

A **wave** is a kind of **oscillation** (disturbance, vibration) that **transports energy** from place to place through space and matter.

# WAVES

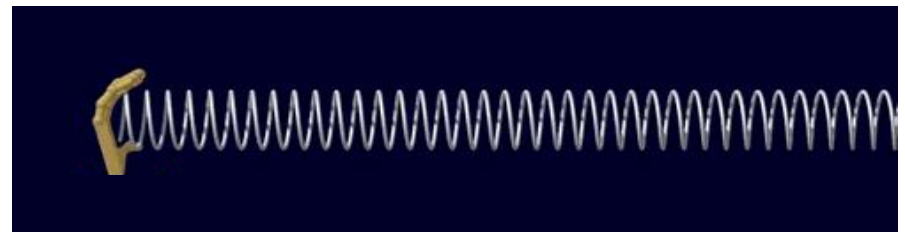
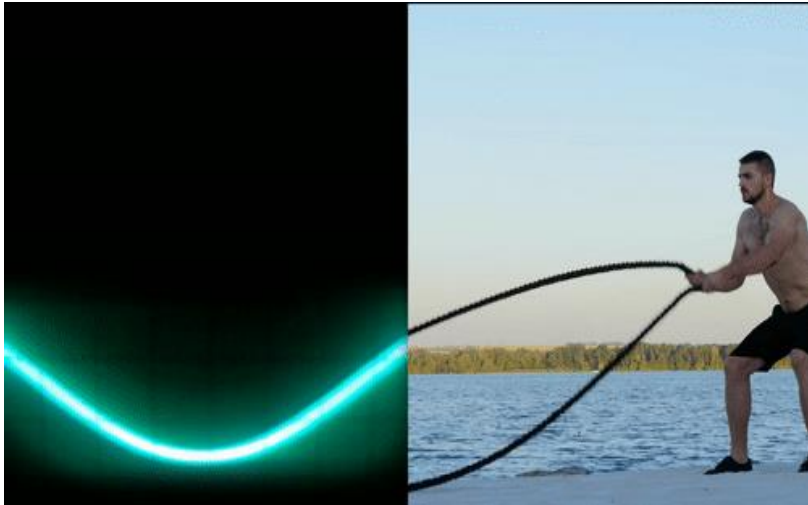
## MECHANICAL:

- oscillations of *matter*
- require a medium

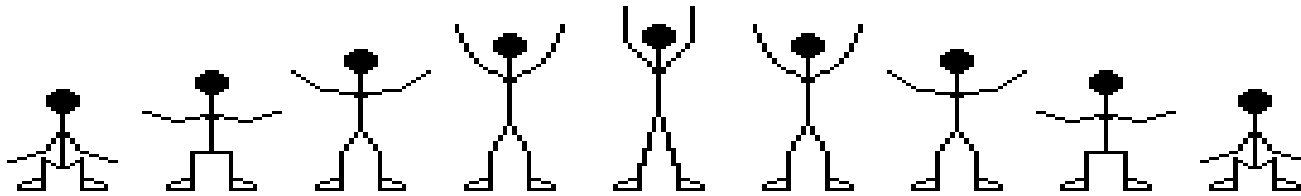
## ELECTROMAGNETIC:

- oscillations of *electric and magnetic field*
- require no medium

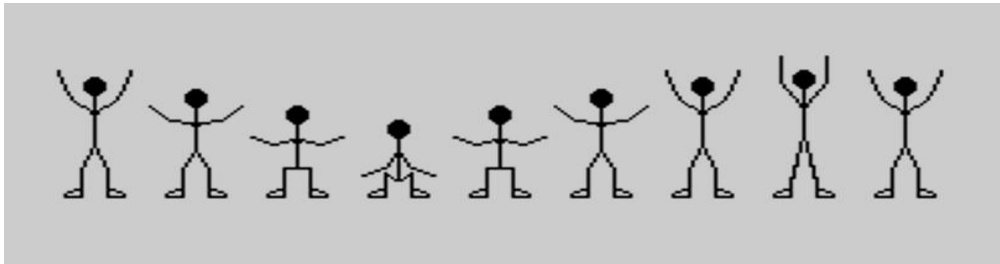
# Examples of waves



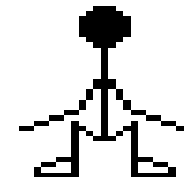
# How to describe a wave?



