CHAPTER

11

Waves

MAIN TOPICS

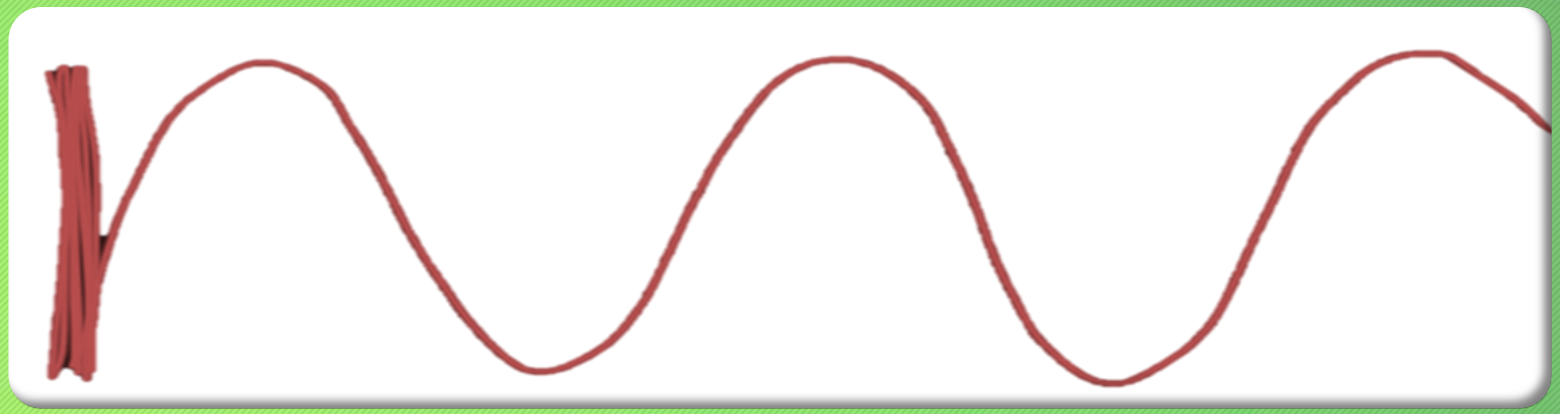
CHAPTER 11

- Waves
- Wave Motion
- Transverse and Longitudinal Waves
- Interference
- Standing waves

WAVES

CHAPTER 11

A Periodic wiggle in space and time that transports energy



A wave can be described as a disturbance that travels through a medium from one location to another location without transporting matter

WAVES CHARACTERISTICS

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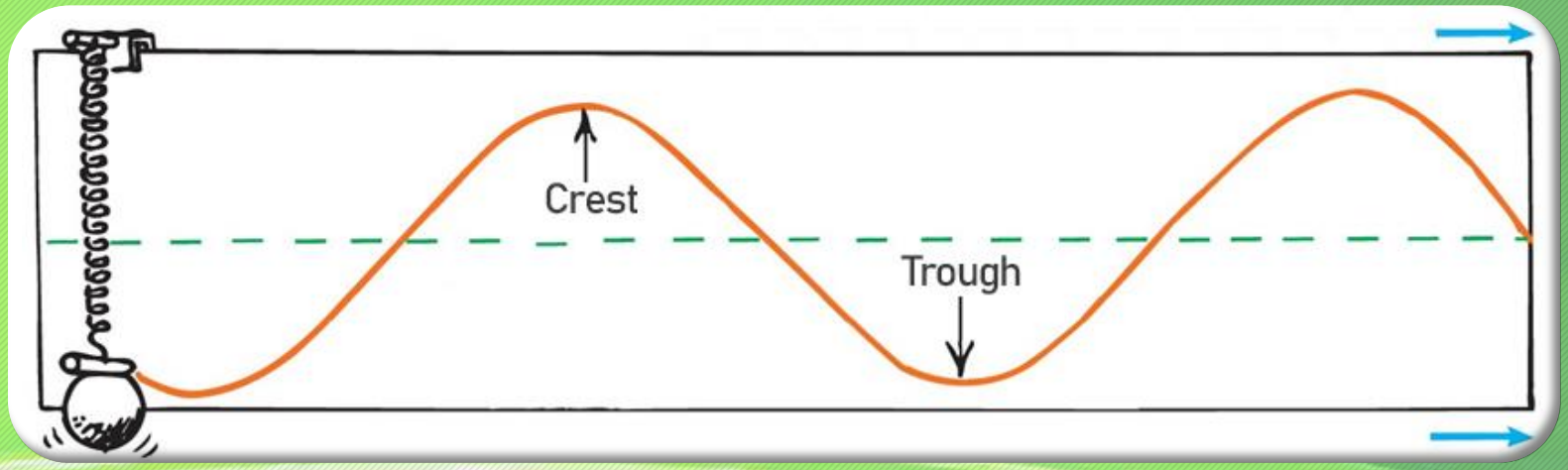
Crests:

