Physics Exploration Homework Supplement   P111-21.pdf

DC Circuits: Resistor Network

Name:

This is an exercise to have you gain familiarity with the concepts of voltage and electric current in a combination series/parallel circuit. The primary emphasis is on making measurements to verify concepts introduced in class. In addition, you will have to figure out one value that can't be directly measured. *The current used is limited so that there is no danger you will get an electrical shock that does more than give a tingle.*

You will find the following setup in the PEC (Thaw 311/312). **The points labeled V are places where you can measure the voltage (always in parallel!) and the unlabeled points right next to each other in the diagram are places to measure current (always in series!).** You will measure voltages by putting the meter across a resistor or the supply; nothing else needs to be changed. You measure currents by replacing the short (a banana plug) across the current measuring points with the ammeter. Have a TA initial this sheet to show you did the work..
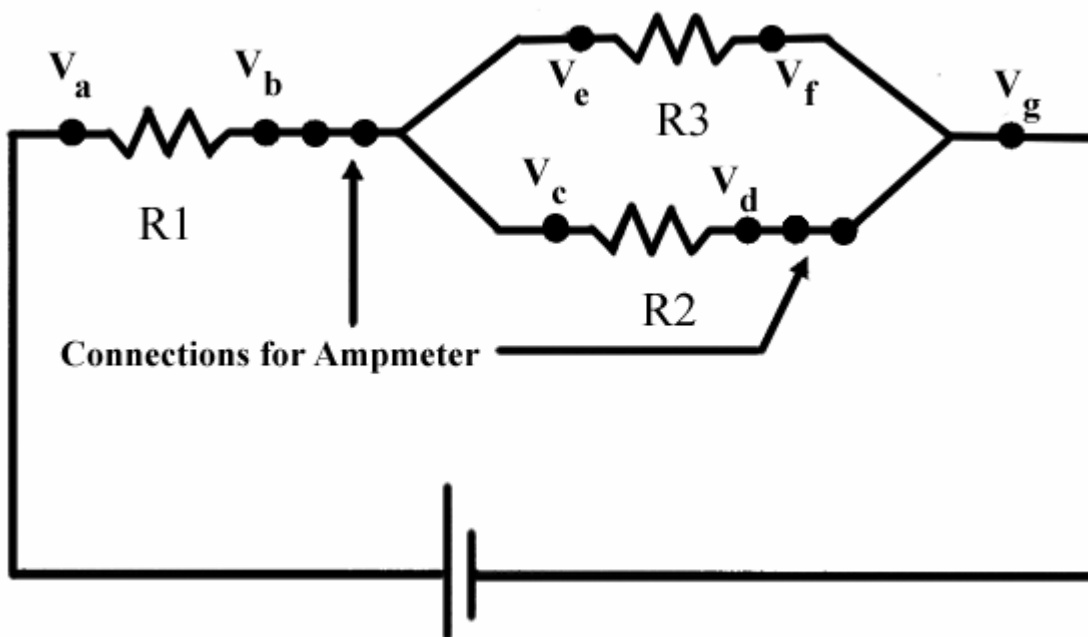
The DC voltage supply should be set to 10V (check the dial to be sure). Since the resistors are all at least 1kΩ, the currents are a few milliamps (mA). The purpose of this exercise is to find the values of the resistors, the voltages at various points, and the currents in each part of the circuit.

1. Use the voltmeter to measure the voltage of the battery, the voltage between V_a and V_g; ; you don't have to disconnect any element in the circuit. Label the battery in the figure with the voltage you find.

2. Now measure the current at Rl (call it I_1) and at R2 (call it I_2) and label the diagram with these values.

3. Now measure the voltages across Rl (called V_1 which is the difference V_a-V_b), R2 (called V_2=V_c-V_d), and R3 (called V_3) and label the diagram accordingly.

4. You now know enough to get the missing quantities-> Rl, R2, R3 and the current in the lower part of the parallel section. Show your work here and label the diagram with these values.

5. There are various checks you can make to be sure nothing wrong developed in your measurements.

   a) Are V_1, V_2, and V_3 all less than the battery voltage?

   b) We learned a simple relationship between V_2 and V_3. Does it hold?

   c) We learned a simple ratio between I_2 and I_3 in terms of the resistances R2 and R3. Does it hold?

   d) Calculate the equivalent resistance of R2 and R3, then the equivalent resistance of the 3 resistors. Does Ohm's Law work for this equivalent resistance?   One of the currents and one of the voltages is used with it.