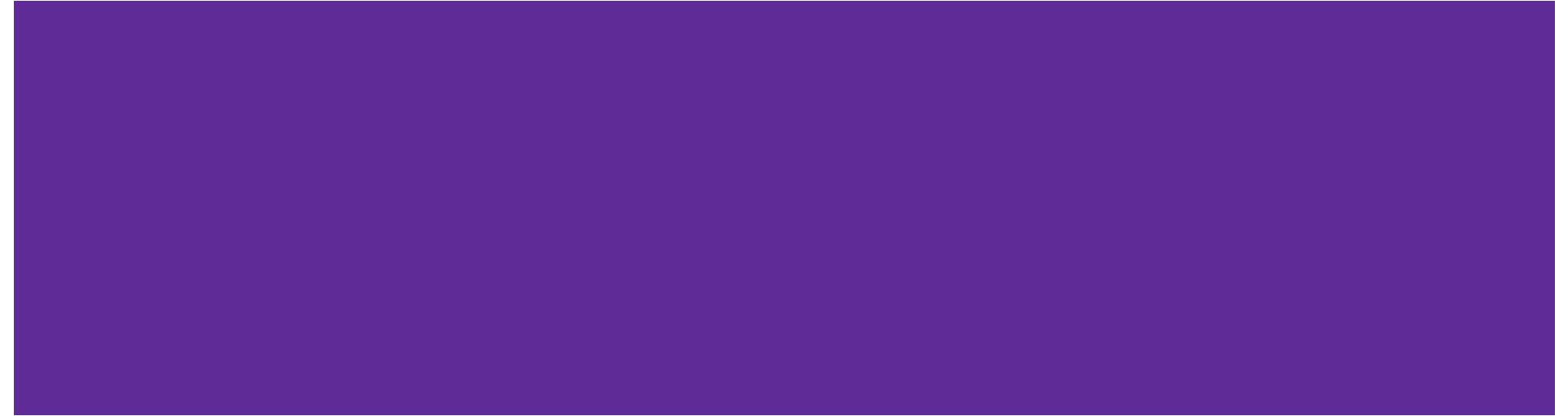


# Waves

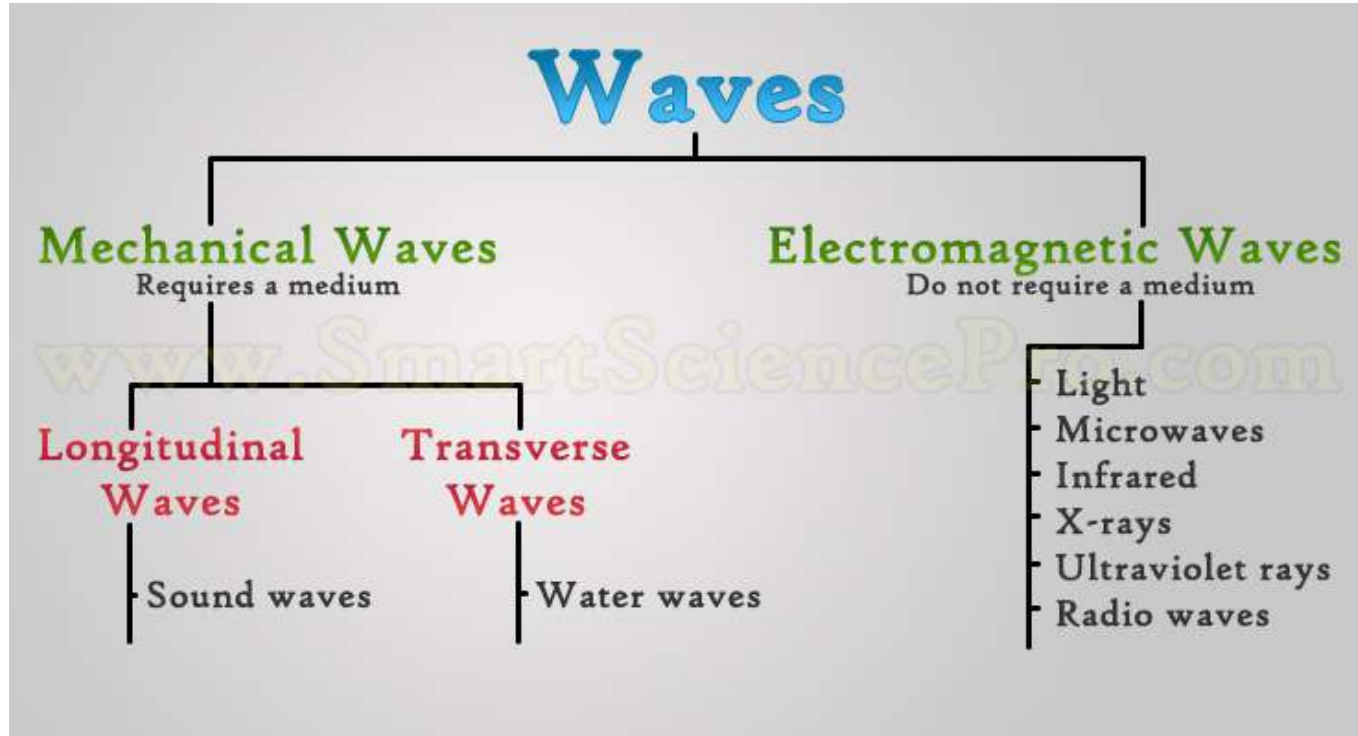
Unit 10 Physics



# **PhET Labs and Cosmos**

Please turn into the Turn In Bin!

