WATER

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➢ INTRODUCTION

Water is an invaluable natural resource, as it sustains life on the earth. The earth is probably the only heavenly body in the entire Solar System, which is known to have water. It is estimated that about 71 per cent of the earth's surface is under water, but about 3 percent of the total water, available on the earth is the freshwater.

(i) The sun's heat causes evaporation of water vapour. When the water vapour cools down. It condenses and forms clouds. From there it may fall on the land or sea in the form of rain, snow or sleet.

(ii) The process by which water continually changes its form and circulates between oceans atmosphere and land is known as the **water cycle**.

(iii) Our earth is like a terrarium. The same water that existed centuries ago still exists today. The water used to irrigate a field in Haryana may have flowed down the Amazon River a hundred years ago.

(iv) The major sources of fresh water are the rivers, ponds, springs and glaciers. The ocean bodies and the seas contain salty water. The water of the oceans is salty or saline as it contains large amount of dissolved salts. Most of the salt is sodium chloride or the common table salt that is used in eating.

(1) Distribution of water bodies.

1. Oceans	97.20	Saline water
2. Ice caps and glaciers	2.00	
3. Groundwater	0.68	
4. Freshwater lakes	0.01	
5. Inland seas	0.01	
6. Atmosphere	0.002	Freshwater
7. Rivers	0.001	
8. Biosphere	0.001	
9. Soil moisture	0.095	

(2) The water is found on the earth's surface in oceans, seas, bays, gulfs, lakes, ponds, rivers, etc.

The water portion of the earth's surface is known as **hydrosphere**. The total volume of water in the hydrosphere, which is fixed and never changes, is estimated at about 1400 million cubic kilometers. One cubic kilometer has about 1000 million tons of water.

➢ WATER CYCLE

(a) The water always changes its form as liquid., solid and gas.

(b) The process by which water changes its form and also circulates between lithosphere, atmosphere and hydrosphere is known as the **water cycle** or the **hydrological cycle**.

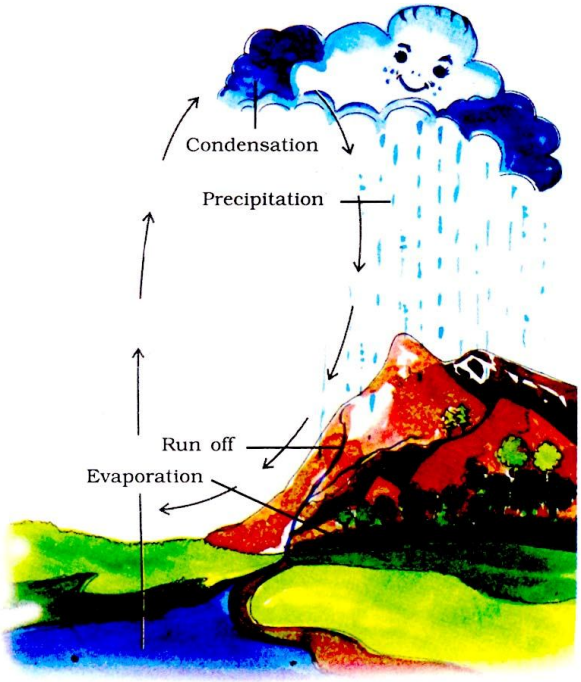
(c) The water cycle has neither a beginning nor an end.

(d) The water cycle is actually a combination of several processes such as – evaporation, transpiration, air mass movement, condensation, precipitation, run-off and ground water movement.

(e) Heat and moisture are very important for the successful operations of the water cycle.

(f) Let's start the water cycle from the oceans, which have more than 97 per cent of the total water on the earth. Sun is the main source of heat for the working of the **water cycle**. The water cycle follows the following steps.

1. The water is heated and evaporation takes place.
2. The water is converted into water vapour.
3. The water vapour enters the atmosphere with the help of vertical and horizontal movements of atmosphere.
4. In higher parts of atmosphere, the water vapour **condenses** and becomes droplets of water.
5. The droplets of water fall on the earth through **precipitation** as rainfall or snowfall.
6. Finally, this water reaches the oceans through various routes.



Water Cycle

➢ FRESH WATER

(1) The total amount of freshwater available on the earth's surface is less than three per cent of the total water on the earth's surface. This freshwater is mostly held in ice caps, glaciers, lakes rivers, atmospheres, etc. The water cycle is largely responsible for the availability of fresh water on the earth.

(2) **Salinity** : The water in the oceans and seas is saline, as it contains large amount of dissolved salts. It is estimated that every 1000 ml (one litre) of ocean water has about 35 gm of dissolved salts.

(3) **Salinity** is the term used to define the total contents of the dissolved salts in the ocean or sea water and it is expressed as ‰ and 35%.

(4) The total amount of the dissolved salts is increasing as salts are being regularly brought from land by the rivers and other sources. Sodium chloride or common salt, which we eat daily, is the most important constituent of dissolved salts in the ocean water. The brackish taste of sea water is mainly due to the presence of common salt in it.

