

How to make batteries work

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Batteries are used to store chemical energy. Placing a battery in a circuit allows this chemical energy to generate electricity which can power device like mobile phones, TV remotes and even cars.

Batteries are a non-renewable form of energy but when rechargeable batteries store energy from renewable energy sources they can help reduce our use of fossil fuels and cut down carbon dioxide and greenhouse gas production.

All batteries are basically stores of chemical energy. Inside a battery, are one or more simple chemical cells. A simple cell must contain an electrolyte and two different metals. It can be made from everyday items like a lemon, zinc nail, and copper penny. The lemon juice in the lemon acts as the electrolyte and the two metals are electrodes. Electricity flows between the two metal. By using different metals you can even produce different voltages.

In a commercial battery, the electrodes are often made from zinc and manganese oxide. These electrodes are separated by the electrolyte - usually in the form of a paste or a liquid. When the battery is wired up in a circuit, an electrochemical reaction takes place. Positively charged ions move from one electrode to the other through the electrolyte. Negatively charged electrons flow from one electrode, out of the battery, out through the circuit, and back to the other electrode. It's this flow of electrons that transfers electrical energy to where it is needed.

Alkaline batteries, like this, eventually run out of stored energy. They can be recycled, but need to be replaced. Rechargeable batteries, like the battery in a phone, can be used again and again. Rechargeable batteries can hold more energy than alkaline batteries. Some can hold huge amounts.

Rechargeable batteries require lots of lithium. There is only a certain amount of lithium in the world. So, we rely on batteries every day, and they can play a big part in making renewable energies work more reliably, but does this out-weigh their environmental costs?

A simple cell contains two different metals (electrodes) separated by a liquid or paste called an electrolyte. When the metals are connected by wires an electrical circuit is completed.

One metal is more reactive than the other. Negatively-charged electrons flow from the more reactive metal through the wires to the less reactive metal. In the graphic above, electrons flow from the magnesium to the copper. Positively-charged ions flow from the copper through the electrolyte to the magnesium.

When a battery stops working, it is because the chemicals in it have been used up. Some batteries are rechargeable and when they are being recharged, electrical energy (from the mains) is transferred back to

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chemical energy (in the battery) to be used again.

You could make your own lemon battery. Put a copper penny (one and two pence pieces work) into the lemon, this will form the positive electrode, and a galvanized zinc nail for the negative electrode.

These can then be attached to a light bulb or buzzer using alligator clips and wires. Three or four lemons are likely to be required to light the bulb. This experiment can be used to explain how a battery works. A battery requires three things - two electrodes and an electrolyte.

The electrodes must be different materials with different chemical reactivity to allow electrons to move round the circuit. This movement requires an electrolyte to complete the circuit, provided by the acidic liquid in the lemon. The flow of electricity can be measured using a voltmeter.

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