PERIOD AND FREQUENCY

The period is the quotient of the time interval and the number of cycles.

$$T = \frac{\Delta t}{N}$$

The frequency is the quotient of the number of cycles and the time interval.

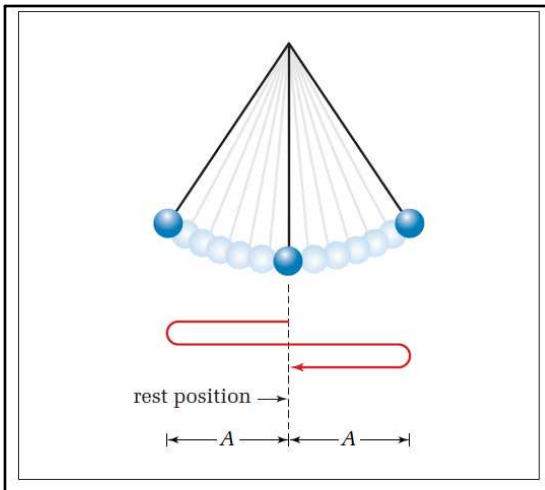
$$f = \frac{N}{\Delta t}$$

The frequency is the reciprocal, or inverse, of the period.

$$f = \frac{1}{T}$$

Quantity	Symbol	SI unit
period	T	s (seconds)
frequency	f	Hz (hertz)
time interval	Δt	s (seconds)
number of cycles	N	none (pure number)

Note: $1\ \text{Hz} = \frac{1}{\text{s}} = 1\ \text{s}^{-1}$



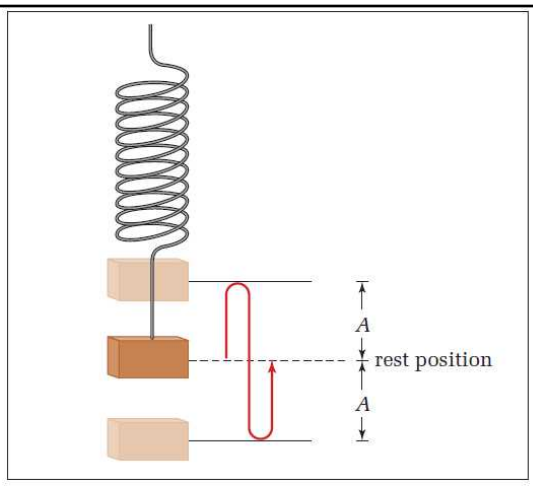


Figure 8.2 **(A)** When a simple pendulum completes one full cycle of its motion, it is in its original position. **(B)** One full cycle of the motion of the mass on a spring brings the mass back to the rest position.

Anatomy of a Wave

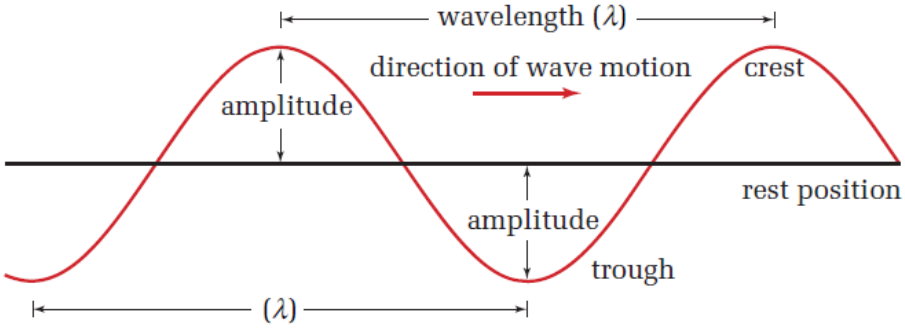


Figure 8.6 This idealized wave illustrates the features that are common to all waves.

Transverse Waves

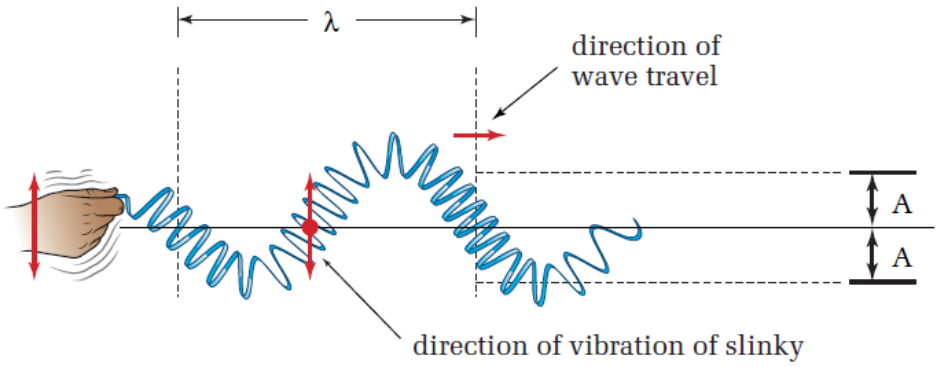


Figure 8.7 When a transverse wave travels along a spring, the segments of the spring vibrate from side to side, perpendicular to the direction of the wave motion.

