McGRAW-HILL DICTIONARY OF SCIENTIFIC AND TECHNICAL TERMS

Sixth Edition

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On the cover: Representation of a fullerene molecule with a noble gas atom trapped inside. At the Permian-Triassic sedimentary boundary the noble gases helium and argon have been found trapped inside fullerenes. They exhibit isotope ratios quite similar to those found in meterorites, suggesting that a fireball meteorite or asteroid exploded when it hit the Earth, causing major changes in the environment. ***(Image copyright © Dr. Luann Becker. Reproduced with permission.)***

Over the six editions of the Dictionary, material has been drawn from the following references: G. M. Garrity et al., *Taxonomic Outline of the Procaryotes,* Release 2, Springer-Verlag, January 2002; D. W. Linzey, *Vertebrate Biology,* McGraw-Hill, 2001; J. A. Pechenik, *Biology of the Invertebrates,* 4th ed., McGraw-Hill, 2000; *U.S. Air Force Glossary of Standardized Terms,* AF Manual 11-1, vol. 1, 1972; F. Casey, ed., *Compilation of Terms in Information Sciences Technology,* Federal Council for Science and Technology, 1970; *Communications-Electronics Terminology,* AF Manual 11-1, vol. 3, 1970; P. W. Thrush, comp. and ed., *A Dictionary of Mining, Mineral, and Related Terms,* Bureau of Mines, 1968; *A DOD Glossary of Mapping, Charting and Geodetic Terms,* Department of Defense, 1967; J. M. Gilliland, *Solar-Terrestrial Physics: A Glossary of Terms and Abbreviations,* Royal Aircraft Establishment Technical Report 67158, 1967; W. H. Allen, ed., *Dictionary of Technical Terms for Aerospace Use,* National Aeronautics and Space Administration, 1965; *Glossary of Stinfo Terminology,* Office of Aerospace Research, U.S. Air Force, 1963; *Naval Dictionary of Electronic, Technical, and Imperative Terms,* Bureau of Naval Personnel, 1962; R. E. Huschke, *Glossary of Meteorology,* American Meteorological Society, 1959; *ADP Glossary,* Department of the Navy, NAVSO P-3097; *Glossary of Air Traffic Control Terms,* Federal Aviation Agency; *A Glossary of Range Terminology, White Sands Missile Range, New Mexico,* National Bureau of Standards, AD 467-424; *Nuclear Terms: A Glossary,* 2d ed., Atomic Energy Commission.

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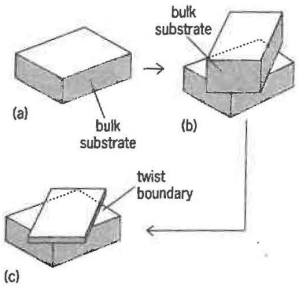
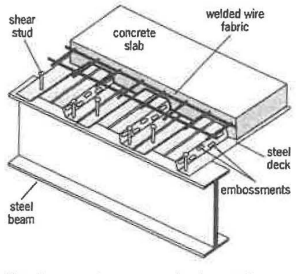


Process flow of forming a semiconductor compliant substrate containing a twist boundary. (*a*) Initial substrate. (*b*) Two substrates bonded at an angle. (*c*) Compliant substrate with a twist boundary, created by removing most of one substrate.



Steel-concrete composite beam in which a steel wide-flange shape (W-shaped deck) is attached to a concrete floor slab.

quantity by a complex number whose real component equals the instantaneous value of the physical quantity, a sinusoidally varying quantity thus being represented by a point rotating in a circle centered at the origin of the complex plane with uniform speed. { 'käm,pleks nō'tā·shən }

complex number [MATH] Any number of the form $a + bi$, where a and b are real numbers, and $i^2 = -1$. { 'käm,pleks 'nəm·bər }

complex number system [MATH] The field of complex numbers. { ¦käm,pleks 'nəm·bər ,sis·təm }

complexometric titration [ANALY CHEM] A technique of volumetric analysis in which the formation of a colored complex is used to indicate the end point of a titration. Also known as chelatometry. Also spelled compleximetric titration. { kəm¦plek·sə¦me·trik ,tī'trā·shən }

complex permeability [ELECTROMAG] A property, designated by μ^*, of a magnetic material, equal to $\mu_0 (L/L_0)$, where L is the complex inductance of an inductance coil in which the magnetic material forms the core when the coil is connected to a sinusoidal voltage source, and L_0 is the vacuum inductance of the coil. { 'käm,pleks ,pər·mē·ə'bil·əd·ē }

complex permittivity [ELEC] A property of a dielectric, equal to $\epsilon_0(C/C_0)$, where C is the complex capacitance of a capacitor in which the dielectric is the insulating material when the capacitor is connected to a sinusoidal voltage source, and C_0 is the vacuum capacitance of the capacitor. { 'käm,pleks ,pər·mə'tiv·əd·ē }

complex plane [MATH] A plane whose points are assigned the real and imaginary parts of complex numbers for coordinates. { ¦käm,pleks 'plān }

complex potential [FL MECH] An analytic function in ideal aerodynamics whose real part is the velocity potential and whose imaginary part is the stream function. [NUC PHYS] A generalization of the potential in the Schrödinger equation describing the scattering of a nucleon by a nucleus in the cloudy crystal-ball model. { 'käm,pleks pə'ten·chəl }

complex reflector [ENG] A structure or group of structures having many radar-reflecting surfaces facing in different directions. { 'käm,pleks ri'flek·tər }

complex relative attenuation [ELECTR] The ratio of the peak output voltage, in complex notation, of an electric filter to the output voltage at the frequency being considered. { 'käm,pleks ¦rel·əd·iv ə,ten·yə'wā·shən }

complex salt [INORG CHEM] A class of salts in which there are no detectable quantities of each of the metal ions existing in solution; an example is $K_3Fe(CN)_6$, which in solution has K^+ but no Fe^{3+} because Fe is strongly bound in the complex ion, $Fe(CN)_6^{3-}$. { 'käm,pleks 'sôlt }

