

magnetglossary

Magnetism is a broad and well-researched science with a language of its own. Our magnet glossary, culled from respected resources around the internet, is your one-stop shop for clear definitions of key magnet terminology. Bookmark it or print it out and keep it close to help when you get stumped by a particularly tricky term – soon you'll be speaking 'magnet' with the best of them!

air gap: An external space or distance between the two poles of a magnetic circuit, through air (most common) or through another non-magnetic material (paint, paper, plastic, etc.), which usually weakens the magnetic force.

alloy: A mixture composed of at least two elements, one of which is a metal.

alnico: An acronym that refers to a group of iron alloys that are comprised mostly of aluminum, nickel, and cobalt (AL + NI + CO).

alternating current (A.C.): An electric current (made up of electrons) running through a circuit, that periodically, but at regular intervals, reverses its direction of movement.

ammeter: A tool that measures the number of electrons moving per second past a specific point in a wire.

ampere (amp): A basic unit that measures electric current.

anisotropic material: A material that has different properties depending on the direction of magnetization. Many magnetic materials, including neodymium and samarium cobalt, have a preferred direction of magnetization.

anneal: A process by which a metal (including magnetic material) is heated, which ensures that it cools slowly, allowing once to change the metal's physical, and sometimes chemical, properties.

antiferromagnetism: Occurring at or below the Neel temperature, a type of magnetism in which the magnetic domains align to form a regular pattern but neighboring, opposing spins.

atom: The smallest unit of matter. (The smallest portion of a chemical element having all the properties of that element.) An atom consists of a center (nucleus) made from protons and neutrons. Electrons (negatively charged particles) surround the nucleus.

attract/attraction: The action of pulling toward or sticking to.

battery: A group of connected cells.

brushes: Wires from a battery that touch the armature of a motor to conduct current between rotating and fixed parts of a generator or motor.

cell: A single electrochemical unit such as a cylindrical flashlight battery. Typically a non-rechargeable alkaline dry cell, batteries convert chemical energy directly into electrical energy.

ceramic magnets: Man-made magnets made of barium or strontium ferrite. They are black in color, very difficult to demagnetize, readily available, and economical, but they can break or chip easily.

circuit: A closed path along which current flows.

closed circuit: A complete electrical circuit with an endless, uninterrupted path through which current can flow.

coercivity: A measure of energy utilized during the process of demagnetization. It refers to the strength of the reverse magnetic field required for demagnetization of a permanent magnet.

coercive force (H_c): Similar to coercivity, this is the specific demagnetizing force necessary to lower the residual induction (Br) of a fully magnetized magnet to zero.

commutator: A device that reverses the direction of a current at each half rotation to maintain the motor shaft's direction. A commutator switches the electrical connections to a rotating coil so that the side of the coil facing a particular direction is always magnetic north.

compass: A device that indicates direction by means of a small magnet turning on a pivot, which points to the Earth's magnetic north.

conductor: In physics and electrical engineering, a conductor is an object or type of material that allows the flow of an electrical current in one or more directions. A metal wire is a common electrical conductor. In metals such as copper or aluminum, the mobile charged particles are electrons.

core: The body upon which a transformer or coil is wound, such as within an electromagnet.

cow magnet: Cow magnets are used by farmers to trap metal that cows sometimes ingest. A cow swallows the magnet, and it sits in the first compartment of their four-part stomachs, collecting the crazy ferrous things they eat (like nails and barbed wire!)

curie temperature (or Curie point): The temperature at which some materials lose their magnetic properties. Discovered by French physicist Pierre Curie in 1895.

current: A flow of electric charge. In electric circuits, this charge is often carried by moving electrons in a wire. It can also be carried by ions in an electrolyte, or by both ions and electrons, such as in plasma.

deflecting force: The apparent deflection (Coriolis acceleration) of a body in motion with respect to the Earth, as seen by an observer on the Earth, attributed to a fictitious force (Coriolis force) but actually caused by the rotation of the Earth and appearing as a deflection to the right in the Northern Hemisphere and a deflection to the left in the Southern Hemisphere.