# Types of Waves



### Longitudinal wave

Source moves  
left and right

Coils move  
left and right



### Transverse Wave

Source moves  
up and down

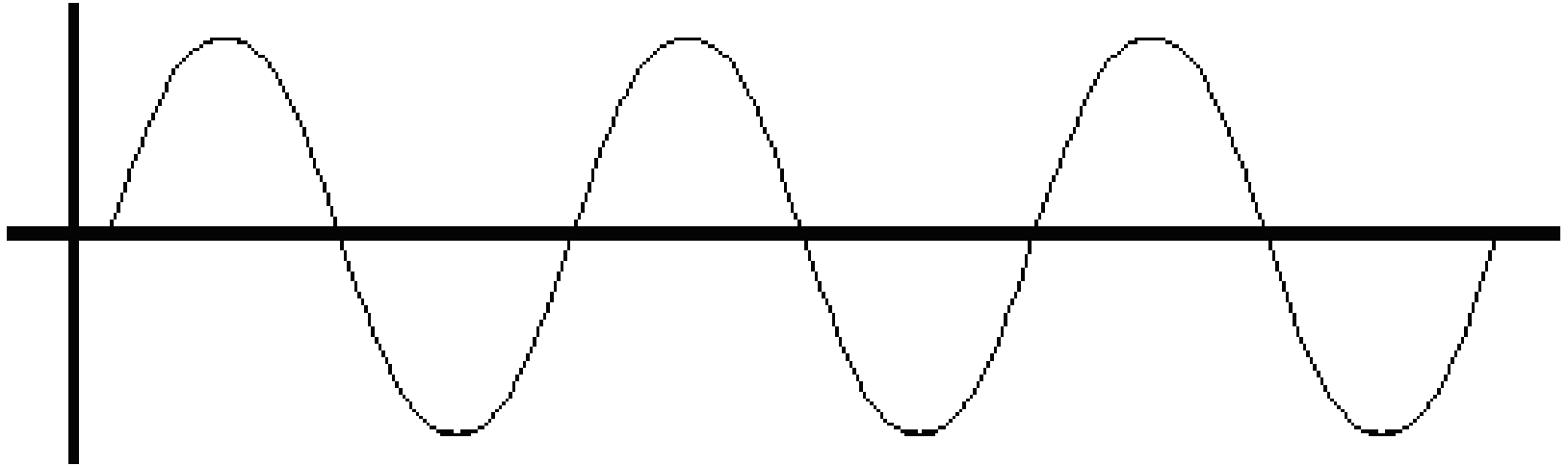
Coils move  
up and down



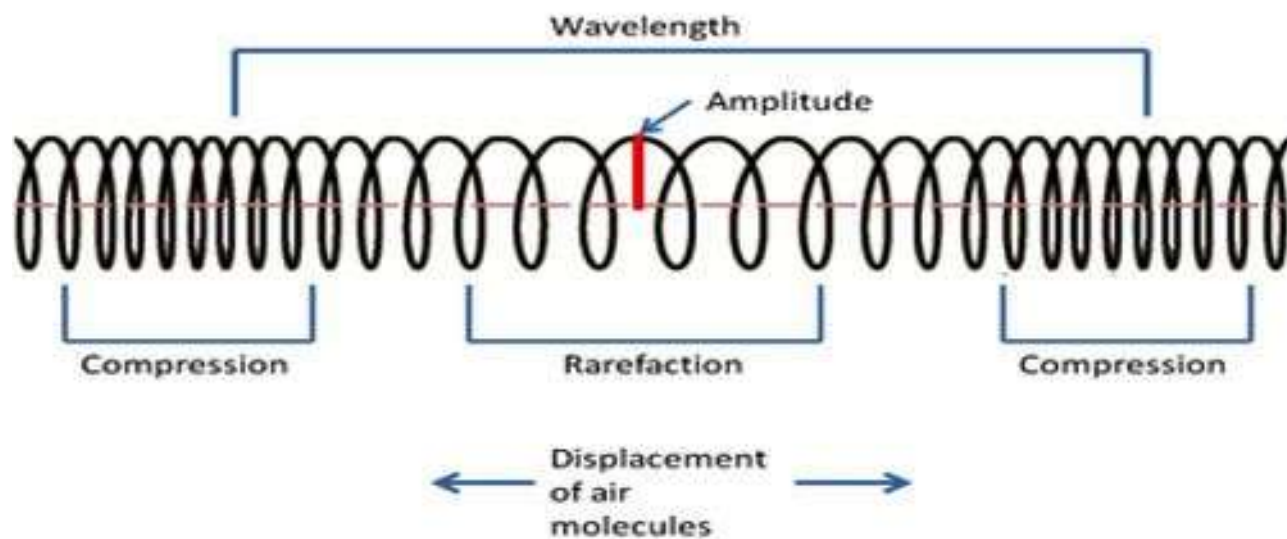
The subsequent direction of motion of individual particles of a medium is the same as the direction of vibration of the source of the disturbance.

