PHYSICS IN MOTION
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Vocabulary List

Unit 1: Introduction to Physics

1B: Scientific Notation and Unit Conversions

conversion factor - multipliers that allow us to convert a quantity expressed in one kind of unit into an equivalent value expressed in another.

base unit - a fundamental unit of measurement that is defined arbitrarily and not based on other combinations of units. Examples from the SI system include the meter, kilogram, liter, second, and kelvin.

derived units - a unit created by combining base units.

Imperial system - a system of units of measurement that is primarily used in the United States and consists of units like the pound, ounce, mile, and inch.

International System of Units (SI) - a complete metric system of units of measurement used by scientists that is based on multiples of ten.

scientific notation - a mathematical expression used to represent a decimal number between 1 and 10, multiplied by ten to a power of 10, so you can write large or small numbers using less digits.

1C: Significant Figures

significant figures - the important digits in a number that express its precision.

1D: Vectors and Scalars

magnitude - the amount or quantity.

Pythagorean Theorem - a theorem that states that the square of the length of the hypotenuse of a right triangle equals the sum of the squares of the lengths of the other two sides.

scalars - quantities that are described by magnitude alone. Examples include time, speed, mass, and distance.

vectors - quantities that express magnitude and direction.

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Unit 1: Introduction to Physics

1E: Graphical Resolution of Vectors

magnitude - the amount or quantity.

Pythagorean Theorem - a theorem that states that the square of the length of the hypotenuse of a right triangle equals the sum of the squares of the lengths of the other two sides.

resultant - a vector quantity that is equal to the addition of two or more vector components acting at the same point.

scalars - quantities that are described by magnitude alone. Examples include time, speed, mass, and distance.

tip-to-tail method - a method of vector addition where one can add any two vectors by placing the tail of one so that it meets the tip of the other one.

vectors - quantities that express magnitude and direction.

1F: Mathematical Resolution of Vectors

magnitude - the amount or quantity.

Pythagorean Theorem - a theorem that states that the square of the length of the hypotenuse of a right triangle equals the sum of the squares of the lengths of the other two sides.

resultant - a vector quantity that is equal to the addition of two or more vector components acting at the same point.

scalars - quantities that are described by magnitude alone. Examples include time, speed, mass, and distance.

tip-to-tail method - a method of vector addition where one can add any two vectors by placing the tail of one so that it meets the tip of the other one.

vectors - quantities that express magnitude and direction.

1G: Graphing Relationships

extrapolation - estimating a value beyond a set of data points on a graph.

hypothesis - an educated guess.

independent variable - a variable that is directly changed in an experiment.

dependent variable - a variable that changes in response to the changing independent variable.

interpolation - estimating a value within a set of data points on a graph.

scientific method - a methodical way to test a hypothesis, based on data collection and having controlled variables.

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Vocabulary List

Unit 2: Describing Motion

2A: Distance and Displacement

displacement - an object's overall change in position; the SI unit is the meter (m).

distance - is a measure of how far an object has traveled; the SI unit is the meter (m).

2B: Speed and Velocity

average speed - an object's total distance traveled divided by the time elapsed. The SI unit is meters/second (m/s).

average velocity - an object's displacement divided by time elapsed. The SI unit is meters/second (m/s).

constant velocity - velocity that remains unchanged.

displacement - an object's overall change in position; the SI unit is the meter (m).

distance - is a measure of how far an object has traveled; the SI unit is the meter (m).

instantaneous velocity - the velocity of an object at a specific point in time.

2C: Acceleration and Kinematic Equations

average acceleration - the rate of change of velocity divided by time elapsed. The SI unit for acceleration is meters per second squared (m/s^2).

constant acceleration - acceleration that doesn't change.

instantaneous acceleration - acceleration at a given moment in time.

kinematics - the science of describing the motion of an object.

2D: Graphing Motion

average acceleration - the rate of change of velocity divided by time elapsed. Can be found by connecting two points on a line on a velocity versus time graph and finding the slope of that line.

average velocity - an object's displacement divided by time elapsed. Can be found by connecting two points on a line on a position versus time graph and finding the slope of that line.

instantaneous acceleration - acceleration at a given moment in time. Can be found by drawing a line tangent to a point on a line on a velocity versus time graph and finding the slope of that line.

instantaneous velocity - the velocity of an object at a specific point in time. Can be found by drawing a line tangent to a point on a line on a position versus time graph and finding the slope of that line.

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Unit 2: Describing Motion

2E: Free Fall

free fall - an object in motion only under the influence of the force of gravity.

