Current of Electricity

Electric current, I, is the rate of flow of charged particles, which may be positively or negatively charged, with respect to time, through a cross-sectional area.

The **electric charge *Q*** passing a point in a circuit is the product of the electric current I in the circuit and the interval of time *t* during which the electric current is passing that point.

$$\boxed{I = \frac{Q}{t}}$$

Microscopic model of current

If *n* is the number of mobile charge carriers per unit volume (i.e. number density), and *q* is the charge of each charge carrier, then the total amount of charge for a particular section of a conductor is

$$Q = q(nAx)$$

Suppose that the charge carriers move with an average speed v_d , then the displacement in a time interval *t* will be $x = v_d t$, which implies the average current is

$$I = \frac{Q}{t} = \frac{qnAv_d t}{t}$$

$$\boxed{I = qnAv_d}$$

The **drift speed v_d** is the average speed at which charge carriers move through a conductor when there is an electric current in the conductor.

The **potential difference** (p.d.), ***V***, between two points in a circuit is the amount of energy per unit charge transferred from electrical energy to other forms of energy when charge passes through those two points.

$$\boxed{V = \frac{W}{Q}}$$

Electrical resistance R, is the ratio of potential difference across a component to the current through it.

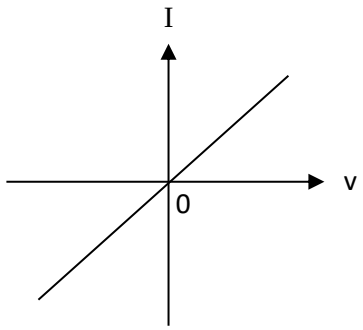
$$R = \frac{V}{I}$$

Resistivity is a relationship between the dimensions of a specimen of a material and its resistance at constant temperature. For a sample of length L, with a uniform cross-sectional area A and resistance R, the resistivity ρ is

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

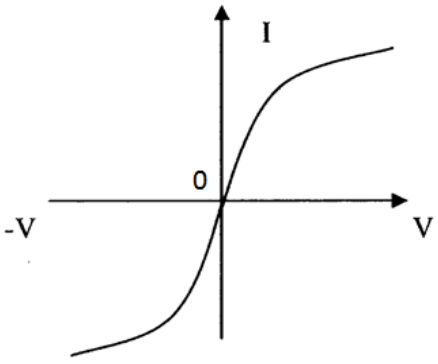
I-V Characteristics

Resistor at constant temperature (Ohmic resistor)



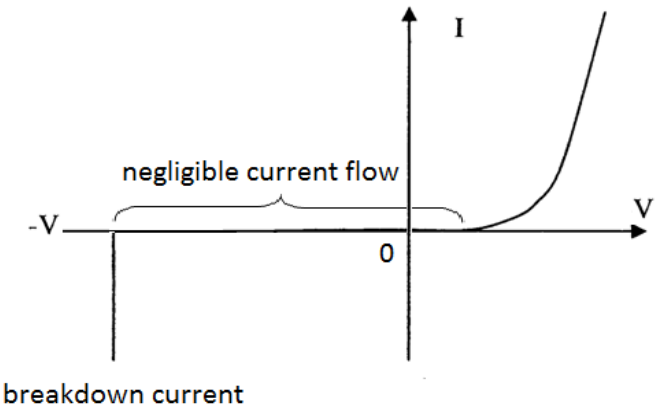
I-V characteristic of an ohmic resistor

Filament Lamp



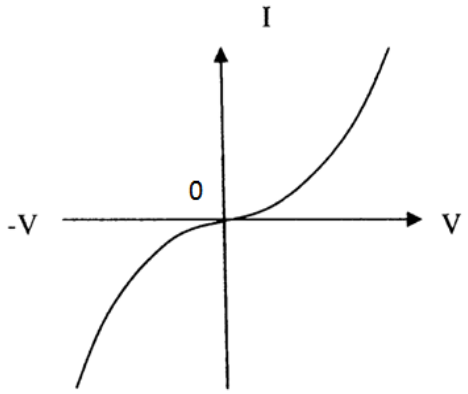
I-V characteristic of a filament lamp

Semiconductor diode



I-V characteristic of a semiconductor diode

Negative Temperature Coefficient (NTC) Thermistor



I-V characteristic of a NTC thermistor

Electrical Power

Electric power is the rate at which electrical energy is supplied to a circuit or consumed by a load with respect to time.

$$\boxed{P = IV}$$

$$\boxed{P = I^2R = \frac{V^2}{R}}$$