

# Hydrosphere

## Learning Objectives

- To understand the importance of water
- To know about fresh water
- To know about the relief features of the ocean floor
- To recognize the movements of ocean water
- To understand marine resources and the need for conservation



## Introduction

We know that, our planet Earth consists of **four spheres**. They are the **Lithosphere, Atmosphere, Hydrosphere** and **Biosphere**. In the earlier chapters, we have studied about the Lithosphere and Atmosphere. We shall now learn the other two spheres namely the Hydrosphere and the Biosphere.

### 4.1 Hydrosphere

One of the most indispensable natural resources on earth is water. The Earth is also called the **Blue planet**, as it holds water in abundance and thus stands unique among all other planets. Hydrosphere consists of water in various forms found on the earth. Over 97% of the water on the Earth's surface is confined to oceans. Less than 3% of water is held on land

as glaciers, ice caps, groundwater, rivers, lakes, and also as the water vapour in air.

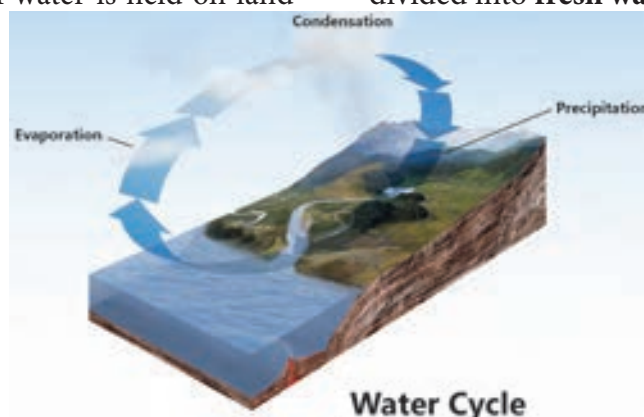
### 4.2 Hydrological Cycle

The Earth's water is not static. It is always in motion. This continuous movement of water on, above and below the earth's surface is called the Hydrological Cycle.



The **three major processes** involved in the water cycle are **evaporation, condensation and precipitation**. Water changes its form constantly i.e. Ice, water and water vapour. This process happens in the blink of an eye or even over millions of years.

Water resources of the Earth can be broadly divided into **fresh water** and **salt water**.



### 4.3 Fresh Water

Rain water is considered to be the purest form of water, as it contains very less proportion of salts when compared to the oceans and seas. Hence it is called fresh water. A major part of fresh water is found in the frozen state in the form of ice caps and glaciers. Around 1% of it is found in the liquid state as rivers, streams, lakes, ponds etc. Surface water may also penetrate through porous rocks and gets collected beneath the Earth's surface. This is called groundwater.

#### Fact

Finland is known as the land of thousand lakes. There are 1,87,888 lakes in Finland.



**Water table** is a level below the ground, where water is found collected beneath the Earth's surface.

**Aquifers** are porous rock strata filled with water, found below the earth's surface.

### 4.4 Oceans

The continents and oceans are however, not evenly distributed in the northern and the southern hemispheres. The northern hemisphere holds 61% of land whereas the southern hemisphere holds 81% of water. It is because of this pattern of land and water distribution, the **northern hemisphere** is called as the **land hemisphere** and the **southern hemisphere** is called as the **water hemisphere**.



#### Hots

- **71% of the earth is covered by water, but very little can be used by humans. Why?**
- **The oceans are salty. Why?**

Oceans and seas are considered as resource bowl of the earth because of the immense availability of food, minerals etc., Present distribution of the world's oceans and major seas are illustrated in the map.



**Sylvia Earle** is a famous American oceanographer. She was named as the first, 'Hero for the Planet' by Time magazine for her efforts towards marine life protections.

**Jacques-Yves Cousteau** (1910-1997) was a famous French Ocean explorer, who conducted extensive under-sea investigations.

He belonged to the information service of the French Navy, and was sent on missions to Shanghai and Japan (1935-1938) and in the USSR (1939).