Longitudinal Waves

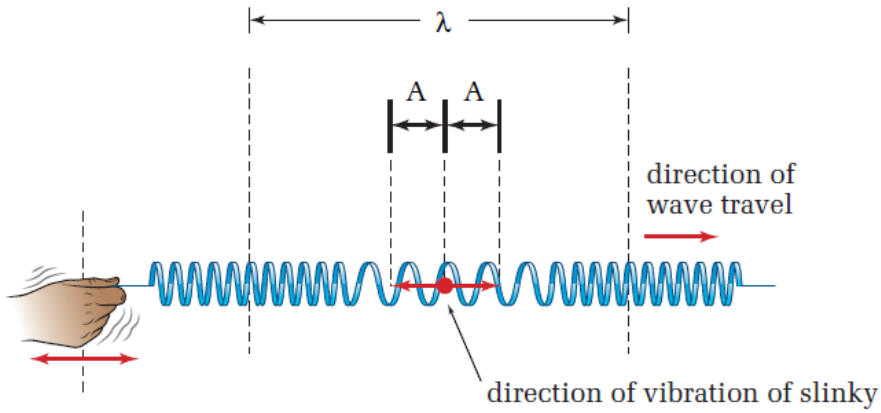


Figure 8.8 When a longitudinal wave travels along a spring, the segments of the spring vibrate parallel to the direction of the wave motion.

THE WAVE EQUATION

The speed of a wave is the product of the wavelength and the frequency.

$$v = f\lambda$$

Quantity	Symbol	SI unit
speed	v	$\frac{\text{m}}{\text{s}}$ (metres per second)
frequency	f	Hz (or s^{-1})(hertz)
wavelength	λ	m (metres)

Unit Analysis

(frequency)(wavelength) = Hz m = s^{-1} m = $\frac{\text{m}}{\text{s}}$

Waves at Boundaries

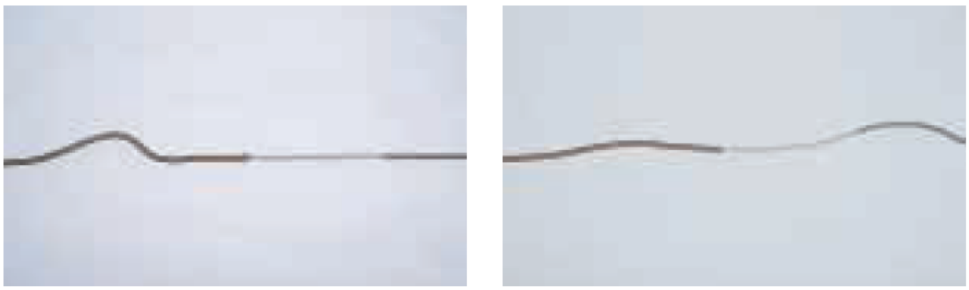


Figure 8.9 At a slow-to-fast interface between two media, the transmitted and reflected pulses are on the same side of the spring.

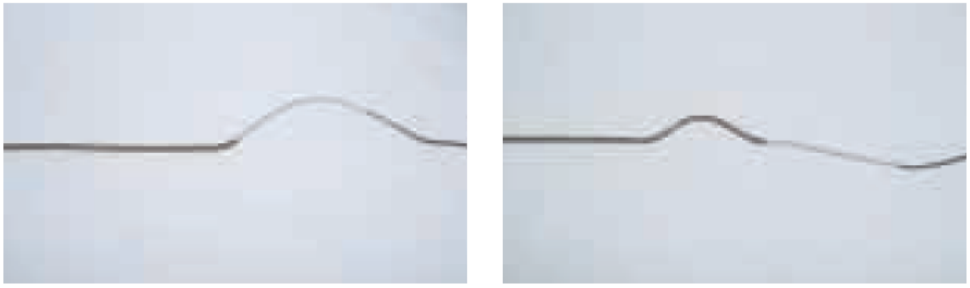


Figure 8.10 At a fast-to-slow interface, the transmitted pulse is on the same side of the spring as the original pulse, but the reflected pulse is inverted.