

Chapter 13

Movements of Ocean Water

Very Short Answer Type Questions

1.Which forces influence the movement of ocean water?

Answer:

The external forces like of the sun, moon and the winds influence the movement of ocean water.

2.What types of movements take place in ocean water.

Answer:

The horizontal and vertical motions are common in ocean water bodies. The horizontal motion refers to the ocean currents and waves. The vertical motion refers to tides.

3.Explain different types of vertical movement in the ocean water.

Answer:

The vertical motion refers to the rise and fall of water in the oceans and seas. Due to attraction of the sun and the moon, the ocean water is raised up and falls down twice a day. The upwelling of cold water from subsurface and the sinking of surface water are also forms of vertical motion of ocean water.

4.How are ripples formed?

Answer:

When a breeze of two knots or less blows over calm water, small ripples form and grow as the wind speed increases until white caps appear in the breaking waves.

5.How do steep and steady waves form?

Answer:

Steep waves are fairly young ones and are probably formed by local wind. Slow and steady waves originate from far away places, possibly from another hemisphere.

6.What factors cause tides?

Answer:

The moon's gravitational pull to a great extent and to a lesser extent the sun's gravitational pull, are the major causes for the occurrence of tides. Another factor is centrifugal force, which is the force that acts to counter balance the gravity. Together, the gravitational pull and the centrifugal force are responsible for creating the two major tidal bulges on the earth.

7.Where does highest tide occur in the world?

Answer:

The highest tides in the world occur in the Bay of Fundy in Nova Scotia, Canada.

8.What are Semi-diurnal tides?

Answer:

The most common tidal pattern, featuring two high tides and two low tides each day. The successive high or low tides are approximately of the same height.

9.What are Diurnal tides?

Answer:

There is only one high tide and one low tide during each day. The successive high and low tides are approximately of the same height.

10.What is a Mixed tide?

Answer:

Tides having variations in height are known as mixed tides. These tides generally occur along the west coast of North America and on many islands of the Pacific Ocean.

11.What are Spring tides?

Answer:

The position of both the sun and the moon in relation to the earth has direct bearing on tide height. When the sun, the moon and the earth are in a straight line, the height of the tide will be higher. These are called spring tides.

12.What are neap tides?

Answer:

When the sun and moon are at right angles to each other and the forces of the sun and moon tend to counteract one another. The moon's attraction, though more than twice as strong as the sun's, is diminished by the counteracting force of the sun's gravitational pull. These are called neap tides.

13.Define ocean currents.

Answer:

Ocean currents are the continuous flow of huge amount of water in a definite direction. Ocean currents are like river flow in oceans. They represent a regular volume of water in a definite path and direction.

14.How are fishing and oceanic currents related?

Answer:

The mixing of warm and cold currents help to replenish the oxygen and favour the growth of planktons, the primary food for fish population. The best fishing grounds of the world exist mainly in these mixing zones.

Short Answer Type Questions

1. How do ocean currents affect the climate? Explain.

Answer:

Effects of currents influenced by temperature.

- Warm currents makes the place warmer where as the cold currents makes the place colder. Example, Warm currents of Kuroshio makes the southern Japan less cold in winter whereas the cold current of Kuroshio makes the winter longer and severe in north Japan.
- Winds passing over warm currents absorbs lot of moisture and cause heavy rainfall in coastal areas. On the other hand winds passing over cold currents do not get any warm currents as such, they make the climate of coastal areas dry. This is the reason why hot deserts are located near the coastal areas from where the cold current passes.
- The places where cold current and warm current near the coastal areas are found in abundance are rich fishing ground. For example, Newfoundland, the east coast of North America where Labrador current and Gulf stream meet.

2. Explain different types of ocean currents.

Answer:

On the basis of depth:

- Surface currents constitute about 10 percent of all the water in the ocean. These water are the upper 400 m of the ocean.
- Deep water currents make up the other 90 percent of the ocean water.

Deep waters sink into the deep ocean basins at high latitudes, where the temperatures- are cold enough to cause the density to increase.

On the basis of temperature:

- **Cold currents:** Cold currents bring cold water into warm water areas. These currents are usually found on the west coast of the continents in the low and middle latitudes and on the east coast in the higher latitudes in the northern hemisphere;

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- **Warm currents:** Warm currents bring warm water into cold water areas and are usually observed on the east coast of continents in the low and middle latitudes. In the northern hemisphere they are found on the west coasts of continents in high latitudes.

3.How do ocean currents get affected by winds and Coriolis force?

