Wave

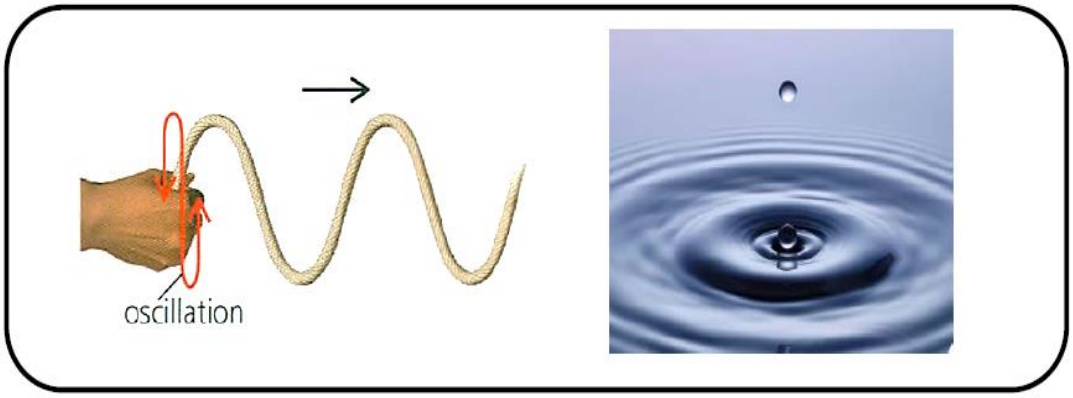
A wave is a disturbance in a medium that carries energy without a net movement of particles.

Wave Motion

It is defined as "*Waves carry **energy** without the net movement of particles*".

Notes

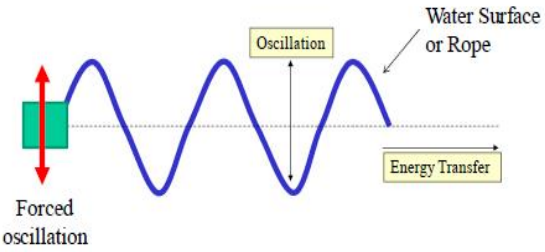
- Waves found around us in so many forms
- Wave motion can be illustrated by vibration in ropes and springs or any particle.



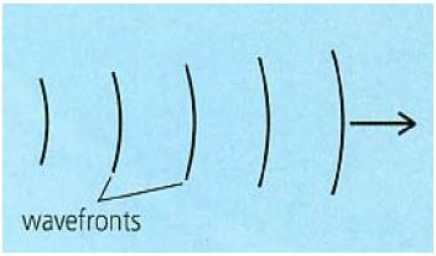
Wave front

A Line connecting points with the same phase.

Side view of wave front



Top view of wave front



There are three basic types of waves:

1) **Mechanical waves**. A wave which needs a medium in order to propagate itself. Sound waves and water waves are all examples of this.

2) **Electromagnetic waves**. These waves are disturbance that does not need any object medium for propagation and can easily travel through the vacuum. They are produced due to various magnetic and electric fields.

3) **Matter waves**. Any moving object can be described as a wave.

Mechanical Waves

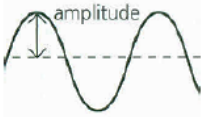
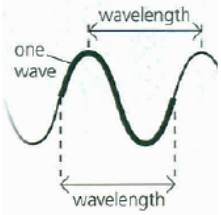
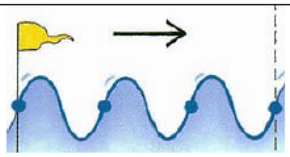
The mechanical waves are seen as a propagation of a specific disturbance that travels in a material medium. This type of wave is a result of the oscillation of matter. Basic mechanical waves are governed by Newton's laws and require a medium. A medium is the substance a mechanical wave propagates through, and the medium produces an elastic restoring force when it is deformed. Mechanical waves transfer energy and momentum without transferring mass. Some examples of mechanical waves are water waves, sound waves, and seismic waves. The medium for water waves is water; for sound waves, the medium is usually air. (Sound waves can travel in other media as well).

Mechanical waves exhibit characteristics common to all waves, such as amplitude, wavelength, period, frequency, and energy. All wave characteristics can be described by a small set of underlying principles.

The simplest mechanical waves repeat themselves for several cycles and are associated with simple harmonic motion. These simple harmonic waves can be modeled using some combination of sine and cosine functions.

Wave properties

A wave is characterized by different properties of it. To get more clarity on these elements, let's summarize each of them one by one:

Term	Symbol	Definition
Amplitude	*A*	Maximum displacement from the mean position in **m** 
Wavelength	λ	Shortest distance between any point on a wave and the equivalent point on the next. **m**  in
Frequency	*f*	The number of complete oscillations that take place 1 second in **Hz (Hertz)**  in
Wave speed	*v*	The speed at which wave fronts pass a stationary point in **m/s**
Period	*T*	The time for one complete oscillation in **s** $T = 1/f \quad , \quad f = 1/T$

The magnitude of the wave velocity is the distance the wave travels in a given time, which is one wavelength in the time of one period, and the wave speed is the magnitude of wave velocity. In equation form, this is

$$v = \frac{\lambda}{T} = \lambda f$$

This fundamental relationship holds for all types of waves. For water waves, v is the speed of a surface wave; for sound, v is the speed of sound; and for visible light, v is the speed of light.