropped. This would indicate that the current setting is a limiting factor and needs to be set higher.
6. Use the tables to record your data.

Table 2: Laboratory Measurements

	Measured Value	**Units**
V_s		
R_1		
R_2		
R_2		

Table 3: Laboratory Measurements

	Measured Value	**Units**
V_{R1} (voltage drop across R_1)		
V_{R2} (voltage drop across R_2)		
V_{R3} (voltage drop across R_3)		
i_{R1} (current through R_1)		
i_{R2} (current through R_2)		
i_{R3} (current through R_3)		
i_{Vs} (current through the source)		

Analysis

1. R**ecalculate** the voltage drops across the resistors and currents through the resistors using the values for the voltage source and resistances recorded in Table 2.

Table 4: Analysis Calculations

	Calculated Value	**Units**
V_{R1} (voltage drop across R_1)		
V_{R2} (voltage drop across R_2)		
V_{R3} (voltage drop across R_3)		
i_{R1} (current through R_1)		
i_{R2} (current through R_2)		
i_{R3} (current through R_3)		
i_{Vs} (current through the source)		

2. Compare these to the current and voltage drops measured and recorded in Table 3. Percentage difference is defined with respect to the calculated results, i.e., % diff = |calculated - measured|/|calculated| × 100%. Record these calculations in Table 5.

Table 5: Comparison – Calculated to Measured

	Enter Value from Table 3	Enter Value from Table 4	Percent Difference
V_{R1} (voltage drop across R_1)			
V_{R2} (voltage drop across R_2)			
V_{R3} (voltage drop across R_3)			
i_{R1} (current through R_1)			
i_{R2} (current through R_2)			
i_{R3} (current through R_3)			
i_{Vs} (current through the source)			

3. State Kirchoff's Voltage Law.

4. Show with the three KVL loop equations and values measured and recorded in Tables 2 and 3 that the law is true for your circuit.

5. State Kirchoff's Current Law.

6. Show with the three KCL node equations and values measured and recorded in Table 3 that the law is true for your circuit.

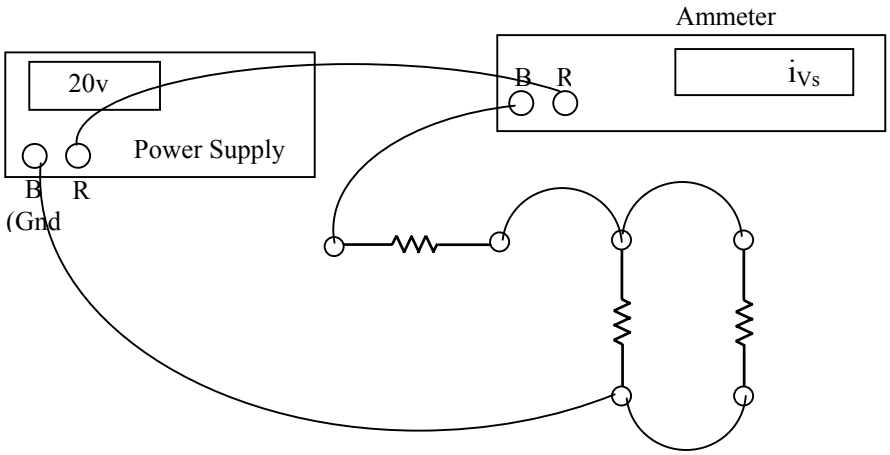
7. State Ohm's Law

8. Show with the three Ohm's Law equations and values measured and recorded in Tables 2 and 3 that the law is true for your circuit.

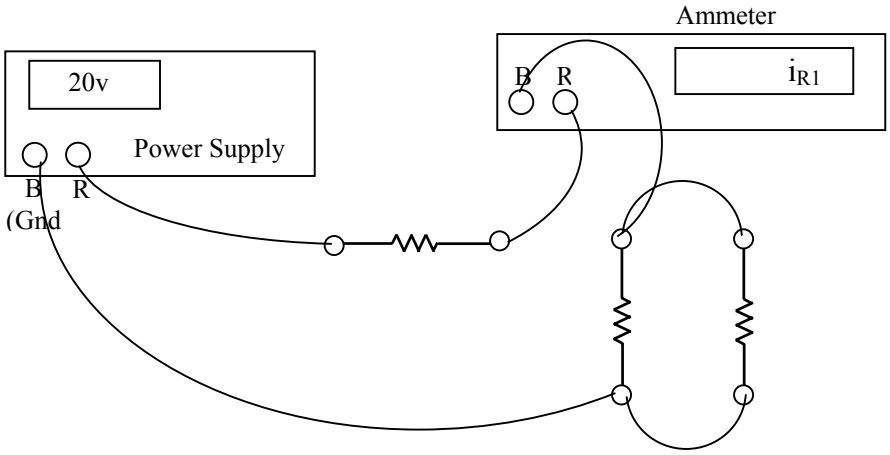
DMM Used as an Ammeter – Schematics for Measurement

Note wires are only connected at a circle (not crossing). Black dots indicate a separate node that is not on a resistor terminal. Keep in mind that you are isolating a particular current (flow) to send through the meter to be measured without changing the nature of the circuit.

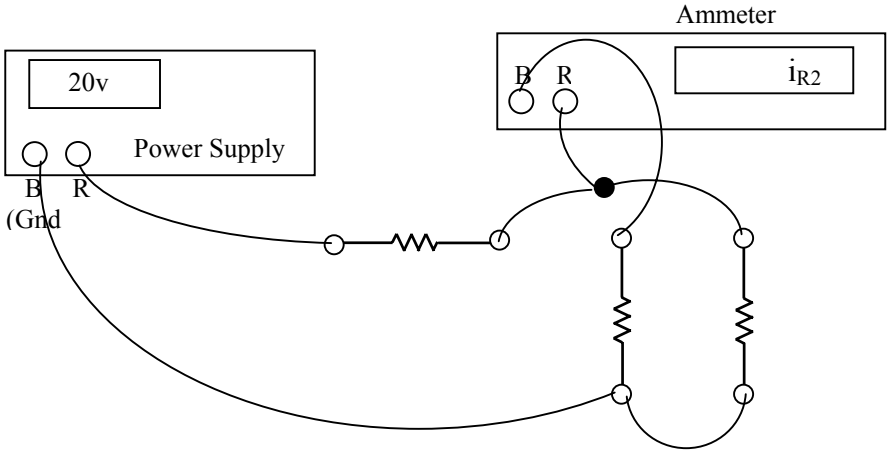
To measure i_{VS}



To measure i_{R1}



To measure i_{R2}



To measure i_{R3}