High points of the wave

Troughs:

Low points of the wave



WAVES CHARACTERISTICS

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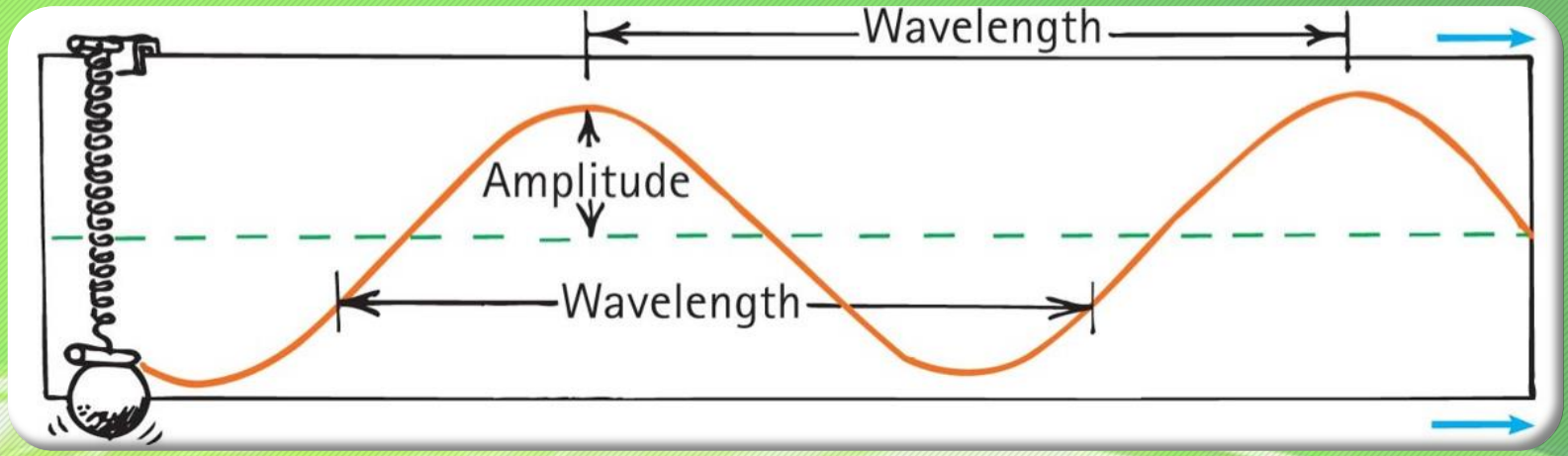
Amplitude:

Distance from the midpoint to crest or trough

Wavelength:

Distance from the top of one crest to the top of the next crest, or distance between successive identical parts of the wave



WAVES CHARACTERISTICS

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Frequency:

number of to-and-fro vibrations in unit time

Unit: 1 vibration per second = 1 Hertz

Period:

defined as the time it takes for a complete vibration

Unit: any unit of time, often second

ANSWER CHECK

CHAPTER 11

The distance between adjacent peaks in the direction of travel for a transverse wave is its

A. frequency.
B. period.
C. wavelength.
D. amplitude.

ANSWER CHECK

CHAPTER 11

The distance between adjacent peaks in the direction of travel for a transverse wave is its

A. frequency.
B. period.
C. wavelength.
D. amplitude.

Explanation:

Or between adjacent troughs or any adjacent identical parts of the waveform.

WAVES CHARACTERISTICS

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Relationship between frequency and period:

Frequency = 1/period

Unit: Hertz (Hz)

Period = 1/frequency

Unit: second (s)

The source of all waves is a vibration.

Higher frequency means increased rate of energy transfer—shorter wavelengths.

