Waves and Erosion: Wearing Away Shorelines

Waves erode and reshape the shoreline they wash over.

Waves erode and reshape the shoreline they wash over. The rate of shoreline erosion depends upon the type of shoreline, the size and force and of waves hitting the shore, and the number and intensity of storms the shore area receives a year. During storms, wave action increases; therefore, erosion generally increases. For example, the powerful waves of Hurricane Andrew in 1992 sliced away parts of Florida's beaches and, in some cases, washed away entire beaches and buildings. Erosion that would have taken years occurred in just a few hours.

Under normal conditions, waves may erode the shore at a rate of one to one-and-a-half meters per year. Along the Florida coast, breaking waves constantly erode the sand and soft soil that compose the beaches. During moderate weather, the effects of erosion along the Florida coast are barely visible to the onlooker. Waves may also deposit sand and soft soil to form new shoreline features.

Along shorelines that are composed of rock, for example on the coast of California, erosion works in a different way. When breaking waves hit the shoreline, they chip fragments off of existing beach rock. These small rocks and sand grains are then swept by waves against other rocks on the shore, causing more beach rock to chip. Waves also cause erosion when breaking storm waves force water into the cracks of rock cliffs. The cracks grow larger and larger and, eventually, the pressure breaks the rocks apart. Erosion is also caused by the chemical action of seawater dissolving minerals from rocks. Over time, the rocks will break apart or dissolve completely.

Sea cliffs are steep faces of rock that have been eroded by waves. Eventually, the sea cliff will be worn away, often breaking off large rocks that fall into the sea. The waves will then erode the large rocks into sand.

The buildup of rock and sand at the bottom of the sea cliff form a flat platform called a **terrace**. Terraces help slow down the erosion of sea cliffs. As waves move across the terrace, they slow, striking the cliff with less energy and force. **Sea stacks** are columns of hard rock left behind by the erosion of a sea cliff. Sea cliffs consist of resistant rock and some less resistant rock. In the formation of a **sea cave**, the less resistant rock is eroded away by waves, leaving behind a hollowed-out portion of sea cliff.

Sea cliffs are steep faces of rock that have been eroded by waves.

Deposits by Waves

Fast-moving waves carry sand, shell fragments, and rock particles across the ocean. As waves slow down and weaken as they approach shorelines, these particles become too heavy for waves to carry. The particles are then deposited offshore or on the shoreline. As a result of waves depositing material in different areas, various shoreline features are formed. These features include beaches, **sand bars**, and **spits**.

Beaches are the shore areas between the high-tide mark and the low tide and usually consist of sand or pebbles.

*Beache*s are the shores areas between the high-tide mark and the low tide mark. They usually consist of sand or pebbles. The type of material that composes a beach will depend upon its source. For example, the white sand on the Atlantic Coast of Florida

came from the erosion of the Appalachian Mountains. The black sands on Hawaii's beaches came from the erosion of volcanic rock.

A *sand bar* is an underwater deposition of sand. Sand bars form when longshore currents (currents that move water parallel to the shore) pass across the opening of a bay or cove. The sediments carried within this current are carried inland by waves and deposited. Sand bars that are attached at one end to a mainland or island and extend into open water are called *spits*. You may have walked out on a spit of land that extended into the ocean to fish or look for shells.

Summary

Waves are formed when energy from earthquakes, the gravitational pull of the moon, or, most commonly, the wind, is transferred to the water. Special terminology is used to describe a wave. The highest point on a wave is the *crest*; the lowest point is the *trough*. The vertical distance between these two points is the *wave height*; and the distance between two adjacent waves' crests is the *wavelength*. Wave types include *deep-water* and *shallow-water waves*. Along shallow coastlines *spilling breakers* form, whereas along steeply sloped coastlines *plunging breakers* occur. In open ocean, water *whitecaps* and *rogue waves* can form. Other contrasting waves are *capillary waves* (very small ripples) and *tsunamis*, or seismic waves, which are the largest and most destructive waves.

The wave action on our beaches causes erosion *of the shoreline and changes the shape of the shoreline.*

The wave action on our beaches causes *erosion* of the shoreline and changes the shape of the shoreline. The wearing away of the coast can create *sea cliffs*, *terraces*, *sea stacks*, and *sea caves*. Erosion is countered by waves depositing sand and pebbles that form *beaches*, *sand bars*, and *spits*.

