

# Waves: Sound and Light

Ch 16, 17, 18

# Objectives

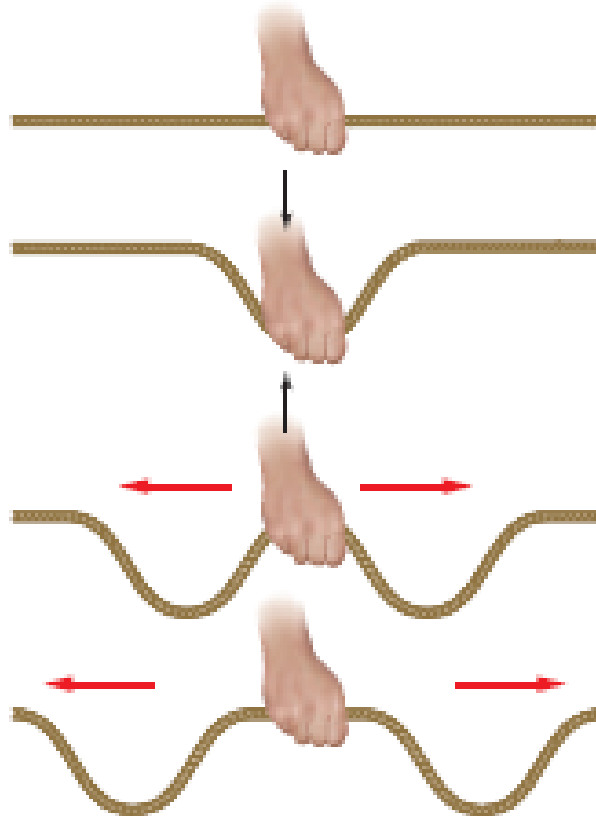
- Understand the properties of transverse and longitudinal waves
- Perform calculations for waves

