Electrical Circuits
Discussion Questions:

1) What is electricity?
2) How does an electrical circuit work?
3) What types of materials conduct electrical energy?
4) How is electrical energy measured?
5) What do the symbols on a circuitry drawing mean?

Electricity

Electricity is energy that can build up in one place and be released as static electricity OR it can be energy that can move from one place to another in a current.

For an electrical current to work, electrons need to travel in a circuit. Materials that allow elcectrons to move freely through them are called ***conductors***. The best conductor of electrical energy in a circuit is metal wire. Copper wires are commonly used.

Materials that do not allow electricity through them are called ***insulators***. Examples of insulators include rubber and plastic. Electrical cords for appliances have insulators. The electrical wire runs through the middle of the insulated cord. This makes the cord safe to touch.

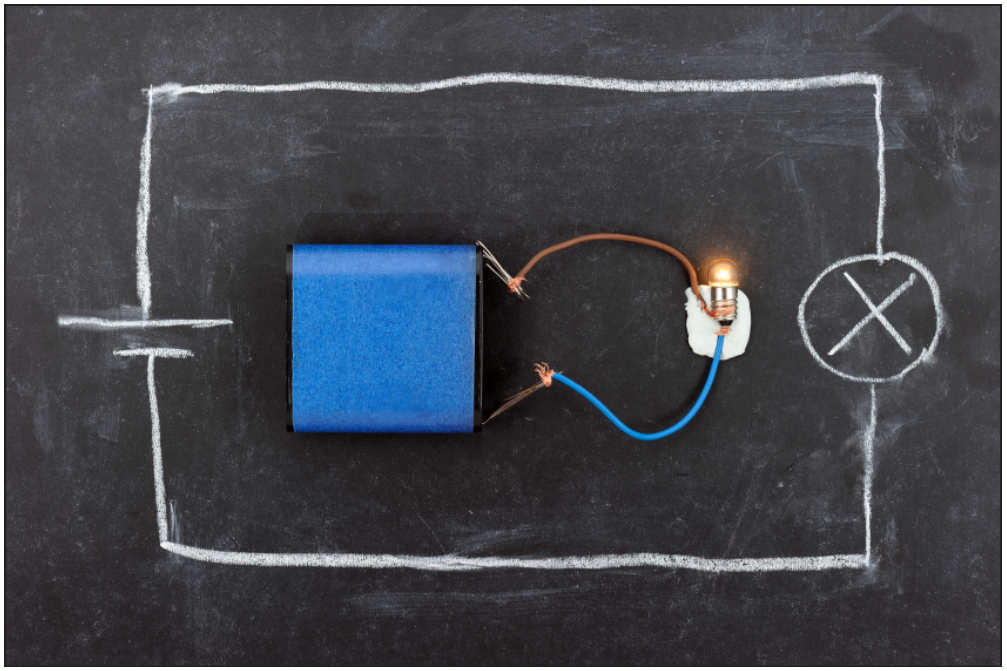
Electrical Circuit

A circuit is a closed path around which electricity can flow. If the path is broken the electricity stops.

A simple circuit needs a power source, like a battery and some electrical wire for the electrons to flow through.

A useful power-saving device in a circuit is a switch. When the switch is turned off, the circuit is boken and no electrical current is able to flow. When the switch is turned on, the circuit is closed and current is able to flow again.

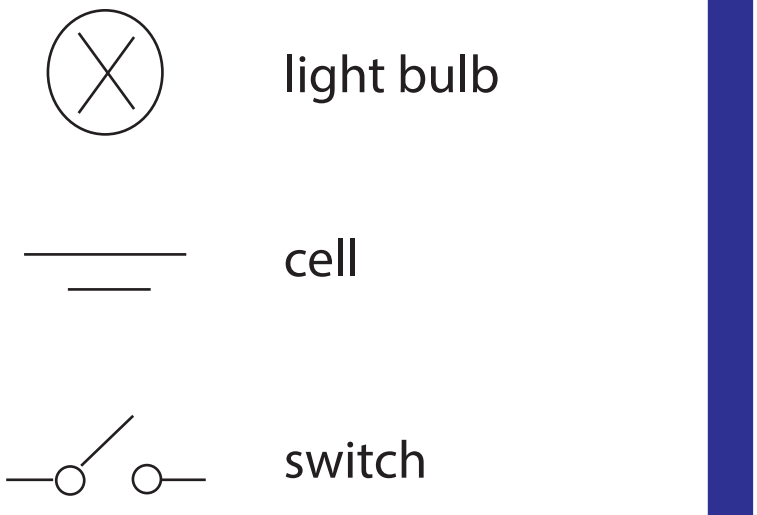
A torch is an example of a simple circuit. The power from the battery (or cell) flows around the circuit to the lightbulb when the switch is turned on.



