① Phys 1402 2016-11-08 Lec 22

Oscillations Time: Period T in s
Freq f in Hz
$f = 1/T$

Amplitude: x_{max} in ?
(Units appropriate for whatever quantity is oscillating.)

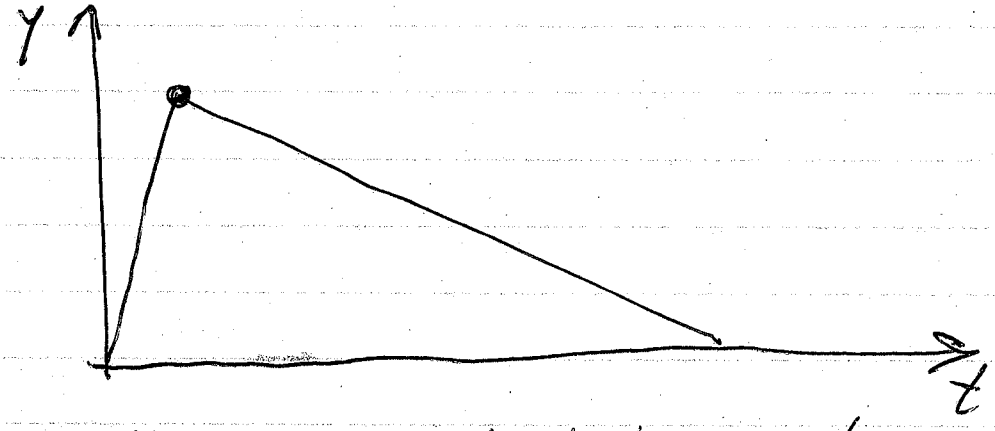
$$x = x_{max} \sin(2\pi f t)$$

Waves: Oscillations that are connected.

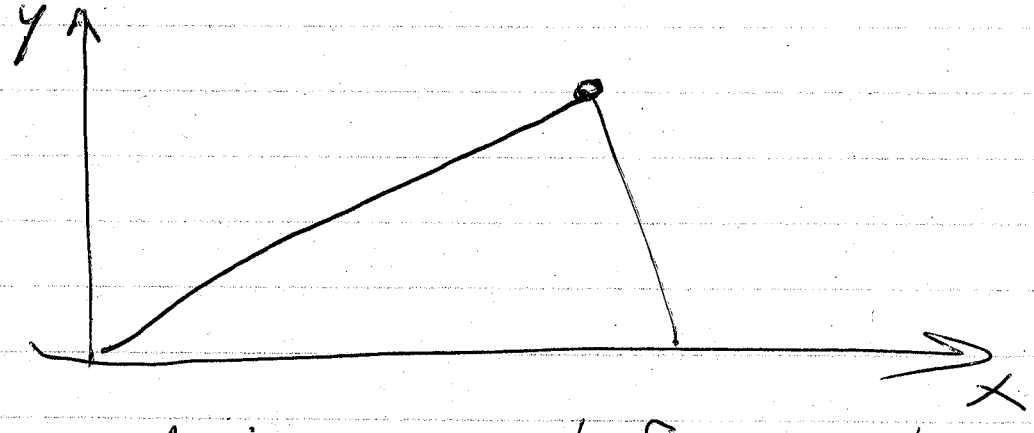
Ex: "The Wave" in a football stadium
Each oscillator is a person
Connection is visual / audable
The wave moves, the people stay at their seats.

(2)

What would the graph of $y(t)$ be?
Raise quickly then lower slowly



When this is applied to a string, the string looks like:



x and t are sort of opposites

Wave is: $y(x - vt)$ (general)

$\sin(x - vt)$ oscillating

$$A\sin\left(\frac{2\pi x}{\lambda} - 2\pi f t\right)$$

③

λ (lambda) is wavelength

$\frac{2\pi x}{\lambda}$ is like $\frac{2\pi t}{T} = 2\pi f t$

λ represents a distance, the repeating distance

The link is: $\frac{2\pi}{\lambda}(x - vt)$

$$\frac{2\pi x}{\lambda} - \underbrace{\frac{2\pi v}{\lambda}}_{=2\pi f} t$$

$v = f\lambda \longleftrightarrow \frac{v}{\lambda} = f$

Ex: Sound Wave $v = 340$ m/s
$f = 680$ Hz

$$v = f\lambda$$
$$(340 \text{ m/s}) = (680 \text{ Hz})\,\lambda$$
$$\frac{340}{680} = 0.5 \text{ m} = \lambda$$

Generally: $f = 20$ Hz ... 20 KHz

Wavelength of wind instruments related to size of instrument.

$$\frac{\lambda}{4} = L \quad \text{or} \quad \frac{\lambda}{2} = L$$

Electromagnetic Waves

	Radio	Long λ	Low-f
	Microwaves		
	Infrared		
	Visible Light	750 nm	400 THz
		400 nm	750 THz
Ionizing	Ultraviolet		
	X-Rays		
	Gamma Rays	Short λ	High-f

Speed of Light $v = c = f\lambda$

$(400\ THz)(750\ nm)$

$(400 \times 10^{12}\ Hz)(750 \times 10^{-9}\ m)$

$3 \times 10^{8}\ m/s$

$300{,}000{,}000\ m/s$