# Mechanical waves

- Need a medium
- Transverse
- Longitudinal

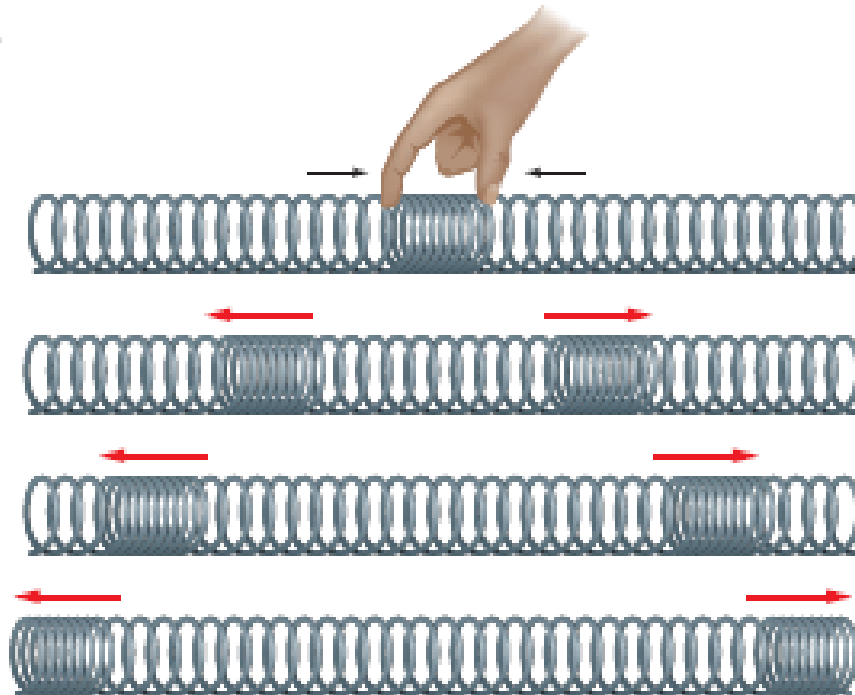
# Transverse waves

- Particles vibrate perpendicular to direction of wave



# Longitudinal waves

- Particles vibrate in direction of wave
- Sound



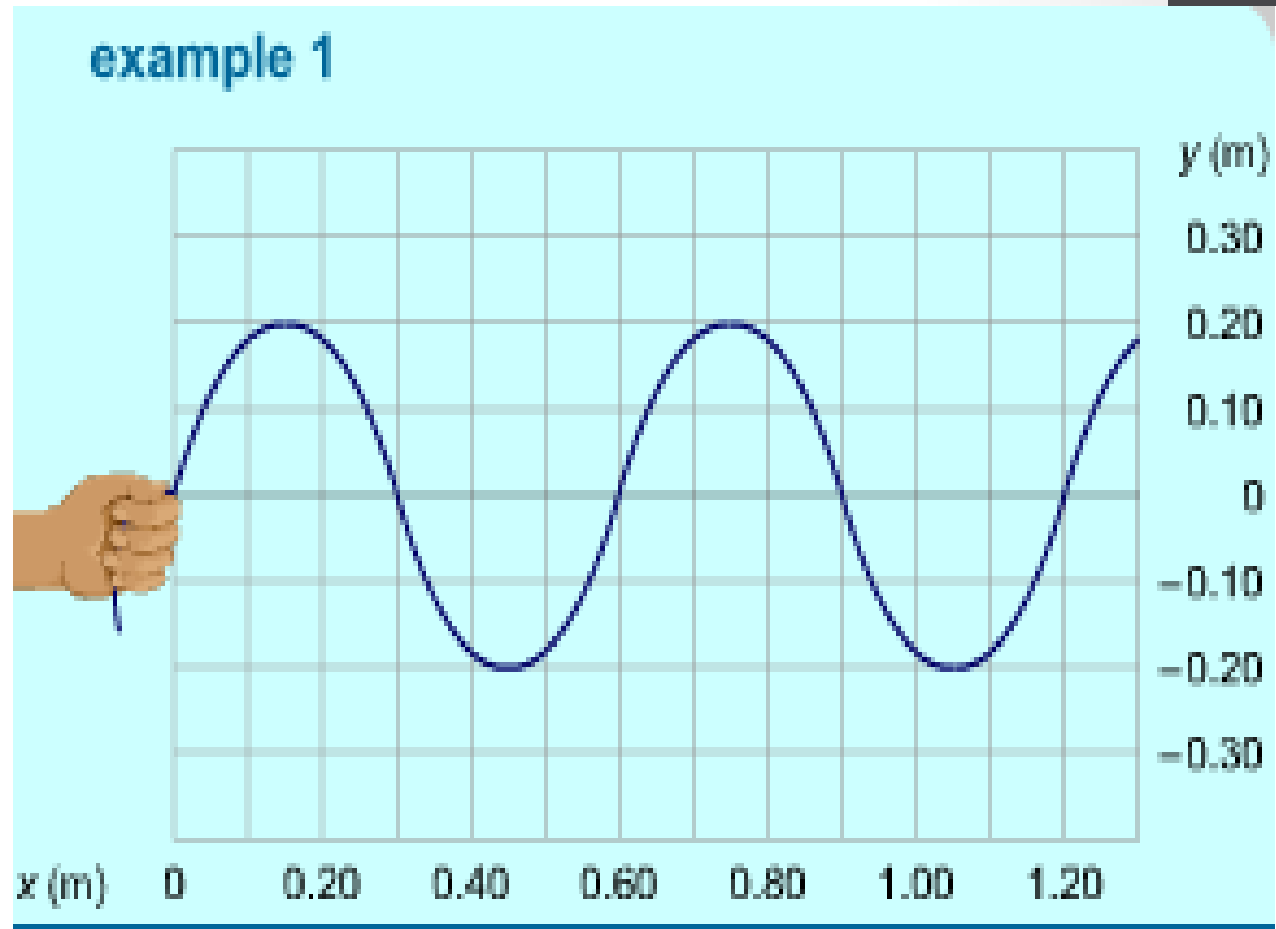
# Ocean waves



- Transverse or longitudinal?

