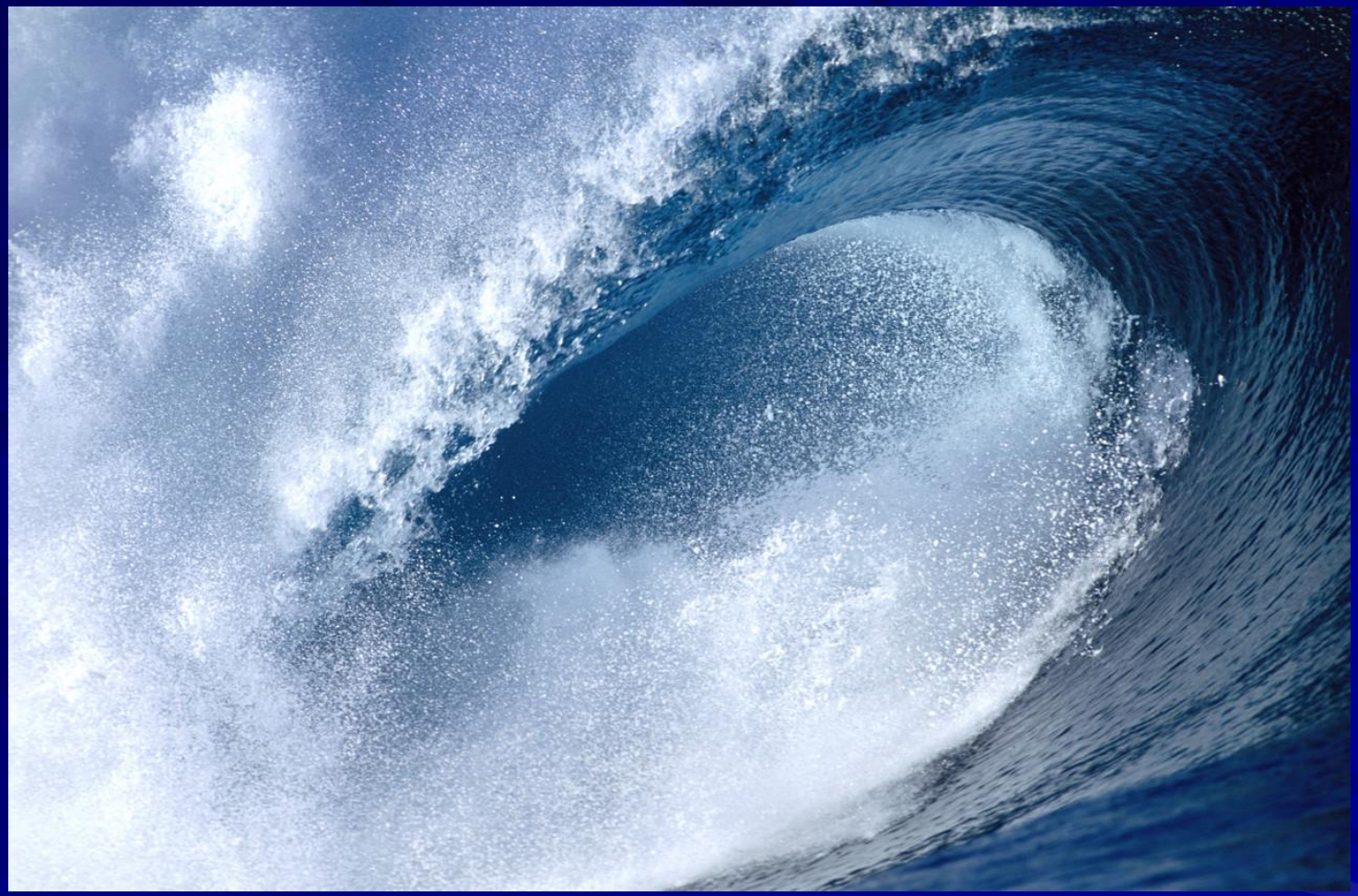


Waves and Wave Properties

A wave is a rhythmic disturbance that carries energy but not matter.

There are two types of waves:

Mechanical Waves

Mechanical waves require a physical medium. Energy causes a molecule of matter to move, and bump into a neighboring molecule. The momentum of the first molecule transfers to the second. The particles in the medium can move in two different ways: either perpendicular or parallel to direction of the wave itself.

In a *longitudinal* wave, the particles in the medium move parallel to the direction of the wave.