#### Honours

- **Cross of War 1939-1945 (1945)**
- **U.S. Presidential Medal of Freedom (1985)**

#### 4.4.1 Relief Of The Ocean Floor

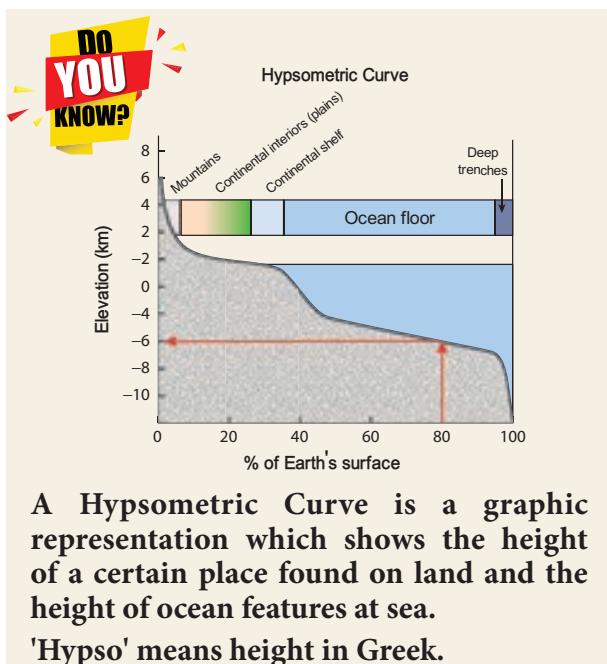
The ocean basins are characterised by the following major relief features:

- (A) Continental shelf
- (B) Continental slope
- (C) Continental rise
- (D) Deep sea plain or Abyssal plain
- (E) Oceanic deep
- (F) Oceanic ridge



##### (A) Continental Shelf

A shallow and gently sloping platform extending out from the adjoining continental land mass into the sea is called Continental Shelf. It is almost a uniform zone of sea bed with a gentle gradient.



The continental shelf is of great significance for the following reasons:

- They are shallower, thus enables sunlight to penetrate through the water. This encourages abundant growth of grass, sea weeds and plankton. Hence these zones become the **richest fishing grounds** in the world. Eg. The **Grand Banks of Newfoundland**.
- The continental shelves have extensive deposits of minerals and mineral fuels. Hence, this zone becomes accessible for oil drilling and mining activities. E.g. Mumbai High in Arabian Sea.

**Geo Connect**

**ONGC:** Oil and Natural Gas Corporation is India's largest oil and gas exploration and production company. Its latest estimate is that about 20 million tons of oil reserves are found west of Mumbai High off shore.