ANSWER CHECK

CHAPTER 11

If the frequency of a particular wave is 20 Hz, its period is

A. $^{1}/_{20}$ second.

B. 20 seconds.

C. more than 20 seconds.

D. none of the above.

ANSWER CHECK

CHAPTER 11

If the frequency of a particular wave is 20 Hz, its period is

A. $^{1}/_{20}$ second.

B. 20 seconds.

C. more than 20 seconds.

D. none of the above.

Explanation:

Note when f = 20 Hz, T = 1/f = 1/(20 Hz) = 1/20 second.

WAVE MOTION

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Wave speed:

- describes how fast a disturbance moves through a medium

- related to the frequency and wavelength of a wave

Speed = Frequency x Wavelength

$V = f \times \lambda$

WAVE MOTION

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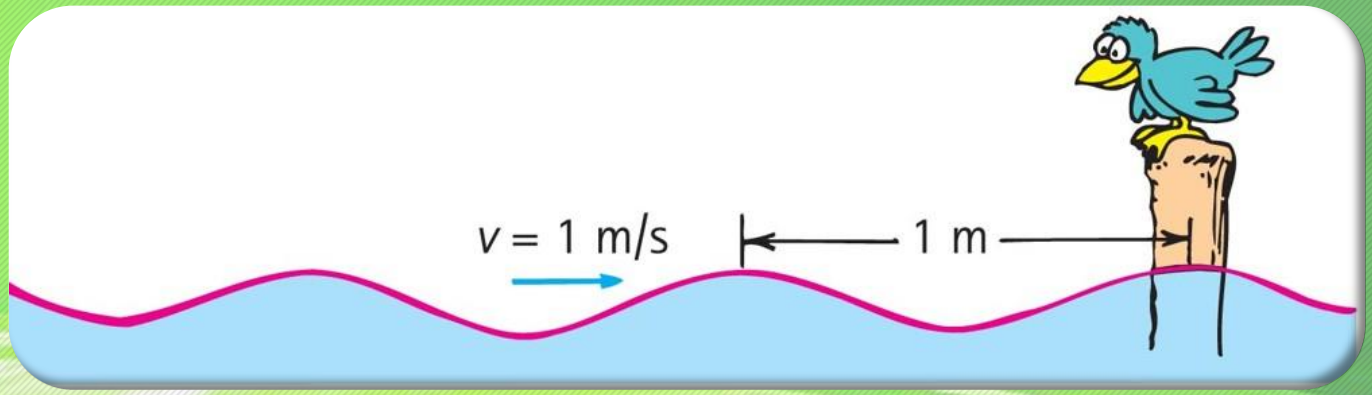
Example:

a wave with wavelength 1 meter and frequency of 1 Hz

Speed = Frequency x Wavelength

= 1 x 1

= 1 m/s



TYPES OF WAVES

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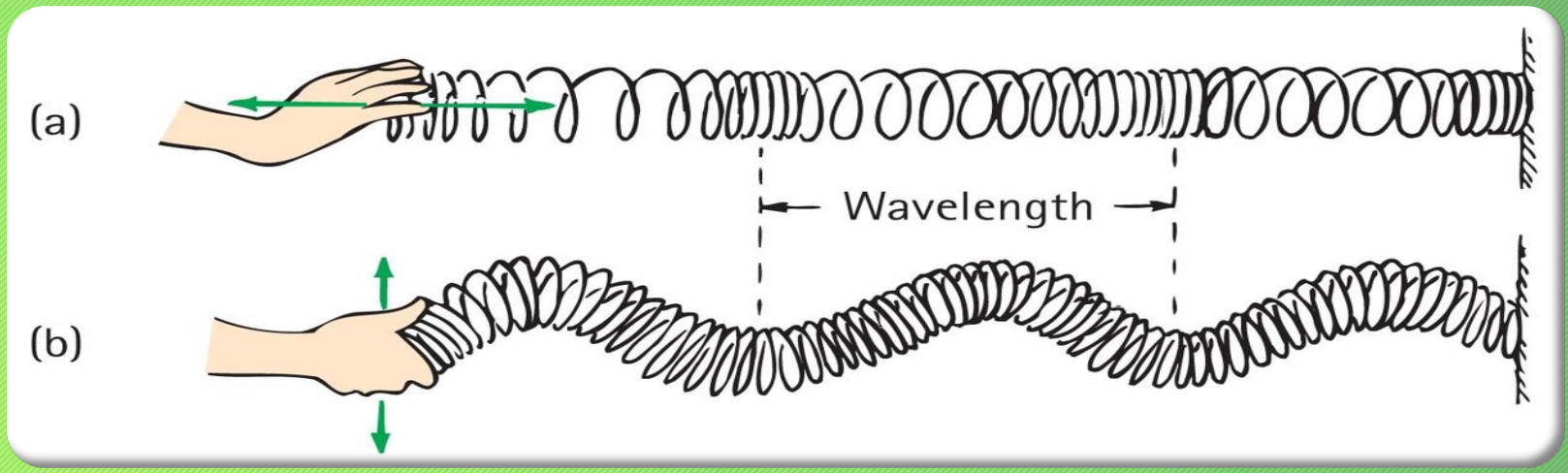
- **Longitudinal waves:**