In a *transverse* wave, the particles in the medium move perpendicular to the direction of the wave.

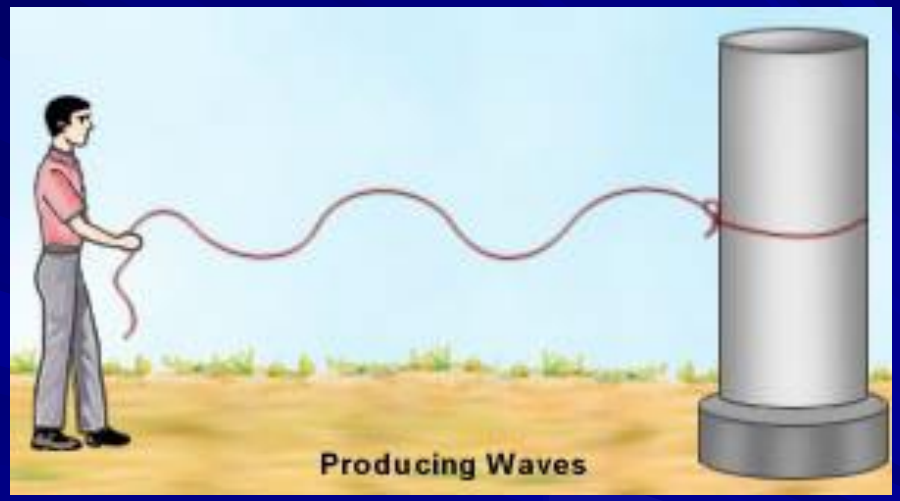
A *surface* wave is often a combination of the two. Particles typically move in circular or elliptical paths at the surface of a medium.

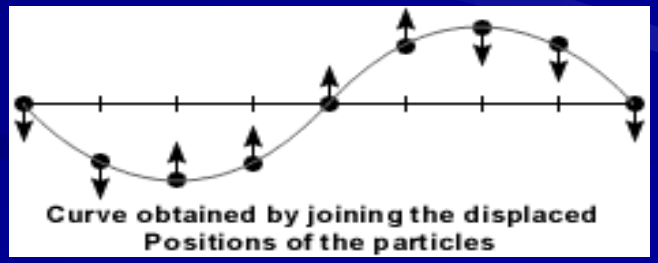
Wave Types

1. Transverse waves: Waves in which the medium moves perpendicular to the direction of the wave

Ex: a crowd doing the “wave”

