# Physics Honors: Waves and Sound

## **Periodic Motion**

• Periodic motion is described as an motion that repeats itself, following the same path for the same amount of time

Examples:

- Pendulums
- Weight on springs
- Guitar strings when plucked

# **Periodic Motion Definitions**

Equilibrium - The point at which the net force on an object is zero

Period- The amount of time it take for the object to complete one cycle of motion

Amplitude - The maximum distance that the object moves away from equilibrium



# What is a wave?

A wave is a disturbance that carries energy through matter or space without transferring matter.

All waves (except for EM waves) require a medium, or substance to move through.





# Diagram of a Wave



### **Transverse Waves**

Transverse waves disturb the particles in the medium perpendicular to the direction of the waves travel



# **Longitudinal Waves**

Longitudinal waves disturb the particles of the medium parallel to the direction of the wave's travel



#### Wave Equation

$$v=\lambda f$$

- v = velocity
- $\lambda$  = wavelength
- f = frequency

## **Wave Equation Practice**

What is the speed of a periodic wave disturbance that has a frequency of 3.5hz and a wavelength of 0.7m?

A sound wave produced by a clock chime is heard 515m away 1.5s later at a frequency of 436 hz. What is the wavelength?

# Principle of Superposition

The principle of superposition states that displacement of a medium caused by two or more waves is the algebraic sum of the displacement by the individual waves.

The result of superposition is called interference.



# **Standing Waves**

 When waves move in opposite directions through the same medium, they will run into positive and negative interferences in the same places each time.

 In this situation, it appears that the waves are standing still, so they are called standing waves



#### Nodes and Antinodes

In a standing wave, the location that does not move at all is called the node





#### Sound Waves

Sound waves are a form of longitudinal waves. Your vocal cords vibrate the air, which creates pressure changes. Sound is measured in decibels (dB)



The decibel scale is logarithmic, which means it gets exponentially louder.

Most people perceive an increase of 10 dB as a doubling in loudness

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Decibels	Example				
0	Silence				
10	Breathing, ticking watch				
20	Rustling leaves, mosquitos				
30	Whispering				
40	Light rain, computer hum				
50	Quiet office, refrigerator				
60	Normal conversation, air conditioner				
70	Shower, toilet flush, dishwasher				
80	City traffic, vacuum cleaner				
90	Music in headphones, lawn mower				
100	Motorcycle, hand drill				
110	Rock concert, chain saw				
120	Thunderclap				
130	Maximum stadium crowd noise				
140	Aeroplane taking off				
150	Fighter jet take off				
160	Shot gun				
170	Fireworks				
180	Rocket launch				

# Sound Waves

Sound waves spread out in all directions.

The distance between each wave crest (wavelength) is the same distance apart.