  the direction in which the medium vibrates is parallel to the direction of wave.



- **Transverse waves:**

  the direction in which the medium vibrates is perpendicular to the direction of wave.

ANSWER CHECK

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The vibrations along a transverse wave move in a direction

A. along the wave.
B. perpendicular to the wave.
C. Both of the above.
D. Neither of the above.

ANSWER CHECK

CHAPTER 11

The vibrations along a transverse wave move in a direction

A. along the wave.

B. perpendicular to the wave.

C. Both of the above.

D. Neither of the above.

Explanation:

The vibrations in a longitudinal wave, in contrast, are along (or parallel to) the direction of wave travel.

INTERFERENCE

CHAPTER 11

Combined effect of two or more overlapping waves

TYPES OF INTERFERENCE

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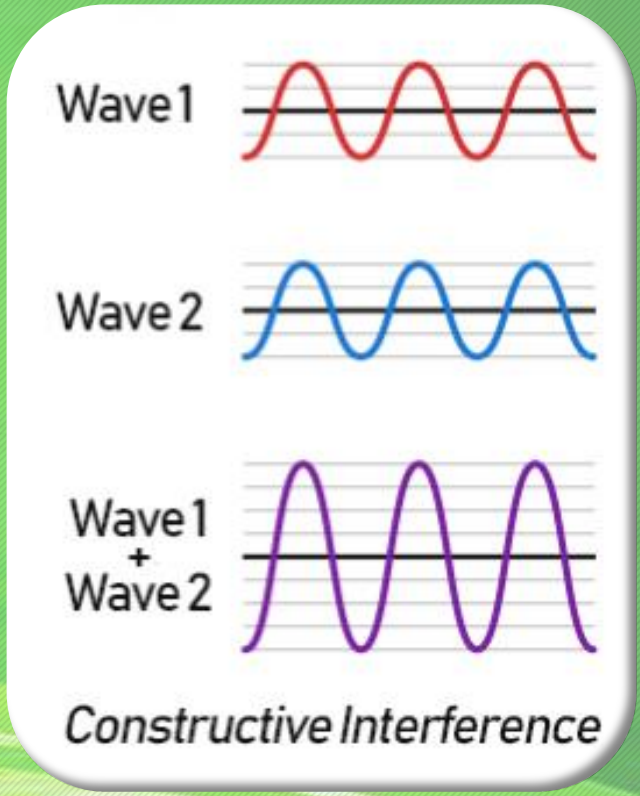
- **Constructive interference:**

  Crest of one wave overlaps crest of another wave. This interference results into a wave of increased amplitude



TYPES OF INTERFERENCE

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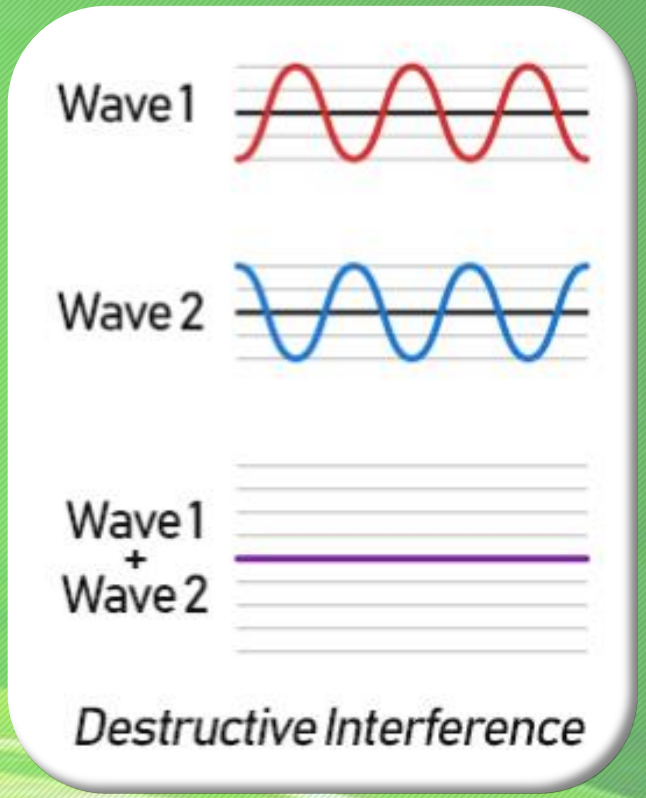
- **Destructive interference:**