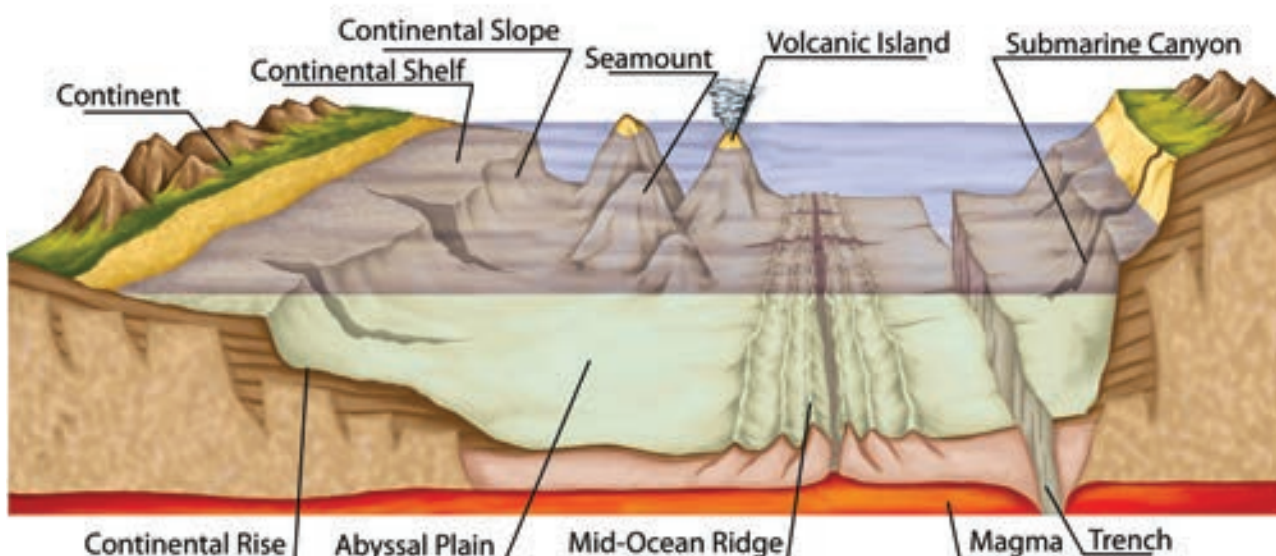
### (B) Continental Slope

A steep slope which descends from the edge of the continental shelf to the deep ocean-bed is called continental slope. It forms a boundary between the Continental Crust and the oceanic crust. This zone is free from deposits as they are steep. The most important characteristic of continental slope is the **presence of deep canyons and trenches**. Due to the low penetration of sunlight, the slope has nearly freezing temperature. Hence aquatic life has very slow rate of metabolism.

### (C) Continental Rise

At the base of the continental slope is a gently sloping layer of sediments which merge into the deep-sea floor. This underwater feature found between continental slope and abyssal plains is called the continental rise. It **consists of submarine fans** which are similar to the alluvial fans found on land.

## Major Relief Features of the Ocean





#### (D) Deep Sea Plains or Abyssal Plains

The deep sea plains or abyssal plains are underwater plains found on the deep ocean floor. These plains extend from continental rise to the mid oceanic ridges. The gradient of the slope is very gentle and it appears as a uniform flat and featureless plain. These plains are usually covered by the thick layer of sediments composed of clay, silt and sand, brought by the rivers. These are often characterized by features like abyssal hills, sea mounts, guyots, coral, atoll etc.



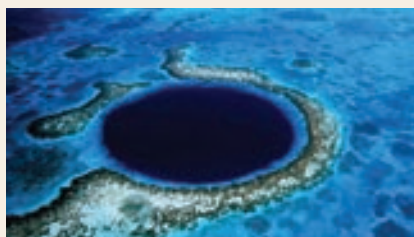
Abyssal plains in the Atlantic and Indian Oceans tend to be extensive than the Pacific Ocean because, majority of the world's largest rivers empty their sediments into either Atlantic or Indian Ocean. E.g. Amazon, Ganga and Brahmaputra rivers.

#### (E) Oceanic Deep

Trenches are the deepest part of the oceans and occupy about 7% of the total relief of the ocean floor. The ocean temperature in the trench is slightly cooler than the freezing temperature. As they are sediment free, most **trenches** are V-shaped with steep sides. **Epicentre of the great earthquakes** are all found in the trenches.



Dragon Hole is the deepest known underwater sink hole in the world. The local fishermen call it the 'eye' of the South China Sea.



#### (F) Oceanic Ridge

Oceanic ridge is a continuous submarine mountain chain. They are made of young

basaltic rock formed when two tectonic plates moves apart. The mid-ocean ridge is probably the most extensive single feature of the earth's topography. Two of the most well known mid-ocean ridges are the Mid-Atlantic Ridge and the East Pacific Ridge. The Mid-Atlantic Ridge is the largest unbroken oceanic ridge.



**Fathoms** ⇒ A nautical measurement of the depth of water in the ocean.

**Isobath** ⇒ An imaginary line on a map joining the points of equal depths.

**Isohaline** ⇒ An imaginary line on a map joining the points of equal salinity in oceans.



Mid Atlantic Ridge

### 4.3.2 Movement of the Ocean Water

The ocean water is dynamic. Temperature, salinity, density, external forces of the sun, moon and the winds keep the ocean waters in movement, both horizontally and vertically. Waves and currents are in **horizontal motion** while tides have **vertical motion**.

