Investigation of the I–V characteristics of a filament of a lamp and a metal wire at constant temperature

Specification reference: **AS Unit 2.2 – Resistance**

Theory:

Ohm's law states that for a conductor the current, I, is directly proportional to the potential difference, V, provided physical factors such as temperature and pressure remains constant. Therefore by plotting the I-V characteristic of each of, a metal wire and a filament lamp, the validity of Ohm's law as applicable to each of these components can be determined. A graph of I against V is linear for a metal wire and non-linear for a filament of a lamp.

Apparatus:

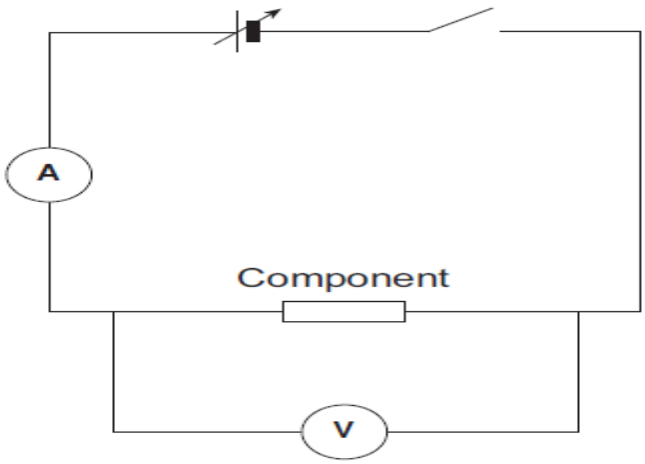
Variable d.c. voltage supply
Switch
Ammeter
Voltmeter
Component either in the form of a filament bulb e.g. 12 V, 24 W bulb or a metal wire e.g. 1 m length of constantan mounted on a wooden batten

Further Guidance for Technicians:

The variable d.c. voltage supply can be constructed from 1.5 V cells and a rheostat. The resolution of the voltmeter and ammeter depend on the d.c. voltage supply used in the circuit.

Experimental method:

The circuit should be set up as follows:



Starting with the output of the variable d.c. voltage supply set to its minimum value, slowly increase the value of the applied voltage. The current through the component and the potential difference across the component should be recorded for a range of values of the applied voltage. A graph of current against voltage should then be plotted. This procedure can be repeated for different components.

Extension:

The I–V characteristics of other components such as a semiconductor diode or an electrolytic solution such as copper sulfate could be investigated. *Data Logging*: Digital ammeters or voltmeters could be used as part of a data logging set up.

Practical Techniques:

- Use appropriate analogue apparatus to record a range of measurements (to include length/distance, temperature, pressure, force, angles, volume) and to interpolate between scale markings.
- Use calipers and micrometers for small distances, using digital or vernier scales.
- Correctly construct circuits from circuit diagrams using D.C. power supplies, cells, and a range of circuit components, including those where polarity is important.

Relevant previous practical past papers:

- PH3 2005 Q2
- PH3 2010 Task A3