2F: Relative Velocity

frame of reference - the view of the person or object observing the motion.

Pythagorean Theorem - a theorem that states that the square of the length of the hypotenuse of a right triangle equals the sum of the squares of the lengths of the other two sides.

relative velocity - the vector difference between the velocities of two objects; the velocity of a body with respect to another regarded as being at rest.

resultant - a vector quantity that is equal to the addition of two or more vector components acting at the same point.

2G: Horizontally Launched Projectiles

hang time - the amount of time a projectile remains in the air.

projectile - an object that is moving through the air.

range - the displacement of a projectile in the horizontal direction.

trajectory - the path taken through the air.

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Vocabulary List

Unit 3: Forces

3A: Newton's Laws Overview

balanced forces - when the sum of the forces acting on an object are equal the object will remain at rest, or it will move at a constant velocity.

force - a push or pull.

net force - the sum of all of the forces acting on an object.

Newton's 1st Law of Motion - an object at rest remains at rest unless an external unbalanced force acts on it; an object in motion remains in motion unless an external unbalanced force acts on it.

Newton's 2nd Law of Motion - an object accelerates in the direction of the net force acting on it.

Newton's 3rd Law of Motion - for every action, there is an equal yet opposite reaction.

unbalanced forces - when the sum of the forces acting on an object are not equal, the object will accelerate or decelerate.

3B: Free Body Diagrams

balanced forces - when the sum of the forces acting on an object are equal the object will remain at rest, or it will move at a constant velocity.

force - a push or a pull.

free body diagram - a figure used to visualize the forces acting on an object in a given condition.

net force (F_{net}) - the sum of all of the forces acting on an object.

unbalanced forces - when the sum of the forces acting on an object are not equal, the object will accelerate or decelerate.

3C: Newton's Second Law Part 1

contact force - a push or pull transmitted across objects touching one another; examples are the applied force, spring force, and the normal force.

field force - pushes or pulls that occur between two objects without the objects touching one another; examples are gravity and the electrostatic force.

friction - a force that resists motion.

gravity (F_G) - one of the four fundamental forces of the universe; is exerted by anything that has mass on anything else that has mass.

inverse-square law - any law stating that a quantity decreases with the inverse square of a physical parameter such as distance.

net force (F_{net}) - the sum of all of the forces acting on an object.

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Unit 3: Forces

3C: Newton's Second Law Part 1 (continued)

newton (N) - a derived unit of measurement for force; one newton is equal to one kilogram times meters divided by seconds squared (kgm/s^2).

Newton's 2nd Law of Motion - an object accelerates in the direction of the net force acting on it.

normal force (F_N) - the support force exerted upon an object by a surface; is always perpendicular to the surface.

weight (w) - the force due to gravity acting on an object; equal to the mass of an object multiplied by the acceleration due to gravity on Earth.

3D: Newton's Second Law Part 2

coefficient of friction (μ) - a ratio of the amount of resistance between two objects.

friction - the resistive force between an two objects.

static friction (F_s) - Friction that occurs when two objects are at rest relative to each other.

kinetic friction (F_k) - the slowing force between two objects moving past each other; one object, or both, can be moving.

net force (F_{net}) - the sum of all of the forces acting on an object.

newton (N) - a derived unit of measurement for force; one newton is equal to one kilogram times meters divided by seconds squared (kgm/s^2).

Newton's 2nd Law of Motion - an object accelerates in the direction of the net force acting on it.

normal force (F_N) - the support force exerted upon an object by a surface; is always perpendicular to the surface.

weight (w) - the force due to gravity acting on an object; equal to the mass of an object multiplied by the acceleration due to gravity on Earth.

3E: Newton's Third Law

action-reaction pairs - pairs of objects in which one object exerts a force, known as the action, on another object, and the other object reacts to that action in a way in which the force is equal in magnitude but opposite in direction.

Newton's 3rd Law of Motion - for every action there is an equal and opposite reaction.

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Vocabulary List

Unit 3: Forces

3F: Gravity

air resistance - the frictional force that air exerts on objects; also known as drag, F_D.

gravity (F_G) - one of the four fundamental forces of the universe; is exerted by anything that has mass on anything else that has mass.

Newton's Universal Law of Gravitation - the gravitational force between two objects increases with and is proportional to the increasing mass and decreases with the square of the distance between them.

terminal velocity - when the force due to gravity equals the force due to air resistance acting on a falling object and the object stops accelerating and moves at a constant velocity.

weight (w) - the force due to gravity acting on an object; equal to the mass of an object multiplied by the acceleration due to gravity on Earth.

