Electrical Technology
(EE-101-F)

Contents

General Terms

- A **conductor** is a material that current can pass through easily, like metals.
- An **insulator** is a material that current cannot pass through easily, like plastic.
- A **resistor** is a material that resists, but doesn’t stop the flow of current.

Electric Current

Electric current is the rate of flow of charge through a conductor:

$$\bar{I} = \frac{\Delta Q}{\Delta t}.$$

The instantaneous current is given by:

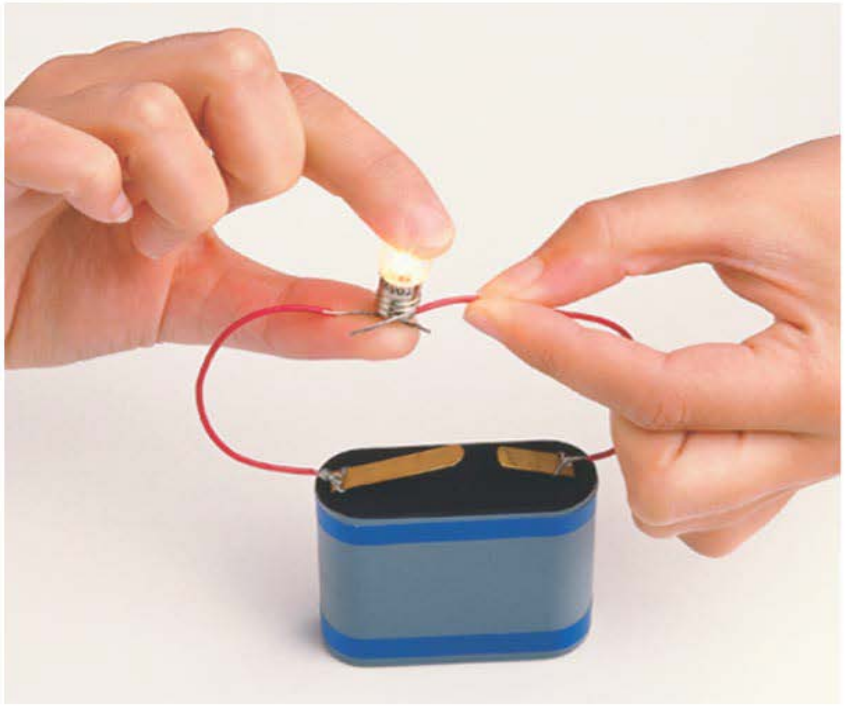
$$I = \frac{dQ}{dt}.$$

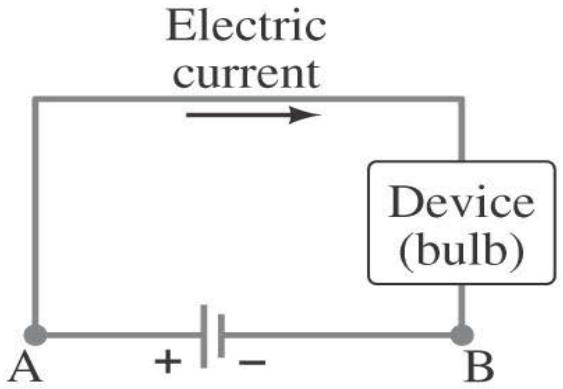
Unit of electric current: the ampere, A:

1 A = 1 C/s.

Electric Current

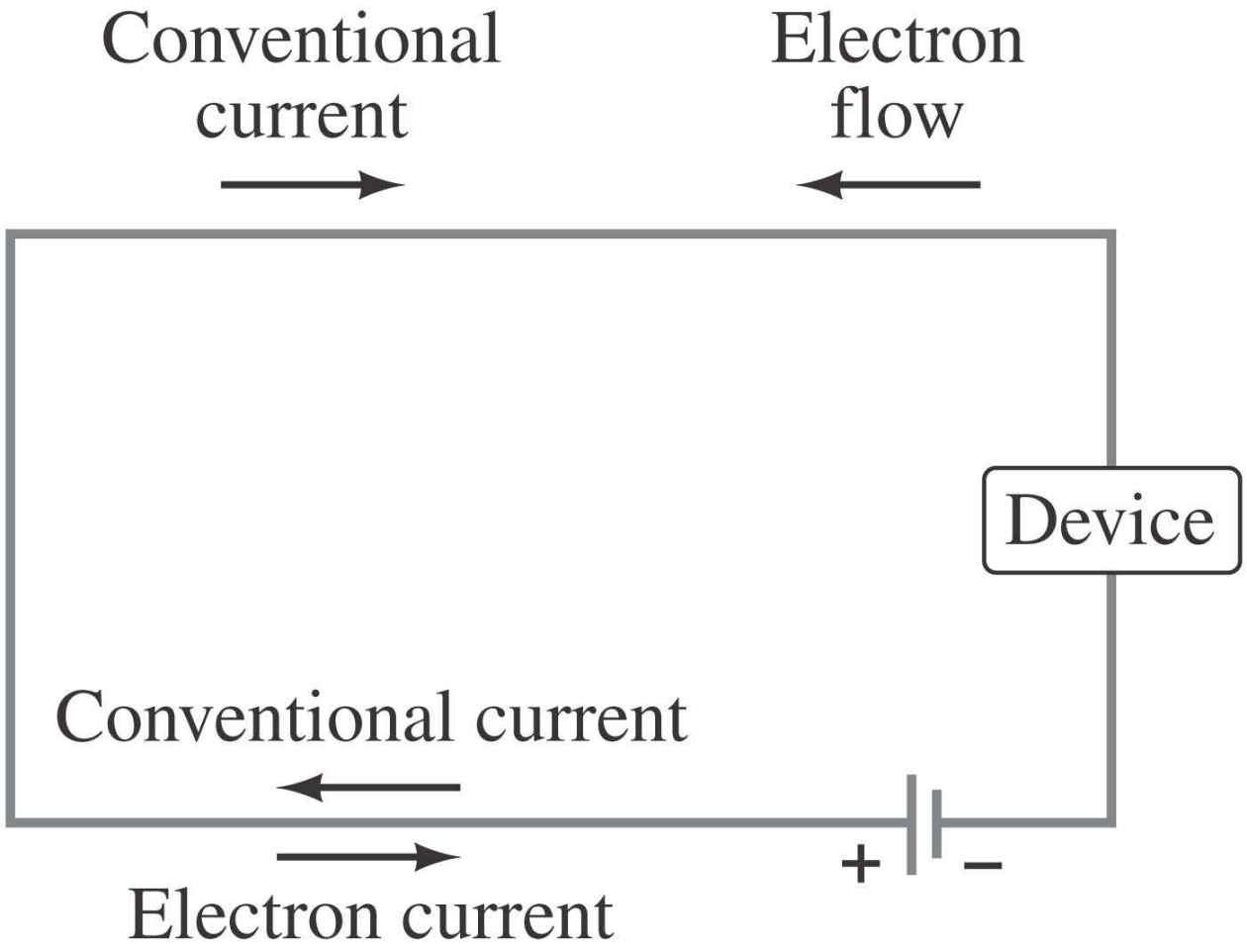
A complete circuit is one where current can flow all the way around. Note that the schematic drawing doesn't look much like the physical circuit!