water waves

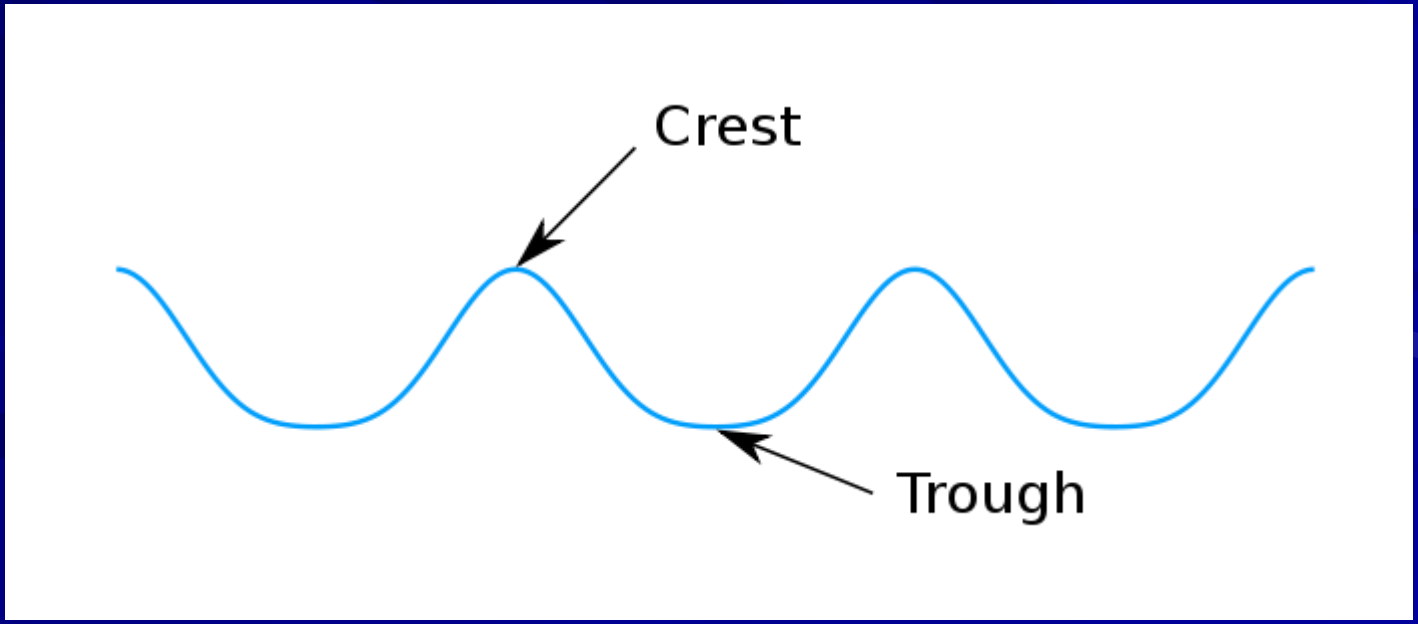




Parts of transverse waves:

Crest: the highest point of the wave

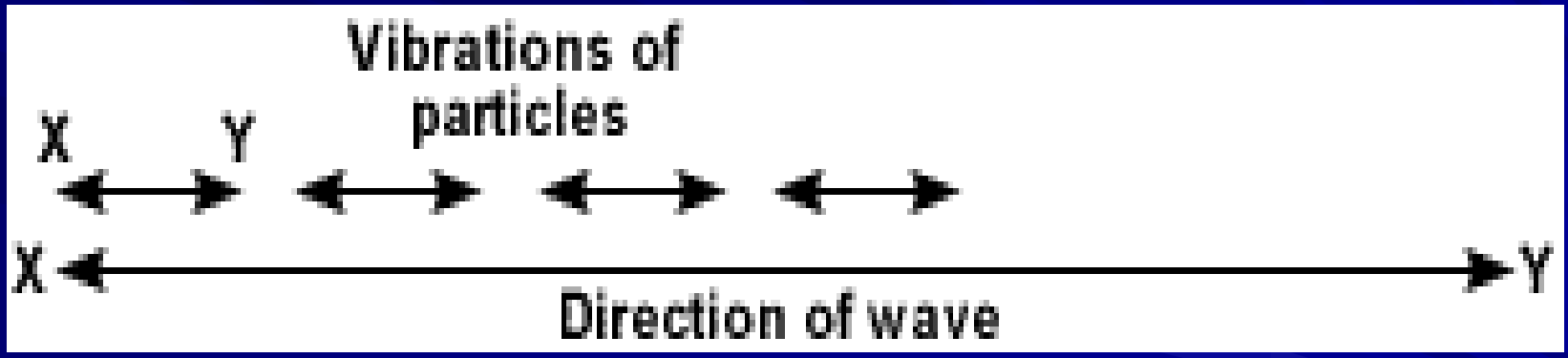
Trough: the lowest point of the wave

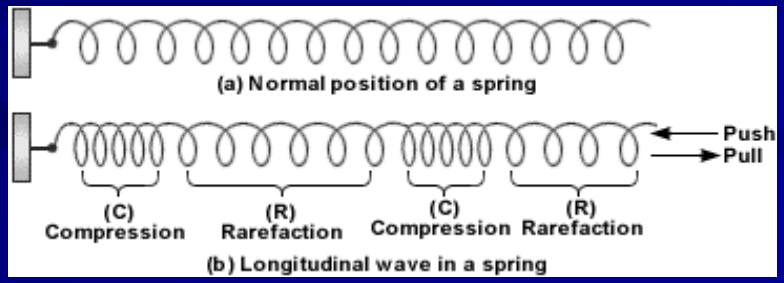


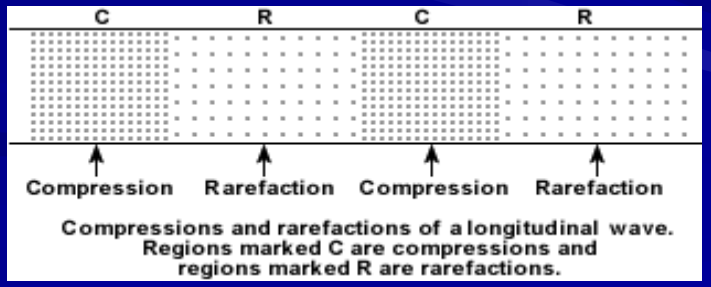
2. Compressional (or longitudinal) waves:

