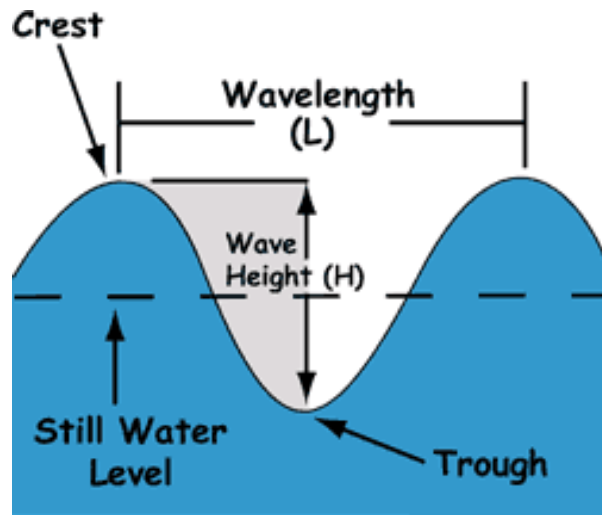
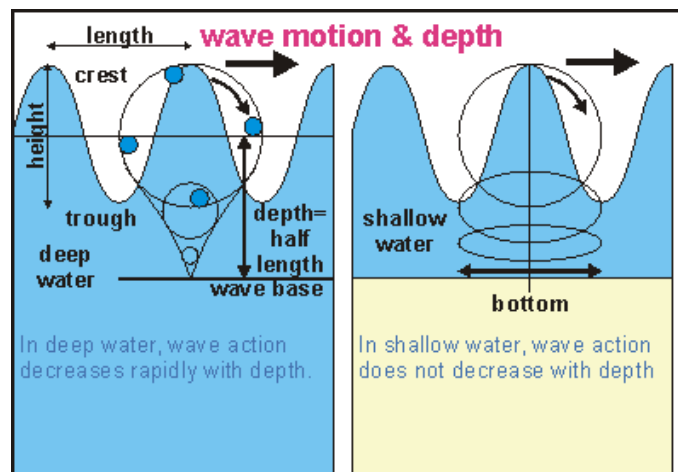


Ocean Waves



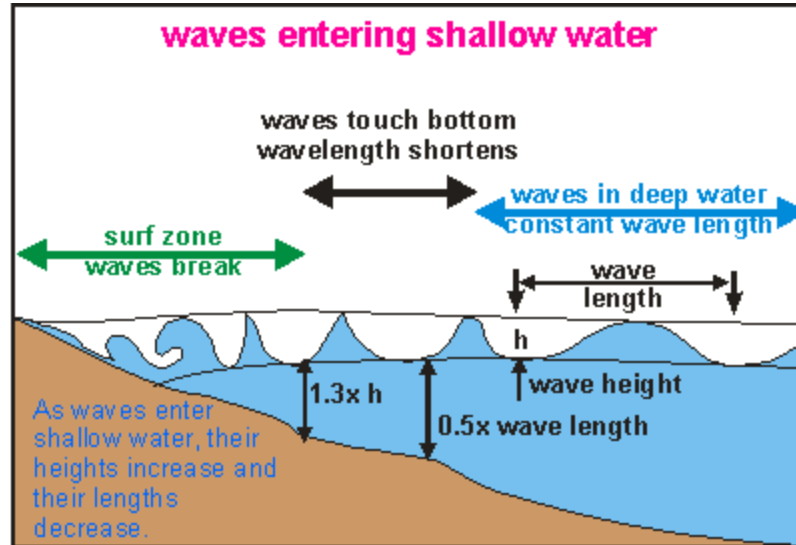
Wave Characteristics

Everything from earthquakes to ship wakes creates waves; however, the most common cause is wind. As wind passes over the water's surface, friction forces it to ripple. The strength of the wind, the distance the wind blows (**fetch**) and the length of the gust (**duration**) determine how big the ripples will become. Waves are divided into several parts. The **crest** is the highest point on a wave, while the **trough**, or valley between two waves, is the lowest point. **Wavelength** is the horizontal distance, either between the crests or troughs of two consecutive waves. **Wave height** is a vertical distance between a wave's crest and the next trough. **Wave period** measures the time in which a wave passes. A wave period can be measured by picking a stationary point and counting the seconds it takes for two consecutive crests or troughs to pass it.