# Vocab

- Speed
- Amplitude
- Wavelength
- Frequency
- Period



# Wave equations

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

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

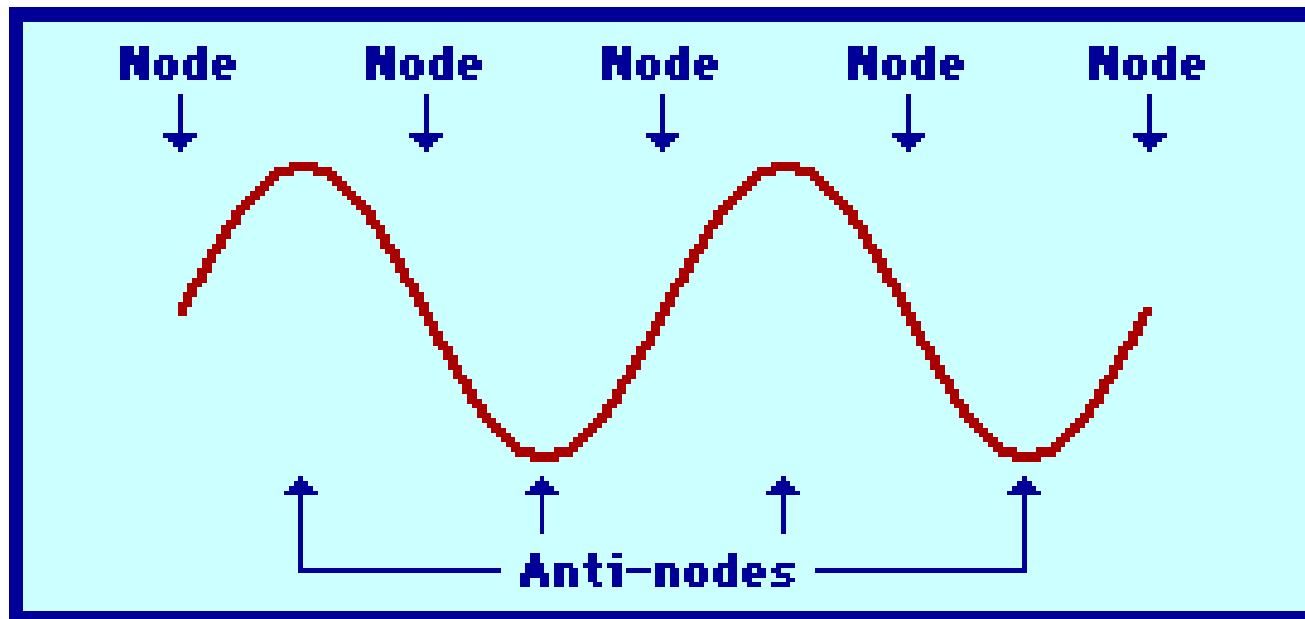
- $f$  = frequency
  - Measured in Hertz (1/s)
- $T$  = period (s)
- $\lambda$  = wavelength
- $v$  = velocity





