Waves and Sound

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Waves

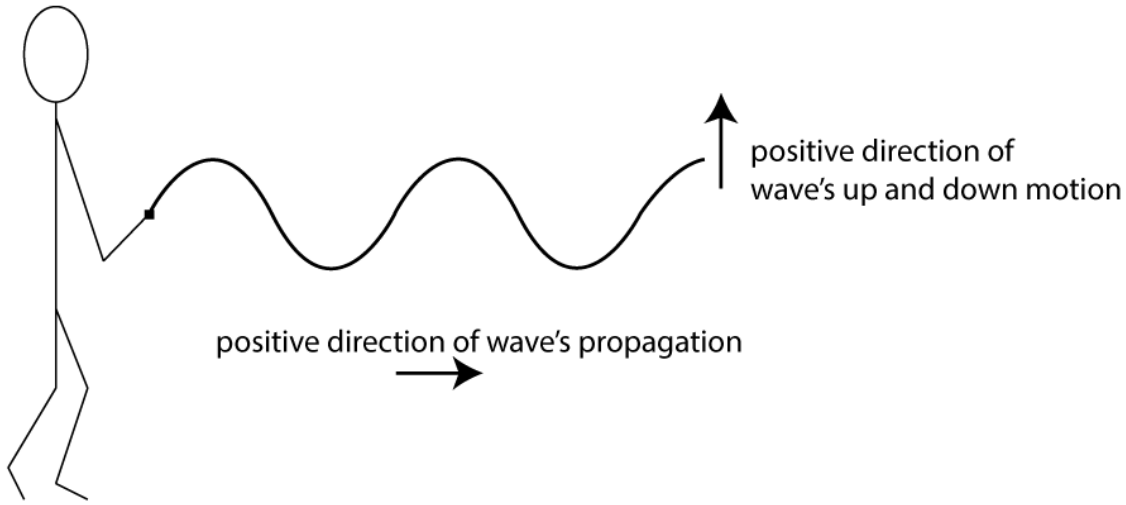
- A traveling disturbance
- Carries energy from place to place

- When a boat makes a wave,
  - the water itself does not get up and move
  - the water pushes a little, then moves back
  - energy is transferred in the wave and is what you feel

Waves

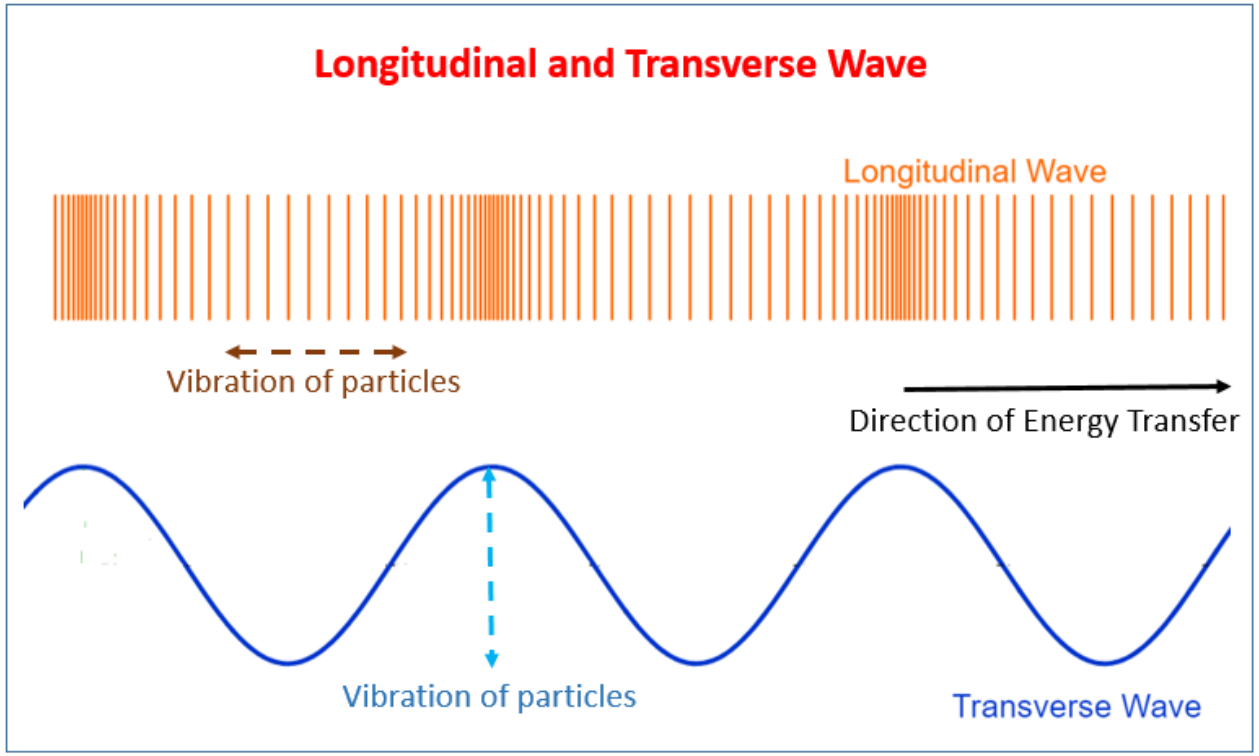
- Transverse
  - Up and down disturbance
  - Wave travels left or right
  - Disturbance is perpendicular to direction of travel

