SLO Assessment Review Guide

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Honors Physics

3A

One dimensional motion

Distance

- How far an object is from the origin
- Measured in meters
- Scalar quantity

Displacement

- Change in position
- Measured in meters
- Vector quantity

Formula

$\Delta d = d_f - d_i$ ← final position minus the initial position.

Example

$d_f = 25.0\text{m}$

$d_i = 5.0\text{m}$

$\Delta d = 20.0\text{m}$

One dimensional motion

Speed

- How fast an object is moving
- Scalar quantity
- Units=m/s

Formula

v=d/t

D=distance

T=time

Example

D=10m

T=5s

V=2m/s

Velocity

- Rate at which an object changes its position
- Vector quantity
- Units= m/s

Formula

V=d/t

V=velocity

D=displacement

T=time

Example

D=90m

T=10s

V=9m/s

One dimensional motion

Acceleration

- Rate at which an object changes its velocity
- Vector quantity
- Units=m/s²

Formula	**Example**
A=v/t	v=50m/s
a=acceleration	t=5s
V=velocity	a=10m/s²
T=time	

One dimensional motion

Vector

- Quantities that have both size and direction
- Units differ depending on the quantity

Example

Acceleration

Velocity

Displacement

Scalar

- Quantities that have distance, time or temperature
- Units differ depending on the quantity

Example

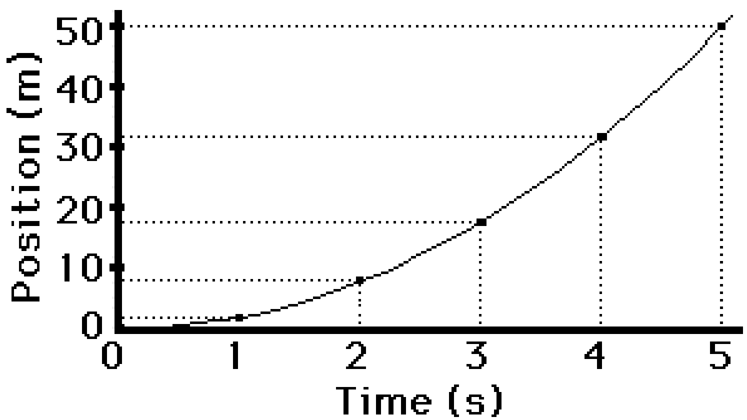
Speed

Distance

One dimensional motion

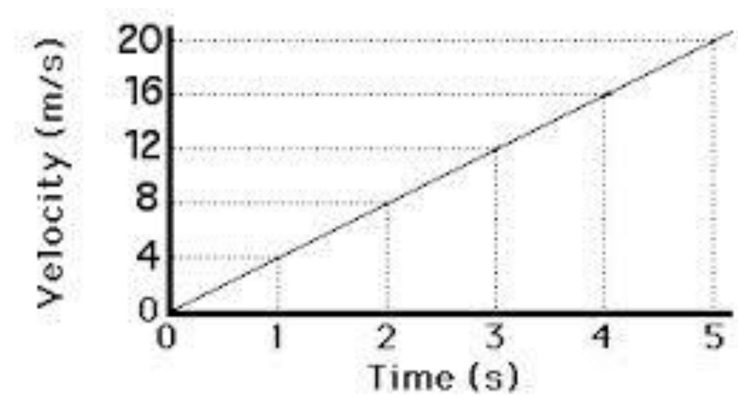
Position vs. time graph

- Used to determine velocity
- Time is on the horizontal axis
- Position is on the vertical axis



Velocity vs. time graph

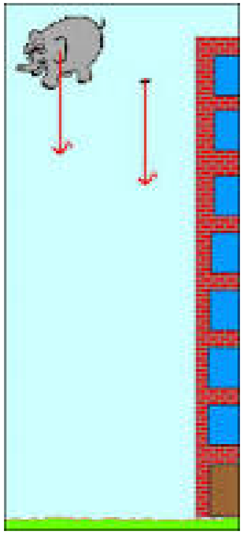
- Used to find acceleration
- Velocity is on the vertical axis
- Time is on the horizontal axis



One dimensional motion

Freefall

- Motion of a body when air resistance is negligible and the action can be considered due to gravity alone