complex sphere *See* Riemann sphere. { 'käm,pleks 'sfir }

complex target [ENG] A radar target composed of a number of reflecting surfaces that, in the aggregate, are smaller in all dimensions than the resolution capabilities of the radar. { 'käm,pleks 'tär·gət }

complex tombolo [GEOL] A system resulting when several islands and the mainland are interconnected by a complex series of tombolos. Also known as tòmbolo cluster; tombolo series. { 'käm,pleks 'täm·bə,lō }

complex tone [ACOUS] A sound wave produced by the combination of simple sinusoidal components of different frequencies. { 'käm,pleks 'tōn }

complex unit [MATH] Any complex number, $x + iy$, whose absolute value, $\sqrt{(x^2 + y^2)}$, equals 1. { 'käm,pleks 'yü·nət }

complex variable [MATH] A variable which assumes complex numbers for values. { 'käm,pleks 'ver·ē·ə·bəl }

complex velocity [FL MECH] In ideal aerodynamic flow, the derivative of the complex potential with respect to $z = x + iy$, where x and y are the chosen coordinates. { 'käm,pleks və'läs·əd·ē }

complex wave [PHYS] A waveform which varies from instant to instant, but can be resolved into a number of sine-wave components, each of a different frequency and probably of a different amplitude. { 'käm,pleks 'wāv }

compliance [MECH] The displacement of a linear mechanical system under a unit force. { kəm'plī·əns }

compliance constant [MECH] Any one of the coefficients of the relations in the generalized Hooke's law used to express strain components as linear functions of the stress components. Also known as elastic constant. { kəm'plī·əns ,kän·stənt }

compliant character [PSYCH] In psychoanalytic theory, traits that include neurotic self-effacement, deference, and inappropriate yielding to another person. { kəm¦plī·ənt 'kar·ik·tər }

compliant substrate [ELECTR] A semiconductor substrate into which an artificially formed interface is introduced near the surface which makes the substrate more readily deformable and allows it to support a defect-free semiconductor film of essentially any lattice constant, with dislocations forming in the substrate instead of in the film. Also known as sacrificial compliant substrate. { kəm¦plī·ənt 'səb,strāt }

complicate [INV ZOO] Folded lengthwise several times, as applied to insect wings. { 'käm·plə,kāt }

compo board *See* composition board. { 'käm,pō ,bōrd }

compole *See* commutating pole. { 'käm,pōl }

component [CHEM] **1.** A part of a mixture. **2.** The smallest number of chemical substances which are able to form all the constituents of a system in whatever proportion they may be present. [ELEC] Any electric device, such as a coil, resistor, capacitor, generator, line, or electron tube, having distinct electrical characteristics and having terminals at which it may be connected to other components to form a circuit. Also known as circuit element; element. [MATH] **1.** In a graph system, a connected subgraph which is not a subgraph of any other connected subgraph. **2.** For a set S, a connected subset of S that is not a subset of any other connected subset of S. **3.** The projection of a vector in a given direction of a coordinate system. [SCI TECH] A constituent part of a system; examples are a vector term which when added to others gives a vector sum, an ingredient of a chemical system, or the mineral portion of a rock. { kəm'pō·nənt }

component bar chart [STAT] A bar chart which shows within each bar the components that make up the bar; each component is represented by a section proportional in size to its representation in the total of each bar. { kəm¦pō·nənt 'bär ,chärt }

component distillation [CHEM ENG] A distillation process in which a fraction that cannot normally be separated by distillation is removed by forming an azeotropic mixture. { kəm'pō·nənt dis·tə'lā·shən }

component-failure-impact analysis [SYS ENG] A study that attempts to predict the consequences of failures of the major components of a system. Abbreviated CFIA. { kəm¦pō·nənt ¦fāl·yər 'im,pakt ə,nal·ə·səs }

component name *See* metavariable. { kəm'pō·nənt ,nām }

component-substances law [CHEM] The law that each substance, singly or in mixture, composing a material exhibits specific properties that are independent of the other substances in that material. { kəm'pō·nənt 'sub·stən·səs ,lò }

component symbol [ELEC] A graphical design used to represent a component in a circuit diagram. { kəm'pō·nənt ,sim·bəl }

component vectors [MATH] Vectors parallel to specified (usually perpendicular) axes whose sum equals a given vector. { kəm'pō·nənt ,vek·tərz }

composing rule *See* composing stick. { kəm'pōz·iŋ ,rül }

composing stick [GRAPHICS] A tool designed for holding type which is being assembled and justified. { kəm'pōz·iŋ ,stik }

Compositae [BOT] The single family of the order Asterales; perhaps the largest family of flowering plants, it contains about 19,000 species. { kəm'päz·ə,tē }

composite [ENG ACOUS] A re-recording consisting of at least two elements. [MATER] A material that results when two or more materials, each having its own, usually different characteristics, are combined, giving useful properties for specific applications. Also known as composite material. { kəm'päz·ət }

composite balance [ELEC] An electric balance made by modifying the Kelvin balance to measure amperage, voltage, or wattage. { kəm'päz·ət 'bal·əns }

composite beam [CIV ENG] A structural member composed of two or more dissimilar materials joined together to act as a unit in which the resulting system is stronger than the sum of its parts. An example in civil structures is the steel-concrete composite beam in which a steel wide-flange shape (I or W shape) is attached to a concrete floor slab. { kəm'päz·ət 'bēm }

as those of calcium or magnesium, which form insoluble deposits in boilers and form precipitates with soap. { 'härd ¦wȯd·ər }