  - Examples:
    - Radio waves, light waves, microwaves, stringed instruments



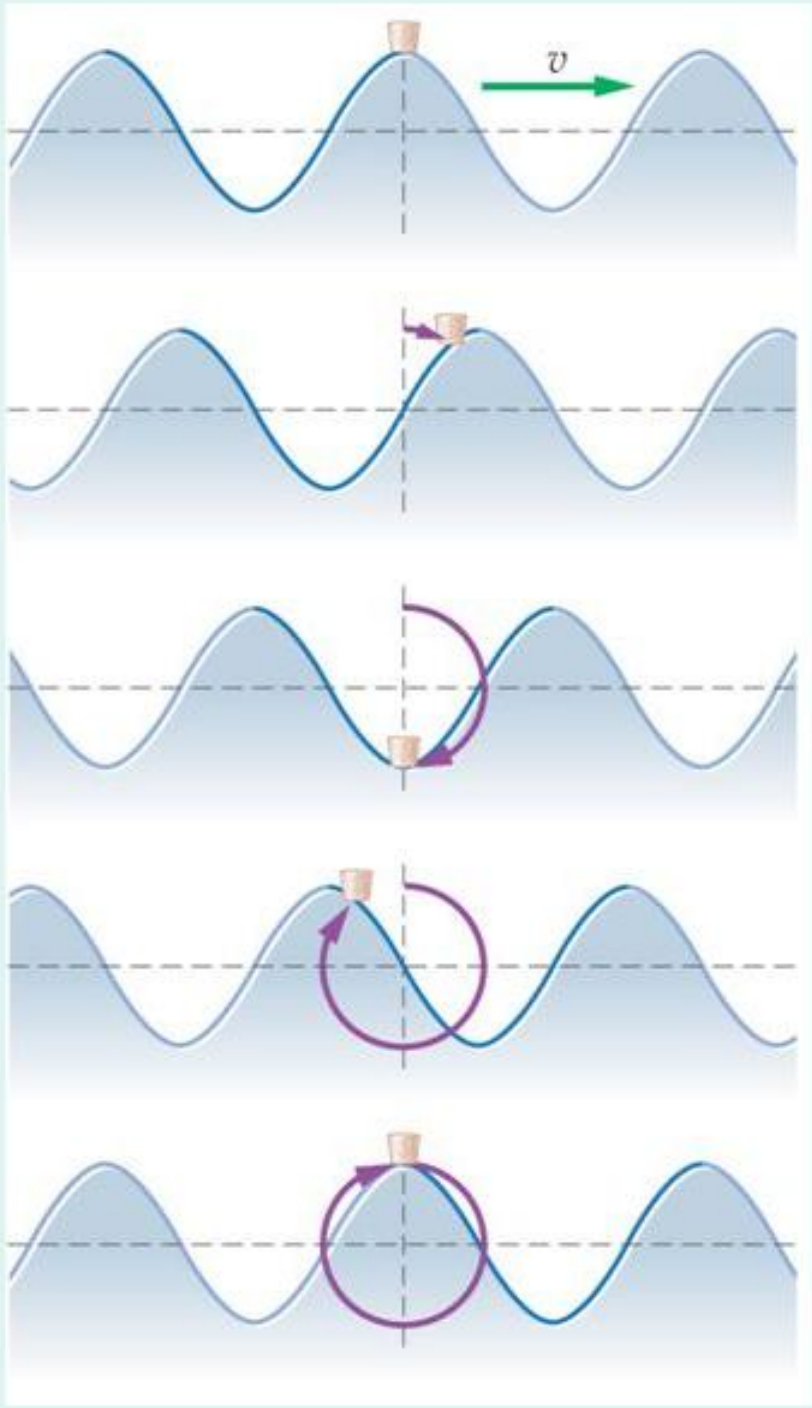
Waves

- Longitudinal Waves
  - Disturbance is left and right
  - Direction of travel is left or right
  - Disturbance and direction of travel are parallel
  - Series of compressed and stretched regions
  - Example:
    - Sound