Answer:

Wind: Wind blowing on the surface of the ocean pushes the water to move.

Friction between the wind and the water surface affects the movement of the water body in its course.

The Coriolis force: The Coriolis force intervenes and causes the water to move to the right in the northern hemisphere and to the left in the southern hemisphere.

4.Differentiate between spring tides and neap tides.

Answer:

S.no.	Spring Tides	Neap Tides
1.	It occurs twice each month new moon day because the sun, moon and earth are in the straight line.	They occur at first and third quarter of the moon. Because during these days the sun, moon form a right angle with each other.
2.	When the rise and fall is more than the normal then it is called the spring tides.	The rise and the fall is considerably low than the normal level.
3.	It is due to complimentary gravitational effect and cause sun, moon and earth are in the	Here the tidal forces do not supplement each other because the moon and earth are in right angles and so the velocity of

	same.	tidal current slows down.
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5.What are waves?

Answer:

Waves are oscillatory movements in water, manifested by an alternate rise and fall of the sea surface. In other words, waves are actually the energy, not the water as such, which moves across the ocean surface. Water particles only travel in a small circle as a wave passes. The maximum wave height is determined by the strength of the wind, i.e. how long it blows and the area over which it blows in a single direction. Waves travel because wind pushes the water body in its course while gravity pulls the crests of the waves downward. The falling water pushes the former troughs upward, and the wave moves to a new position. The actual motion of the water beneath the waves is circular. It indicates that things are earned up and forward as the wave approaches, and down and back as it passes.

6.Where do waves in the ocean get their energy from?

Answer:

Wind provides energy to the waves. Wind causes waves to travel in the ocean and the energy is released on shorelines. The motion of the surface water seldom affects the stagnant deep bottom water of the oceans. As a wave approaches the beach, it slows down. This is due to the friction occurring between the dynamic water and the seafloor. Waves continue to grow larger as they move and absorb energy from the wind. Most of the waves are caused by the wind driving against water. When a breeze of two knots or less blows over calm water, small ripples form and grow as the wind speed increases until white caps appear in the breaking waves.

7.What are tides?

Answer:

The periodical rise and fall of the sea level, once or twice a day, mainly due to the attraction of the sun and the moon, is called a tide. Tides vary in their frequency, direction and movement from place to place and also from time to time.

8.How are tides caused?

Answer:

Tides are caused by:

- The moon's gravitational pull to a great extent
- The sun's gravitational pull to some extent are the major causes for the occurrence of tides.
- Another factor is centrifugal force, which is the force that acts to counter balance the gravity.

Together, the gravitational pull and the centrifugal force are responsible for creating the two major tidal bulges on the earth. On the side of the earth facing the moon, a tidal bulge occurs while on the opposite side though the gravitational attraction of the moon is less as it is farther away, the centrifugal force causes tidal bulge on the other side. The 'tide-generating' force is the difference between these two forces; i.e. the gravitational attraction of the moon and the centrifugal force.

9.How are tides related to navigation?

Answer:

Since tides are caused by the earth- moon-sun positions which are known accurately, the tides can be predicted well in advance. This helps the navigators and fishermen plan their activities. Tidal flows are of great importance in navigation. Tidal heights are very important, especially harbours near rivers and within estuaries having shallow 'bars' at the entrance, which prevent ships and boats from entering into the harbour. Kolkata port on Hugli river is an example for it.

Long Answer Type Questions

1. In how many categories can tides be classified on the basis of their height and frequency?

Answer:

- **Semi-diurnal tide:** It is the most common tidal pattern, featuring two high tides and two low tides each day. The successive high or low tides are approximately of the same height.
- **Diurnal tide:** There is only one high tide and one low tide during each day. The successive high and low tides are approximately of the same height.
- **Mixed tide:** Tides having variations in height are known as mixed tides. These tides generally occur along the west coast of North America and on many islands of the Pacific Ocean.
- **Spring tides:** The position of both the sun and the moon in relation to the earth has direct bearing on tide height. When the sun, the moon and the earth are in a straight line, the height of the tide will be higher. These are called spring tides.
- **Neap tides:** When the sun and moon are at right angles to each other and the forces of the sun and moon tend to counteract one another. The moon's attraction, though more than twice as strong as the sun's, is diminished by the counteracting force of the sun's gravitational pull. These are called neap tides.