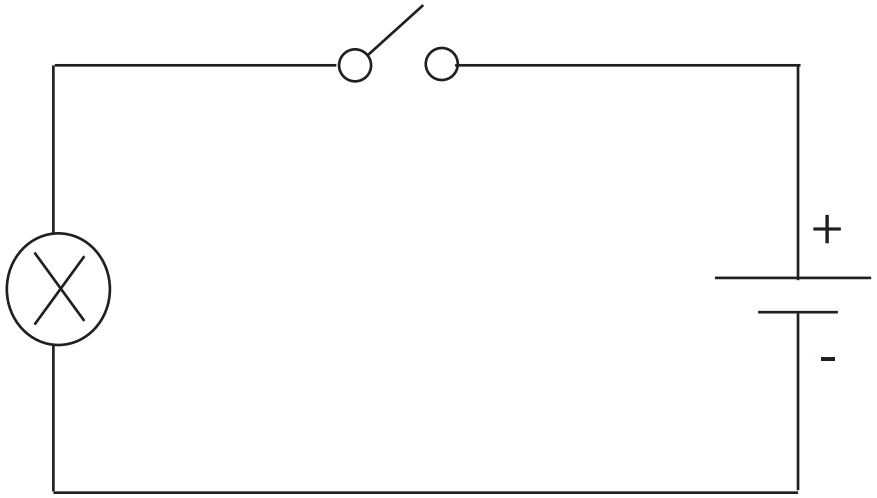
Drawing simple circuits

Circuit drawings use symbols to represent the different parts of an electrical circuit.

Follow the line coming out of the battery (cell) with your finger and you will stop at the switch. If the switch is closed then the current will flow through the light bulb and back to the battery. The circuit will be complete.



