

# Physics

Chapter 11: Vibrations and Waves

Chapter 12: Sound

Section 11.4

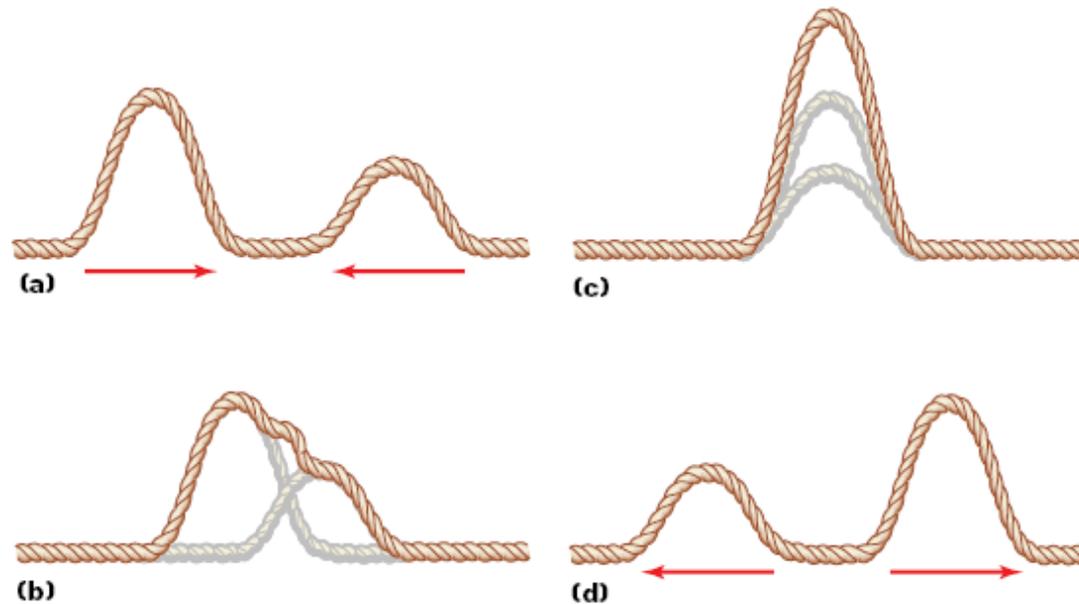
Wave Interactions

# Wave Interference

- Two waves, unlike matter, can occupy the same place at the same time; the resulting displacement of the medium is determined by the principle of superposition.
- Mechanical waves and electromagnetic waves can both occupy the same space at the same time.

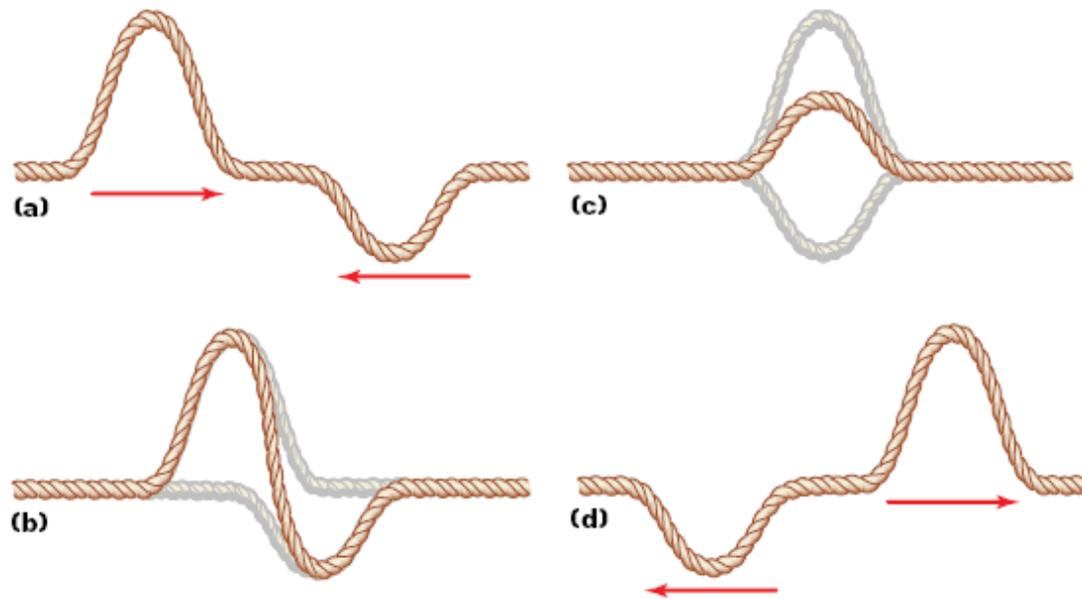
# Constructive Interference

--When two waves meet and their displacements combine to produce a larger wave, the interference is called constructive interference.



# Destructive Interference

- When the displacements of the two waves are opposite, the waves may cancel each other, producing destructive interference.
- Destructive interference may be complete or partial.



# Longitudinal Waves

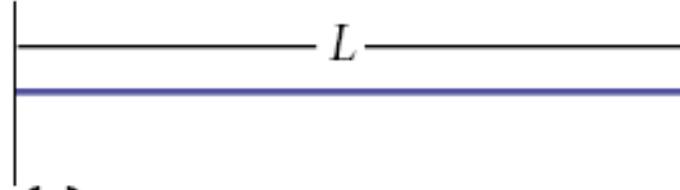
- Longitudinal waves, such as sound waves, may also exhibit constructive and destructive interference.
- Longitudinal waves exhibit interference when two compressions meet (constructive interference) or when a compression meets a rarefaction (destructive interference).

# Reflection

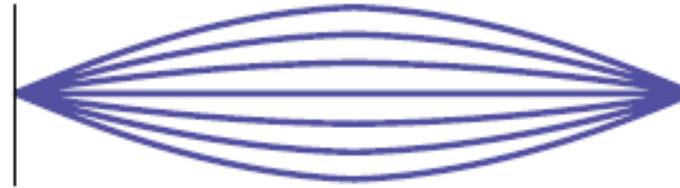
- When a wave reaches a boundary with an object that it cannot pass through, it may be reflected.
- If the pulse is reflected from a free end, it is reflected back on the same side; the pulse is said to be reflected.
- If the pulse is reflected from a fixed end, it is reflected back upside down; the pulse is reflected and inverted.

# Standing Waves

- A periodic wave that reflects and meets other waves can produce a standing wave pattern.
- The areas where destructive interference causes the medium to be at rest is called a node or nodal line; the points between where the maximum displacement occurs are called antinodes.



**(a)**



**(b)**



**(c)**



**(d)**

--The distance between adjacent nodes is related to the length of the spring or rope; the distance of two antinodes is equal to one wavelength.

Number of Nodes	Wavelength
2	$2 L$
3	$L$
4	$2/3 L$
5	$1/2 L$
6	$2/5 L$
7	$1/3 L$
8	$2/7 L$

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