Practice

Circle the letter of the correct answer.

1. Waves are created by some form of _____ that disturbs the water.

   a. chemical
   b. energy
   c. wave
   d. trough

2. The _____ is the highest point of a wave.

   a. wavelength
   b. amplitude
   c. crest
   d. trough

3. The trough is the _____ part of a wave.

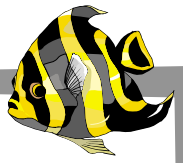
   a. biggest
   b. widest
   c. highest
   d. lowest

4. The distance from still-water level to a wave's crest is called the wave _____ .

   a. amplitude
   b. crest
   c. trough
   d. length

5. The _____ is the vertical distance between the trough and the crest.

   a. energy
   b. wavelength
   c. wave height
   d. momentum



6. The distance between two adjacent waves' crests is called the _____ .

   a. trough
   b. amplitude
   c. wave height
   d. wavelength

7. As waves approach the shore, they become _____ , bigger, and more numerous.

   a. faster
   b. slower
   c. stronger
   d. deeper

8. Shallow-water waves become _____ in shape.

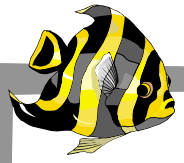
   a. trochoidal
   b. oval
   c. elliptical
   d. shorter

9. Deep-water waves called _____ are long, low, and evenly spaced apart with rounded curves.

   a. capillary
   b. seismic
   c. cat's paws
   d. swells

10. When a wave breaks, the energy that was stored in the wave is _____ .

    a. increased
    b. decreased
    c. lost
    d. released



11. The _____ breaker, common in Florida, is a quiet wave.

    a. elliptical
    b. crashing
    c. spilling
    d. plunging

12. The _____ breaker produces a crashing sound.

    a. spilling
    b. plunging
    c. shallow-water
    d. capillary

13. The smallest waves are _____ waves, or ripples.

    a. surface
    b. shallow-water
    c. tsunami
    d. capillary

14. The most destructive wave in the ocean is the _____ , or seismic wave.

    a. tsunami
    b. capillary
    c. deep-water
    d. elliptical

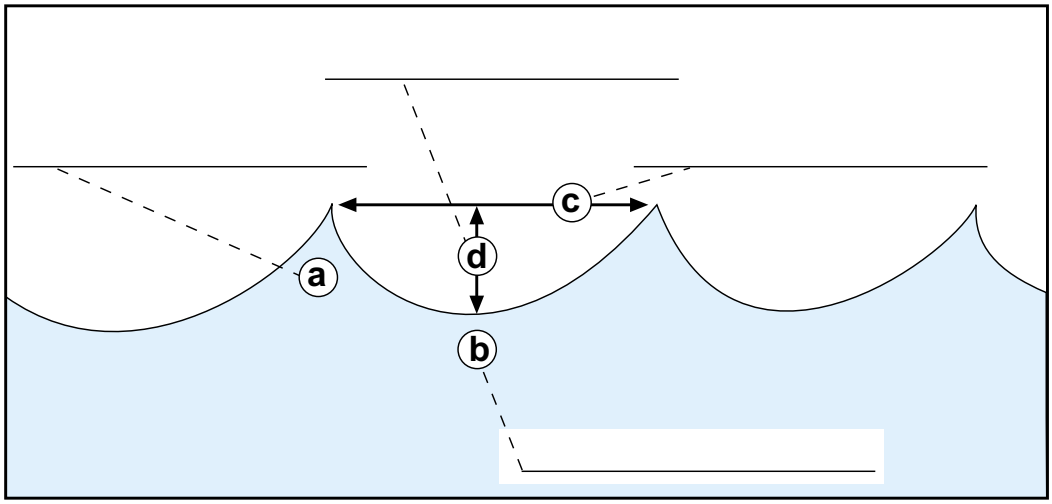
15. Water gets its wave energy from the gravitational pull of the moon, earthquakes, and, most commonly, the _____ .

    a. wind
    b. Earth
    c. rotation
    d. erosion

Practice

Answer the following.

1. Label the wave diagram below. Write the correct term by each letter in the diagram.



2. Complete the chart below by filling in the description of each wave.

Wave Characteristics	
spilling breaker	
plunging breaker	