



# TEACHER GUIDE

## WAVE PROPERTIES GRADES 3-5

### COMMON MISCONCEPTIONS

- **Sound travels in a beam like light from a flashlight.**  
Sound moves air particles in all directions—it doesn't just travel in a straight line like light.
- **Sound can travel through space.**  
Since there is no air in space, there are no particles for sound to move. In space or inside a vacuum sound cannot be heard because it cannot travel.

### WAVES

Energy, not matter, travels by waves. Although it appears that water is moving in one direction when it is wavy, in fact, individual water molecules actually move up and down, not in a sideways direction. Evidence of this can be seen if a ball is placed in wavy water. The ball moves up and down but not sideways.

### TRANSVERSE WAVES

Water waves are transverse waves. At this grade level, understanding of transverse waves is limited to water, not electromagnetic waves or other types of waves. Understanding of this type of wave is focused on a few key points:

- Waves transfer energy not matter
- Amplitude and wavelength
- How increased or decreased energy affect amplitude and wavelength

Amplitude is defined as the height of the wave, or the distance between a wave's peak and its resting point, which is the surface of calm water for water waves. Wavelength is the distance between the peak of one wave and the next. Students should understand that amplitude increases with increased energy, and that wavelength decreases with increased energy. In other words, the greater the energy, the closer the waves are together.

## LONGITUDINAL WAVES

Not all energy travels through transverse waves. Another type of waves, called longitudinal waves, transfer energy such as sound energy. Energy travels through this type of waves as particles vibrate back and forth. Sound waves must have a medium to travel through. Without air, sound cannot be heard.

Sound can also be transferred through other mediums, such as water. Many students will be aware that they can still hear sounds while underwater, but things sound differently than they do above water. Dolphins and other marine mammals use sound to communicate underwater through a process called echolocation.

Earthquakes produce both transverse and longitudinal (compressional) waves. P waves are the primary waves to travel from the earthquake epicenter. These are longitudinal waves. S waves are secondary. These are transverse waves. The energy from the earthquake moves the ground up and down as it travels through the earth. This causes damage to buildings at the surface.

Longitudinal waves also have amplitude and wavelength. Wavelength is the distance between compressions and amplitude is how close together the compressions are. This is much more difficult to visualize for students than the concepts applied to transverse waves. At this level it is enough for students to understand that longitudinal waves are affected by the amount of energy being transferred. Music is a good example. When energy increases, amplitude increases as well. Increased amplitude means a louder sound. Wavelength decreases with increased energy (resulting in increased frequency—a concept/term not addressed at this level) and the pitch of the sound goes up.

