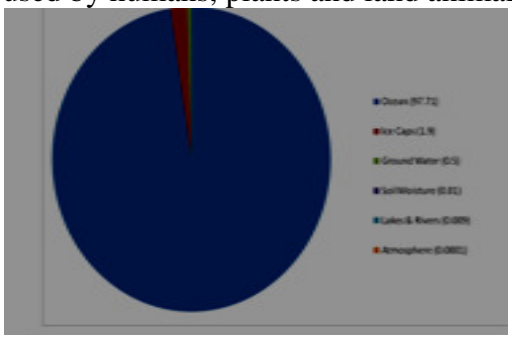
27A. GLOBAL CIRCULATION OF WATER

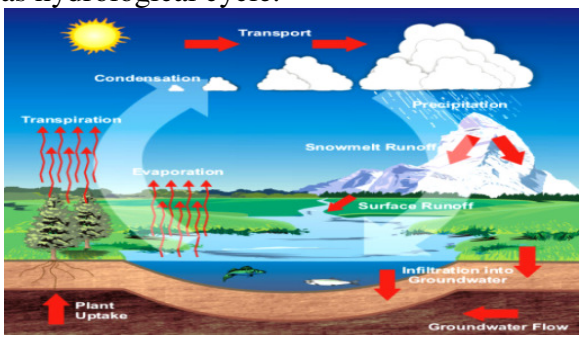
- Water is one of our most precious resources.
- Over 97% of the water on earth is salt water which is present in the oceans. We cannot drink salt water or use it for irrigation of crops.
- While only 2.7% of the water present on earth is fresh water that contains less than 1000 ppm of dissolved solid of any type.
- About 2% of the earth's fresh water (i.e. about 66% of all fresh water) is in solid form, locked in ice caps of Antarctica and glaciers that occupy high alpine locations.
- Only 1% of all the earth's waterr is in a form that can be used by humans, plants and land animals.



- The fresh water is found in lakes, rivers, streams, ponds and in the ground and only small amount (0.001%) of water is found as vapor in the atmosphere.

- The distribution of fresh water, however, is geographically uneven, varying greatly from country to country and even within a country from one region to another region.
- Though water is a renewable resource, but fresh water is finite.
- Fresh water is a scarce resource in many parts of the world including India. It is under increasing pressure as a result of pollution of water sources and increasing demand of the growing population.
- **IMPORTANCE OF WATER FOR LIFE AND HABITAT**
  - Water is also an important ecological factor that determines the structure and functioning of ecosystem.
  - The cycling of all other elements depends on water as it serves as a medium for their transportation during the various steps and is the solvent medium for the nutrient uptake by the plants and other organisms.
  - Fresh water ecosystems are the main sources for drinking water, agriculture, industry, sanitation, as well as for fresh water fisheries.
  - Fresh water also provide recreational opportunities (Swimming, rafting, snorkeling) and a means of transportation (Ships, boats, canoe etc).
  - Fresh water ecosystems are home to numerous organisms (Fish, amphibians, aquatic plants and invertebrates). It has been estimated that 40% of all known fish species on earth are found in fresh water ecosystems.
  - Water is a necessity for all life on earth.
  - Human survival since the ages depends on the relationship between human settlements and availability of fresh water resources.
  - Per capita availability of fresh water is declining all over the world. Water crisis has not only affected crop production but it has also impacted the environment quality, wildlife and other living creatures.
  - It is the most important component of protoplasm in the cells of living organisms, 70% of our body is made up of water.
  - Water is also the only source of hydrogen and one of the many sources of oxygen available to the body through metabolic processes.

- **GLOBAL HYDROLOGICAL CYCLE**
  - Continuous movement of water in all its forms (ice, liquid and vapour) by a system is known as hydrological cycle.



