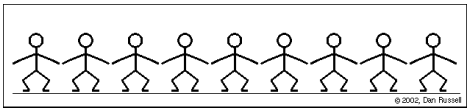


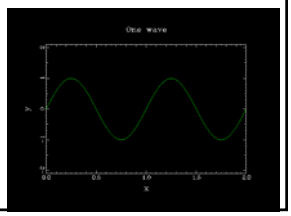
Waves

Waves

- **Transfer energy NOT matter. . .most waves created by vibrations**
- **Ways to classify waves:**
  - **Transverse**
  - **Compressional**
  - **Mechanical**
  - **Electromagnetic**

Transverse Waves

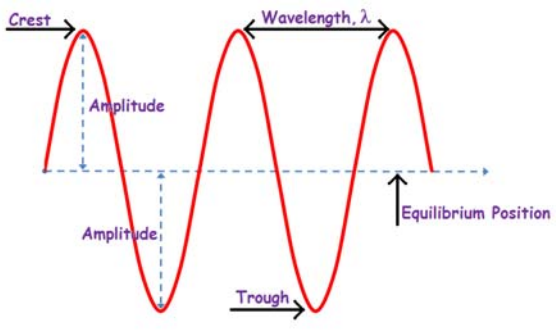
- **The medium (what the wave is traveling through) moves perpendicular to the energy**
  - **examples: Radio, microwaves, Infrared, Visible Light, UV, X-ray, Gamma, THE wave, water waves**



Parts of Transverse Waves

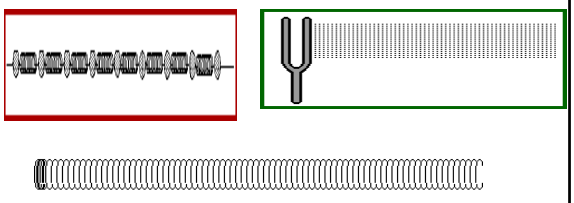
- Crest: the maximum positive displacement
- Trough: the maximum negative displacement
- Wavelength (λ): distance between successive parts of a wave: crest to crest or trough to trough
- Amplitude: distance from normal resting position to the top of the crest or the bottom of the trough.

Parts of Transverse Waves



Compressional Waves

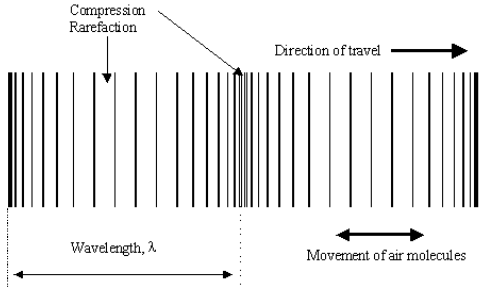
- (also known as longitudinal waves) the medium moves parallel to the energy.
  - examples: some earthquake waves, SOUND



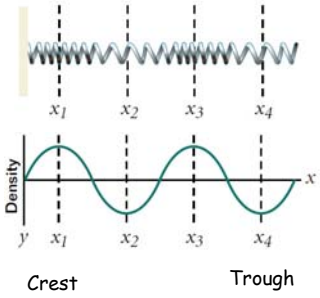
Parts of Compressional Waves

- **Wavelength** (λ): distance between successive parts of a wave: compression to compression or rarefaction to rarefaction
- Compression: area where the density and pressure of the medium are greater than normal (particles are closer together)
- Rarefaction: area where the density and pressure of the medium are less than normal. (particles are farther apart)

Parts of Compressional Waves



Compressional Waves



Crest Trough

Mechanical Waves

- Need a medium to travel through
  - examples: water waves, **sound waves**, THE wave
- **speed of sound = 332 m/s** (in air at 0°C)
- in general, as the density of the medium increases the speed of sound increases

Electromagnetic Waves

- Created by accelerating electric charges
- Can travel through empty space.
  - examples: **Light** (in order from long wavelength to short)
  - radio, micro, IR, visible light, UV, X-ray, Gamma

Electromagnetic Waves

- **speed of light: c = 3 E 8 m/s** (ALL electromagnetic waves travel at this speed through a vacuum)
- in general, as the density of the medium increases the speed of light decreases

Period vs Frequency

- Period – (T) – The time it takes for one cycle (= how long?)
  - Measured in seconds
- Frequency – (f) – The number of cycles in a given time (= how many?)
  - Measured in Hertz (Hz)
- Frequency is the inverse of the Period
  f = 1 / T

Speed of a wave

- We find speed by distance divided by time.
  - The same holds true for waves!
- Speed of a wave = Wavelength/Period
- Speed of a wave = Wavelength*Frequency

Speed of a Wave

- The speed of a wave is constant within a medium.
- The speed can change when a wave enters a new medium
- All waves of the same type travel at the same speed
  - This means wavelength is inversely proportional to frequency!
    - If the wavelength increases the frequency has to decrease!
    - If the wavelength decreases the frequency has to increase!

Wave Equation

$$V = f\lambda$$

- v = velocity (m/s)
- f = frequency (Hertz = waves/second)
- λ = wavelength (meters / wave)