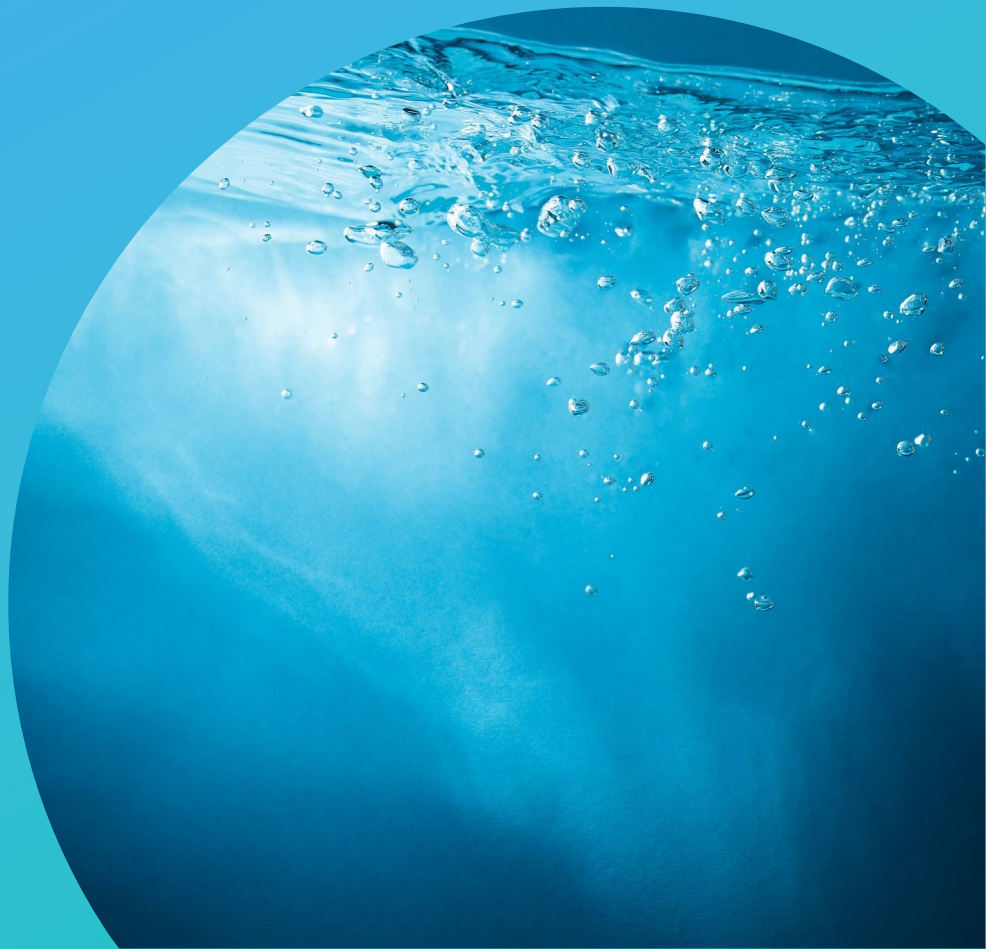
WAVES

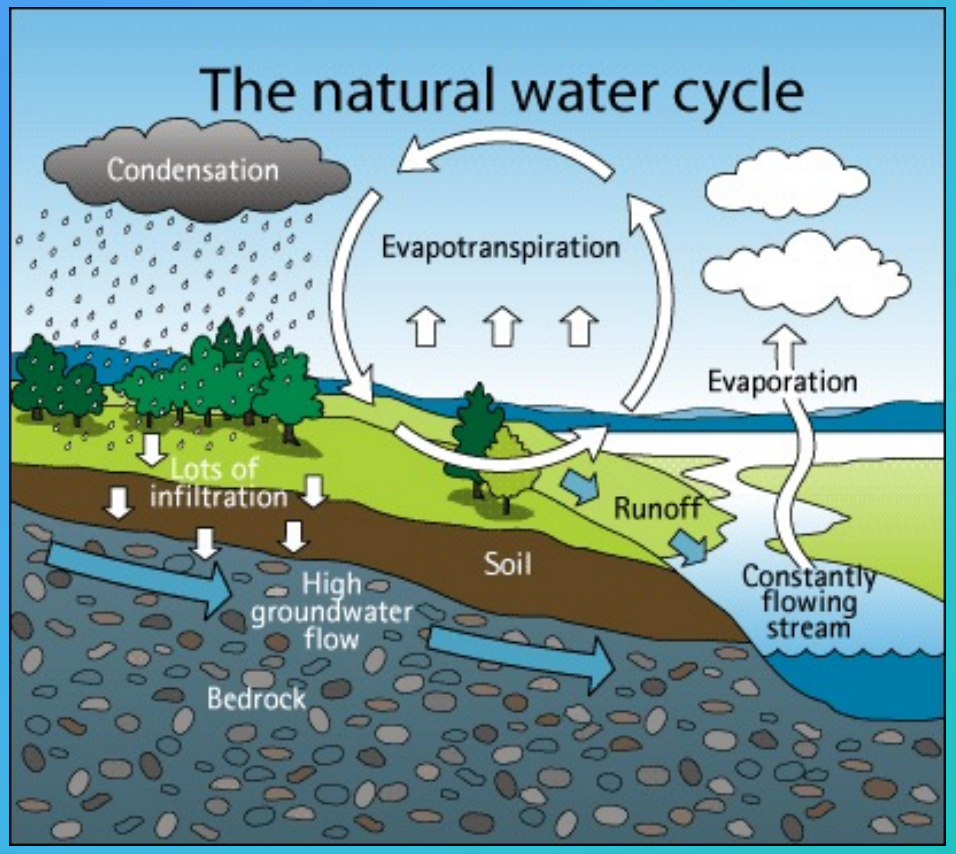
Water **A**wareness and **V**alue for
Environmental **S**ustainability

