Water: A Precious Resource

Sources of Water

Do you know that on an average an individual consumes about 2.9 litres of water everyday?

Water is required not only for drinking but also for many other purposes in our day-to-day lives.

Irrigation in agriculture, industrial processes, domestic purposes such as cooking and cleaning are some of the major uses of water.

What are the sources of water?

We know that water is available from various sources. Some of the common sources of water are ponds, lakes, rivers, wells, and reservoirs.

The water that we use in our homes is supplied from these sources. In villages, people directly use water from the ponds, rivers, lakes, canals, reservoirs etc.

Is water in icebergs salty?

The water in icebergs is not salty, rather it is fresh water. This can be explained by the principle of freezing. Iceberg is the solidified form of water. During the process of solidification the water molecules come close to one another and get packed tightly. This leaves no space for the molecules of salt.

Where does the water in these ponds, lakes, rivers, and wells come from?

Recall a picture of the globe. The area covered by the land is very small as compared to the area covered by water. Water covers two-third (2/3) of the total surface area of the world.

Interestingly, did you know that some of the water from the oceans and seas evaporates and is the primary source of rain? Rainwater feeds into the ponds, lakes, rivers, and wells etc, which in turn are the main sources of water for us.

You may be familiar with instances of the taps in your house running dry for days at a stretch, on account of a shortage of water in your city. We know that there are places in this country where the shortage of water is so severe that people stand in long queues to fetch a few buckets of water! In the villages people have to fetch water from very far distances.

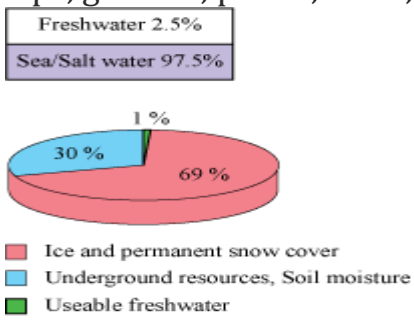
There are numerous fights over water. Marches and protests, against the unavailability of this valuable resource, are fairly common. All these problems are due to the limited availability of fresh water as a resource.

Interestingly, did you know that another name for our planet is '**Blue planet'?** This is because our planet appears to be blue in color when seen from the outer space. This color is because a vast area on Earth is covered with water.

You may know that about 71% of the total surface area of the Earth is covered with water that is contained in the oceans, seas, lakes, rivers, ponds, etc. The remaining 29% is the land surface area. If such a large area is covered with water, then **why is there a scarcity of water?**

Water on the Earth is found in the oceans, seas, lakes, ice caps, rivers, ponds, under the ground, and also in the atmosphere as vapor. The oceans and seas alone account for about 97.5 % of the total water found on the surface of the Earth. This water from the oceans and seas is not suitable for human consumption as it is salty. The remaining 2.5 % is fresh water and is found

trapped in the ice caps, glaciers, ponds, lakes, rivers and underground water that is suitable for use.



Source of fresh water	**Percentage**
Ice and glaciers	69%
Ground water	30%
Surface water	1%

We basically use both surface water and ground water. We obtain ground water by using wells and tube wells.

This is the reason why we face scarcity of water.

Let us perform an activity to understand the amounts of water available in different forms

Collect the items listed below

- A test tube
- A ladle or dropper of 5 ml capacity
- A beaker of 500 ml or larger capacity
- A bucket with a capacity of more than 20 litres
- A small beaker of 150 ml capacity

1.Pour 20 litres of water in a bucket.

These twenty litres of water represents the total water available on Earth.

2.When 100 ladles of water from this bucket is removed it amounts to 500 ml of water. (100 ladles of 5 ml capacity each)

This 500 ml of water in the beaker represents the fresh water available on the Earth.

3.When 30 ladles of water from this beaker is transferred to another beaker, it amounts to 150 ml of water. (30 ladles of 5 ml capacity each)

This 150 ml or 30 ladles full of water represents the usable ground water.