Hardwick conveyor loader head [MIN ENG] A dust collector for belt conveyors used at the loading station; a scraper chain runs at the bottom of a coal hopper and collects underbelt fines. { 'härd,wik kən¦vā·ər 'lōd·ər ,hed }

hard-wire [ELEC] To connect electric components with solid, metallic wires as opposed to radio links and the like. { 'härd ¦wīr }

hard-wired [COMPUT SCI] Having a fixed wired program or control system built in by the manufacturer and not subject to change by programming. { 'härd ¦wīrd }

hard-wire telemetry *See* wire-link telemetry. { 'härd ¦wīr tə'lem·ə·trē }

hardwood [MATER] Dense, close-grained wood of an angiospermous tree, such as oak, walnut, cherry, and maple. { 'härd,wůd }

hardwood bearing [MECH ENG] A fluid-film bearing made of lignum vitae which has a natural gum, or of hard maple which is impregnated with oil, grease, or wax. { 'härd,wůd ¦ber·iŋ }

hardwood forest [ECOL] **1.** An ecosystem having deciduous trees as the dominant form of vegetation. **2.** An ecosystem consisting principally of trees that yield hardwood. { 'härd ,wůd ¦fär·əst }

hard x-ray [ELECTR] An x-ray having high penetrating power. { 'härd ¦eks,rā }

Hardy plankton indicator [ENG] Metal-shrouded net sampler designed to collect specimens of plankton during normal passage of a ship. { 'härd·ē 'plaŋk·tən ,in·də,kād·ər }

hardy plant [BOT] A plant able to withstand low temperatures without artificial protection. { ¦härd·ē ¦plant }

Hardy-Schulz rule [PHYS CHEM] An increase in the charge of ions results in a large increase in their flocculating power. { 'härd·ē 'shůlts ,rül }

hardystonite [MINERAL] $Ca_2ZnSi_2O_7$ A white mineral composed of zinc calcium silicate. { 'härd·dē·stə,nīt }

Hardy-Weinberg law [GEN] The concept that frequencies of both genes and genotypes will remain constant from generation to generation in an idealized population where mating is random and evolutionary forces (such as mutation, migration, selection, or genetic drift) are absent. { ¦härd·dē 'wīn,bərg ,lȯ }

hare [VERT ZOO] The common name for a number of lagomorphs in the family Leporidae; they differ from rabbits in being larger with longer ears, legs, and tails. { her }

Hare *See* Lepus. { her }

harelip [MED] A congenital defect, sometimes hereditary, marked by an abnormal cleft between the upper lip and the base of the nose. Also known as cleft lip. { 'her,lip }

Hare's hygrometer [ENG] A type of hydrometer in which the ratio of the densities of two liquids is determined by measuring the heights to which they rise in two vertical glass tubes, connected at their upper ends, when suction is applied. { 'herz hī'gräm·əd·ər }

Hargreaves process [CHEM ENG] A process for the manufacture of salt cake (sodium sulfate) by passing a mixture of sulfur dioxide and air through sodium chloride brine in a countercurrent manner. { 'här·grēvz ,prä·səs }

Haring cell [PHYS CHEM] An electrolytic cell with four electrodes used to measure electrolyte resistance and polarization of electrodes. { 'her·iŋ ,sel }

Harker diagram *See* variation diagram. { 'härk·ər ,dī·ə,gram }

Harker-Kasper inequalities [SOLID STATE] Inequalities used in the analysis of crystal structure by x-ray diffraction which relate the structure factors and help to determine their phase factors. { 'härk·ər 'kas·pər ,in·i'kwäl·əd·ēz }

Harkin's rule [PHYS] An empirical rule for the calculation of the nuclear abundances of an element's isotopes stating that isotopes with an odd mass number are less abundant than their even-mass-number neighbors. { 'här·kənz ,rül }

Harlechian [GEOL] A European stage of geologic time: Lower Cambrian. { här'lek·ē·ən }

HARM *See* high-aspect-ratio micromachining.. { ¦āch¦ā¦är'em *or* härm }

harman [ORG CHEM] $C_{12}H_{10}N_2$ Crystals that melt at 237–238°C; inhibits growth of molds and certain bacteria. Also known as arabine; loturine; passiflorin. { 'här·mən }

harmatan *See* harmattan. { ,här·mə'tan }

harmattan [METEOROL] A dry, dust-bearing wind from the northeast or east which blows in West Africa especially from late November until mid-March; it originates in the Sahara as a desert wind and extends southward to about 5°N in January and 18°N in July. Also spelled harmatan; harmetan; hermitan. { ,här·mə'tan }

harmetan *See* harmattan. { ,här·mə'tan }

harmful interference [COMMUN] Radiation, emission, or induction which endangers the functioning of a radionavigation broadcasting service or of a safety broadcasting service, or obstructs or repeatedly interrupts a radio service operating in accordance with the appropriate regulations. { 'härm·fůl ,int·ə'fir·əns }

harmless-depth theory [MIN ENG] Formerly, the hypothesis that there was a certain depth below which mining could be carried on without risk of damage to the surface. { 'härm·ləs ¦depth ,thē·ə·rē }

harmonic [ACOUS] One of a series of sounds, each of which has a frequency which is an integral multiple of some fundamental frequency. [MATH] A solution of Laplace's equation which is separable in a specified coordinate system. [PHYS] A sinusoidal component of a periodic wave, having a frequency that is an integral multiple of the fundamental frequency. Also known as harmonic component. { här'män·ik }

harmonica bug [ELECTR] A surreptitious interception technique applied to telephone lines; the target instrument is modified so that a tuned relay bypasses the switch hook and ringing circuit when a 500-hertz tone is received; this tone was originally generated by use of a harmonica. { här'män·ə·kə ,bəg }

harmonic analysis [MATH] A study of functions by attempting to represent them as infinite series or integrals which involve functions from some particular well-understood family; it subsumes studying a function via its Fourier series. [PHYS] Any method of identifying and evaluating the harmonics that make up a complex waveform of sound pressure, voltage, current, or some other varying quantity. { här'man·ik ə'nal·ə·səs }

