Year 11 Physics

Marks / 24

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Validation test

Finding the resistivity of a wire.

**Question 1 (1 marks)**

In your experiment, why did you need to measure your data at multiple points?

**By taking an average/mean, we can reduce the effect of errors of individual measurements**

**Question 2 (1 marks)**

In your experiment, how do you think temperature could impact your results?

**An increase of temperature increases the resistance of the wires**

**Question 3 (2 marks)**

Show mathematically how the resistance or a material decreases when the cross sectional area increases.

**R = ρ l / A Let ρ & l = 1**

**R = 1 / A R and A have an inverse relationship**

**R = 1 / (2A) Double A**

**Therefore the resistance is halved**

**Question 4 (7 marks)**

Two wires A and B of the same material have resistances of 6.0 Ω and 54.0 Ω, respectively. The length of A is double the length of B.

1. What is the ratio of the **diameter** of wire A to the diameter of wire B? (3 marks)

**R = ρ l / A ρ = same for both objects**

**lA = 2 x lB**

**ρ = R A /lRA = 6, RB = 54**

**RA AA / lA = RB AB /lB Sub in lA = 2 x lB**

**RA AA / (2lB) = RB AB /lB Common denominator of IB cancel it out**

**RA AA / (2) = RB AB Sub in RA = 6, RB = 54**

**6 AA / (2) = 54 AB**

**AA = 18 AB A = π D2/4**

**π DA2/4 = 18 π DB2/4 Cancel out common factors (π /4)**

**DA2.  = 18 DB2 Remove squares**

**DA.  = 4.24 DB**

**Diameter DA is 4.24 times larger**

1. If two wires are connected in parallel across a 6.0V battery, what is the current in each wire? (4 marks)

**Voltage across circuit: 6V**

**Voltage in parallel is the same**

**Current across Wire A I = V / R = 6 / 6 = 1 A**

**Current across Wire B I = V / R = 6 / 54 = 0.111 A**

**Question 5 (13 marks)**

Two physics students conducted an experiment to examine the effect that length has on the resistance of a wire, the wires were made of the same material and had the same diameter (0.6mm). Their results are shown in the table below.

*Table 1: Student’s results table*

|  |  |
| --- | --- |
| **Length of wire (m)** | **Resistance (mΩ)** |
| 0.45 | 26.5 |
| 0.60 | 34.9 |
| 1.20 | 70.2 |
| 1.80 | 105.9 |
| 2.00 | 116.5 |

1. Produce a linear graph from the independent and dependent variables in the table, using the background information as a guide. (4 marks)

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1. Draw a line of best fit on the graph on the previous page. (1 mark)
2. From the graph, calculate the gradient of your line of best fit (2 mark)

**Should be close to 58.45 x 10-3 Ωm/m2**

1. Using the data given above and your graph, calculate the experimental value for the resistivity of the wires. Using the gradient, determine the resistivity value of the wires used by the students used in this experiment. (3 marks)

**Gradient 58.45 x 10-3 Ωm/m2**

**58.45 x 10-3 Ωm/m2 = R / l**

**A = 0.00062 x π / 4**

**= 2.83 x 10-7mm2**

**R = ρ l / A**

**Therefore**

**R / l = ρ / A**

**58.45 x 10-3 = ρ / A**

**ρ = 58.45 x 10-3 x 2.83 x 10-7**

**Average Resistivity = 1.654 x 10-8**

1. The students looked up the manufacturer of the wire and saw they claimed an accuracy of with ± 2% of expected values.

Look at the chart below and state what material the wire most likely is and then calculate the percentage difference between the experimental value you calculated in part c) and the accepted value. Comment on whether your experimental result is within the accepted range or not.

ρ

|  |  |  |
| --- | --- | --- |
| Material | Resistivity (ohm m) | |
| Silver | 1.59 | x10-8 |
| Copper | 1.68 | x10-8 |
| Copper, annealed | 1.72 | x10-8 |
| Aluminium | 2.65 | x10-8 |

(3 marks)

**Closest is Copper**

**(1.68-1.654)/1.68 = 1.55%**

**Within tolerance of +/- 2%**