Department of Electrical and Computer Engineering
University of New Hampshire

ECE 541: Electric Circuits

Laboratory Exercise #1

Weeks of 9/12/22 (Group A) and 9/19/22 (Group B)

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1. Introduction

The instruments covered in this laboratory exercise are the DC power supply and Digital Multimeter (DMM). It is important to understand how each instrument functions, what range(s) of voltage and current over which it was designed to operate, the basic accuracy of the instrument, and how to properly and safely use the instrument. The material in this laboratory exercise will include the basics of each instrument while more advanced applications will be covered in future laboratory exercises.

In the second section of this exercise you will be asked to perform basic circuit measurements and report on what you have recorded. It is important to understand how to properly connect electronic instruments to a circuit, make basic measurements, and understand how the instrument might affect the measurement being made.

Please include proper units in your measurements and answers where appropriate.

2. Procedure

2.1. Resistance Measurements

- Using the DMM (ohm measurement mode) measure the resistance of the following resistors:

1.8 kΩ: 1.76 k 2.7 kΩ: 2.68 k 3.3 kΩ: 3.25 k

- Are the resistors within the stated tolerance (5% or 10%)? Please explain by comparing the actual vs. labeled values.

$1.76/1.8 = 0.97$ $2.68/2.7 = 0.99$ $3.25/3.3 = 0.98$

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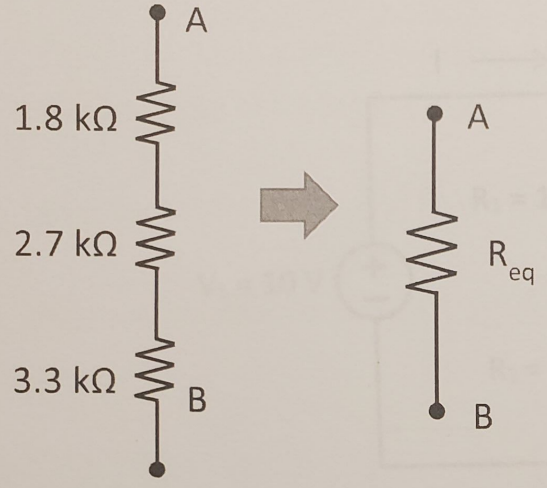
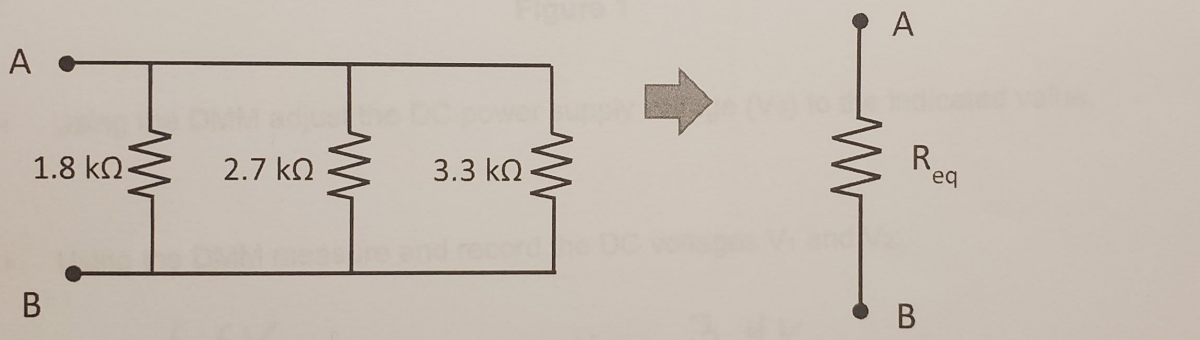
- Construct the following resistor circuits and measure the equivalent resistance from points A and B.



Measured Value: 7.7 k



Measured Value: 0.8 k

2.2. Voltage Measurements

- Connect the DC power supply and two resistors as shown in the circuit diagram in Figure 1.

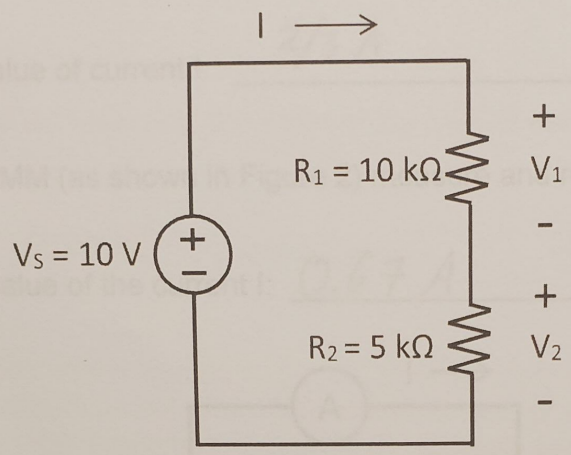


Figure 1

- Using the DMM adjust the DC power supply voltage (V_S) to the indicated value.

