Name: _____ Date: _____ Period: _____

Oceans and Coastal Processes: READING

HOW DO COASTLINES CHANGE?

The beach is a dynamic part of a system that transports sediment. The sediment of which the beach is composed is on a journey that transports weathered rock from the land into the ocean. A beach is one of Earth's most active environments of deposition and erosion. There are two primary sources of sediment for beaches. Waves, particularly in storms, erode the coast and cause the shoreline to migrate toward the land. Rock and sediment fall or are washed onto the beach. Streams and rivers sweep other material into the ocean. Beaches are zones of transport where sediments move along the shore by wave action and currents.

WAVES

The energy of most waves comes from wind. The greater the wind's velocity and the greater the distance it blows over open water, the larger the waves it creates. Because winds can blow for greater distances over the ocean than over a lake, ocean waves are usually larger than waves on lakes. Friction between moving air and the surface of the water sets up waves that move forward in the direction of the wind. The waves you observe can be deceiving. It may look as if the water is moving forward with the waves. However, energy not water is transferred by waves. Figure 16-10 shows that as the energy of the wave moves forward, surface water moves in circles. Deep water is not affected by waves. When the wave enters shallow water near shore, the crest moves faster than the bottom of the wave and a breaker forms. As the wave breaks, it gives up its energy along the shore. This energy can do three things along the beach:

1. By causing abrasion, wave energy breaks up sand and rock in the surf zone. (Abrasion is the wearing away of sediments caused by collisions.)
2. Wave energy can erode the beach, including sediments and rock behind the beach.
3. Wave energy transports sand and sediment parallel to the shore.

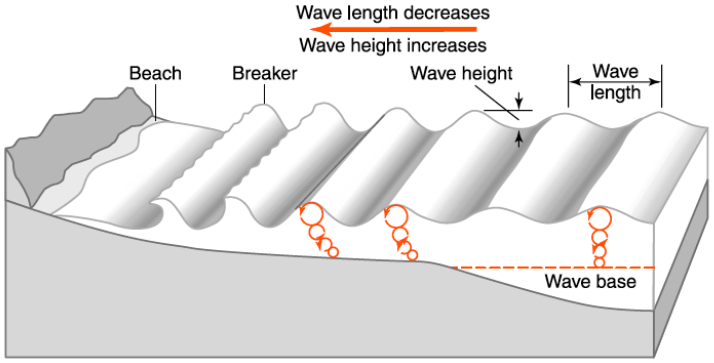

Figure 16-10 Ocean waves are driven by winds. In deep water, waves make the surface water move in circles as they carry their energy forward. Waves break in shallow water, giving up their energy to abrade and transport beach sediments.

LONGSHORE TRANSPORT

Most waves approach the beach at an angle. The result is a zigzag motion that carries sand (or whatever sediment the beach is made of) downwind along the beach as shown in Figure 16-11. The resulting motion of the water along the shore is called a longshore current, and the motion of the sediment is known as longshore transport.

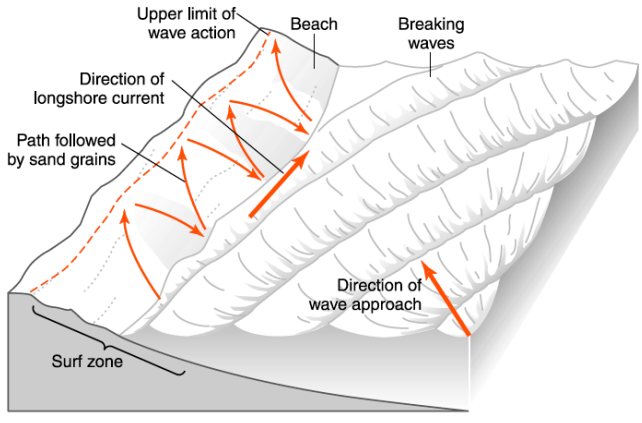

Figure 16-11 As waves wash onto a beach, beach sediment moves forward and back in the surf zone. Beach sediment is also carried parallel to the shore in the downwind direction. The result is longshore transport.

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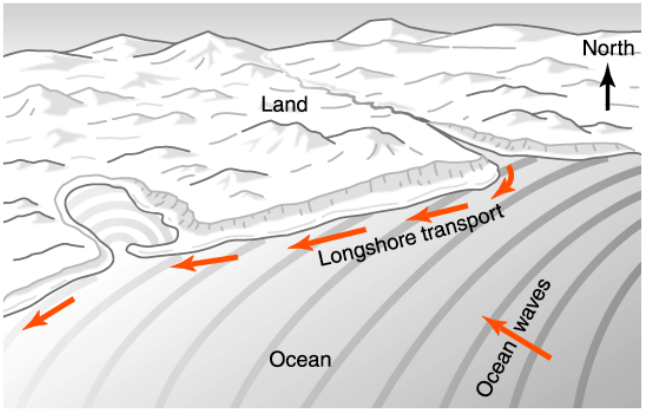
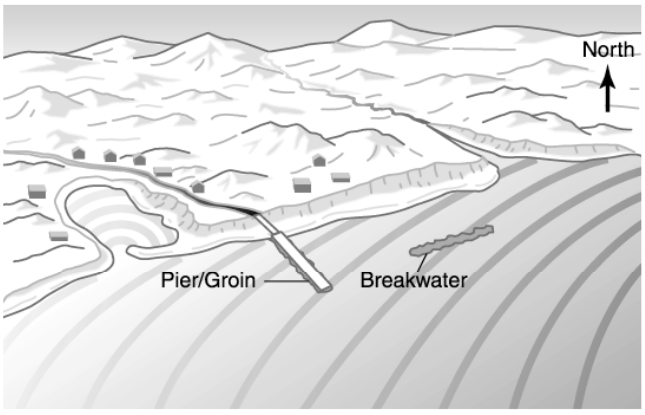
DEPOSITIONAL FEATURES