  Crest of one wave overlaps trough of another wave. This interference results into a wave of decreased amplitude



STANDING WAVES

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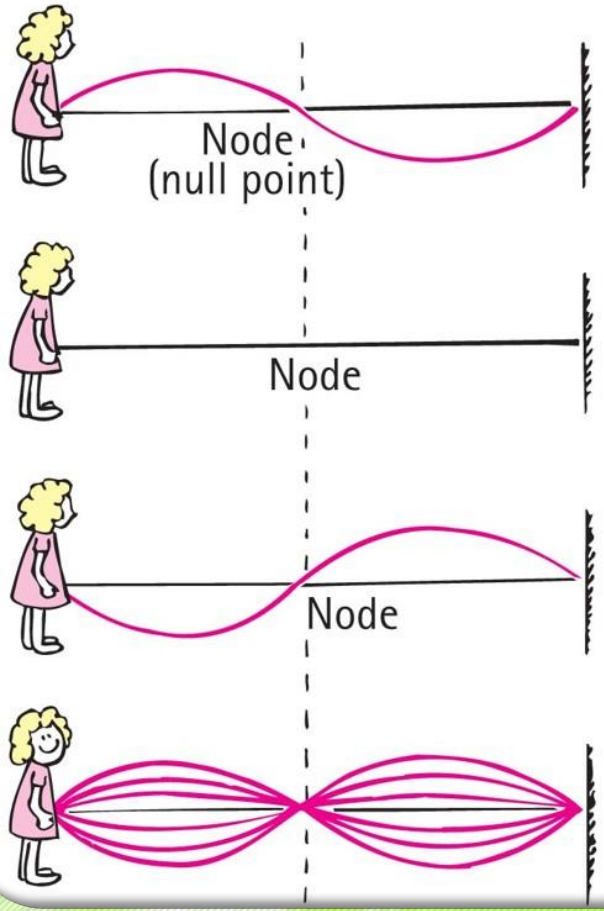
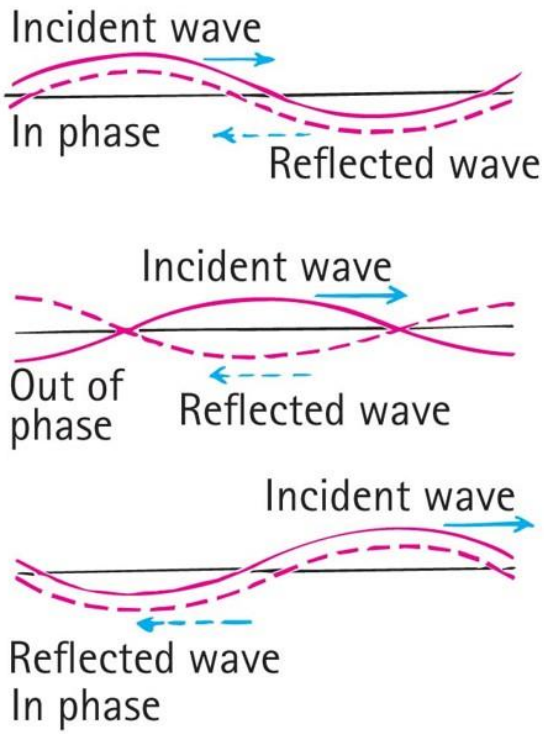
Standing waves are produced when two sets of waves of equal amplitude and wavelength pass through each other in opposite directions.





NODES

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A point along a standing wave where the wave has minimum amplitude.