Gravitational Acceleration

- The acceleration of an object in freefall that results from the influence of Earths gravity.
- Units =m/s^2

Formula

g=gravity→ $9.8 m/s^2$

$$a = \frac{\Delta v}{t} = \frac{-9.8\ m/s}{1\ s}$$

Newton's Laws

Inertia

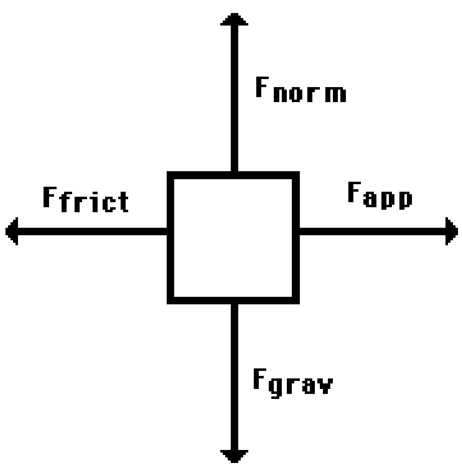
- The tendency of an object to resist change

Example

Newton's laws

Free Body Diagram

- Diagrams used to show the relative magnitude and direction of all forces acting upon an object in a given situation.



Net force

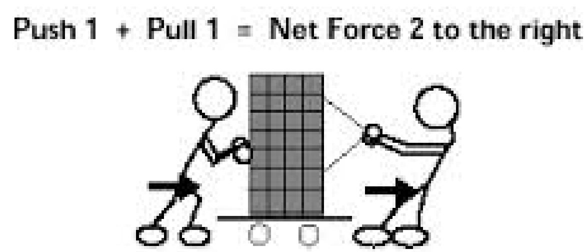
- The overall force acting on an object.
- Units are(N) Force

Formula→

$$F = ma$$

F = Net force
m = mass
a = acceleration

Example

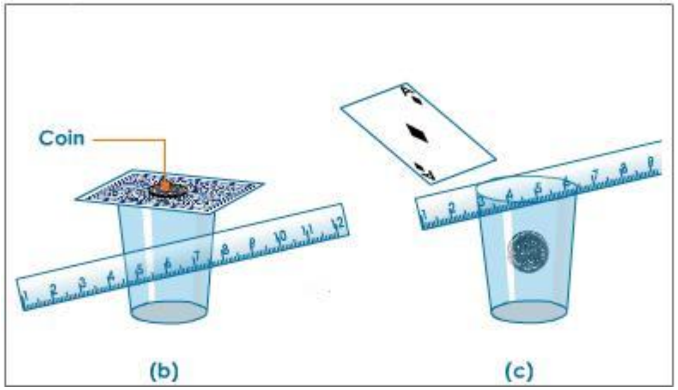


Newton's Laws

Newton's 1st Law

- An object at rest stays at rest and an object in motion stays in motion with the same speed and in the same direction unless acted upon by an unbalanced force.

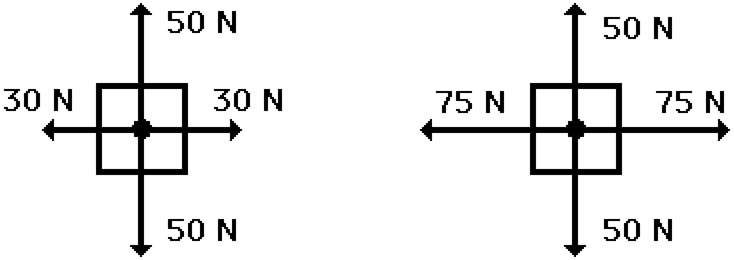
Example



Equilibrium

- When all the forces that act upon an object are balanced

Example



These two objects are at equilibrium since the forces are balanced. However, the forces are not equal.