(5) The amount of dissolved salts present in the ocean or sea water is not the same everywhere, rather it varies greatly from one part of the ocean to another. On an average, the salinity of the ocean water decreases from the equator towards the poles. Very high salinity has been recorded in inland seas and lakes.

(6) The salinity of sea or ocean water largely depends on the amount of evaporation, precipitation, flow of freshwater from rivers, ocean currents, sea waves, etc.

(7) Salinity increases the density of sea water. **Dead Sea** in Israel has the highest salinity and the swimmers can float in Dead Sea, due to very dense water.

(8) Water is a very precious resource, as it is essential for our survival. The shortage of freshwater is mainly due to excessive use and unequal access to water. In view of the shortage of freshwater, increasing demand and large-scale pollution, it is unrgently needed to conserve freshwater for balanced and adequate supply.

Some of the measures for the conservation of freshwater are as under.

1. Stop reckless and unscientific use of water.
2. Encourage reuse through recycling of water.
3. Diverting the flood water to drought prone regions.
4. Develop techniques to raise the level of underground water.
5. Storing water through rainwater harvesting.

➢ OCEANS

The oceans are the main source of moisture in the atmosphere, and they help in the moderation of high temperature during the summer season and low temperature during the winter season. The oceans connect all the continents, as they are used as highways for travel and trade.

There are four major oceans on the earth. These are the Pacific Ocean, the Atlantic Ocean the Indian Ocean and the Arctic Ocean. There is another continuous waterbody around the Antarctica continent. Some geographers have named it as the Southern Ocean or the Antarctic Ocean.

1. **The Pacific Ocean :** It is the largest ocean and it covers about 35 per cent of the earth's surface. It exceeds the total land surface of the earth and its average depth is about 4600 metres. This ocean has many **deeps** and **trenches**. Most of them are on the western side. The Mariana Trench (about 11000 metres deep) is the deepest. Along the coast of Asia, there are many marginal seas, such as the Sea of Okhotsk, the Sea of Japan the Yellow Sea, the East China Sea, the South China Sea, the Celebes Sea, the Banda Sea, etc.

2. **The Atlantic Oceans :** This ocean is roughly half the size of the Pacific Ocean and is located between North and South Americas on the west and Europe and Africa on the east. The average depth of water is about 3600 metres and there are no trenches. The most important relief feature is the **Mid-Atlantic Ridge**. The average height of the ridge is about 4000 metres. The Atlantic Ocean has many marginal seas, such as Labrador Sea, Gulf of Mexico, Caribbean Sea, etc. on the west side and Norwegian Sea, the North Sea, the Bay of Biscay, the Gulf of Guinea, etc. on the east side.

3. **The Indian Ocean :** This ocean is smaller than both the Pacific and the Atlantic Oceans. This ocean is open in the north and thus called the **Half Ocean**. The Indian Ocean is bonded by Africa in the west, Asia in the north and Australia in the south-east. The average depth of water is about 4000 metres and there are not many deeps and trenches. The important marginal seas are the Arabian Sea, the Bay of Bengal, the Andaman Sea, the Red Sea, the Persian Gulf, etc.

4. **The Arctic Ocean :** This ocean is situated around the North Pole and is bounded by the continents of North America, Europe and Asia. The Arctic Ocean is permanently frozen, but is connected to the Pacific Ocean by the Bering Strait and to the Atlantic Ocean through Greenland Channels. The marginal seas of the Arctic Ocean are the Lincoln Sea, the Beaufort Sea, the Chukchi Sea, the East Siberian Sea, the Laptev Sea, the Kara Sea, the Barents Sea, the Greenland Sea, etc.

(a) Ocean Circulation

(i) Unlike the calm waters of ponds and takes, ocean water keeps moving continuously, it is never still. The movements that occur in oceans can be broadly categorized as waves, fides and currents.

(ii) **Waves :** When the water on the surface of the ocean rises and falls alternately, they are called waves.

(iii) During a storm, the winds blowing at very high speed form huge waves. These many cause tremendous destruction. An earthquake, a volcanic aruption or underwater landslides can shift large amounts of ocean water. As a result a huge tidal wave called tsunami, that may be as high as 15 mt., is formed. The largest tsunami ever measured was 150 ml. high. These waves travel at a speed of more than 700 km, per hour. The tsunami of 2004 caused wide spread dmage in the coastal areas of India. The Indira point in the Andaman and Nicobar islands got submerged after the tsunami.

