# Chapter 13: Movements of Ocean Water

## Exercises — Exercises

Q1 1 (i). Upward and downward movement of ocean water is known as the: (a) tide (b) current (c) wave (d) none of the above

(a) tide. The rise and fall of ocean water, caused mainly by the attraction of the sun and the moon, is the vertical motion called a tide. Currents and waves are horizontal motions.

Q2 1 (ii). Spring tides are caused: (a) as a result of the moon and the sun pulling the earth gravitationally in the same direction. (b) as a 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.

(a). Spring tides occur when the sun, the moon and the earth lie in a straight line, so their gravitational pulls act together and the tide is higher. This happens twice a month, at full moon and at new moon.

Q3 1 (iii). The distance between the earth and the moon is minimum when the moon is in: (a) Aphelion (b) Perigee (c) Perihelion (d) Apogee

(b) Perigee. Perigee is the point in its orbit where the moon is closest to the earth, which gives unusually high and low tides. Aphelion and perihelion relate to the earth and sun, and apogee is the moon's farthest point.

Q4 1 (iv). The earth reaches its perihelion in: (a) October (b) September (c) July (d) January

(d) January. The earth is closest to the sun (perihelion) around 3rd January each year, when tidal ranges are much greater than average. In contrast, aphelion occurs around 4th July.

Q5 2 (i). What are waves?

Waves are the energy, not the water itself, moving across the ocean surface. Water particles only travel in small circles as a wave passes, while the wave train moves ahead. They are a horizontal motion of ocean water, mostly produced by wind.

Q6 2 (ii). Where do waves in the ocean get their energy from?

Waves get their energy from the wind. Wind blowing against the water surface transfers energy to it, creating ripples that grow into larger waves. The energy travels across the ocean and is finally released on the shorelines.

Q7 2 (iii). What are tides?

Tides are the periodic rise and fall of the sea level, once or twice a day, mainly due to the attraction of the sun and the moon. They are a vertical motion of ocean water and, unlike surges, are regular and predictable.

Q8 2 (iv). How are tides caused?

The moon's gravitational pull, and to a lesser extent the sun's, is the major cause of tides. Together with the centrifugal force that counterbalances gravity, it creates two tidal bulges: one on the side facing the moon and one on the opposite side.

Q9 2 (v). How are tides related to navigation?

Tides can be predicted well in advance because the earth-moon-sun positions are accurately known, helping navigators plan voyages. Tidal heights matter greatly for harbours near rivers and estuaries with shallow bars at the entrance that stop ships from entering.

Q10 3 (i). How do currents affect the temperature? How does it affect the temperature of coastal areas in the N. W. Europe?

Ocean currents transport heat from one latitude belt to another, much like the atmospheric circulation. Warm currents carry warm water from low latitudes towards the poles, while cold currents bring cold water from polar regions towards the tropics. They therefore warm or cool the air over the coasts they flow along.

West coasts of continents in tropical and subtropical latitudes are bordered by cool waters, so temperatures are relatively low with narrow daily and annual ranges; there is fog but the areas are generally arid. East coasts in these latitudes are washed by warm currents, giving warm and rainy climates.

West coasts in the middle and higher latitudes, which include north-western Europe, are bordered by warm waters. These cause a distinct marine climate with cool summers, relatively mild winters and a narrow annual range of temperature. Thus the coastal areas of N. W. Europe are much milder than their high latitude would otherwise suggest.

Q11 3 (ii). What are the causes of currents?

Ocean currents are influenced by two kinds of forces: primary forces that start the water moving and secondary forces that influence its flow.

Primary forces: (i) Heating by solar energy expands the water; near the equator the sea level is about 8 cm higher than in the middle latitudes, creating a slight gradient down which water flows. (ii) Wind blowing over the surface pushes the water, and friction between wind and water moves it along its course. (iii) Gravity pulls water down the pile and creates gradient variation. (iv) The Coriolis force deflects moving water to the right in the northern hemisphere and to the left in the southern hemisphere. The large accumulations of water and the flow around them are called gyres, producing large circular currents in all ocean basins.

Secondary forces: differences in water density affect the vertical movement of currents. Salty and cold water is denser and tends to sink, while less dense water rises. Cold polar water sinks and moves towards the equator, and warm surface water flows from the equator towards the poles to replace it. Prevailing winds and, in monsoon regions, monsoon winds further shape the major currents.