4.When a quarter or $\frac{1}{4}$th of this 150 ml of water is removed into another beaker, it amounts to 37.5 ml or 7.5 ladles of water. (A quarter of 150 ml means $\frac{150}{4} = 37.5 \text{ ml}$ of water, i.e. 7.5 ladles of water)

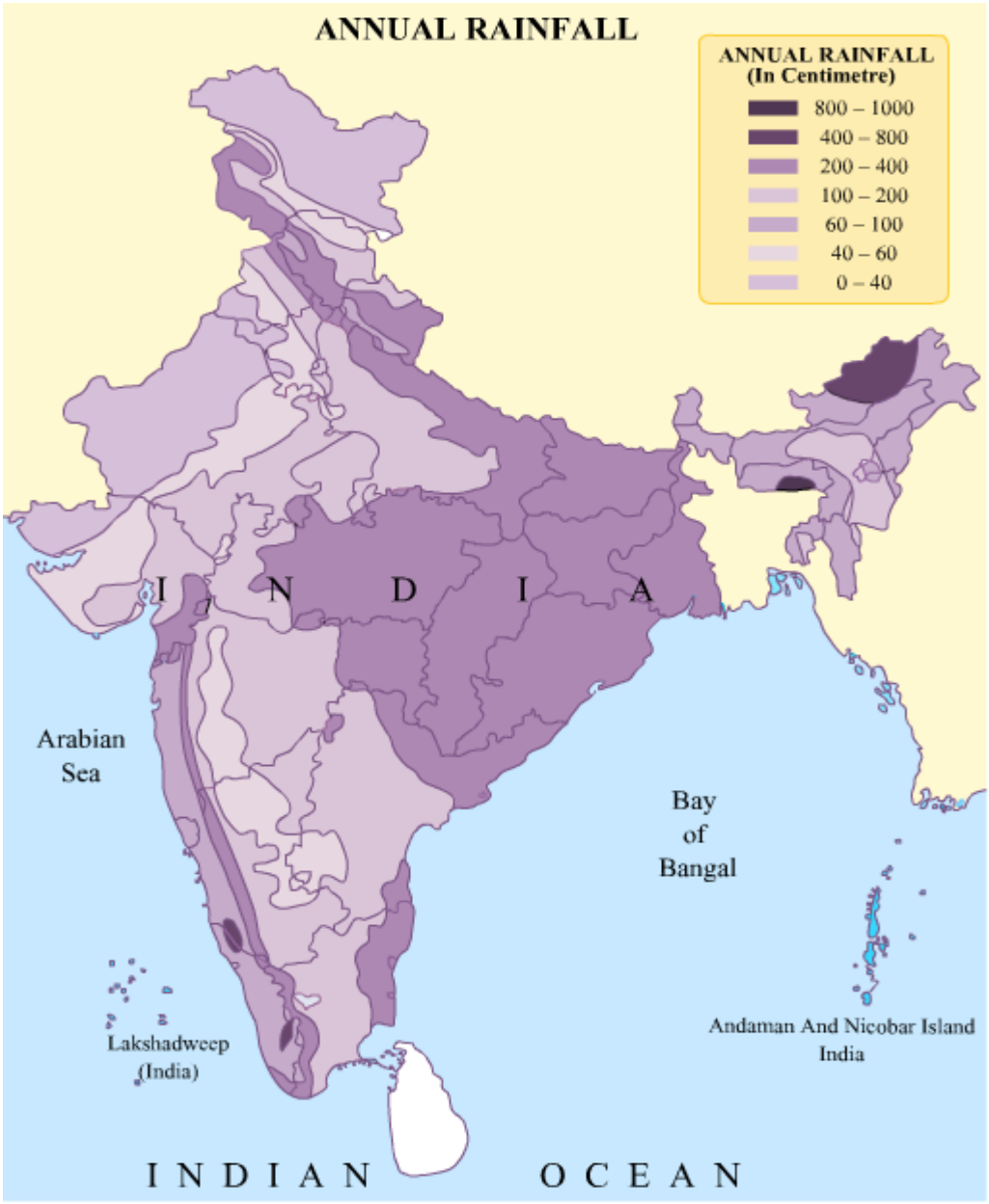
This 37.5 ml or 7.5 ladles represents the water in all lakes, rivers, ponds etc of the world.

Thus, the quantity of usable water that is available on the Earth's surface is very small in comparison to the total available water on Earth. Therefore, water is indeed a limited resource and should be conserved.

Distribution of Water in India

In India, water availability is greatly dependent on the seasonal monsoons. The distribution of rain water varies in different parts of the country. Some regions such as the north eastern states and the Western Ghats receive excess rainfall while
regions of western India such as the Thar desert of Rajasthan do not receive adequate rainfall.

This uneven distribution of rain causes floods in some areas and droughts in the parts where there is scanty rainfall.
The given map shows the average annual rainfall received by the different parts of India.



Water Cycle

Physical States of Water

Water is found in solid, liquid, and gaseous states in the environment. In the solid state, it is found in the form of ice, and as a liquid, it exists as water. It is present as water vapour in the gaseous state.

