Tuesday, May 30, 2017 9:00 PM

Current Electricity

Current

A useful form of electricity occurs when electric charge flows from one location to another. Moving electric charge is known as current (I).

Current can be defined as the rate of flow of electric charge.

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

I = current, $\frac{C}{s}$, Ampere (Amps, A)
Q = charge, C (coulombs)
t = time, s

Example: Calculate the current through a toaster if it takes 900 C to toast your bread in 2.0 minutes.

900 C → Q
2.0 minutes → time

2.0 min = 120 sec.

$$I = \frac{Q}{t} = \frac{900}{120} = 7.5\,A$$

Example: How many electrons flow through a wire in 1.0 seconds if 2.0 Amps of current is flowing?

n = ?
1.0 seconds → t
2.0 Amps → I

$$I = \frac{Q}{t} \qquad (1.0)2.0 = \frac{Q}{1.0}(1.0)$$

$$2.0\ C = Q$$

$$Q = ne$$

$$\frac{2.0}{1.6\times10^{-19}} = \frac{n(1.6\times10^{-19})}{1.6\times10^{-19}} \qquad 1.25\times10^{19} \text{ electrons} = n$$

Voltage (Electric Potential or Potential Difference)

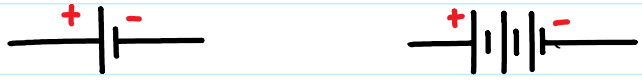
Recall Unit 8, if you have an object and raise it above Earth's surface, you increase its potential energy. A similar situation occurs when we have unlike charges. Since they attrack each other, we must do work on them to pull them apart. The work done is stored as electric potential energy.

The energy gained or lost per unit of charge is known as electric potential (or voltage). Voltage is measured in Volts (V).

Electric Circuits

A basic circuit contains:

1) A source of electrical energy (generator, battery, cell)



2) Device that uses up the electrical energy (lights, resistors)

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light :

resistor :

3) Everything is connected by means of a conductor (wires)

4) Switches

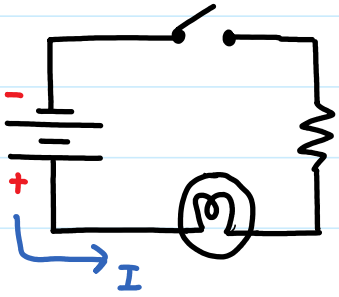
"closed"

current can flow

"open"

current cannot flow

Example :



Voltage/Battery (V)

- Source of electrical energy (this is what makes the electrons flow)
- the output is measured in volts
- also known as "potential difference"

Current (I)

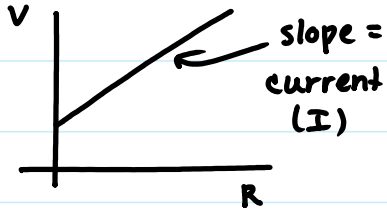
- current flows from the positive terminal through the circuit to the negative terminal.
- current in measured in amps, A.

Resistors / Resistance (R) :

- use the energy (heat, light)
- resistance in measured in Ohms, Ω

Resistance is related to electric current and voltage by : Ohm's Law

$$V = IR \quad \text{or} \quad I = \frac{V}{R}$$



Example : Find the resistance of a toaster that uses 120V and 7.5 A.

V I

$$V = IR$$

$$\frac{120}{7.5} = \frac{7.5R}{7.5}$$

$$16\,\Omega = R$$