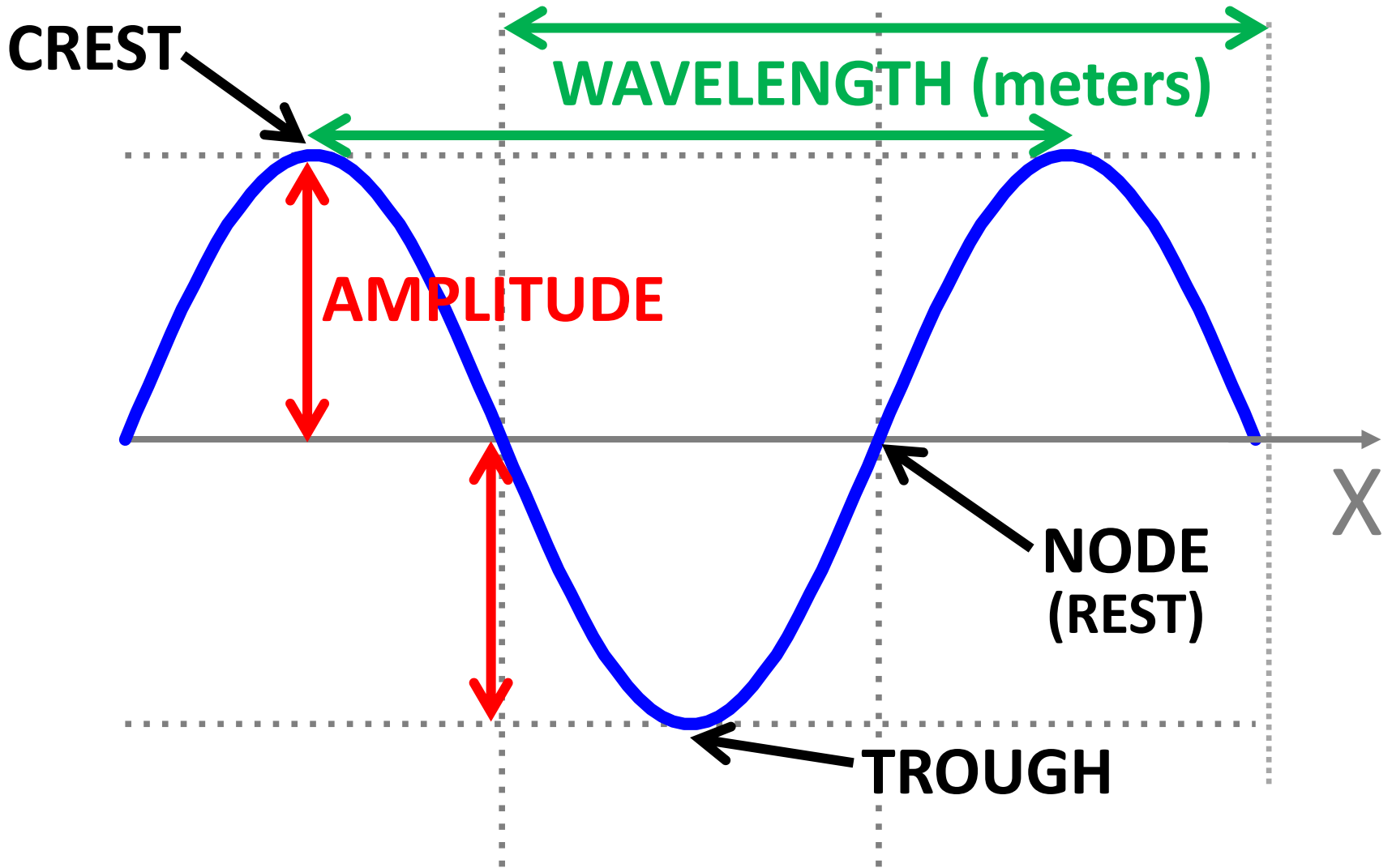
1. Take a “snapshot” – look at wave shape at a particular moment in time.



