Ch - 11

Hydrosphere

Hydrosphere refers to the combined mass of water found on the earth such as in oceans, rivers, streams, lakes, in the atmosphere and underground.
The earth is called a blue planet because 71 % of it is covered by water.
The main source of water on earth are :-

i) Ocean
ii) Water on land
iii) Underground water
iv) Water in the atmosphere

Water cannot be created nor it can be destroyed. It can only be transformed into different states.
The circulation of water continuously among atmosphere, hydrosphere and lithosphere is called hydrological cycle.

Movement in Ocean water - The three different ways of movement in ocean water are :-

i) Waves
ii) Tides
iii) Ocean current

a) Waves - Waves are oscillatory movement in water manifested by an alternate rise and fall of sea water. They are mainly produced by winds on the surface of the oceans.

b) Tides - The rise and fall of sea water due to gravitational force of the moon and the sun are called tides.

c) Tidal waves - The sea waves produced by tides are called tidal waves.

ii) Tidal range - The difference between high and low tide water is called tide range.

iii) High-tide water - The rise of sea water and its movement towards the coast is called tide and the resultant high water level is known as high-tide water.

iv) Low-tide water - The fall of sea water and its movement towards the sea called ebb and the resultant low water level is called low tide water.

Factors that cause tides -

i) Occurence of high and low tides is due to gravitational forces of the moon on the Earth's water surface, and to some extent it is affected by the gravitational force of the sun

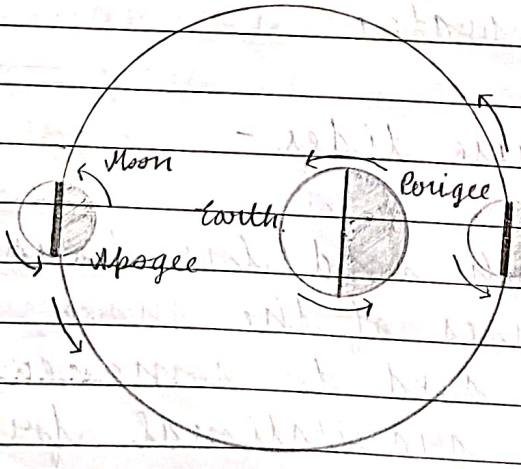
ii) The surface of the earth facing the moon experiences maximum gravitational force of the moon. Consequently the water on the surface is pulled up and a high tide occurs.

iii) A high tide is also formed at the opposites side of the earth simultaneously of because of the reactionary force causing outward bulge of water.

iv) The moon rotates from west to east and ~~relatives~~ revolves around the earth along on elliptical orbit. Thus the distance between the moon and the earth changes during different times every month.

a) The period of farthest distance between the moon and the earth is known as Apogee.

b) The period of nearest distance between the moon and the earth is called Perigee



Varying distances of the earth and moon.

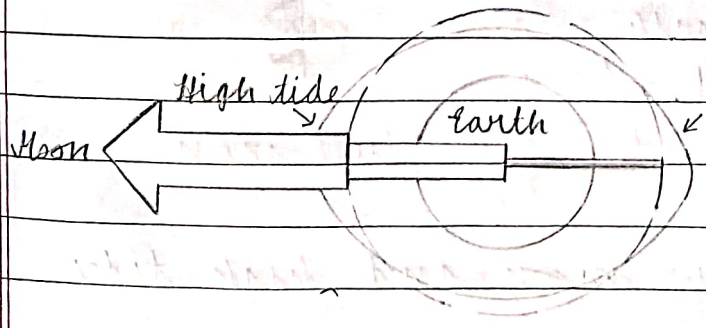
Periodicity of Tides

→ On an average every place experiences tide twice a day. Since the earth complete one rotation in 24 hours, every place should experience tide after 12 hours but this never happens.

→ Each day tide is delayed by 26 minutes. It is because the moon also revolves around the earth in a west to east direction. When the tide centre completes one round, the position of moon is ahead of the tide's centre by that time. With the result the tide centre takes another 52 minutes to come under the moon.