#### (A) Waves

Of all the movements of the oceans, sea waves are considered to be the strongest. Sea waves are ripples on water caused when winds blow over

the sea. The height of these waves depends on the speed of wind, its duration and the direction from which they blow. Sometimes waves are also caused by tremors felt on the ocean floor. Such waves are quite destructive and called **Tsunami**.

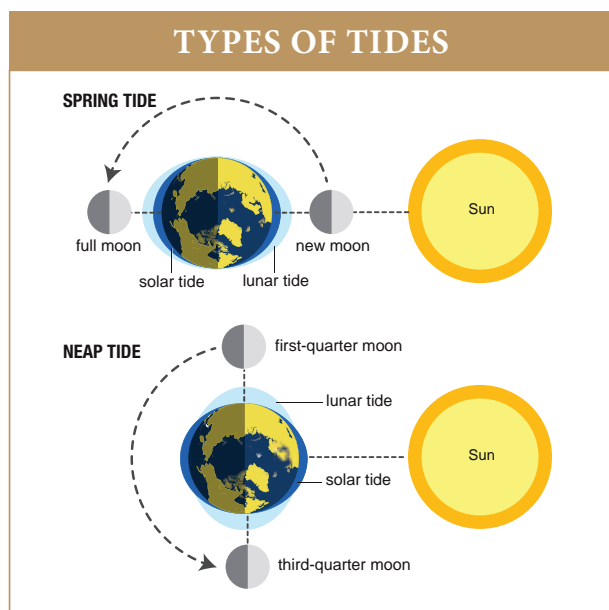


The energy of the falling wave water is used to turn hydro turbines to generate power. Wave energy power plants have been installed at Vizhinjam in Kerala coast and Andaman and Nicobar islands of India.

### (B) Tides

The periodic rise and fall of sea water due to the gravitational pull of the sun and moon on earth are called tides. They are classified broadly into **Spring tides** and **Neap tides**.

When **the Sun, Moon and Earth are aligned in the same line**, the collective gravitation pull of the sun and moon on earth's water strengthens to form a high tide known as **spring tide**. Such tides always occur on **full moon** and **new moon** days.



When **the sun and the moon are at right angles**, their gravitational forces work against each other, causing a low tide called **neap tide**. A neap tide occurs between two spring tides i.e., twice a month, when **the first and last quarter moon** appears.



Potential tidal energy zones of India are the Gulf of Khambhat, Gulf of Kutch and Sundarbans.



### MARITIME BORDERS



Maritime boundary of most the Countries is fixed to be 12 nautical miles from the baseline. This was fixed by the U.N. Convention on the Law of the sea 2013 where as Jordan and Palau have 3 nautical miles as their maritime boundary and Benin, Republic of Congo, El Salvador, Peru and Somalia have 200 nautical miles.

### (C) Oceans Currents

The movement of oceanic water on the surface and at the depths in a definite direction is called ocean current. Ocean currents are in **clockwise motion in the northern hemisphere** and in the **anti-clockwise motion in the southern hemisphere**.

The factors that generate ocean currents are:

- Earth's rotation
- Prevailing winds and
- Differences in temperature and salinity of ocean water.

On the basis of temperature, ocean currents are classified as **warm currents** and **cold currents**. The movement of ocean currents from the high latitudes (temperate and polar zones) towards low latitudes (tropical zones) is called cold current. Eg. Labrador in Atlantic Ocean and Peruvian cold current in South Pacific Ocean.



**NIO** (National Institute of Oceanography) was established in 1st January 1966. The headquarters of NIO is located at Dona Paula, Goa. It Conducts research and observations to understand oceanic features, Ocean engineering, marine Archaeology etc.