# Vocabulary to Build

Crest, Trough, Amplitude (m), Wavelength (m), Period (T) (s)



## Longitudinal Wave



# Frequency and period

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

The period of an oscillator is one over its frequency.

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

The frequency of an oscillator is one over its period.

# Wave Speed Equation



# Worksheet Practice

# Wave Station Practice

For each wave A-L...

Units

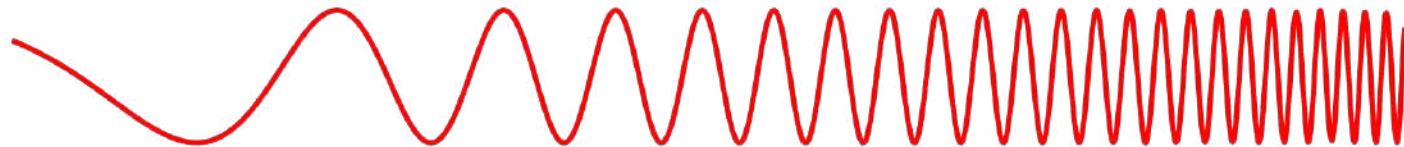
- Amplitude cm
- Wavelength cm
- # of Waves in view waves
- Time for waves to pass s
- Period = Time / # of Waves s
- Frequency = # of Waves / Time Hz
- Speed = wavelength / period cm/s

# Is there a relationship?

Choose 3 to graph by yourself. Determine what type of relationship (no correlation, positive, negative, inverse). You must choose at least one with amplitude and one without amplitude.

- Amplitude vs. Frequency
- Period vs. Frequency
- Frequency vs. Speed
- Period vs. Speed
- Wavelength vs. Speed
- Amplitude vs. Speed
- Wavelength vs. # of waves
- Frequency vs. Wavelength
- Amplitude vs. Period

Penetrates Earth's Atmosphere?



Radiation Type  
Wavelength (m)

**Radio**  
 $10^3$

**Microwave**  
 $10^{-2}$

**Infrared**  
 $10^{-5}$

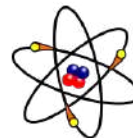
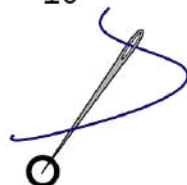
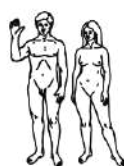
**Visible**  
 $0.5 \times 10^{-6}$