# Nodes and Antinodes

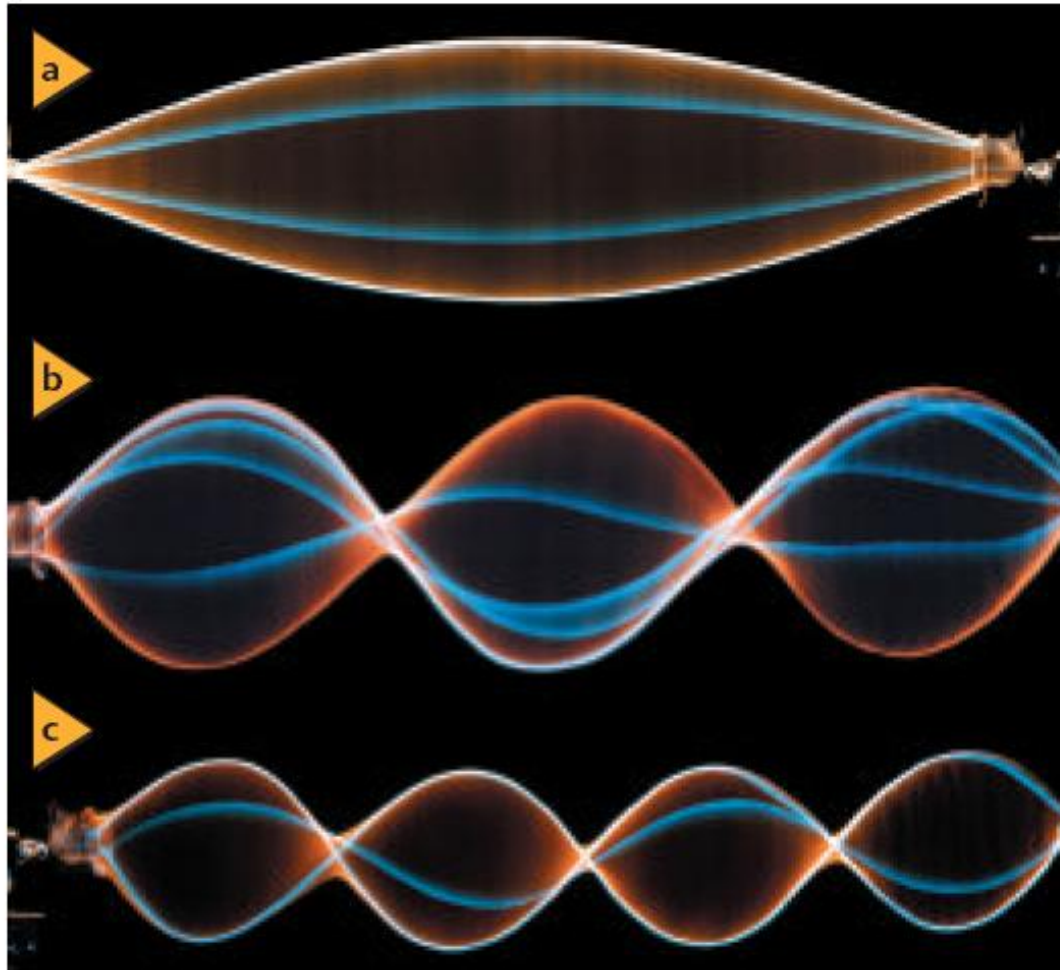
- Node—point at which medium is undisturbed
  - Displacement is zero
- Antinode—displacement is greatest