MODULE 1: INTRODUCTION TO WATER



Water: The Molecule of Life

- Covers 71% of Earth’s surface.
- 96.5% of Earth's water is saltwater found in oceans, while only 2.5% is freshwater.
- Essential for all living organisms
- Exists in three states: liquid, solid (ice), gas (water vapor).



The Natural Water Cycle

- Driven by the sun's energy
- Continuous loop of water movement
- Essential for all life on Earth
- Consists of five main stages (evaporation, condensation, precipitation, collection, and runoff)

Evaporation and Transpiration

EVAPORATION: LIQUID WATER TRANSFORMS INTO WATER VAPOR (GAS)

TRANSPIRATION: PLANTS ABSORB WATER THROUGH THEIR ROOTS AND RELEASE A SIGNIFICANT AMOUNT AS WATER VAPOR THROUGH THEIR STOMATA.

LIGHT ENERGY FROM THE SUN POWERS BOTH EVAPORATION AND TRANSPIRATION.

Condensation

Condensation is the process where water vapor becomes liquid

How it occurs:

Cooling to Dew Point: Air cools to its dew point.

Saturation: Air becomes so saturated with water vapor it cannot hold any more water.

Cloud Formation: As water vapor rises, it cools and condenses to form clouds.

Precipitation and Runoff

Precipitation Formation:

Water vapor condenses into larger droplets in clouds.

When droplets are heavy enough, they fall as precipitation.

Types of Precipitation:

Rain: Falls to the earth.

Ice: Forms in colder clouds at higher altitudes.

Post-Precipitation:

Groundwater: Some water is absorbed into the ground, forming groundwater pockets.

Runoff: Other water flows into streams, rivers, and oceans.

Water Cycle:

Continuous loop of water movement.