demagnetization curve: The specific term for the second (or fourth) quadrant of a major hysteresis loop. The points on this curve are designated by the coordinates B_d and H_d.

demagnetize: The loss or removal of magnetic properties. Also called degauss.

diamagnetic: A term used to describe materials that are of or relating to a class of substances, as bismuth and copper, whose permeability is less than that of a vacuum: in a magnetic field, their induced magnetism is in a direction opposite to that of iron.

direct current (D.C.): The movement of electrons/ions (electric current) in one direction.

dip/dipping needle: An early type of magnetometer—a compass (pivoting needle) suspended at its center of gravity and rotating in a vertical plane.

dipolar: A pair of equal (electric) charges or magnetic poles, slightly separated, that have opposite signs or polarity.

domain: A portion of a ferromagnetic material where the magnetic moments are aligned because of interactions between molecules or atoms.

eddy currents: Electrical currents produced on the surface of metal by a variation in the strength of an electromagnetic field.

electricity: A build-up of energy or flow of electrons.

electromagnet: A type of magnet whose magnetic field is created by the flow of electric current. The magnetic field disappears when the current stops.

electromagnetic coil: An electromagnetic coil is an electrical conductor such as a wire in the shape of a coil, spiral or helix. Electromagnetic coils are used in electrical engineering, in applications where electric currents interact with magnetic fields, in devices such as inductors, electromagnets, transformers, and sensor coils.

electromagnetic/electric wave: A wave produced by the acceleration of an electric charge and propagated by the periodic variation of intensities of, usually, perpendicular electric and magnetic fields.

electromagnetic field: A combination of alternating electric and magnetic fields.

electromagnetic induction: The method by which a current may be made to flow due to a changing magnetic field. Faraday's Law and Lenz's Law are the two laws that explain electromagnetic induction.

electromechanical relay: A signal-actuated switching device that typically is in the form of a multi-turn coil wound on an iron core near an armature with an end-contact that moves.

electron: Negatively charged particles surrounding the nucleus of an atom.

energy: The ability to do work.

energy transfer: A pattern of loss of energy such as the oscillation of two magnetic pendulums.

equilibrium position: A situation where forces are in balance at the midpoint of motion.

Faraday's Law: A basic law of electromagnetism (called electromagnetic induction) discovered by 19th century physicist Michael Faraday. The law predicts how a magnetic field will interact with an electric circuit to produce a voltage/electromotive force.

ferrite: A ceramic compound, containing a mixed oxide of iron and other metals, that is often (but not always) magnetic.

ferromagnetic: A characteristic or property of materials such as iron, cobalt, nickel, and iron alloys that are attracted to a magnet or which can become magnetic.

ferrous: A material/metal that contains iron and is often (but not always) magnetic.

flexible magnets: Pliable, man-made magnets made of a vinyl material mixed with ceramic magnet powder.

flux: The rate of flow of fluid, particles, or energy. Or, a quantity expressing the strength of a field of force in a given area.

flux density: The magnetic, radiant, or electric flux per unit of cross-sectional area.

fluxmeter: Any instrument for measuring magnetic flux, usually by measuring the charge that flows through a coil when the flux changes.

force: A push or pull that can cause or change motion.

fuse: A protective device, used in an electric circuit, containing a conductor that melts under heat produced by an excess current, thereby opening the circuit.

galvanometer: A simple device capable of detecting electrical flow. The galvanometer also has a built-in compass showing the direction of the magnetic field inside the coil.

gauss: (B): A unit of magnetic flux density equal to 1.

gaussmeter: A magnetometer that measures the intensity of a magnetic field, calibrated in gauss.

generator: A rotating machine producing electricity.

gilbert: A unit of magneto motive force.

grade: An assigned rating, based on strength, for magnetic material.

gradient: The rate of change on distance of a variable quantity, such as temperature or pressure, in the direction of maximum change.

hypothesis: A proposal or tentative guess that often serves as a basis for further investigation.

hysteresis: In a ferromagnetic material; the lag in the response of magnetic induction to changes of magnetic intensity.