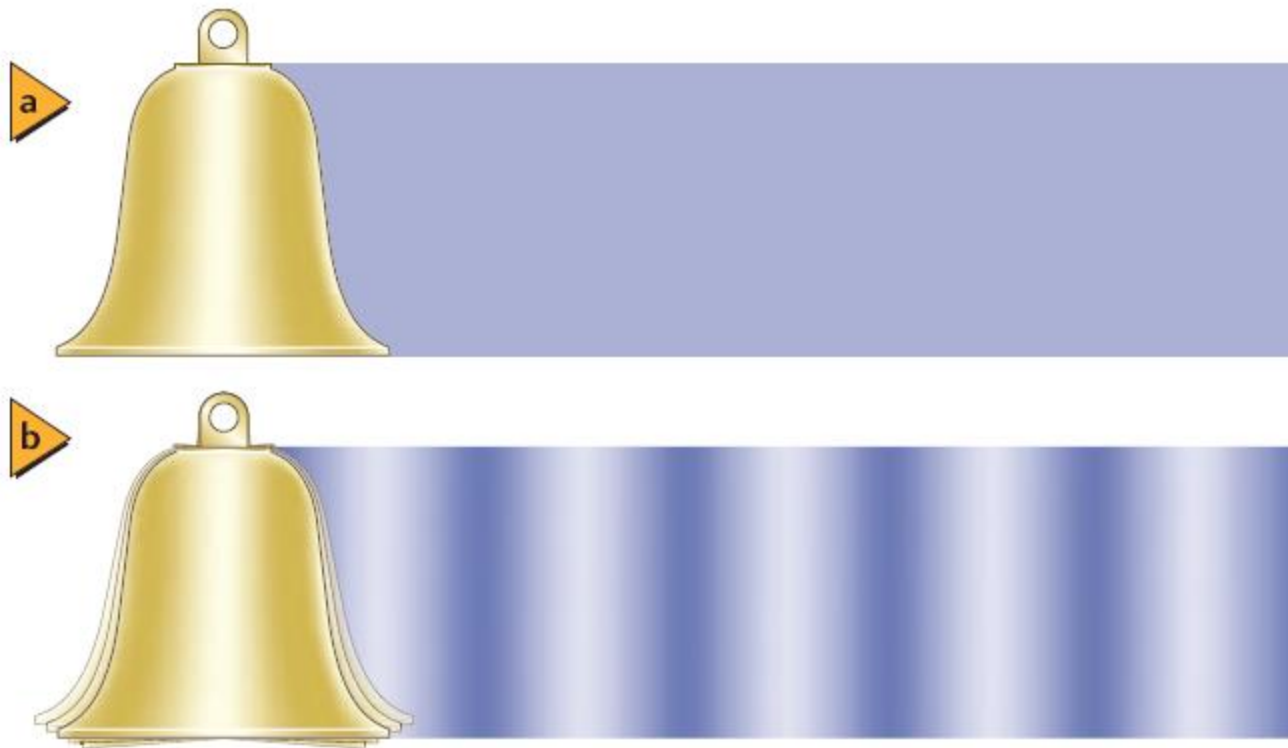
# Nodes and Antinodes

- Standing wave—appears to be standing still
- Nodes and antinodes in standing wave

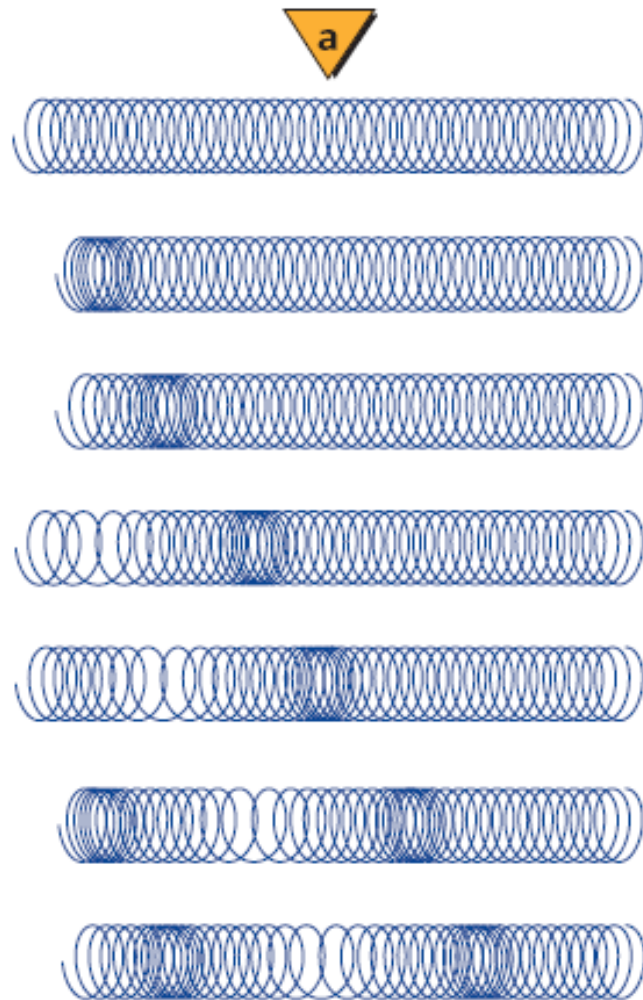
■ **Figure 14-14** Interference produces standing waves in a rope. As the frequency is increased, as shown from top to bottom, the number of nodes and antinodes increases.