→ Thus, a particular tide centre takes 24 hours 52 minutes to come under the moon. But by that time there is another tide at the opposite side of the referred tide centre and this happens after 12 hours 26 minutes.

→ Tide centre shifts westward
It is because the Earth rotates from west to east.



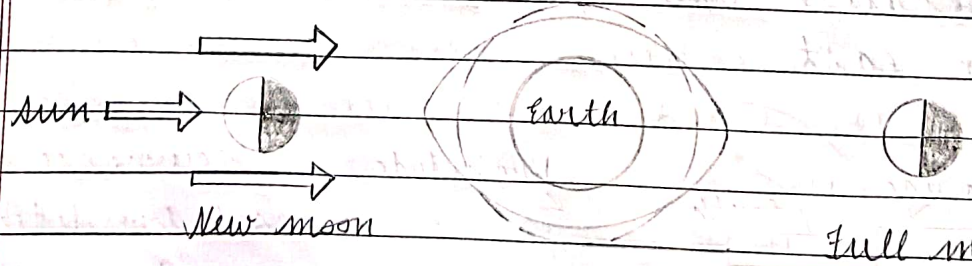
Occurrence of high and low tides due to gravitational forces of the moon on the earth's water surface

Types of Tides -

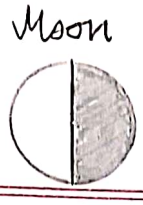
Two important types of tides

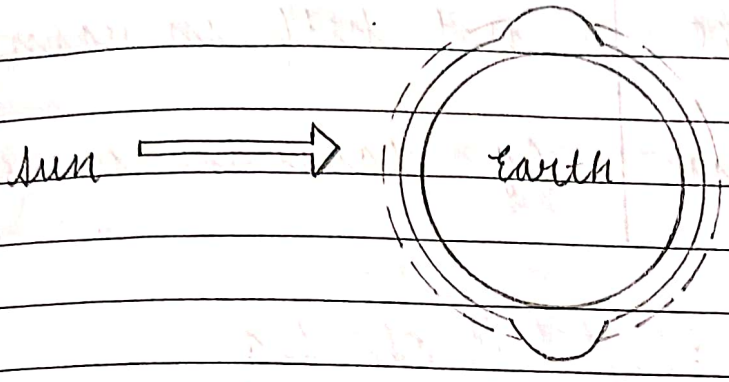
i) Spring tides
ii) Neap tides

Spring tides	Neap tides
They are the highest high tides caused when the sun, moon and Earth are almost in the same line.	These tides are lower than the normal high tides and they occur when the sun, moon and the earth are in a position of a right angle from each other.
This gravitational force of the moon and sun work together with a combined force.	The tide producing forces of the moon and the sun work in apposite direction.
It occurs twice in a month on the full moon or the new moon day	It occurs on the seventh or eight day of every fortnight.



Full moon and new moon and high tides





Quadrature and low tide

Ocean Currents

Large masses of surface water that circulate in regular patterns around the oceans are called ocean currents.

Types of ocean currents -

Based on temperature :

Warm Ocean currents	Cold Ocean currents
i) They blow from low latitudes in tropical zones to high latitudes in temperate & sub-polar zones.	i) They blow from high latitudes of the polar regions to the low latitudes to the warm equator region.
ii) They bring warm water to the cold water area, increase temperature of the coast,	ii) They bring cold water to the warm water region, decrease temperature of the coast, do

help in rainfall.	not help in rains.
Eg- Gulf streams current.	Eg - Labrador current

Based on depth :
(caused due to difference in density and gravity)

	Surface currents	Deep Water Currents
i)	They constitute about 10 % of all the water in the ocean.	i) They make up 90 % of the ocean water
ii)	These ocean currents lie at upper 400 m of the ocean.	ii) They sink into the deep ocean basins at high latitude.

