Module 10: Waves

Keywords: amplitude, frequency, wavelength

Formulas:

$\lambda = \frac{V}{f} = VT$, where V is the speed of the wave

$U_{max} = A\omega$, where U is the speed of a piece of the string.

$y(x,t) = A\sin(\omega t - kx)$ - general wave equation, $\omega = 2\pi f$

$\lambda = \frac{2L}{n}$ for fixed-fixed and open-open standing waves $(n = 1, 2, 3\ldots)$

$\lambda = \frac{4L}{n}$ for open-closed standing waves $(n = 1, 3, 5\ldots)$,

where n is number of **half wavelengths**

$E \propto A^2$

Key points:

- Wavelength is just a length of one full wave
- Standing wave is a combination of two waves traveling in opposite directions, each having same A and f.
- Fixed end reflects wave like a mirror (symmetry across y-axis)
- Open end reflects wave with symmetry across x-axis.
- Amplitude is related to intensity of the light/loudness of a sound.

General approach:

- Use general wave equation to find y-position at time t and location x.
- If there are multiple waves present, superpose them (at each location x add y-positions of all waves).
- Using the relationships between λ, V, f, T solve for unknown(s).

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