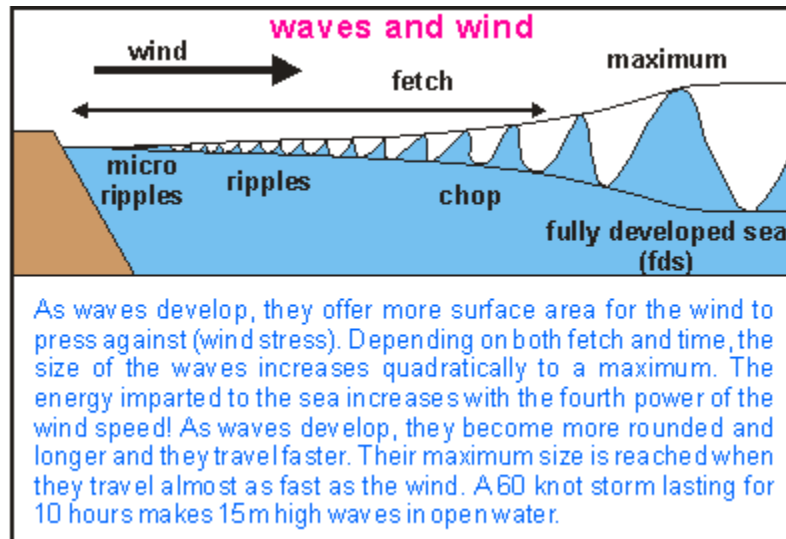
Deep-Water Waves

In deep water, a wave is a forward motion of energy, not water. In fact, the water does not even move forward with a wave. If we followed a single drop of water during a passing wave, we would see it move in a vertical circle, returning to a point near its original position at the wave's end. These vertical circles are more obvious at the surface. As depth increases, their effects slowly decrease until completely disappearing about half a wavelength below the surface.



Shallow-Water Waves

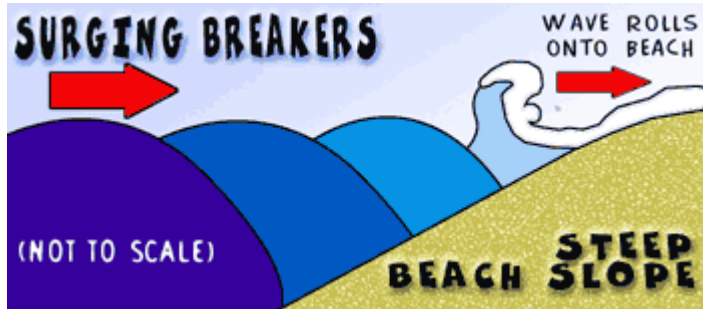
As waves enter shallow water, they slow down, grow taller and change shape. At a depth of half its wave length, the rounded waves start to rise and their crests become shorter while their troughs lengthen. Although their period (frequency) stays the same, the waves slow down and their overall wave length shortens. The 'bumps' gradually steepen and finally break in the surf when depth becomes less than 1.3 times their height. Note that waves change shape in depths depending on their wave length, but break in shallows relating to their height!



Breakers

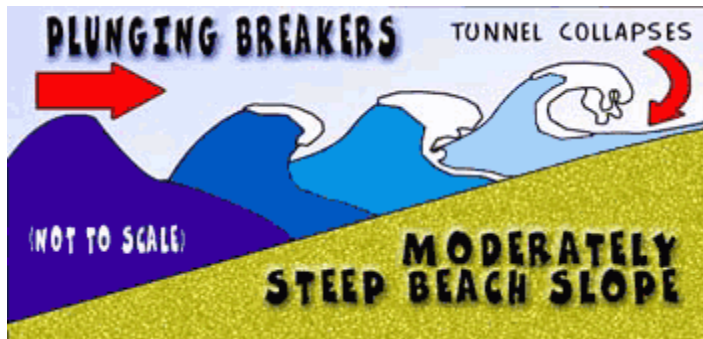
In deep waters, only wavelength and wave period affect a wave's speed. As the wave approaches shallow water, or water that is half the wavelength or less deep, the ocean floor begins to affect the wave's shape and speed. Wave height increases, and the crests become more peaked. As the steepness increases, the wave becomes unstable. The forward speed of the crest becomes faster than the speed of the wave, and the wave breaks.

We can describe breaking waves in three different ways: **Surging Breakers**, **Plunging Breakers** and **Spilling Breakers**. You see examples of these at the beach.



Surging Breakers happen on beaches where the slope is very steep. The wave does not actually break. Instead, it rolls onto the steep beach. These kinds of breakers are known for their destructive nature.

From "Ocean Talk" by Naval Meteorology and Oceanography Command.



Plunging Breakers happen on beaches where the slope is moderately steep. This kind of wave normally curls over forming a tunnel until the wave breaks. Expert surfers love this type of wave!

From "Ocean Talk" by Naval Meteorology and Oceanography Command.



Spilling Breakers occur on beaches with gentle slopes. These waves break far from the shore, and the surf gently rolls over the front of the wave.

Ocean Waves Questions

1. What three factors determine the size of a ripple on the ocean surface?
2. What are the differences between wave height, wavelength, and wave period?
3. Describe the movement of a water molecule in a deep-water wave.
4. At what point do waves begin to change upon entering shallow water?
5. What causes a wave to “break” into the shoreline?
6. Describe surging breakers and indicate where these breakers occur.
7. Describe plunging breakers and indicate where these breakers occur.
8. Describe spilling breakers and indicate where these breakers occur.