

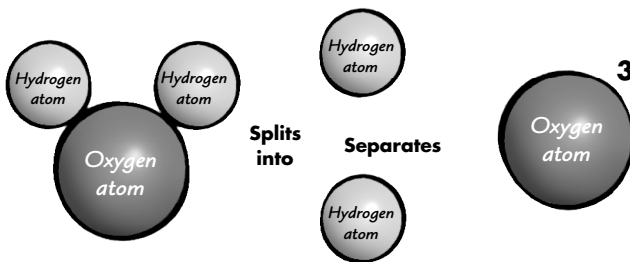
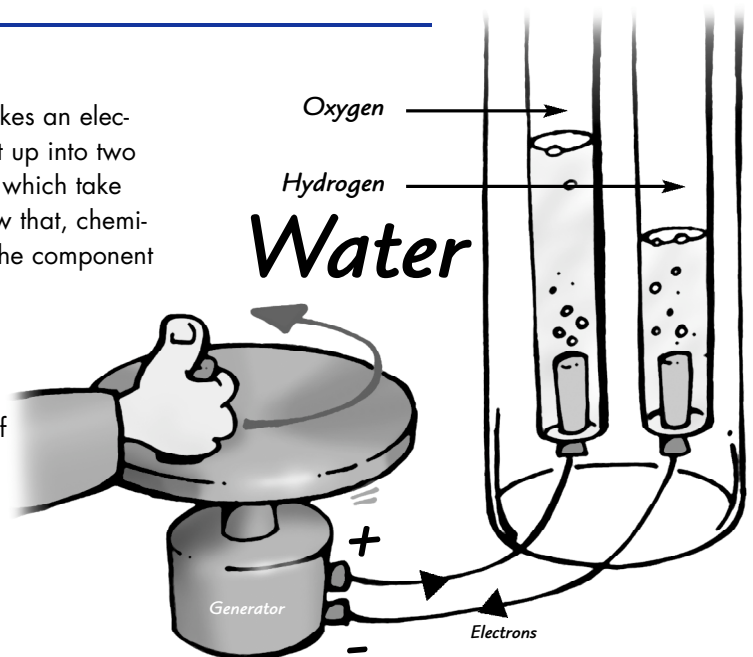
## Hydrogen Rocket

**What to do:** Turn the handle until you have enough rocket fuel (when the lights go green).

**What happens:** The gases burn and shoot the rocket up in the air.

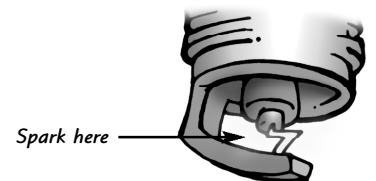
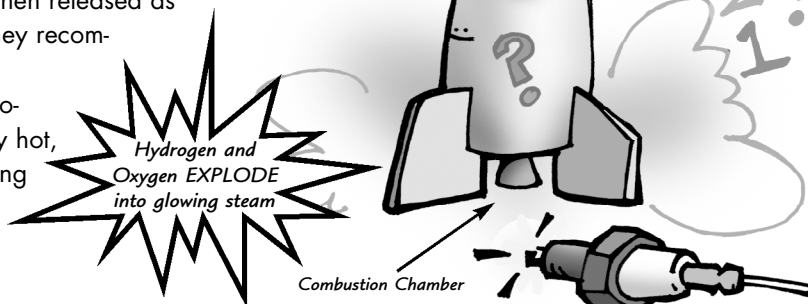
### How it works?

1. When you turn the handle, you turn a generator which makes an electric current pass through the water in the exhibit and split it up into two gases. The gases bubble up separately from the two wires which take the electric current into and out of the water. You may know that, chemically speaking, water is an oxide of hydrogen ( $H_2O$ ), so the component gases are Hydrogen and Oxygen.
2. As you keep turning the handle, you will notice there is always twice as much of one gas than the other. Since the chemical formula ( $H_2O$ ) means that there are two atoms of hydrogen attached to one atom of oxygen to make the smallest particle (or molecule) of water, you know which gas is which.



3. When you have sufficient gas to power the rocket, you can press the button to start the "count-down" sequence. Firstly, two valves open to allow the oxygen and hydrogen to mix in the combustion chamber just below the rocket. Then a spark-plug in the combustion chamber sets fire to the mixture of gases, in just the same way that a mixture of petrol vapour and air in a car engine is ignited.

4. The hydrogen and oxygen burn very quickly and turn back into water. The energy which you provided when you split up the water is 'stored' in the separated gases as chemical energy and then released as heat when they recombine. The water produced is very hot, so it is glowing steam.