Physical Properties of Water

- Water is a colourless, tasteless, and transparent liquid. It also has no smell.
- Boiling point of pure water is 100°C at 760 mm of Hg pressure. However, boiling point of water increases due to increase in pressure and presence of dissolved impurities.
- Pure water freezes at 0°C at 760 mm of Hg pressure. However, freezing point of water decreases due to increase in pressure and presence of dissolved impurities.
- The state of water changes on heating or cooling. On heating, the state of water changes from liquid state to gaseous state (vapour). Similarly, on cooling, the state of water changes from liquid state to solid state (ice).
- Pure water is a bad conductor of heat and electricity.
- Water absorbs a fixed amount of heat. It has been found that 1 g of water always absorbs 4.2 J (=1 Calorie) of heat energy when heated through 1°C. This fixed amount of heat energy is called specific heat capacity. Specific heat capacity is the fixed amount of heat energy required to raise the temperature of 1 g of water by 1°C.

Water undergoes different processes in the environment and is found in different states during these processes. This cyclic process through which water circulates in the environment is called the **water cycle**.

Let us first describe the process of water cycle for you.

By now, you know the steps involved in a water cycle. Now, let us look at each step.

Evaporation

Have you observed that when the floor is wiped with water, the water dries up in some time? The roads and buildings that become wet after rainfall, dry up soon after. You may have also observed that the water level in a container reduces when it is kept in it for a long time.

Where is all this water disappearing?

The process whereby water disappears into air is called **evaporation**. During evaporation, liquid water is converted into gaseous water vapour.

How does evaporation occur? What are the factors that affect evaporation? Let us understand.

Wet two handkerchiefs and squeeze out the water. Dry one of it outside in the sun and the other inside a room. Observe the time taken for both of them to dry. Do they take the same amount of time?

The handkerchief that was put out to dry in the sun dries up faster than the one inside the room. This is because the heat from the sun speeds up the time taken for evaporation. Thus, ***heat is essential for evaporation.***

Then how did the handkerchief inside the room dry?

This is because the heat from the sun also heated the air inside the room, although indirectly. This warm air converted the water on the handkerchief into vapor. Since direct sunlight did not reach the room, the handkerchief took longer to dry.

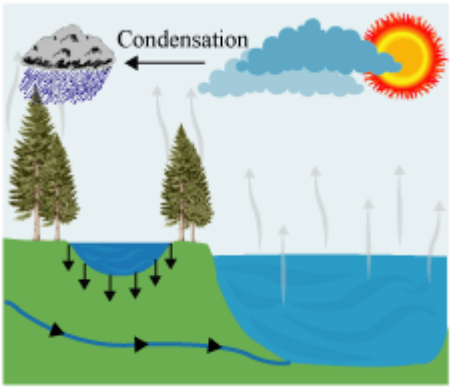
When water is poured over plants kept in pots, it is absorbed by the plant roots. Water is essential for plant growth. The plant utilizes the required quantities of water and the excess water is lost by the surface of the leaves as vapor through the process of ***transpiration.***

Thus, we can say that evaporation and transpiration are the processes by which water is converted into water vapor.

Since sunlight falls on all the water bodies such as oceans, seas, lakes, ponds, and rivers, water is being continuously converted to water vapor. Where does all this water vapor go? Does it disappear forever?

Condensation

As water vapor moves higher up, it cools down and forms water droplets through the process of **condensation**. Many water droplets join together to form clouds.



Precipitation

The water vapour that condenses as clouds falls down as rainfall, snow, or hail by the process of precipitation.

When clouds are large and laden with water, the water begins to fall as **rainfall.**

This rain enters the rivers, ponds, lakes, and other water bodies.

Some of the rainwater that falls on the ground enters the soil and adds to the **groundwater.** The returning of rain water into large water bodies and groundwater is known as **run off**.

This groundwater can be a source of water for the lakes. It can be drawn out using hand pumps and tube wells and utilized. The overuse of groundwater, however, can reduce its availability, thereby increasing water scarcity. When the

land surface is covered with concrete, the amount of rainwater that can enter the soil drastically reduces, leading to a further decrease in the availability of ground water.

Thus, we now understand that water enters the atmosphere as water vapor by the processes of evaporation and transpiration. Water vapor condenses to form clouds and falls as rain. Rain water again runs off to large water bodies such as rivers, lakes, oceans, or groundwater.

Rajat wanted to observe the various processes that cause a change in the state of water in the environment. Let us try and mimic the processes.

Did you know that when rainwater flows on the ground, it washes away the valuable top soil? When this top soil is lost, plants cannot grow. This process is called soil erosion.