A simple circuit with a light bulb

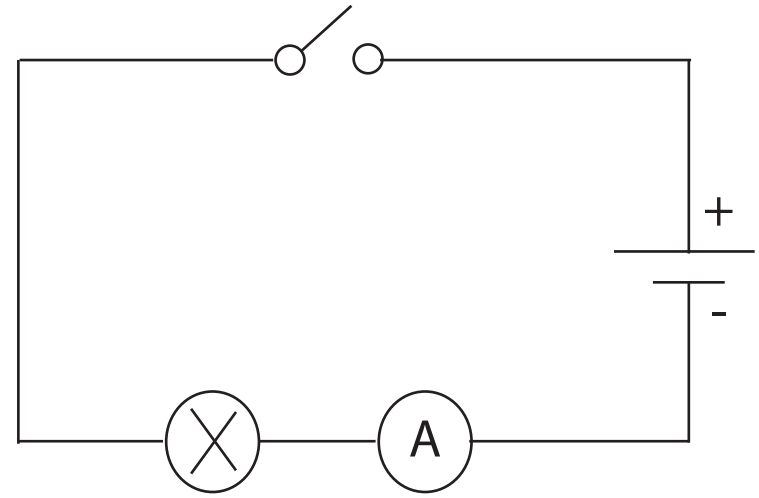


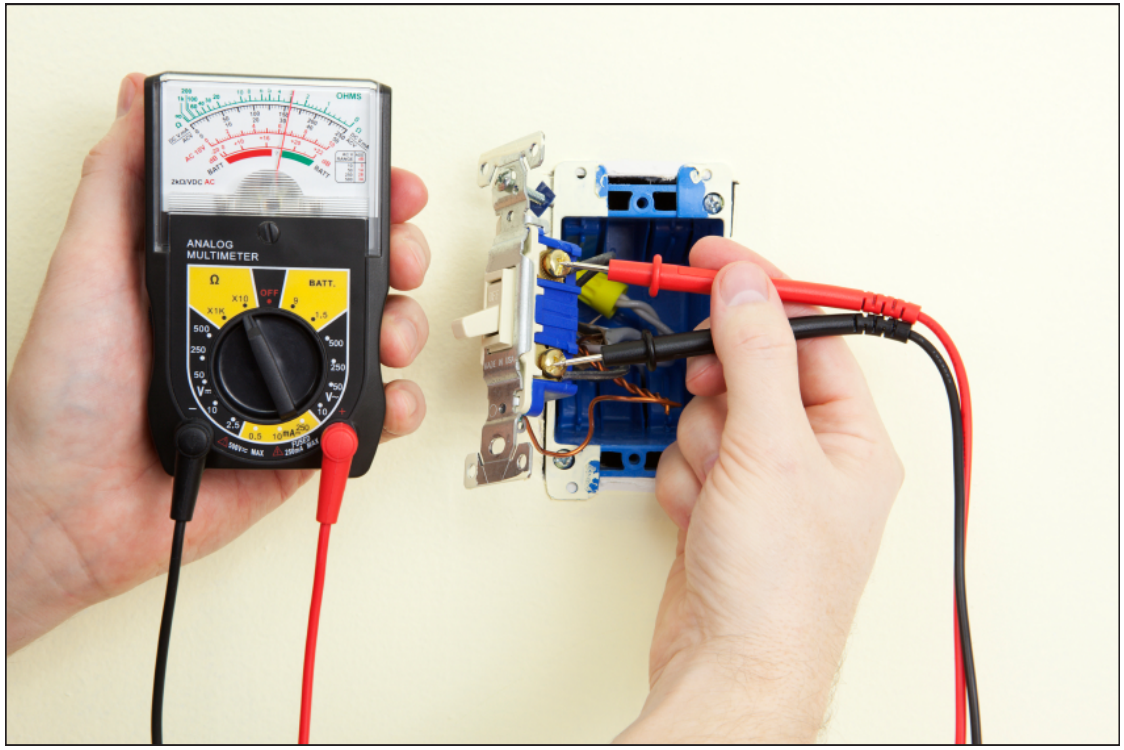
Measuring Current

Current is measured in amperes. We often abbreviate this to ***amps*** or ***A***. The amount of current flowing through a circuit is measured by an ammeter.

An ammeter is connected in series in a circuit to test the amount of current flowing through it.

A circuit with an ammeter connected.





The ampere is named after the French mathematician and physicist André-Marie Ampère who lived from 1775 to 1836.
He explored the relationship between electricity and magnetism.

Voltage

Voltage is measured by a voltmeter and expressed as volts which is abbreviated as V.

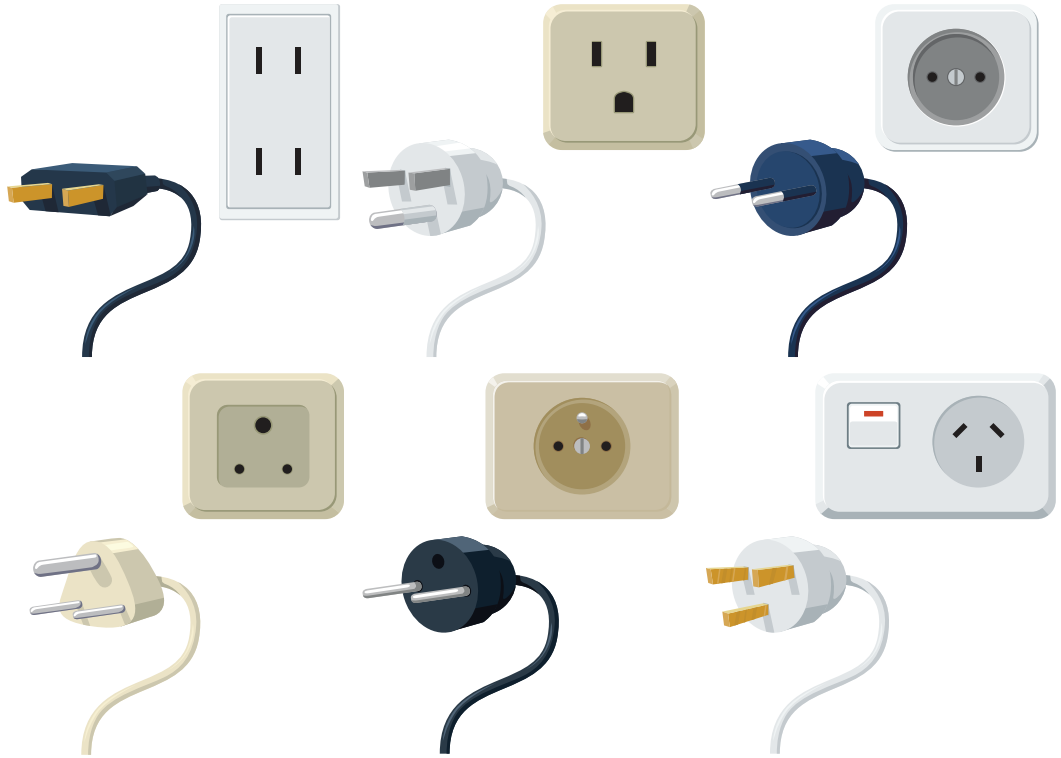
Voltage is a measurement of the force that is needed to move current through the wires. It is the electromagnetic force that pushes the electrons around the circuit.