2. Watch a particular point over time.



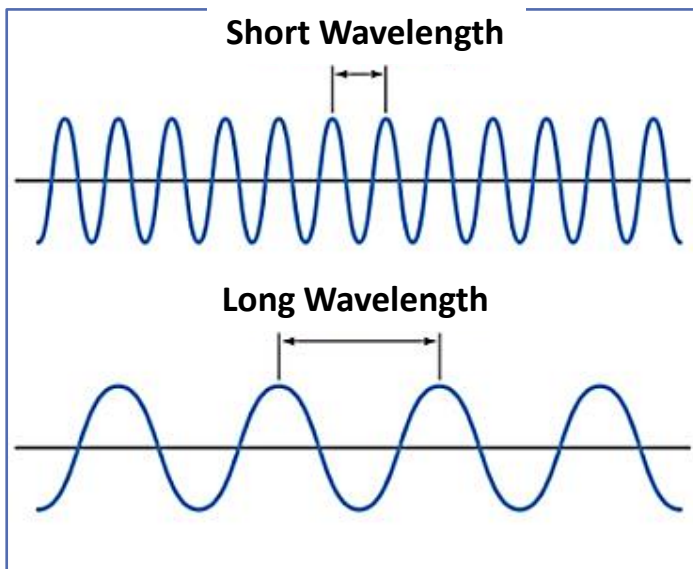
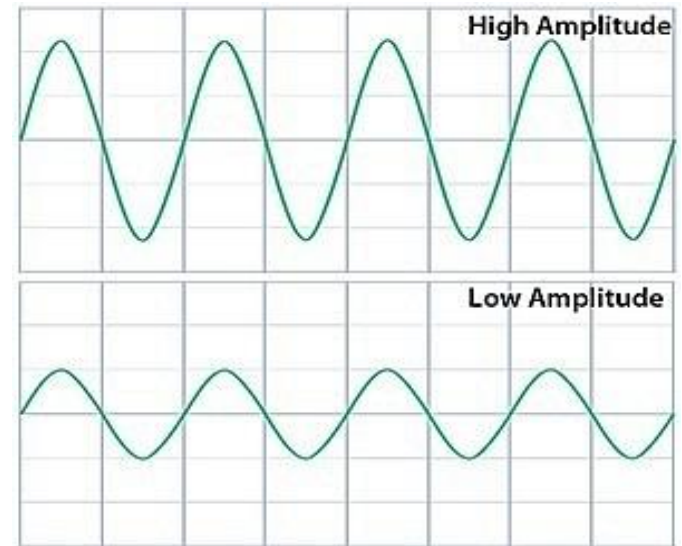
# How to describe a wave in space?



# Notations and Units

**AMPLITUDE (A):** maximum amount of vibration measured from the rest position.

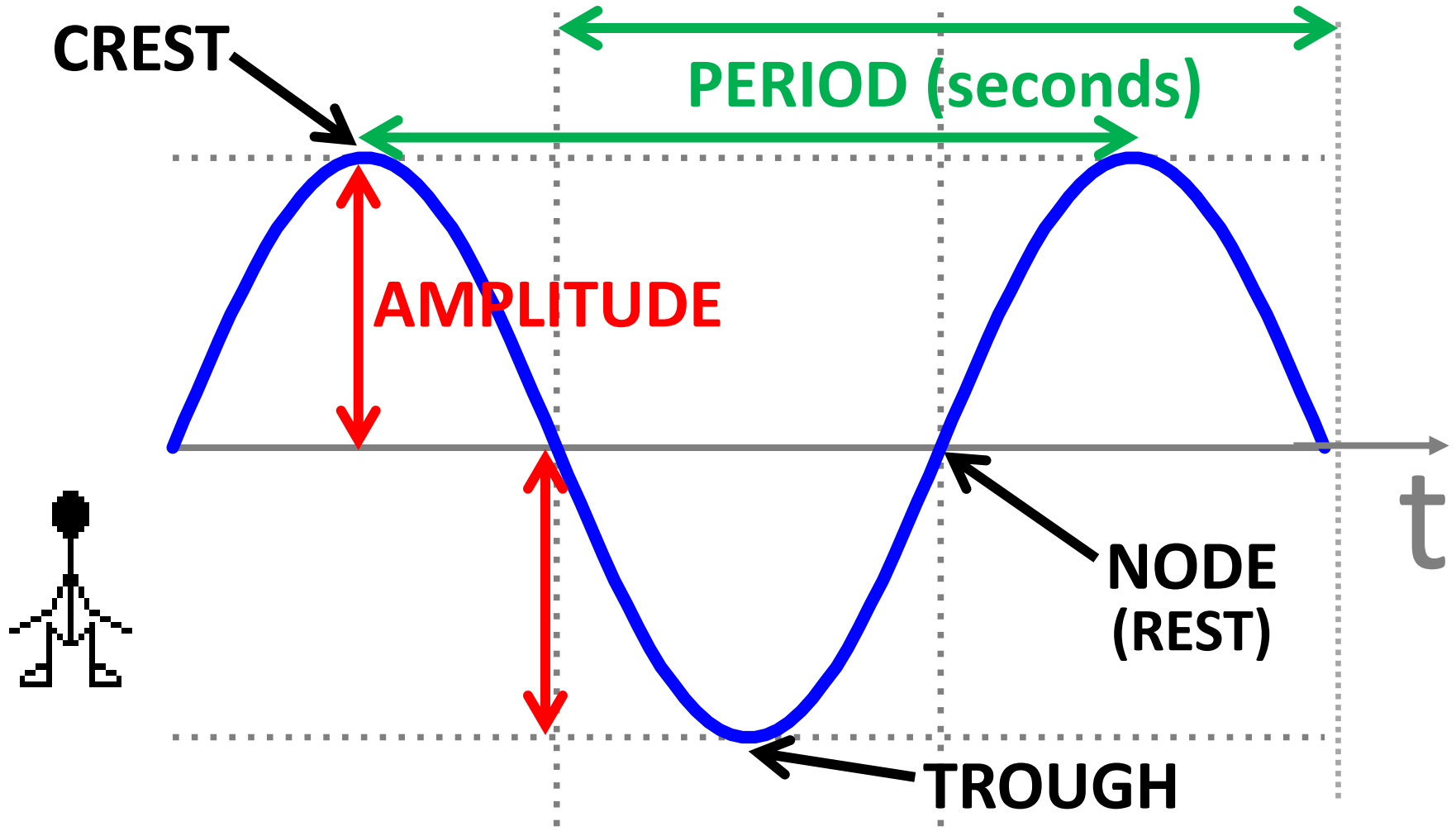
- Unit of measurement: depends on the physical quantity that is oscillating
- Examples: distance (meters), pressure (pascals), electric field strength (volts/meter)



