

Phyz Examples: Waves

Physical Quantities • Symbols • Units • Brief Definitions

Wavelength • λ • meter: m • The distance through which a complete cycle of a wave is observed (e.g. from one crest to the next crest).

Amplitude • A or x_{max} • meter: m • The distance between the equilibrium position of a medium and the top of a crest or bottom of a trough of a wave passing through it. Indicative of the energy associated with the wave.

Frequency • f or ν (nu) • hertz: Hz • The rate at which a source or observer of waves oscillates. Related to the rate at which a source transmits energy to an observer.

Period • T • seconds: s • The time required for a source or observer of waves to oscillate through one cycle.

Speed • v_w • meters per second: m/s • The rate at which a wave passes or propagates through a medium or through space.

Equations

$$f = 1/T \cdot \text{frequency} = 1 / \text{period}$$

$$v_w = f\lambda \cdot \text{The Wave Equation} \cdot \text{wave speed} = \text{frequency} \cdot \text{wavelength}$$

$$f_{beat} = f_2 - f_1 \cdot \text{beat frequency} = \text{higher frequency} - \text{lower frequency}$$

Smooth Operations Examples

1. Ripples on a pond pass a rock at a frequency of 5.0 Hz; there is a distance of 6.0 cm between the wave crests. What is the speed of the waves?

$$1. f = 5.0 \text{ Hz} \quad \lambda = 0.060 \text{ m} \quad v = ?$$

$$v = f\lambda$$

$$v = 5.0 \text{ Hz} \cdot 0.060 \text{ m}$$

$$v = \underline{0.30 \text{ m/s}}$$

2. Waves in a wave machine travel at 60 cm/s. If one end of the wave sticks is wiggled once every two seconds, what wavelength will be produced?

$$2. v = 0.60 \text{ m/s} \quad T = 2 \text{ s} \quad (f = 1/T = 0.5 \text{ Hz})$$

$$\lambda = ?$$

$$v = f\lambda \Rightarrow \lambda = v/f$$

$$\lambda = 0.60 \text{ m/s} / 0.5 \text{ Hz}$$

$$\lambda = \underline{1.2 \text{ m}}$$