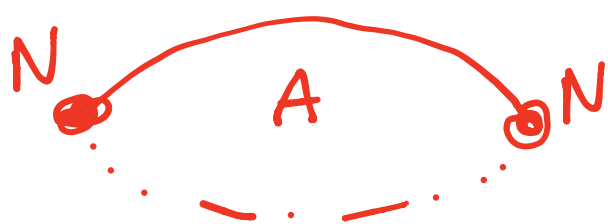


Standing Wave - appears stationary with a changing amplitude

- created by two identical waves moving opposite directions interfering.
- only certain wavelengths create SW's, b/c they must begin and end on a node or antinode

↓
fixed

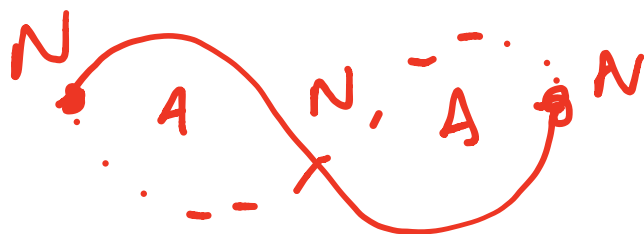
↓
free



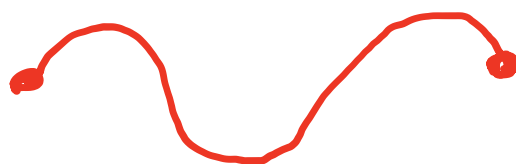
Nodes - no $\vec{d}$
Antinodes - max $\vec{d}$



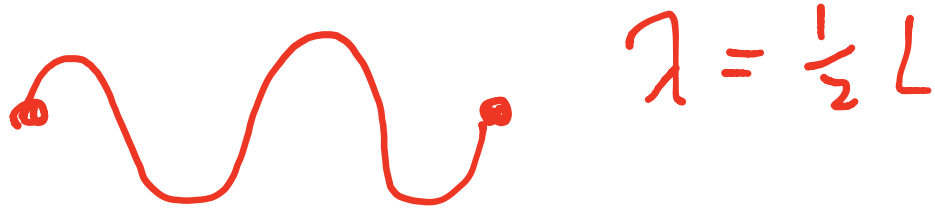
$$\lambda = 2L$$



$$\lambda = L$$



$$\lambda = \frac{2}{3}L$$



Natural frequency -

the frequency an object vibrates at when struck

- the longest wavelength SW for the object.
- Depends on length, shape, material.

Resonance - happens when an object is forced to vibrate at its natural frequency.

- Spontaneous increase in vibrational amplitude
 - thing's gonna shake

Doppler Effect

- When an observer moves relative to any wave source, the observed f will change.

Wave	moving towards	moving away
General	$f \uparrow$	$f \downarrow$
Sound	higher pitch	lower pitch
Light	more blue	more red

- In the 1930's Edwin Hubble measures the light from nearby galaxies
 - finds that all but one are redshifted.
 - galaxies are moving apart
 - universe is expanding
 - ↳ Big Bang Theory

When the object moves at
the speed of sound the
wave crests overlap.

