

QIV

$$I = \frac{\Delta Q}{\Delta t} = \text{rate of flow of charge}$$

$$e = 1.60 \times 10^{-19} \text{ C elementary charge}$$

$$V = \frac{W}{Q} \text{ work done per unit charge}$$

$1 \text{ V} = 1 \text{ J C}^{-1}$

Charge: property of matter that causes it to experience an electrical force

Charge is quantised

$$Q = ne$$

total charge = number of charge carriers $\times$ elementary charge (1.60×10^{-19})

kinetic energy of an electron is equal to the work done on the part

$$W = eV \rightarrow eV = \frac{1}{2}mv^2$$

Mean drift velocity: average velocity of a charge carrier.

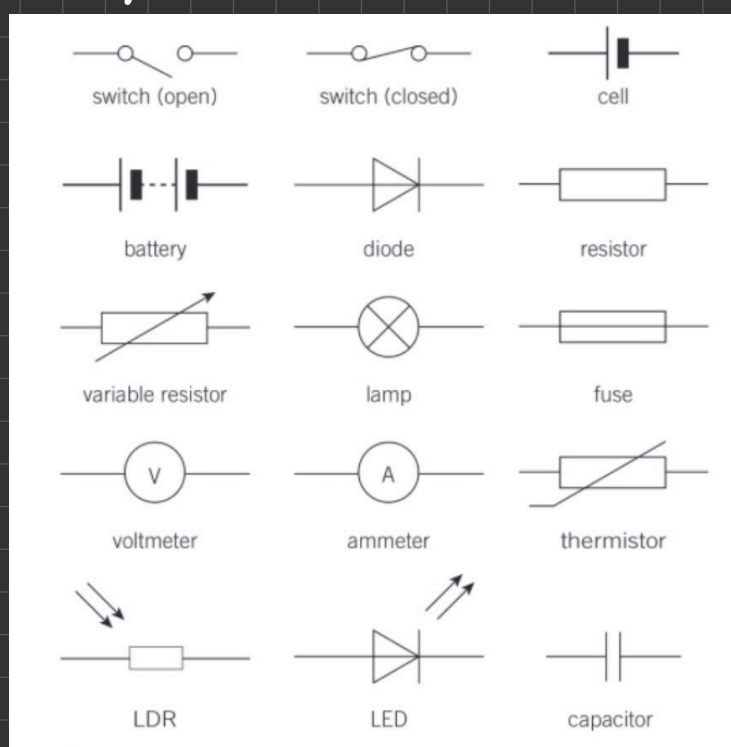
$$I = env$$

Different materials have different charge carriers

Insulators $\rightarrow$ Semiconductors $\rightarrow$ Conductors

increasing charge carriers

Kirchoff's first law states: for any point in a circuit, total current in = total current out



Energy and Power

Power: rate of doing work

$$P = \frac{W}{t} \quad P = VI \quad W = VIt$$

Calculating the cost of Energy

convert work into kWh $W = \text{pt} - \text{hrs}$

$$1 \text{ kWh} = 3.6 \times 10^6 \text{ J}$$

$$\text{cost} = \text{kWh} \times \text{price per kWh}$$

$$\text{e.g. } 0.8 \text{ kWh} \times 12.3 \text{ p} = 9.84 \text{ p}$$

E.m.f. - Electromotive force

$\rightarrow$ work done to charge carriers when they gain energy as they pass through a cell or power supply

$$\mathcal{E} = \frac{W}{Q} \text{ measured in volts}$$

Resistance: is the p.d. across a component, divided by the current going through it

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

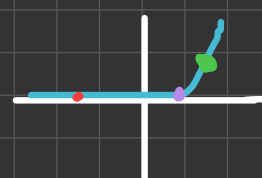
Ohm's Law: In an ohmic conductor the current is proportional to the p.d. at a constant temperature

$$V = IR$$

IV Characteristics

Chapter 8+9
Q, I, R E+P

Diode

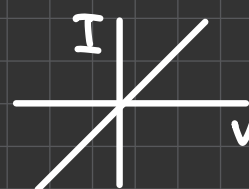


- P.d. not proportional to current
- diode does not obey ohm's law
- behaviour depends on polarity

Resistance is high, no current
Threshold p.d., starts conducting

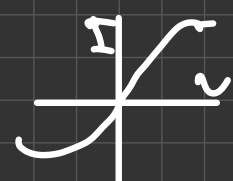
Resistance decreases as current rises at a faster rate than p.d.
from here the diode has small resistance

Resistor



Resistor obeys ohm's law
current proportional to p.d.
Resistance is constant and is the same regardless of polarity

Filament lamp



current not proportional to p.d.
lamp does not obey ohm's law
p.d. increases at a faster rate than current
Resistance increases because as current increases temperature increases so more collisions

An Experiment to investigate Ohm's Law

Vary the resistance of the variable resistor to change the p.d. of the circuit

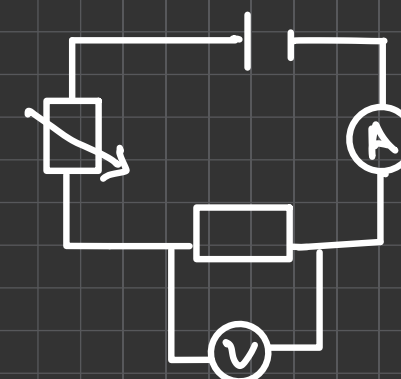
Measure the current with an ammeter

Measure the p.d. with a voltmeter

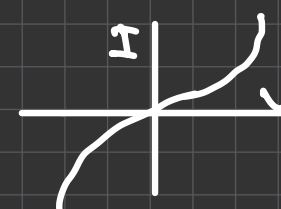
Plot a graph of V against I

Graph should be a straight line through origin if ohm's law is correct

R is the gradient of the graph



Thermistor



Current not proportional to p.d. $\therefore$ does not obey ohm's law
current increasing at a faster rate than p.d.
 $\therefore$ resistance decreases as V increases
Resistance $\downarrow$ as current and temp $\uparrow$ because number density $\uparrow$ as more conducting electrons are freed