A battery for example may have a potential energy of 1.5 volts. This would be sufficient to use in a small appliance such as a torch.

A common voltage for a car battery is 12 volts. A higher potential energy is needed to work the electrical system in a car.

The power outlets in your house provide a much higher voltage to work lights, heating and machinery such as refrigerators, kitchen appliances and computers. This energy is potentially fatal to humans. People should be very careful using power outlets.

Power outlets and cords look different in different parts of the world.



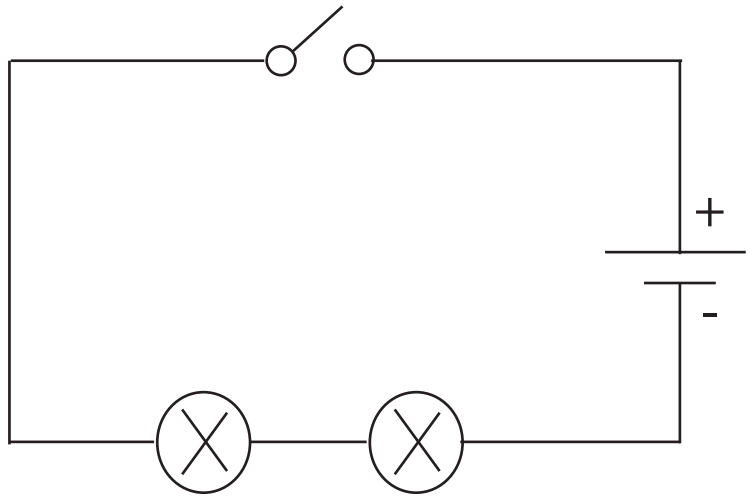
Circuits in Series

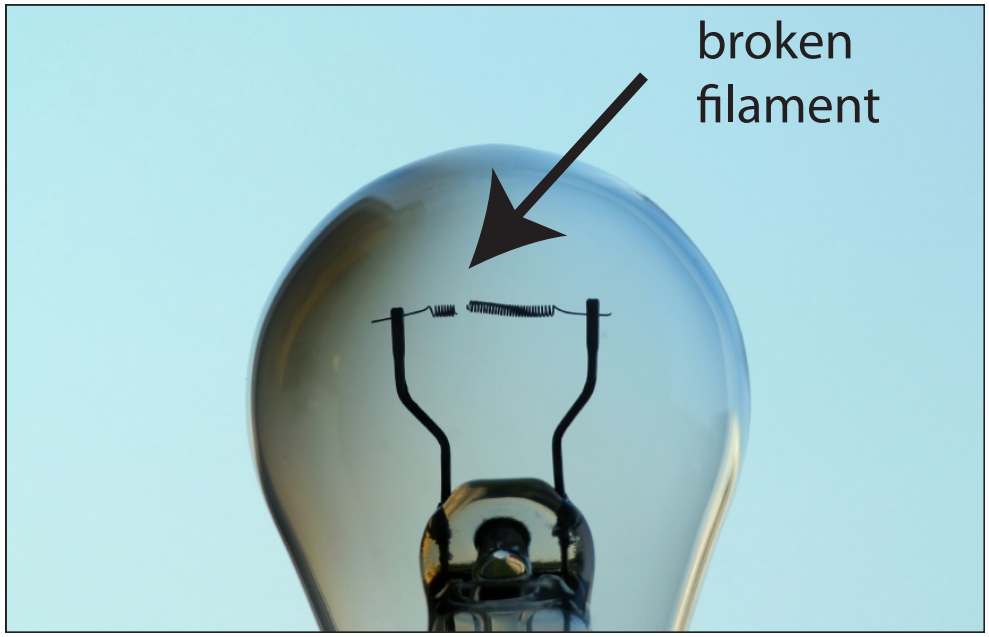
When one or more components are connected in the same loop of a circuit we say they are in ***series***.