3G: Circular Motion

centripetal acceleration (a_c) - the acceleration of an object moving in a circle that is directed toward the center of the circle.

centripetal force (F_c) - any force that causes an object to move in a circle.

circular motion - anytime an object moves in a way that traces out a circular path.

period (T) - the time it takes to go around a circle once.

tangential velocity (v_T) - the velocity of an object in its circular path that is directed tangent to the circle at that given point.

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Vocabulary List

Unit 4: Momentum and Energy

4A: Momentum and Impulse

impulse (I) - the product of the force acting on an object over the time during which the force acts.

impulse-momentum theorem - this theorem states that the impulse applied to an object is equal to the change in momentum of an object.

momentum (p) - the quantity of motion of an object or, mass in motion; is calculated by multiplying the mass of an object by the velocity of an object.

4B: Conservation of Momentum

closed system - matter does not enter or leave a system, and no net outside forces act on the system.

law of conservation of momentum - in a closed and isolated system, the total momentum of objects in the system before a collision is equal to the total momentum in the system after the collision.

momentum (p) - the quantity of motion of an object or, mass in motion; is calculated by multiplying the mass of an object by the velocity of an object.

4C: Collisions

collision - when momentum or kinetic energy is transferred from one object to another.

elastic collision - a collision where objects bounce off of one another; momentum and kinetic energy are conserved.

inelastic collision - when two objects collide and do not bounce away from each other; momentum is conserved, kinetic energy is not conserved.

kinetic energy (KE) - the energy of motion; equal to one half times mass times the square of the velocity of an object.

momentum (p) - the quantity of motion of an object or, mass in motion; is calculated by multiplying the mass of an object by the velocity of an object.

perfectly inelastic collision - when objects stick together, so that their final velocities are the same; momentum is conserved, kinetic energy is not conserved.

4D: Work

closed system - matter does not enter or leave a system, and no net outside forces act on the system.

energy - the ability to do work.

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Vocabulary List

Unit 4: Momentum and Energy

4D: Work (continued)

joule (J) - a unit of work or energy equal to the work done by a force of one newton acting through a displacement of one meter.

law of conservation of energy - energy is never created or destroyed, it is transferred or transformed from one form to another.

work (W) - when a force causes displacement of an object.

4E: Kinetic Energy and Gravitational Potential Energy

energy - the ability to do work.

gravitational potential energy (PE_g) - the stored energy of an object due to its position relative to a reference point on Earth; is equal to the mass of an object multiplied by the acceleration due to gravity multiplied by the height of the object relative to the reference point.

kinetic energy (KE) - the energy of motion; equal to one half times mass times the square of the velocity of an object.

law of conservation of energy - energy is never created or destroyed, it is transferred or transformed from one form to another.

potential energy - stored energy that can come in a variety of forms such as spring, gravity, and chemical.

4F: Work-Energy Theorem

energy - the ability to do work.

kinetic energy (KE) - the energy of motion; equal to one half times mass times the square of the velocity of an object.

work (W) - when a force causes displacement of an object.

work-energy theorem - this theorem states that the work done on an object will either add kinetic energy to an object or take kinetic energy away; work is equal to an object's change in kinetic energy.

4G: Spring Potential Energy

equilibrium position - an object at its natural position, where it has no tendency to move and the net force acting on it is zero.

Hookean Springs - when the force needed to compress or stretch a spring by a given displacement is linear and abides by Hooke's Law.

non-Hookean Springs - when the force needed to compress or stretch a spring by a given displacement is not linear and does not abide by Hooke's Law.

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Unit 4: Momentum and Energy

4G: Spring Potential Energy (continued)

spring constant (k) - a characteristic of a spring that is equal to the force exerted on it divided by the displacement the spring stretches; the unit is a Newton per meter (N/m).

spring force (F_s) - this force is equal to the spring constant for a given spring multiplied by the displacement the spring is stretched from the equilibrium position.

spring potential energy (PE_s) - the amount of stored energy in a spring; is equal to one half times the spring constant times the displacement the spring is stretched from the equilibrium position, squared.

4H: Conservation of Energy

conservative force - forces that cause energy to be converted into forms that can be easily regained; examples are gravity, the electrostatic force, and the spring force.

gravitational potential energy (PE_G) - the stored energy of an object due to its position relative to a reference point on Earth; is equal to the mass of an object multiplied by the acceleration due to gravity multiplied by the height of the object relative to the reference point.

kinetic energy (KE) - the energy of motion; equal to one half times mass times the square of the velocity of an object.