**Ultraviolet**  
 $10^{-8}$

**X-ray**  
 $10^{-10}$

**Gamma ray**  
 $10^{-12}$

Approximate Scale  
of Wavelength



Buildings

Humans

Butterflies

Needle Point

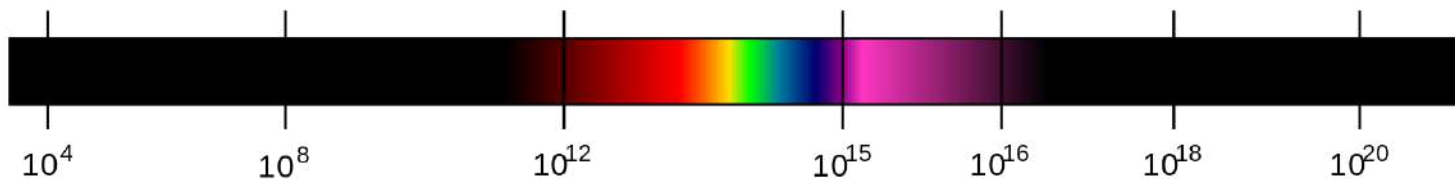
Protozoans

Molecules

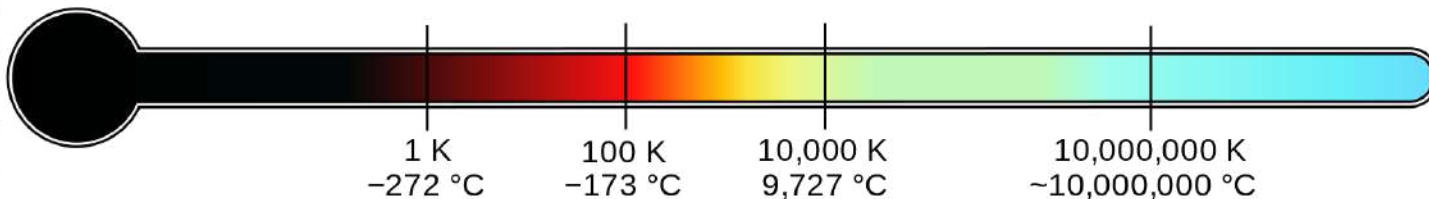
Atoms

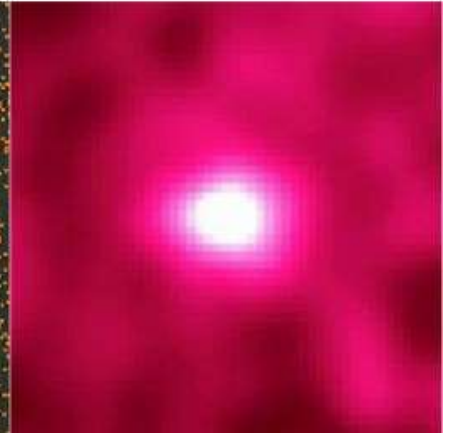
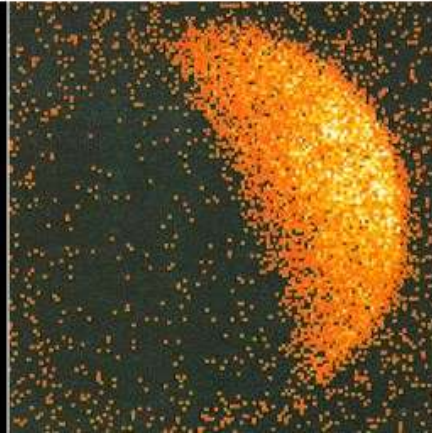
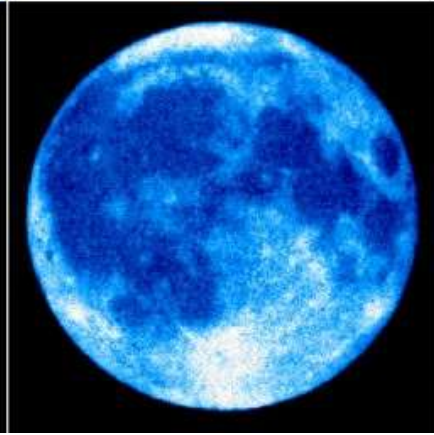
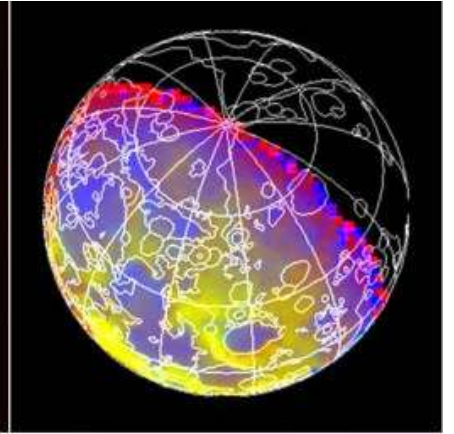
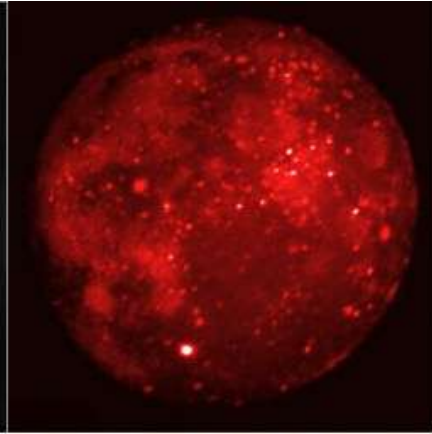
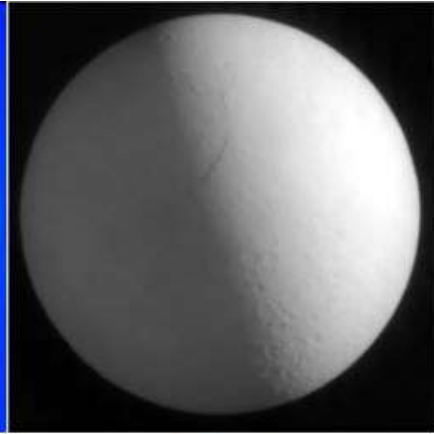
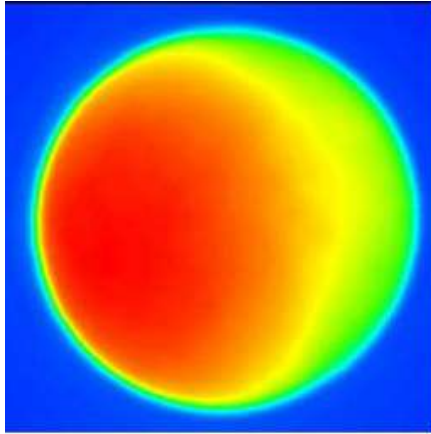
Atomic Nuclei