Water is found in many different states and these states keep changing depending on the temperature and other environmental conditions.

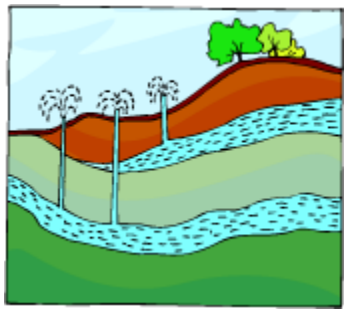
More to perform, observe, and learn

We can observe the processes that occur in the environment in our everyday lives. Do you notice that when water is placed in ice trays and kept in a freezer, it changes into solid ice cubes? Further, when water is heated in a pan, it changes into gaseous vapors. You may also have observed that on heating water in a container that is covered with a lid, the water vapour cools down after some time to form droplets of water under the lid! When a glass filled with icy cold water is kept on the table, in normal temperatures, small droplets of water are formed over the external surface of the glass.

Origin Of Ground Water

When we dig into the ground, we find that the underground soil contains moisture.

On digging deeper, the moisture in the soil increases. After a certain distance inside the ground, we find water. This is ground water.



The water that is found under the surface of the Earth and is responsible for the presence of water in the wells, tube wells, and springs is called **ground water**. The porous regions in the soil and gaps in between the rocks are filled with this ground water. The upper limit of this layer of ground water, which fills into all the porous spaces between the soils, is called the **water table**.

The amount of water in the water table varies from place to place.

Sometimes the water table of a place is found at a depth of less than a metre whereas in another place, it may not be found even at a depth of hundreds of metres!

India's deepest ground water table (as recorded in 2006) is at Madhudi village in Agali Mandal, Andhra Pradesh.

What is the source of this ground water?

Rain water and water from the other water bodies on the surface of the Earth seeps down into the soil and is stored as ground water. This passing down of water through the soil is known as **infiltration.**
At places the groundwater is stored between layers of hard rock below the water table. This is known as an aquifer. Water in the aquifers can be usually pumped out with the help of tube wells or handpumps.

Having difficulty in understanding?

Now do you know from where the water comes in wells and hand pumps?

Depletion Of Groundwater Table

Ground water is the rain water that infiltrates into the soil. Although the amount of ground water available is high in some regions and low in other regions, its utilization is uniformly high across all regions.

Extracting larger quantities of ground water than the amount seeping into the soil has resulted in the depletion and exhaustion of the available groundwater reserves.

Many factors have led to a decrease in the groundwater table. Some of them are listed below

- Increase in population
- Increased industrial activities
- An increase in agricultural activities
- Scanty rainfall
- Deforestation

Let us discuss a few major factors in detail

Increase of population

With an increase in population there is an increased demand for essential factors that help support human life. Water is one such essential factor. With an increase in population, the amount of water utilized has also increased.

The open areas which allow rain water to seep in have decreased as a result of construction of houses and other facilities to support the growing population. This has led to a further decrease in the quantity of ground water.

Industrial activities

With an increase in population, there has also been an increase in the demand for many industrially manufactured products. In order to support this demand, more and more industries are coming up. All industrial processes require water. Therefore, industrial expansion has led to an increase in the amount of water consumed by industries which has led to a further depletion of ground water.

Agricultural activities

India is an agricultural country. About 72% of its population is dependent on agriculture. We know that agriculture depends upon the availability of water. Farmers use water obtained from various sources like

- Ground water
- Rain water
- Canal water etc

The use of ground water for agricultural purposes has resulted in the depletion of ground water reserves. An increase in the rate of agricultural activities, will lead to a further depletion of ground water reserves.

Availability of water

In some regions the amount of water resources that is available is sufficient for the needs of the people. However, there are several other regions that face an acute shortage of water. Every year, we hear of droughts and floods in several parts of India. One of the main reasons for this uneven distribution of water is unequal rainfall. This directly affects the ground water reserves. If rainfall is scanty, then the amount of water that infiltrates into the ground to recharge the groundwater reduces. This makes the water table go down.

Proper use of water

If we look carefully at the water supply system of towns and cities, we would observe a well planned pipe system. The water supply authority supplies water through this system.

However, we commonly observe that a large quantity of water is lost due to leakage of pipes etc. This results in the wastage of precious water. Such wastages should be avoided since water as a resource is limited and needs to be conserved.