# Sound waves—pressure

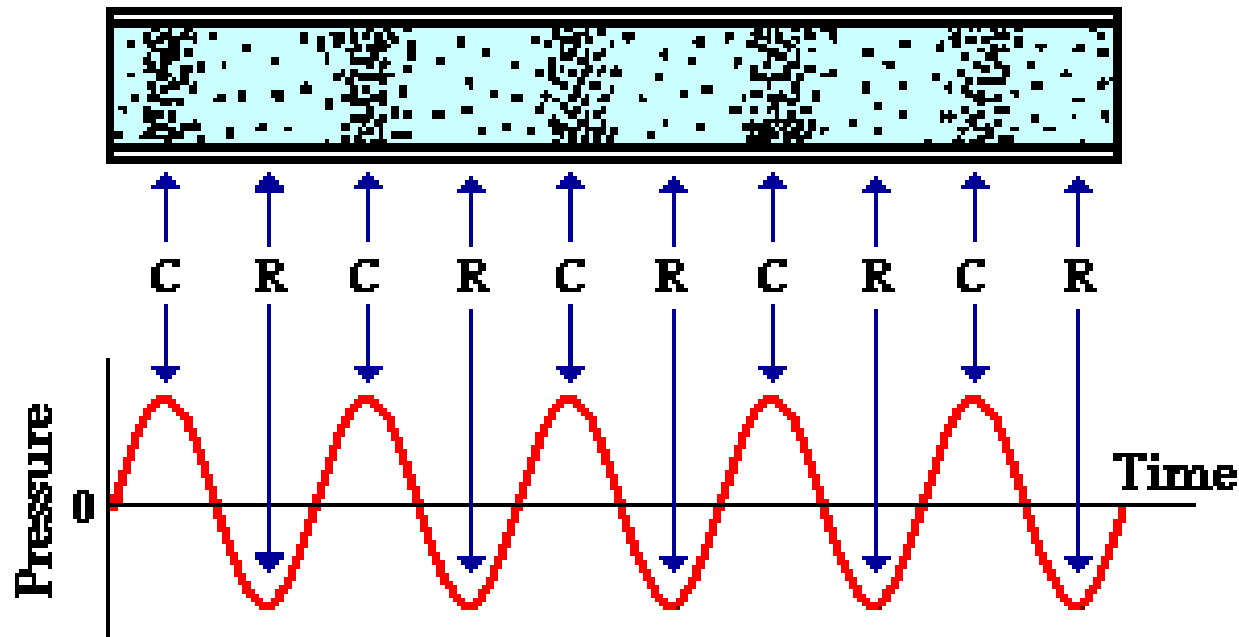


# Sound waves—longitudinal



# Sound waves—longitudinal

Sound is a Pressure Wave



**NOTE:** "C" stands for compression and "R" stands for rarefaction

- Bottom wave only represents fluctuations
- Sound is NOT a transverse wave!