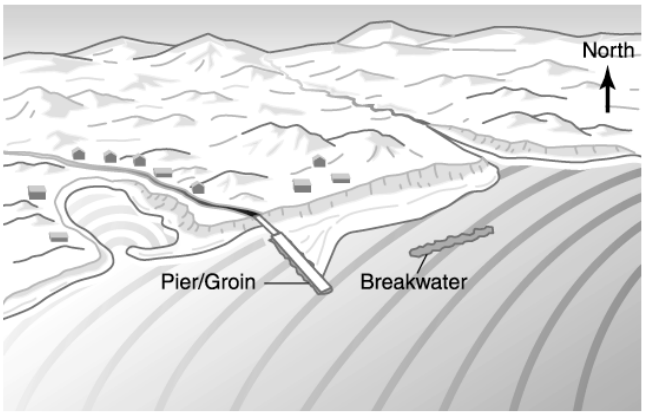
A variety of coastal features are related to wave erosion and longshore transport. Sometimes the advance and retreat of the waves deposits sand that forms low ridges along the shore. They are called sandbars. If you have ever waded in the ocean along a sandy beach and encountered a shallow area separated from the shore by deeper water, you have found an underwater sandbar. A spit is a sandbar that forms a continuation of a beach into deep water. Spits sometimes grow across bays, forming a bay-mouth bar. Similar offshore features that rise above sea level are barrier islands. A shallow bay called a lagoon separates barrier islands from the mainland.



A



B



C

The maps of New York State in the Earth Science Reference Tables show the series of islands that separate the south shore of Long Island from the Atlantic Ocean. Jones Beach and Fire Island are a part of this series of barrier islands. These features are common on gently sloping coastlines with abundant sand. Examine the diagrams to the left, part A shows a shoreline in balance. Beach sand originates from sediment carried by the river on the right and eroded from the bluffs along the shore. Waves from the southeast bend as they enter shallow water near the shore, and a longshore current carries sand westward. The sand spit growing across the bay makes it clear that the principal direction of sand carried by longshore transport is toward the west. Part B shows a breakwater built parallel to the shore to protect boats from large waves. A groin/pier has been built from the shore out into the ocean. The structures are very new in Part B and no changes in the beach are visible. Part C shows how the beach changes in response to these two obstructions. The beach gets wider behind the offshore breakwater as sand builds outward from the beach. This is because wave energy has been reduced behind the breakwater and deposition increases. Westward transport deposits sand on the upwind side of the solid pier. However, the beach shrinks on the downwind side where the flow of sand has been stopped. Even the sand spit is reduced because sand movement was stopped by the groin/pier. In general, when a groin or solid pier is constructed into the ocean in a region of longshore transport, the beach becomes wider on the upwind side and narrower in the downwind side.

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Oceans and Coastal Processes: QUESTIONS

1. What are the two primary sources of sediment for beaches?

   _____

   _____

2. What are ocean waves caused by? What effects how large they are?

   _____

   _____

3. Explain what a longshore current is.

   _____

   _____

4. Briefly define the following terms:

   sandbar: _____

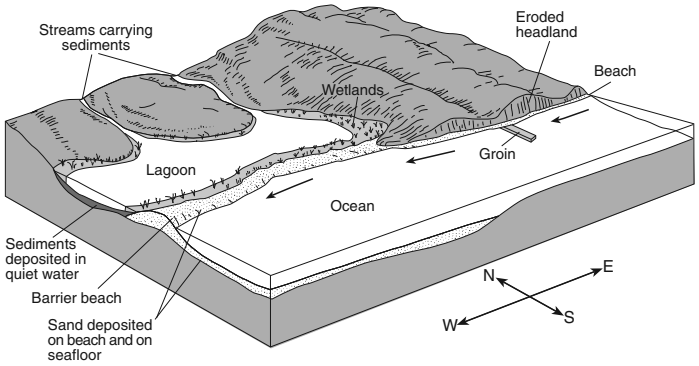
   spit: _____

   bay-mouth bar: _____

   lagoon: _____

   groin/pier: _____

Base your answers to questions 5 through 7 on the diagram to the right. The arrows show the direction in which sediment is being transported along the shoreline. A barrier beach has formed, creating a lagoon (a shallow body of water in which sediments are being deposited). The eroded headlands are composed of diorite bedrock. A groin has recently been constructed. Groins are wall-like structures built into the water perpendicular to the shoreline to trap beach sand.



