# Electrical Circuits and Conductors

## Electricity

Electricity is a form of energy used to power many everyday items, such as kettles and mobile phones. It is essential to our daily lives. Lighting buildings, watching television, using computers, cooking meals and keeping in touch with family and friends all rely on electricity.

## Sources of electricity

Electricity comes from two sources, mains electricity and cells. Mains electricity is used when we turn on a light switch or plug an electrical appliance into a socket. Cells contain chemicals that create electrical energy. They are usually used to power small, portable devices, such as torches. A battery is made of two or more cells.

mains electricity

cell

battery

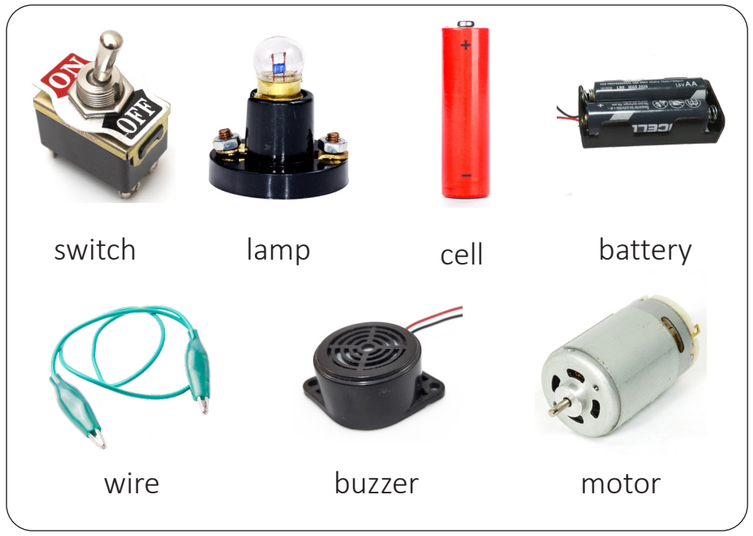
Power stations generate most of the mains electricity we use. Electricity travels through overhead and underground wires, known as power lines, to buildings, including homes, shops, offices and factories.

## Safety

Mains electricity is very powerful. If not used carefully, it can be dangerous, causing fires, burns, electric shocks and death. Electricity can be dangerous when people overload plug sockets, touch electrical items with wet hands or touch damaged wires. It is important to use electrical appliances safely.

## Components

All electrical items are made up of components, which make them work.

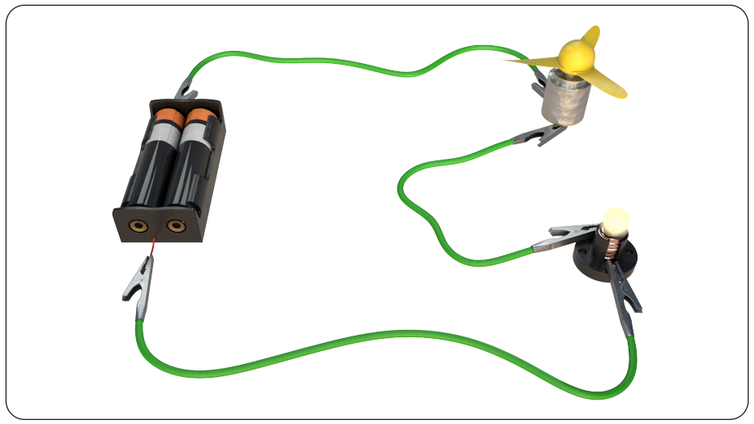



Components have different jobs. A cell and battery provide electrical power. A wire connects different components and conducts electric current. A lamp emits light. A switch makes or breaks a circuit. A buzzer makes a sound. A motor creates movement.

## Circuits

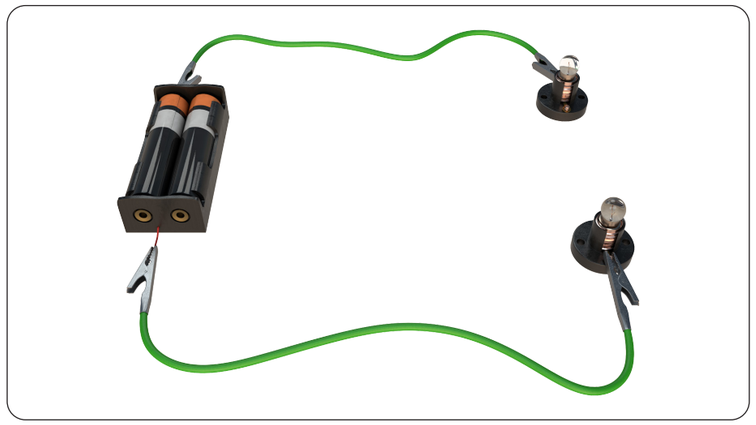
A circuit is a collection of components connected by wires through which an electric current can flow. If a circuit forms a complete loop with a single path for electric current to flow, it is called a series circuit.