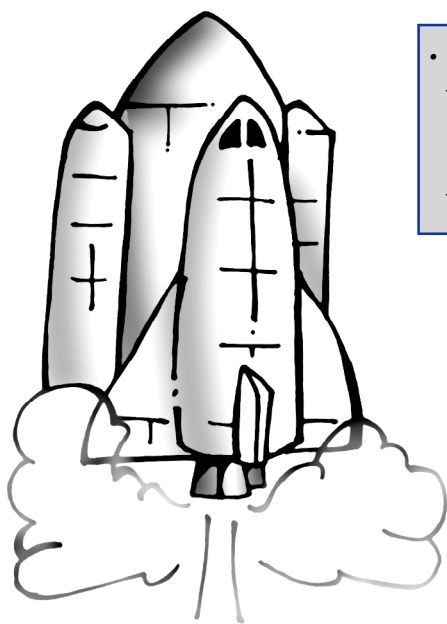
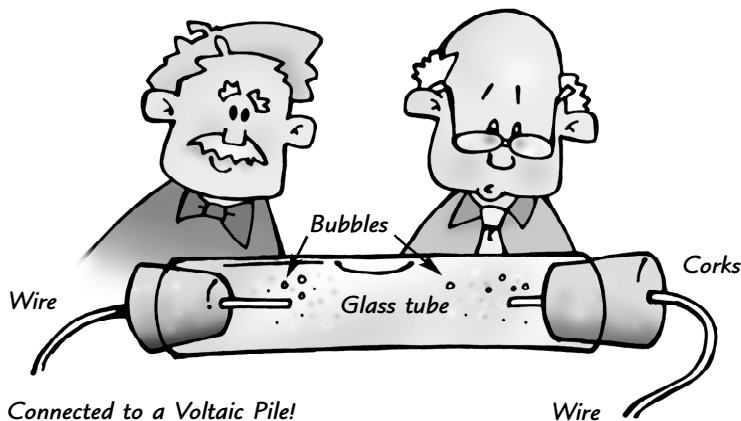


5. The hot steam is at a very high pressure and as it expands, it shoots the rocket upwards. After the expansion, when things have cooled down, you may see a few drops of water condensed on the inside of the combustion chamber. That's the water which took so much of your energy to split up!

6. The rocket slides up and down a vertical wire so that it returns to the right position after each flight. Mains electricity is only used to run the exhibit's electronics. Splitting up the water relied solely on your muscle power!

## Did you know?

- Splitting up water by passing an electric current through it was first done by Nicholson and Carlisle in 1800. Water was the first substance to be "electrolysed". They used the battery which had just been invented by Signor Volta to produce the electric current (*The generator was invented 30 years later*).

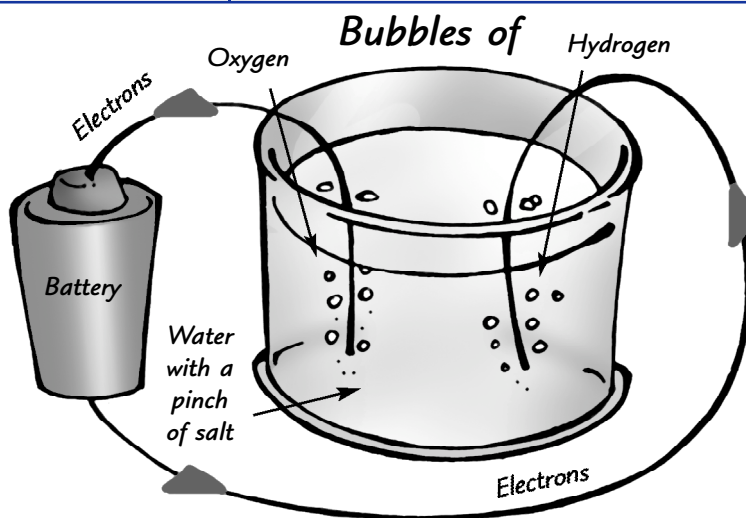


- Hydrogen and oxygen are used to power the biggest space rockets because they provide the most energy per ton of any fuel. In order to get plenty on board, the gases have to be liquified and kept very cold until needed. Rockets need to take their own oxygen for burning the hydrogen; when we have hydrogen-powered cars, we can use the oxygen in the air.

- Electrolysis (-lysis means "splitting" or "breaking down") is an important process in industry and chemistry. Aluminium is obtained by electrolysis of its molten ore. Aluminium smelters need a lot of electrical power, so they have their own power stations, usually driven by water turbines.

## Things you can try yourself

You can do your own electrolysis of water using two bits of wire and a battery. If the water has a little salt in it, so much the better, because pure water is rather a bad conductor. You should be able to see the bubbles of hydrogen and oxygen rising from the two wires where they dip into the water.



**Caution:** Never, ever, try any experiments with electricity from the mains