KNOWLEDGE EXPANDER

WATER

Shell NXplorers

WHY IS WATER AN ESSENTIAL COMPONENT OF ALL LIFE ON EARTH?

Water can be found in the bodies of all living things. Water is used as a solvent and transport mechanism in respiration and photosynthesis.

When scientists search for life on other planets they first look for water.

Humans can survive for longer without food than they can without water.

Water is needed to complete full life cycles; seeds can remain dormant in dry conditions for thousands of years but will start growing with water present.

HOW DOES WATER MOVE THROUGH THE WATER CYCLE?

ENERGY FROM THE SUN MAKES WATER MOVE THROUGH THE WATER CYCLE

97–98% of the world's water is in the seas and oceans and is salt water.

Animals and plants that live on land are dependent on fresh water, but less than 1% of the world's water is available for them.

Most of the world's fresh water is locked up in the polar ice caps.

Water is never destroyed but is constantly used by animals and plants and returned to the water cycle. Fresh water, after it is used by humans, is often polluted when it is returned to the water cycle.

HOW WILL GLOBAL WARMING AND CLIMATE CHANGE AFFECT THE WATER CYCLE?

“Warm moist air can lead to heavy rainstorms, which in turn leads to increased flood events.”

TRADITIONAL RAINFALL PATTERNS WILL BECOME INCREASINGLY UNPREDICTABLE, SOME AREAS WILL BECOME DRIER, OTHERS WETTER

Warm air can hold more moisture than cold air.

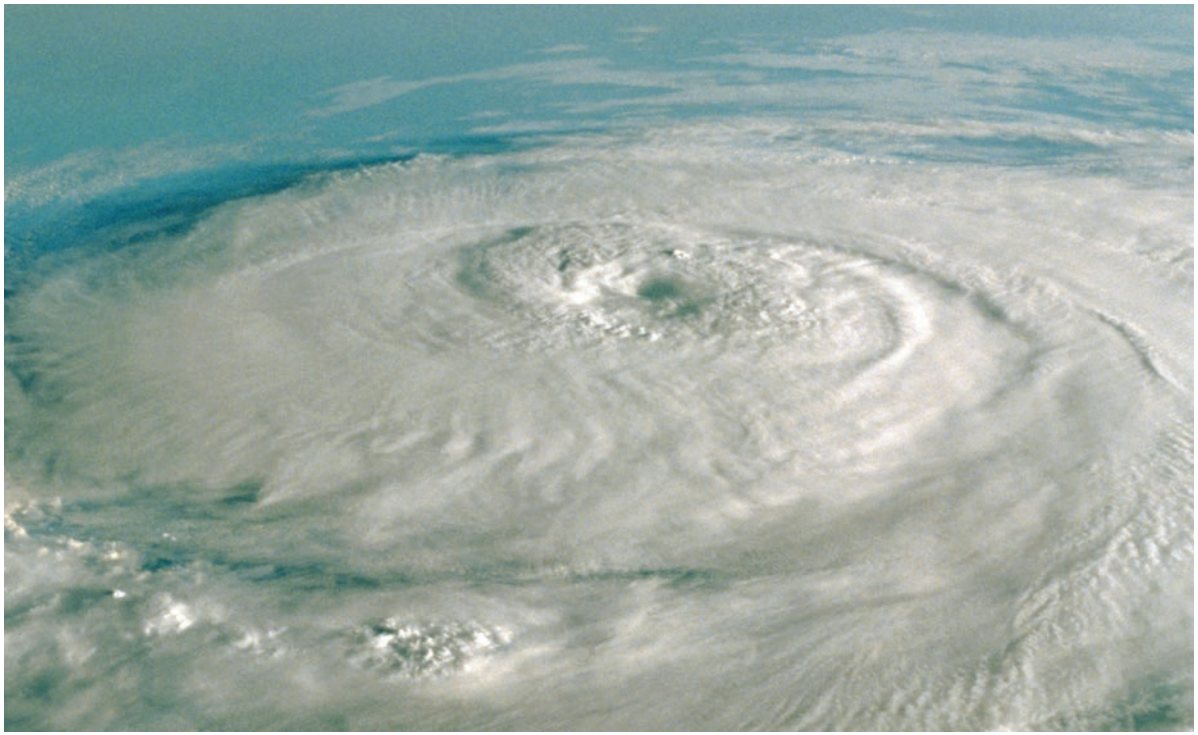
Evaporation generally accelerates with warmer temperatures.

High evaporation rates can dry out soils more quickly in times of long dry weather periods.

Warm moist air can lead to heavy rainstorms, which in turn leads to increased flood events.

Erosion of soils can reduce agriculture productivity and lead to increased pollution of rivers and coastal seas because of the agricultural chemicals, urban run-off and increased turbidity.

Water quality can be affected by increased temperatures because of increased algal growth or reduced dissolved oxygen capacity.



WHY IS SAFE WATER AND SANITATION IMPORTANT?

DIRTY WATER IS THE BIGGEST KILLER OF PEOPLE ON EARTH

Almost all unsafe water and poor sanitation deaths occur in the developing world.

Each year 3.4 million people die from disease linked to dirty water, lack of toilets or poor hygiene.

Bacteria, viruses and parasites (sometimes termed Neglected Tropical Diseases) live in dirty water.

Trachoma causes blindness but can be prevented by better washing with soap.

Diarrhoeal disease leads to dehydration and kills 2,200 children every day.

When people are ill they miss school, cannot go to work or help their families grow food.

The UN Millennium Development Goal on sanitation will be missed in 2015.