2. Write the characteristics of waves in the oceanic water.

Answer:

Characteristics of waves in the oceanic water are given below:

- The highest and lowest points of a wave are called the crest and trough.
- Wave height is the vertical distance from the bottom of a trough to the top of a crest of a wave.
- Wave amplitude is one-half of the wave height.
- Wave period is merely the time interval between two successive wave crests.
- Wavelength is the horizontal distance between two successive crests.

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- Wave speed is the rate at which the wave moves through the water, and is measured in knots.
- Wave frequency is the number of waves passing a given point during a one-second time interval.

3.Explain how do heating of solar energy, wind, gravitation and coriolis force affect the ocean currents.

Answer:

Heating by solar energy: Heating by solar energy causes the water to expand, that is why, near the equator the ocean water is about 8 cm higher in level than in the middle latitudes. This causes a very slight gradient and water tends to flow down the slope.

- **Wind:** Wind blowing on the surface of the ocean pushes the water to move. Friction between the wind and the water surface affects the movement of the water body in its course.
- **Gravity:** Gravity tends to pull the water down the pile and create gradient variation.
- **The Coriolis force:** The coriolis intervenes and cause the water to move to the right in the northern hemisphere and to the left in the southern hemisphere.

4.Differentiate between warm currents and cold currents.

Answer:

S.no.	Warm currents	Cold currents
1.	They flow from equatorial regions to high latitudes.	They flow from polar region to low latitudes.

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2.	Its temperature is higher than the surrounding water.	Its temperature is below than the surrounding water.
3.	It raises the temperature of coastal areas and are observed normally on the east coast of lower and middle latitude.	It reduces the temperature of the coastal area and are observed on the west of continent in lower and middle latitudes.
4.	Winds passing over warm currents absorb a good amount of moisture and bring heavy rainfall on the coastal areas.	Winds passing over cold currents becomes dry and little rainfall on the coaarea.
5.	Warm currents are of great help to navigation because they melt ice bergs.	Cold currents hinder navigation because they create ice bergs.
6.	Warm currents keep the ports open in the polar regions free from ice.	Cold currents make the parts unoperational in lower latitudes as they are ice bound.

5. How do currents affect the temperature? How does it affect the temperature of coastal areas in the N. W. Europe?

Answer:

Impact of currents on temperature varies depending on whether currents are warm or cold.

1. **Cold currents:** Cold currents bring cold water into warm water areas. These currents are usually found on the west coast of the continents in the low and middle latitudes (true in both hemispheres) and on the east coast in the higher latitudes in the Northern Hemisphere.

2. **Warm currents:** Warm currents bring warm water into cold water areas and are usually observed on the east coast of continents in the low and middle latitudes (true in both hemispheres). In the northern hemisphere they are found on the west coasts of continents in high latitudes.

In North West Europe, warm currents exist. They increase the temperature in coastal areas of N. W. Europe.

6. What are the causes of currents?

Answer:

Ocean currents are like river flow in oceans. They are caused by two types of forces namely:

1. Primary forces that initiate the movement of water;
2. Secondary forces that influence the currents to flow.

Primary Forces: The primary forces that influence the currents are:

- **Heating by solar energy:** Heating by solar energy causes the water to expand. That is why, near the equator the ocean water is about 8 cm higher in level than in the middle latitudes. This causes a very slight gradient and water tends to flow down the slope.

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- **Wind:** Wind blowing on the surface of the ocean pushes the water to move. Friction between the wind and the water surface affects the movement of the water body in its course.
- **Gravity:** Gravity tends to pull the water down the pile and create gradient variation.
- **Coriolis force:** The Coriolis force intervenes and causes the water to move to the right in the northern hemisphere and to the left in the southern hemisphere. These large accumulations of water and the flow around them are called Gyres. These produce large circular currents in all the ocean basins.

7. Make a list of currents which are found in Pacific, Atlantic and Indian Ocean.

Answer:

This is a listing of the seventeen major surface ocean currents.

Agulhas Current	Indian	Warm
Alaska Current	North Pacific	Warm
Benguela Current	South Atlantic	Warm/Cool
Brazil Current	South Atlantic	Warm
California Current	North Pacific	Cool
Canaries Current	North Atlantic	Cool

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East Australian Current	South Pacific	Warm
Equatorial Current	Pacific	Warm
Gulf Stream	North Atlantic	Warm
Humboldt (Peru)Current	South Pacific	Cool
Kuroshio (Japan)Current	North Pacific	Warm
Labrador Current	North Atlantic	Cool
North Atlantic Drift	North Atlantic	Warm
North Pacific Drift	North Pacific	Warm
Oyashio (Kamchatka)Current	North Pacific	Cool
West Australian Current	Indian	Cool
West Wind Drift	South Pacific	Cool

8.How is the movement of currents influenced by prevailing winds? Give examples.

