

# The Hydrosphere

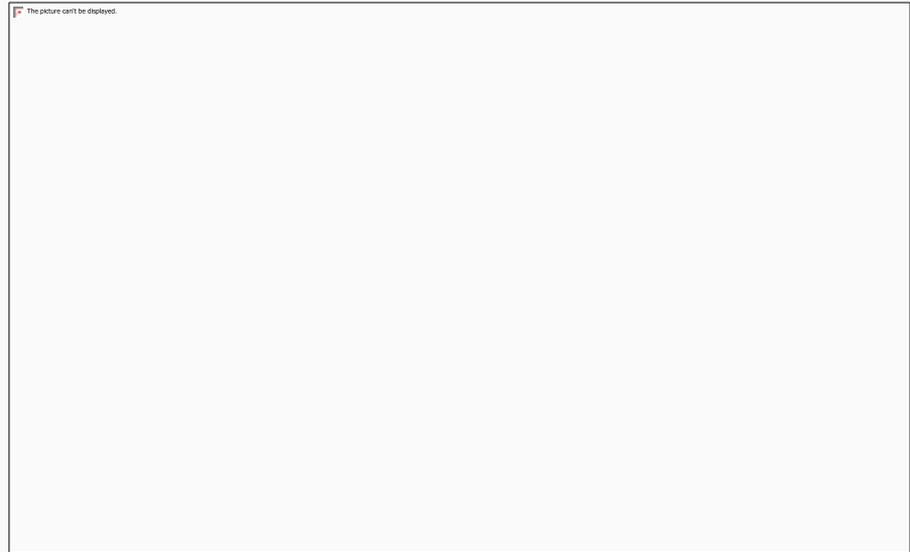
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# 1. Water Properties

The **hydrosphere** is the liquid part of the Earth.

It is the combination of all water masses in **solid** state (poles, glaciers, ice, hail and frost), **liquid** (oceans, seas, rivers, lakes, dew and groundwater) and **gas** (water vapor in the atmosphere).



# 1. Water Properties

The properties of water are:

## Physical:

1. It is colorless, odorless and tasteless
2. It freezes at 0 degrees celsius and boils at 100 degrees celsius
3. It's density is 1 kg/L at 4 degrees celsius and 0.9 kg/L at 0 degrees celsius
4. It is necessary to add a lot of heat to increase its temperature
5. It is a good solvent

**Chemical:** These properties depend on the combination of water with other molecules

1. It reacts with a wide variety of molecules
2. It binds easily to salts

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# Water Properties

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# 2. Water Distribution on Earth

## 2.1 Seas and Oceans

Seas and oceans cover almost **75% of Earth's surface**. This water is **salty**. 3% of it is composed of dissolved salts. The main type of salt is called common salt of sodium chloride (NaCl).

**Tides and ocean currents** cause water to be in **constant movement** across the planet. This fact is essential for delivering precipitation and for the climate.

# 2. Water Distribution on Earth

## 2.2 Inland Waters

They are found on the continents. They are **fresh water masses** with low concentrations of mineral salts (0.2%).

- **Glaciers** are thick masses of ice that move slowly due to gravity. They include continental **glaciers, ice caps and alpine glaciers**.
- **Groundwater** is found under the surface of the Earth. It can be found in cracks and hollows in rocks and can form **aquifers**. The upper level is called the phreatic level.
- **Surface waters** are liquid fresh water bodies on the terrestrial surface. They are the main sources of drinking water for living beings.

# Water Distribution on Earth

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## 3. The Water Cycle

The **water cycle** describes the continuous movement of water from the Earth's surface to the atmosphere as **water vapor**, and its return in solid or liquid state. Water **changes state** as it moves from one place to another. The movement towards the atmosphere is due to **solar energy**. The movement towards the Earth's surface is due to **gravity**.

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<https://www.youtube.com/watch?v=y5gFI3pMvo>  
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## **Evaporation**

a. The Sun's heat changes from liquid to vapor, which moves into the atmosphere

## **Condensation**

b. Water that infiltrates underground and slowly moves towards aquifers of the sea

## **Precipitation**

c. Water vapor gets cold in the upper layers of the troposphere and changes into liquid state

## **Retention**

d. Water changes from liquid to vapor due to transpiration and evaporation

## **Runoff**

e. When the drops of water reach a big size, they start falling due to gravity

## **Infiltration**

f. When water goes through pores and cracks and creates aquifers

## **Evapotranspiration**

g. Water can be kept in liquid state or solid state

## **Ground water**

h. The water that moves over the Earth's surface (rivers and streams) from high areas to low areas towards the sea

# 4. The Importance of Water

## **Water affects the climate:**

The presence of water in the atmosphere affects **temperature**. In coastal areas, the climate is mild. But some places experience extreme temperatures when atmospheric humidity is low (desert areas). **Precipitation** in an area depends on the amount of water in the atmosphere and on the temperature.

There are **thermal interactions** between the atmosphere and the oceans. This means that they **exchange heat**.

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**Desert zone**

Rainy zone

**Desert zone**

Rainy zone

# 4. The Importance of Water

## **Water modifies the landscape:**

Water transforms **topography** (the forms and features of the Earth's surface) by erosion, transportation and sedimentation.



# 4. The Importance of Water

## Water in living things:

Water is very important for all living things. These are some of the most important reasons:

- It is the most **abundant component** of living things.
- It serves as an **inner skeleton** for many organisms (invertebrates and plants).
- It **dissolves nutritive substances** that are in the ground.
- It is the **home** and **transportation mechanism** for many living things.

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## 5. Water Resources

Water is a **natural resource** since we find it in nature and use it to satisfy our vital needs, food requirements, energy needs and leisure needs. The combination of **all water present in nature** is called **water resources**.

# 5.1 Water Use and Management

Water is a **restricted resource** for living things and for the development of human populations. That's why it is so **important** to **preserve** it.

**Water use** by humans is classified into:

1. **Consumptive use:** It prevents the reuse of water. It includes agricultural, domestic, urban and industrial activities.
  - a. There is a loss of water.
2. **Non-consumptive use:** It does not result in the loss of water. The water can be reused. It includes uses such as transportation, leisure activities and hydropower production.

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## 5.2 Water Quality and Water Treatment

**Drinking water** is water that humans can safely drink without damaging their health. Its **characteristics** are: *it has the right quantity of gases and mineral salts; it's odorless, colorless and has a pleasant taste; it does not contain harmful chemical substances; it's pathogen-free.*

**Water treatment** is a set of physical and chemical processes that turn natural water into **drinking water**. This process is done at a water treatment plant.

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## 5.3 Water Pollution

The main sources of water **pollution** are:

- **Pesticides and fertilizers** from agricultural activities
- **Dumping** of industrial waste into seas and oceans
- **Toxic gases** from factories and vehicles in atmospheric water vapor
- **Wastewater** from domestic and urban activities

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## 5.4 Water Purification

**Polluted water** must be treated to remove physical, chemical and biological pollutants, which are then **dumped into the environment**. This is done at **sewage treatment plants**.

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# 5.5 Environmental Problems Related to Water

The **main problems** of water pollution are:

- The **salinization of groundwater** in aquifers located close to the sea
- The **pollution of drinking water** by agricultural or industrial substances
- The **accumulation of floating solid waste** in seas and oceans
- The disproportionate growth of **microorganisms** in lakes and lagoons due to the increase of nutrient (phosphates and nitrates) runoff
- The **alteration of the water cycle** due to the modification of river courses
- Serious health risks for humans and ecosystems

