WJEC (Wales) Physics A-level

SP2.2b - Determination of the Resistivity of a Metal

Practical Flashcards

State the equation used to calculate the resistivity of a wire.

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$$\rho = \frac{RA}{l}$$

How does the resistance of a wire change when the cross-sectional area decreases?

How does the resistance of a wire change when the cross-sectional area decreases?

The resistance of a wire is inversely proportional to the cross-sectional and so as the area decreases, the resistance will increase.

How does the resistance of a wire change when the length is decreased?

How does the resistance of a wire change when the length is decreased?

The resistance of a wire directly proportional to the length of the wire, so as the length of the wire decreases, its resistance also decreases.

How does the resistance of a wire change if the resistivity is increased?

How does the resistance of a wire change if the resistivity is increased?

The resistance of a wire is directly proportional to its resistivity, so as resistivity increases, the resistance also increases.

What is the unit of resistivity?

What is the unit of resistivity?

Ωm

Ohm - Metres

How do you ascertain the cross-sectional area of a thin wire?

How do you ascertain the cross-sectional area of a thin wire?

Using a micrometer, measure the wire's diameter in at least three different places along the wire. Then input the average diameter into the circular area equation.

Suggest how the length of conducting wire can be varied when carrying out this experiment.

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One end of the wire can be fixed and the other end can be connected to the circuit using a crocodile clip. The length of conducting wire can be changed by varying the position of the crocodile clip.

Describe how the length of the wire should be measured.

Describe how the length of the wire should be measured.

The length of the wire should be measured using a metre ruler, while the wire is held taut. This reduces the likelihood of an incorrect measurement due to kinks in the wire.

What device is used to measure the potential difference across the wire, and how is it connected?

What device is used to measure the potential difference across the wire, and how is it connected?

A voltmeter should be connected in parallel across the wire.

What device is used to measure the current flowing through the wire, and how is it connected?

What device is used to measure the current flowing through the wire, and how is it connected?

An ammeter should be connected in series with the wire.

Why should the power supply be switched off between readings?

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The temperature of the wire should remain constant throughout the experiment. Switching the power supply off between readings will help ensure this, by mitigating the effect of heating of the wire.

Why should the temperature of the wire remain constant throughout this experiment?

Why should the temperature of the wire remain constant throughout this experiment?

Temperature changes can affect the resistance of the wire. In this experiment, temperature is therefore a control variable.

Why does the resistance of a wire increase when its temperature increases?

Why does the resistance of a wire increase when its temperature increases?

As temperature increases, the metal ions gain more kinetic energy and so vibrate more. These vibrating ions make it harder for charge to pass through the wire and so the wire's resistance increases.

How can the resistivity of a wire be determined from a graph of resistance against length?

How can the resistivity of a wire be determined from a graph of resistance against length?

The gradient of the graph will be R/L and so by multiplying the gradient by the wire's cross-sectional area, you will obtain the wire's resistivity.

Why should the current, used in this experiment, be kept low?

Why should the current, used in this experiment, be kept low?

As current increases, the temperature of the wire will increase. By keeping the current low, the heating effect is kept to a minimum.

Suggest how you could ensure that your length measurements are taken from the same position each time.

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A metre ruler could be taped in place below the fixed wire.

What factors lead to uncertainties in this experiment?

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There will be resistance between the crocodile clips and wire as well as at the contact of the leads and the power supply. There may also be a zero error due to the positioning of the ruler and crocodile clip at the zero end.

What device could replace the voltmeter and ammeter in this experiment?

What device could replace the voltmeter and ammeter in this experiment?

Instead of a voltmeter and ammeter, a multimeter could be used to measure the current and potential difference. Note that this may lower the resolution of your data, depending on the number of significant figures provided by the devices you have available.

How can the percentage difference in your experimental value and accepted value be calculated?

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[(Your Value - Accepted Value)/Accepted Value] x 100%

Does the resistivity of a material change depending on dimensions?

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Resistivity is a material property and so is fixed for a given material, regardless of dimensions.