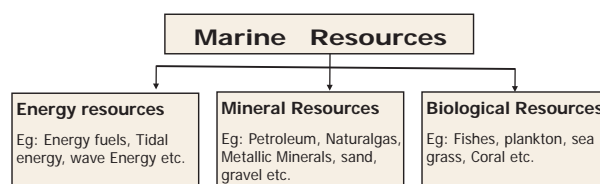
## 4.5 Marine Resources

The biotic and abiotic resources found in the oceanic water and at the bottoms are called marine resources. The ocean's resources play a vital role in sustaining the needs of society. A diverse array of marine organisms is used for food, medicine, cosmetics, and a wealth of industrial applications. The world's demand for energy, minerals and water have become increasingly dependent on non-living marine resources.



### Hots

- What will happen if the seas and oceans contain only fresh water?



### 4.4.1 Conservation Of Marine Resources

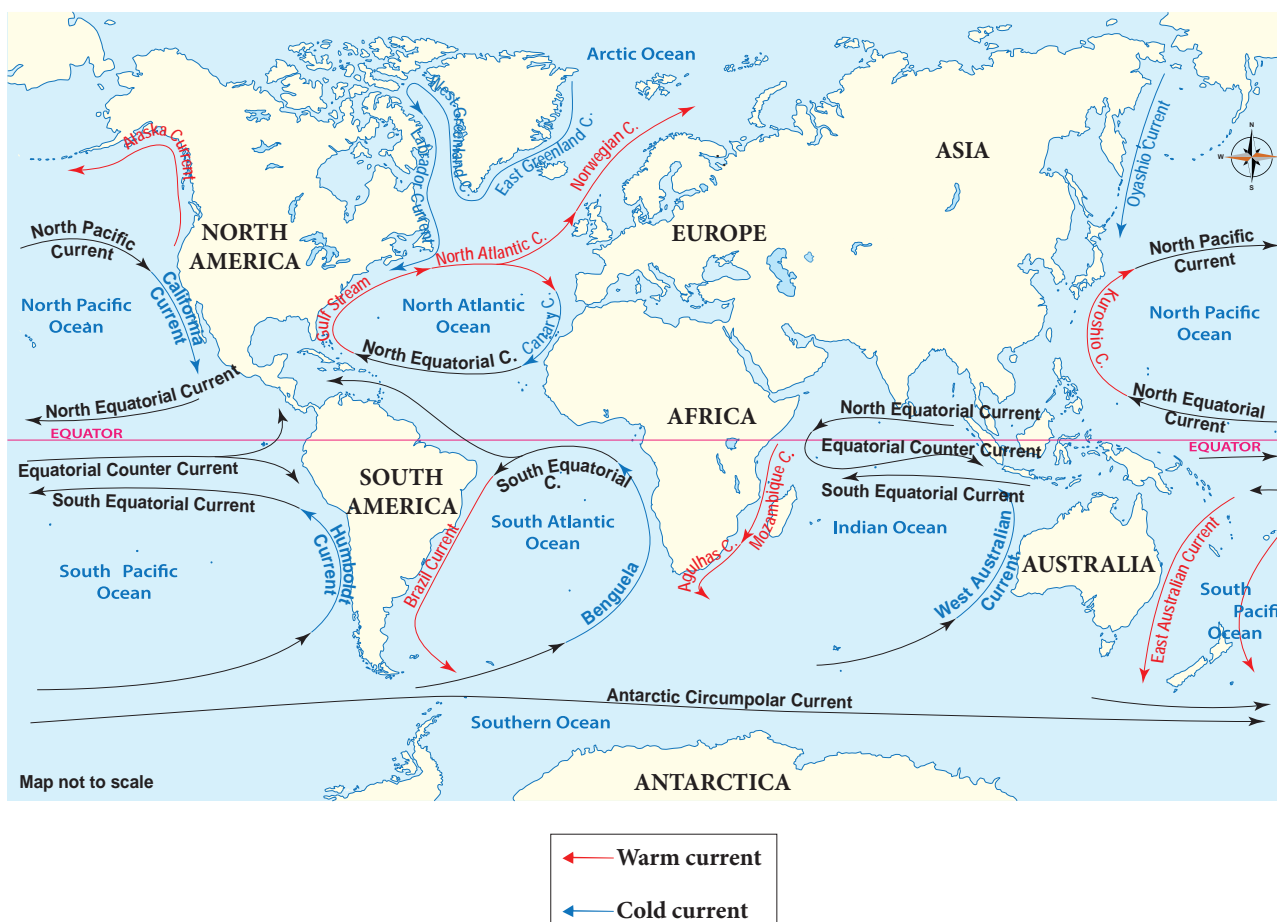
Oceans are the life blood of planet earth and mankind. The humankind depends on the marine resources for its survival. They are also essential for the economic prosperity, social well-being and quality of life. Oceans have extensive deposits of oil reserves. Besides a major fishing ground, it helps in generating non-conventional energy, development of many ports and harbours for trade activities. Coastal tourism also attracts people around the world, thereby contributing to the economy of many countries.

