# Reading Science

Name: ______________________________ Date: __________

## Waves All Around

1 How long has it been since you watched waves at the beach? Did you pay attention to their shapes? If you are standing at the shore, they look like they are coming right at you. But what if you walk out on a pier jutting into the water? Ocean waves look a bit different if you can see them from their side.

2 If you watch one spot, you can see that the water rises and dips in a regular pattern. Find something floating on the waves to look at—perhaps a seagull or a jellyfish. You will see that the object moves forward a little bit as the water goes up and then moves backward as the water goes down. The water molecules are not actually being moved to the shore. The waves represent areas of pressure moving through the water, and the water is pushed upward as it is compressed by the higher pressure portions of the wave. The way that the height of the water changes over time is a property of what physicists call a standing wave.

3 Waves can be described by three properties: wavelength, frequency, and amplitude. You can easily observe these properties on your own in ocean waves. The very highest point of each wave is the peak, and the lowest is the trough. The horizontal distance from peak to peak (or trough to trough) is the wavelength. The frequency is how many peaks go by in a certain amount of time. For waves on the ocean, we might report frequency as waves per minute. A common term for the passing of a wave from one peak to the next is one cycle. For waves with higher frequency, a unit called Hertz (Hz) has been created. One Hz is one cycle per second. The last property is amplitude. The vertical distance from the height of the peak to the level of the trough is divided by two to give the amplitude. In other words, imagine a line that traveled along the middle height of the wave. The amplitude is the distance from that line to a peak or trough. There are many other waves in nature that are almost the same shape as ocean waves and can be described by the same properties. We can look at a few examples.

4 First, imagine that you have tied one end of a rope to a door knob. If you stand so that your arm is pointed at the door knob, the taut rope shows the middle line we use to measure amplitude. If you give the rope some slack and move your arm up and down, you will see a wave in the rope. The amplitude is large on the end that you hold. Closer to the door knob, the rope cannot move up and down as far. The amplitude of the wave decreases to zero at the knot.






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5 Another type of wave is the sound wave. These are also pressure waves that move through matter such as air or water. When sound waves are fed into a device called an oscilloscope, it will show the sound wave as a picture on a screen. A note of a single pitch, like from a flute or an opera singer, will show up as a regular wave. A really low note will have a low frequency. 20 Hz is about the lowest frequency a person can hear. A note of high pitch has a high frequency. When the opera singer hits “high C”, she produces sound waves at 1046.5 Hz.

6 Light can also be described by a wave. We are not able to see the form of these waves, but we can model them mathematically. Visible light does not have a different “pitch,” like sound, but it does come in different colors. It is the property of wavelength that changes when we compare light of different colors. The wavelengths of light are very, very small. A special unit of distance called a nanometer (nm) is used to report light wavelengths. There are one billion (1,000,000,000) nanometers in one meter. Violet light has the shortest wavelength at 400 nm. Red light, at 740 nm, has the longest wavelength of visible light. In contrast, the wavelengths of sound waves are measured in centimeters.