

## FAQ's

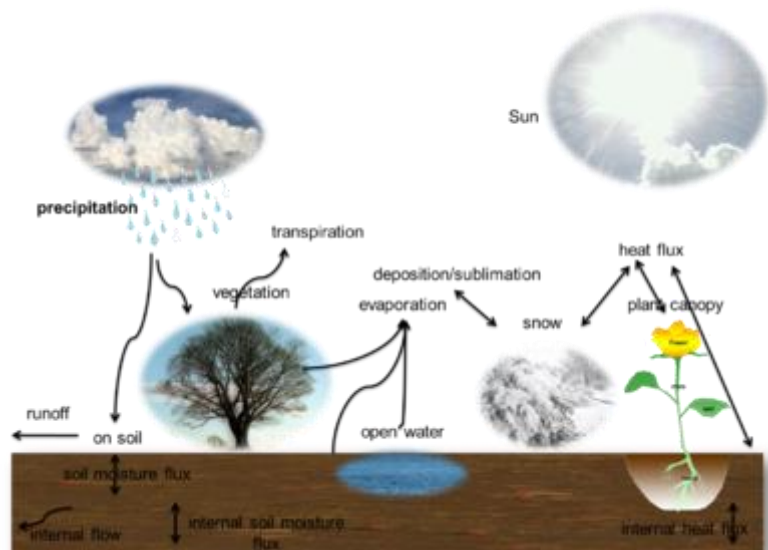
### **Discuss the hydrological cycle.**

The **water cycle**, also known as the **hydrological cycle** or the **H<sub>2</sub>O cycle**, describes the continuous movement of water on, above and below the surface of the Earth. The mass of water on Earth remains fairly constant over time but the partitioning of the water into the major reservoirs of ice, fresh water, saline water and atmospheric water is variable depending on a wide range of climatic variables. The water moves from one reservoir to another, such as from river to ocean, or from the ocean to the atmosphere, by the physical processes of evaporation, condensation, precipitation, infiltration, runoff, and subsurface flow. In doing so, the water goes through different phases: liquid, solid (ice), and gas (vapor).

The water cycle involves the exchange of energy, which leads to temperature changes. For instance, when water evaporates, it takes up energy from its surroundings and cools the environment. When it condenses, it releases energy and warms the environment. These heat exchanges influence climate.

The evaporative phase of the cycle purifies water which then replenishes the land with freshwater. The flow of liquid water and ice transports minerals across the globe. It is also involved in reshaping the geological features of the Earth, through processes including erosion and sedimentation. The water cycle is also essential for the maintenance of most life and ecosystems on the planet.

### **Processes**



Many different processes lead to movements and phase changes in water

### **Precipitation**

Condensed water vapor that falls to the Earth's surface . Most precipitation occurs as rain, but also includes snow, hail, fog drip, graupel, and sleet.<sup>[1]</sup> Approximately  $505,000 \text{ km}^3$  (121,000 cu mi) of water falls as precipitation each year, 398,000  $\text{km}^3$  (95,000 cu mi) of it over the oceans.<sup>[2]</sup> The rain on land contains 107,000  $\text{km}^3$  (26,000 cu mi) of water per year and a snowing only 1,000  $\text{km}^3$  (240 cu mi). 78% of global precipitation occurs over the ocean.

### **Canopy interception**

The precipitation that is intercepted by plant foliage, eventually evaporates back to the atmosphere rather than falling to the ground.

### **Snowmelt**

The runoff produced by melting snow.

### **Runoff**

The variety of ways by which water moves across the land. This includes both surface runoff and channel runoff. As it flows, the water may seep into the ground, evaporate into the air, become stored in lakes or reservoirs, or be extracted for agricultural or other human uses.

### **Infiltration**

The flow of water from the ground surface into the ground. Once infiltrated, the water becomes soil moisture

or groundwater. A recent global study using water stable isotopes, however, shows that not all soil moisture is equally available for groundwater recharge or for plant transpiration.

### **Subsurface flow**

The flow of water underground, in the vadose zone and aquifers. Subsurface water may return to the surface (e.g. as a spring or by being pumped) or eventually seep into the oceans. Water returns to the land surface at lower elevation than where it infiltrated, under the force of gravity or gravity induced pressures. Groundwater tends to move slowly, and is replenished slowly, so it can remain in aquifers for thousands of years.

### **Evaporation**

The transformation of water from liquid to gas phases as it moves from the ground or bodies of water into the overlying atmosphere.<sup>[7]</sup> The source of energy for evaporation is primarily solar radiation. Evaporation often implicitly includes transpiration from plants, though together they are specifically referred to as evapotranspiration. Total annual evapotranspiration amounts to approximately 505,000 km<sup>3</sup> (121,000 cu mi) of water, 434,000 km<sup>3</sup> (104,000 cu mi) of which evaporates from the oceans. 86% of global evaporation occurs over the ocean.

### **Sublimation**

The state change directly from solid water (snow or ice) to water vapor.

### **Deposition**

This refers to changing of water vapor directly to ice.

### **Advection**

The movement of water — in solid, liquid, or vapor states — through the atmosphere. Without advection, water that evaporated over the oceans could not precipitate over land.

### **Condensation**

The transformation of water vapor to liquid water droplets in the air, creating clouds and fog.

**Transpiration**

The release of water vapor from plants and soil into the air. Water vapor is a gas that cannot be seen.

**Percolation**

Water flows vertically through the soil and rocks under the influence of gravity

**Plate tectonics**

Water enters the mantle via subduction of oceanic crust. Water returns to the surface via volcanism.

