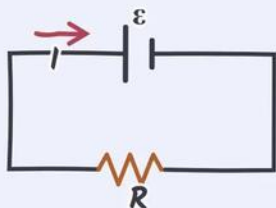


charge in motion, the law relating it to voltage, and how resistors combine

Current, charge and potential difference

- electric current is the rate of flow of charge, $I = Q/t$, measured in amperes
- conventional current flows from positive to negative, while the electrons actually move the other way. Both statements are true and the convention came first
- potential difference between two points is the work done in moving one coulomb of charge between them, measured in volts
- a cell provides the potential difference that drives the current round the circuit
- Ohm's law: at constant temperature the current through a conductor is proportional to the potential difference across it, so $V = IR$
- resistance opposes the flow of charge and is measured in ohms



a single loop with a cell and a resistor: the cell supplies the potential difference and the same current passes through every part of the loop, since there is nowhere else for the charge to go

The relations of this chapter

current as rate of flow of charge

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

Ohm's law

$$V = IR$$

resistance of a wire

$$R = \rho \frac{l}{A}$$

resistors in series

$$R_s = R_1 + R_2 + R_3$$

resistors in parallel

$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$$

power dissipated

$$P = VI = I^2 R$$

the third line says resistance rises with length and falls with thickness, which is why a long thin wire resists more than a short thick one of the same material

What resistance depends on *

- length: a longer conductor has more resistance, in direct proportion
- area of cross section: a thicker conductor has less resistance, in inverse proportion
- material: expressed as the resistivity ρ , which is a property of the substance itself
- temperature: for a metal, resistance increases as it gets hotter
- copper and aluminium have low resistivity, which is why they are used for connecting wires
- nichrome has high resistivity and does not oxidise readily, which is why heating elements are made of it