Waves

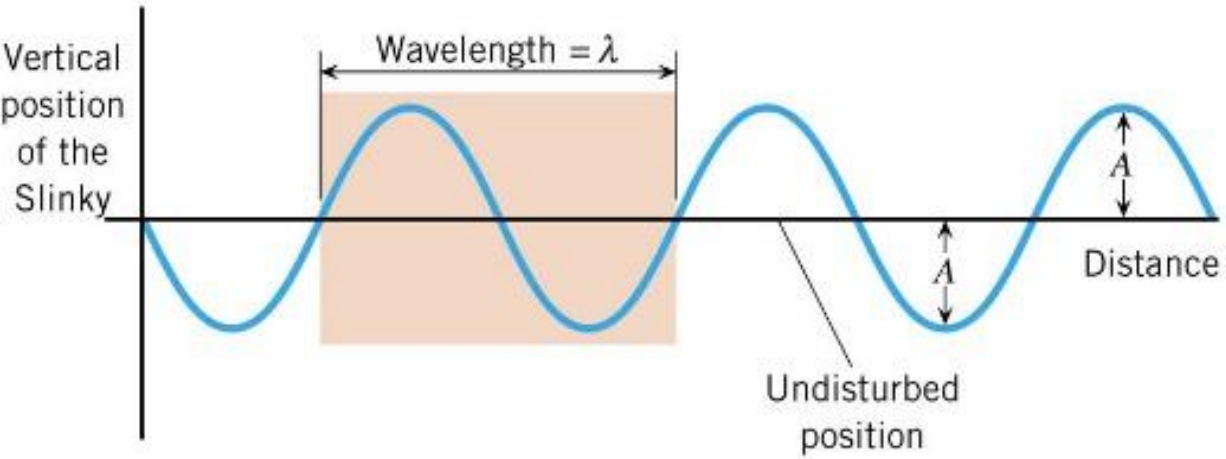
- Other
  - Water waves are a combination
  - Water at the surface of a water wave travels in small circles



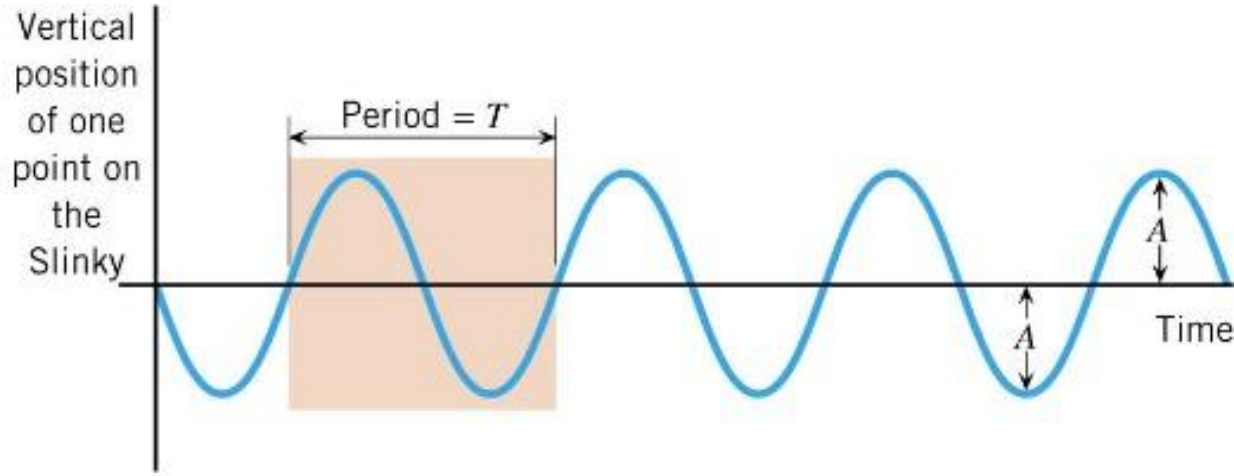
Waves

- Periodic → pattern is regularly repeated
- Cycle → one unit of pattern

- Wavelength (λ) → Distance of one cycle
- Amplitude (A) → height from equilibrium to crest



