How do batteries work?

KS2 KS3 Ages 7-14 ⏰ 3 min read

A battery stores chemical energy and converts it to electrical energy when needed. Inside every battery, a chemical reaction is waiting to happen — one that involves electrons moving from one material to another. The battery channels that electron movement through a circuit to power your device.

The basic structure

Every battery has three key components: two electrodes and an electrolyte. The **anode** (negative electrode) is a material that readily gives up electrons. The **cathode** (positive electrode) is a material that readily accepts them. Between them is the **electrolyte** — a substance that allows charged ions to flow between the electrodes internally, while forcing electrons to flow through the external circuit (your device) to get from anode to cathode. That flow of electrons through your device is the electric current that powers it.

Think of a battery as a hill and electrons as water. The chemical energy in the battery is like the water at the top of the hill — potential energy, waiting to flow. Connect a circuit and you open a channel: the water flows downhill through your device (the turbine), doing useful work as it goes. When all the water has flowed to the bottom (the chemical reaction is complete), the battery is flat. A rechargeable battery uses electricity to pump the water back up the hill, resetting the system.

What makes lithium-ion batteries special?

Lithium-ion batteries — the type in your phone and in electric cars — use lithium ions moving between a graphite anode and a lithium cobalt oxide cathode. Lithium is the lightest metal and loses electrons very readily, which gives lithium-ion batteries a very high energy density — lots of energy stored per gram of weight. This is why they revolutionised portable electronics and electric vehicles: the same amount of energy, in a much smaller, lighter package.

Why do batteries wear out?

Each charge-discharge cycle causes small physical changes to the electrodes — tiny cracks, material depositing in the wrong places. Over hundreds or thousands of cycles, these changes accumulate and reduce how much charge the battery can hold. This is why older phones don't hold their charge as well as new ones — the battery's physical structure has degraded through use.