Phys 1402 2014-11-06

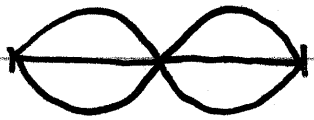
Speed of repeating waves

$$v = f\lambda$$

Wave Examples

- Light/Radio $v_{light} = c = 3\times10^{8}\ m/s$
  Elec. & Mag. Fields
- Sound $v_{sound} \approx 340\ m/s$
  Pressure oscillations in material.
- Surface waves
  - Water waves
  - Waves on jello
- Waves on strings $v = \sqrt{F_T/\mu}$

Pictures of Standing Waves

i		λ	$f = \frac{v}{\lambda}$
1		$2L$	$\frac{v}{2L} = f_0$
2		L	$\frac{v}{L}$
3		$\frac{2L}{3}$	$\frac{3v}{2L}$
i		$\frac{2L}{i}$	$i\left(\frac{v}{2L}\right) = if_0$

$2L = i\lambda$

Each f_i is a multiple of the fundamental frequency (f_0).

When one oscillation causes a wave, the wave's frequency comes from the stimulus.

For a string w/ clamped ends, 2·L is important.

The round trip time is

$$t_{lap} = \frac{2L}{v}$$

(T = period of osc.)

If t_{lap} is exactly T, the wave reinforces itself.

This also happens if $2T = t_{lap}$

$$iT = \frac{2L}{v} \qquad i = \text{any integer}$$

$$i\left(\frac{1}{f}\right) = \frac{2L}{f\lambda}$$

$$i\lambda = 2L$$

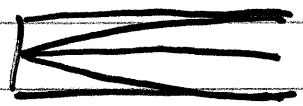
If the round trip distance ($2L$) is an integer # wavelengths ($i\lambda$), the wave is reinforced.

(4)

If one end is loose, $4L$ is the repeating distance. Also, $2L$ is a "bad" distance because the pulse is inverted.

If the ends are different

$$i\lambda = 4L \qquad i = \text{odd integers}$$

i		λ	$f = \frac{v}{\lambda}$
1		$4L$	$\frac{v}{4L}$
3		$\frac{4}{3}L$	$\frac{3v}{4L}$
		$\frac{4L}{i}$	$\frac{iv}{4L} = if_0$