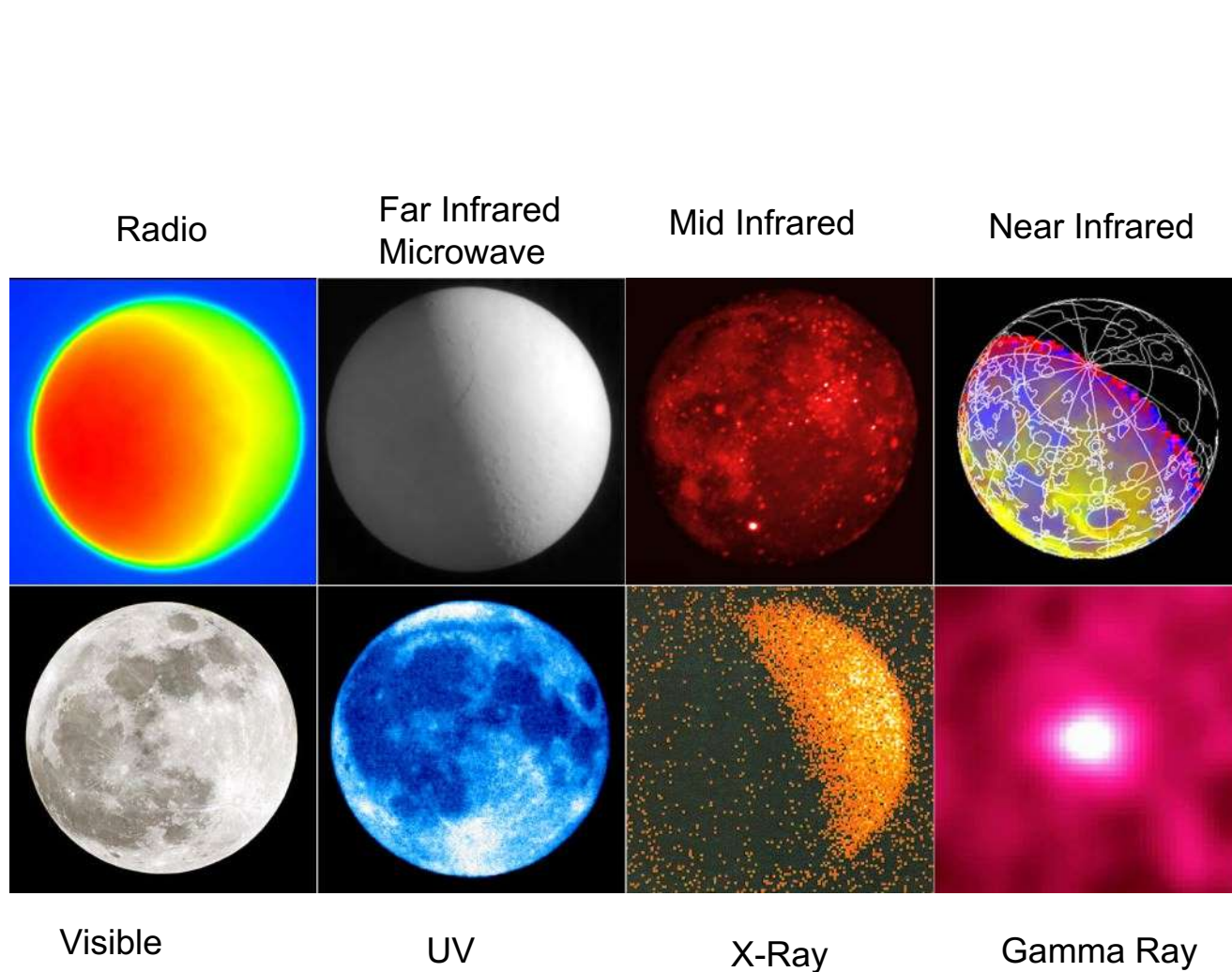
Frequency (Hz)



Temperature of  
objects at which  
this radiation is the  
most intense  
wavelength emitted







Radio

Microwave

Infrared

Visible

Ultraviolet

X-ray

Gamma-ray



AM radio



Amateur  
radio



Aircraft  
communication



Microwave  
oven



TV Remote  
Control



Night vision  
goggles



UV light  
from the Sun



Airport security  
scanner



PET  
scan



Terrestrial  
gamma-ray  
flashes



# Go to PDF Powerpoint

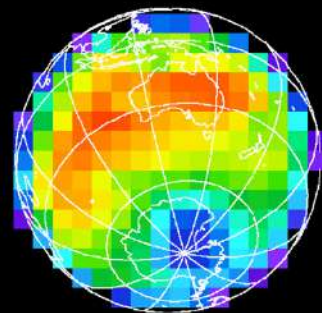
- Dog
  - Unknown Object
  - Explain False Color Imaging (Sensor -> data -> assign color -> create image we can see)
  - Coloring Monday and Tuesday in class
- 
- Tuesday- Wien's Law, look at example
  - Start next activity when gone

