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Lab 05 – DC Circuits II

Lab Worksheet

Complete this lab worksheet and turn it in for credit. Show all your work including the calculations you performed (attach additional sheets if necessary).

5.4.1 Individual Resistances

Measure the resistance of each resistor using the ohmmeter. Include uncertainties.

R_1 = 162 Ω

R_2 = 327 Ω

R_3 = 473 Ω

According to bands

R_1: (15) 10 ±10%

R_2: (34)

R_3: (47) 10 ±10%

5.4.2. Resistors in Series

1. Predict the equivalent resistance of the circuit shown in fig. 5.1 in the lab manual using the values of your resistors measured in 5.4.1.

$R_{series} = 162\Omega + 327\Omega + 473\Omega = 962\ \Omega$

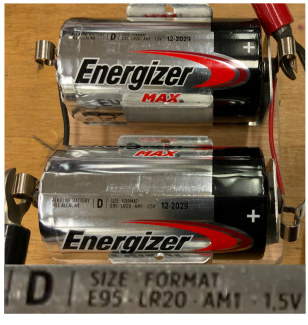
2. ~~Measure and record the series resistance using the ohmmeter include the uncertainty~~.

R_{series} = _____

3. Build the setup shown in fig. 5.2 of the lab manual. Measure and record the battery voltage and the current drawn from the battery along with uncertainty. $V_{Battery} = V_1 + V_2$

V_{batt} = 1.48V

I_{batt} = 0.00154A
1.54 mA



Now compute the resistance of the circuit.

$V = IR$

$R = \frac{V}{I}$

$R = \frac{1.48V}{0.00154A} \approx 961.03\Omega$

4. Make an agreement chart showing the three measurements of the series resistance from (1), (2) and (3). Include it with this worksheet. Discuss the agreement of these measurements.

ohmmeter	Prediction	Ohm's law
962	961	961

These values aggreged very well with each other all within 1Ω of each other with the prediction and ohms law both being the exact same. While the Ohmmeter was off by 1. This is probably the case due to the value we observed as the value fluctuated due to the ohmmeters reading.

5. Now measure the voltage across each resistor along with its uncertainty. Use that measurement, and the resistance measured in 5.4.1 to determine the current flowing through each resistor.

$I_{in} = I_{out}$

$V_1 =$ .25V	$I_1 =$ 0.00154A
$V_2 =$ .5V	$I_2 =$ 0.00154A
$V_3 =$ .73V	$I_3 =$ 0.00154A

$R = \frac{V}{I}$

$R_1 \cong 162.33$

$R_2 \cong 324.67$

$R_3 \cong 474.02$

Are your measurements consistent with what we expect for series resistors? Explain your answer.

Yes, for our numbers are within range of both our measured and proclaimed original equipment manufactured resistor lable bands

5.4.3 Resistors in Parallel

1. Predict the equivalent resistance of the circuit shown in fig. 5.3 in the lab manual using the values of your resistors measured in 5.4.1.

$$\left[\left(\frac{1}{162}\right)+\left(\frac{1}{327}\right)+\left(\frac{1}{473}\right)\right]^{-1} \cong 88.14\Omega$$

2. Measure and record the parallel resistance using the ohmmeter.

88.15Ω

3. Build the setup shown in fig. 5.4 of the lab manual. Measure and record the battery voltage and the current drawn from the battery.

V_{batt} = 1V

I_{batt} = 0.014 A

Now compute the resistance of the circuit with its uncertainty.

$R_{circuit}$ = 87.72Ω

4. Make an agreement chart showing the measurements you made in (2) and (3). Include it with this worksheet. Discuss the agreement. How do they compare to your predicted resistance in (1)?

ohmmeter	predictions	Ohms law
88.14	88.15	87.72

Without calculating for uncertainties all of our values of the resistors are withing 1% of each other.

5. Now measure the current through each resistor along with its uncertainty. Use that measurement, and the resistance measured in 5.4.1 to determine the voltage across each resistor.

V=IR I=V/R Volts remain the same, but current splits

162Ω	I_1 = 0.00617A	V_1 = 1V
327Ω	I_2 = 0.00305A	V_2 = 1V
473Ω	I_3 = 0.00211A	V_3 = 1V

$\frac{1}{162} \cong 0.00617A$

$\frac{1}{327} \cong 0.00305A$

$\frac{1}{473} \cong 0.00211A$

Are your measurements consistent with what we expect for parallel resistors? Explain your answer. Yes for our calculated resistance is lower than our smallest resistor 88.14Ω < 162Ω (Ohms meter; smallest resistor)

5.4.4 Resistors in Series and Parallel

1. Given the values of your resistors from 5.4.1, compute the equivalent resistance of the circuit shown in fig. 5.6.

$R_{Total} = \left[\frac{1}{R_1} + \frac{1}{R_3}\right] + R_2$

$R_1 = 162\Omega$

$R_2 = 327\Omega$

$R_3 = 473\Omega$

$\left[\frac{1}{162\Omega} + \frac{1}{473\Omega}\right]^{-1} + 327\Omega \cong 447\Omega$

2. Construct the circuit, and measure the battery voltage, and current drawn by the battery. Use this to determine the resistance of the circuit compute the percent uncertainty.

$R = \frac{V}{I}$; $\frac{1.44V}{.00323A} \approx 446.8\Omega$

3. Compare the circuit resistance from (2) with the computed equivalent resistance from (1). Compute the percent difference, and compare it to the percent uncertainties in the measurement.

$$\left(\frac{(447 - 446.8)}{447}\right)100$$

≈ 0.044

62% 50

50% 62 = 31

$\approx 4\%$