Wastage of water or mismanagement of water resources can take place both at the individual and authority levels. Let us look at some ways in which we can help minimize the wastage of water

While brushing our teeth, shaving, washing, cleaning, bathing etc, we should not keep the taps running as this leads to a lot of water being wasted. In order to conserve water, care should be taken to minimise the amount of water used during all these activities.

The government authorities on their part should take care to immediately repair the supply lines that are faulty and leaking.

Let us summarise the steps that can be used to conserve water

- Turning off the taps while we are brushing, shaving etc.
- Using only the required quantities of water during bathing
- Using a bucket and cloth for washing vehicles instead of a hose pipe
- Mopping instead of washing while cleaning the floor etc.

Consequences of depleting water reserves on the environment

Depleting water reserves will not only affects us, but also the plants. Plants need water and nutrients from the soil. They use carbon dioxide and water to prepare food and release oxygen in the process.

Thus, if all the green plants of the Earth are lost, then there will be no oxygen available for our survival.

Rainwater Harvesting

Water is a precious resource. However, as a result of over utilization and negligence on the part of humans, a considerable amount of it is wasted.

Wastage of water occurs at many places. Some instances include

- When the municipal water supply pipes leak or break, it results in a lot of water being wasted
- When we keep the taps running during shaving, bathing, washing, etc., we waste a lot of water
- Rain water, a valuable source of water flows into the drains, etc and gets wasted

In order to prevent this loss of water we need a proper system for the management of water.

Planned development, effective distribution and limiting the amount of water utilized for all activities are factors underlying the principle of water management.

Some of the methods which help in managing the water resources are discussed below

Rainwater harvesting

Collecting rainwater for use in future by storing it in storage reservoirs is called rainwater harvesting.

When rainwater falls on the ground, it runs down into the lakes, rivers, ponds, seas, and oceans. Some of it also evaporates into the air. Thus, precious rainwater is lost. To stop this loss of water, rainwater is collected and stored for future use. It is done by using different methods listed below.

In rooftop rainwater harvesting, the water storage tank is always installed below the ground level.

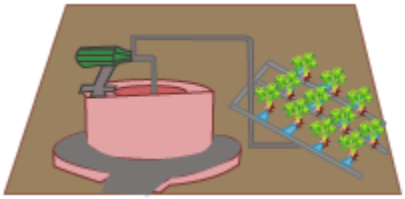
Rainwater storage as ground water

Another simple method of conservation of water is to allow the rainwater that falls on the ground to be absorbed into the soil so as to increase or add to the ground water content.

A 2400 sq feet area that receives an average rainfall of about 120 cm annually (a moderate rainfall area) can harvest about 22, 9000 litres of water. Therefore, if rainwater is conserved, then scarcity of water will definitely decrease.

In India rain water harvesting is an age old practice followed in many areas. Have you heard of ***Bawris***? These are traditional architectural wonders that were built in the state of Rajasthan. They were used for collecting water. In course of time, these traditional structures became unused and waste materials started to deposit on these reservoirs.

Acute shortage of water in these areas forced the people to start thinking again about the traditional methods of water harvesting.



Many traditional and scientific agricultural techniques help to reduce the rate of water consumption. One such method in agriculture is **drip irrigation**.

Drip irrigation is a method of irrigation in which irrigation water is supplied to the plants directly using small pipes, thereby reducing both the consumption and loss of water.

Effects of scarcity of water:

Health:
In many developing countries, people are forced to drink low quality water from flowing streams, many of which are contaminated. There are many water-borne diseases that leads to people die. Less water also means sewage does not flow, and mosquitoes are other insects breed on stagnant dirty water. This will result in infectious diseases like malaria.
Lack of quality water causes huge sanitation issues, i.e., In many place like clinics, restaurants, public places, people are forced to use very little water for cleaning. They indirectly compromises with the health of staff members and people who use the facilities.

Hunger:
It takes a lot of water to grow food and care for plants and animals. We use 70% of water sources for agriculture and irrigation and rest 30% for domestic purpose. Less water means lower yield. It means farm animals will die and others

will not do well without water. The result is constant hunger, thirst and low quality of life.

Education:
It is a bit hard to see how water and education is related to each other. In many places, Boys have to walk for several miles to get water. They get tired and some have to miss school. As a result, their education get hampered. In other places, girls and women are not allowed to go to school at all so that they can serve the family by getting water and taking care of other family needs.

Poverty:
Access of quality water is a key to economic prosperity and better living standards. Restaurants, hotels and shopping places need to keep clean to attract tourists and foreign investments. Manufacturing activities, commercial farms, and mining processes all need a lot of water to thrive. Lack of water means no economic activities will happen and the people will be in constant poverty.