Waves

Vibratory disturbance that propagates through a medium or field

Waves

- Transfer energy without the transfer of mass
- Mechanical waves, such as sound, require a medium for transmission (No sound in outer space); (denser media provide for faster sound waves)
- Electromagnetic waves, such as light, do not require a medium. They are alternative electric and magnetic fields.

Types of Waves

- Longitudinal waves. The motion of the disturbance is parallel to the direction of travel of the wave through the medium.

- Examples: sound, compression waves in springs ("slinky")

- Transverse waves. The motion of the disturbance is perpendicular to the direction of travel of the wave through the medium.

- Example: wave in rope or string

Periodic Waves

- If the disturbance is repeated regularly, without interruption or change, a series of regular disturbances in the medium is produced. This series of regular, repeated disturbances is called a periodic wave.

Characteristics of Periodic Waves

- Period = time for one complete cycle (s)
- Frequency = 1/Period = 1/T   (Hertz = 1/s)
- Wavelength = distance from crest to crest (m)
- Amplitude = max displacement of the wave from its equilibrium (at its "crest"). The wave has its max energy at this max displacement. ("loudness" or "brightness"). The max displacement negatively is trough.

Speed of Waves

- Speed = frequency x wavelength (m/s)
- Frequency is in Hertz (1/s)
- Wavelength is in m

- Sound at room temp approx 340 m/s (sound travels faster in denser media)
- Light in vacuum 3 x 10^8 m/s

Example

- If the frequency is 2 Hertz, find the period.
- $T = 1/f = \frac{1}{2}$ (s)

- Periodic waves are produced by a generator at the rate of one wave every 0.50 s. What is the period?
- $T = 0.50$ s

Example

- If the frequency of sound is 440 Hertz, determine the period of the wave.

- T = 1/f = 1/440 = 0.0023 s

Group Activity

- Given the speed of light is 3 x 10^8 m/s determine the wavelength of each of the following given their frequencies.
- 1. blue light f = 6.3 x 10^14 Hertz
- 2. green light f = 5.6 x 10^14 Hertz
- 3. yellow light f = 5.10 x 10^14 Hertz
- 4. orange light f = 4.9 x 10^14 Hertz
- 5. red light f = 4.1 x 10^14 Hertz