harmonic analyzer [ELECTR] An instrument that measures the strength of each harmonic in a complex wave. Also known as harmonic wave analyzer. { här'man·ik 'an·ə,liz·ər }

harmonic antenna [ELECTROMAG] An antenna whose electrical length is an integral multiple of a half-wavelength at the operating frequency of the transmitter or receiver. { här'män·ik an'ten·ə }

harmonic attenuation [ELECTR] Attenuation of an undesired harmonic component in the output of a transmitter. { här'män·ik ə,ten·yə'wā·shən }

harmonic average *See* harmonic mean. { här,män·ik 'av·rij }

harmonic component *See* harmonic. { här'män·ik kəm'pō·nənt }

harmonic conjugates [MATH] **1.** Two points, P_3 and P_4, that are collinear with two given points, P_1 and P_2, such that P_3 lies in the line segment P_1P_2 while P_4 lies outside it, and, if x_1, x_2, x_3, and x_4 are the abscissas of the points, $(x_3 - x_1)/(x_3 - x_2) = -(x_4 - x_1)/(x_4 - x_2)$. **2.** A pair of harmonic functions, u and v, such that $u + iv$ is an analytic function, or, equivalently, u and v satisfy the Cauchy-Riemann equations. { här'män·ik 'kän·jə·gəts }

harmonic content [PHYS] The components remaining after the fundamental frequency has been removed from a complex wave. { här'män·ik 'kän·tent }

harmonic conversion transducer [ELECTR] A conversion transducer of which the useful output frequency is a multiple or a submultiple of the input frequency. { här'män·ik kən¦vər·zhən tranz,dü·sər }

harmonic decline [PETRO ENG] One of three types of decline in oil or gas production rate (the others are constant-percentage and hyperbolic), in which the nominal decline in production rate per unit of time expressed as a fraction of the production rate is proportional to the production rate itself. { här'män·ik di'klīn }

harmonic detector [ELECTR] Voltmeter circuit so arranged as to measure only a particular harmonic of the fundamental frequency. { här'män·ik di'tek·tər }

harmonic distortion [ELECTR] Nonlinear distortion in which undesired harmonics of a sinusoidal input signal are generated because of circuit nonlinearity. { här'män·ik di'stȯr·shən }

which studies the biological and chemical components of medically useful substances that occur naturally (primarily those synthesized by plants). { ˌfär·məˈkäg·nə·sē }

pharmacokinetics [PHARM] The study of the way that drugs move through the body after they are swallowed or injected. { ˌfär·mə·kō·kiˈned·iks }

pharmacolite [MINERAL] $CaH(AsO_4)\cdot 2H_2O$ A white to grayish monoclinic mineral composed of hydrous acid arsenate of calcium, occurring in fibrous form. { färˈmak·əˌlīt }

pharmacologic pyrogen [PHARM] A naturally occurring pharmacologic agent, such as serotonin or a catecholamine, that controls body temperature; it can cause fever when injected under experimental conditions. { ˌfär·mə·kəˈläj·ik ˈpī·rəˌjən }

pharmacology [CHEM] The science dealing with the nature and properties of drugs, particularly their actions. { ˌfär·məˈkäl·ə·jē }

pharmacophobia [PSYCH] Abnormal fear of medicine. { ˌfär·mə·kəˈfō·bē·ə }

pharmacopoeia [PHARM] A book containing a selected list of medicinal substances and their dosage forms, providing also a description and the standards for purity and strength for each. { ˌfär·məˈpē·ə }

pharmacosiderite [MINERAL] $Fe_3(AsO_4)_2(OH)_3\cdot 5H_2O$ Green or yellowish-green mineral composed of a hydrous basic iron arsenate and commonly found in cubic crystals. Also known as cube ore. { ˌfär·mə·kōˈsīd·əˌrīt }

pharmacotherapy [MED] The treatment of disease by means of drugs. { ˌfär·mə·kōˈther·ə·pē }

pharmacy Also known as pharmaceutics. [MED] **1.** The art and science of the preparation and dispensation of drugs. **2.** A place where drugs are dispensed. { ˈfär·mə·sē }

pharyngeal aponeurosis [ANAT] The fibrous submucous layer of the pharynx. { fəˈrin·jē·əl ˌap·ō·nùˈrō·səs }

pharyngeal bursa [EMBRYO] A small pit caudal to the pharyngeal tonsil, resulting from the ingrowth of epithelium along the course of the degenerating tip of the notochord of the vertebrate embryo. { fəˈrin·jē·əl ˈbər·sə }

pharyngeal cleft [EMBRYO] One of the paired open clefts on the sides of the embryonic pharynx between successive visceral arches in vertebrates. { fəˈrin·jē·əl ˈkleft }

pharyngeal plexus [ANAT] A plexus of veins situated at the side of the pharynx. [NEUROSCI] A nerve plexus innervating the pharynx. { fəˈrin·jē·əl ˈplek·səs }

pharyngeal pouch [EMBRYO] One of the five paired sacculations in the lateral aspect of the pharynx in vertebrate embryos. Also known as visceral pouch. { fəˈrin·jē·əl ˈpauch }

pharyngeal tonsil *See* adenoid. { fəˈrin·jē·əl ˈtän·səl }

pharyngeal tooth [VERT ZOO] A tooth developed on the pharyngeal bone in many fishes. { fəˈrinˊjē·əl ˈtüth }

pharyngitis [MED] Inflammation of the pharynx. { ˌfarˈən'jīd·əs }

Pharyngobdellae [INV ZOO] A family of leeches in the order Arhynchobdellae that is distinguished by the lack of jaws. { fəˌriŋˌgäbˈdelˈəˌdē }

pharyngology [MED] The science of the pharyngeal mechanism, functions, and diseases. { ˌfarˈiŋˈgäl·ə·jē }

