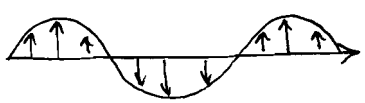


Things You Should Know About Waves

(for this lab and for your midterm.)

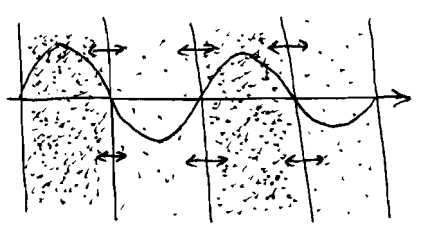
D. Riehmiller
1/22/07

Transverse Wave: direction of vibration is perpendicular to direction of propagation



example: wave on a string, electromagnetic wave

Longitudinal Wave: direction of vibration is parallel to direction of propagation



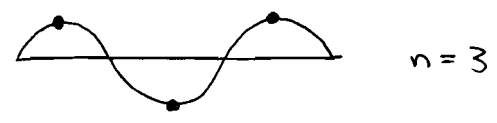
example: sound waves, fluid compression waves, slinky (see Cutnell, Fig. 16.3)

* air molecules vibrate back and forth to transfer compression wave

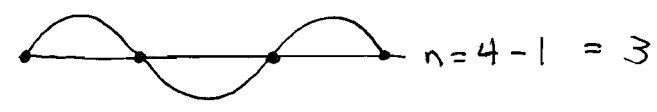
Harmonics (= modes)

The harmonic of a wave is the same thing as its mode number, n . You can find n using either of two ways:

(A) Count the number of anti-nodes (top and bottom)



(B) Count the number of nodes (where the wave touches the x-axis) and subtract 1



examples

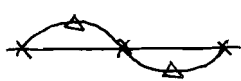
$n=1$ ("fundamental" mode)



$$\frac{x}{n=2-1=1}$$

$$\frac{\Delta}{n=1}$$

$n=2$



$$n=3-1=2$$

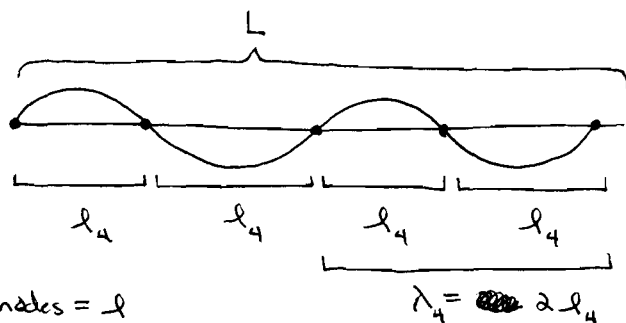
$$n=2$$

Frequency and Wavelength

$$v = f \lambda$$

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

a string:



length between 2 nodes = l

total length = L

mass of string = m

tension applied to string = F

speed of propagation = v

for this mode ($n=4$), the wavelength

$$\lambda_4 = 2l_4$$

Since l will change depending on which mode the string is in, but L is fixed, we

can say $l_n = \frac{L}{n}$. Then $\lambda_n = \frac{2L}{n}$

$$\text{and } f_n = v \cdot \frac{n}{2L} = n \cdot f_1$$

$$v = \sqrt{\frac{F}{m/L}}$$

* often, the "mass density" m/L is written as μ (a constant), and is given to you in the problem.

Other Stuff

- be familiar with the Doppler Effect (Cutnell 16.9)
- beat frequency between 2 sources = $|f_{\text{source 1}} - f_{\text{source 2}}|$
- understand constructive and destructive interference (Cutnell 17.1 and 17.2) and work through the examples.
- speed of sound in air: $v = 331.5 + (0.6T) \text{ m/s}$, T in $^{\circ}\text{C}$

* note: this handout covers only the section on waves - and at that, only what I consider most important. Your midterm may cover waves in more detail, and you'll also need to know simple harmonic motion and electrostatics.