# THEMIS

Visible Image



Temperature Image



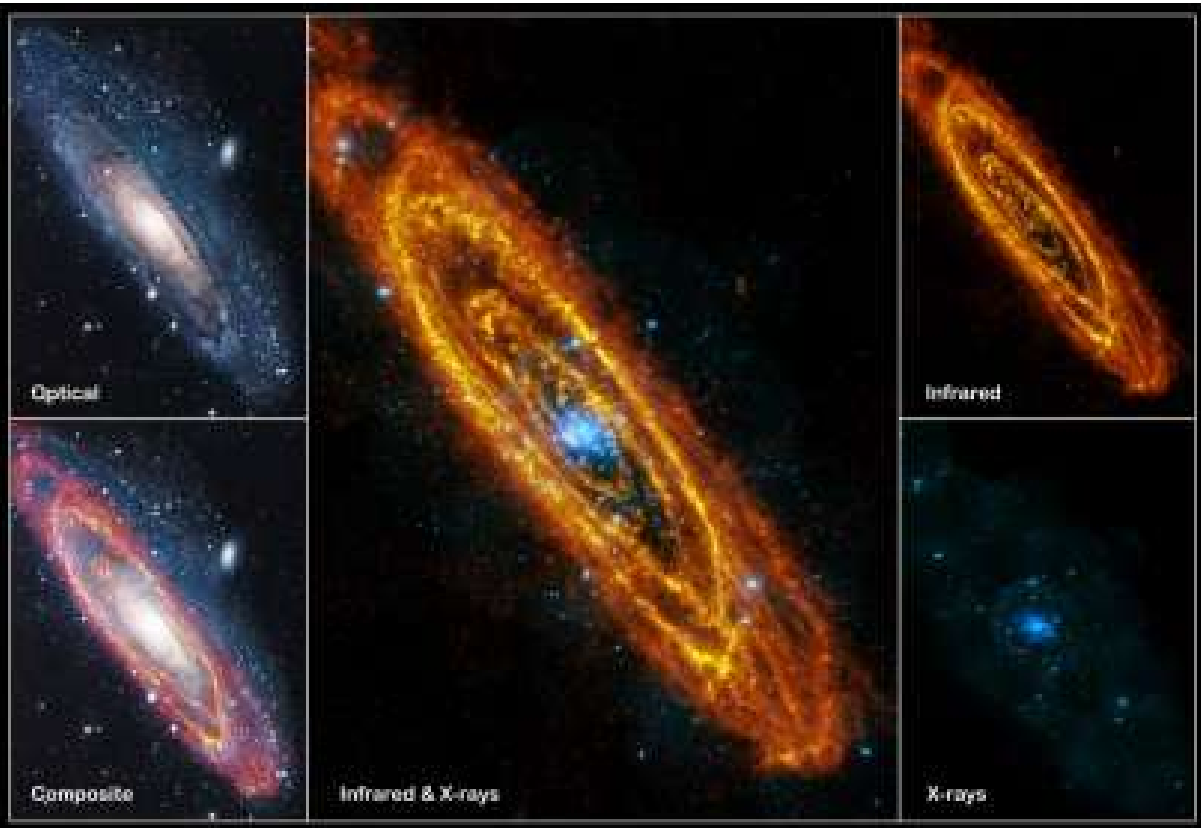


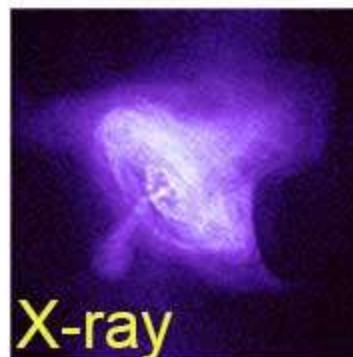
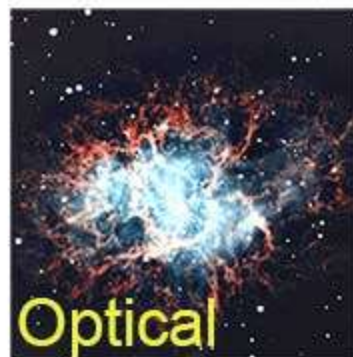
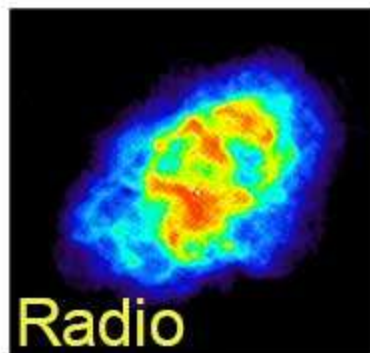
<https://www.jpl.nasa.gov/spaceimages/details.php?id=PIA22343>

