

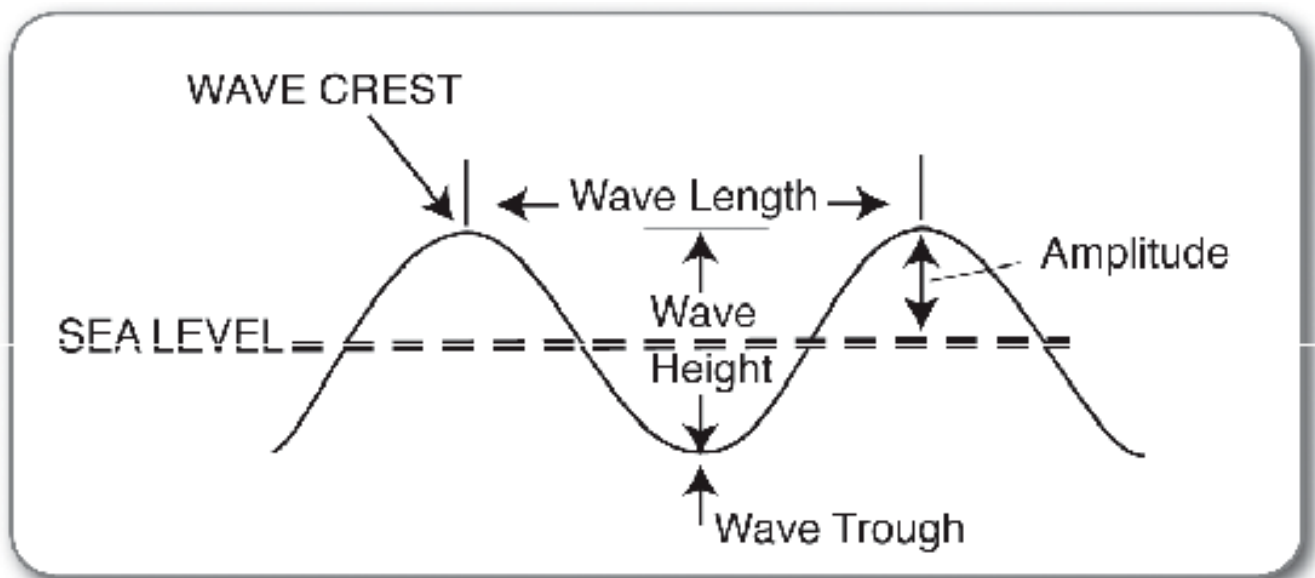
# Wave Concepts and Terminology for Students and Teachers

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## Wave

The repeating and periodic disturbance that travels through a medium (e.g. water) from one location to another location.

## Wave characteristics



### Wave crest

The highest part of a wave.

### Wave trough

The lowest part of a wave.

### Wave height

The vertical distance between the highest (crest) and lowest (trough) parts of a wave.

**Wavelength**

The distance from a certain point on one wave to the same point on the next wave (e.g. distance between two consecutive wave crests or between two consecutive wave troughs).

**Wave amplitude**

One half the distance from the crest to the trough. Wave amplitude is a more technical term for wave height and is used in engineering technology.

**Wave frequency**

The number of waves passing a fixed point in a specified period of time. Frequency has units of waves per second or cycles per second. Another unit for frequency is the Hertz (abbreviated Hz) where 1 Hz is equivalent to 1 cycle per second.

**Wave period**

The time it takes for two successive crests (one wavelength) to pass a specified point.

**Wave speed**

The distance the wave travels divided by the time it takes to travel that distance. Wave speed is determined by dividing the wavelength by the wave period. In symbols  $c = \lambda / T$ , where  $c$  is the wave speed,  $\lambda$  (lambda) is the wavelength, and  $T$  is the period.

**Wave Steepness**

The ratio of height to wavelength. When wave steepness exceeds 1:7, breakers form. If a wave has a height of one foot and a length from crest to crest of 8 feet, then the ratio is 1:8 and this wave is not going to break. But if the height is 1 foot and the length decreases to 5 feet, then the ratio is 1:5 and this wave has now become so steep that the crest topples and the wave breaks.

## **Types of Ocean Waves**

### **Capillary waves**

Very small waves with wavelengths less than 1.7 cm or 0.68 inches. They are the first waves to form when the wind blows over the surface of the water and are created by the friction of wind and the surface tension of the water. These tiny little waves increase the surface area of the sea surface and if the wind continues to blow, the size of the wave will increase in size and become a wind wave.

### **Chop**

Small waves causing the ocean surface to be rough.

### **Ripples**

The ruffling of the water's surface due to pressure variations of the wind on the water. This creates stress on the water and results in tiny short wavelength waves called ripples. Ripples are often called capillary waves. The motion of a ripple is governed by surface tension.

### **Standing Wave**

Waves that move back and forth (oscillate) in a vertical position. They do not move forward but appear as crests and troughs in a fixed position. Standing waves are created when a wave strikes an obstruction head-on and then are reflected backwards in the direction they came from.

### **Swell**

The smooth undulation (rising and falling of waves) of the ocean surface that forms as waves move away from the storm center where they are created. As waves move out and away from the storm center, they sort themselves out into groups of similar speeds and wavelengths. This produces the smooth undulating ocean surface called a swell. Swells may travel thousands of kilometers from the storm center until they strike shore.

## **Other terms**

### **Beaufort Scale**

A scale of wind velocity used for estimating the force or speed of winds. It is a numbered scale from 0 to 12 to describe wave size and sea conditions. The Beaufort Scale was developed by Rear Admiral Sir Francis Beaufort. 0 on the Beaufort scale represents the calmest of seas (the water is so smooth that it looks like glass). A 12 on the Beaufort scale represents hurricane force waves.

### **Breakers**

When a wave approaches shore, it touches bottom and the front of the wave slows down and the back overtakes the front. This forces the water into a peak that curves forward. This peak will eventually fall forward in a tumbling rush of foam and water called a breaker. Waves break on or near shore or over reefs or offshore sandbars. There are three types of breaking waves: plunging breakers, spilling breakers and collapsing breakers. Breakers may be one or a combination of these types.

### **Cat's Paws**

A light breeze that ruffles small areas of a water surface.

### **Fetch**

The uninterrupted area or distance over which the wind blows (in the same direction). Fetch is important because the interrelationship between wind speed and duration, both functions of fetch, is predictive of wave conditions.

### **Orbital depth**

The depth to which the orbital motion of the wave energy can be felt. This depth is equal to half of the wavelength. At the sea surface, orbital diameter is equal to wave height. As depth increases, less wave energy can be felt. The orbital depth is the depth where zero energy remains. For example, if a wave at the surface has a height of 4 meters and a wavelength of 45 m, then the depth where no motion from the wave exists is  $45/2$  or 22.5 meters.

### **Seas**

A chaotic jumble of waves of many different sizes (wave heights, wavelengths, and periods).