15% of the world's population still practice open defecation (a major source of disease).

HOW IS WATER MADE SAFE TO DRINK?

THE MAIN RISK OF DISEASE FROM DIRTY WATER COMES FROM THE PRESENCE OF VIRUSES, BACTERIA OR OTHER MICRO-ORGANISMS

The presence of toxic chemicals from industrial or agricultural pollution is also a hazard to health.

Water can be cleaned using physical methods (for example filtering), chemical methods (for example chlorine), or more usually in rich countries a combination of both methods. Suspended solids are removed from water using physical separation methods of screening and filtration. Filter beds are constructed from a range of media. Traditionally these were sand; today a combination of sand and granulated activated carbon (GAC) filter is commonly used in modern water treatment works.

GAC is commonly used to adsorb natural organic compounds, taste and odour compounds, and synthetic organic chemicals in drinking water treatment. Adsorption is both the physical and chemical process of accumulating a substance at the interface between liquid and solids phases. Activated carbon is an effective adsorbent because it is a highly porous material providing a large surface area to which contaminants may adsorb.

Reverse Osmosis (RO) uses ultra-fine synthetic membranes to filter out bacteria and even viruses. RO is an essential process that takes place inside the bodies of plants and animals. It was first demonstrated in 1748 by Jean-Antoine Nollet in France. It was not until the late 1940s when the US government challenged the science community to find new ways to desalinate seawater.

The first commercial desalination plant opened in California in 1965.

Chlorination was first used to disinfect water in the UK around 1897. At that time the country was suffering regular typhoid and cholera outbreaks (See Dr John Snow and Sims Woodhead).

Chlorination has played a critical role in protecting drinking water supplies from waterborne infectious diseases for 90 years. Filtration and chlorine disinfection of drinking water have been responsible for a large part of the 50% increase in life expectancy in developed countries during the 20th century. This fact led Life magazine to recently cite drinking water filtration and chlorination as ‘probably the most significant public health advance of the millennium’.

HOW DO HUMANS CONSUME MOST WATER?

WHEN WE THINK ABOUT HUMANS USING WATER WE TEND TO FOCUS ON DRINKING, WASHING, COOKING AND FLUSHING THE TOILET, BUT THESE ACTIVITIES ARE NOT HOW PEOPLE USE THE MOST WATER

Around 65% of a person's daily water use is linked to food production. Between 20 and 45% of a person's daily water use is for industrial processes; that means the water embedded in the manufactured things we buy such as mobile phones, jeans and televisions.

Scientists can calculate the total amount of water needed to produce 1 kilogram of the different types of food on our plates or an industrial product. This is called its 'Water Footprint' or 'embedded water'.

The water footprint for different types of food varies considerably. Vegetables, in general, have a much lower water footprint than meat products, although there are some exceptions to this general rule.

Water is also involved in energy production. Most power stations use coal, oil, gas or nuclear fuel to heat water and turn it into steam to produce electricity. This process uses large volumes of water from rivers, lakes or coastal locations.

Scientists can calculate the water footprint for each kWh of electricity produced and therefore for each kWh we consume in our lives.

Every man-made product we use has had to be manufactured in a factory which uses raw materials, energy and, you guessed it, water! To build a typical car uses 400,000 litres of water; even 1 litre of bottled water takes 5 litres of water to produce it (and the bottle!).

HOW DOES CLEAN WATER GET DELIVERED TO PEOPLE'S HOMES?

> **"Groundwater is brought up to the surface by wells, using manual or electric pumps. It is then carried to people's homes in buckets or moved along a network of pipes for further treatment."**

LESS THAN 1% OF THE WORLD'S WATER IS AVAILABLE FOR HUMANS TO USE

Water can be sourced from rivers, lakes and reservoirs or from groundwater.

Surface waters such as rivers and lakes are easily polluted.

Groundwater is generally a more reliable source of clean water and can be accessed by building wells or drilling boreholes to pump up the water that has been naturally filtered by the soils and rocks.

Water-bearing rocks are called aquifers and are a vitally important source of clean water for humanity across the globe.

If groundwater gets polluted (from saltwater intrusion or man-made chemicals) it can be very difficult to clean up.

Groundwater is brought up to the surface by wells, using manual or electric pumps. It is then carried to people's homes in buckets or moved along a network of pipes for further treatment.

In many cities in the developing world private water sellers deliver clean water to houses but this can be too expensive for many poor households and they are forced to continue to use dirty, untreated water.

Treated water supplies are usually universally available in developed countries. But these water supply systems are expensive to run and maintain and questions of affordability for low income households are becoming increasingly common in all nations.

WHAT ARE PEOPLE DOING TO REDUCE THE AMOUNT OF WATER THEY USE AND WASTE EVERYDAY?

PEOPLE MOSTLY USE WATER IN THEIR HOMES FOR PERSONAL HYGIENE (WASHING), CLEANING AND COOKING

Drinking water generally is a very small percentage of the total water used in homes.

Preventing the use of hosepipes can provide large water savings. A hosepipe ban is often the first action initiated by water supply companies at the onset of a drought.

Collecting rainwater from roofs to use for garden irrigation, flushing toilets or laundry can save large volumes of expensive, fully-treated potable water from being used for non-potable reasons.

Short showers generally use less water than a full bath; they save energy too by using less heated water.

Toilet flushing can account for 20% of total water used in a home; low volume flushes help reduce the percentage of total water supplied for each flush.

Water efficient washing machines and dishwashers are now available; in some countries all new machines need to show water use as well as energy consumption.