**Experiment 6:**

Voltage Divider

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**Purpose**:

The purpose of this experiment was to calculate resistance with voltage and current as well as to calculate resistivity.

**Data**:

Table : calculating the resistance of an object with voltage and another resistor

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Vin | v2 | r1 | Vin/V2 | **N** | r2 | SR2 |
| 12 | 8.82 | 9 | 1.360544 | 10 | 24.94734 | 0.067136 |
| 12 | 8.7 | 9.5 | 1.37931 | **slope** |  |  |
| 12 | 8.57 | 10 | 1.400233 | **(units)** | %error | R2 ACC |
| 12 | 8.45 | 10.5 | 1.420118 | 0.040084 | 0.997309 | 25 |
| 12 | 8.33 | 11 | 1.440576 | **intercept** |  |  |
| 12 | 8.22 | 11.5 | 1.459854 | **(units)** |  |  |
| 12 | 8.11 | 12 | 1.479655 | 0.999214 |  |  |
| 12 | 8 | 12.5 | 1.5 | **R2** |  |  |
| 12 | 7.89 | 13 | 1.520913 | 0.999942 |  |  |
| 12 | 7.79 | 13.5 | 1.540436 | **Sy** |  |  |
|  |  |  |  | **(units)** |  |  |
|  |  |  |  | 0.00049 |  |  |
|  |  |  |  | **Sslope** |  |  |
|  |  |  |  | **(units)** |  |  |
|  |  |  |  | 0.000108 |  |  |
|  |  |  |  | **Sintercept** |  |  |
|  |  |  |  | **(units)** |  |  |
|  |  |  |  | 0.001223 |  |  |

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Vin** | **Vw** | **Vw** | **L** | **Rw** | **N** | **D** | **ρ** | **ρ** | **ρacc** | **% diff** | **R3,wire,ρ** |
| (V) | (mV) | (V) | (m) | (Ω) | 10 | (mm) | (Ω\*m) | (μΩ\*m) | (μΩ\*m) | 2.264786 | (Ω) |
| 12.00 | 42.0 | 0.042 | 1.00 | 3.459609 | **slope** | 0.63 | 1.05554E-06 | 1.05554 | 1.08 |  | 3.386132 |
|  | 38.0 | 0.038 | 0.90 | 3.129075 | **(units)** |  |  |  |  |  |  |
| **Vwire** | 34.0 | 0.034 | 0.80 | 2.798763 | 3.386132 | **D** | **Sρ** | **Sρ** |  |  | **R3,wire,Ohm** |
| (V) | 30.0 | 0.03 | 0.70 | 2.468672 | **intercept** | (m) | (Ω\*m) | (μΩ\*m) |  |  | (Ω) |
| 0.0420 | 26.0 | 0.026 | 0.60 | 2.138801 | **(units)** | 0.00063 | 1.5933E-08 | 0.015933 |  |  | 3.459609 |
|  | 22.0 | 0.022 | 0.50 | 1.80915 | 0.096053 |  |  |  |  |  |  |
| **V2** | 18.0 | 0.018 | 0.40 | 1.47972 | **R2** | **A** |  |  |  |  | **% error** |
| (V) | 14.0 | 0.014 | 0.30 | 1.150509 | 0.998181 | (m2) |  |  |  |  | 2.123851 |
| 11.958 | 10.0 | 0.01 | 0.20 | 0.821518 | **Sy** | 3.11725E-07 |  |  |  |  |  |
|  | 4.0 | 0.004 | 0.10 | 0.328443 | **(units)** |  |  |  |  |  |  |
| **R2** |  |  |  |  | 0.046425 |  |  |  |  |  |  |
| (Ω) |  |  |  |  | **Sslope** |  |  |  |  |  |  |
| 985 |  |  |  |  | **(units)** |  |  |  |  |  |  |
| I |  |  |  |  | 0.051113 |  |  |  |  |  |  |
| **0.01214** |  |  |  |  | **Sintercept** |  |  |  |  |  |  |
|  |  |  |  |  | **(units)** |  |  |  |  |  |  |
|  |  |  |  |  | 0.031714 |  |  |  |  |  |  |

Table : calculating resistivity with voltage, length, and resistance.

**Calculations**:

**Discussion**:

The value of the pencil (R2) was calculated to be 24.947 ohms with an error of +-.0671 ohms. This passes the precision accuracy test, which shows that this data is reliable, the % error was also quite small, only 1%, this value was calculated from the slope of the compared data from r1 and Vin/V2 data. the data in general was about what I would expect, the R2 value was .999 so the data is predictable. Any sources of error were likely from the limits of precision on the simulation rather than any random error, or a problem with the fundamental experiment.

The value of the resistivity was calculated to be 1.08 +-.0159 microohm meters. While the %difference for these values is only 2.3% it fails the precision accuracy test. As is usually the case with these simulated experiments, this is almost definitely not caused by any kind of random error and is almost entirely due to the precision limitations of the simulations. This was calculated from the area of the cross section of the wire and the relationship of resistance of the wire and the length, both have values about what one would expect them to be.

**Conclusion & results**:

R2 = 24.94734 +-0.067136 ohms

%error: 0.997%

p = 1.05554 +-0.015933 microohm meters

%diff = 2.264786%

These calculated values are very expected with low error. They are quite close to the accepted values that were given, so the data is reliable, even though there was a precision accuracy failure, it was still close to the accepted value, 2.3%.

**Questions**:

62.0905882x more resistive

2a.) Vin is greater than Vg, this shows there is some impedance affecting the precision of the instruments

2b.) With Rs at 0.1Rg, Vin is 808V, while when Rs is 100Rg it is 8.08 V. As Rs grows in magnitude the Vin gets closer and closer to 8, Vg. As it the magnitude shrinks, it increases quickly, approaching infinity.