#### DISTRIBUTION OF MAJOR OCEAN CURRENTS AND EFFECTS

Ocean	Name of the Current	Effects
South Atlantic Ocean	Benguela Current [Cold]	Leads to foggy conditions along the coast of Namibia. Helped in the development of Namibian & Kalahari deserts
North Atlantic Ocean	Canaries [Cold]	Influences the extension of Sahara Desert
	Gulf Stream [Warm]	Its confluence with the Labrador current produces heavy fog along the coast of Newfoundland, obstacles the navigation. Hence, Newfoundland is one of the major fishing grounds of the world.
	North Atlantic Drift [Warm]	It keeps the ports at higher latitudes ice-free throughout the year. Eg. Port of Rorvik (Norway), Murmansk and Severodvinsk (Russia)
	Labrador [Cold]	Its confluence with Gulf Stream creates fog and hinders navigation.
South Pacific Ocean	Peruvian / Humboldt Current [Cold]	It is one of the causes for the formation of Atacama desert. Change in the nature of Peruvian current, is also associated to the formation of "ELNINO".

North Pacific Ocean	Kuroshio Current [Warm]	It plays a vital role in carrying large amount of heat to the adjacent land areas and forms cloud cover that cause rainfall.
	Oyashio / Kurile Current [Cold]	Its confluence with the Kuroshio current produces heavy fogs around Hokkaido, which become potential hazards for navigation. Hence, Hokkaido acts as the major fishing ground of the world.
	Alaska Current [Warm]	Keeps the seaports of Alaska open throughout the year.
	California Current [Cold]	Leads to foggy conditions along the coast of California. It is one of the reason for the formation of Arizona & Sonata deserts.
Indian Ocean	West Australian Current [Cold]	Leads to foggy conditions along the western coast of Australia. It helped in the genesis of west Australian desert.

## Major Ocean Currents of the World







## The Great Barrier Reef

The Great Barrier reef is the world's largest coral reef system composed of 2,900 individual reefs and 900 islands stretching for about 2,000 kilometres.

It covers an area of about 3,50,000 km. The reef is located in the Coral sea, off the coast of Queensland, Australia. The Great Barrier Reef can be seen from the outer space. This sprawling coral reef system is one of the most biologically diverse places on the planet. Coral reefs are built by billions of tiny organisms, known as Coral polyps. CNN labelled it as one of the seven natural wonders of the world.



## Recap

- Hydrosphere, the third sphere of Earth, is a collection of all forms of water on the earth.
- Hydrological cycle is the continuous movement of water on Earth.
- Water is available on Earth as fresh and salt water. Over 97% of the water on the Earth's surface is confined to oceans.
- The five major oceans of the world are the Pacific, the Atlantic, the Indian, the Southern and the Arctic ocean.
- The major relief of the ocean floor are continental shelf, continental slope, continental rise, abyssal plains, ocean deeps and ocean ridges.
- Marine resources are nothing but the biotic and abiotic resources found in the oceans.
- Oceans are the lifelines of Earth and mankind. Hence, they need to be conserved.