hysteresis loop: The magnetic flux generated while the magnetizing force is changed. Specifically, this is a closed curve obtained for a material by plotting (usually to rectangular coordinates) corresponding values of magnetic induction, B, for ordinates and magnetizing force, H, for abscissa when the material is passing through a complete cycle between definite limits of either magnetizing force, H, or magnetic induction, B.

induced magnetism: The process of transforming a piece of unmagnetized magnetic material into magnetic material by touching it or bringing it near the pole of a permanent magnet.

induction: The process by which a current can be induced to flow due to a changing magnetic field.

insulation/insulator: Material such as plastic, glass or porcelain that does not easily conduct electricity. Used to shield shock or to prevent an electrical fire.

intrinsic coercive force (H_{CI}): A term to measure a magnetic material's ability to resist demagnetization. It is equal to the demagnetizing force which reduces the intrinsic induction, B_i, in the material to zero after magnetizing to saturation.

ion: An atom or a molecule in which the total number of electrons is not equal to the total number of protons, giving the atom or molecule a net positive or negative electrical charge. Ions can be created, by either chemical or physical means, via ionization.

iron alloy: A metal compound made mostly of iron mixed with materials such as steel (carbon), chromium, nickel, and/or other materials.

irreversible losses: Partial demagnetization caused by any number of factors, from exposure to high and low temperatures, and to external magnetic fields. Despite the 'irreversible' name, such losses are recoverable through re-magnetization. Magnets can be stabilized against irreversible losses by partial demagnetization induced by temperature cycles or by external magnetic fields.

isotropic: A magnet without a preferred direction of magnetization.

keeper: A ferromagnetic bar made from soft iron or steel which is placed across the poles of a permanent magnet to help preserve the strength of the magnet by completing the magnetic circuit. Keepers also have a useful safety function as they stop external metal being attracted to the magnet. Most magnets do not need a keeper - just those with low coercivity, meaning they are easily susceptible to stray fields, like Alnico.

lead: A short, stripped section of wire coming from an electrical device.

Lenz's Law: The law that states that the direction of current induced in a conductor by a changing magnetic field will be such that it will create a field that opposes the change that produced it. Named after a Russian physicist of Baltic German descent Heinrich Lenz in 1834.

levitation: The process of rising, lifting, or suspending an object in midair.

light emitting diode (LED): A semiconductor employing unidirectional conduction and which emits light when voltage is applied to its terminals.

lodestone: Naturally occurring magnetic iron ore having polarity, such as magnetite.

magnet: An object that attracts other objects made of certain metals (iron, steel, nickel, and cobalt).

magnetic: The capability to be attracted by a magnet or to acquire the properties of a magnet.

magnetic assembly: An assembled device, often designed for a specific application, that combines magnet alloy and non-magnet material, thereby buffering the magnet from mechanical stress and increasing the magnet's strength.

magnetic circuit: A **magnetic circuit** is made up of one or more closed loop paths containing a **magnetic flux**. The flux is usually generated by permanent magnets or electromagnets and confined to the path by **magnetic cores** consisting of ferromagnetic materials like iron, although there may be air gaps or other materials in the path.

magnetic declination: The difference (measured as an angle, which varies from place to place) between true north on a map and the north reading that is indicated by a compass.

magnetic domains: Areas (almost like mini magnets) within a material in which the magnetic fields of atoms are grouped and aligned.

magnetic energy: Magnetic energy is the energy within a magnetic field. This energy results in various metals either repelling or attracting each other.

magnetic field: An invisible area around a magnet in which forces (push and pull) are exerted on ferromagnetic material.

magnetic flux/flux density: The number of magnetic field lines (magnetic flux density) passing through a closed surface (such as a conducting coil).

magnetic lines of force: Curved lines used to represent a magnetic field, drawn such that the number of lines relates to the magnetic field's strength at a given point and the tangent of any curve at a particular point.

magnetic moment: A concept representing individual atoms or molecules behaving like tiny magnets.

magnetic north: The point on the surface of Earth's Northern Hemisphere at which the planet's magnetic field points vertically downwards (in other words, if a magnetic compass needle is allowed to rotate about a horizontal axis, it will point straight down). There is only one location where this occurs, near (but distinct from) the Geographic North Pole. The North Magnetic Pole moves over time due to magnetic changes in the Earth's core.

magnetic poles: The points where a magnet's strength is concentrated including "north" and "south" designations, which refer to how suspended magnets orient along north-south planes. On different magnets, like poles repel each other, opposite poles attract.