Newton's Laws

Newton's 2nd Law

- states that the acceleration of an object is dependent upon the net force acting upon the object and the mass of the object

Formula

$a = F_{net} / m$

$F_{net} = m \cdot a$

$$F = ma$$

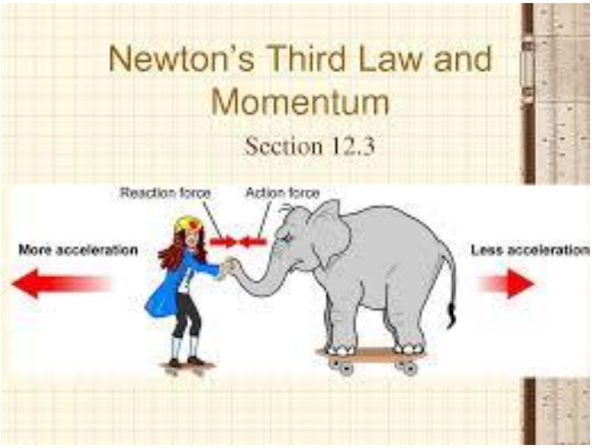
F = Net force
m = mass
a = acceleration

Example

Newton's 3rd Law

- For every action, there is an equal and opposite reaction

Example



Momentum and Impulse

Momentum

- Mass in motion
- Depends on mass and velocity
- Unit is kg•m/s

Formula

p = m • v

P= Momentum
M= Mass
V= Velocity

Impulse

- Relates to Newton's 2nd Law
- Change in momentum
- Unit is kg•m/s or N•s

Formula

$$F\Delta t = m\Delta v$$

The Impulse — The Change in Momentum

Work, Power, and Energy

Work

- When a force acts upon an object to cause a displacement of the object

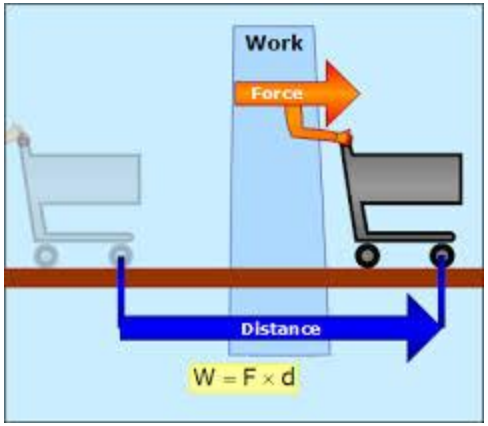
Formula

W=f*d

W=work

F=force

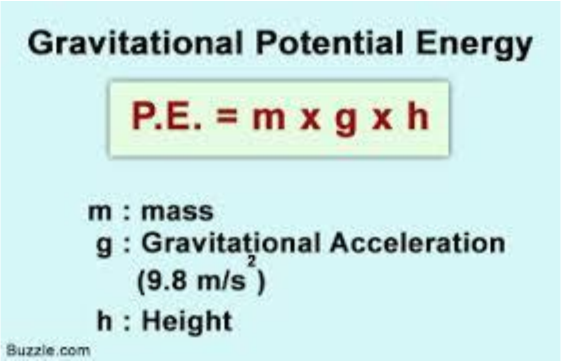
D=displacement



Potential Energy

- The stored energy of position possessed by an object.
- Gravitational potential energy and Elastic potential energy
- Unit is Joule

Formula



Work, Power, and Energy

Kinetic Energy

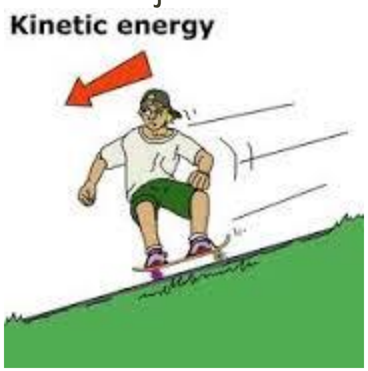
- energy of motion
- Unit is Joule

Formula

KE = 0.5 • m • v^2

m = mass of object

v = speed of object



Mechanical Energy

- *The energy that is possessed by an object due to its motion or due to its position*
- *Mechanical energy can be either* kinetic energy *or* potential energy

Formula

TME = PE + KE

PE=Potential Energy

KE=Kinetic Energy

A drawn bow possesses mechanical energy in the form of elastic potential energy.