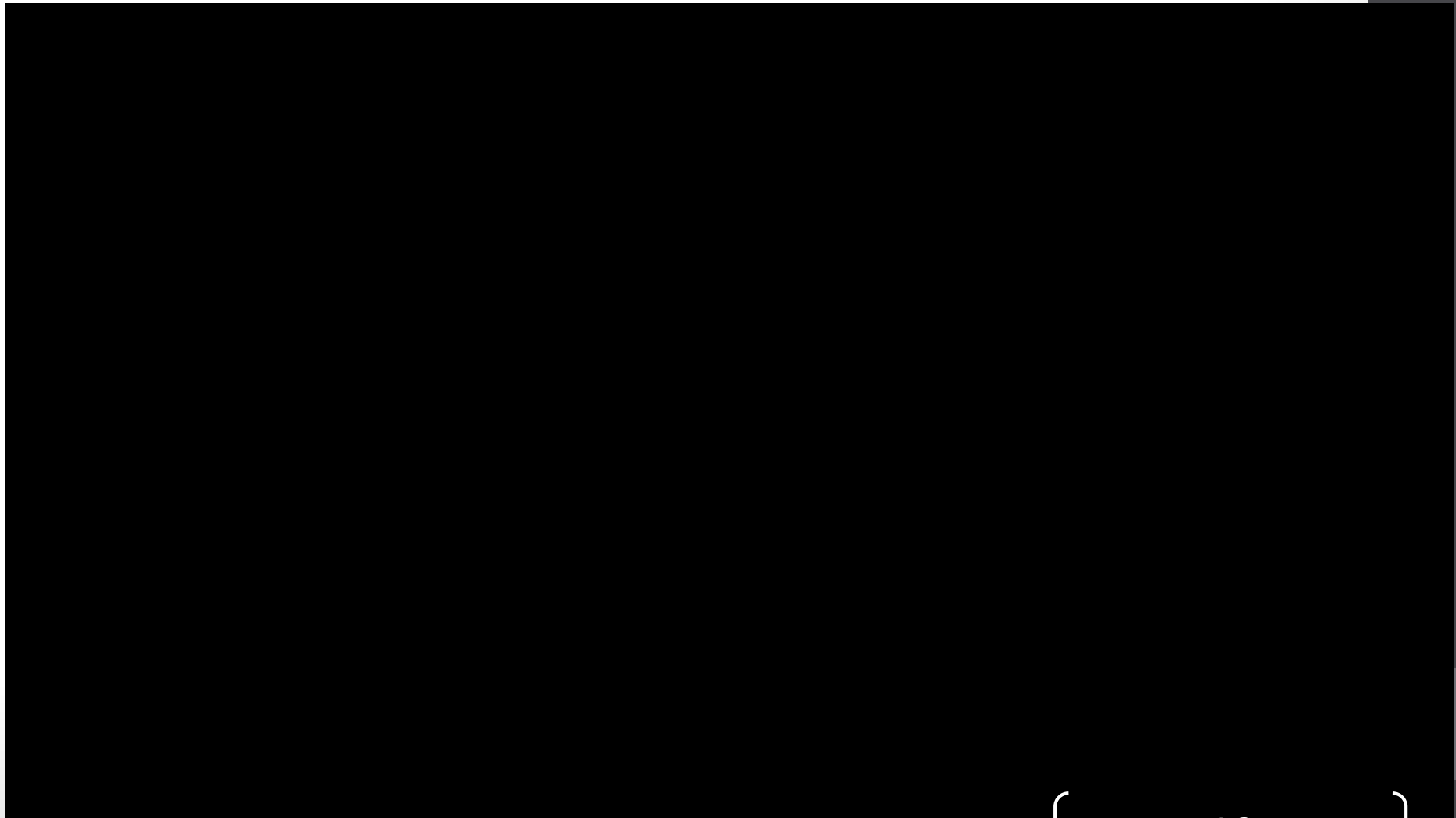
# Doppler Effect

$$f_o = f_s \left( \frac{v \pm v_o}{v \mp v_s} \right)$$

- [Siren clip](#)
- Hand out
- [CharlielsSoCoolLike](#)