Magnetic Resonance Imaging (MRI): A medical imaging technique that utilizes large, tube-shaped magnets and high-frequency radio waves to create detailed images of the body's organs and tissues.

magnetic saturation: The state reached when an increase in applied external magnetic field H cannot increase the magnetization of the material further, so the total magnetic flux density B essentially levels off. (It continues to increase very slowly due to the vacuum permeability.)

magnetically coupled: The occurrence when one object affects the motion of another object, such as with swinging magnetic fields.

magnetite: A black igneous, iron-containing mineral with magnetic properties.

magnetization: The property/characteristic of being magnetic, the degree to which an object has been magnetized, or the process of making a material magnetic (either temporarily or permanently).

magnetosphere: The region surrounding a planet in which the planet's magnetic field, rather than a solar magnetic field, controls the motion of charged particles.

maximum energy product (BH max): The quality index representing both the saturation magnetization and coercivity of a permanent magnet.

maximum operating temperature: The continuous temperature to which the magnet may be exposed with no significant long-range instability or structural changes. Also known as maximum service temperature.

Maxwell: Unit of magnetic flux in the C.G.S. electromagnetic system. One maxwell is one line of magnetic flux.

megagauss-oersteds (MGOe): Mega (million) Gauss Oersteds is the unit of measure used in stating the maximum energy product for a magnet material.

motion: Movement, change in position.

motor: A device that converts the movement of electrons (electricity) into the movement of the other objects (such as a compass needle).

natural magnet: Minerals or metals that occur naturally in the Earth and create a stable magnetic field (permanent magnets) without having their properties altered artificially by humans (for example, lodestone/magnetite).

neodymium: A metallic, rare earth element (symbol Nd) that is the most powerful permanent magnet in the world (and is often combined with iron and boron for this purpose).

neutron: A subatomic particle, symbol n or n^0 , with no net electric charge and a mass slightly larger than that of a proton.

nonpermeable: A material that has the same magnetic permeability as that of free space (no magnetization).

north pole: A magnet's pole that is attracted to the geographic North Pole.

nucleus: The positively charged central core of an atom, consisting of protons and neutrons and containing nearly all its mass.

oersted (H): A unit of measure for magnetizing force. Named for the scientist heralded as the father of electromagnetism, an Oersted is the unit of magnetic field strength in the cgs system. One oersted equals a magnetomotive force of one gilbert per centimeter of flux path.

open circuit: An interrupted electrical circuit in which current does not flow. This is a condition that exists in a magnetized magnet when it is free from any external flux path of high permeability material.

open switch: Position of a switch whereby electricity does not flow. The circuit is open or broken and cannot conduct current.

orientation direction: Also known as “easy axis” or just “axis,” the preferred direction in which some magnets (called oriented or anisotropic magnets) should be magnetized to achieve maximum magnetism. Other magnets, called unoriented or isotropic magnets, can be magnetized in any direction.

oriented (anisotropic) magnet: The preferred and only direction of magnetization for isotropic magnets.

oscillation: A regular back-and-forth movement.

oscillation rate: A measurement (time or simply a count of the number of oscillations) of one complete cycle of back-and-forth movement that occurs before a return to the initial position.

paramagnetic: Materials that are not attracted to magnetic fields (i.e. plastic, wood, or aluminum).
pendulum: A suspended mass that can freely swing under the influence of gravity.

permanent magnet: A magnet alloy that holds its magnetism permanently, unless it is exposed to extremely high temperatures.

permeability: A material’s ability to create magnetic fields within itself.

permeameter: An instrument that measures magnetic permeability (a material’s ability to create internal magnetic fields).