Work, Power, and Energy

Power

- The standard metric unit is Wyatt
- The rate at which work is done

Formula

$$\text{Power} = \frac{\text{Work}}{\text{Time}} = \frac{\text{Force} \cdot \text{Displacement}}{\text{Time}}$$

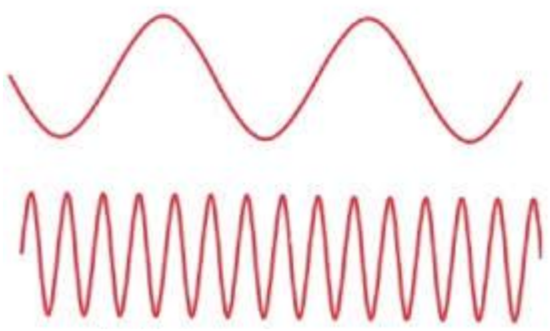
$$\text{Power} = \text{Force} \cdot \frac{\text{Displacement}}{\text{Time}}$$

$$\boxed{\text{Power} = \text{Force} \cdot \text{Velocity}}$$

Periodic Motion

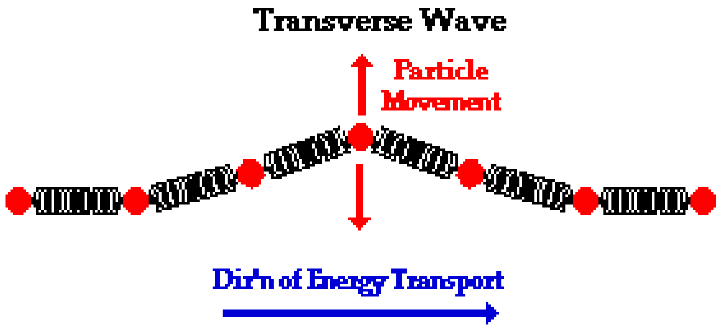
Wave

- Can be described as a disturbance that travels through a medium from one location to another location.
- The repeating and periodic disturbance that moves through a medium from one location to another is referred



Transverse Wave

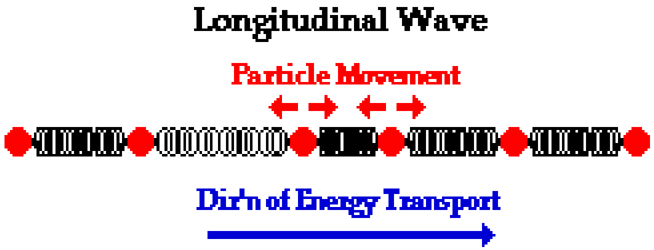
- Particles of the medium move in a direction perpendicular to the direction that the wave moves



Periodic Motion

Longitudinal Wave

- particles of the medium move in a direction parallel to the direction that the wave moves



Example

Sound Waves

Mechanical Wave

- A wave that is not capable of transmitting its energy through a vacuum.
- Require a medium in order to transport their energy from one location to another.

Example

Sound Waves

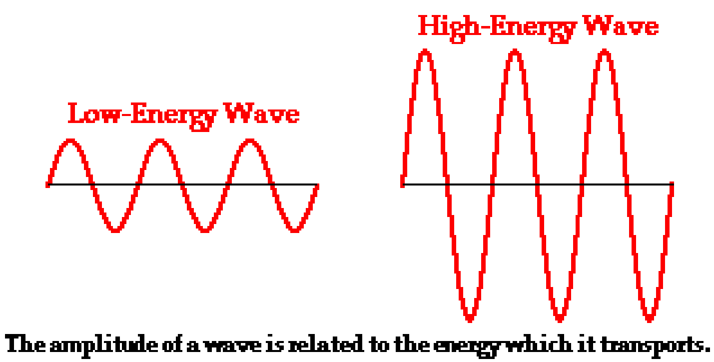
Water Waves

Ocean Waves are Mechanical Waves

Periodic Motion

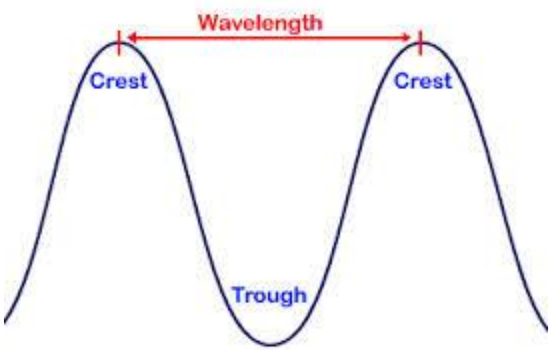
Amplitude

- The maximum amount of displacement of a particle on the medium from its rest position.
- The distance from rest to crest