  - It involves the following three processes evaporation and evapotranspiration; precipitation and surface runoff.
  - Atmospheric water, surface water and ground water are all part of this hydrological cycle.
- **Evaporation and evapotranspiration**
  - The largest reservoirs of water on the earth's surface are the oceans, seas and other water bodies like lakes, rivers and streams provide about 90% moisture to the atmosphere through evaporation each day.
  - So evaporation can be defined as the phase where there is change of liquid water into vapour or gas on heating. The sun is the source of heat.Water from atmosphere is carried upwards by the rising air currents.
  - Some portion of water vapour enters the atmosphere through sublimation, a process by which water changes from solid state which is ice, directly into vapour without changing into liquid form.
  - Plants loose large quantities of water through transpiration releasing about 10% of the water in the atmosphere.
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- **Precipitation**
  - High up in the atmosphere the air cools and loses its capacity to hold water vapour. As a result the excess water condenses i.e., changes from vapour to liquid and forms cloud droplets. The droplets ultimately grow in size and cause precipitation.
  - There are four major types of precipitation namely drizzle, rain, snow and hail. Thus most of the water is returned to the oceans and on land in the form of rain, snow, hail etc.
- **Surface runoff**
  - When precipitation falls over land, it travels through various routes. Some of it evaporates back into the atmosphere; some of it enters the ground and is stored as ground water.
- Ground water is found in two layers of the soil:
  - Zone of aeration where the gaps are completely filled with water. Zone of saturation where the gaps are filled with air as well as water.
  - Boundary between these two zones is known as the water table, which rises or falls as the level of ground water increases or decreases.
  - At different stages of the water cycle human beings and other organisms intercept it and withdraw water for their use.
- **Balance and Stores of Water**
  - If all of this ice were to melt then it would release enough water to keep the rivers of the world flowing for up to 1000 years!
  - Table shows natural stores of water in the global hydrological cycle

Stores	Percentage (%)
Oceans	97.71
Ice caps	1.9
Ground water	0.5
Soil moisture	0.01
Lakes and rivers	0.009
Atmosphere	0.0001

  - As water continually evaporates, condenses and precipitates, the rate of evaporation and rate of precipitation at a global level is equal and the total amount of water vapour in the atmosphere is approximately the same over

time. But evaporation over the continents is less than precipitation while the converse is true over the oceans.

- **INDUCED CHANGES IN THE HYDROLOGICAL CYCLE**
  - Human activities deliberately or accidentally have changed the global water cycle in many ways.
  - The movement of water vapour across oceans and continents are altered by air pollution which causes global warming.
  - Causing changes in precipitation patterns inevitable as precipitation is dependent on ambient temperature.
  - Evaporation rate and pattern change due to altered ground surface conditions.
  - Increasing or decreasing the length or density of the river channels, can directly change river runoff.
  - Ground water can be affected by pumping out excessive water that lowers the water table or through increased percolation due to water logging to development of reservoirs and dam
  - Altering the vegetation pattern from deforestation, cropping or afforestation etc. can significantly greater influence of runoff water.

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Check Yourself

1. The phase where water is released in the form of snow or hail is known as:
   a. Precipitation
   b. Condensation
   c. Evaporation
   d. Sublimation
2. Water can be stored in the body of living organism for:
   a. 10-20 days
   b. 180 days
   c. 14 days
   d. 27 days
3. Evaporation over the continent is :
   a. More than precipitation
   b. Less than precipitation
   c. Equal to precipitation
   d. Cannot compared
4. Most of the fresh water is store is in the form of:
   a. Ice caps and polar region
   b. Ocean
   c. Sea
   d. Lakes
5. Hydrological cycle is driven by:
   a. Tidal energy
   b. Solar energy
   c. Wind energy
   d. Electrical energy

Ans: 1.a 2.b 3.b 4.a 5.b

Stretch Yourself

1. Why do we need to fresh water?
2. Define water table.
3. How much percentage of fresh water available on the earth?
4. How does precipitation occur?
5. Define the terms: evaporate on, transpiration and precipitation.

Test Yourself

1. Water is most important renewable natural resource on the earth." Justify this statement in your words.
2. Describe main process of hydrological cycle.
3. Mention reasons about to induce changes in the hydrological cycle.
4. "Human activities alter the global hydrological cycle in several ways. "Explain in brief.