<http://www.intellicast.com/Global/Satellite/Infrared.aspx?region=hiusa>

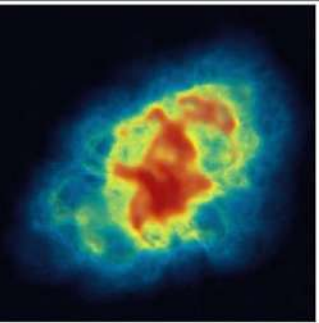
# Tuesday & Wednesday Student Goals

- Finish coloring the galaxy false colored images on Multiwavelength Packet 3 and 4
- Get a Galactic Inquiry packet and complete the activities (make sure you read the directions)!
- Read and answer the questions on Pages 5-7 in your Multiwavelength Packet





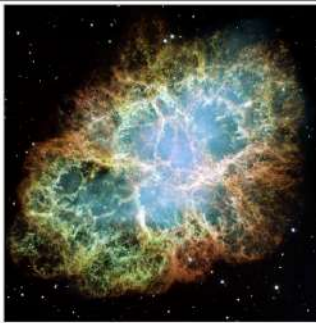
## CRAB NEBULA



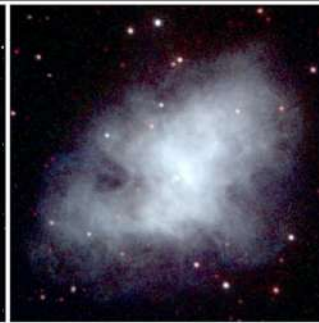
RADIO



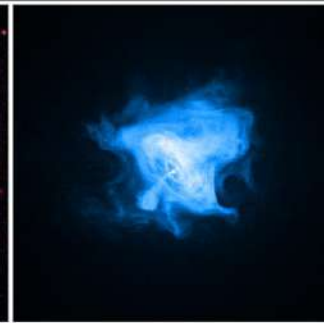
INFRARED



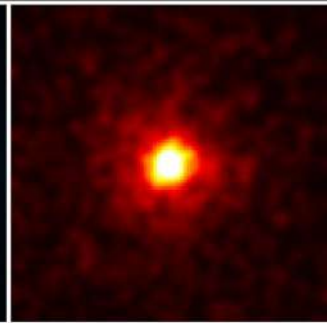
VISIBLE LIGHT



ULTRA VIOLET



X-RAYS



GAMMA RAYS

# Wrap It Up- Build a Model

You need to show

- Wavelength (2 different ways to find)
- Amplitude
- Speed
- Frequency
- Any other important information

# Determining Relationships from Data

Determine the relationships using Waves on a String PhET lab and Wave Stations.

**You must state your answer, reasoning and why with equations AND data.**

- 1) Does amplitude affect the frequency, wavelength and/or speed?
- 2) If wavelength increases, what happens to frequency?
- 3) If wavelength decreases, what happens to frequency?
- 4) If frequency increases, what happens to speed?
- 5) If wavelength increases, what happens to speed?
- 6) When speed increases, what must happen to frequency, wavelength and amplitude?

**Must be done for Friday- we are peer reviewing.**

# Determining Relationships

## Peer Review:

- You will pair up with another group from another table.
- Present your findings for all questions
- Give feedback and ask questions (look for evidence)
- Make any changes after peer review and turn in!



### Longitudinal wave

Source moves  
left and right

Coils move  
left and right



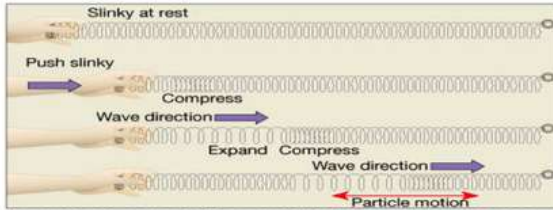
### Transverse Wave

Source moves  
up and down

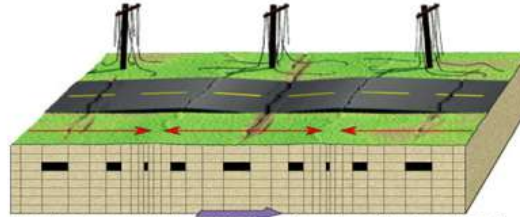
Coils move  
up and down



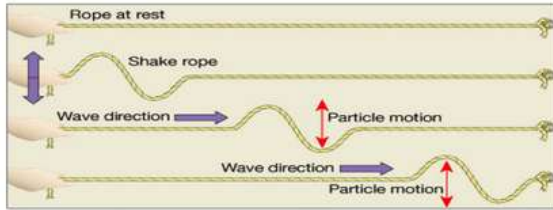
The subsequent direction of motion of individual particles of a medium is the same as the direction of vibration of the source of the disturbance.



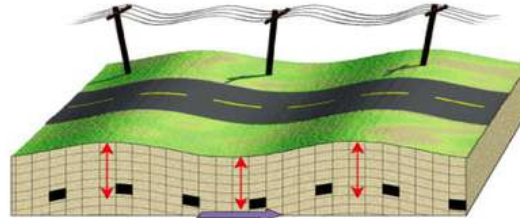
P waves are compression waves that alternately compress and expand the material through which they pass.