Waves in which the medium moves back and parallel to the direction of the wave

Ex: sound waves, seismic waves



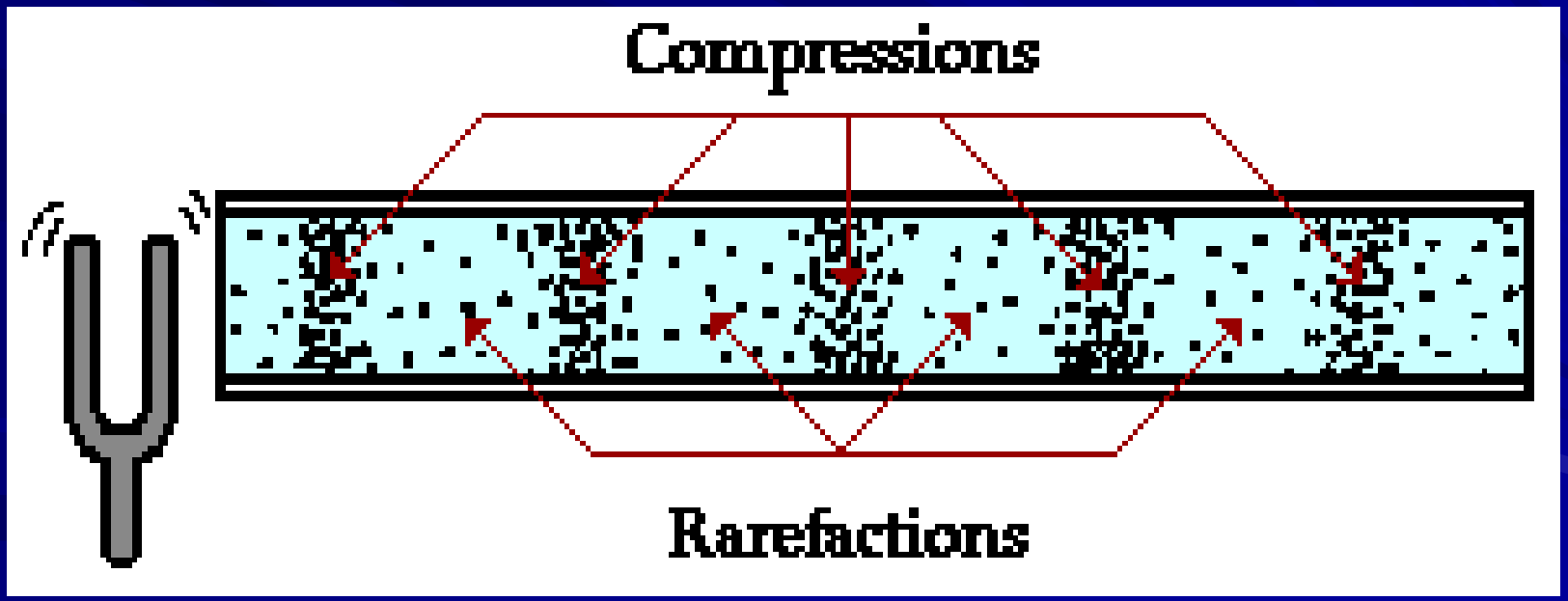




Parts of longitudinal waves:

Compression: where the particles are close together

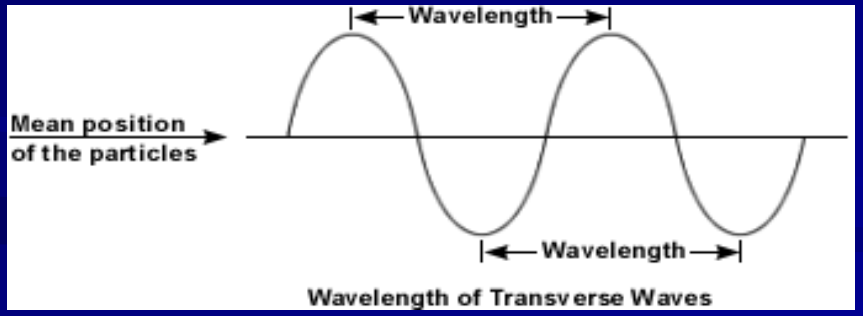
Rarefaction: where the particles are spread apart