**WAVELENGTH ( $\lambda$ ):** the distance over which the wave's shape repeats itself.

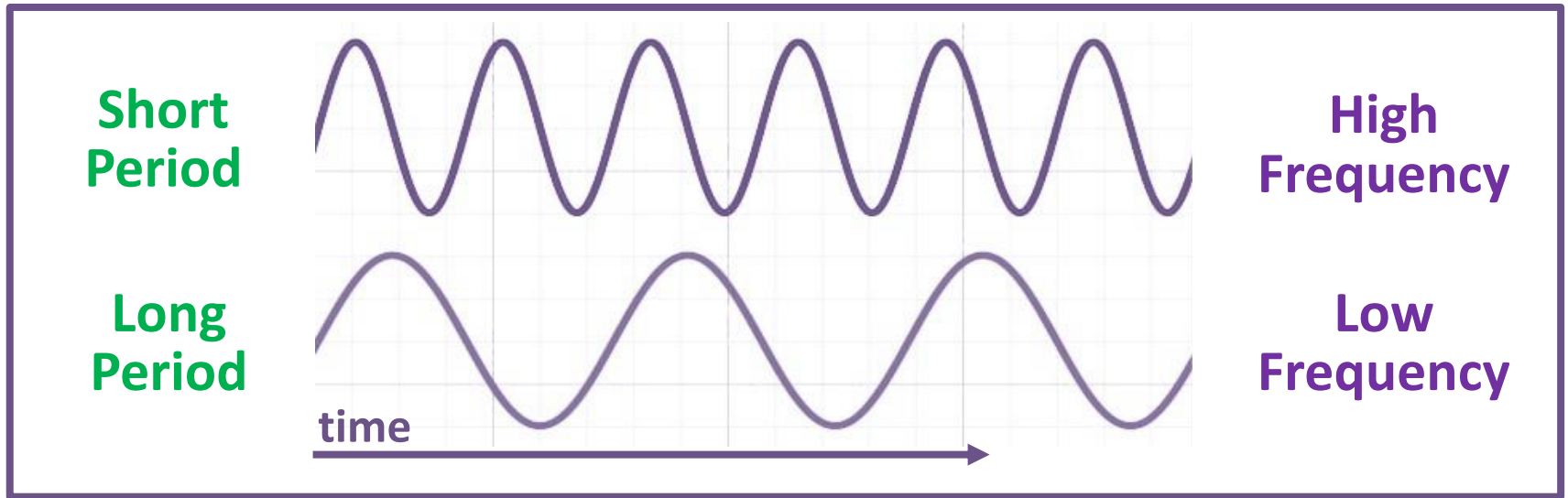
- Unit of measurement: meters
- Examples: the sounds of thunder are waves with wavelengths from few tenths to a few meters; the wavelengths of visible light are in the range of 400 to 750 *nanometers* (billionths of a meter)