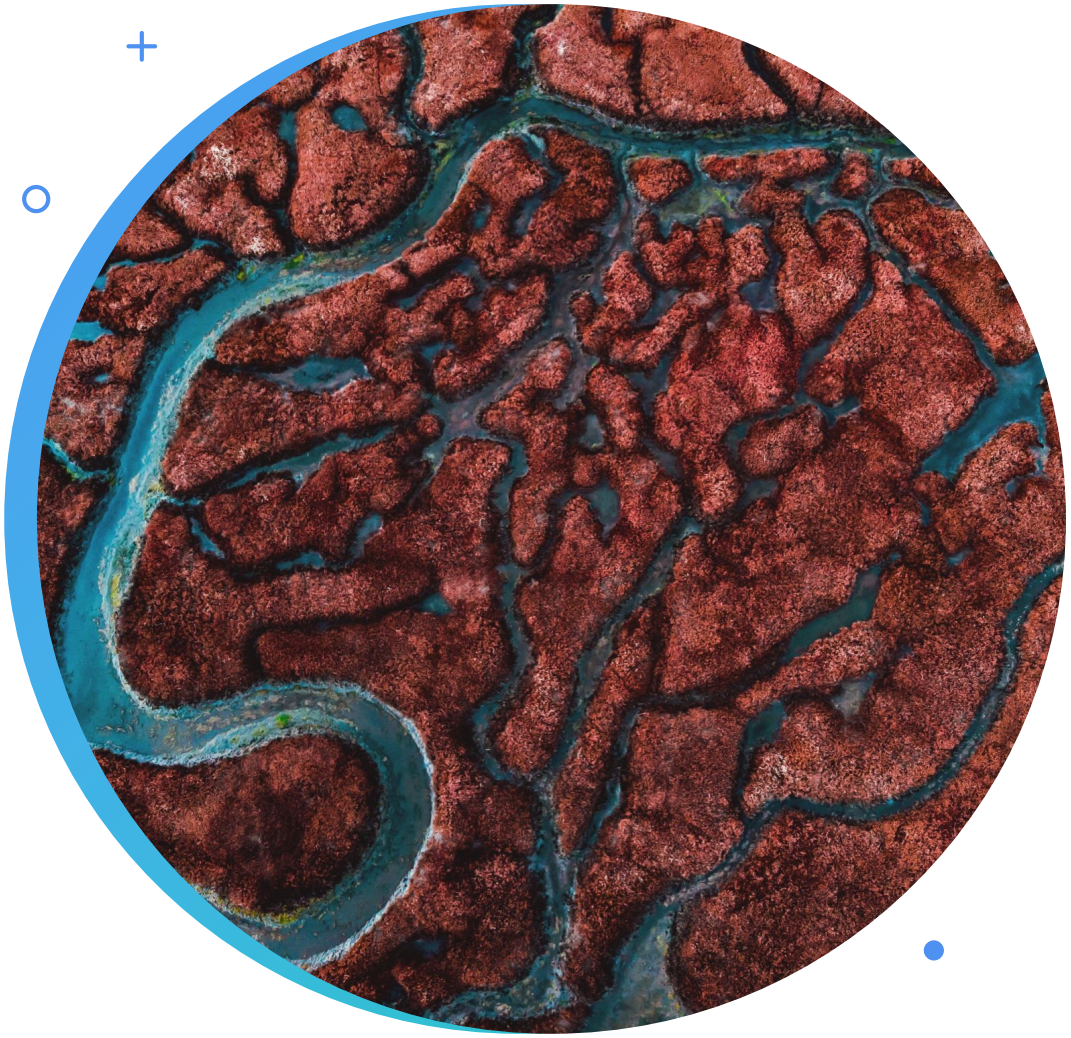
Ensures a constant supply of freshwater essential for all life on Earth.

Stores of the Water Cycle

- Water in the atmosphere in the form of water vapour or water droplets in clouds
- Surface stores such as puddles, lakes, rivers and reservoirs
- Interception is how precipitation is prevented from reaching the ground, usually by being caught on leaves or branches
- Aquifers are permeable rocks such as limestone and sandstone which can hold water
- Ice and snow
- Seas and oceans

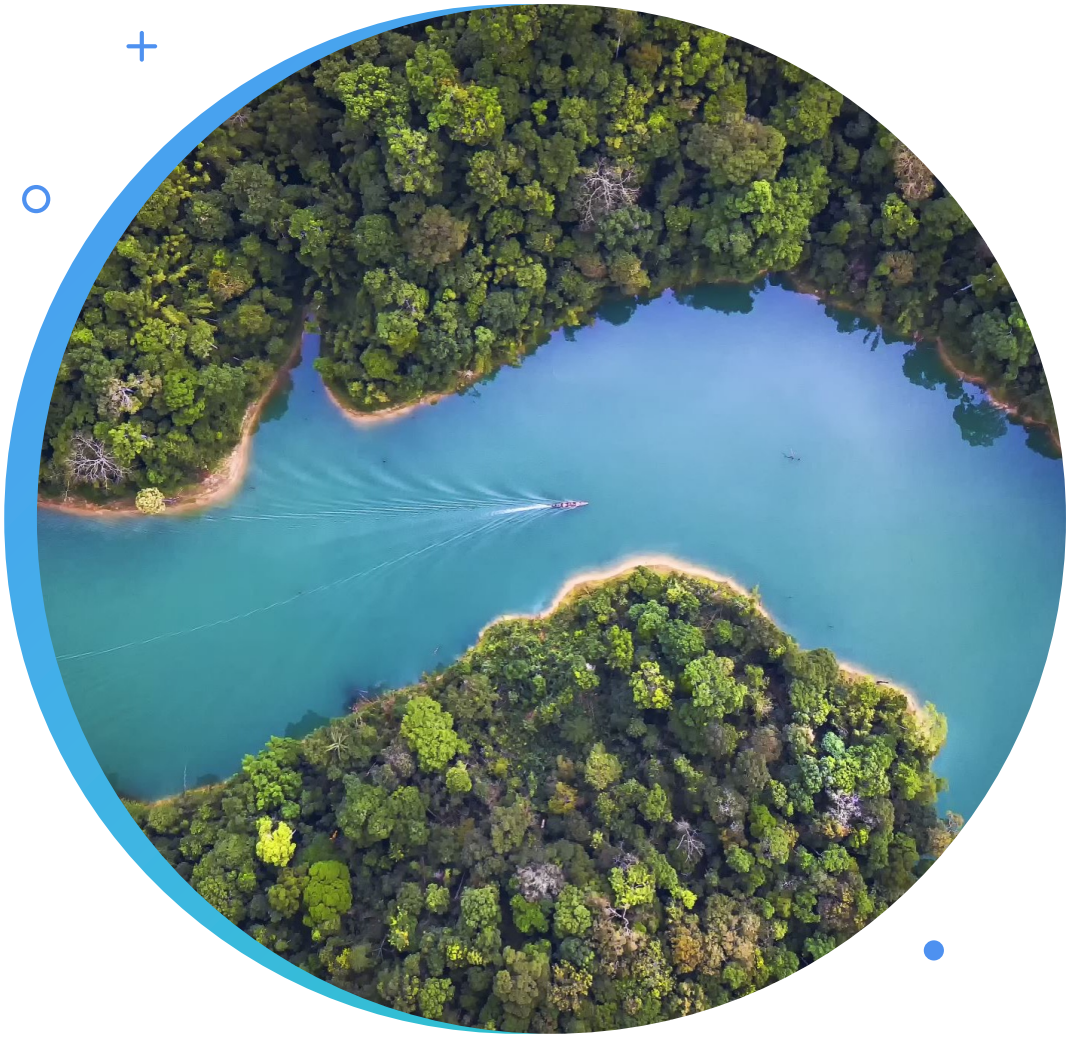
Water's Temperature Regulator: High Heat Capacity