(iv) Tsunami or the harbour wave struck havoc in the Indian Ocean on the 26 December 2004. The wave was the result of the earthquake that had its epicenter clse to te western boundary of Sumatra. The magnitude of the earthquake was 9º on the Richter scale. As the Indian plate went under the Burma plate, there was a sudden movement of the sea floor, causing the earthquake. The ocean floor was displaced by about 10 – 20 mt. and tilted in a downwardly direction. A huge mass of ocean water flowed to fill in the gap that was being created by the displacement . This marked the withdrawal of the water mass from the coastlines of the landmasses in the south and southeast Asia. After thrusting of the India plate below the Burma plate, the water mass rushed back towards the coastline. Tsunami travelled at a speed of about 800 k.m. per hour, comparable to speed to commercial aircraft and completely washed away some of the islands in the Indian ocean. The Indira point in the Andaman and Nicobar islands that marked the southernmost point of India got completely submerged. As the wave move from earthquake epicenter from Sumatra towards the Andaman islands and Srilanka the wave length decreased with decreasing depth of water.The travel speed also declined from 700–900 k.m. per hour to less than 70 k.m. perhour. Tsunami waves travelled upto a depth of 3 km, from the coast killing more than 10,000 people and affected more than lakh of house. In India, the worst affected were the coastal areas of Andhra Pradesh. Tamil Nadu, Kerala, Pondicherry and the Andaman and Nicobar islands.

(v) While the earthquake cannot be predicted up in advance, it is possible to give a three-hour notice of a potential tsunami. Such early warning system are in place across the Pacific ocean, but not in the Indian Ocean. Tsunamis are rare in the Indian Ocean as the seismic activity is less as compared to the Pacific

(vi) The tsunami that ravaged that South and South east Asian coasts in December 2004 is the most devastating tsunami in the last several hundred years. The large damage caused to life and property was primarily a result of lack of monitoring the early warning systems and knowledge among the coast dwellers of Indian ocean.

The first indication that tsunami is approaching is the rapid withdrawal of water from the coastal region, followed by destructive wave. When this happened on the cost, instead of people going to high ground they started assembling at the coast to view the miracle. As a consequence there was a large casualty of curious onlookers when the gigantic wave (tsunami) struck.

(vii) **Tides** : The rhythmic rise and fall of ocean water twice in a day is called a tide. It is high tide when water covers much of the shore by rising to its highest level. It is low tide when water falls to its lowest level and recedes from the shore.

(viii) The strong gravitational pull exerted by the sun ad the moon on the earth's surface causes the tides. The water of the earth closer to the moon gets pulled under the influence of the moon's gravitational force and causes high tide. During the full moon and new moon days, the sun, the moon and the earth are in the same line and the tides are highest. These tides are called spring tides. But when the moon is in its first and last quarter, the ocean waters get drawn in diagonally opposite direction by the gravitational pull of sun and earth resulting in low tides.

(ix) High tides help in navigation. They raise the water level close to the shores. This helps the ships to arrive at the harbour more easily. The high tides also help in fishing. Many more fish come closer to the shore during the high tide. This enables fishermen to get a plentiful catch. The rise and fall a water due to tides is being used to generate electricity in same places.

(b) Ocean Currents

(i) Ocean currents are streams of water flowing constantly on the ocean surface in definite direction. The ocean currents may be warm or cold. Generally, the warm ocean currents originate near the equator and move towards the poles. The cold current carry water from polar or higher latitudes to tropical or lower latitudes.

(ii) The Labrador Ocean current is cold current while the Gulf Stream is a warm current. The ocean current influence the temperature condition of the area.

(iii) Warm current bring about warm temperature over land surface. The areas where the warm and cold currents meet provide the best fishing grounds of the world Seas around Japan and the eastern coast of North America are such examples.

(iv) The areas where a warm and cold current meet also experience foggy weather making it difficult for navigation.

(c) Effects of Ocean Currents

(i) Ocean currents have great influence on the climate and economic activities of the coastal regions.

(ii) Warm ocean currents raise the temperature of the coasts along which they flow while cold ocean currents lower the temperature. For example, the warm North Atlantic Drift keeps the coast of Norway warm and ice-free even in winter. On the other hand, the Newfoundland coast of North America, located at lower latitudes, is icebound for about eight to nine months in a year under the influence of the cold Labrador Current.

(iii) Winds blowing over warm currents are moist and bring rainfall to the coastal regions. Winds blowing over cold currents are dry and cool and hence they carry hardly any moisture. The western coast of Europe and the eastern coast of the US.A. receive rainfall due to the North Atlantic Drift and the Gulf Stream respectively. On the other hand, the Atacama desert in South America and the Nambic Desert are examples of deserts formed by the influence of cold currents.

(iv) In place where warm and cold ocean currents meet, dense fog is produced. It reduces visibility and can cause dangerous accidents. One such area is near New found land coast, where the Gulf Stream and the Labrador Current meet.

(v) In places where warm and cold currents meet tiny organisms called planktons are found in abundance. Planktons are an excellent source of food for fish. Hence, such regions are rich fishing grounds. Some of the richest fishing areas of the world are near the Newfoundland coast, where the gulf Stream and the Labrador current meet and near Japan, where Kuro Shio meets the Oya Shio.

(vi) Ocean currents influence navigation Ships sailing along the current will sail faster and save time and fuel. Warm currents also help to melt icebergs, which are a potential danger to ships.