Electric Current

By convention, current is defined as flowing from + to -. Electrons actually flow in the opposite directionrons.



Resistance

Opposition to the flow of electrons.

It changes electrical energy into thermal energy and/or light.

Measured in ohms.

Conductors have less resistance than insulators.

Ohm's Law

$$\text{Effect} = \frac{\text{Cause}}{\text{Opposition}}$$

- Every conversion of energy from one form to another can be related to this equation.
- In electric circuits the effect we are trying to establish is the flow of charge, or *current*. The *potential difference*, or *voltage* between two points is the cause ("pressure"), and *resistance* is the opposition encountered.

Ohm's Law

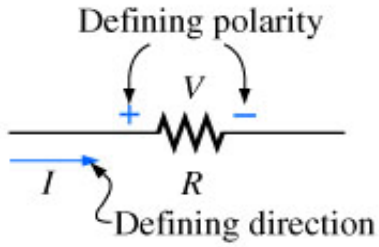
$$I = \frac{E}{R}$$

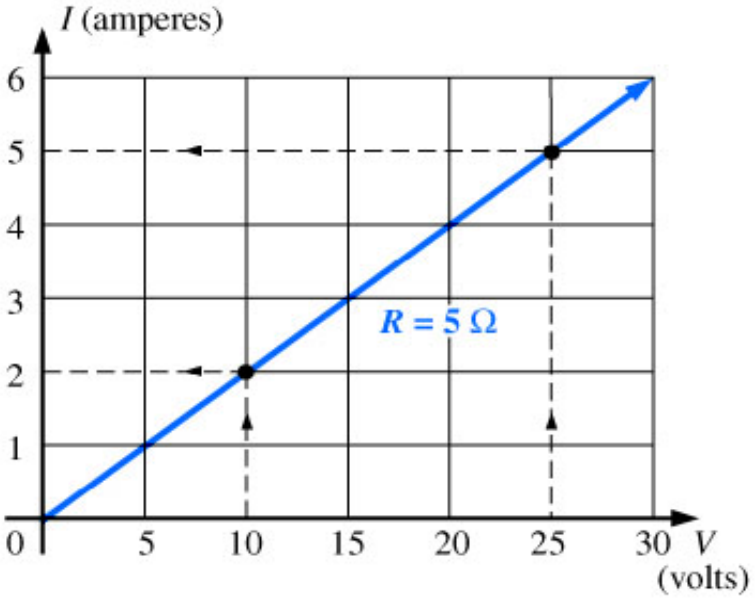
Where: **I = current (amperes, A)**

E = voltage (volts, V)

R = resistance (ohms, Ω)

Plotting Ohm's Law





Laws of Resistance

- The resistance R offered by a conductor depends on the following factors :
- (i) it varies directly as its length
- (ii) It varies inversely as the cross section A of the conductor
- (iii) It depends on the nature of the material .
- (iv) It also depends on the temperature of the conductor

Resistivity

The resistance of a wire is directly proportional to its length and inversely proportional to its cross-sectional area:

$$R = \rho \frac{\ell}{A}.$$

The constant ρ is known as it's specific resistance or the resistivity, is characteristic of the material. If ℓ is 1m and $A = 1m^2$ then $R = \rho$

The specific resistance of a material may be defined as the resistance between the opposite faces of a meter cube of that material. Units of ρ are ohm-m (Ω-m)

EFFECT OF TEMP ON RESISTANCE

- The effect of rise in temp is :
- **To increase the resistance of pure metals**: The increase is large and fairly regular for normalranges of temp. The temp graph is straight line . **Metals have positive temp co-efficient of resistance.**
- **To increase the resistance of alloys** . In their case the increase is relatively small and irregular.
- **To decrease the resistance of electrolytes , insulators** (such as paper , glass , mica etc.)and partial conductors such as carbon. **Insulators are said to possess a negative temp-coefficient .**
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