Resistor networks

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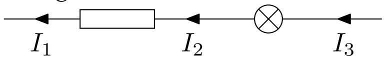
Since a current is a flow of electrons, and the electrons cannot escape from the wire, the current in a series ciruit is everywhere the same. Electrical components do not use up current, e.g. in a lightbulb, the electrons flow through the filament and out the other side, and so the current leaving the bulb is the same as the current entering it.



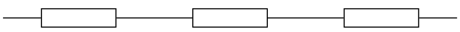
The currents I_1, I_2 and I_3 above are the same.

At a junction of wires, some of the electrons entering the junction will flow one way, and some another way, but because the number of electrons flowing into the junction has to be the same as the number leaving it, the currents into and out of the junction will be equal.

Resistor networks

It is often necessary to find the total resistance of some complicated bunch of resistors in an electrical circuit. There are rules to help us with this, however.

Resistors in series



For resistors in series, we simply add the resistances up along the path of the current. For N resistances,

$$R = R_1 + R_2 + \ldots + R_N$$
$$= \sum_{i=1}^{N} R_i.$$

Resistors in parallel

For N resistors in parallel, the resistance decreases as the number of resistors increases, as the current has more ways to go.

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots + \frac{1}{R_N}$$
$$= \sum_{i=1}^{N} \frac{1}{R_i}.$$