Chapter 10: Waves

10.1 The Nature of Waves

10.2 Wave Properties

What's in a wave?

1. A wave is a rhythmic disturbance that transfers energy.
2. All waves are made by something that vibrates.
3. A wave will exist only as long as it has energy to carry

Mechanical Waves

1. Needs matter to travel through. Known as medium.
2. Medium can be a solid, liquid, a gas, or a combination.

Examples:

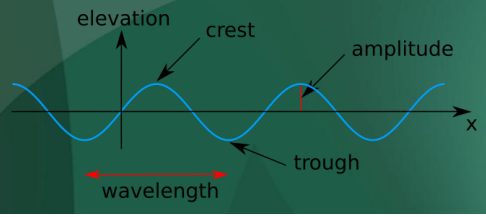
wave type	medium
ocean	water
sound	air

Types of Mechanical Wave

1. Transverse – moves back and forth at right angles to the direction that the wave travels
2. Compressional - (longitudinal) Moves back and forth along the same direction that the wave travels

WAVE DIFFER

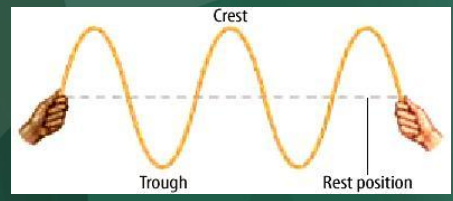
1. How much energy they carry (amplitude)
2. How fast they travel (velocity)
3. How they look



DIFFERENT FEATURES

Transverse waves

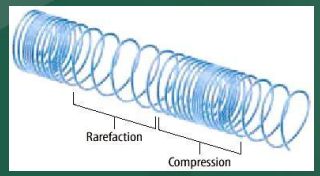
1. Crests-high point on wave
2. Troughs-low point on wave



DIFFERENT FEATURES

Compression waves

1. Compressions-region where medium is crowded
2. Rarefactions-coils are spread apart



WAVE PROPERTIES

1. Wavelength - distance from a point on a wave to the same corresponding point on the next wave.
2. Frequency - number of waves that pass a point in one second (expressed in Hertz- 1 Hz is the same as 1/second)

WAVE PROPERTIES

3. Wavelength has an inverse relationship to wave frequency. (As frequency increases, wavelength decreases)
4. Wave velocity depends on the type of wave and medium.

WAVE SPEED

1. Sound is faster in more dense media and in higher temps. faster in liquids and solids than they do in gases
2. Light is slower in more dense media, but faster in a vacuum. Slower in liquids and solids than they do in gases.

WAVE SPEED

$$v = \lambda \times f$$

v = velocity (speed), unit m/s

λ = wavelength, unit meter

f = frequency, unit hertz

EXAMPLE

$$v = \lambda \times f$$

What is the speed of a sound wave that has a wavelength of 2.00m and a frequency of 170.5 Hz?

v = (2.00m) (170.5 Hz)

v = 341 m/s

EXAMPLE

$v = \lambda \times f$

The lowest pitched sounds humans can hear have a frequency of 20.0 Hz. What is the wavelength of these sound waves if their wave speed is 340.0 m/s?

$\lambda = \frac{340 \text{ m/s}}{20.0 \text{ Hz}}$

=

λ = 17 meters

PRACTICE

$v = \lambda \times f$

A wave traveling in water has a frequency of 500.0 Hz and a wavelength of 3.0 m. What is the speed of the wave?

The highest-pitched sound humans can hear have a wavelength of 0.017 m in air. What is the frequency of these sound waves if their wave speed is 340.0 m/s?