Wavelength

- The length of one complete wave cycle
- Units are Lambda



$$Wavelength(\lambda) = \frac{Velocity(v)}{Frequency(f)}$$

Periodic Motion

Speed

- The distance traveled by a given point on the wave in a given period of time.
- Units=m/s
- **Speed = Wavelength • Frequency**

Formula

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

v : speed $(m.s^{-1})$
λ : wavelength (m)
T : period (s)

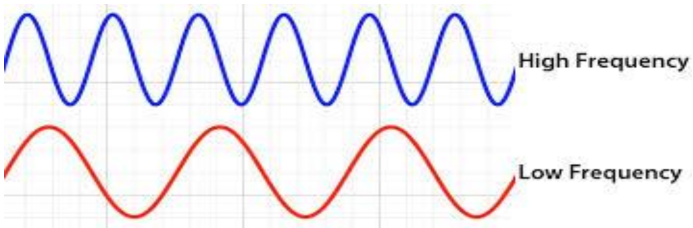
Frequency

- How often the particles of the medium vibrate when a wave passes through the medium.
- Unit for frequency is the Hertz (Hz)
- 1 Hz is equivalent to 1 cycle/second.

Formula

$$\text{period} = \frac{1}{\text{frequency}} \qquad \text{frequency} = \frac{1}{\text{period}}$$

Example



Periodic Motion

Period

- The time for a particle on a medium to make one complete vibrational cycle.
- Measured in units of time such as seconds, hours, days or years.

Formula

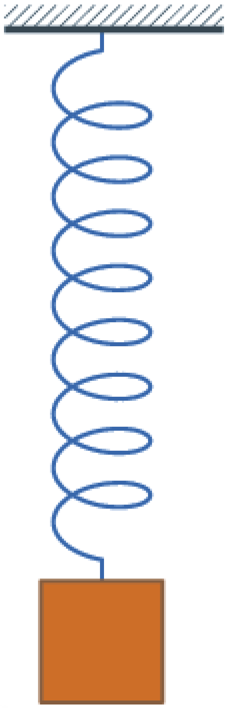
$$\text{period} = \frac{1}{\text{frequency}} \qquad \text{frequency} = \frac{1}{\text{period}}$$

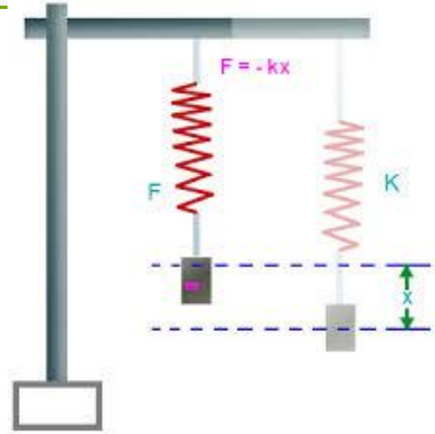
Pendulum

- An object that is considered to vibrate.

Example

Mass on a spring





Periodic Motion

Period of a Pendulum

- The time it takes for the pendulum to complete one full cycle
- The mass of the Pendulum, and the length of the string affects the period of a pendulum

Formula

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

T=period
L=length
g=gravitational acceleration

Spring Force

- The force exerted by a compressed or stretched spring upon any object that is attached to it
- Magnitude of the force is proportional to the amount of stretch or compression of the spring.