The two light bulbs in this circuit are in series. Interestingly, if one lamp breaks the other will not light.

This is because each light bulb has a thin wire inside it called a filament. If the filament breaks the circuit is broken and electricity cannot flow.

A circuit with two light bulbs in series





Circuits in Parallel

When one or more components are connected in separate loops of a circuit we say they are in ***parallel***.

The two light bulbs in this circuit are in parallel. The current is shared between the two loops. This means that even if one bulb breaks the other will still work.

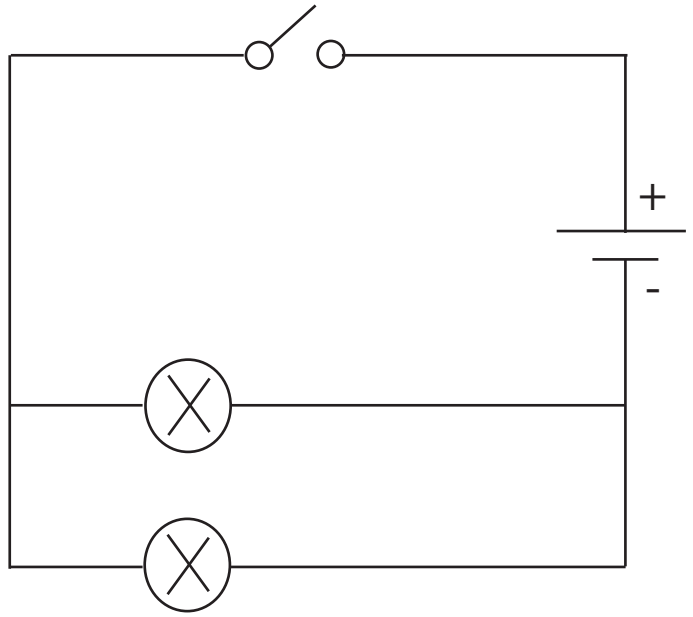
Appliances need to be connected to your home's electrical circuit in parallel. This way, if one appliance breaks the others will still work. Your home may be supplied by a number of different circuits.

Circuit breakers detect when something is wrong in the circuit. For example, when a unit in the circuit is overheating the circuit breaker automatically shuts down that circuit to prevent further damage.

Homes have multiple circuits to share the electricity load. The lighting in an average house may be wired into one or two circuits. Power supply for appliances may be separated into five or six different circuits.

Appliances that use a lot of power, such as air conditioners, usually run in their own dedicated circuits. This means that if the air conditioning circuit blows, the refrigerator will not be affected, preventing food spoilage.

A circuit with two light bulbs in parallel



More Symbols

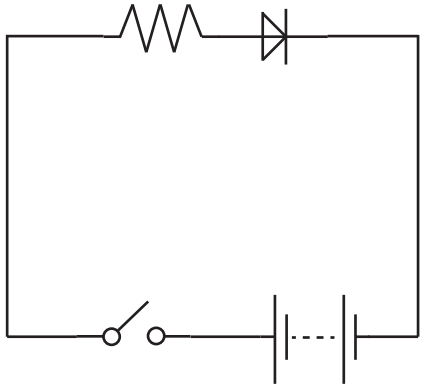
When current runs through a conductor heat is produced. Thinner wires get hotter faster.

Some electronic components are prone to 'blowing' if the current is too high for them. LED lights are a good example of this.

Resistors are materials that hold electrons more closely, slowing down the flow of electrons through them and thereby reducing the current.

Fuses are a safeguard for an electrical circuit. These are replaceable parts that will 'blow' when wires are overheating due to to a high current. They act like a switch, shutting down the circuit before any other components are damaged.

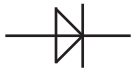
A simple circuit with a resistor and an LED lamp



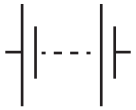
lamp

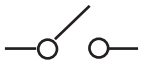

buzzer


fuse


LED lamp


cell


battery


switch


resistor