pharyngoscope [MED] An instrument for examining the pharynx. { fəˈriŋ·gəˌskōp }

pharyngo-tonsillar diphtheria [MED] A type of diphtheria that is characterized by a sore throat, difficulty in swallowing, and low-grade fever. { fəˌriŋ·gōˌtänsˈəl·ərˈdifˈthir·ē·ə }

pharynx [ANAT] A chamber at the oral end of the vertebrate alimentary canal, leading to the esophagus. { ˈfarˈiŋks }

phase [ASTRON] One of the cyclically repeating appearances of the moon or other orbiting body as seen from earth. [CHEM] Portion of a physical system (liquid, gas, solid) that is homogeneous throughout, has definable boundaries, and can be separated physically from other phases. [MATH] An additive constant in the argument of a trigonometric function. [MET] A constituent of an alloy that is physically distinct and is homogeneous in chemical composition. [PHYS] **1.** The fractional part of a period through which the time variable of a periodic quantity (alternating electric current, vibration) has moved, as measured at any point in time from an arbitrary time origin; usually expressed in terms of angular measure, with one period being equal to 360° or 2π radians. **2.** For a sinusoidally varying quantity, the phase (first definition) with the time origin located at the last point at which the quantity passed through a zero position from a negative to a positive direction. **3.** The argument of the trigonometric function describing the space and time variation of a sinusoidal disturbance, $y = A \cos [(2\pi/\lambda)(x - vt)]$, where x and t are the space and time coordinates, v is the velocity of propagation, and λ is the wavelength. [THERMO] The type of state of a system, such as solid, liquid, or gas. { fāz }

phase advancer [ELEC] Phase modifier which supplies leading reactive volt-amperes to the system to which it is connected; may be either synchronous or asynchronous. { ˈfāz adˌvan·sər }

phase age *See* age of phase inequality. { ˈfāz ˌāj }

phase-alternation line system [COMMUN] A color television system used in Europe, in which the phase of the color subcarrier is changed from scanning line to scanning line, requiring transmission of a line switching signal as well as a color burst. Abbreviated PAL system. { ˈfāz ˌōl·tərˈnā·shən ˌlīn ˌsis·təm }

phase angle [PHYS] The difference between the phase of a sinusoidally varying quantity and the phase of a second quantity which varies sinusoidally at the same frequency. Also known as phase difference. { ˈfāz ˌaŋ·gəl }

phase-angle meter *See* phase meter. { ˈfāz ˈaŋ·gəl ˌmēd·ər }

phase-balance relay [ELEC] Relay which functions by reason of a difference between two quantities associated with different phases of a polyphase circuit. { ˈfāz ˈbal·ənsˈrēˌlā }

phase behavior [PETRO ENG] The equilibrium relationships between water, liquid hydrocarbons, and dissolved or free gas, either in reservoirs or as liquids and gases are separated above ground in gas-oil separator systems. { ˈfāz biˌhāv·yər }

phase boundary [PHYS] The interface between two or more separate phases, such as liquid-gas, liquid-solid, gas-solid, or, for immiscible materials, liquid-liquid or solid-solid. { ˈfāz ˌbaůn·drē }

phase change [PHYS] **1.** The metamorphosis of a material or mixture from one phase to another, such as gas to liquid, solid to gas. **2.** *See* phase shift. { ˈfāz ˌchānj }

phase-change coefficient *See* phase constant. { ˈfāz ˌchānj ˌkō·iˌfish·ənt }

phase-change material [ENG] A material which is used to store the latent heat absorbed in the material during a phase transition. { ˈfāz ˌchānj məˌtir·ē·əl }

phase-change recording [COMPUT SCI] An optical recording technique that uses a laser to alter the crystalline structure of a metallic surface to create bits that reflect or absorb light when they are illuminated during the read operation. { ˈfāz ˌchānj riˈkȯrd·iŋ }

phase coherence [PHYS] The existence of a statistical or time coherence between the phases of two or more waves. { ˈfāz kōˌhir·ənsˈ }

phase comparator [COMPUT SCI] A comparator that accepts two radio-frequency input signals of the same frequency and provides two video outputs which are proportional, respectively, to the sine and cosine of the phase difference between the two inputs. { ˈfāz kəmˌpar·əd·ər }

phase-comparison relaying [ELEC] A method of detecting faults in an electric power system in which signals are transmitted from each of two terminals every half cycle so that a continuous signal is received at an intermediate point if there is no fault between the terminals, while a periodic signal is received if there is a fault. { ˈfāz kəmˌpar·ə·sən ˈrēˌlā·iŋ }

phase conductor [ELEC] In a polyphase circuit, any conductor other than the neutral conductor. { ˈfāz kənˌdək·tər }

phase-conjugate system [OPTICS] An adaptive optics system in which the wavefront to be corrected is measured directly, using either a geometric or interferometric test. { ˈfāz ˈkänˌjə·gətˌsis·təm }

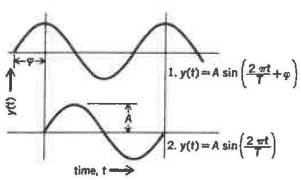
phase constant [ELECTROMAG] A rating for a line or medium through which a plane wave of a given frequency is being transmitted; it is the imaginary part of the propagation constant, and is the space rate of decrease of phase of a field component (or of the voltage or current) in the direction of propagation, in radians per unit length. Also known as phase-change coefficient; wavelength constant. { ˈfāz ˌkän·stənt }

phase-contrast microscope [OPTICS] A compound microscope that has an annular diaphragm in the front focal plane of the substage condenser and a phase plate at the rear focal plane of the objective, to make visible differences in phase or

PHARYNGOBDELLAE

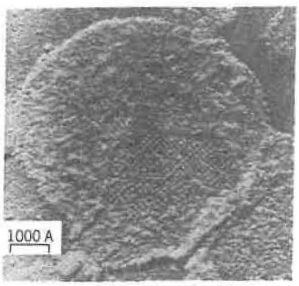
Dorsal and ventral view of *Erpobdella punctata*, a jawless leech common in lakes and streams in the Northern Hemisphere.

