EECE 2150 - Circuits and Signals: Biomedical Applications

Lab 2

Getting started with Ohm's Law, KVL, KCL, and Multi-Meter Measurements

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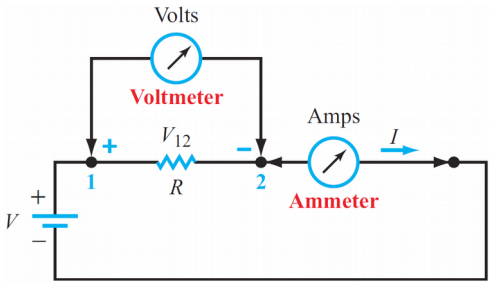
Part 1. A Very Simple DC Circuit

Figure 1. Simple resistor circuit for Part 1.

1.1 **Q1:** 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 and record in your circuit (on a circuit diagram) the ***actual*** value of the resistor with the digital multi-meter (DMM) in ohmmeter configuration *before* you connect it to the circuit. *Note that if you measure resistance with an ohmmeter when a device is connected in a circuit you may get an incorrect measurement! If you are not sure why, discuss it with the instructor or a TA/HCA. This is likely to trip you up again during the semester if you don't understand the issue, so be sure to find out what we mean if it is not clear to you!*

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).*** **Q2:** Are the values what you predicted?



1.4 **Q3:** What would the loop current be if the applied voltage were doubled?

Part 2. KCL

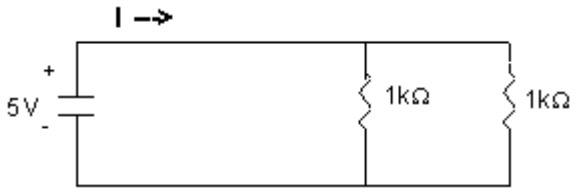


Figure 2. Parallel resistor circuit for Part 2

2.1 **Q4:** How much current do you expect to flow through each resistor in theory?

2.2 Assemble the circuit shown in Figure 2. If helpful, you can use the breadboard worksheet (online). As always, remember to measure and record 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. **Q5:** Do these measurements satisfy KCL?

2.4 Now change one of the resistors to a 2 kΩ resistor (again, measure the actual value) and repeat your measurements. **Q6:** Is KCL satisfied again?

Part 3. KVL

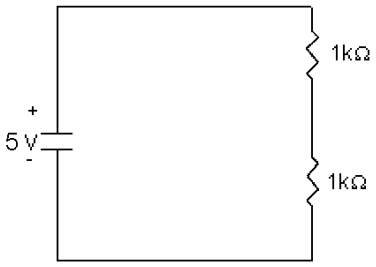


Figure 3. Series resistor circuit for Part 3.

3.1 **Q7: (a)** Considering the circuit in Figure 3, what values do you expect for the voltages across each of the two resistors? **(b)** across both resistors together)?

3.2 Assemble the circuit shown in Figure 3, remembering to measure and record the resistor values.

3.3 Using the DMM in voltage mode, measure the voltages across each of the two resistors and across the source. **Q8:** Do your results agree with KVL?

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

3.5. Now replace 2kΩ 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 3B.

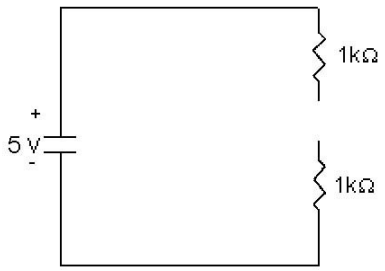


Figure 3B. Disconnected (open) circuit.

3.6 Measure the voltage across each resistor. Measure the voltage across the disconnection (that is between the disconnected ends of the resistors). **Q9: (a)** Does this make sense? **(b)** What does your result tell you about the amount of current flowing in the circuit? (Hint: how much current is flowing through the 1kΩ resistors?) For the meter to work there must be some current flowing through it. **(c)** What does the measurement of the voltage across the disconnection imply about the resistance of the meter itself?

Part 4 - For the Write-Up… (DiMarzio section only; others may have different expectations)…

Answer the remaining numbered questions, Qn in your notebook. Make sure the instructor or TA signs the book before you leave.

IMPORTANT: BEFORE YOU LEAVE THE LAB:

(a) Place all of the components that your removed from the red tool box 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 of the equipment you have used on your workbench.

(d) Make sure you return your protoboard, the equipment wires and your reusable container to the front window.

(e) Make sure to have your notebook signed by an instructor or TA before you leave the lab.

Department of Electrical Engineering, Northeastern University.
Last updated: 1/13/16, N. McGruer based on verstion from 8/10/15, M.Niedre. Some minor modifications, mostly edits, and change to hand-in assignment, by D. Brooks on 9/19/16.