

**Key Information**

- Due to difference in temperature, salinity, density and the external forces like of the sun, moon and the winds the ocean water moves both horizontally and vertically.
- The horizontal motion refers to the ocean currents and waves. The vertical motion refers to tides and upwelling of subsurface or sinking of surface ocean water.
- 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.
- Ocean currents are like river flow in oceans. They represent a regular volume of water in a definite path and direction.
- Flooding of coastal areas caused by storms (cyclone) are called surges.
- The large accumulations of water and the flow around them are called Gyres.
- The time between the high tide and low tide, when the water level is falling, is called the ebb currents.
- The time between the low tide and high tide, when the tide is rising, is called the flood currents.

**WHAT CAUSES SEA WAVES?**

- Waves derive their energy and motion from wind at the ocean's surface.
- When a breeze of two knots or less blows over calm water, small ripples form and grow as the wind speed increases.
- 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.
- Water beneath the waves moves in circular motion standing at same place as the wave trains move ahead.

**WHAT CAUSES TIDES IN THE OCEAN?**

- Tides are caused by gravitational pull of Moon and, to a lesser extent the Sun.
- Another factor is centrifugal force, which is the force that acts to counter balance the gravity.
- On the side of the earth facing the moon, a tidal bulge occurs due to gravitational pull of moon which is greater than the centrifugal force.
- On the opposite side of the earth, the gravitational pull of moon is less, as it is farther away from moon, the centrifugal force is dominant which causes another tidal bulge.

**WHAT ARE THE DIFFERENT TYPES OF TIDES?****Tides based on Frequency of occurrence in one day or 24 hours**

- Semi-diurnal tide: 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.

#### **Monthly tidal cycle - Based on the Sun, Moon and the Earth Positions**

- Spring tides: 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 and they occur twice a month, one on full moon period and another during new moon period.
- Neap tides: When the sun and moon are at right angles to each other (first and third quarters of the Moon) and the forces of the sun and moon tend to counteract one another. The gravitational pull is diminished which results in smallest daily tidal range.



Normally, there is a seven-day interval between the spring tides and neap tides.

#### **What are the Importance of Tides?**

- 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.
- Tides are also helpful in desilting the sediments and in removing polluted water from river estuaries.
- Tides are used to generate electrical power (in Canada, France, Russia, and China). A 3 MW tidal power project at Durgaduani in Sunderbans of West Bengal is under way.

#### **Which factors influence OCEAN CURRENTS?**

Ocean currents are influenced by -

- Due to heating by solar energy, near the equator, the ocean water expands and 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 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 tends to pull the water down the pile and create gradient variation.
- 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.

### Types of Ocean Currents

- Surface currents constitute about 10 per cent of all the water in the ocean, these waters are the upper 400 m of the ocean;
- Deep water currents make up the other 90 per cent of the ocean water.
- Cold currents bring cold water into warm water areas.
- Warm currents bring warm water into cold water areas.

### What are the Effects of Ocean Currents?

- Ocean currents influence human activities such as fishing and navigation.
- Ocean currents influence climate of coastal areas. For e.g.
  - Cold current flow parallel to the west coasts of the continents in tropical and subtropical latitudes. This results in cold and arid climates.
  - Warm currents flow parallel to the west coasts of the continents in the middle and higher latitudes. This results in cool summers and mild winters.
  - Warm currents flow parallel to the east coasts of the continents in tropical and subtropical latitudes. This results in warm and rainy climates.

### MAP WORK – Locate these ocean currents on map.