- Using the DMM measure and record the DC voltages V_1 and V_2:

V_1: 6.6V V_2: 3.4V

- Reverse the leads of the DMM then measure and record the DC voltages V_1 and V_2:

V_1: 6.6V V_2: 3.4V

- What effect did reversing the leads of the DMM have on voltage measurements?

nothing

2.3. Current Measurements

- Calculate the expected value of the current I in Figure 1.

  Expected value of current I: 2/3 A

- Using the DMM (as shown in Figure 2) measure and record the current I.

- Measured value of the current I: 0.67 A

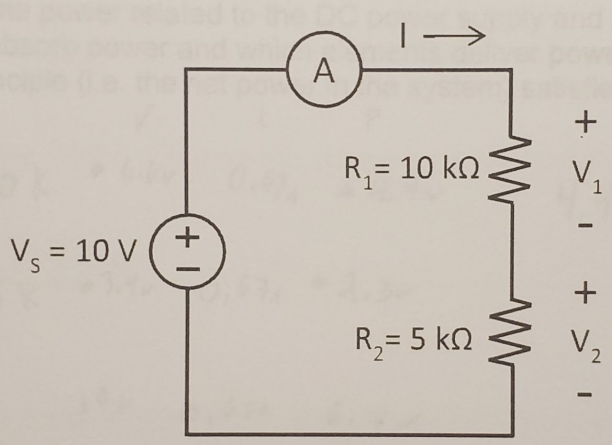


Figure 2

- Show the TA how you measured the above current.

  TA's initial: [signature].

- Reverse the leads of the DMM then measure and record the current I:

  I: -0.67

- Place the DMM between the 10K and 5K resistors and measure the current:

  I: 0.67

- Comment on the current measurement taken between the DC power supply and the 10K resistor; and the current measurement taken between the two resistors.

The current was the same everywhere

- What effect did reversing the leads of the DMM have on current measurements?

reversed measurement 0.67 → 0.67

- Calculate the power related to the DC power supply and the two resistors. Which elements absorb power and which elements deliver power? Is the conservation of energy principle (i.e. the net power in the system) satisfied?

	V	I	P
10 K	6.6v	0.67A	4.4w
5 K	3.4v	0.67A	2.3w
V_s	10v	0.67A	6.7w

4.4 + 2.3 = 6.7

Conservation of energy is satisfied

2.4. Kirchhoff's Voltage and Current Laws

- Build the circuit as shown in Figure 3 below.

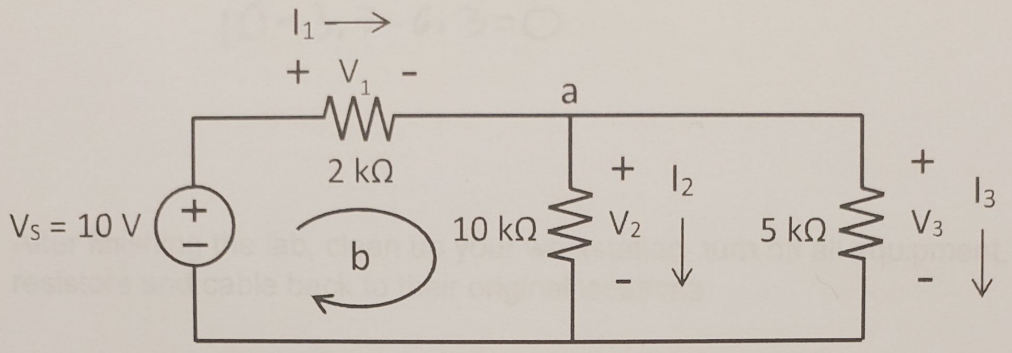


Figure 3

- Using the DMM, measure the voltages V_1, V_2, and V_3.

V_1: 3.7V, V_2: 6.3V, V_3: 6.3V

- Use the measured voltages above and Ohm's Law to calculate the currents I_1, I_2, and I_3.

I_1: 1.8, I_2: 0.6, I_3: 1.2

- Verify Kirchhoff's Current Law (KCL) by applying the law at node a. Set up the equation and use your experimental measurements.

$1.8 - 0.6 - 1.2 = 0$

- Verify Kirchhoff's Voltage Law (KVL) by applying the law around loop b. Set up the equation and use your experimental measurements.

$10 - 3.7 - 6.3 = 0$

- After finishing the lab, clean up your workstation, turn off all equipment, place resistors and cable back to their original locations.

TA's Signature: _____