permeance coefficient (Pc): A straight line passing through the origin of the demagnetization curve with a slope of negative B_d/H_d . The permeance coefficient is calculated using the geometric parameters of the magnet or magnetic circuit. The primary purpose of calculating the permeance coefficient is to determine the operating point (B_d , H_d) of the magnet on the normal demagnetization curve. Considering two magnets of identical material grade and pole surface area, the longer of the two will have a greater permeance coefficient and therefore a greater B_d . Also referred to as the shear line, load line, unit permeance, or operating slope.

photon: A quantum (small particle) of electromagnetic radiation or light.

polarity of a magnetized magnet: The North Pole of a magnet is that pole which is attracted to the geographic North Pole. Therefore, the North Pole of a magnet will repel the north-seeking pole of a magnetic compass.

pole: The parts of a magnet that have magnetic strength. There are two poles to every magnet--north and south. Two like poles (north-north or south-south) repel. Two opposite poles (north-south) attract.

pole piece: A structure composed of material of high magnetic permeability (traditionally soft iron) that serves to direct the magnetic field produced by a magnet. A pole piece attaches to and extends a pole of the magnet, hence the name.

power: The amount of energy produced or consumed per unit time.

proton: A subatomic particle, symbol p or p^+ , with a positive electric charge of $+1e$ elementary charge and a mass slightly less than that of a neutron.

pull test: A common, reliable method for determining the strength or breakaway force of a magnet.

rare earth: A term used to describe high-energy magnet material, including neodymium and samarium cobalt.

reach out: The distance a magnetic field extends from the source of the magnetism.

remanence/remnant induction: After an applied magnetizing force is removed, the magnetic induction that stays/remains in a magnetic circuit.

repel/repulsion: Push away.

residual induction Br (or flux density): The magnetic induction corresponding to zero magnetic force in a magnetic material after full magnetization in a closed circuit. Sometimes referred to as flux density. Can be measured in gauss or Tesla.

residual magnetism: The magnetization left behind in a ferromagnetic material (such as iron) after an external magnetic field is removed. Also the measure of that magnetization.

samarium cobalt: A class of rare earth material that is available in both sintered and bonded forms. Samarium Cobalt has an approximate energy product range of 18-33 MGOe and exhibits better temperature stability than Neodymium. series: Batteries connected so that the positive end of one touches the negative end of the next in line.

series circuit: A closed (uninterrupted) electrical circuit with current following in only one path (with no branching of the path).

sintered: A term describing the most common method (powder metallurgy)—in which a mixture of materials is pulverized into a fine powder, compacted, and then heated to become dense—for making magnets. Neodymium, samarium cobalt, and ferrite magnets are produced in this manner.

solenoid: Commonly formed in a cylinder, current flowing through a single coil of wire produces an electromagnet. A solenoid is used to convert electrical energy into mechanical energy.

south pole: The wandering point on the Earth's Southern Hemisphere where the geomagnetic field lines are directed vertically upwards.

static electricity: A stationary electric charge, typically produced by friction, that causes sparks or crackling or the attraction of dust or hair.

temperature coefficient: The factor that describes the reversible changes in magnetic properties due to temperature changes, expressed as the % change per unit of temperature. The magnetic property spontaneously returns when the temperature is cycled to its original point.

temporary magnet: A magnet that is made of a material that does not allow it to hold its magnetism permanently (for example, a nail).

Tesla: A unit of measurement for magnetic induction (flux density). 1 Tesla = 10,000 Gauss.

transformer: An instrument that can increase or decrease (change) an electric current.

true north: North according to the Earth's axis, not magnetic north.

unoriented (isotropic) material: An isotropic magnet without a preferred direction of magnetization.

vibration: An oscillating movement, such as with a pendulum limited by two extreme positions.

volt: A unit of measure for electrical potential, electrical potential difference, and electromotive force. (The difference of potential that is capable of driving one ampere of current against one ohm of resistance.) Named for Italian physicist Alessandro Volta.

voltmeter: A tool that measures the electrical pressure that pushes electrons through wires.

watts: A derived unit of power in the International System of Units (SI), (symbol: W). Named after the Scottish engineer James Watt (1736–1819).

weber: The practical unit of measure for total magnetic flux.