When an electric current flows through all the components of a circuit, it is called a complete circuit. A complete circuit has no gaps and can make a lamp light up, a buzzer sound or a motor move.



complete series circuit

When an electric current cannot flow through all the components of a circuit, it is called an incomplete circuit. Missing wires, open switches, loose wire connections or broken components create gaps, which stop the electric current from flowing around the circuit.



incomplete series circuit



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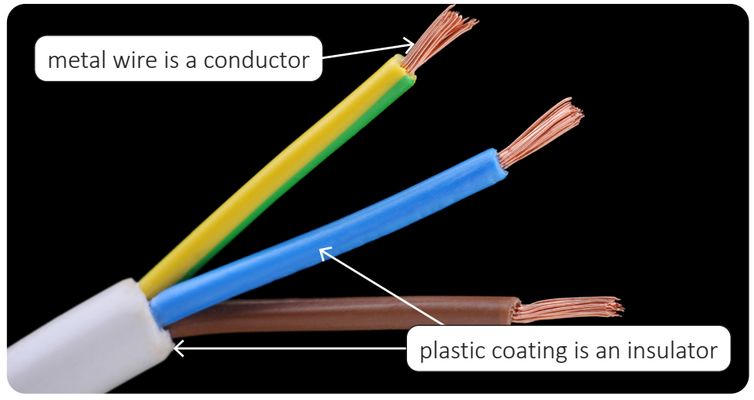
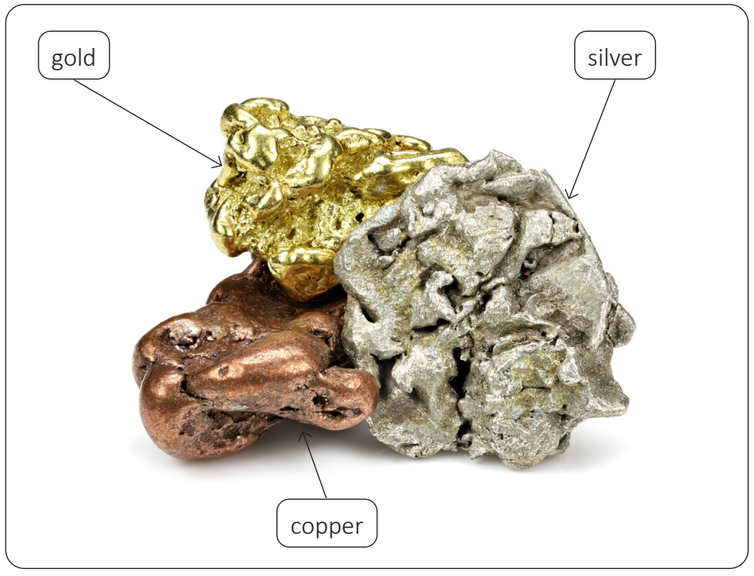
## Electrical conductivity

Electrical conductivity is a measure of a material's ability to allow an electric current to pass through it. Materials that allow an electric current to pass through them are conductive. They have low resistance. Materials that do not allow an electric current to pass through them are non-conductive. They have high resistance. Many non-conductive materials, such as plastic, are used as electrical insulators.



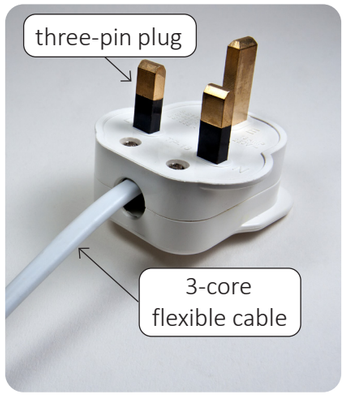

The metals silver, copper and gold are the three best conductors of electricity. Some non-metals, such as graphite, also conduct electricity. Most other materials are non-conductive.

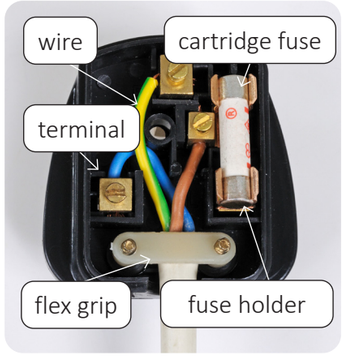



## Plugs

In the United Kingdom, we use three-pin plugs with 3-core flexible cable wired into them to safely connect our electrical appliances to the mains electricity supply.

Plugs and 3-core flexible cable include parts made from metal and plastic. The metal parts are conductors and allow electric current to pass through them to make electrical appliances work. The plastic parts are insulators. They do not allow any electric current to pass through them. They cover the metal parts, so when people handle a plug, cable or electrical appliance, they do not come into direct contact with electricity.



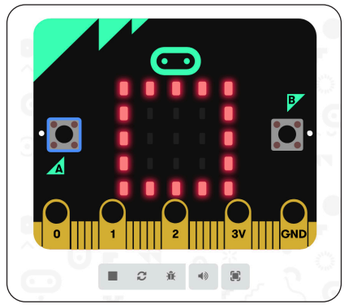

wired plug

## Programmable technologies

Programmable technologies are devices that can operate automatically by following a set of instructions that have been programmed into them. Robotic vacuum cleaners, microwaves and washing machines are examples of programmable technologies. People input instructions into a device then the device performs tasks independently.

## Micro:bit

A micro:bit is a small, programmable computer with an LED display, buttons and sensors. Micro:bits can be programmed to carry out a sequence of instructions.




## Future of electricity

At the moment, most mains electricity is made by burning fossil fuels, such as coal, oil and gas, which pollute the environment. Fossil fuels are also running out, so alternative forms of renewable energy are needed. Renewable energy includes solar power, wind power and geothermal energy. People can also help to save electricity by turning off lights and appliances when not in use or using low energy, LED light bulbs.

solar power

## Glossary

| | |
|---|---|
| **conduct** | To allow electricity to pass through. |
| **electric current** | The flow of electric charge through a circuit. |
| **LED** | Light-emitting diode. A device that emits light when part of a complete circuit. |
| **renewable** | Something that can be used and then easily replaced. |
| **resistance** | The ability of a conductor to oppose the flow of electric current. |



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