8 Ocean Circulation

Lesson Plan

Contents

- An overview of ocean activity and its significance
- To understand waves, tides and currents in oceans

Objectives

- To understand the activities of ocean water
- To learn about waves, tides and ocean currents and their influence
- To know about the impact of ocean activity on life in the coastal areas
- To appreciate the need to be aware of and alert to the movements of the oceans

Teacher's Aids

- Globe
- Pictures, charts, atlas and wall maps
- Blackboard
- Internet

Tips for Teacher

- Explain the movements of the ocean water–waves, tides and currents.
- Students should be encouraged to know places, locations and their placement on the maps.

Background and Reading

- Read the lesson aloud and explain, sharing the aids, etc., pausing to examine and explain the data in the boxes.
- Particularly focus on the surface of the oceans, the currents underneath and the movement of the plates under the oceans.
- Forces like the wind acting on the surface of the water and Earth movements that affect the water inside–both affect the movement of water.
- There are horizontal and vertical movements of water in the oceans.

The Waves

- Water on the surface rising and falling usually by force of wind, tides, volcanic activity and undersea earthquakes – waves.
- Crest – top part; trough – bottom part; horizontal distance between two crests or two waves – wavelength. Vertical distance between trough and crest – wave height. Time taken between two crests to pass same fixed spot – wave period.
- Travel long distances without change in deep water – in shallow water the height increases; length, height and strength of waves depend on wind force – can cause great damage.
- Undersea earthquake or volcanic eruption – sets off massive waves called tsunami [Japanese: tsu – harbour; nami – water] – waves travel in all directions from the focus of earthquake – open ocean – massive wavelengths – travel at 600 km to 1000 km an hour – approaching coast, enter shallow water – wavelength decreases and height increases to about 25 metres – approaches like a wall of water – immense destruction up to 3 km inland – even pushing ships inland – detected by seismograph.
- Case Study – Tsunami of 26 December 2004 – epicentre west coast of Sumatra – 9.0 on Richter Scale – ocean floor displaced 10-20 metres – speed of waves about 800 km an hour, height about 20 metres – waves travelled 3 km inland – killed over 250,000 people and millions rendered homeless – affected Indonesia, Malaysia, Thailand, Sri Lanka, Bangladesh and India and even Africa – in India, Andhra Pradesh, Tamil Nadu, Kerala, Puducherry, Odisha and Andaman and Nicobar Islands affected – damaged mangroves, coral reefs, coastal wetlands, forests, rock formations and groundwater – epidemics caused by contaminated fresh water – salinity affected soil and water.

The Tides

- Rise and fall of sea water due to gravitational forces of Sun and Moon – tides – tidal waves – rise and move towards coast: high tide; fall and move towards sea: low tide.
- Most important cause – gravitational pull of Sun and Moon on Earth's surface – every day two high and two low tides.

Spring and Neap Tides

- Spring Tide: Full moon or new moon day each month – Sun, Moon and Earth in the same line – combined gravitational pull – highest tide in the month.
- Neap Tide: Half moon days each month – Sun and Moon at right angles to the Earth – opposing gravitational pulls – high tide is lower than usual and low tide is higher than normal.

Significance of Tides

1. High tides help some rivers to become navigable – Kolkata and London.
2. Tidal currents keep river mouths free of sediment – carrying silt into the open sea.
3. Force of water due to rise and fall can be used for generating electricity.
4. Fishermen sail out with low tide and return at high tide – helps fishing industry.
5. Sea water stored in coastal areas used for making salt.

The Ocean Currents

- Constant and regular movement of water on the surface of oceans – currents.
- Speed – about 5-10 km an hour.
- Two categories on basis of temperature – warm and cold currents. Warm originate near Equator and flow towards Poles – cold originate near Poles and flow towards the tropical regions.
- Factors affecting currents:
  (i) Difference in temperature of ocean water
  (ii) Difference in salinity of ocean water
  (iii) The direction of winds
  (iv) The rotation of the Earth
  (v) The shape of the coastline

Currents of the Indian Ocean

- Warm currents:
  (i) North Equatorial Current (ii) South-west Monsoon Drift (summer)
  (iii) North-east Monsoon Drift (winter)
  (iv) South Equatorial Current (vi) Agulhas Current
- Cold currents:
  (i) West Wind Drift (ii) West Australian Current

Currents of the Pacific Ocean

- Warm currents:
  (i) North Equatorial Current (ii) Kuroshio Current
  (ii) North Pacific Current (iv) South Equatorial Current
  (v) East Australian Current
- Cold currents:
  (i) Oyashio Current (ii) West Wind Drift
  (iii) Peru Current

Currents in the Atlantic Ocean

- Warm Currents:
  (i) North Equatorial Current (ii) Gulf Stream
  (iii) North Atlantic Drift (iv) South Equatorial Current
  (v) Brazil Current
- Cold Currents:
  (i) Labrador Current (ii) Canary Current
  (iii) West Wind Drift (iv) Benguela Current

Effects of Ocean Currents

(i) Affect temperature, atmospheric pressure, winds, level of humidity, precipitation in adjoining areas – warm currents increase capacity of wind to carry more moisture; cold currents lower it.

(ii) Some areas cold and warm currents meet – create dense fog – navigational problems; examples: Gulf Stream [warm] and Labrador Current [cold] meet near Newfoundland – known as the graveyard of a thousand ships.

(iii) Large fishing areas where warm and cold currents meet - Japan, Newfoundland, west coast of North America.

(iv) Warm currents – keep harbours open in winter – facilitate navigation and trade.

(v) Icebergs move with cold currents from Polar regions – danger and damage to ships- example: Labrador Current.

Assessment Corner

Oral Assignment

A. Ask for answers at random from the students. Confirm the right answers. Let them write down the correct answers if they like in their books.

Written Assignment

B–E. The teacher has two options – (i) Either do these exercises orally first and then ask the students to write them down. OR (ii) Ask the students to write the answers on their own. Then the teacher can announce the correct answers and students can ask their partners to cross check them.

In either case, the answers can be written as homework and the teacher can check them in the class.

Think Tank

G. HOTS questions: Discuss the questions in the class and let the students write the answers to F and G as homework. Teacher should assess individual work.