(a) At a particular time

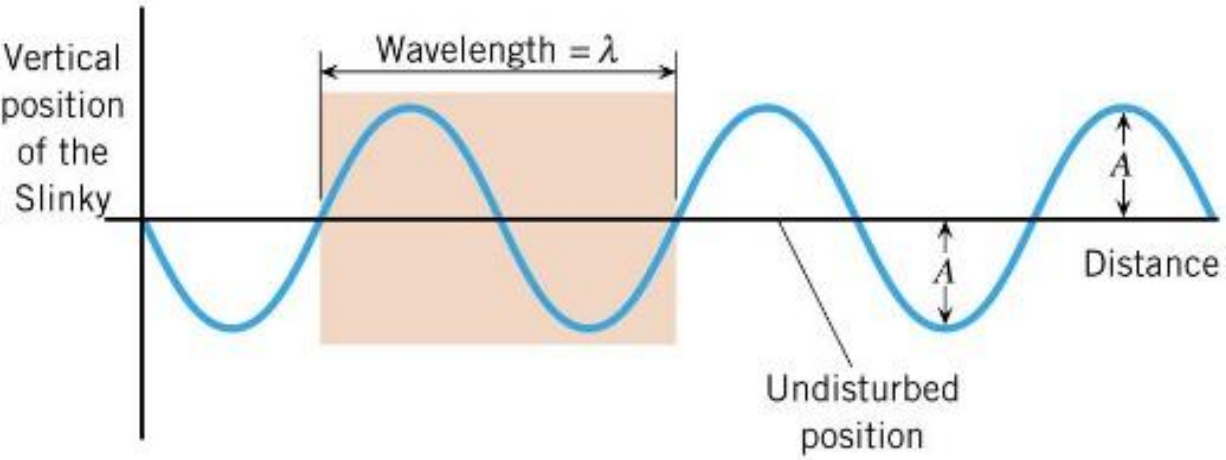


(b) At a particular location

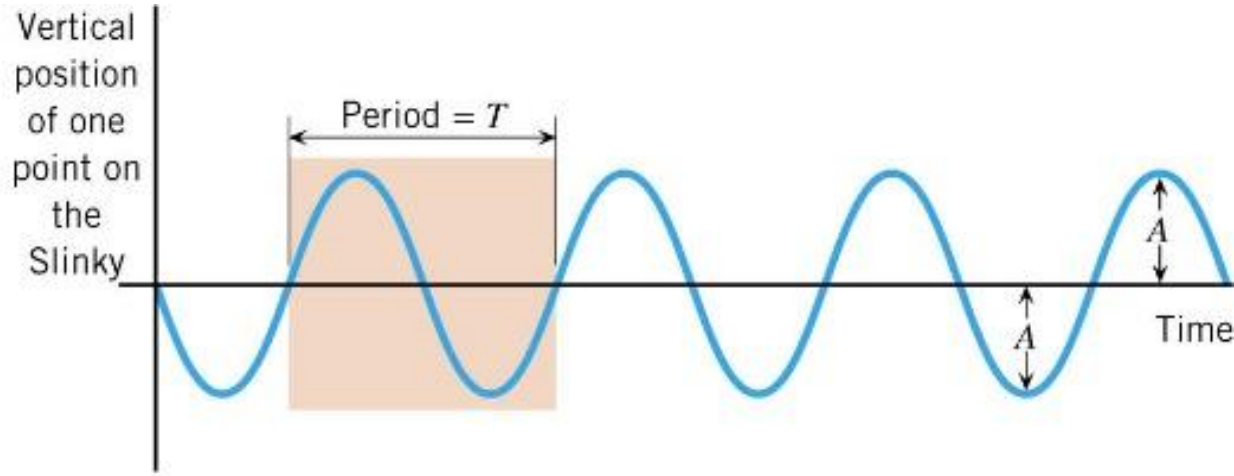
Waves

- Period (T) → time it takes for one cycle
  - Unit: s
- Frequency (f) → # of cycles per second
  - Unit: 1/s = 1 hertz (Hz)

- $f = \frac{1}{T}$
- $v = \frac{\lambda}{T} = f \cdot \lambda$



(a) At a particular time



(b) At a particular location

Waves

- WAUS operates at a frequency of 90.7 MHz. These waves travel at 2.99×10^8 m/s. What is the wavelength and period of these radio waves?

- $\lambda = 3.30$ m
- $T = 1.10 \times 10^{-8}$ s

Waves

- You are sitting on the beach and notice that a duck floating on the water moves up and down 15 times in 1 minute. What is the frequency of the water waves?

- $f = 0.25$ Hz