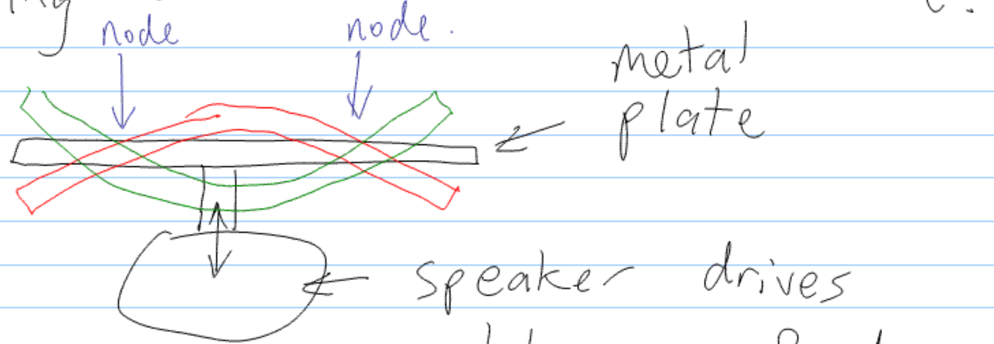
Ch. 14 end:

Annoying Sound: Chladni Plate:



Sand doesn't shake off node.

Ch. 20: Waves.

Definition:

Transverse wave: → particle oscillations are perpendicular to direction of wave motion

Longitudinal wave: particle osc. are parallel (or anti-parallel) to dir. of wave motion.

(ie) Wave on a string: transverse.

Sound is a longitudinal wave. individual air particles move back & forth in direction of wave travel. → There is also a change in density and, therefore, pressure in a sound wave.

Light or other Electromagnetic Waves are transverse; since the Electric & Magnetic fields oscillate perp to direction of wave motion

Note: Speed of a wave depends on properties of the medium.

(ie) wave on string:

$$V = \sqrt{\frac{T_s}{\mu}}$$

V = speed of transverse waves on string [m/s]

T_s = tension of string [N]

μ = mass per unit length of string ("linear density") [kg/m]

Let's describe the wave mathematically.

t = time , x = position of a "1-D" wave

D = "displacement" ← describes the motion of particles in the medium.

or Δy

$$D = f(x - vt)$$ v = speed of wave.

↖ "function of"

Note: D can be any function, and waves will propagate.

One interesting function is a sine wave:

$$D = A \sin(kx - \omega t + \phi_0)$$

D = disturbance

A = amplitude of wave

same units perhaps m.

"sin" is the function, produces a number between -1 and +1

k = wave number $= \frac{2\pi}{\lambda}$ $\left[\frac{\text{radians}}{m}\right]$

where λ = "lambda" = wavelength [m]

ω = angular frequency $= \frac{2\pi}{T}$ $\left[\frac{\text{rad}}{s}\right]$

where T = period [s]

freq, f, of a wave is related to wavelength & speed: $\boxed{v = f\lambda}$

$$f = v/\lambda$$

Quiz3: $\lambda = 10$ m. $\quad f = \frac{50 \cancel{m}/s}{10 \cancel{m}}$

$v = 50 m/s$ $\quad f = 5 \frac{1}{s}$

or $f = 5$ Hz

5 cycles / se

Quiz 4 argument of "sin" is called the "phase". phase $= kx - \omega t + \phi_0$

ϕ_0 = phase constant.

- "sin" will oscillate completely when phase changes by 2π.

→ from crest to adjacent trough is $\frac{1}{2}$ oscillation, or π radians.

Note: so far waves we have discussed are "1-D" → they travel in a straight line.

In real life, waves spread out in 2 or 3 D:

3-D wave. $D = f(x, y, z, t)$

↑ $\underbrace{x, y, z}_{\text{spatial}}$, t time coordinate function. coordinates

→ In 2-D wave motion, we can plot locations of wave crests.

→ wave fronts connect all adjacent wave crests.