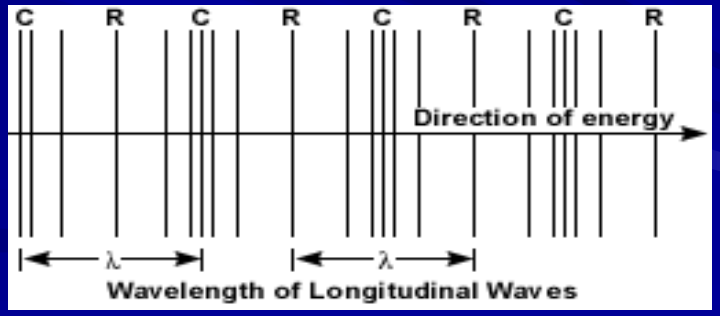


Wave Properties

Wave properties depend on what (type of energy) is making the waves.

1. Wavelength: The distance between one point on a wave and the exact same place on the next wave.





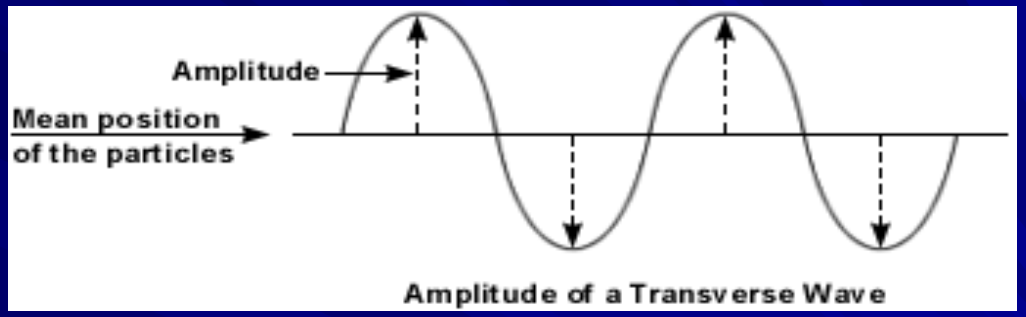
2. Frequency: How many waves go past a point in one second; unit of measurement is hertz (Hz).

The higher the frequency, the more energy in the wave.

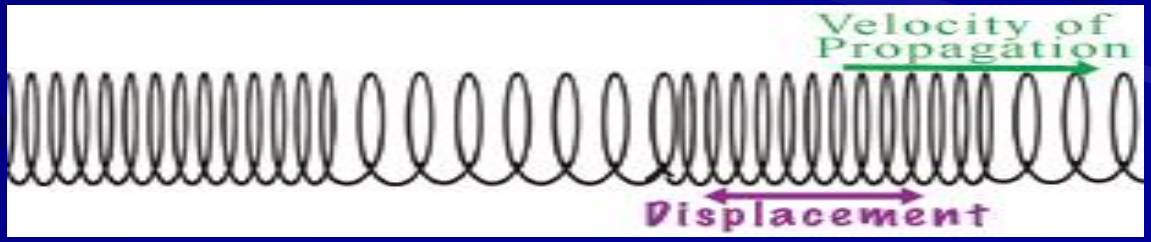
- 10 waves going past in 1 second = 10 Hz
- 1,000 waves go past in 1 second = 1,000 Hz
- 1 million waves going past = 1 million Hz

3. Amplitude: How far the medium moves from rest position (where it is when not moving).

For transverse waves, the highest point is the crest, and the lowest point is the trough.



With compressional waves, closer together (compressions) and further apart (rarefactions) the particles are, the larger the amplitude



Changing Wave Direction

1. Reflection: When waves bounce off a surface.

   If the surface is flat, the angle at which the wave hits the surface will be the same as the angle at which it leaves the surface (angle in = angle out).

   This is the law of reflection.

2. Refraction: Waves can bend.

This happens when a wave enters a new medium and its SPEED CHANGES.

The amount of bending depends on the medium it is entering.

3. Diffraction: The bending of waves AROUND an object.

The amount of bending depends on the size of the obstacle and the size of the waves.

Large obstacle, small wavelength = low diffraction

Small obstacle, large wavelength = large diffraction

Electromagnetic Waves

Waves that DO NOT NEED matter (a medium) to transfer energy. They can travel through the vacuum of space. EM waves are considered transverse waves because they have similar characteristics.

Examples: radiation, TV & radio waves, X-rays, microwaves, lasers, energy from the sun, visible light

Electromagnetic spectrum

The electromagnetic spectrum illustrates the range of wavelengths and frequencies of electromagnetic waves.