202: Principles of electrical science

Handout 3: Ohms law

Learning outcome
The learner will:
4. understand the relationship between resistance, resistivity, voltage, current and power.

Assessment criteria
The learner can:
4.4 explain the relationship between current, voltage and resistance in parallel and series DC circuits.

Ohm's law

Current

The uniform flow of electrons through a conductor is referred to as electric current.

The unit of electric current is the **ampere** (A).

In formulae, the symbol for electric current is **I**.

Electromotive force (EMF)

The EMF provides a difference in potential between two open terminals of an electrical circuit. When the circuit is complete, this potential difference causes the electrons to flow in a uniform direction around the circuit and produce a flow of current.

The unit of EMF is the **volt** (V).

In formulae, the symbol for EMF is **V**.

Resistance

Every circuit presents some opposition to the flow of current in the electric circuit, which has to be overcome by the electrical pressure applied. This opposition is called **resistance**.

The unit of resistance is the **ohm** (Ω)

In formulae, the symbol for resistance is **R**.

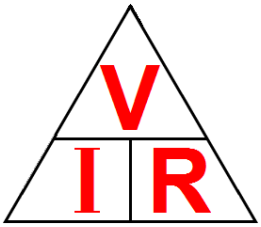
Ohm's law

In 1827 a man named Georg Ohm published his experiments regarding the relationship between current, voltage and resistance. His findings, referred to as **Ohm's law**, are shown below:

> The current flowing in any circuit is directly proportional to the applied voltage and inversely proportional to the resistance of the circuit, provided that the temperature of the circuit remains constant.

The simple relationship between symbols is shown on the right.

The simple method of transposing the symbols is to use the cover-up method, ie cover the symbol required; the answer is then given by the other two symbols.



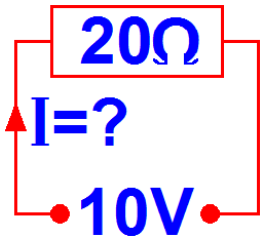
$$V = I \times R$$

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

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

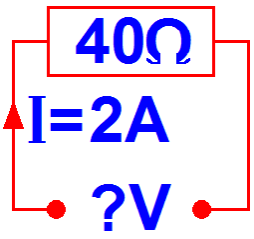
Example 1
An EMF of 10 volts is applied to a resistance of 20Ω. Calculate the current that will flow.

$$I = \frac{V}{R} = \frac{10}{20} = 0.5A$$



Example 2
Calculate the applied EMF when 2 amperes flows through a resistance of 40Ω.

$$V = I \times R = 2 \times 40 = 80 \text{ volts}$$



Example 3
When an EMF of 50 volts is applied to a circuit, a current of 5 amperes flows. Calculate the resistance of the circuit.

$$R = \frac{V}{I} = \frac{50}{5} = 10\ \Omega$$