Name:	ID:	Date:

Ohm's Law and Parallel and Series Combination of Resistors	**EM-1**

PURPOSE

The purpose of this experiment is to verify Ohm's law and apply it to find the value of an unknown resistance, and to investigate a circuit with series and parallel combinations of resistors.

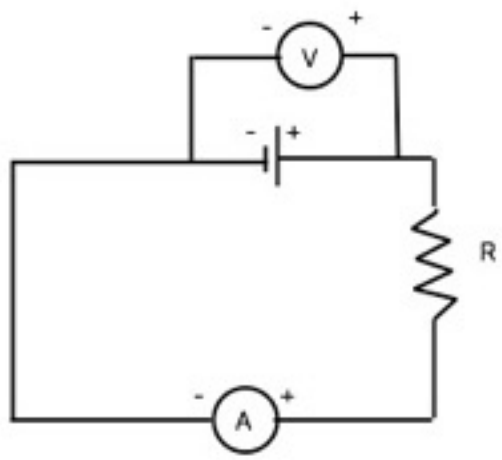
EQUIPMENT

A DC power supply (within the lab set), a voltmeter, an ammeter, three resistors, connecting wires, and linear graph paper.

PROCEDURE

PART A: VERIFYING OHM'S LAW

1. Construct the circuit shown below (circuit A):



While constructing a circuit, be sure that all devices are turned off, and the ranges of the ammeter and voltmeter should be the largest ranges at the beginning. Now, turn on the power supply. By using the voltage fixing knob of the power supply, adjust different voltage values, and read the corresponding voltage and current values in the voltmeter and ammeter, respectively. For each reading, bring the range fixing knob of the voltmeter and ammeter to the smallest possible range to get the most precise reading. For example, when the reading of the voltmeter is around 2.50 V, the range of the voltmeter can be 0 - 5.00 V or larger, but not, for instance, 0 - 1.00 V. Take measurements for six different output voltages of the supply. Record your measurements in Table 1 with the corresponding errors and using the correct number of significant figures. <u>Do not</u> disconnect the circuit when you finish taking your data; it will be necessary in Part B.

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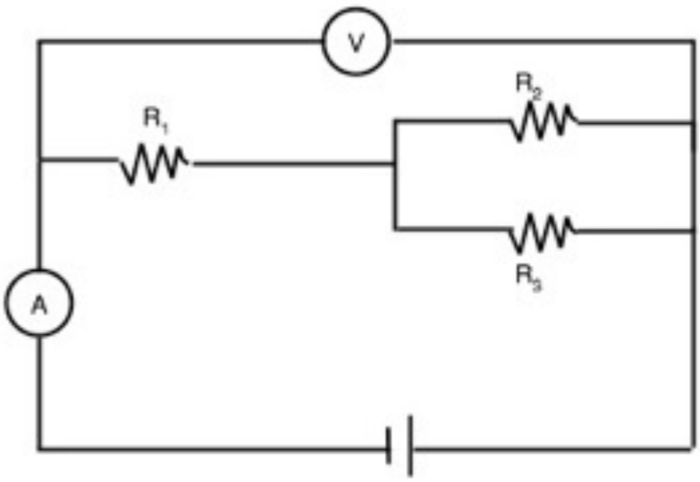
2. Using the data in Table 1, plot the graph of V (voltage) vs I (current) on linear graph paper. Draw the best line and the worst line and determine their slopes.
3. Using these slopes, find the value of the resistance with the corresponding error, that is, R±ΔR. Also calculate the value of the resistance using its color code, and record the value with the corresponding error.

PART B: SERIES AND PARALLEL COMBINATION OF RESISTORS

4. Now, denote the resistance used in Part A as R_1, and take two other resistors, and denote them as R_2, and R_3. Measure and record the resistance values of these resistors. To do this, firstly disconnect R_1 from circuit A, and connect R_2 in place of R_1. Take only one data involving a voltage accross the resistor and the corresponding current, and using Ohm's law (R=V/I), calculate the value of R_2. Repeat the same operation for R_3. Also calculate the values of the resistances using their color codes. Record all values with the corresponding errors in Table 2.

5. Using the three resistors, construct the following circuit (circuit B):



As you notice, the ammeter measures the main branch current, and the voltmeter measures the main branc voltage. Take only one data involving a voltage accross the main branch and the corresponding current, and calculate the equivalent resistance, R_{eq}, of the three resistors. Calculate the R_{eq} one more time, using the color code values and the formulae for series and parallel combination of resistors, and compare your results. To calculate the equivalent resistance using color code values, you should note that R_2 and R_3 are connected in parallel, and you should first calculate the equivalent resistance of this combination, say, R_{23}. Then you should combine R_{23} with R_1 by noting that R_{23} and R_1 are in series. That means:

$$\frac{1}{R_{23}} = \frac{1}{R_2} + \frac{1}{R_3};$$
$$R_{eq} = R_1 + R_{23}.$$

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DATA AND RESULTS:

PART A: VERIFYING OHM'S LAW

1. Record your data of V and I measurements in Table 1 below. Report your measurements with correct number of significant figures and errors.

Table 1

Reading No.	$V \pm \Delta V$ (V)	$I \pm \Delta I$ (mA)
1		
2		
3		
4		
5		
6		

2. Report the slope of the V vs I graph with the correct number of significant figures, error and units.

$m \pm \Delta m$=…………………………..

3. From the above slope, find the value of the resistance $R \pm \Delta R$. How is R related to the slope of the V vs I graph? Why? Find also the value of $R \pm \Delta R$ from the color code and compare it with the measured value.

$R \pm \Delta R$=…………………………..(measured)
$R \pm \Delta R$=…………………………..(color coded)

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PART B: SERIES AND PARALLEL COMBINATION OF RESISTORS

4. Report your voltage and current readings for calculating R_2 and R_3, values of R_2 and R_3 calculated using those readings, and values of R_2 and R_3 calculated using color codes in Table 2 below. Report your results with the correct number of significant figures, error and units.

Table 2

	V±ΔV (V)	I±ΔI (mA)	R±ΔR (Ω) (R=V/I)	R±ΔR (Ω) (color code)
R_2				
R_3				

5. Report the voltage and current measurements for circuit B with the correct number of significant figures, error and units.

V=…………………… I=……………………

R_{eq}=……………………(R=V/I) R_{eq}=……………………(color code)