Answer:

The prevailing winds, or winds that usually blow in the same direction, influence ocean currents because the wind causes friction on the water surface causing the water to move in the same direction as the wind. Some prevailing winds are called “trade winds” because merchants on sailboats used these regular winds to sail across the Indian Ocean or Atlantic Ocean to trade their goods. The wind made sailing to some places very easy and other places very difficult. Some of these regular winds change direction during certain months. This is called monsoon. Monsoon winds blow one direction from May to October, then change directions from November to April, which allowed the merchants to sail home in Monsoon areas of the world. The monsoon winds mainly effects South Asia (India). Indian traders sailed west to Africa in the summer and east back to India in the winter.

9.Why some currents are warm or cold?

Answer:

There are several warm ocean currents that move warm water away from the equator. These currents of water have warm air above the water. The warm air raises the temperature of the land it touches. These areas enjoy a much warmer climate than other places at the same latitude. Areas such as England would be much colder without the warm Gulf Stream. Warm ocean currents flow on the eastern side of a continents. They only reach the western side in high latitude areas. Another characteristic is that they flow away from the equator. Warm currents have higher temperatures, so they are less dense than cold water. Usually warm water has a higher salinity, but it remains less dense than cold water, so cold water is heavier and flows under warm water. The water is warmed on the surface, so warm currents flow across the surface of the ocean. As a warm current cools down, it drops down and becomes a cold water currents.

10.What are under currents?

Answer:

Under currents deep in the ocean flow in the opposite direction from the surface current above them. They replace the surface waters that are moving out. A major

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under current circles the globe at about 30 mph. The main under current is called the Great Conveyor Belt. It is truly like an underwater river. In fact, under currents are called “submarine rivers”.

Map Skill

1.Show on a world map the currents of the oceans.

Answer:

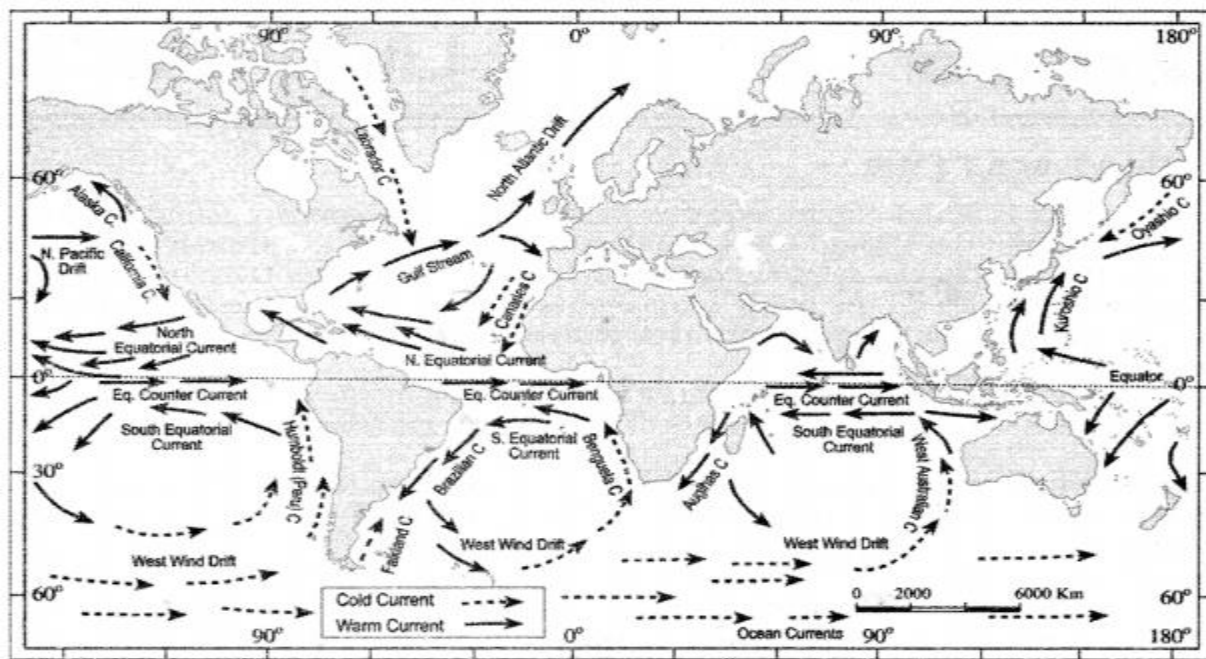


Fig: Major currents in the Pacific, Atlantic and Indian oceans

Multiple choice questions.