Causes of ocean currents

i) Level of salinity } main causes
ii) Temperature }
iii) The Earth's rotation
iv) Planetary winds : a) Trade winds
b) Westerly winds
c) Polar winds
v) Land

Give reasons -

i) Warm currents produce a milder climate
ans since they bring warm water into the cold water areas.

ii) Eastern coasts ~~change~~ of USA are we comparitively cold.
ans As they are influenced by a cold current.

iii) Coast of Norway are not frozen in winter whereas its adjoining coasts are frozen for most parts of the year.
ans It is because of the warming effect of warm North Atlantic Drift.

iv) The waters of the Oyashio current form the richest fishing grounds in the world.
ans It is owing to extremely high nutrient content of the cold water and the very high tides in some areas.

v) There is heavy rainfall in Queensland but the Atacama desert is arid.
ans It is because Queensland in Australia is affected by warm East Australian current where as Atacama desert in South America is influenced by cold Peruvian current.

vi) Rich fishing ground are located on the Pacific coast of North America.
ans It is due to the mixing of warm Alaska

and cold california current.

vii) Atlantic water flows in the Mediterranean sea surface.

and Because Atlantic ocean water has less salinity than Mediterranean sea therefore the density of Atlantic ocean water is less.

Effect of Ocean Currents

I. On Climate -

1. Temperature - Warm currents raise the temperature where as cold currents decreases the temperature of the places where they flow.

2. Rainfall - Warm currents have a greater capacity to absorb moisture therefore they help in rains on the other hands cold currents discourage rainfall.

3. Fog - Dense fog occurs where the warm and cold ocean currents meet. It is because water vapours of the warm air currents condenses and form fog when it mixes with cold current. (Fog - minute water droplets suspended in the air)

4. Violent Storms :- The meeting of warm and cold ocean currents also result in storms. This is the reason why hurricanes are common on the eastern coast of USA.

II. On Marine Organism -

Ocean currents move organic material (microscopic organisms called plankton) off the coast. Plankton is fish food → higher concentration of plankton, higher the concentration of fish.

III. On Commerce -

i) Warm ocean currents keep the harbour open even during winters facilitating trade throughout the year.

ii) Sailing vessels (ships) move faster when they follow the direction of ocean currents. They become slow when going against the direction of ocean currents.

iii) Cold currents transport ice bergs which may be dangerous for ships. Also mixing of warm and cold currents create thick fog due to which ships are not able to locate the floating ice bergs.

Important Ocean currents & their effect

1. Gulf Stream -

i) Its a powerful, warm and swift ocean current of the Atlantic ocean that originates in the Gulf of Mexico and follows the eastern coast of USA.

ii) It is a strong ocean current which has led to development of cyclones (Hurricanes) and is a potential source of renewable power generation.

2. North Atlantic Drift (Warm) -

i) It is a warm ocean current which splits from Gulf Stream at 30° to 40° North and flows towards the west coast of Europe under the impact of westerly winds.

ii) It keeps the western ports of Europe free from ice even in winter thus helps in trade throughout the year.

3. Labrador cold current (Atlantic Ocean) -

i) Flows from Arctic ocean along the canadian coast. It meets with Gulf stream warm current near New Found land island and forms fog as well as one of the richest fishing ground in the world.

ii) It also transports ice bergs into the North Atlantic Ocean.

4. Kuroshio warm current (Pacific Ocean) -

i) Strong current also called Black stream flows from Taiwan to the eastern coast of Japan.

ii) Warm waters of this current sustains the northern most coral reefs in Japan. It also has the concentration of Uranium between 5 to 6 million ton every year.

5. Oyashio current (cold) (Pacific Ocean) -

i) It originates in the Arctic Ocean and moves south ward via Bering sea and collides with warm Kuroshio current off the coast of Japan.

ii) It forms the richest fishing ground in the world owing to the extremely high nutrient content of the cold water.