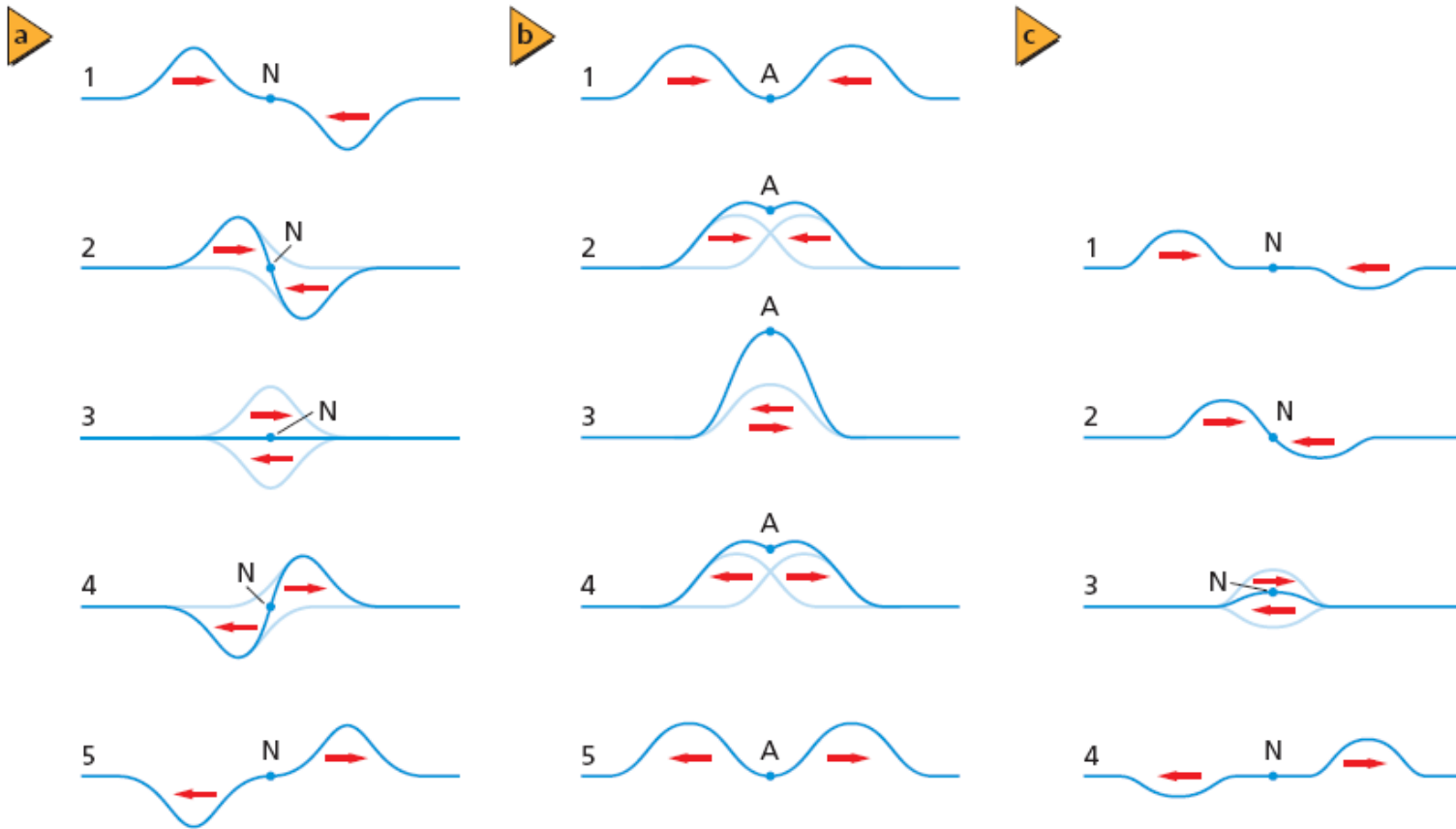


# Doppler Effect





# Law of superposition



# Wave Terms

- Transverse wave
- Longitudinal wave
- Wavelength
- Frequency
- Period
- Amplitude
- Trough
- Crest
- Standing wave
- Interference
- Node
- Antinode
- Doppler Effect

# Periodic Motion

- Repeating regular cycle (springs, pendulums)
- Hooke's Law for spring:  $F = -kx$
- Pendulum:

$T \equiv$  period

$l \equiv$  length

$g \equiv$  gravity

$$T = 2\pi \sqrt{\frac{l}{g}}$$

- Rearrange pendulum equation for length and gravity:

$$T = 2\pi \sqrt{\frac{l}{g}}$$