Formula

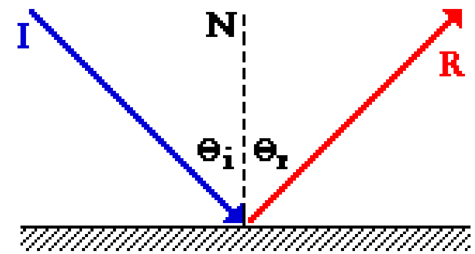
$F_{spring} = -k \cdot x$

F_{spring}= Force exerted upon the spring

X= Displacement

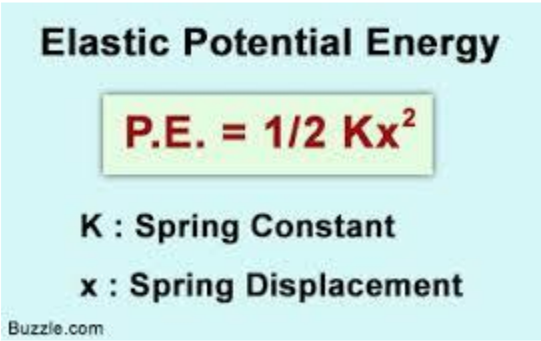
K= spring constant.

Periodic Motion



Potential Energy of a Spring

- The amount of force is directly proportional to the amount of stretch or compression



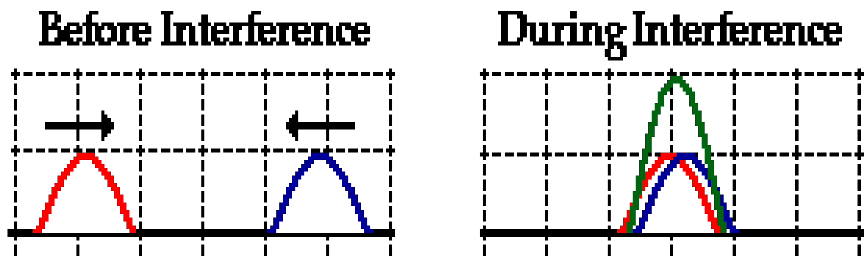
Reflection

- Waves reflect in a way that the angle at which they approach the barrier equals the angle at which they reflect off the barrier.
- incident ray- ray of light approaching the mirror
- Reflected ray-ray of light that leaves the mirror
- Normal line-the point of incidence where the ray strikes the mirror
- Angle of incidence-angle between the incident ray and the normal
- Angle of reflection-angle between the reflected ray and the normal

Periodic Motion

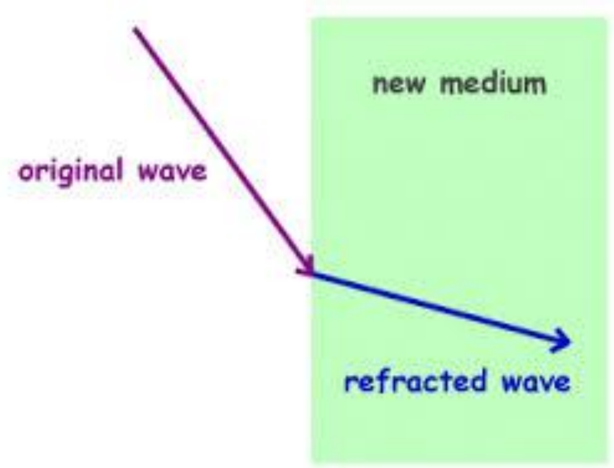
Interference

- When two waves meet while traveling along the same medium.
- Causes the medium to take on a shape that results from the net effect of the two individual waves upon the particles of the medium.



Refraction

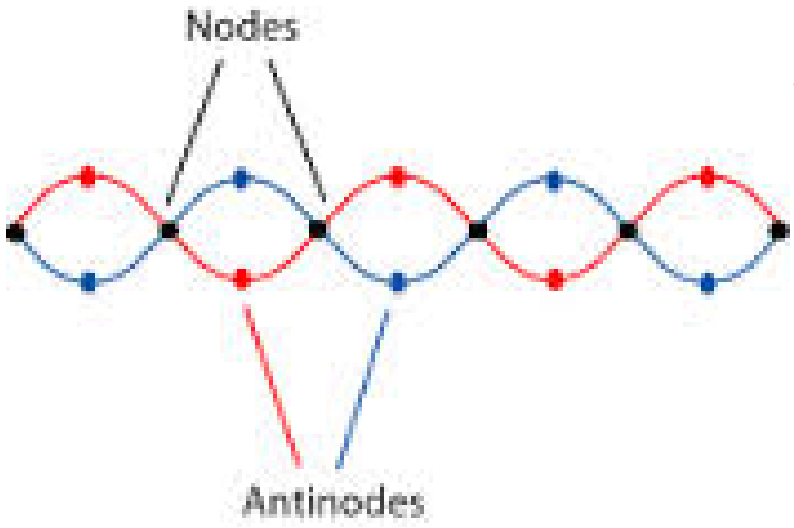
- Involves a change in the direction of waves as they pass from one medium to another.
- (the bending of the path of the waves)
- a change in speed and wavelength of the waves.



