VOLTAGE AND CURRENT IN D.C. CIRCUITS

Name _________________________________

PURPOSE: To determine how voltages and currents are distributed in D.C. circuits.

PART 1 – VOLTAGE

NOTE: During this lab you will be measuring the voltage of your batteries many times. You may notice that the voltage may decrease as the lab continues. This is normal and has no more significance other than the batteries are being used and therefore losing energy. **DO NOT FORGET UNITS!**

1. Measure the resistance of resistor “A” (before making a circuit) and record here.
   \[ R_A = \quad \text{__________} \]

2. Place a connecting wire from the (-) spring on one battery to the (+) on the other battery. (Use the two inner-most springs.) When making any circuits for this lab make sure that this wire is always there.

3. Using wires make a circuit connecting resistor “A” to the batteries.

4. Using the multimeter, measure the voltage of the combined batteries by placing the leads on the two outer-most springs of the two batteries. Record the value here.
   \[ V_O = \quad \text{__________} \]

5. Measure the voltage drop across resistor “A” while the circuit is working.
   \[ V_A = \quad \text{__________} \]

   *How does this voltage in #5 compare to the measurement in #4?*

6. Now connect resistors “A” and “B” in series just like you connected two light bulbs in series in the previous lab.

7. Re-measure the voltage of the combined batteries as you did in Step #4. Record the value here.
   \[ V_O = \quad \text{__________} \]

8. Measure the voltage drop across each of the resistors like you did in Step #5.
   \[ V_A = \quad \text{__________} \quad V_B = \quad \text{__________} \quad \text{Sum } V_A + V_B = \quad \text{__________} \]

   *How does the sum of \( V_A \) and \( V_B \) compare with the voltage in #7?*


10. Re-measure the voltage of the combined batteries as you did in Step #4. Record the value here.
    \[ V_O = \quad \text{__________} \]
11. Measure the voltage drops across each of the three resistors.

\[ V_A = \quad V_B = \quad V_C = \quad \text{Sum } V_A + V_B + V_C = \quad \]

*How does the sum of all three voltages compare with the voltage in #10?*

*Make a general statement about how voltages in series circuits work.*

12. Connect resistors “A” and “B” in parallel just like you connected two light bulbs in parallel in the previous lab.

13. Re-measure the voltage of the combined batteries as you did in Step #4. Record the value here.

\[ V_O = \quad \]

14. Measure the voltage drop across each of the resistors.

\[ V_A = \quad V_B = \quad \]

*How do these two voltage drops compare to the voltage in #13?*

15. Connect all three resistors in parallel just like you connected three light bulbs in parallel in the previous lab.

16. Re-measure the voltage of the combined batteries as you did in Step #4. Record the value here.

\[ V_O = \quad \]

17. Measure the voltage drop across each of the three resistors.

\[ V_A = \quad V_B = \quad V_C = \quad \]

*How do these voltages in #17 compare to the voltage in #16?*

*Make a general statement about voltages in parallel circuits.*
PART 2 – CURRENT

18. Construct a circuit using the two batteries and only resistor “A”. Make sure that the multimeter is in the 200mA range. DO NOT move the red wire to a new hole! (Whatever reading you get from the meter needs to be converted to amperes by moving the decimal point three places to the left.) Remove one of the circuit wires and replace it with the multimeter leads, one at each end. Record the reading.

\[ \text{I}_A = \text{________} \]

19. You measured the resistance of resistor “A” in Step #1, and the voltage across it in Step #5. Use these values and Ohm’s Law to calculate the current that should be passing through resistor “A”. (Show all work!)

Why might there be any difference between your calculation in #19 and your reading from #18?

20. Measure the resistance of bulb “A” by simply putting the leads of the ohmmeter on the springs on either side of the bulb, WITHOUT it hooked into a circuit.

\[ R_{\text{bulb}} = \text{________} \]

21. Construct a circuit similar to the one from Step #18, except use bulb “A” in place of resistor “A”. Measure the voltage drop across bulb “A”.

\[ V_{\text{bulb}} = \text{________} \]

22. Remove one of the circuit wires and replace it with the multimeter leads, one at each end. Record the reading. (Make sure you are still in the 200mA scale.)

\[ \text{I}_{\text{bulb}} = \text{________} \]

23. You measured the resistance of bulb “A” in Step #20, and the voltage across it in Step #21. Use these values and Ohm’s law to calculate the current that should be passing through bulb “A”. (Show all work!)

Why is there a large difference between the value you calculated in #23 and the value you measured in #22?

24. Construct a circuit with all three resistors in series. Remove the wire that connects resistor “A” to resistor “B” and replace it with the multimeter leads. What is the current passing through resistor “A”?

\[ \text{I}_A = \text{________} \]
25. Replace the wire that connects resistor “A” to resistor “B”. Remove the wire that connects resistor “B” to resistor “C” and replace it with the multimeter leads. What is the current that passed through resistor “B”?

\[ I_B = \text{___________} \]

26. Replace the wire that connects resistor “B” to resistor “C”. Remove the wire that connects resistor “C” to the batteries and replace it with the multimeter leads. What is the current that passed through resistor “C”?

\[ I_C = \text{___________} \]

*How do the readings from #24 - #26 compare?*

*Make a general statement about how current flows through different parts of a series circuit.*

27. Measure the resistances of resistor “A” and resistor “B” before they are hooked in any circuit.

\[ R_A = \text{___________} \quad R_B = \text{___________} \]

28. Connect these two resistors in parallel using the diagram from below. Make sure resistor “A” is on top, and that resistor “B” is on the bottom.
29. Remove the wire labeled #1 in the diagram of the circuit and replace it with the leads of the multimeter. What is the total current running through this circuit?

\[ I_o = \ \ \text{__________} \]

30. Replace wire #1 from above. Remove the wire labeled #2 in the diagram of the circuit and replace it with the leads of the multimeter. What is the current running through resistor “A”?

\[ I_A = \ \ \text{__________} \]

31. Replace wire #2 from above. Remove the wire labeled #3 in the diagram of the circuit and replace it with the leads of the multimeter. What is the current running through resistor “B”?

\[ I_B = \ \ \text{__________} \]

32. Add the current running through resistor “A” to the current running through resistor “B”.

\[ \text{Sum } I_A + I_B = \ \ \text{__________} \]

How does the sum of the currents in the two resistors compare to the total current in the circuit, #29?

Which of the two resistors had the greater resistance? ______ What was true about the current passing through this resistor compared to the current passing through the second resistor?

Make a general statement about how current flows through different parts of a parallel circuit.