EECE 2150 - Circuits and Signals: Biomedical Applications
Lab 2
Getting started with Ohm's Law, KVL, KCL, and Multi-Meter Measurements

Part 1. A Very Simple DC Circuit

Figure 1. Simple resistor circuit for Part 1.

1.1 Considering figure 1, how much current do you expect to flow through the resistor (in theory)?

1.2 Assemble the circuit shown in Figure 1 on your protoboard. Be sure to measure the ***actual*** value of the resistor with the digital multi-meter (DMM) in ohmmeter configuration before you connect it to the circuit.

1.3 Measure the voltage drop across the resistor and the loop current using the DMM in voltmeter and ammeter configurations respectively. ***(Important: Voltage is measured across a circuit element; current is measured through the Ammeter).*** Are the values what you predicted?

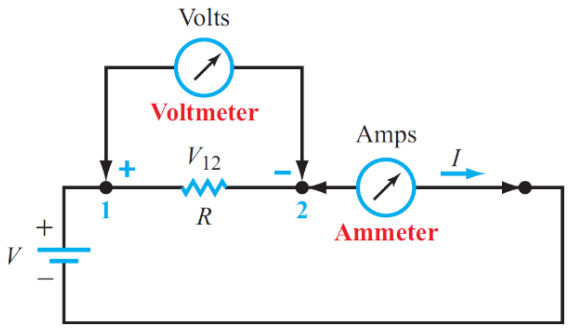

Figure 2. Connection of the Voltmeter and Ammeter in a DMM. Voltmeter is connected across the terminals of the component while the Ammeter is connected in series with the component

1.4 What would the loop current be if the applied voltage were doubled?

Part 2. KCL

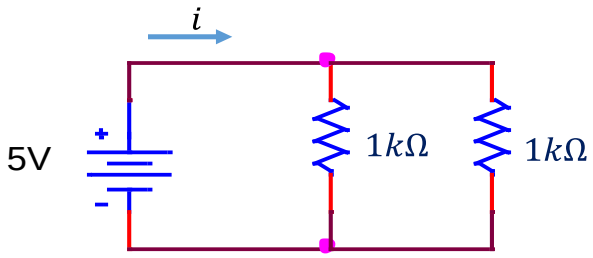

Figure 3. Parallel resistor circuit for Part 2

2.1 How much current do you expect to flow through each resistor in theory?

2.2 Assemble the circuit shown in Figure 3. If helpful, you can use the breadboard worksheet (online). As always, remember to measure the ***actual resistor values*** using the DMM in ohmmeter configuration.

2.3 Using the DMM in its current mode, measure the total current i and the current through each resistor. Do these measurements satisfy KCL?

2.4 Now change one of the resistors to a $2\ k\Omega$ resistor (again, measure the actual value) and repeat your measurements. Is KCL satisfied again?

Part 3. KVL

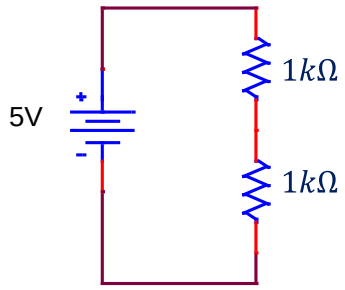

Figure 4. Series resistor circuit for Part 3.

3.1 Considering the circuit in Figure 4, what values do you expect for the voltages across each of the two resistors? Across both resistors (or equivalently, the voltage source)?

3.2 Assemble the circuit shown in Figure 4, remembering to measure the true resistor values.

3.3 Using the DMM in voltage mode, measure the voltages across each of the two resistors and across the source. Do your results agree with KVL?

3.4 Change one of the resistors to $2k\Omega$ and re-measure the voltage drops. Verify this measurement with KVL calculations.

3.5. Now replace $2k\Omega$ with the 1kΩ resistor, and then disconnect the two resistors from each other, leaving everything else connected, with an open circuit between the two resistors as in Figure 4B.

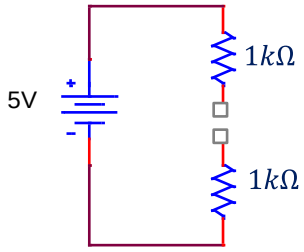

Figure 4B. Disconnected (open) circuit.

3.6 Measure the voltage across each resistor. Measure the voltage across the disconnection (that is between the disconnected ends of the resistors). Does this make sense? What does your result tell you about the amount of current flowing in the circuit? (Hint: how much current is flowing through the $1k\Omega$ resistors?) For the meter to work there must be some current flowing through it. What does the measurement of the voltage across the disconnection imply about the resistance of the meter itself?

Part 4 - For the Write-Up…

To be submitted in one week:

- Answer all questions above.
- Follow instructions for writing lab reports available on Canvas
- Submit to Canvas

Reports will be required for all Labs. They will need to be submitted on Canvas one week after the session in which the lab work is finished. If you are not finished with the lab work, it is your responsibility to finish the work during any of the laboratory "office hours" during the week. Please follow instructions for writing lab reports available on Canvas. Late Lab reports will be accepted with a 10% penalty up to one day late. When you have finished the lab work on a Lab, you should have your Lab Notebook signed off by a TA or the instructor who will ask a few questions to see if you have understood what you have measured.

IMPORTANT: BEFORE YOU LEAVE THE LAB:

a. Place all of the components that your removed from the toolbox back in that box and return it to the cabinet that houses them
b. Collect all used components and wires from your bench and place them in your group's reusable plastic container. If you are not going to use these components or wires again, please discard them in the trash bin located in your lab room.
c. Turn off all the equipment you have used on your workbench.
d. Make sure you return your protoboard, the equipment wires and your reusable container to the cabinet.
e. Make sure to have your notebook signed by an instructor or TA before you leave the lab.

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Last updated: I Salama, 8/18/2021, N. McGruer, 1/13/16, based on version from 8/10/15, M.Niedre.