

*Water is H<sub>2</sub>O, hydrogen two parts, oxygen one, but there is a third thing that makes it water and nobody knows what that is.*

DH LAWRENCE

## Water = weird

Water, or hydrogen oxide, is the strangest substance known to science, despite being one of the commonest. Seventy-five per cent of the surface of the Earth and 70 per cent of our own bodies are made from it.

It combines two of the most common elements in the universe – hydrogen and oxygen – in the simplest way possible. Despite this, it doesn't behave like any other substance. There are at least 66 recorded anomalies, the most obvious being that no other substance is found simultaneously as liquid, solid and gas. Most substances shrink as they cool, but when water cools below 39F (4°C) it starts to expand and become lighter (that's why we shouldn't leave wine bottles in the freezer and why icebergs float). Most of this weirdness is because a water molecule can form four hydrogen bonds with another water molecule (most other similar hydrogen compounds form only two or three). Water molecules like to stick together, so it takes a lot of energy to shift them. Hence the high boiling point (it takes 10 times as much energy to heat water as it does to heat iron) and the low freezing point.

## Water = life

Without water, there would be no life. Its capacity to retain heat has helped to keep the temperature of the planet stable (ocean temperatures are three

times more stable than those on land). Its transparency allows life-sustaining light to penetrate its depths. Also, because it can dissolve almost anything, it is the



medium in which life's key metabolic exchanges take place. But how does an intrinsically "sticky" substance end up being such a good solvent? Because although the bonds between water molecules are strong, they aren't stable. They are constantly being broken and remade: a single molecule of water experiences about 10,000,000,000,000,000 collisions per second with other water molecules. Water is a seething mass that surrounds and re-bonds around molecules of other substances. This life-giving property, paradoxically, also makes it the most destructive substance on the planet. Sooner or later, water eats away everything.

## Fresh water

Ninety seven per cent of the world's water is in the ocean. Of the three per cent of fresh water, three quarters of it is locked in the polar ice caps, some of it billions of years old. Most of the rest is groundwater, in the soil and rock, seeping

gradually back into the sea. Less than one per cent of the world's freshwater (0.008 per cent of the total) is sufficient to fill all the world's rain-clouds, lakes, swamps and rivers. Seventy per cent of available fresh water each year is used in agriculture. It takes 2,800 litres of water to grow a kilogram of rice and 50 glasses of water to grow enough oranges to make a glass of orange juice. As long as they drink eight pints of water a day, most people can go without food for a month. There is a clear link between access to safe water in a country and its GDP. It is estimated that by 2025 more than half of the world will be facing problems caused by lack of water. More than a quarter of the British water supply is wasted through leaky pipes. There is half as much fresh water in Africa today as there was in 1970. The human brain is 80 per cent water.

## More weirdness

Hot water freezes faster than cold water. This was first noted by Aristotle and demonstrated by Sir Francis Bacon, but it was only accepted through the persistence of a Tanzanian schoolboy, Erasto Mpemba, who in 1963 repeatedly demonstrated that hot ice cream mixture set more quickly than cold. We still don't know exactly why.