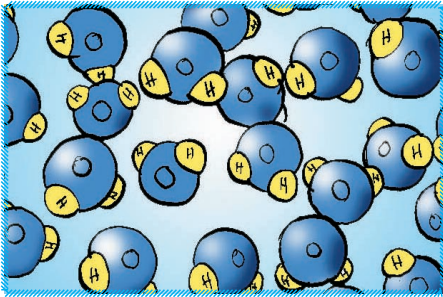


water is life

The water molecule is one of the most versatile structures known. Comprising two atoms of hydrogen and one of oxygen (H₂O), water has remarkable dissolving powers and is therefore a supreme solvent. Changing from solid to liquid to gas, water absorbs large amounts of energy in the form of heat, and releases equivalent amounts when going from gas to liquid to solid.



Water sculpts landscapes as rivers, waves and floods; it dissolves soft soluble rocks (such as limestone) and erodes hard insoluble rocks (such as granite); it obscures the sun as clouds; it carries chemicals dissolved in it; it transports suspended materials that will be deposited on flood plains, along coastal margins, and on deep ocean floors. Its capacity for heat exchange drives our weather systems!

In our bodies it is the most abundant molecule present. As a solvent it allows the transport of vital materials such as foodstuffs and oxygen into and within cells, and the export of waste products such as ammonia and carbon dioxide from cells.

Water is absolutely essential for all forms of life. We experience this every day when we become thirsty. Why do we need so much water? Simply because our bodies consist of approximately 75% water. If we do not drink enough water we may dehydrate. When you dehydrate it means that you have lost more water from the cells that build your muscles, than has been replaced. That is a very dangerous situation, because irreversible damage may be done to your body, and if you lose too much water you will die.

All forms of life on Earth have always been dependent on water for survival, and today water holds the key to survival in the future too. When Neil Armstrong landed on the moon in 1969 he described Planet Earth as “a shining blue pearl spinning in space”. The blue colour is, in fact, the water that is present on Earth and the atmosphere.



Approximately 97% of all water is found in the sea which covers about 70% of the Earth's surface. The seawater contains a large amount of salt in solution, which means that it cannot be used as it is. Only the remaining 3% is fresh water. Of this 3%, less than 1% is available for life on Earth, whilst the rest is in the form of ice at the poles, within the Earth's crust as groundwater, and in the atmosphere as water vapour (see diagram on page 2). This means that very little fresh water is available on Earth in a form that can readily be used for human consumption.

the water (hydrological) cycle

The water that we have on Earth is very old. The same water that is used presently was used by the dinosaurs millions of years ago. This is because the Earth recycles its water, i.e. it re-uses the water. This recycling of water is called the **water cycle** (see diagram on page 2).

Water exists on Earth as water droplets and is found in oceans, rivers, lakes, dams, the soil, and other places. Heat from the sun causes some of these water droplets to change from a liquid to a gas, called water vapour. This process is called **evaporation**.

At the same time some water vapour is released from plant leaves through very tiny openings in the leaves, by way of a process called **transpiration**. As soon as the water vapour is released from the leaves, it forms part of the other water vapour in the air. Another process by which water vapour is formed is

when evaporation occurs from the ice sheets at the poles, and from glaciers. This process is called **sublimation**. The reverse process whereby water vapour freezes without condensing into water is also called **sublimation**. The water vapour that has been released into the air eventually cools down and changes from a gas to a liquid, and thus back into water droplets. This process is called **condensation**. While these water droplets float in the atmosphere they join together to form clouds.

As soon as the combined droplets become too heavy to stay in the air, they fall to the Earth as either **rain or hail**. On the other hand, if the air temperature is low enough, some of the water vapour may freeze before it condenses into water (by the process of sublimation). When this happens **snow** is formed which falls to the ground as very light flakes instead of water droplets. By a similar process of sublimation, water vapour that occurs close to the ground surface may freeze if the temperature falls below freezing point. In such a situation, **frost** will form on surfaces such as leaves, grass and even rocks. If the temperature is very low during the night, but not at freezing point, very small water droplets may form, by condensation, from water vapour in the air, which we observe as **dew**. The rain, hail, snow, frost and dew all form part of a process called **precipitation**.

Some of these water droplets fall into the oceans, some into rivers and streams, some into lakes and dams, and some onto the land. On land it either seeps into the ground to form groundwater, or forms surface drainage when it runs on the surface through rivers, lakes and dams and ultimately back into the ocean. Water knows no boundaries, and as it flows over the Earth's surface, it is used by communities of plants, animals and humans in order to survive. At any stage in the cycle the water can be reheated by the sun and evaporate, then the whole cycle repeats itself, and so it will continue without interruption throughout time.