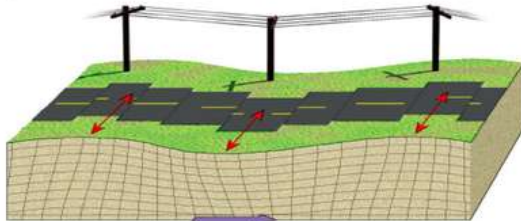
The back-and-forth motion produced as P waves travel along the surface can cause the ground to buckle and fracture.



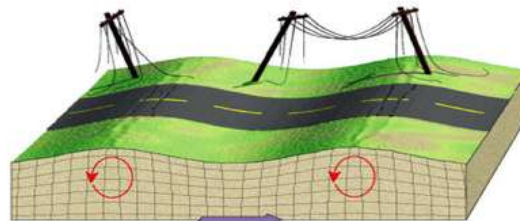
S waves are transverse waves which cause material to shake at right angles to the direction of wave motion. The length of the red arrow is the displacement, or amplitude, of the S wave.



S waves cause the ground to shake up-and-down and sideways.



One type of surface wave moves the ground from side to side and can damage the foundations of buildings.



Another type of surface wave travels along Earth's surface much like rolling ocean waves. The arrows show the movement of rock as the wave passes. The motion follows the shape of an ellipse.

# Period and Frequency

$$\text{Frequency} = \frac{1}{\text{Periodic time}} \quad \text{or} \quad f = \frac{1}{T} \text{ Hz}$$

$$\text{Periodic time} = \frac{1}{\text{Frequency}} \quad \text{or} \quad T = \frac{1}{f} \text{ sec}$$

# Practice Problems

Complete all practice problems #1-#6 for Monday

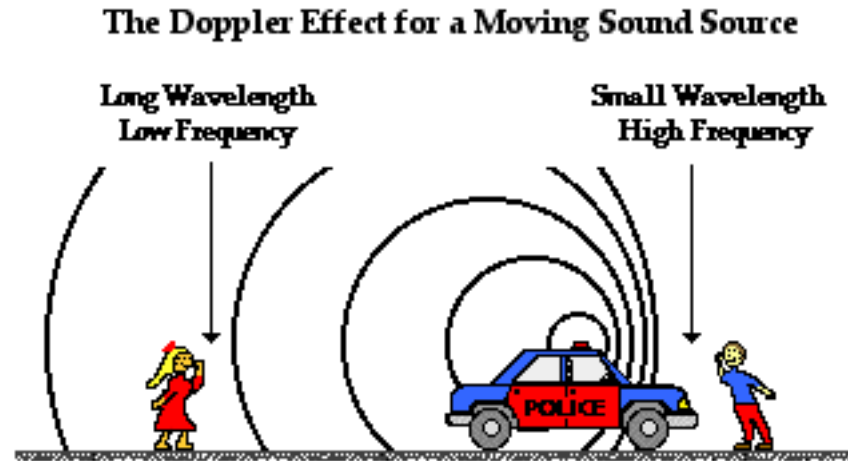
# Sound Waves

Type of Noise	Listen through	Result
Tap Lightly on Desk	Air	
Tap Lightly on Desk	Desk	
Tap Hard on the Desk	Air	
Tap Hard on the Desk	Desk	

# Doppler Effect

<https://www.youtube.com/watch?v=a3RfULw7aAY>

<https://www.youtube.com/watch?v=wrzWAox8NCM>



## Equation for the doppler effect

$$f' = f \left( \frac{v + v_o}{v - v_s} \right)$$

$f'$  = observed frequency

$f$  = source frequency

$v$  = speed of sound (343 m/s)

$v_o$  = observer velocity

$v_s$  = source velocity

+ **If going towards**

- **If going away**

# Sample Problem

**A car travels towards you with a velocity of 10 m/s. The car horn has a frequency of 250 Hz.**

What is the frequency when the car is coming towards you?

What is the frequency when the car is going past you?

What is the frequency if you run towards the car at 5 m/s?

What is the frequency if you run away from the car at 6 m/s?



**By the end of the hour**

Complete all practice problems and turn in!

# Wave Vocabulary Project

Vocab Words:

Transmission, Reflection, Refraction,  
Absorption, Diffraction, Scattering,  
Interference

# Wave Vocabulary Mini Project

You and your group 1-2 students will randomly be given a vocab word. For each work create a **mini poster** (1-2 sheets of copy paper):

- Title and names
- Definition in a way a students would understand
- Drawing/Diagram of what this looks like
- Examples in everyday life
- Compare or contrast to another vocab word

You must also choose a **demonstration/physical example** that will show this vocabulary word. It should be simple and easy to have in class tomorrow during our gallery walk.

**Topics for Unit 10 Test- Study Guide will be available on  
Google Classroom Later today**