PHASE ANGLE



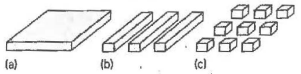
An illustration of the meaning of phase for a sinusoidal wave, $y(t)$. The difference in phase between waves 1 and 2 is φ and is called the phase angle. For each wave, A is the amplitude and T is the period.

QUANTASOME



Membranes containing chlorophyll taken from a spinach chloroplast. This chromium-shadowed preparation shows that the membrane is composed of a highly ordered array of units, or quantasomes. Scale bar is 1000 angstroms. (*After R. B. Park, courtesy of Science, 144 (3621), 1964*)

QUANTIZED ELECTRONIC STRUCTURE



Geometric configurations of quantized electronic structures: (*a*) quantum well; (*b*) quantum wires; (*c*) quantum dots.

quantal response [STAT] Response to treatment which has only two outcomes, all or none. { 'kwänt·əl ri,späns }

quantasome [CYTOL] One of the highly ordered array of units that has a "cobblestone" appearance in electron micrographs of the lamella of chloroplasts, and thought to be the most probable site of the light reaction in photosynthesis. { 'kwän·tə,sōm }

quantic [MATH] A homogeneous algebraic polynomial with more than one variable. { 'kwän·tik }

quantification [SCI TECH] The act of quantifying, that is, of giving a numerical value to a measurement of something, as in computer applications, psychology, or market research. { ,kwän·tə·fə'kā·shən }

quantifier [MATH] Either of the phrases "for all" and "there exists"; these are symbolized respectively by an inverted A and a backward E. { 'kwän·tə,fī·ər }

quantile [STAT] A value which divides a set of data into equal proportions; examples are quartile and decile. { 'kwän,tīl }

quantitative analysis [ANALY CHEM] The analysis of a gas, liquid, or solid sample or mixture to determine the precise percentage composition of the sample in terms of elements, radicals, or compounds. { 'kwän·ə·tād·iv ə'nal·ə·səs }

quantitative genetics [GEN] The study of continuously varying traits, such as height or milk yield. { 'kwän·ə·tād·iv jə'ned·iks }

quantitative geomorphology [GEOL] The assignment of dimensions of mass, length, and time to all descriptive parameters of landform geometry and geomorphic processes, followed by the derivation of empirical mathematical relationships and formulation of rational mathematical models relating these parameters. { 'kwän·ə·tād·iv ˌjē·ō·mȯr'fäl·ə·jē }

quantitative inheritance [GEN] The acquisition of characteristics which show a quantitative and continuous type of variation. { 'kwän·ə·tād·iv in'her·əd·ənts }

quantitative structure-activity relationships [BIOCHEM] The establishment of statistical correlations between the potencies of a series of structurally related compounds and one or more quantitative structural parameters, such as lipophilicity, polarity, and molecular size, by using multilinear regression analysis. { 'kwän·ə,tād·iv ˌstrək·chər ak'tiv·əd·ē ri'lā·shən,ships }

quantitative trait [GEN] A trait that is under the control of many factors, both genetic and environmental, each of which contributes only a small amount to the total variability of the trait. { ,kwänt·ə,tād·iv 'trāt }

quantitative trait locus [GEN] The location of a gene that affects a quantitative trait. { ,kwänt·ə,tād·iv ˌtrāt 'lō·kəs }

quantity [COMPUT SCI] In computers, a positive or negative real number in the mathematical sense; the term quantity is preferred to the term number in referring to numerical data; the term number is used in the sense of natural number and reserved for "the number of digits," the "number of operations," and so forth. [MATH] Any expression which is concerned with value rather than relations. { 'kwän·əd·ē }

quantity-distance tables [ORD] The regulations pertaining to the amounts and kinds of explosives that can be stored and the proximity of such storage to buildings, highways, railways, magazines, or other installations. { 'kwän·əd·ē 'dis·təns ,tā·bəlz }

quantity meter [ENG] A type of fluid meter used to measure volume of flow. { 'kwän·əd·ē ,mēd·ər }

quantity of electricity *See* charge. { 'kwän·əd·ē əv ,i,lek'tris·əd·ē }

quantization [COMMUN] Division of the range of values of a wave into a finite number of subranges, each of which is represented by an assigned or quantized value within the subrange. [QUANT MECH] **1.** The restriction of an observable quantity, such as energy or angular momentum, associated with a physical system, such as an atom, molecule, or elementary particle, to a discrete set of values. **2.** The transition from a description of a system of particles or fields in the classical approximation where canonically conjugate variables commute, to a description where these variables are treated as noncommuting operators; quantization (first definition) is a result of this procedure. [SCI TECH] The restriction of a variable to a discrete number of possible values; thus the age of a person is usually quantized as a whole number of years. { ,kwän·tə'zā·shən }

quantization distortion [COMMUN] Inherent distortion introduced in the process of quantization of a waveform. Also known as quantization noise; quantumization distortion; quantumization noise. { ,kwän·tə'zā·shən di,stȯr·shən }

quantization level [COMMUN] Discrete value of the output designating a particular subrange of the input. { ,kwän·tə'zā·shən ,lev·əl }

quantization noise *See* quantization distortion. { ,kwän·tə'zā·shən ,nȯiz }

quantized electronic structure [ELECTR] A material that confines electrons in such a small space that their wave-like behavior becomes important and their properties are strongly modified by quantum-mechanical effects. { ˌkwän,tīzd i·lek·ˌträn·ik 'strək·chər }

quantized frequency modulation [COMMUN] Frequency modulation that involves quantization; it uses time and frequency redundancy within a voice frequency channel during each transmitted symbol; used to combat distortion due to multipath, selection fading, and noise spikes. { 'kwän,tīzd 'frē·kwən·sē ,mäj·ə,lā·shən }