- Heat Capacity is the amount of heat required to change the temperature of one gram of a substance by one degree Celsius.
- For water, this amount is one calorie or 4.18 Joules.
- **Key Characteristics:**
  - Water has a high specific heat capacity.
  - Requires a lot of energy to raise its temperature.
- **Significance:**
  - Moderates Earth's climate.
  - Stabilizes aquatic environments.
  - Helps organisms maintain their body temperature.



SURFACE WATER: RIVERS, LAKES, AND MORE

- Surface water constitutes only about 0.3% of Earth's freshwater.
- Vital for drinking water, irrigation, recreation, and transportation. Vulnerable to pollution from various sources.



GROUNDWATER: THE HIDDEN RESERVOIR

- Groundwater makes up about 97% of Earth's freshwater.
- Stored in underground aquifers, layers of rock and soil saturated with water.
- Accessed through wells and springs.
- Over pumping and contamination can lead to depletion and quality degradation.

The Global Water Challenge: Scarcity and Unequal Distribution

- **Freshwater Scarcity:**
  - Freshwater is a finite resource with uneven distribution.
  - Scarcity due to climate change, population growth, and inefficient use.
  - Affects human populations, ecosystems, and economies.
- **Water Distribution Patterns:**
  - **Equator:** Ample water due to high rainfall.
  - **North of Equator (~30°):** Physical water scarcity, arid conditions.
  - **South of Equator (~30°):** Some water scarcity, less severe, varied latitudes.
  - **High Latitudes:** Sufficient rainfall for freshwater supply.
- **Exceptions:**
  - High population densities (e.g., UK).
  - Economic water scarcity due to poverty (e.g., Nigeria).

WATER AND HEALTH: THE ESSENTIAL LINK

- **Importance:**
  - Fundamental human right and essential for a healthy life.
  - Prevents waterborne diseases (cholera, typhoid, dysentery).
  - Improves public health and well-being.
- **Current Challenge:**
  - 1 in 4 people lack access to safe drinking water.
  - Unsafe water causes over a million deaths annually.
- **Action Needed:**
  - Invest in clean water infrastructure and sanitation.
  - UN Goal 6: Ensure access to water and sanitation for all by 2030.
  - Urgent need for accelerated progress to meet this goal.

Pop Quiz

How does the unique molecular structure of water contribute to its remarkable properties as a solvent, its high heat capacity, and its ability to form hydrogen bonds?

Why is evaporation important for cooling the Earth's surface and regulating global temperatures?

How do tiny water droplets or ice crystals in clouds grow and eventually form precipitation?

What happens to precipitation after it falls to the ground?

Pop quiz

How does water's high heat capacity help regulate Earth's climate and stabilize temperatures in aquatic environments?

What are the main factors contributing to water scarcity in different regions of the world?

What are some of the most common waterborne diseases, and how are they transmitted?