14.1(B) Wave Properties

Waves

I can define, analyze, and solve problems involving the properties of waves.

Examples of Waves

- Crowd
- Ocean
- Hand
- Sound
- Heat
- Light
- Gamma
- Radio
- Infrared
- Micro
- UV

WHAT IS A WAVE?

• a disturbance
• created by a source
• travels through a medium

A ripple forms when raindrops hit the pond.
What is the source?
What is the medium?

Types of Waves

An **electromagnetic wave** is a wave that is capable of transmitting its energy through a vacuum (i.e., empty space).

Examples:

- Light, radio waves, microwaves

**Mechanical waves** require a medium in order to transport their energy from one location to another.

Examples:

- Sound wave, water waves, seismic waves

Types of Waves

An **electromagnetic wave** is a wave that is capable of transmitting its energy through a vacuum (i.e., empty space).

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Examples: Sound wave, water waves, seismic waves
Mechanical Waves

Transverse Waves vibrate perpendicular to the direction of the wave’s motion.

Longitudinal Waves vibrate in the same direction, or parallel, to the direction of the wave’s motion.

Surface Waves have characteristics of both transverse and longitudinal waves.

Visualizing Waves

Transverse

Longitudinal

Measuring a Wave

The Wave Equation

\[ f = \frac{1}{T} \]

\( f \) = frequency

\( T \) = period

\( \lambda \) = wavelength

\( v \) = velocity

Wavelength \( \lambda = \frac{v}{f} \)
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**EXAMPLE Problem 3**

Characteristics of a Wave: A sound wave has a frequency of 192 Hz and travels the length of a football field, 91.4 m, in 0.271 s.

a. What is the speed of the wave?

b. What is the wavelength of the wave?

c. What is the period of the wave?

Known:
- $f = 192$ Hz
- $d = 91.4$ m
- $t = 0.271$ s

Unknown:
- $v = ?$
- $\lambda = ?$
- $T = ?$

- Solve for $v$:
  
  $$v = \frac{d}{t} = \frac{91.4 \text{ m}}{0.271 \text{ s}} = 337 \text{ m/s}$$

- Solve for $\lambda$:
  
  $$\lambda = \frac{d}{f} = \frac{91.4 \text{ m}}{192 \text{ Hz}} = 0.477 \text{ m}$$

- Solve for $T$:
  
  $$T = \frac{1}{f} = \frac{1}{192 \text{ Hz}} = 0.00521 \text{ s}$$

Problems (1-5)
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Transverse Waves

Longitudinal Waves