quantized Hall conductance [PHYS] The reciprocal of the von Klitzing constant, equal to e^2/h, where e is the charge of the electron and h is Planck's constant. { ˌkwän,tīzd 'hȯl kən,dək·təns }

quantized Hall resistance *See* von Klitzing constant. { ˌkwän,tīzd 'hȯl ri,zis·təns }

quantized pulse modulation [COMMUN] Pulse modulation that involves quantization, such as pulse-numbers modulation and pulse-code modulation. { 'kwän,tīzd 'pəls ,mäj·ə,lā·shən }

quantized Rabi oscillations [ATOM PHYS] Rabi oscillations that occur when only a small number of photons are present at discrete frequencies determined by the number of photons. { ˌkwän,tīzd 'rä·bē ˌäs·ə,lā·shənz }

quantized spin wave *See* magnon. { 'kwän,tīzd 'spin ,wāv }

quantized vortex [CRYO] A circular flow pattern observed in superfluid helium and type II superconductors, in which a superfluid flows about a normal (nonsuperfluid) cylindrical region or core which has the form of a thin line, and either the circulation or the magnetic flux is quantized. { 'kwän,tīzd 'vȯr,teks }

quantizer [ELECTR] A device that measures the magnitude of a time-varying quantity in multiples of some fixed unit, at a specified instant or specified repetition rate, and delivers a proportional response that is usually in pulse code or digital form. { kwän'tīz·ər }

quantum [COMMUN] One of the subranges of possible values of a wave which is specified by quantization and represented by a particular value within the subrange. [QUANT MECH] **1.** For certain physical quantities, a unit such that the values of the quantity are restricted to integral multiples of this unit; for example, the quantum of angular momentum is Planck's constant divided by 2π. **2.** An entity resulting from quantization of a field or wave, having particlelike properties such as energy, mass, momentum and angular momentum; for example, the photon is the quantum of an electromagnetic field, and the phonon is the quantum of a lattice vibration. { 'kwän·təm }

quantum acoustics [ACOUS] The study of the properties of propagating sound waves that are directly attributable to the underlying quantum-mechanical nature of the medium. { 'kwän·təm ə'kü·stiks }

quantum anomaly [QUANT MECH] A phenomenon whereby a quantity that vanishes according to the dynamical rules of classical physics acquires a finite value when quantum rules are used. { ˌkwän·təm ə'näm·ə·lē }

quantum cascade laser [OPTICS] A semiconductor laser whose light is generated by electronic transitions between bound states created by quantum confinement in alternating ultrathin layers of semiconductor material. { ˌkwänt·əm ˌkas,kād 'lā·zər }

quantum chaos [QUANT MECH] The dynamics of quantum systems whose classical counterparts exhibit chaotic behavior. { ˌkwänt·əm 'kā,äs }

quantum chemistry [PHYS CHEM] A branch of physical chemistry concerned with the explanation of chemical phenomena by means of the laws of quantum mechanics. { 'kwän·təm 'kem·ə·strē }

quantum chromodynamics [PART PHYS] A gauge theory of

tiller [BOT] A shoot that develops from an axillary or adventitious bud at the base of a stem. [NAV ARCH] A lever attached to the rudder of a boat or ship and used to turn the rudder from side to side, usually turned by hand in a boat and by mechanical devices in a ship. { 'til·ər }

Tilletiaceae [MYCOL] A family of fungi in the order Ustilaginales in which basidiospores form at the tip of the apibasidium. { tə,lē·shē'ās·ē,ē }

tilleyite [MINERAL] $Ca_5(Si_2O_7)(CO_3)_2$ A white mineral consisting of a carbonate and silicate of calcium. { 'til·ē,īt }

tillite [PETR] A sedimentary rock formed by lithification of till, especially pre-Pleistocene till. { 'ti,līt }

Tillodontia [PALEON] An order of extinct quadrupedal land mammals known from early Cenozoic deposits in the Northern Hemisphere and distinguished by large, rodentlike incisors, blunt-cuspid cheek teeth, and five clawed toes. { ,til·ə'dän·chə }

tilloid [GEOL] A nonglacial till-like deposit. [PETR] A rock of uncertain origin which resembles tillite. { 'ti,lȯid }

till plain [GEOL] An extensive, relatively flat area overlying a till. { 'til ,plān }

till sheet [GEOL] A sheet, layer, or bed of till. { 'til ,shēt }

tilt [AERO ENG] The inclination of an aircraft, winged missile, or the like from the horizontal, measured by reference to the lateral axis or to the longitudinal axis. [ELECTROMAG] **1.** Angle which an antenna forms with the horizontal. **2.** In radar, the angle between the axis of radiation in the vertical plane and a reference axis which is normally the horizontal. [METEOROL] The inclination to the vertical of a significant feature of the circulation (or pressure) pattern or of the field of temperature or moisture; for example, troughs in the westerlies usually display a westward tilt with altitude in the lower and middle troposphere. [OPTICS] The angle between the plane of a photograph from a downward-pointing camera and the horizontal plane. { tilt }

tilt angle [ELECTROMAG] The angle between the axis of radiation of a radar beam in the vertical plane and a reference axis (normally the horizontal). { 'tilt ,aŋ·gəl }

tilt block [GEOL] A tilted fault block. { 'tilt ,bläk }

tilt boundary [SOLID STATE] A boundary between two crystals that differ in orientation by only a few degrees, consisting of a series of edge dislocations; it is formed during polygonization. Also known as bend plane; polygon wall. { 'tilt ,baün·dre }

tilted iceberg [OCEANOGR] A tabular iceberg that has become unbalanced, so that the flat, level top is inclined. { 'til·təd 'īs,bərg }

tilted interface [GEOL] Oil-water interface in which water moves in a generally linear direction under an oil accumulation which is, for instance, in an anticline. { 'til·təd 'in·tər,fās }