# How to describe a wave in time?



**FREQUENCY: number of waves per second**

# Notations and Units



**PERIOD (T):** The time it takes to make one complete vibrational cycle.

➤ Unit of measurement: seconds

**FREQUENCY (f):** number of waves per second.

➤ Unit of measurement: hertz (Hz)

$$\text{FREQUENCY} = \frac{1}{\text{PERIOD}}$$

$$1\text{Hz} = \frac{1}{1\text{s}}$$



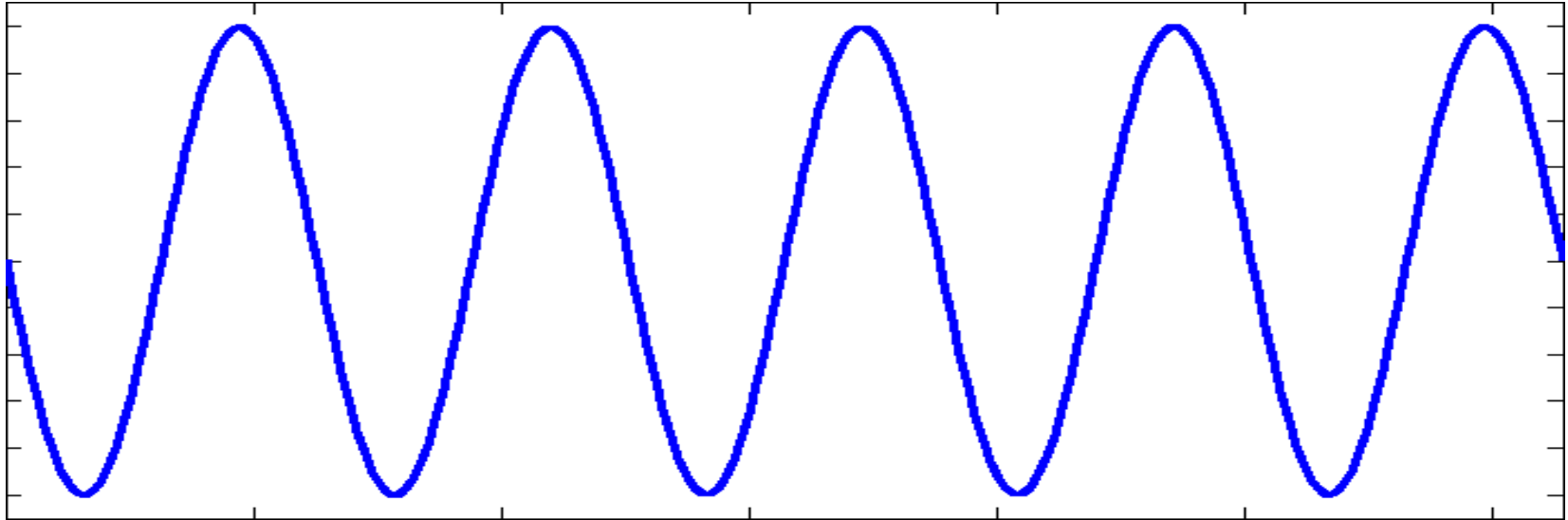
Can you identify **two**  
different kinds of  
mechanical waves  
that are created when  
someone plays a  
musical instrument?





# A traveling wave

is a wave that **moves** through space and matter.