Sound Waves

Node

- The position along a medium that appear to be stationary
- Points of no displacement



Antinode

- points along the medium that undergo the maximum displacement during each vibrational cycle of the standing wave.
- Opposite of a Node

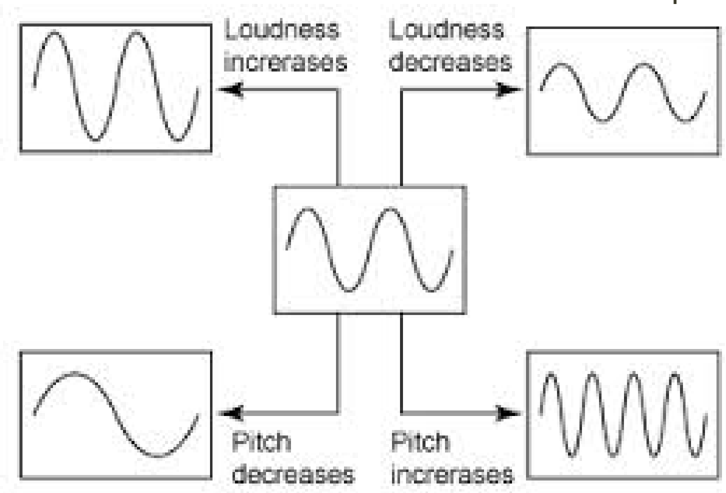
Sound Waves

Pitch

- The word used to refer to frequency
- High pitch=high frequency
- Low pitch= low frequency

Loudness

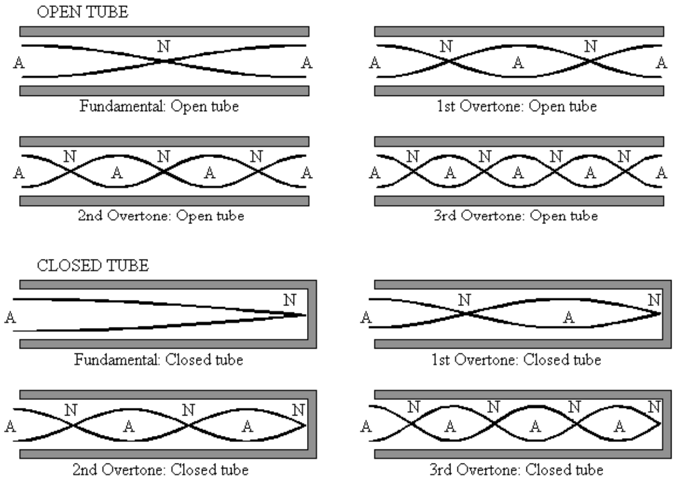
- Relates to the amplitude
- Higher the amplitude of a wave the louder
- Lower the amplitude the quieter



Sound Waves

Open ended pipe

- When a column of air is capable of being forced into vibrational resonance
- Both ends of the pipe are open to surrounding air
- Air is able to vibrate back and forth



Closed ended pipe

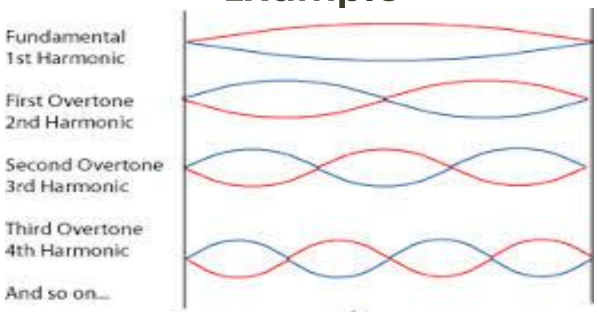
- When a column of air is capable of being forced into vibrational resonance
- One end of the pipe is closed to the surrounding air and the other end is open to the surrounding air
- Air at the open end is able to vibrate back and forth(forms an antinode
- Air at the closed end isn't able to vibrate back and forth(forms a node)