tilt error [NAV] The error caused by the propagation of signals over the tilted ionosphere reflecting layer or, in systems requiring reception over two or more widely separated locations, by the different heights of the ionosphere reflecting layer for the various transmissions. { 'tilt ,er·ər }

tilth [GEOL] The physical condition of a soil as expressed in terms of fitness for growth of specified plants or crops. { tilth }

tilting dozer [MECH ENG] A bulldozer whose blade can be pivoted on a horizontal center pin to cut low on either side. { 'tilt·iŋ 'dō·zər }

tilting idlers [MECH ENG] An arrangement of idler rollers in which the top set is mounted on vertical arms which pivot on spindles set low down on the frame of the roller stool. { 'tilt·iŋ 'īd·lərz }

tilting mixer [MECH ENG] A small-batch mixer consisting of a rotating drum which can be tilted to discharge the contents; used for concrete or mortar. { 'tilt·iŋ 'mik·sər }

tilting-type boxcar unloader [CIV ENG] A mechanism that is used to unload material such as grain from a boxcar; the car, with its door open, is held by end clamps on the specialized piece of track and tilted 15% from the vertical and then tilted endwise 40% to the horizontal to discharge the material at one end of the car, and 40% in the opposite direction to discharge the material from the opposite end. { 'tilt·iŋ ¦tīp 'bäks,kär ən'lōd·ər }

tiltmeter [ENG] An instrument used to measure small changes in the tilt of the earth's surface, usually in relation to a liquid-level surface or to the rest position of a pendulum. { 'tilt,mēd·ər }

tilt mold [MET] A mold that rotates from a horizontal to a vertical position during filling to reduce agitation and risk of dross entrapment. { 'tilt ,mōld }

tilt/rotate code [ENG] A code that instructs a "golf ball" printing element which angle of tilt and rotation is needed to print a given character. { 'tilt'rō,tāt ,kōd }

tilt rotor [AERO ENG] An assembly of rapidly rotating blades on a vertical takeoff and landing aircraft, whose plane of rotation can be continuously varied from the horizontal to the vertical, permitting performance as helicopter blades or as propeller blades. { 'tilt ,rōd·ər }

tilt slab construction *See* tilt-up construction. { 'tilt ,slab kən,strək·shən }

tilt-up construction [BUILD] A method for constructing concrete wall panels by casting them horizontally adjacent to their final positions and then tilting them into vertical positions after the concrete has cured. Also known as tilt slab construction. { 'tilt,əp kən,strək·shən }

timber [MATER] Wood used for building, carpentry, or joinery. { 'tim·bər }

timber connector [ENG] A metal fastener that has a series of sharp teeth digging into the wood and is tightened with bolts to join sections of timber in heavy construction. { 'tim·bər kə,nek·tər }

timbered stope [MIN ENG] A stope made of square-set timbering or any of its variations. { 'tim·bərd 'stōp }

timbering [MIN ENG] The timber structure used for supporting the faces of an excavation during the progress of construction. { 'tim·bə·riŋ }

timbering machine [MIN ENG] An electrically driven machine to raise and hold timber in place while the supporting posts are being set, the posts having been cut to desired length previously by the machine's power-driven saw. { 'tim·bə·riŋ mə,shēn }

timberline [ECOL] The elevation or latitudinal limits for arboreal growth. Also known as tree line. { 'tim·bər,līn }

timber mat [MIN ENG] Broken timber forming the roof of an ore deposit that is being extracted by a caving method, such as top slicing. { 'tim·bər 'mat }

timber packer *See* pack builder. { 'tim·bər ,pak·ər }

timber puller [MIN ENG] A machine used to remove the timber supports in a mine. { 'tim·bər ,pùl·ər }

timber trolley [MIN ENG] A carriage consisting of a timber or steel base, mounted on wheels, with U-shaped arms. { 'tim·bər ,träl·ē }

timber truck [MIN ENG] Any truck or car used for hauling timber inside of a mine. { 'tim·bər ,trək }

timbre [ACOUS] That attribute of auditory sensation in terms of which a listener can judge that two sounds similarly presented and having the same loudness and pitch are dissimilar. Also known as musical quality; quality of sound. { 'tam·bər }

time [PHYS] **1.** The dimension of the physical universe which, at a given place, orders the sequence of events. **2.** A designated instant in this sequence, as the time of day. Also known as epoch. { tīm }

time-and-altitude azimuth [NAV] In celestial navigation, the azimuth derived by a computation in which meridian angle, declination, and altitude are parameters, the values of which are either known or assumed. { ¦tīm ən 'al·tə,tüd ¦az·ə·məth }

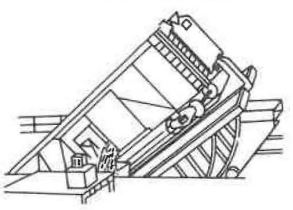
time and material contract [IND ENG] A contract providing for the procurement of supplies or services on the basis of direct labor hours at specified fixed hourly rates (which rates include direct and indirect labor, overhead, and profit), and material at cost. { ¦tīm ən mə'tir·ē·əl ,kän,trakt }

time and motion study [IND ENG] Observation, analysis, and measurement of the steps in the performance of a job to determine a standard time for each performance. Also known as time-motion study. { ¦tīm ən 'mō·shən ,stəd·ē }

time assignment speech interpolation [COMMUN] Modulation technique based on the fact that speech is never a continuous stream of information, but consists of a large number of short signals; therefore, the period between the speech signals is used for transmitting other data including additional speech signals. { 'tīm ə¦sīn·mənt 'spēch ,in·tər·pə,lā·shən }

time-average holographic interferometry [OPTICS] The study of holograms of a vibrating surface which have been averaged over time; illumination of such a hologram yields an image of the surface on which are superimposed interference fringes which are contour lines of equal displacement of the

TILTING-TYPE BOXCAR UNLOADER



Drawing of a tilting-type unloader. *(Link-Belt Co.)*