1.Which force intervenes and causes the water to move to the right in the northern hemisphere and to the left in the southern hemisphere?

- (a) Farrell law
- (b) The Coriolis force
- (c) Gravitational force
- (d) Effect of rotation of the earth.

Answer:

- (b) The Coriolis force

2.Primary force which affects the ocean currents:

- (a) Heating by solar energy
- (b) Wind
- (c) Gravity
- (d) All of these.

Answer:

- (d) All of these

3.What is the time between the high tide and low tide, when the water level is falling, is called?

- (a) Ebb
- (b) Waves
- (c) Currents
- (d) Gyres.

Answer:

- (a) Ebb

4.The Coriolis force intervenes and causes the water to move to the right in the northern hemisphere and to the left in the southern hemisphere. These large accumulations of water and the flow around them are called what?

- (a) Ebb
- (b) Waves
- (c) Currents
- (d) Gyres.

Answer:

- (d) Gyres

5.What per cent of ocean water is in the form of deep water currents?

- (a) 50%
- (b) 60%
- (c) 80%
- (d) 90%.

Answer:

- (d) 90%

6.To what depth exist the upper layer of ocean stream?

- (a) 200 metres
- (b) 300 metres
- (c) 40 metres
- (d) 500 metres.

Answer:

- (d) 500 metres

7.What is the name given to movement of water due to metrological effects?

- (a) Surges
- (b) Tides
- (c) Waves
- (d) Currents.

Answer:

- (a) Surges

8.What is the name given to time when the distance between the earth and the moon is minimum?

- (a) Aphelion
- (b) Perigee
- (c) Perihelion
- (d) Apogee.

Answer:

- (6) Perigee

9.The heights and lowest points of a wave are called_____and_____.

- (a) Crest and trough
- (b) Trough and crest
- (c) Edd and surge
- (d) Surge and ebb.

Answer:

- (a) Crest and trough

10.How much time interval normally exist between neap tides and spring tides?

- (a) 7 days
- (b) 10 days
- (c) Two weeks
- (d) One month.

Answer:

- (a) 7 days

11.What percent of ocean water is in the form of surface currents?

- (a) 50%
- (b) 40%
- (c) 20%
- (d) 10%.

Answer:

- (d) 10%

12. It is the horizontal distance between two successive crests.

- (a) Wave speed
- (b) Wave length
- (c) Wave frequency
- (d) Wave gap.

Answer:

- (b) Wave length

13. Where do highest tide occur in the world?

- (a) Bay of Fundy in Nova Scotia, Canada
- (b) Bay of Hudson in USA
- (c) Bay of Bengal in India
- (d) Arabian Sea.

Answer:

- (a) Bay of Fundy in Nova Scotia, Canada.

14. What is the unit for measuring speed of waves?

- (a) Km
- (b) Knot
- (c) Cm
- (d) Millibars.

Answer:

- (b) Knot

15. At which place is being a 3 watt electric generating plant established in Sundarban in West Bengal?

- (a) Durgaduani
- (b) Haldia
- (c) Ganga
- (d) 24 pargana.

Answer:

- (a) Durgaduani

16. Which of the following is not a primary force which affects ocean currents?

- (a) Heating by solar energy
- (b) Wind
- (c) Gravity
- (d) Debilitation.

Answer:

- (d) Debilitation

17. Those tides whose length varies are called what?

- (a) Spring tides
- (b) Neap tides
- (c) Mixed tides
- (d) High tides.

Answer:

- (d) Mixed tides

18. Upward and downward movement of ocean water is known as the:

- (a) Tide
- (b) Current
- (c) Wave
- (d) None of the above.

Answer:

- (a) Tide

19. Spring tides are caused:

- (a) As result of the moon and the sun pulling the earth gravitationally in the same direction.
- (b) As result of the moon and the sun pulling the earth gravitationally in the opposite direction.
- (c) Indention in the coast line.
- (d) None of the above.

Answer:

- (a) As result of the moon and the sun pulling the earth gravitationally in the same direction.

20. The distance between the earth and the moon is minimum when the moon is in:

- (a) Aphelion
- (b) Perigee
- (c) Perihelion
- (d) Apogee.

Answer:

- (b) Perigee

21. The earth reaches its perihelion in:

- (a) October
- (b) September
- (c) July
- (d) January.

Answer:

- (d) January