Chapter 11: Ohm's Law and Resistance

Ohm's Law

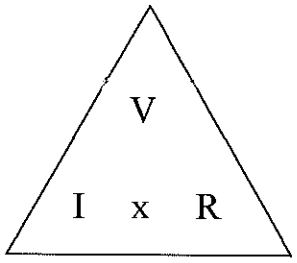
Ohm's Law describes the behaviour of most metallic conductors at constant temperature. You will remember it by the equation:

$V = I \times R$ **where:**

V is the voltage (also known as the **potential difference**) across the material in volts
I is the current in amps
R is the resistance in ohms (symbol Ω)

This can be rearranged to calculate the **resistance**:

$$R = \frac{V}{I}$$



Example 1

A 47 Ω resistor has a current of 0.65 A flowing through it. Calculate the potential difference across it.

Answer

$V = IR$
$= 0.65 \times 47$
$= 31$ V

Example 2

A 47 kΩ resistor is attached to a 3.0 V supply. Calculate the current.

Answer

$$I = \frac{V}{R}$$
$$= \frac{3.0}{47 \times 10^3}$$
$$= 6.4 \times 10^{-5} \text{ A}$$

Example 3

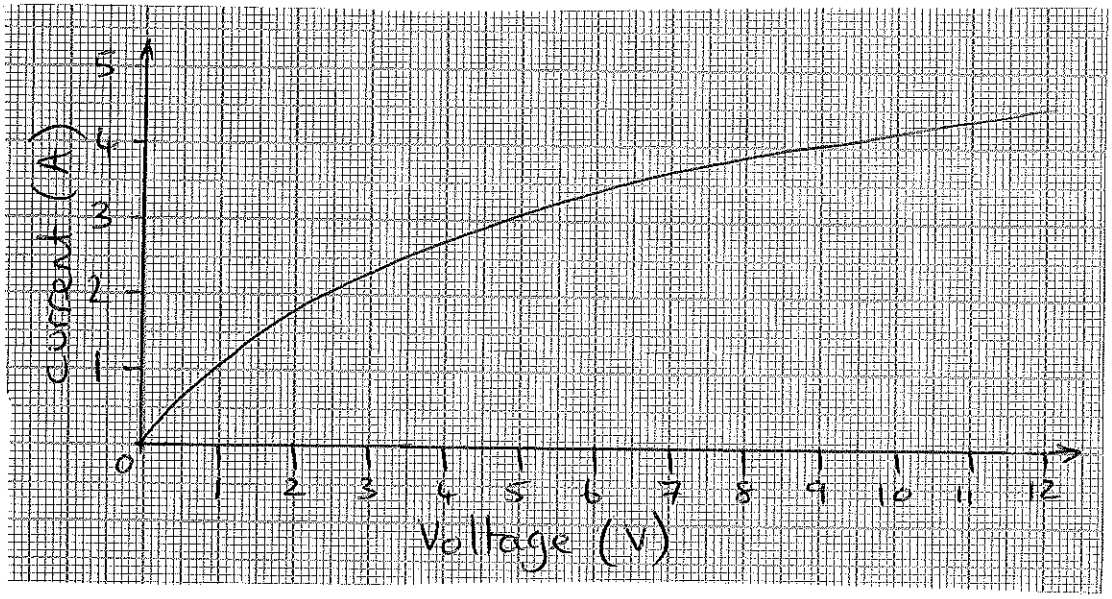
A 230 V supply is attached to a heater. A current of 1.2A flows. Calculate its resistance.

Answer

$$R = \frac{V}{I}$$
$$= \frac{230}{1.2}$$
$= 190$ Ω (to 2 sig fig)

Questions

1. Look at the graph below. It shows the relationship between voltage and current for a heater.



   a) Read off the values of current at a voltage of 6V and then calculate the resistance of the heater.
   b) Repeat this process to calculate the resistance of the heater at V=10V

2. Voltmeters are designed to have high resistance so little current flows through them when placed in parallel across a component.

   A voltmeter has a resistance of 450 MΩ. It can read voltages up to 200V. At this voltage what current will flow through the meter?

3. A current of 2.8 mA flows through a 47MΩ resistor. Calculate the potential difference across the resistor in volts.

4. A resistor has a value of 150 kΩ with a manufacturing tolerance of +/- 5% . Calculate the maximum possible current when it is connected to a 1.50 V supply?