Sound Waves

Standing Wave

- When a wave appears to be standing still

Example



$L=\frac{1}{2}\lambda \xrightarrow{\text{algebra}} \lambda=\frac{2}{1}L$

$L=\frac{2}{2}\lambda \xrightarrow{\text{algebra}} \lambda=\frac{2}{2}L$

$L=\frac{3}{2}\lambda \xrightarrow{\text{algebra}} \lambda=\frac{2}{3}L$

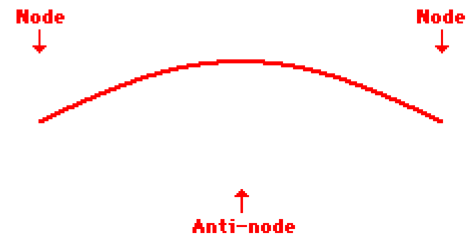
$L=\frac{4}{2}\lambda \xrightarrow{\text{algebra}} \lambda=\frac{2}{4}L$

Harmonics

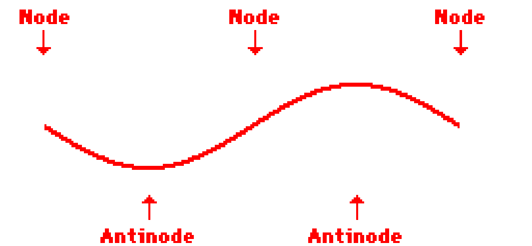
- Frequencies and their associated wave patterns

Examples

First Harmonic Standing Wave Pattern



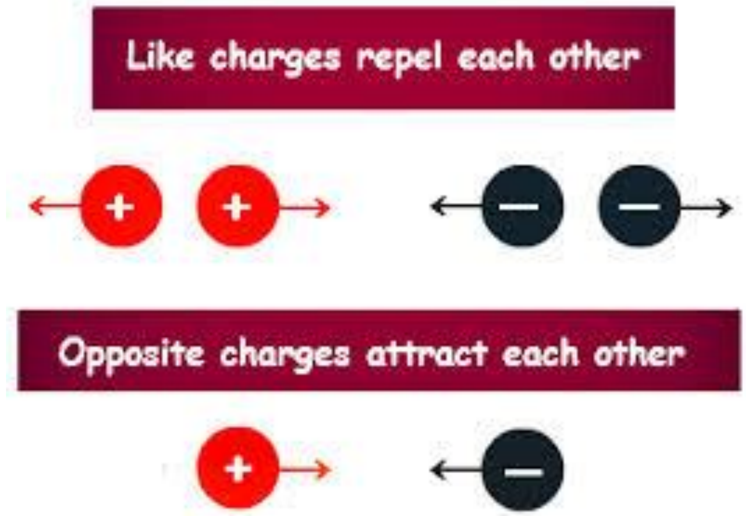
Second Harmonic Standing Wave Pattern



Charge and Electric Force

Charge

- Measured in units of Coulombs
- Positive charge
- Negative charge
- Neutral charge
- The quantity of charge on an object reflects the amount of imbalance between electrons and protons on that object



Charges and Electric Force

Proton	**Electron**
In nucleus	Outside nucleus
Tightly Bound	Weakly Bound
Positive Charge	Negative Charge
Massive	Not very massive

The charge on a single electron is -1.6×10^{-19} Coulomb. The charge on a single proton is $+1.6 \times 10^{-19}$ Coulomb

Charge and Electric Force

Coulombs Law

- electrical force between two charged objects is directly proportional to the product of the quantity of charge on the objects and inversely proportional to the square of the separation distance between the tw

Formula

$$F = \frac{kq_1q_2}{r^2}$$

$\vec{F}$ = Coulombic force = the electric force between two charged particles

q_1 = point charge #1

q_2 = point charge #2

k = Coulomb's Constant = $9 \times 10^9\ Nm^2/C^2$

r = distance separating the charges

$\hat{r}$: indicates the direction of the r - vector from charge 1 to 2

Electric Force

- The attractive or repulsive interaction between any two charged objects