Water cycle thus involves many of the intermediate processes.

**What are the different sources of water pollutants?****Sewage (Waste Water)**

Sewage is another name for waste water from domestic and industrial processes. Despite strict regulatory control, the Environment Agency data shows that the water and sewage industry accounted for almost a quarter of the serious water incidents in England and Wales in 2006.

**Agricultural Pollution**

The agriculture industry covers 76% of the land area of England and Wales. Agricultural processes such as uncontrolled spreading of slurries and manure, disposal of sheep dip, tillage, ploughing of the land, use of pesticides and fertilisers can cause water pollution. Accidental spills from milk dairies can also affect the quality of water.

**Oil Pollution**

Every year there are about 3,000 pollution incidents involving oil and fuels in England and Wales. Oil spillages affect water quality in a number of ways. Oil can make drinking water unsafe to drink. A substantial amount of oil released into oceans and seas will destroy wildlife and the ecosystems that sustain them. Oil spills also reduce

oxygen supplies within the water environment. The main causes of oil related water pollution are:

- loss from storage facilities
- spillage during delivery and;
- deliberate disposal of waste oil to drainage systems

## **Radioactive Substances**

Radioactive waste is another source of water pollution. Radioactive substances are used in nuclear power plants, industrial, medical and other scientific processes. They can be found in watches, luminous clocks, television sets and x-ray machinery. There are also naturally occurring radioisotopes from organisms and within the environment. If not properly disposed of, radioactive waste can result in serious water pollution incidents.

## **River dumping**

Lots of people dump supermarket trolleys, bicycles, garden cuttings and electronic waste into rivers or river banks. This is illegal and offenders may be charged for fly-tipping if caught. River dumping not only causes water pollution; it also harms wildlife and increases the risk of flooding. Fly-tipping (this includes river dumping) is a criminal offence

## **Marine Dumping**

The Worldwide Fund for Nature (WWF) estimates that a staggering amount of waste enters into the sea every year. Part of this is due to deliberate dumping of waste into coastal waters. Other sources of waste at sea include plastics and other materials blown or washed from land. Marine dumping is illegal under international legislation.

## **What is eutrophication?**

**Eutrophication**, or more precisely **hypertrophication**, is the ecosystem's response to the addition of artificial or

natural nutrients, mainly phosphates, through detergents, fertilizers, or sewage, to an aquatic system. One example is the "bloom" or great increase of phytoplankton in a water body as a response to increased levels of nutrients. Negative environmental effects include hypoxia, the depletion of oxygen in the water, which may cause death to aquatic animals.

Eutrophication arises from the oversupply of nutrients, which induces explosive growth of plants and algae. When such organisms die, they consume the oxygen in the body of water, thereby creating the state of hypoxia. The availability of phosphorus generally promotes excessive plant growth and decay, favouring simple algae and plankton over other more complicated plants, and causes a severe reduction in water quality. Phosphorus is a necessary nutrient for plants to live, and is the limiting factor for plant growth in many freshwater ecosystems. Phosphate adheres tightly to soil, so it is mainly transported by erosion. Once translocated to lakes, the extraction of phosphate into water is slow, hence the difficulty of reversing the effects of eutrophication.

### **Discuss two methods by which water can be purified.**

**Water purification** is the process of removing undesirable chemicals, biological contaminants, suspended solids and gases from contaminated water. The goal is to produce water fit for a specific purpose. Most water is disinfected for human consumption (drinking water), but water purification may also be designed for a variety of other purposes, including fulfilling the requirements of medical, pharmacological, chemical and industrial applications. The methods used include physical processes such as filtration, sedimentation, and distillation; biological processes such as slow sand filters or biologically active carbon; chemical processes such as flocculation and chlorination and the use of electromagnetic radiation such as ultraviolet light.

## **Membrane filtration**

Membrane filters are widely used for filtering both drinking water and sewage. For drinking water, membrane filters can remove virtually all particles larger than 0.2  $\mu\text{m}$ —including *giardia* and *cryptosporidium*. Membrane filters are an effective form of tertiary treatment when it is desired to reuse the water for industry, for limited domestic purposes, or before discharging the water into a river that is used by towns further downstream. They are widely used in industry, particularly for beverage preparation (including bottled water). However no filtration can remove substances that are actually dissolved in the water such as phosphorus, nitrates and heavy metal ions.

## **Slow sand filters**

Slow sand filters may be used where there is sufficient land and space, as the water must be passed very slowly through the filters. These filters rely on biological treatment processes for their action rather than physical filtration. The filters are carefully constructed using graded layers of sand, with the coarsest sand, along with some gravel, at the bottom and finest sand at the top. Drains at the base convey treated water away for disinfection. Filtration depends on the development of a thin biological layer, called the zoogeal layer or Schmutzdecke, on the surface of the filter. An effective slow sand filter may remain in service for many weeks or even months if the pre-treatment is well designed and produces water with a very low available nutrient level which physical methods of treatment rarely achieve. Very low nutrient levels allow water to be safely sent through distribution systems with very low disinfectant levels, thereby reducing consumer irritation over offensive levels of chlorine and chlorine by-products. Slow sand filters are not backwashed; they are maintained by having the top layer of sand scraped off when flow is eventually obstructed by biological growth.

A specific "large-scale" form of slow sand filter is the process of bank filtration, in which natural sediments in a riverbank are used to provide a first stage of contaminant filtration. While typically not clean enough to be used directly for drinking water, the water gained from the associated extraction wells is much less problematic than river water taken directly from the major streams where bank filtration is often used.