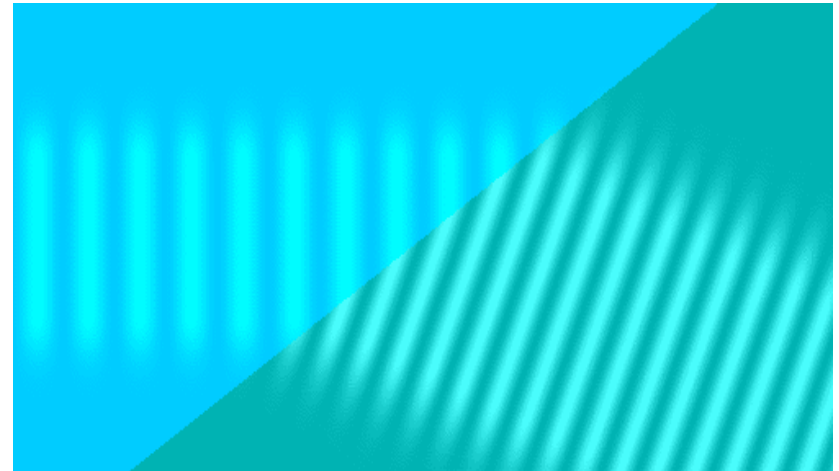
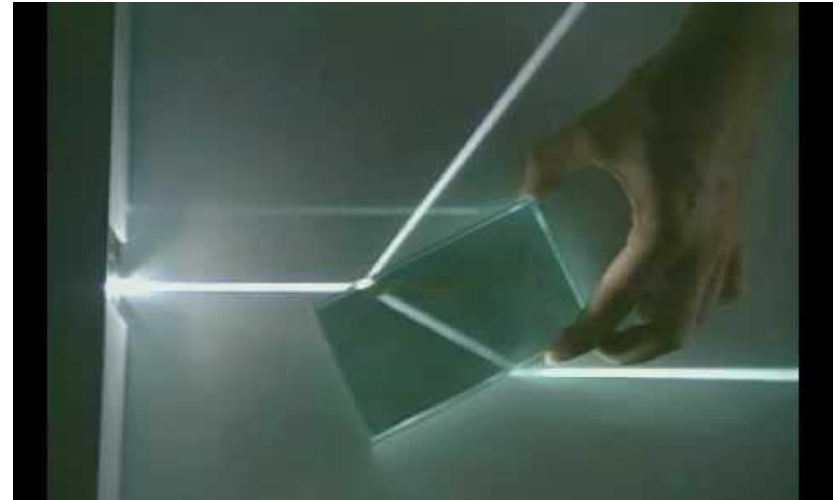
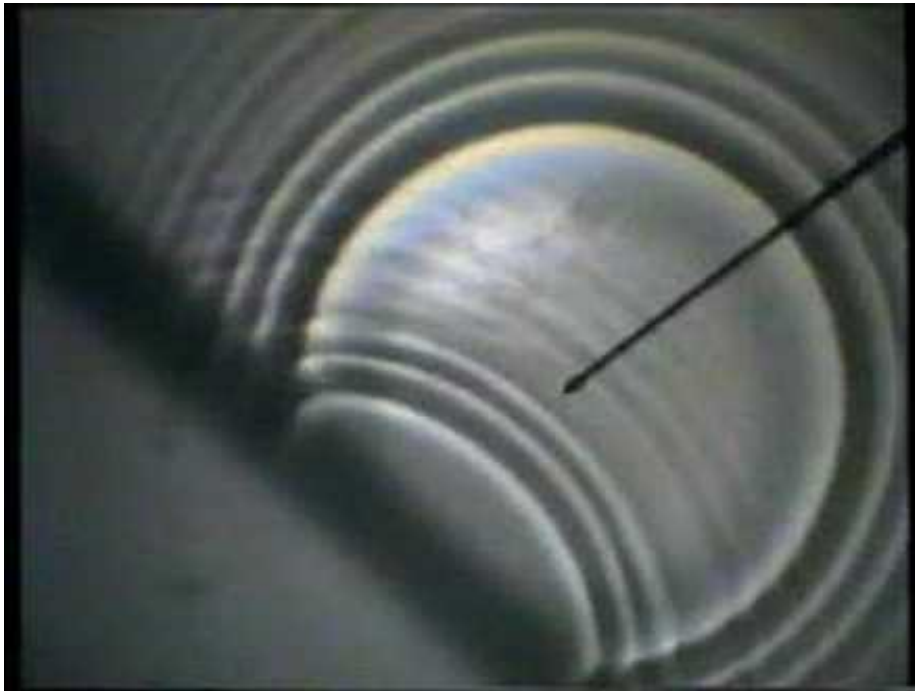


$$\text{FREQUENCY} = \frac{\text{VELOCITY (speed)}}{\text{WAVELENGTH}}$$

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

Light and sound are both examples of traveling waves.

Traveling waves can  
**reflect** off objects  
and surfaces...



...and **refract** - change their direction when  
entering a different medium at an angle.