

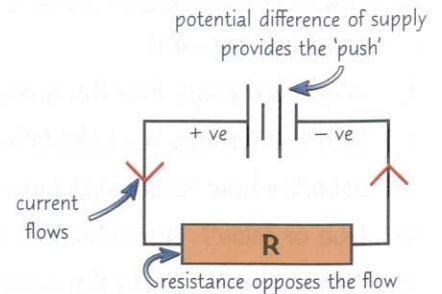
Current and Circuits

It's pretty bad news if the word **current** makes you think of delicious cakes instead of physics. Learn what it means, as well as some handy **symbols** to show items like **batteries** and **switches** in a circuit.

Current is the Flow of Electrical Charge



- Current** is the **flow** of electric charge (e.g. electrons) around the circuit. Current will **only flow** through an electrical component if there is a **potential difference** across that component, and if the circuit is **complete** (closed). Unit: **ampere**, A.
- Potential difference** (or voltage) is the **driving force** that **pushes** the charge round. Unit: **volt**, V.
- Resistance** is anything that **slows the flow** down. Unit: **ohm**, Ω .
- The current flowing **through a component** depends on the **potential difference** across it and the **resistance** of the component (p.185).



Generally speaking, the **higher the potential difference** across a given component, the **higher the current** will be. And the **greater the resistance** of a component, the **smaller the current** that flows (for a given potential difference across the component). There's more on resistance on p.185.

Total Charge Through a Circuit Depends on Current and Time

- Current** is the **rate of flow** of **charge**. In **metals**, the current is caused by a flow of **electrons**.
- If a **current** (I) flows past a point in a circuit for a length of **time** (t), then the **charge** (Q) that has passed this point is given by this formula:

$$\text{charge} = \text{current} \times \text{time}$$



The electrons come from the metal atoms. You need to know about atomic structure (p.172).

- To use this formula, you need **current** in **amperes**, A, **charge** in **coulombs**, C, and **time** in **seconds**, s.

EXAMPLE:

A battery passes a current of 0.25 A through a light bulb over a period of 4 hours. How much charge does the battery transfer through the bulb altogether?

$$\text{charge} = \text{current} \times \text{time} = 0.25 \times (4 \times 60 \times 60) = 3600 \text{ C}$$

Watch out for units — your time needs to be in seconds if you're calculating charge.

Circuit Symbols You Should Know

You need to be able to use these symbols to **interpret** and **draw circuit diagrams**.

There's more about a.c. and d.c. on p.192.

cell 	battery 	open switch 	closed switch 	filament lamp 	fuse 	LED 	power supply d.c. a.c.
resistor 	variable resistor 	ammeter 	voltmeter 	diode 	LDR 	thermistor 	motor

I think it's about time you took charge...

Electrons in circuits actually move from -ve to +ve, but it's conventional to draw current as though it's flowing from +ve to -ve. It's what early physicists thought (before they found out about the electrons), and it's stuck.

Q1 Calculate how long it takes a current of 2.5 A to transfer a charge of 120 C.

[2 marks]

Current and Circuits

Warm-Up

Fill in the blanks in these sentences with the words below.
 You don't have to use every word, but each word can only be used once.

..... is the rate of flow of electric charge (electrons) around a circuit.

The driving force that pushes current around a circuit is called the

A current will flow around a circuit if the circuit is and there is a source of

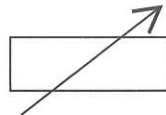
The current flowing through a component when the potential difference across it increases or when the resistance of the component

- | | | | |
|----------------------|-----------|---------|----------------------|
| coulomb | energy | current | potential difference |
| potential difference | decreases | closed | increases |

1 **Figure 1** shows a circuit symbol.



Figure 1



The circuit symbol shown is a

- A resistor.
- B variable resistor.
- C thermistor.
- D fuse.

[Total 1 mark]

2 A current of 3.5 A flows through a simple circuit containing a battery and a resistor.



a) Calculate how much charge passes through the light bulb in 120 seconds.

Charge = C
 [3]

b) Calculate how long it will take for 770 C to pass through the light bulb.

Time = s
 [3]

[Total 6 marks]