Law of Conservation of Energy - energy is never created or destroyed, it is transferred or transformed from one form to another.

non-conservative force - forces that cause energy to be converted into forms that cannot be easily regained; examples are friction and air resistance.

4I: Power

power (P) - The amount of work done in a given amount of time; the amount of force exerted at a given velocity; SI unit is the watt.

work (W) - when a force causes displacement of an object.

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Vocabulary List

Unit 5: Electricity and Magnetism

5A: Introduction to Electricity

current electricity - the flow of electric charge through a circuit.

electrostatic force (F_E) - one of the four fundamental forces of the universe; the attraction and repulsion of particles based on their electrical charges; is equal to Coulomb's constant times the magnitude of two charges divided by the distance between the charges, squared.

static electricity - the accumulation of electric charge on the surface of or within a material.

5B: Static Electricity

conduction - the transfer of charge by direct contact.

conductor - a material electrons can easily travel across.

charging by friction - the transfer of electrons by two objects being rubbed together.

electrostatic force (F_E) - one of the four fundamental forces of the universe; the attraction and repulsion of particles based on their electrical charges; is equal to Coulomb's constant times the magnitude of two charges divided by the distance between the charges, squared.

induction - charging a neutral object by bringing a charged object close to, but not touching, the object.

insulator - material that resists the movement of charge.

law of conservation of charge - electric charge cannot be created or destroyed, but can be transferred from one object to another.

static electricity - the accumulation of electric charge on the surface of or within a material.

triboelectric series - a list of materials that ranks materials by how easily they give up or receive electrons.

polarization - the process of separating opposite charges within an object.

5C: Coulomb's Law

Coulomb's Law - law devised by Charles Coulomb that explains the factors that affect contribute to the electrostatic force; is equal to Coulomb's constant times the magnitude of two charges divided by the distance between the charges, squared.

electric field (E) - a region around a charged particle or charged object within which a force is exerted on other charged particles or charged objects.

electrostatic force (F_E) - one of the four fundamental forces of the universe; the attraction and repulsion of particles based on their electrical charges; is equal to Coulomb's constant times the magnitude of two charges divided by the distance between the charges, squared.

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Vocabulary List

Unit 5: Electricity and Magnetism

5D: Electric Potential Energy and Electric Potential

electric field (E) - a region around a charged particle or charged object within which a force is exerted on other charged particles or charged objects.

electric potential (V) - also known as voltage, the electric potential energy per unit charge; the SI unit is the volt (V).

electric potential energy (PE_E) - energy stored by electric charges; the energy that a charge in an electric field possesses, which gives it the ability to do work; the SI unit is the joule (J).

kinetic energy (KE) - the energy of motion; equal to one half times mass times the square of the velocity of an object.

5E: Current Electricity

current (I) - the flow of electric charge per unit time; SI unit is the ampere, (A).

current electricity - the flow of electric charge.

electric potential (V) - also known as voltage, the energy capacity of a unit of charge; the SI unit is the volt (V).

resistance (R) - the opposition of a material to the flow of electric current; the SI unit is the ohm (Ω).

static electricity - the accumulation of electric charge on the surface of or within a material.

5F: Ohm's Law

circuit - a closed loop through which electrical charges can continuously flow.

current (I) - the flow of electric charge per unit time; SI unit is the ampere, (A).

electric potential (V) - also known as voltage, the energy capacity of a unit of charge; the SI unit is the volt (V).

Ohm's Law - law formulated by Georg Ohm that relates current, voltage, and resistance within a circuit; voltage is equal to current times resistance.

resistance (R) - the opposition of a material to the flow of electric current; the SI unit is the ohm (Ω).

5G: Series Circuits

closed circuit - a circuit with no breaks, in which current can flow continuously.

equivalent resistance (R_{eq}) - the total resistance of a collection of resistors; for a series circuit, is equal to the sum of the resistances of the individual resistors. For a parallel circuit, the reciprocal of the equivalent resistance is equal to the reciprocal of each of the resistances of the individual resistors.

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Unit 5: Electricity and Magnetism

5G: Series Circuits (continued)

Ohm's Law - law formulated by Georg Ohm that relates current, voltage, and resistance within a circuit; voltage is equal to current times resistance.

open circuit - a circuit with a break, either a switch or malfunction in which current cannot flow.

series circuit - a closed loop in which the current follows a single path.

voltage drop - loss of voltage due to resistance.

