Electrical Wiring and Safety
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- Electrical safety
- Electrical cables and plugs
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- Summary activities
Why is electricity dangerous?

Warning signs are used to alert people to the presence of high voltage electricity.

When a current passes through living material, it causes an electric shock.

This interferes with nerve signals from the brain to the body, and can cause a heart attack, muscle spasms and breathing difficulties.

Other dangers include overheated and faulty appliances, which may lead to electrical fires.
Using electricity safely

Although electricity can be very dangerous, it is also incredibly useful and is essential for modern life.

What precautions can be taken to make electricity safer?

- Do not overload sockets.
- Wire plugs correctly.
- Never mix water and electricity.
- Regularly check cables for breaks and loose wires.
- Never stick anything other than a plug in a socket.
- Use earth wires, fuses and circuit breakers to prevent accidents in the event that a fault develops.
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Inside a cable

An electrical cable usually contains three wires.

These wires are made of copper because it is a good conductor of electricity. Each wire is made of thin strands of copper to keep the cable flexible.

Each wire is encased in plastic to stop the wires from touching and causing a short circuit. Plastic is used as it is a good insulator, as well as being tough and flexible. The whole cable is encased in another layer of plastic.

Two of the wires form the electrical circuit, while the third wire is a safety feature.
What does each wire do?

Each of the wires in a cable performs a specific function.

The **neutral wire** completes the circuit. It is kept at a zero voltage by the electricity company.

The **live wire** carries the high voltage.

The **earth wire** is a safety wire that is needed to earth appliances with a metal case. This makes it safer to touch the appliance if it develops a fault.
Which wire is which?
Inside a plug

The three pins in an electrical **plug** are connected to the three wires inside a cable.

Could you wire a plug?
Materials inside a plug
What’s wrong?
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What is a fuse?

A **fuse** is a safety device containing a thin wire that melts if the current is too high, breaking the circuit and protecting the cable from overheating and catching fire.

Fuses act as an early warning system, preventing appliances from being damaged by surges in electricity and warning owners of faults.

All UK plugs are fitted with fuses. Fuses are available in a range of amperes to suit different current values.
Earthing is a process used to increase the safety of electrical appliances and prevent electric shocks.

An earth wire is essential for any appliance with a metal case. Without an earth wire, electricity could begin to flow through the metal casing if a fault developed.

The earth wire provides an alternative path for the current.

If the live wire becomes loose and touches the metal case, the very large current flows through the earth wire and blows the fuse in the plug, breaking the circuit.
How on earth...?
Circuit breakers

All homes have **fuse boxes**. These are safety devices between the sockets in the home and the mains supply from the street.

Newer fuse boxes contain **Residual Current Circuit Breakers (RCCBs)**, which detect a difference in current between the live and neutral wires. They use an **electromagnet** to break the circuit if the current difference becomes too large.

RCCBs detect current surges much quicker than a fuse.
Fuse or circuit breaker?
Double insulated

Another way of improving the safety of electrical appliances is to make them **double-insulated**.

Double-insulated appliances have **plastic** cases, without any wires connected to the case. The case cannot become **live**, because plastic does not conduct electricity.

In the UK, double-insulated appliances are marked with a symbol of two squares.
Double insulated or not?
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