Investigation to Determine the Resistivity of a Metal PAG 3.1

Introduction

In this experiment, you will measure the current through different lengths of a metal wire. You will then determine the resistivity of the metal wire. The p.d., *V,* across the wire is related to the length, *L,* of the wire by the expression *V / I = ρ L* / A where *I*, *ρ* and *A* are constants for the experiment. *I* is the current in the wire, *ρ* is the resistivity of the wire and *A* is the cross sectional area of the wire. This expression may also be written as *V =* (*ρ I* / *A*)× *L*

Aim: To determine the resistivity of a metal

Equipment: 1 m length of resistance wire, micrometer, crocodile clips, connecting leads, power supply, multimeters.

Health and safety: The metal wire may get hot.

Record your planned procedure to minimise this hazard and get it authorised by your teacher before proceeding with the experiment.

Procedure

1. Set up the circuit shown below in Fig.1, so that the d.c. supply is in series with the metal wire*.* The length of wire in the circuit is adjusted and connected into the circuit using crocodile clips.

**­­­**

**A**

**V**

*L*

**+**

metal wire

Fig. 1

1. Connect the circuit as shown above.
2. Adjust the length, *L*, of wire in the circuit so that it is 50.0 cm.
3. Adjust the power supply so that the reading on the voltmeter is around 3.0 V.
4. Note the reading on the ammeter. This must be kept constant throughout the experiment.
5. Record the reading on both the ammeter and voltmeter for a range of different lengths of the metal wire. (Remember, the ammeter reading should always be the same.)
6. Tabulate your data in a table.
7. Plot a graph of V against *L*.
8. Determine the gradient of your graph.
9. By taking appropriate measurements with the micrometre, determine the diameter of the metal wire.
10. Calculate the cross-sectional area, A, of the metal wire.
11. Use your answers to steps 4, 5 and 10 to determine a value for the resistivity.

1.2.1 Practical skills

**Use and application of scientific methods and practices**

(b) safely and correctly use a range of practical equipment and materials

(c) follow written instructions

(d) make and record observations/measurements

(e) keep appropriate records of experimental activities

(f) present information and data in a scientific way

**Research and referencing**

(h) use online and offline research skills including websites, textbooks and other printed scientific sources of information

(i) correctly cite sources of information

**Instruments and equipment**

(j) use a wide range of experimental and practical instruments, equipment and techniques appropriate to the knowledge and understanding included in the specification.

*Through use of the apparatus and techniques listed below, and a minimum of 12 assessed practicals, learners should be able to demonstrate all of the practical skills listed within 1.2.1 and CPAC as exemplified through:*

1.2.2 Use of apparatus and techniques

(b) use of appropriate digital instruments, including electrical multimeters, to obtain a range of measurements (to include time, current, voltage, resistance and mass)

(e) use of calipers and micrometers for small distances, using digital or vernier scales

(f) correctly constructing circuits from circuit diagrams using DC power supplies, cells, and a range of circuit components, including those where polarity is important

Common Practical Assessment Criteria, CPAC

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| (1) Follows written procedures |
| (3) Safely uses a range of practical equipment and materials |
| (4) Makes and records observations |