5H: Parallel Circuits

complex circuit - a circuit that consists of series and parallel circuit components.

electric potential (V) - also known as voltage, the energy capacity of a unit of charge; the SI unit is the volt (V).

equivalent resistance (R_{eq}) - the total resistance of a collection of resistors; for a series circuit, is equal to the sum of the resistances of the individual resistors. For a parallel circuit, the reciprocal of the equivalent resistance is equal to the reciprocal of each of the resistances of the individual resistors.

Ohm's Law - law formulated by Georg Ohm that relates current, voltage, and resistance within a circuit; voltage is equal to current times resistance.

parallel circuit - a closed circuit in which the current divides into two or more paths before recombining to complete the circuit.

5I: Electrical Power

efficiency - ratio of the total energy output divided by the energy input into a device.

electric power (P) - the electrical work done per unit time; SI unit is the watt (W).

electrical work (W) - the work done on a charged particle by an electric field.

5J: Magnetism

electromagnetism - the interaction of electric currents or fields with magnetic fields.

magnetism - an effect produced by the motion of electric charge, resulting in attractive and repulsive forces between objects.

magnetic field (B) - a region around a magnetic material or a moving electric charge within which the force of magnetism acts.

magnetic force (F_B) - a push or a pull exerted on a moving charge that is equal to the magnitude of that charge multiplied by the velocity of the charge multiplied by the strength of the magnetic field where the charge is located.

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Unit 5: Electricity and Magnetism

5K: Generators and Motors

alternating current - current that reverses direction multiple times per second.

commutation - the electromechanical process by which direct current is turned into alternating current.

direct current - current that runs in only one direction.

electromagnetic induction - a phenomenon that creates a current in a circuit when there is relative motion between the wire and the magnetic field.

Faraday's Law - a law that predicts how a magnetic field will interact with an electric circuit to produce an electromotive force.

generators - devices that convert mechanical energy into electrical energy.

motors - devices that convert electrical energy into mechanical energy.

rotor - a moving component of an electromagnetic system in an electric motor or generator. Its rotation is due to the interaction between the windings and magnetic fields which produces a torque around the rotor's axis.

stator - the stationary component of an electric motor or generator.

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Vocabulary List

Unit 6: Waves and Optics

6A: The Nature of Waves

amplitude - the distance from the equilibrium position to the maximum or minimum intensity of a wave.

electromagnetic wave - oscillating electric and magnetic fields that need no physical medium through which to travel.

frequency (f) - the number of wavelengths that pass a given point per second; SI unit is the Hertz (Hz).

harmonic motion - the repetition of a wave with a constant frequency.

longitudinal wave - a wave that vibrates in the direction of propagation; e.g. sound waves.

mechanical wave - a wave requiring a physical medium through which to travel.

period (T) - the time it takes for one wave cycle to occur; SI unit is seconds (s).

spring constant (k) - a characteristic of a spring that is equal to the force exerted on it divided by the displacement the spring stretches; the unit is Newton/meter (N/m).

spring force (F_s) - this force is equal to the spring constant, k, for a given spring multiplied by the displacement the spring is stretched from the equilibrium position, x.

spring potential energy (PE_s) - the amount of stored energy in a spring; is equal to one half times the spring constant, k, times the displacement the spring is stretched from the equilibrium position, x, squared.

transverse wave - a wave that vibrates perpendicular to the direction of propagation; ex. electromagnetic waves

wavelength (λ) - The distance between two waves that includes on full compression and one full rarefaction of a sound wave or one full crest and one full trough of an electromagnetic wave; SI unit is meters (m).

6B: Sound Wave Properties

amplitude - the distance from the equilibrium position to the maximum or minimum intensity of a wave.

decibel (dB) - a unit of measurement that represents the logarithmic ratio between a sound wave's highest and lowest pressure.

elasticity - how quickly the molecules of a material 'bounce back' after a wave has moved through them.

electromagnetic wave - oscillating electric and magnetic fields that need no physical medium through which to travel.

frequency (f) - the number of wavelengths that pass a given point per second; SI unit is the Hertz (Hz).

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Unit 6: Waves and Optics

6B: Sound Wave Properties (continued)

longitudinal wave - a wave that vibrates in the direction of propagation; e.g. sound waves.

mechanical wave - a wave requiring a physical medium through which to travel.

period (T) - the time it takes for one wave cycle to occur; SI unit is seconds (s).

timbre - the quality of a sound.

transverse wave - a wave that vibrates perpendicular to the direction of propagation; e.g. electromagnetic waves

wavelength (λ) - The distance between two waves that includes on full compression and one full rarefaction of a sound wave or one full crest and one full trough of an electromagnetic wave; SI unit is meters (m).

6C: Doppler Effect

Doppler effect - an increase or decrease in the frequency of sound, light, or other waves as the source and observer move toward or away from each other.

sonic boom - a loud noise caused by the shock wave from an object traveling faster than the speed of sound.

6D: Sound: Diffraction and Interference

beat - what is heard as changes in amplitude when sound waves with almost identical frequencies interfere with one another.

compressions - compressed areas of high pressure in a sound wave.

constructive interference - when two waves are identical in frequency and, in the case of a sound wave, their compressions and rarefactions are aligned in phase.

destructive interference - when two waves interfere and are 180º out of phase with each other.

diffraction - the bending of waves around a barrier.

interference - the combination of two or more waves to form a resultant wave in which the displacement is either reinforced or canceled.

principle of superposition - when waves in space interfere with one another, they combine to form bigger or smaller waves.

rarefactions - areas of lower pressure in a sound wave.

reverberation - the compounding of many reflected soundwaves upon one another within a space.

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Unit 6: Waves and Optics

6E: Sound: Standing Waves and Resonance

antinode - the position on a standing wave where constructive interference occurs.

constructive interference - when two waves are identical in frequency and, in the case of a sound wave, their compressions and rarefactions are aligned in phase.

destructive interference - when two waves interfere and are 180º out of phase with each other.

fundamental frequency (f_1) - the lowest resonant frequency at which an object will resonate that produces the simplest standing wave.

harmonic - an overtone accompanying a fundamental tone at a fixed interval, produced by vibration of a string, column of air, etc., in an exact fraction of its length.

node - the position on a standing wave where destructive interference occurs.

resonance - occurs when small forces are applied at the resonant frequency of an object and the amplitude of the vibration increases.

resonant frequency - the natural frequency at which an object vibrates.

standing wave - a wave produced by the interference of two traveling, identical waves moving in opposite directions.

6F: Electromagnetic Wave Properties

amplitude - the height of a transverse wave measured from the equilibrium position to the top of a crest or the bottom of a trough.

crest - the highest point on a transverse wave.

electromagnetic spectrum - the range of wavelengths or frequencies over which electromagnetic radiation extends, includes radio, microwave, infrared, visible, ultraviolet, x-ray, and gamma radiation.

far infrared - infrared waves that are far from visual light.

frequency (f) - the number of wavelengths that pass by a given point every second; SI unit is the Hertz (Hz).

gamma radiation - a part of the electromagnetic spectrum with wavelengths less than 1pm; used in cancer treatment and also given off by supernova and the sun.

infrared radiation - a part of the electromagnetic spectrum with wavelengths from 1μm - 1mm in length; we experience these waves as heat, some are used in remote controls.

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Vocabulary List

Unit 6: Waves and Optics

6F: Electromagnetic Wave Properties (continued)

microwave radiation - a part of the electromagnetic spectrum with wavelengths from 1mm-1m in length; used with communication satellites, microwave ovens, and cell phones.

near infrared - infrared waves that are closer to visual light.

period (T) - the length of time it takes for a wavelength to pass by a given point in space measured in seconds; SI unit is seconds (s).

photoelectric effect - the emission of electrons when light shines on a material.

picometer - one trillionth of a meter, 10^{-12}.

radio radiation - a part of the electromagnetic spectrum with wavelengths from 1cm -1km in length; uses include being used to transmit AM, FM, and television signals.

trough - the lowest point on a transverse wave.

ultraviolet radiation - a part of the electromagnetic spectrum with wavelengths from 10nm - 400nm in length; emitted by the sun and can penetrate living cells.

visible light radiation - a part of the electromagnetic spectrum with wavelengths from 400nm - 700nm in length; the part of the electromagnetic spectrum we can see with our eyes.

wavelength (λ) - the length on a transverse wave that includes one full crest and one full trough; SI unit is the meter (m).

wave-particle duality - the idea that light behaves like a particle and like a wave.

x-ray radiation - a part of the electromagnetic spectrum with wavelengths from 0.01nm - 10 nm in length; can penetrate skin and muscle but, are blocked by bone allowing for the formation of x-ray images.

6G: Light: Polarization

Malus' Law - this law states that the intensity of a beam of plane-polarized light after passing through a polarizer varies as the square of the cosine of the angle through which the polarizer is rotated from the position that gives maximum intensity.

polarization - the act of restricting the vibrations of a transverse wave, especially light, wholly or partially to one direction.

polarized light - light that is reflected or transmitted through certain media so that all vibrations are restricted to a single plane.

unpolarized light - when light waves' electric fields point in any direction perpendicular to the wave's motion.

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Vocabulary List

Unit 6: Waves and Optics

6H: Light: Diffraction and Interference

constructive interference - when two waves interact in phase with one another, that is, their peaks and their troughs are in sync; it increases the amplitude of the combined wave.

destructive interference - when the peak of one wave overlaps with the trough of another wave, diminishing the amplitude of the combined wave.

diffraction - the bending of a wave around a barrier.

Huygens' principle - every point on a wave behaves as a separate wave, or wavelet.

interference - the overlapping of waves forming a resultant wave of increased or decreased amplitude.

maxima - areas of constructive interference as two waves overlap one another; with light, seen as bright spots on the screen.

minima - areas of destructive interference as two waves overlap one another; seen as dark spots on the screen.

wave-particle duality - the idea that light behaves like a particle and like a wave.

6I: Color

additive color mixing - when wavelengths from different parts of the visible spectrum overlap to create new colors.

color - the property of an object that produces different sensations on the eye as a result of the way the object reflects or emits light.

dye - a substance that is biological in nature that changes the color of reflected or transmitted light as the result of wavelength-selective absorption; soluble

luminance (L) - the amount of light reflected off a surface; SI unit is candelas per meters squared (cd/m^2)

luminous intensity (I) - the measure of the brightness of light in a given direction; SI unit is the candela (cd).

opaque - a material that allows no light to pass through it.

pigment - made from inorganic sources that change the color of reflected or transmitted light as the result of wavelength-selective absorption; are insoluble.

primary colors of light - the three colors of light, red, blue, and green, from which all other colors of light can be obtained through additive color mixing.

primary colors of pigment - the three colors of pigment, red, blue, and yellow, from which all other colors of pigment can be obtained through subtractive color mixing.

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Vocabulary List

Unit 6: Waves and Optics

6I: Color (continued)

secondary colors - occur when two primary colors are combined.

subtractive color mixing - occurs when some wavelengths of light are reflected and other are absorbed.

translucent - a material that allows some, but not all, light to pass through it.

transparent - a material that allows all light to pass through it.

6J: Spectral Composition

absorption spectrum - a spectrum of electromagnetic radiation transmitted through a substance, showing dark lines or bands due to absorption of specific wavelengths.

blueshift - the shift of spectral lines toward shorter wavelengths caused by objects moving toward us.

Doppler effect - an increase or decrease in the frequency of sound, light, or other waves as the source and observer move toward or away from each other.

emission spectrum - a spectrum of the electromagnetic radiation emitted by a source; caused by greatly heating a substance or subjecting it to electric current.

excited state - energy levels in the orbitals of the electron cloud of an atom that are not ground state.

ground state - the lowest energy state of an atom or other particle.

quanta - individual packets of light energy.

redshift - the shift of spectral lines toward longer wavelengths caused by objects moving away from us.

spectral composition - the wavelengths of light that characterize an object.

6K: Reflection

diffuse reflection - when light rays strike a rough surface.

law of reflection - this law states that the angle of the incident ray equals the angle of the reflected ray.

reflection - when a wave bounces off a surface when interacting with a material.

specular reflection - when light is reflected off of a shiny or glossy surface.

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Vocabulary List

Unit 6: Waves and Optics

6L: Spherical Mirrors

center of curvature (C) - the point in the center of the imaginary sphere from which the mirror is cut.

concave mirror - a converging mirror that focuses light inward from the surface of a mirror.

convex mirror - a diverging mirror that focuses light outward from the surface of a mirror.

focal length (f) - the distance from the center of a mirror to the focal point.

focal point (F) - the point in space where parallel light rays meet after bouncing off a mirror.

principle axis - the horizontal line that connects the center of the spherical mirror with the center of the sphere the mirror is part of.

radius of curvature (R) - the distance from the center of a mirror to the center of curvature.

real image - an image formed when light rays converge in real space.

law of reflection - this law states that the angle of reflection is equal to the angle of incidence of a light wave that bounces off a surface.

virtual image - an image that appears when light rays converge behind a mirror.

6M: Refraction

critical angle (Θ_c) - the angle of incidence beyond which rays of light passing through a denser medium to the surface of a less dense medium are no longer refracted but totally reflected.

internal reflection - when light strikes an interface at an angle greater than the critical angle and is reflected back into a more dense medium.

refraction - the bending of light rays as they move from one transparent medium to another.

refraction index (n) - a ratio that describes how much light bends as it moves from one medium to another.

Snell's Law - the law states that the ratio of the sines of the angles of incidence and refraction is constant for all incidences in any given pair of media for electromagnetic waves of a definite frequency.

6N: Spherical Lenses

center of curvature (C) - the point in the center of the imaginary sphere from which the lens is cut.

concave lens - a diverging lens that possesses at least one surface that curves inwards; it spreads out light rays that have been refracted through it.

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Vocabulary List

Unit 6: Waves and Optics

6N: Spherical Lenses (continued)

convex lens - a converging lens that has at least one surface that curves outwards; it bends light rays inward that have been refracted through it.

focal length (f) - the distance from the center of a lens to the focal point.

focal point (F) - the point in space where parallel light rays meet after bending through a lens.

principle axis - the horizontal line that connects the center of the spherical lens with the center of the sphere the lens is part of.

radius of curvature (R) - the distance from the center of a lens to the center of curvature.

real image - an image formed when light rays converge in real space.

Snell's Law - the law states that the ratio of the sines of the angles of incidence and refraction is constant for all incidences in any given pair of media for electromagnetic waves of a definite frequency.

virtual image - an optical image formed from the apparent divergence of light rays from a point, as opposed to an image formed from their actual divergence.

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Vocabulary List

Unit 7: Nuclear Physics

7A: Radioactive Decay

alpha decay - the radioactive decay process in which an alpha particle is emitted from the nucleus.

alpha particle - a positively charged particle that is emitted from a nucleus during alpha decay and consists of two neutrons and two protons.

antineutrino - the antiparticle of a neutrino that differs from a neutrino in the direction of its spin; a neutral subatomic particle that has almost no mass and is released from a radioactive nucleus during beta minus decay.

beta minus decay - a type of radioactive decay where a neutron decays into a proton, which remains in the nucleus, an electron, and an antineutrino.

beta particle - a particle that is emitted during beta decay. During beta minus decay the beta particle is an electron, during beta plus decay, the beta particle is a positron.

beta plus decay - a type of radioactive decay where a proton decays into a neutron, which remains in the nucleus, a positron, and a neutrino.

gamma decay - a type of radioactive decay in which a nucleus that is in an excited state releases gamma radiation.

gamma radiation - an electromagnetic wave that is released from a radioactive nucleus during gamma decay.

isotopes - a form of an element that has the same number of protons but a different number of neutrons. The atomic number for isotopes of a given element is the same but the mass number is different.

neutrino - the antiparticle of an antineutrino that differs from a neutrino in the direction of its spin; a neutral subatomic particle that has almost no mass and is released from a radioactive nucleus during beta plus decay.

radioactive decay - the spontaneous emission of charged particles and/or energy from an atom.

stable isotopes - Isotopes of an element that don't emit radioactive particles or radiation.

strong nuclear force - the strongest of the four fundamental forces also having the shortest range, this attractive force holds the protons and neutrons in the nucleus of an atom together.

unstable isotopes - isotopes of an element that undergo nuclear decay and emit particles, energy, or both.

weak nuclear force - one of the fundamental forces that is one million times weaker than the strong force, acts at distances of less than 10^{-18} meters, changes one type of quark to another that are found within protons and neutrons, and is responsible for beta decay.

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Vocabulary List

Unit 7: Nuclear Physics

7B: Fission

binding energy (E) - the amount of energy used to keep a nucleus together; equal to the mass defect times the speed of light, squared.

critical mass - the minimum amount of fissile material that can undergo fission needed to maintain a nuclear chain reaction.

fission - the process of splitting an atom into smaller, lighter atoms, releasing energy.

mass defect (Δm) - the difference in mass between the particles within a nucleus and the particles by themselves, not bound within a nucleus.

radioactive decay - the spontaneous emission of charged particles and/or energy from an atom.

strong nuclear force - the strongest of the four fundamental forces also having the shortest range, this attractive force holds the protons and neutrons in the nucleus of an atom together.

7C: Fusion

binding energy (E) - the amount of energy used to keep a nucleus together; equal to the mass defect times the speed of light, squared.

fusion - when two light atomic nuclei come together, or fuse, to form a heavier nucleus, releasing energy.

mass defect (Δm) - the difference in mass between the particles within a nucleus and the particles by themselves, not bound within a nucleus.

proton-proton fusion - the multistep nuclear fusion process by which hydrogen fuses with hydrogen to form helium.

radioactive decay - the spontaneous emission of charged particles and/or energy from an atom.

7D: Half-life

carbon dating - a method of determining the age of substances that contain organic material by looking that the ratio of carbon-12 to carbon-14 they contain.

half-life - the time it takes for half of a radioactive substance to decay.

radioactive decay - the spontaneous emission of charged particles and/or energy from an atom.