The Gangetic Dolphin was declared the National Aquatic Animal in 2010. This has become an endangered species. Are the



Dolphins really at risk? If so, list out the reasons.



## EXERCISE



### I Choose the correct answer

1. The temperature of the ocean waters generally \_\_\_\_\_ at greater depth.  
a) increases                      b) decreases  
c) remains constant      d) none of the above
2. Ocean currents are produced due to \_\_\_\_\_.  
a) due to rotation of earth  
b) due to variation in temperature  
c) due to earth's movement  
d) all the above
3. Consider the following statements.
  1. Most of the fishing grounds occur in areas where the continental shelf is wide.
  2. Fishing is well developed in warm tropical waters.
  3. Mixing of warm and cold currents facilitates plant nutrients for fish.
  4. Inland fishing became significant in India.  
a) 1 and 2 are correct.  
b) 1 and 3 are correct.  
c) 2,3 and 4 are correct.  
d) 1,2 and 3 are correct





4. The oceanic ridge comes into existence due to
- convergence of tectonic plates
  - divergence of tectonic plates
  - lateral movements of plates
  - steering of plates.
5. Which of the following indicates the correct sequence of the topography beneath the surface of the sea?
- Continental shelf-Continental slope-Sea plain-Sea trench.
  - Continental slope-Continental shelf-Sea plain-Sea trench.
  - Sea plain-Continental slope-Continental shelf-Sea trench.
  - Continental slope-Sea plain-Continental shelf-Sea trench.
6. Which of the following is not correctly matched?
- Gulf Stream - Pacific Ocean
  - Labrador current - North Atlantic Ocean
  - Canary current - Mediterranean sea
  - Mozambique current - Indian Ocean.

## II. Assertion(A), Reason (R) type Questions.

### Directions

- both A and R are correct and R explains A.
  - both A and R are correct but R does not explain A.
  - A is correct but R is false.
  - A is false but R is correct
1. **Assertion (A):** Oceans are always shown in blue in maps.  
**Reason(R):** It indicates the natural colour of the oceans.

2. **Assertion(A):** Flat topped seamounts are known as Guyots.

**Reason(R):** All guyot features are of volcanic origin.

3. **Assertion(A):** Submarine canyons are deep gorges on the ocean floor.

**Reason(R):** They are mainly restricted to continental shelf, slope and rise

4. **Assertion (A):** Atolls are more common in the Atlantic ocean.

**Reason(R):** The marine population at the depth is less.

## III. Match the following:

- |                       |                                    |
|-----------------------|------------------------------------|
| 1. Mariana trench     | - Decreases salinity in the oceans |
| 2. Great Barrier Reef | - Along the coast of Japan         |
| 3. Spring tides       | - Deepest point in the Pacific     |
| 4. Heavy rains        | - Australia                        |
| 5. Kuroshio current   | - Second order landform            |
| 6. Continental slope  | - On full and new moon days        |

## IV. Answer the following in brief:

- What do you mean by the term Hydrosphere?
- What is hydrological cycle?
- Mention the various relief features of ocean floor
- What are the factors that generate the ocean currents?
- Write a brief note on sea waves.

#### V. Give reasons for the following:

1. The northern hemisphere and the southern hemisphere are called land and water hemispheres respectively.
2. Continental shelf provides good fishing ground.

#### VI. Distinguish the following:

1. Spring tide and Neap tide.
2. Abyssal plains and Ocean deeps.

#### VII. Answer in a paragraph:

1. Write a note on continental shelf and continental slope.
2. What do you mean by ocean currents? Explain its types.
3. Explain the influences of the marine resources on mankind.



## ICT CORNER

### Geography - Hydrosphere

Let us know the names of the earth's spheres by using memory cards



#### Steps

Step 1: Open the Browser type the URL Link given below (or) Scan the QR Code.

Step 2: You see the Earth's Spheres cards.

Step 3: Click the cards and choose correct Spheres and Examples

#### Website URL :

<https://matchthememory.com/Earthspheres>

<https://www.purposegames.com/game/the-hydrosphere-game>