5. The groin structure will change the pattern of deposition along the shoreline, initially causing the beach to become
   A. wider on the western side of the groin
   C. narrower on both sides of the groin
   D. wider on the eastern side of the groin
   E. wider on both sides of the groin

6. Which event will most likely occur during a heavy rainfall?
   A. Less sediment will be carried by the streams.
   C. An increase in sea level will cause more sediments to be deposited along the shoreline.
   D. The shoreline will experience a greater range in tides.
   E. The discharge from the streams into the lagoon will increase.

7. The sediments that have been deposited by streams flowing into the lagoon are most likely
   A. sorted and layered
   C. unsorted and layered
   D. sorted and not layered
   E. unsorted and not layered

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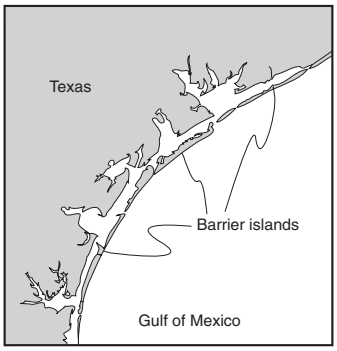
8. Which natural agent of erosion is mainly responsible for the formation of the barrier islands along the southern coast of Long Island, New York?
   A. mass movement
   C. running water
   D. ocean waves
   E. prevailing winds

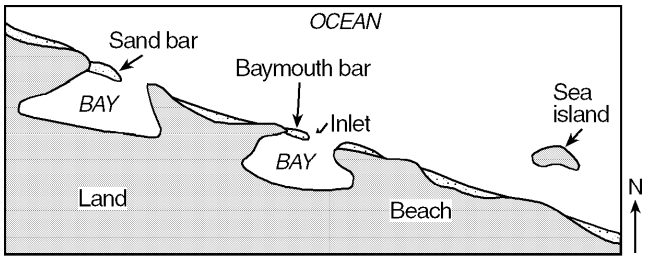


9. The map on the right shows barrier islands in the ocean along the coast of Texas.
   A. mass movement
   C. wave action
   D. streams
   E. glaciers

9. Why do the particles carried by a river settle to the bottom as the river enters the ocean?
   A. The velocity of the river water decreases as it enters the ocean.
   C. The large particles have a greater surface area than the small particles.
   D. The density of the ocean water is greater than the density of the river water.
   E. The kinetic energy of the particles increases as the particles enter the ocean.

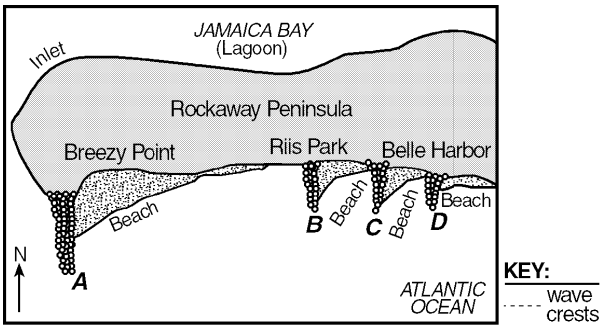
10. The map on the right shows some features along an ocean shoreline.

    In which general direction is the sand being moved along this shoreline by ocean (long-shore) currents?
    A. NE
    C. SW
    D. NW
    E. SE

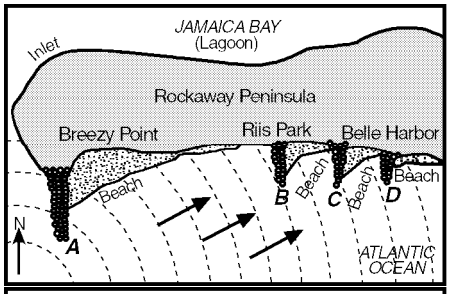


10. The map below shows Rockaway Peninsula, part of Long Island's south shore, and the location of several stone barriers, A, B, C, and D, that were built to trap sand being transported along the coast by wave action.

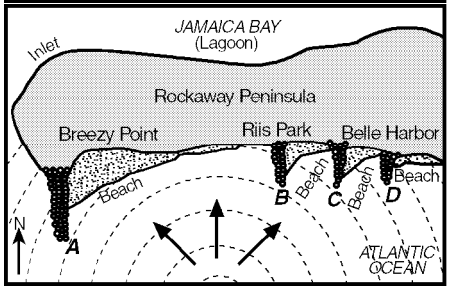
    On which one of the following maps do the arrows best show the direction of wave movement that created the beaches in this area?



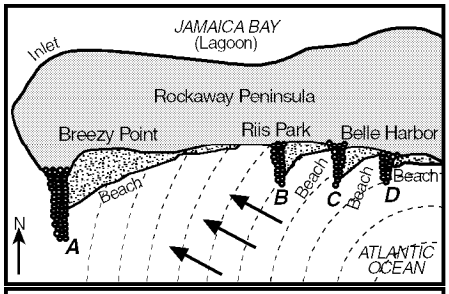
A)



B)



C)



D)