**PHYS 202L** [**RESISTANCE**](http://hyperphysics.phy-astr.gsu.edu/hbase/electric/resis.html)                  Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Partner(s):\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Purpose I: To investigate the resistance of a metal wire using a [digital multi meter](http://www.youtube.com/watch?v=bF3OyQ3HwfU) (DMM) and determine its resistivity.

Apparatus: DMM, one long metal (nichrome) wire (≈100 cm), connector box, micrometer, and meter stick.

Theory: Resistance, R of a metal wire of length *L* and cross-sectional area *A* is given by:

                    

The plot of R versus L will yield a slope of *ρ/A.* Knowing A, the resistivity can be determined.

Procedure:

Variation of resistance with length:

1. Set the DMM to measure resistances and connect it to the connector box.
2. Connect one end of the long metal wire to one of the terminals of the connector box.
3. Measure 10 cm length of wire, (do not cut the wire) and connect it to the other terminal so that there is exactly 10 cm of wire between the terminals.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| J:\Courses\PHYS 202L\Resistance\pic connection of wire.jpg |

|  |  |
| --- | --- |
| L (cm) | R (ohm) |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

 |

1. Record the resistance value and repeat the above procedure for other lengths: 20, 30, 40, 50, 60, 70, 80, 90, 100 cm.
2. Plot a graph, R versus L, determine its slope, and attach the graph to your report.
3. Measure the diameter of the wire with a micrometer, calculate the cross-sectional area, and calculate the resistivity of the metal.

Variation of resistance with diameter:

1. Fold the wire into half and then again half to make 4 equal pieces. 
2. Measure the resistance of one fold, two folds, three folds, and four folds.
3. Tabulate your data, plot an appropriate graph, and see what happens.
4. Add an appropriate trend line, and obtain resistivity from your fit.
5. Attach your graph to the report.

DATA

Variation of resistance with length:

Slope of R versus L, graph:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Diameter of wire = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_    Cross-Sectional area of wire =\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Experimental resistivity of wire = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Accepted resistivity of wire = 1.00 x 10-4 ohm.cm. % Error = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Variation of resistance with diameter:

Slope or Coefficient of the fit = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Length of wire = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_    Cross-Sectional area (for 1 fold) =\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Experimental resistivity of wire = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Accepted resistivity of wire = 1.00 x 10-4 ohm.cm.

                                    % Error = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Write Conclusion for Purpose I.

Purpose II: To investigate various combinations of resistors.

Apparatus: Three resistors, DMM (digital multimeter), and 5-banana plug wires.

Theory: When two or more resistances are connected in series the equivalent resistance, RS is given by;

|  |  |
| --- | --- |
|  |  |

When two or more resistances are connected in parallel the equivalent resistance, RP is given by:

|  |  |
| --- | --- |
|  |  |

Procedure:
1. Determine the values of the three resistors using [the resistor color code.](http://nearbus.net/wiki/index.php?title=File:Resistor_color_codes.jpg)
2. Measure the values of the three resistors using the [digital multimeter](http://www.youtube.com/watch?v=bF3OyQ3HwfU) (DMM).
3. Observe the tolerance values and record them in the data table.

|  |  |  |  |
| --- | --- | --- | --- |
|   | R1 | R2 | R3 |
| From resistor color code |   |   |   |
| From digital multi- meter |   |   |   |
| Tolerance |   |   |   |

4. Connect R1 and R2 in series and measure the equivalent resistance. Also calculate it.
5. Connect R1 and R2 in parallel and measure the equivalent resistance. Also calculate it.

|  |  |  |
| --- | --- | --- |
| Diagram | Measured | Calculated |
| R1 and R2 in series: |  |  |
| R1 and R2 in parallel: |  |  |
| 6. Rank the values of R1, R2, R1 series R2, R1 parallel R2 in descending order: |

7. Connect the three resistors in various combinations and obtain various values of resistances. Measure the equivalent resistances. Also calculate the equivalent resistances using the measured values for R1, R2, and R3.
8. Identify the lowest and highest resistance values in the table.

|  |  |  |
| --- | --- | --- |
| Resistor combination diagram | Resistance (R) Values | Rank the R values from High to Low |
| Measured | Calculated |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |