Collection By

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Mechanical Engineering

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abscissa. The value corresponding to the horizontal distance of a point on a graph from the Y axis. The X coordinate.

absolute deviation. The difference between a single measured value and the average of several measurements made in the same way.

absolute error. The actual difference between a measured value and its accepted value.

absolute zero. The temperature of a body at which the kinetic energy of its molecules is at a minimum; O^oK or -273.16 ^oC.

absorption spectrum. A continuous spectrum interrupted by dark lines or bands that are characteristic of the medium through which the radiation has passed.

acceleration. Time rate of change of velocity.

acceptor. An element with three valence electrons per atom which when added to a semiconductor crystal provides electron "holes" in the lattice structure of the crystal.

accuracy. Closeness of a measurement to the accepted value for a specific physical quantity; expressed in terms of error.

adhesion. The force of attraction between unlike molecules.

adiabatic process. A thermal process in which no heat is added to or removed from a system.

alpha particle. A helium-4 nucleus, especially when emitted from the nucleus of a radioactive atom.

alternating current. An electric current that has one direction during one part of a generating cycle and the opposite direction during the remainder of the cycle.

ammeter. An electric meter designed to measure current.

ampere. The unit of electric current; one coulomb per second.

amplifier. A device consisting of one or more vacuum tubes (or transistors) and associated circuits, used to increase the strength of a signal.

amplitude. The maximum displacement of a vibrating particle from its equilibrium position.

angle of incidence. The angle between the incident ray and the normal drawn to the point of incidence.

angle of reflection. The angle between the reflected ray and the normal drawn to the point of incidence.

angle of refraction. The angle between the refracted ray and the normal drawn to the point of refraction.

Angstrom. A unit of linear measure equal to 10^{-10} m.

angular acceleration. The time rate of change of angular velocity.

angular impulse. The product of a torque and the time interval during which it acts.

angular momentum. The product of the rotational inertia of a body and its angular velocity.

angular velocity. The time rate of change of angular displacement.

anode. (1) The positive electrode of an electric cell. (2) The positive electrode or plate of an electronic tube. (3) "The electron-poor electrode.

antimatter. A substance composed of antiparticles.

antiparticle. A counterpart of a subatomic particle having opposite properties (except for equal mass).

aperture. Any opening through which radiation may pass. The diameter of an opening that admits light to a lens or

apparent power. The product of the effective values of alternating voltage and current.

arc tangent. The inverse function to the tangent. Symbol: arctan or $\tan^{-1}$. Interpretation: "An angle whose tangent is

armature. A coil of wire formed around an iron or steel core that rotates in the magnetic field of a generator or motor.

atom. The smallest particle of an element that can exist either alone or in combination with other atoms of the same or other elements.

atomic mass unit. One-twelfth of the mass of carbon-12, or $1.6605655 \times 10^{-27}$ kg.

atomic number. The number of protons in the nucleus of an atom.

atomic weight. The weighted average of the atomic masses of an element's isotopes based on their relative abundance.

audio signal. The alternating voltage proportional to the sound pressure produced in an electric circuit.

average velocity. Total displacement divided by elapsed time.

back emf. An induced emf in the armature of a motor that opposes the applied voltage.

band spectrum. An emission spectrum consisting of fluted bands of color. The spectrum of a substance in the molecular state.

barometer. A device used to measure the pressure of the atmosphere.

baryon. A subatomic particle with a large rest mass, e.g., the proton.

basic equation. An equation that relates the unknown quantity with known quantities in a problem.

basic law of electrostatics. Similarly charged objects repel each other. Oppositely charged objects attract each other.

beam. Several parallel rays of light considered collectively.

beat. The interference effect resulting from the superposition of two waves of slightly different frequencies propagating in the same direction. The amplitude of the resultant wave varies with time.

becquerel. The rate of radioactivity equal to one disintegration per second.

beta particle. An electron emitted from the nucleus of a radioactive atom.

betatron. A device that accelerates electrons by means of the transformer principle .

bevatron. A high-energy synchrotron.

binding energy. Energy that must be applied to a nucleus to break it up.

boiling point. The temperature at which the vapor pressure of a liquid equals the pressure of the atmosphere.

boson. A subatomic particle with zero charge and rest mass, e.g., the photon.

Boyle's law. The volume of a dry gas varies inversely with the pressure exerted upon it, provided the temperature is constant.

breeder reactor. A nuclear reactor in which a fissionable material is produced at a greater rate than the fuel is consumed.

Brownian movement. The irregular and random movement of small particles suspended in a fluid, known to be a consequence of the thermal motion of fluid molecules.

bubble chamber. Instrument used for making the paths of ionizing particles visible as a trail of tiny bubbles in a liquid.

calorie. The quantity of heat equal to 4.19 joules.

calorimeter. A heat-measuring device consisting of nested metal cups separated by an air space.

candle. The unit of luminous intensity of a light source.

capacitance. The ratio of the charge on either plate of a capacitor to the potential difference between the plates. capacitive reactance. Reactance in an a-c circuit containing capacitance which causes a lagging voltage.

capacitor. A combination of conducting plates separated by layers of a dielectric that is used to store an electric charge.

capillarity. The elevation or depression of liquids in small-diameter tubes.

cathode. (1) The negative electrode of an electric cell. (2) The electron-emitting electrode of an electronic tube. (3) The electron-rich electrode.

cathode rays. Particles emanating from a cathode; electrons.

Celsius scale. The temperature scale using the ice point as 0° and the steam point as 100°, with 100 equal divisions, or degrees, between; formerly the centigrade scale.

center of curvature. The center of the sphere of which the mirror or lens surface forms a part.

center of gravity. The point at which all of the weight of a body can be considered to be concentrated.

centrifugal force. Force that tends to move the particles of a rotating object away from the center of rotation.

centripetal acceleration. Acceleration directed toward the center of a circular path.

centripetal force. The force that produces centripetal acceleration.

chain reaction. A reaction in which the material or energy that starts the reaction is also one of the products and can cause similar reactions.

Charles' law. The volume of a dry gas is directly proportional to its Kelvin temperature, providing the pressure is constant.

chemical change. A change in which new substances with new properties are formed.

chemical equivalent. The quantity of an element, expressed in grams, equal to the ratio of its atomic weight to its valence.

chromatic aberration. The nonfocusing of light of different colors.

circular motion. Motion of a body along a circular path.

cloud chamber. A chamber in which charged subatomic particles appear as trails of liquid droplets.

coefficient of area expansion. The change in area per unit area of a solid per degree change in temperature.

coefficient of cubic expansion. The change in volume per unit volume of a solid or liquid per degree change in temperature.

coefficient of linear expansion. The change in length per unit length of a solid per degree change in temperature.

coefficient of sliding friction. The ratio of the force needed to overcome sliding friction to the normal force pressing the surfaces together.

coherence. The property of two wave trains with identical wavelengths and a constant phase relationship.

cohesion. The force of attraction between like molecules.

color. The visual perception of light associated with its frequency or wave length.

commutator. A split ring in a d-c generator, each segment of which is connected to an end of a corresponding armature loop.

complementary colors. Two colors that combine to form white light.

complete vibration. Back-and-forth motion of an object describing simple harmonic motion.

component. One of the several vectors that can be combined geometrically to find a resultant vector.

composition of forces. The combining of two or more component forces into a single resultant force.

compression. The region of a longitudinal wave in which the distance separating the vibrating particles is less than their equilibrium distance.

concave. Surface with center of curvature on the same side as the observer.

concave lens. A lens that diverges parallel light rays (assuming the outside refractive index to be smaller).

concave mirror. A mirror that converges parallel light rays incident on its surface.

concurrent forces. Forces with lines of action that pass through the same point.

condensation. The change of phase from a gas or vapor to a liquid.

conductance. The reciprocal of the ohmic resistance.

conductor. A material through which an electric charge is readily transferred.

conservative forces. Forces for which the law of conservation of mechanical energy holds true; gravitational forces and electrostatic forces.

continuous spectrum. A spectrum without dark lines or bands or in which there is an uninterrupted change from one color to another.

converging lens. A lens that is thicker in the middle than it is at the edge and bends incident parallel rays toward a common point.

convex. Surface with center of curvature on the opposite side from the observer.

convex lens. A lens that converges parallel light rays (assuming the outside refractive index to be smaller). convex mirror. A mirror that diverges parallel light rays incident on its surface.

cosmic rays. High-energy nuclear particles apparently originating from outer space.

cosmotron. A high-energy synchrotron.

coulomb. The quantity of electricity equal to the charge on 6.25×10^{18} electrons.

Coulomb's law of electrostatics. The force between two point charges is directly proportional to the product of their magnitudes and inversely proportional ta the square of the distance between them.

Coulomb's law of magnetism. The force between two magnetic poles is directly proportional to the strengths of the poles and inversely proportional to the square of their distance apart.

couple. Two forces of equal magnitude acting in opposite directions in the same plane, but not along the same line.

crest. A region of upward displacement in a transverse wave.

critical angle. That limiting angle of incidence in the optically denser medium that results in an angle of refraction of 90°.

critical mass. The amount of a particular fissionable material required to make a fission reaction self-sustaining.

critical point. The upper limit of the temperature-pressure curve of a substance.

critical pressure. The pressure needed to liquefy a gas at its critical temperature.

critical temperature. The temperature to which a gas must be cooled before it can be liquefied by pressure.

critical velocity. Velocity below which an object moving in a vertical circle will not describe a circular path.

curie. The quantity of any radioactive nuclide that has a disintegration rate of $3.7 \times 1O^{1O}$ becquerels.

current sensitivity. Current per unit scale division of an electric meter. cut-off bias. The smallest negative grid voltage, for a given plate voltage, that causes a vacuum tube to cease to conduct.

cut-off frequency. A characteristic threshold frequency of incident light below which, for a given material, the photoelectric emission of electrons ceases.

cut-off potential. A negative potential on the collector of a photoelectric cell that reduces the photoelectric current to zero.

cycle. A series of changes produced in sequence that recur periodically.

cyclotron. A device for accelerating charged atomic particles by means of D-shaped electrodes.

damping. The reduction in amplitude of a wave due to the dissipation of wave energy.

decay constant. The ratio between the number of nuclei decaying per second and the total number of nuclei.

decibel. A unit of sound intensity level. The smallest change of sound intensity that the normal human ear can detect.

declination. The angle between magnetic north and the true north from any surface location; also called variation.

dees. The electrodes of a cyclotron.

density. See mass density.

derived unit. A unit of measure that consists of combinations of fundamental units .

dew point. The temperature at which a given amount of water vapor will exert equilibrium vapor pressure.

diamagnetism. The property of a substance whereby it is feebly repelled by a strong magnet.

dichroism. A property of certain crystalline substances in which one polarized component of incident light is absorbed and the other is transmitted.

dielectric. An electric insulator. A nonconducting medium.

dielectric constant. The ratio of the capacitance with a particular material separating the plates of a capacitor to the capacitance with a vacuum between the plates.

diffraction. The spreading of a wave disturbance into a region behind an obstruction .

diffraction angle. The angle that a diffracted wavefront forms with the grating plane.

diffraction grating. An optical surface, either transmitting or reflecting, with several thousand equally spaced and parallel grooves ruled in it.

diffusion. (1) The penetration of one type of particle into a mass of a second type of particle. (2) The scattering of light by irregular reflection.

dimensional analysis. The performance of indicated mathematical operations in a problem with the measurement units alone.

diode. A two-terminal device that will conduct electric current more easily in one direction than in the other.

direct current. An essentially constant value current in which the movement of charge is in only one direction.

direct proportion. The relation between two quantities whose graph is a straight line.

dispersion. The process of separating polychromatic light into its component wavelengths.

displacement. (1) A change of position in a particular direction. (2) Distance of a vibrating particle from the midpoint of its vibration.

dissipative forces. Forces for which the law of conservation of mechanical energy does not hold true; frictional forces.

distillation. The evaporation of volatile materials from a liquid or solid mixture and their condensation in a separate vessel.

diverging lens. A lens that is thicker at the edge than it is in the middle and bends incident parallel rays so that they appear to come from a common point.

domain. A microscopic magnetic region composed of a group of atoms whose magnetic fields are aligned in a common direction.

donor. A substance with five valence electrons per atom which when added to a semiconductor crystal provides free electrons in the lattice structure of the crystal.

Doppler effect. The change observed in the frequency with which a wave from a given source reaches an observer when the source and the observer are in relative motion.

double refraction. The separation of a beam of unpolarized light into two refracted plane-polarized beams by certain crystals such as quartz and calcite.

drift tubes. Charged cylinders used to accelerate charged subatomic particles in a linear accelerator.

ductility. The property of a metal that enables it to be drawn through a die to form a wire.

eddy currents. Closed loops of induced current set up in a piece of metal when there is relative motion between the metal and a magnetic field. The eddy currents are in such direction that the resulting magnetic forces oppose the relative motion.

Edison effect. The emission of electrons from a heated metal in a vacuum. effective value of current. The magnitude of an alternating current that in a given resistance produces heat at the same average rate as that magnitude of steady direct current.

efficiency. The ratio of the useful work output of a machine to total work input.

elastic collision. A collision in which objects rebound from each other without a loss of kinetic energy.

elastic limit. The condition in which a substance is on the verge of becoming permanently deformed.

elastic potential energy. The potential energy in a stretched or compressed elastic object.

elasticity. The ability of an object to return to its original size or shape when the external forces producing distortion are removed.

electric current. The rate of flow of charge past a given point in an electric circuit.

electric field. The region in which a force acts on an electric charge brought into the region.

electric field intensity. The force per unit positive charge at a given point in an electric field.
electric ground. (1) A conductor connected with the earth to establish zero (ground) potential. (2) A common return to an arbitrary zero potential.

electrification. The process of charging a body by adding or removing electrons.

electrochemical cell. A cell in which chemical energy is converted to electric energy by a spontaneous electron transfer reaction.

electrochemical equivalent. The mass of an element, in grams, deposited by one coulomb of electric charge.

electrode. A conducting element in an electric cell, electronic tube, or semiconductor device.

electrolysis. The conduction of electricity through a solution of an electrolyte or through a fused ionic compound, together with the resulting chemical changes .

electrolyte. A substance whose solution conducts an electric current.
electrolytic cell. A cell in which electric energy is converted to chemical energy by means of an electron-transfer reaction.

electromagnetic induction. The process by which an emf is set up in a conducting circuit by a changing magnetic flux linked by the circuit.

electromagnetic interaction. The interaction that keeps electrons in orbit and forms bonds between atoms and molecules.

electromagnetic waves. Transverse waves having an electric component and a magnetic component, each being perpendicular to the other and both perpendicular to the direction of propagation.

electromotive force. See emf.

electron. A negatively charged subatomic particle having a rest mass of 9.109534×10^{-31} kg and a charge of $1.6021892 \times 10^{-19}$ c.

electron shell. A region about the nucleus of an atom in which electrons move and which is made up of electron orbitals.

electron volt. The energy required to move an electron between two points that have a difference af potential of one volt.

electronics. The branch of physics concerned with the emission, behavior, and effects of electrons.

electroscope. A device used to observe the presence of an electrostatic charge.

elementary colors. The six regions of color in the solar spectrum observed by the dispersion of sunlight: red, orange, yellow, green, blue, indigo, and violet.

elongation strain. The ratio of the increase in length to the unstretched length.

emf. The energy per unit charge supplied by a source of electric current.

emission spectrum. A spectrum formed by the dispersion of light from an incandescent solid, liquid, and gas.

endothermic. Referring to a process that absorbs energy.

energy. The capacity for doing work.

energy level. One of a series of discrete energy values that characterize a physical system governed by quantum rules.

entropy. (1) The internal energy of a system that cannot be converted to mechanical work. (2) The property that describes the disorder of a system.

equilibrant force. The force that produces equilibrium.

equilibrium. The state of a body in which there is no change in its motion.

equilibrium position. Midpoint of the path of an object describing simple harmonic motion.

equilibrium vapor pressure. The pressure exerted by vapor molecules in equilibrium with a liquid.

evaporation. The change of phase from a liquid to a gas or vapor.

exclusion principle. No two electrons in an atom can have the same set of quantum numbers

exothermic. Referring to a process that liberates energy.

external combustion engine. A heat engine in which the fuel burns outside the cylinder or turbine chamber.

farad. The unit of capacitance; one coulomb per volt.

faraday. The quantity of electricity (96,500 coulombs) required to deposit one chemical equivalent of an element.

Faraday's first law. The mass of an element deposited during electrolysis is proportional to the quantity of charge that passes through the electrolytic cell.

Faraday's second law. The mass of an element deposited during electrolysis is proportional to the chemical equivalent of that element.

ferromagnetism. The property of a substance by which it is strongly attracted by a magnet.

Feynman diagram. A diagram showing the production and exchange of particles during a subatomic interaction.

first law of photoelectric emission. The rate of emission of photoelectrons is directly proportional to the intensity of the incident light.

first law of thermodynamics. When heat is converted to another form of energy, or when another form of energy is converted to heat, there is no loss of energy.

fission. The splitting of a heavy nucleus into nuclei of intermediate mass.

flash tube. The ionization tube that emits the light in a chemical laser.

Fleming valve. The first vacuum-tube diode.

fluorescence. The emission of light during the absorption of radiation from another source.

flux. Flow.

f-number. The ratio of the focal length of a lens to the effective aperture.

focal length. The distance between the principal focus of a lens or mirror and its optical center or vertex.

focal plane. The plane perpendicular to the principal axis of a converging lens or mirror and containing the principal focus.

focus. A point at which light rays meet or from which rays of light appear to diverge.

force. (1) A physical quantity that can affect the motion of an object. (2) A measure of the momentum gained per second by an accelerating body.

force of gravity. See gravity.

forced vibration. Vibration that is due to the application of a periodic force, and not to the natural vibrations of the system.

forward bias. Voltage applied to a semiconductor P-N junction that increases the electron current across the junction.

fractional distillation. The process of separating the components of a liquid mixture by means of differences in their boiling points.

frame of reference. Any system for specifying the precise location of objects in space.

freezing point. The temperature at which a liquid changes to a solid.

frequency. Number of vibrations, oscillations, or cycles per unit time.

friction. A force that resists the relative motion of objects that are in contact with each other.

fuel cell. An electrochemical cell in which the chemical energy of continuously supplied fuel is converted into electric energy.

fundamental. The lowest frequency produced by a musical tone source. That harmonic component of a wave which has the lowest frequency.

fundamental unit. Any one of seven basic units of measure.

fusion. (1) The change of phase from a solid to a liquid; melting. (2) A reaction in which light nuclei combine, forming a nucleus with a larger mass number.

galvanometer. An instrument used to measure minute electric currents.

gamma ray. High energy photon emitted from the nucleus of a radioactive atom.

Geiger tube. Ion sensitive instrument used for the detection of subatomic particles.

gravitational field. Region of space in which each point is associated with a value of gravitational acceleration.

gravitational force. The mutual force of attraction between particles of matter.

gravitational interaction. The interaction between particles of matter that has no known distance limitations, but is the weakest interaction of all.

gravitational potential energy. Potential energy acquired by an object when it is moved against gravity.

graviton. The carrier for the gravitational interaction.

gravity. The force of gravitation on an object on or near the surface of a celestial body.

grid. An element of an electronic tube. An electrode used to control the flow of electrons from the cathode to the plate.

grid bias. The grid-to-cathode voltage.

half-life. The length of time during which, on the average, half of a large number of radioactive nuclides decay.

harmonics. The fundamental and the tones whose frequencies are whole number multiples of the fundamental.

heat. Thermal energy in the process of being added to or removed from, a substance.

heat capacity. The quantity of heat needed to raise the temperature of a body one degree.

heat engine. Any device that converts heat energy into mechanical work.

heat of fusion. The heat required per unit mass to change a substance from solid to liquid at its melting point.

heat of vaporization. The heat required per unit mass to change a substance from liquid to vapor at its boiling point.

heat pump. A device that absorbs heat from a cool environment and gives it off to a region of higher temperature.

heat sink. A reservoir that absorbs heat without a significant increase in temperature.

henry. The unit of inductance; one henry of inductance is present in a circuit when a change in the current of 1 ampere per second induces an emf of 1 volt.

Hooke's law. Below the elastic limit, strain is directly proportional to stress.

hyperbola. Graph of an inverse proportion.

hypercharge. A property of some baryons and leptons that is conserved in strong and electromagnetic interactions but not in weak interactions.

hypothesis. A plausible solution to a problem.

ice point. The melting point of ice when in equilibrium with water saturated with air at standard atmospheric pressure.

ideal gas. A theoretical gas consisting of infinitely small molecules that exert no forces on each other; also called perfect gas.

illumination. The luminous flux per unit area of a surface.

image. The optical counterpart of an object formed by lenses or mirrors.

impedance. (1) The ratio of applied wave-producing force to resulting displacement velocity of a wave-transmitting medium. (2) The ratio of sound pressure to volume displacement at a given surface in a sound-transmitting medium. (3) The ratio of the effective voltage to the effective current in an a-c circuit.

impedance matching. A technique used to ensure maximum transfer of energy from the output of one circuit to the input of another.

impulse. The product of a force and the time interval during which it acts.

index of refraction. The ratio of the speed of light in a vacuum to its speed in a given matter medium.

induced magnetism. Magnetism produced in a ferromagnetic substance by the influence of a magnetic field.

inductance. The Property of an electric circuit by which a varying current induces a back emf in that circuit or a neighboring circuit.

induction. The process of charging one body by bringing it into the electric field of another charged body.

inductive reactance. Reactance in an a-c circuit containing inductance, which causes a lagging current.

inelastic collision. A collision in which the colliding objects stick together after impact.

inertia. The property of matter that opposes any change in its state of motion.

inertial frame of reference. A nonaccelerating frame of reference in which Newton's first law holds true.

infrared light. Electromagnetic waves longer than those of visible light and shorter than radio waves.

infrasonic range. Vibrations in matter below 20 cycles/second.

instantaneous current. The magnitude of a varying current at any instant of time.

instantaneous velocity. Short displacement divided by elapsed time. Slope of the line that is tangent to a velocity graph at a given point.

instantaneous voltage. The magnitude of a varying voltage at any instant of time.

insulator. A material through which an electric charge is not readily transferred.

intensity level. The logarithm of the ratio of the intensity of a sound to the intensity of the threshold of hearing.

interaction. Any change in the amount or quantum numbers of particles that are near each other.

interface. A surface that forms the boundary between two phases or systems.

interference. (1) The superposing of one wave on another. (2) The mutual effect of two beams of light, resulting in a reduction of energy in certain areas and an increase of energy in others.

internal combustion engine. A heat engine in which the fuel burns inside the cylinder or turbine chamber.

internal energy. Total potential and kinetic energy of the molecules and atomic particles of a substance.

intersecting storage ring. An accelerator in which particles collide as they move in opposite directions.

inverse photoelectric effect. The emission of photons of radiation from a material when bombarded with high speed electrons.

inverse proportion. The relation between two quantities whose product is a constant and whose graph is a hyperbola.

ion. An atom or a group of atoms having an electric charge.

ionization chamber. A device used to detect the passage of charged rays or particles by their ionizing effect on a gas.

ionization energy. The energy required to remove an electron from an atom.

irregular reflection. Scattering. Reflection in many different directions from an irregular surface.

isothermal process. A thermal process that takes place at constant temperature.

isotopes. Atoms whose nuclei contain the same number of protons but different numbers of neutrons.

joule. The unit of work; the product of a force of one newton acting through a distance of one meter.

Joule's law. The heat developed in a conductor is directly proportional to the resistance of the conductor, the square of the current, and the time the current is maintained.

junction detector. A solid-state device based on the transistor principle that is used to detect the passage of charged particles.

Kelvin scale. The scale of temperature having a single fixed point, the temperature of the triple point of water, which is assigned the value 273.16 ^{o}K.

kilogram. A unit of mass in the metric system; one of the seven fundamental units.

kilowatt hour. A unit of electric energy equal to 3.6×10^{6} w s.

kinetic energy. Energy possessed by an object because of its motion.

kinetic theory. The molecules of matter are continuously in motion and the collisions between molecules are perfectly elastic.

Kirchhoff's first law. The algebraic sum of the currents at any circuit junction is equal to zero.

Kirchhoff's second law. The algebraic sum of all changes in potential occurring around any loop in a circuit equals zero.

laser. An acronym for light amplification by stimulated emission of radiation.

law. A statement that describes a natural phenomenon; a principle.

law of conservation of baryons. When a baryon decays or reacts with another particle, the number of baryons is the same on both sides of the equation.

law of conservation of energy. The total quantity of energy in a closed system is constant.

law of conservation of hypercharge. Hypercharge is conserved in strong and electromagnetic interactions, but not in weak interactions.

law of conservation of leptons. In a reaction involving leptons, the arithmetic sum of the lepton numbers is the same on each side of the equation.

law of conservation of mechanical energy. The sum of the potential and kinetic energies of an ideal energy system is constant.

law of conservation of momentum. When no net external forces are acting on an object, the total vector momentum of the object remains constant.

law of entropy. A natural process always takes place in such a direction as to increase the entropy of the universe.

law of heat exchange. In any heat transfer system, the heat lost by hot materials equals the heat gained by cold materials .

Lenz's law. An induced current is in such a direction that its magnetic property opposes the change by which the current is induced.

lepton. A subatomic particle with a small rest mass, e.g., the electron. line of flux. A line so drawn that a tangent to it at any point indicates the direction of the magnetic field.

line of force. A line so drawn that a tangent to it at any point indicates the direction of the electric field.

line spectrum. A spectrum consisting of monochromatic slit images having wavelengths characteristic of the atoms present in the source.

linear accelerator. A device for accelerating particles in a straight line through many stages of small potential difference.

liquefaction. The change to the liquid phase. The condensation of a gas to a liquid.

liter. A special name for the cubic decimeter. Symbol: L.

longitudinal wave. A wave in which the vibrations are parallel to the direction of propagation of the wave.

loop. A midpoint of a vibrating segment of a standing wave.

loudness. The sensation that depends principally on the intensity of sound waves reaching the ear.

lumen. The unit of luminous flux; the luminous flux on a unit surface all points of which are at unit distance from a point source of one candle:

luminous. Visible because of the light emitted by its oscillating particles.

luminous flux. The part of the total energy radiated per unit of time from a luminous source that is capable of producing the sensation of sight.

machine. A device that multiplies force at the expense of distance or that multiplies distance at the expense of force.

magnetic field. A region in which a magnetic force can be detected.

magnetic field intensity. The force exerted by a magnetic field on a unit N pole situated in the field.

magnetic flux. Lines of flux through a region of a magnetic field, considered collectively.

magnetic flux density. The magnetic flux through a unit area normal to the magnetic field; also called magnetic induction.

magnetic force. A force associated with motion of electric charges.

magnetosphere. A region of the upper atmosphere in which the motion of charged particles is governed primarily by the magnetic field of the earth.

magnification. The ratio of the image distance to the object distance; the ratio of the image size to the object size.

malleability. The property of a metal that enables it to be hammered or rolled into sheets.

mass. A measure of the quantity of matter; a fundamental physical quantity.

mass density. Mass per unit volume of a substance.

mass number. (1) The sum of the number of protons and neutrons in the nucleus of an atom. (2) The integer nearest to the atomic mass.

mass spectrograph. Instrument used to determine the mass of ionized particles.

matter. Anything that has the properties of mass and inertia.

matter wave. A property of matter that is directly proportional to Planck's constant and inversely proportional to mass and velocity.

mechanical equivalent of heat. The conversion factor that relates heat units to work units; 4.19 j/cal.

mechanical wave. A wave that originates in the displacement of a portion of an elastic medium from its normal position, causing it to oscillate about an equilibrium position.

medium. Any region through which a wave disturbance propagates. Mechanical waves require a matter medium. Electromagnetic waves propagate through a vacuum and various matter media.

melting point. The temperature at which a solid changes to a liquid.

meniscus. The crescent-shaped surface at the edge of a liquid column.

meson. A subatomic particle with a rest mass intermediate between that of a lepton and a baryon; the carrier of the strong interaction.

meter. A unit of length in the metric system equivalent to 1,650,763.73 wave-lengths of the orange-red light emitted by krypton-86. One of the seven fundamental units of measure.

metric system. A system of measurement that is based on decimal multiples and subdivisions.

moderator. A material that slows down neutrons .

mole. Amount of substance containing the Avogadro number of particles such as atoms, molecules, ions, electrons etc. It is 6.02×10^{23} particles.

molecule. The smallest chemical species of a substance that is capable of stable independent existence.

momentum. The product of the mass and velocity of a moving body.

monochromatic light. Light composed of a single color.

mutual inductance. The ratio of the induced emf in one circuit to the rate of change of current in the coil of another circuit.

neutral weak current. A subatomic reaction in which leptons collide without change in the charges of the colliding particles .

neutron. A neutral subatomic particle having a mass of 1.674943×10^{-27} kg.

newton. The unit of force; a derived unit having the dimensions kg m/s^2. The force required to accelerate a one-kilogram mass at a rate of one meter per second each second.

Newton's first law of motion. A body at rest or in uniform motion in a straight line will remain at rest or in the same uniform motion unless acted upon by an external force; also called the law of inertia.

Newton's law of universal gravitation. The force of attraction between any two particles of matter in the universe is directly proportional to the product of their masses and inversely proportional to the square of the distance between their centers of mass.

Newton's second law of motion. The acceleration of a body is directly proportional to the net force exerted on the body, is inversely proportional to the mass of the body, and has the same direction as the net force; also called the law of acceleration.

Newton's third law of motion. If one body exerts a force on a second body, then the second body exerts a force equal in magnitude and opposite in direction on the first body; also called the law of interaction.

node. A point of no disturbance of a standing wave.

noise. Sound produced by irregular vibrations in matter which is unpleasant to the listener.

noninertial frame of reference. An accelerating frame of reference in which Newton's first law of motion does not hold true.

normal. A line drawn perpendicular to a line or surface.

N-type germanium. "Electron-rich" germanium consisting of equal numbers of free electrons and bound positive charges so that the net charge is zero.

nuclear binding force. The force that acts within the small distances between nucleons .

nuclear change. A change in the identity of atomic nuclei.

nuclear mass defect. The arithmetic difference between the mass of a nucleus and the larger sum of its uncombined constituent particles.

nuclear reactor. A device in which the controlled fission of certain substances is used to produce new substances and energy.

nucleon. A proton or neutron in the nucleus of an atom.

nucleus. The positively charged dense central part of an atom.

nuclide. An atom of a particular mass and of a particular element.

octave. The interval between a given musical tone and one with double or half the frequency.

ohm. The unit of electric resistance; one volt per ampere.

Ohm's law. The ratio of the emf applied to a closed circuit to the current in the circuit is a constant.

optical center. The point in a thin lens through which the secondary axes pass.

optical density. A property of a transparent material that is a measure of the speed of light through it.

orbital. The probability pattern of position of an electron about the nucleus of an atom.

order of magnitude. A numerical approximation to the nearest power of ten.

ordinate. The value corresponding to the vertical distance of a point on a graph from the X axis. The Y coordinate.

oscilloscope. A cathode-ray tube with associated electronic circuits that enable external voltages to deflect the electron beam of the cathode-ray tube simultaneously along both horizontal and vertical axes.

parallel circuit. An electric circuit in which two or more components connected across two common points in the circuit so as to provide separate conducting paths for the current.

parallelogram method. The graphic method of finding the resultant of two vectors that do not act along a straight line.

paramagnetism. The property of a substance by which it is feebly attracted by a strong magnet.

pendulum. A body suspended so that it can swing back and forth about an axis.

penumbra. The partially illuminated part of a shadow.

period. (1) The time for one complete cycle, vibration, revolution, or oscillation. (2) The time required for a single wavelength to pass a given point.

periodic motion. Motion repeated in each of a succession of equal time intervals.

permeability. The property of a material by which it changes the flux density in a magnetic field from its value in air.

phase. (1) A condition of matter. (2) In any periodic phenomenon, a number that describes a specific stage within each oscillation. (3) The angular relationship between current and voltage in an a-c circuit. (4) The number of separate voltage waves in a commercial a-c supply.

phase angle. (1) Of any periodic function, the angle obtained by multiplying the phase by 360 if the angle is to be expressed in degrees, or by 2pi if in radians. (2) The angle between the voltage and current vectors.

phasor. A representation of the concepts of magnitude and direction in a reference plane; a rotating vector.

photoelastic. Pertaining to certain materials that become double refracting when strained.

photoelectric effect. The emission of electrons by a substance when illuminated by electromagnetic radiation of sufficiently short wavelength.

photoelectrons. Electrons emitted from a light-sensitive material when it is illuminated with light of sufficiently short wavelength.

photometer. An instrument comparing the intensity source with that of a standard source.

photometry. The quantitative measurement of visible radiation from light sources .

photon. A quantum of light energy; the carrier of the electromagnetic interaction.

photovoltaic effect. The generation of a potential difference across a P-N junction as a consequence of the absorption of incident light of appropriate frequency.

physical change. A change in which the composition and identifying properties of a substance remain unchanged. physical quantity. A measurable aspect of the universe, such as length.

physics. The science that deals with the relationships between matter and energy. The second half of life.

piezoelectric effect. The property of certain natural and synthetic crystals to develop a potential difference between opposite surfaces when subjected to a mechanical stress, and conversely.

pitch. The identification of a certain sound with a definite tone; depends on the frequency which the ear receives.

pivot point. The point from which the lengths of all torque arms are measured.

Planck's constant. A fundamental constant in nature that determines what values are allowed for physical quantities in quantum mechanics; $h = 6.63 \times 10^{-34}$ j s.

plasma. A gas that is capable of conducting an electric current.

plate. The anode of an electronic tube.

P-N junction. The boundary between P and N-type materials in a semiconductor crystal.

polarized light. Light radiations in which the vibrations of all light waves present are confined to planes parallel to each other.

polarizing angle. A particular angle of incidence at which polarization of reflected light is complete.

polychromatic light. Light composed of several colors.

positive rays. Rays coming through holes in a cathode on the side opposite the anode in a discharge tube. Positively charged ions.

potential difference. The work done per unit charge as a charge is moved between two points in an electric field.

potential energy. Energy that is the result of the position of an object. potential gradient. The change in potential per unit distance.

power. The time rate of doing work. power factor. The cosine of the phase angle between current and voltage in an a-c circuit.

precession. The motion that results from the application of a torque that tends to displace the axis of rotation of a rotating object.

precision. The agreement between the numerical values of two or more measurements made in the same way and expressed in terms of deviation; the reproducibility of measured data.

pressure. Force per unit area.

primary. A transformer winding that carries current and normally induces a current in one or more secondary windings.

primary cell. An electrochemical cell in which the reacting materials must be replaced after a given amount of energy has been supplied to the external circuit.

primary colors. Colors in terms of which all other colors may be described or from which all other colors may be evolved by mixtures.

primary pigments. The complements of the primary colors.

principal axis. (1) A line drawn through the center of curvature and the vertex of a curved mirror. (2) A line drawn through the center of curvature and the optical center of a lens.

principal focus. A point at which rays parallel to the principal axis converge or from which they diverge after reflection or refraction.

principle. See law.

principle of parity. For every process in nature there is a mirror-image process which is indistinguishable from the original process.

propagate. To travel through a material or space.

propagation. The act of propagating. The action of traveling through a material or space.

property. A measurable aspect of matter, e.g., mass and inertia.

proton. A positively charged subatomic particle having a mass of $1.6726485 \times 10^{-27}$ kg and a charge equal and opposite to that of the electron.

P-type germanium. "Hole-rich" germanium consisting of equal numbers of free positive holes and bound negative charges so that the net charge is zero.

pulse. A single nonrepeated disturbance.

quality. The property of sound waves that depends on the number of harmonics and their prominence.

quantum. An elemental unit of energy; a photon of energy hf.

quantum mechanics. The branch of physics that heals with the behavior of particles whose specific properties are given by quantum numbers.

quantum number. One of a set of notations used to characterize a discrete value that a quantized variable is allowed to assume.

quantum theory. A unifying theory based on the concept of the subdivision of radiant energy into discrete quanta (photons) and applied to the studies of structure at the atomic and molecular levels.

quark. A hypothetical subatomic particle of which all other subatomic particles are composed.

quiescent. A steady-state condition. The operating condition of an electronic circuit when no input signal is applied.

radian. A unit of angular measurement. The angle that, when placed with its vertex at the center of a circle, subtends on the circumference an arc equal in length to the radius of the circle. Approximately 57.3^{o}.

radio waves. Also called Hertzian waves. Electromagnetic radiations produced by rapid reverses of current in a conductor.

radioactivity. The spontaneous breakdown of an atomic nucleus with the emission of particles and rays.

radioisotope. An isotope of an element that is radioactive.

rarefaction. The region of a longitudinal wave in which the vibrating particles are farther apart than their equilibrium distance .

ray. A single line of light from a luminous point. A line showing the direction of propagation of light.

reactance. The nonresistive opposition to current in an a-c circuit.

reaction motor. A heat engine whose acceleration is produced by the thrust of exhaust gases.

real image. An image formed by actual rays of light.

rectifier. A device for changing alternating current to direct current.

rectilinear propagation. Traveling in a straight line.

reflectance. The ratio of the light reflected from a surface to the light falling on it, expressed in percentage.

reflection. The return of a wave from the boundary of a medium.

refraction. The bending of a wave disturbance as it passes obliquely from one medium into another in which the disturbance has a different velocity.

regelation. The melting of a substance under pressure and the refreezing after the pressure is released.

regular reflection. Reflection from a polished surface in which scattering effects are negligible.

relative deviation. Percentage average deviation of a set of measurements.

relative error. Percentage absolute error of a set of measurements.

relative humidity. The ratio of the water vapor pressure in the atmosphere to the equilibrium vapor pressure at a given temperature.

relativistic mass. The mass of an object in motion with respect to the observer.

residual magnetism. Magnetism retained in a magnet after the magnetizing field has been removed.

resistance. The ratio of the potential difference across a conductor to the magnitude of current in it.

resistivity. A proportionality constant that relates the length and cross-sectional area of a given electric conductor to its resistance, at a given temperature.

resolution of forces. The resolving of a single force into component forces acting in given directions on the same point.

resonance. (1) The inducing of vibrations of a natural rate by a vibrating source having the same frequency. (2) The condition in an a-c circuit in which the inductive reactance and capacitive reactance are equal.

rest mass. The mass of an object not in motion.

resultant. A vector representing the sum of several vector components. resultant force. The single force that has the same effect as two or more forces applied simultaneously at the same point.

reverse bias. Voltage applied to a semiconductor P-N junction that reduces the electron current across the junction.

rheostat. A variable resistance.

root-mean-square (rms) current. The effective value of an alternating current; the square root of the mean of the instantaneous values squared.

rotary motion. Motion of a body about an internal axis.

rotational equilibrium. The state of a body in which the sum of all the clockwise torques in a given plane equals the sum of all the counterclockwise torques about a pivot point.

rotational inertia. The property of a rotating object that resists changes in its angular velocity.

scalar quantity. A quantity that is completely specified by a magnitude.

scientific notation. A positive number expressed in the form of $M \times 10^n$ in which M is a number between 1 and 10 and n is an integral power of 10.

scintillation counter. A device that counts the impacts of charged subatomic particles on a fluorescent screen by means of a photomultiplier tube.

second. A unit of time; equivalent to 9,192,631,770 vibrations of cesium-113. One of the seven fundamental units of measure.

second law of photoelectric emission. The kinetic energy of photoelectrons is independent of the intensity of the incident light.

second law of thermodynamics. It is not possible for an engine to transfer heat from one body to another at a higher temperature unless work is done on the engine.

secondary. A transformer output winding in which the current is due to inductive coupling with another winding called the primary.

secondary axis. Any line other than the principal axis drawn through the center of curvature of a mirror or the optical center of a lens.

secondary emission. Emission of electrons as a result of the bombardment of an electrode by high-velocity electrons.

selectivity. The property of a tuned circuit that discriminates between signal voltages of different frequencies.

self-inductance. The ratio of the induced emf across a coil to the rate of change of current in the coil.

series circuit. An electric circuit in which the components are arranged to provide a single conducting path for current.

series resonance. A condition in which the impedance of a series circuit containing resistance, inductance, and capacitance is equal to the resistance of the circuit and the voltage across the circuit is in phase with the current.

shear strain. The ratio of the amount of deformation of the side of a body to the length of the side.

short circuit. An electric circuit through a negligible resistance that usually shunts a normal load and overloads the circuit.

significant figures. Those digits in an observed quantity (measurement) that are known with certainty plus the first digit that is uncertain.

simple harmonic motion. Motion in which the acceleration is proportional to the displacement from an equilibrium position and is directed toward that position.

solar spectrum. The band of colors produced when sunlight is dispersed by a prism.

solenoid. A long helical wound coil of insulated wire.

solid state detector. A device used to detect the passage of charged subatomic particles by their crystal-distorting or ionizing effects on a nonconducting or nonconducting solid.

solidification. The change of phase from a liquid to a solid.

sonometer. A device, consisting of two or more wires or strings stretched over a sounding board, used for testing the frequency of strings and for showing how they vibrate.

sound. The series of disturbances in matter to which the human ear is sensitive. Also similar disturbances in matter above and below the normal range of human hearing.

sound intensity. The rate at which sound energy flows through a unit area.

space charge. The negative charge in the space between the cathode and plate of a vacuum tube.

spark chamber. A device used to detect the passage of charged subatomic particles by the light flashes they trigger.

specific gravity. The ratio of the mass density of a substance to that of water.

specific heat. The heat capacity of a material per unit mass.

spectroscope. Optical instrument used for the study of spectra.

speed. Time rate of motion.

spherical aberration. The failure of parallel rays to meet at a single point on a spherical surface after reflection or refraction.

spinthariscope. A device used to detect subatomic particles by the light flashes they produce on a zinc sulfide screen.

standard pressure. The pressure exerted by 760 mm of mercury at O ^{o}C.

standard temperature. O^{o}C, 273°K.

standing wave. The resultant of two wave trains of the same wavelength, frequency, and

amplitude. traveling in opposite directions through the same medium .

static electricity. Electricity at rest.

steam point. The boiling point of water at standard atmospheric pressure.

steradian. The ratio of the intercepted surface area of a sphere to the square of the radius. A unit of solid angle.

storage cell. An electrochemical cell in which the reacting materials are regenerated by the use of a reverse current from an external source.

strain. The relative amount of distortion produced in a body under stress.

stress. The distorting force per unit area.

strong nuclear interaction. The interaction that holds the particles of the nucleus together and is independent of charge.

sublimation. The change of a solid to a gaseous phase without passing through the liquid phase.

superconductivity. The condition of zero resistivity below the transition temperature of a substance.

supercooling. The process of cooling a substance below its normal phase change point without a change of phase.

superposition. Combining the displacements of two or more waves vectorially to produce a resultant displacement.

surface tension. The tendency of a liquid surface to contract; the measure of this tendency in newtons per meter.

sympathetic vibration. See resonance (1).

synchrotron. A particle accelerator in which the oscillating frequency varies.

technology. The application of science to human needs and goals.

temperature. The physical quantity that is proportional to the average kinetic energy of translation of particles in matter.

temporary magnet. A magnet produced by induction.

tensile strength. The force required to break a rod or wire of unit cross-sectional area.

theory. A plausible explanation of an observed event, supported experimentally and confirmed by experiments designed to test predictions based upon the explanation.

thermal energy. The total potential and kinetic energy associated with the random motions of the particles of a material.

thermionic emission. The liberation of electrons from the surface of a hot body.

thermocouple. An electric circuit composed of two dissimilar metals whose junctions are maintained at different temperatures .

thermodynamics. Study of quantitative relationships between heat and other forms of energy.

thermoelectric effect. The production of an electron current in a closed circuit consisting of two dissimilar metals as a result of the emf developed when the two junctions are maintained at different temperatures.

thermonuclear reaction. Nuclear fusion.

third law of photoelectric emission. Within the region of effective frequencies, the maximum kinetic energy of photoelectrons varies directly with the difference between the frequency of the incident light and the cut-off frequency.

thought experiment. An idealized experiment that cannot be performed under actual conditions.

threshold of hearing. The intensity of the faintest sound audible to the average human ear, 10^{-16} w/cm^2 at 10^3 hz.

threshold of pain. For audible frequencies of sound, an intensity level above which pain results in the average human ear. Rock concert.

tolerance. Degree of precision obtainable with a measuring instrument.

torque. Product of a force and the effective length of its torque arm.

torque arm. The perpendicular distance between the line of action of the torque producing force and the axis of rotation.

total reflection. The reflection of light at the boundary of two transparent media when the angle of incidence exceeds the critical angle.

transformer. A device for changing an alternating voltage from one potential to another.

transistor. A semiconductor device used as a substitute for vacuum tubes in electronic applications.

transition temperature. A specific temperature at which the resistivity of some materials drops suddenly to zero.

translational equilibrium. The state of a body in which there are no unbalanced forces acting on it.

transuranium elements. Elements with atomic number greater than 92.

transverse wave. A wave in which the vibrations are at right angles to the direction of propagation of the wave.

triode. Vacuum tube consisting of a plate, grid, and cathode.

triple point. The single condition of temperature and pressure at which the solid, liquid, and vapor phases of a substance can coexist in stable equilibrium.

trough. A region of downward displacement in a transverse wave.

tuning fork. A metal two-prong fork that produces a sound of a definite pitch.

ultrasonic range. Vibrations in matter above 20,000 vibrations/second.

ultraviolet light. Electromagnetic radiations of shorter wavelength than visible light but longer than X rays.

umbra. The part of a shadow from which all light rays are excluded.

uncertainty principle. It is impossible to specify simultaneously both the position of an object and its momentum.

unified field theory. The principle that all forces in the universe are part of a single concept.

unit magnetic pole. One that repels an exactly similar pole placed one centimeter away with a force of one dyne.

universal gas constant. Constant of proportionality, R, in the ideal gas equation.

universal gravitational constant. Constant of proportionality in Newton's law of universal gravitation; $G = 6.67 \times 10^{-11}\ nm^2/kg^2$.

Van de Graaff generator. A particle accelerator that transfers a charge from an electron source to an insulated sphere by means of a moving belt composed of an insulating material.

vapor. The gaseous phase of a substance that exists as a liquid or solid under normal conditions.

vaporization. The change in phase from a solid or a liquid to a gas. variation. See declination.

vector quantity. A quantity that is completely specified by a magnitude and a direction.

velocity. Speed in a particular direction.

vertex. The center of a curved mirror.

virtual image. An image that only appears to be formed by rays of light.

viscosity. The ratio of shear stress to the rate of change of shear strain in a liquid or gas.

volt. The unit of potential difference. The potential difference between two points in an electric field such that one joule of work moves a charge of one coulomb between these points.

voltage sensitivity. Voltage per unit scale division of an electric instrument.

voltaic cell. A device that changes chemical into electric energy by the action of two dissimilar metals immersed in an electrolyte.

voltmeter. An instrument used to measure the difference of potential between two points in an electric circuit.

volume strain. The ratio of the decrease in volume to the volume before stress is applied.

W particle. The theoretical carrier for weak subatomic interactions.

watt. The unit of power; one joule per second.

wavelength. In a periodic wave, the distance between consecutive points of corresponding phase.

weak nuclear interaction. The interaction that produces pairs of particles that have unusually long half-lives.

weber. The unit of magnetic flux.

weight. The measure of the gravitational force acting on a substance.

Wheatstone bridge. Instrument used for the measurement of electric resistance.

work. The product of a displacement and the force in the direction of the displacement.

work function. The minimum energy required to remove an electron from the surface of a material and send it into field-free space.

working equation. The equation derived from a basic equation as an expression of the unknown quantity in a problem directly in terms of the unknown quantities stated in the problem. The working equation is the mathematical expression of the solution to the problem.

X rays. Invisible electromagnetic radiations of great penetrating power.

Young's modulus. The ratio of stress to strain in a solid.

Zeeman effect. The splitting of atomic energy levels into two or more sublevels by means of a magnetic field as seen in spectral lines under these conditions.

Collection By

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Mechanical Engineering