

GLOSSARY

A

absolute humidity a measure of the actual amount of water vapor in the air at a given time—for example, in grams per cubic meter

absolute magnitude a classification scheme to compensate for the distance differences to stars; calculations of the brightness that stars would appear to have if they were at a defined standard distance

absolute zero the theoretical lowest temperature possible, which occurs when all random motion of molecules has ceased

abyssal plain the practically level bottom of the ocean floor

acceleration a change in velocity per change in time; by definition, a change in velocity can result from a change in speed, a change in direction, or a combination of changes in speed and direction

accretion disk a flat bulging disk of gas and dust from the remains of the gas cloud that forms around a protostar

achondrites homogeneously textured stony meteorites

acid any substance that is a proton donor when dissolved in water; generally considered a solution of hydronium ions in water that can neutralize a base, forming a salt and water

acid-base indicator a vegetable dye used to distinguish acid and base solutions by a color change

air mass a large, more or less uniform body of air with nearly the same temperature and moisture conditions throughout

air mass weather the weather experienced within a given air mass; characterized by slow, gradual changes from day to day

alcohol an organic compound with a general formula of ROH, where R is one of the hydrocarbon groups—for example, methyl or ethyl

aldehyde an organic molecule with the general formula RCHO, where R is one of the hydrocarbon groups—for example, methyl or ethyl

alkali metals members of family IA of the periodic table, having common properties of shiny, low-density metals that can be cut

with a knife and that react violently with water to form an alkaline solution

alkaline earth metals members of family IIA of the periodic table, having common properties of soft, reactive metals that are less reactive than alkali metals

alkane a hydrocarbon with a single covalent bond between the carbon atoms

alkene a hydrocarbon with a double covalent carbon-carbon bond

alkyne a hydrocarbon with a carbon-carbon triple bond

allotropic forms elements that can have several different structures with different physical properties—for example, graphite and diamond are two allotropic forms of carbon

alpha particle the nucleus of a helium atom (two protons and two neutrons) emitted as radiation from a decaying heavy nucleus; also known as an alpha ray

alpine glaciers glaciers that form at high elevations in mountainous regions

alternating current an electric current that moves first in one direction, then in the opposite direction with a regular frequency

amino acids organic functional groups that form polypeptides and proteins

amp a unit of electric current; equivalent to C/s

ampere the full name of the unit amp

amplitude the extent of displacement from the equilibrium condition; the size of a wave from the rest (equilibrium) position

angle of incidence the angle of an incident (arriving) ray or particle to a surface; measured from a line perpendicular to the surface (the normal)

angle of reflection the angle of a reflected ray or particle from a surface; measured from a line perpendicular to the surface (the normal)

angular momentum quantum number in the quantum mechanics model of the atom, one of four descriptions of the energy state of an electron wave; this quantum number describes the energy sublevels of electrons within the main energy levels of an atom

angular unconformity a boundary in rock where the bedding planes above and below

the time interruption unconformity are not parallel, meaning probable tilting or folding followed by a significant period of erosion, which in turn was followed by a period of deposition

annular eclipse event that occurs when the penumbra reaches the surface of Earth; as seen from Earth, the Sun forms a bright ring around the disk of the new moon

Antarctic Circle the parallel identifying the limit toward the equator where the Sun appears above the horizon all day for at least one day during the summer; located at 66.5°S latitude

anticline an arch-shaped fold in layered bedrock

anticyclone a high-pressure center with winds flowing away from the center; associated with clear, fair weather

antinode the region of maximum amplitude between adjacent nodes in a standing wave

apogee the point at which the Moon's elliptical orbit takes the Moon farthest from Earth

apparent local noon the instant when the Sun crosses the celestial meridian at any particular longitude

apparent local solar time the time found from the position of the Sun in the sky; the shadow of the gnomon on a sundial

apparent magnitude a classification scheme for different levels of brightness of stars that you see; brightness values range from 1 to 6 with the number 1 (first magnitude) assigned to the brightest star and the number 6 (sixth magnitude) assigned to the faintest star that can be seen

apparent solar day the interval between two consecutive crossings of the celestial meridian by the Sun

aquifer a layer of sand, gravel, or other highly permeable material beneath the surface that is saturated with water and is capable of producing water in a well or spring

Archean a block of time of 4,000 to 2,500 million years before the present; one of three Precambrian eons before the time of visible life

Arctic Circle the parallel identifying the limit toward the equator where the Sun

appears above the horizon all day for at least one day up to six months during the summer; located at 66.5°N latitude

area the extent of a surface

arid the dry climate classification; receives less than 25 cm (10 in) precipitation per year

aromatic hydrocarbon an organic compound with at least one benzene ring structure; cyclic hydrocarbons and their derivatives

artesian the term describing the condition where confining pressure forces groundwater from a well to rise above the aquifer

asteroids small rocky bodies left over from the formation of the solar system; most are accumulated in a zone between the orbits of Mars and Jupiter

asthenosphere a plastic, mobile layer of Earth's structure that extends around Earth below the lithosphere; ranges in thickness from a depth of 130 km to 160 km

astronomical unit the radius of Earth's orbit is defined as one astronomical unit (AU)

atmospheric stability the condition of the atmosphere related to the temperature of the air at increasing altitude compared to the temperature of a rising parcel of air at increasing altitude

atom the smallest unit of an element that can exist alone or in combination with other elements

atomic mass unit the relative mass unit (u) of an isotope based on the standard of the carbon-12 isotope, which is defined as a mass of exactly 12.00 u; one atomic mass unit (1 u) is 1/12 the mass of a carbon-12 atom

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

atomic weight the weighted average of the masses of stable isotopes of an element as they occur in nature, based on the abundance of each isotope of the element and the atomic mass of the isotope compared to C-12

autumnal equinox one of two times a year that daylight and night are of equal length; occurs on or about September 23 and identifies the beginning of the fall season

avalanche a mass movement of a wide variety of materials such as rocks, snow, trees, soils, and so forth in a single chaotic flow; also called debris avalanche

Avogadro's number the number of C-12 atoms in exactly 12.00 g of C; 6.02×10^{23} atoms or other chemical units; the number of chemical units in 1 mole of a substance

axis the imaginary line about which a planet or other object rotates

B

background radiation ionizing radiation (alpha, beta, gamma, etc.) from natural sources; between 100 and 500 millirems/yr of exposure to natural radioactivity from the environment

Balmer series a set of four line spectra, narrow lines of color emitted by hydrogen atom electrons as they drop from excited states to the ground state

band of stability a region of a graph of the number of neutrons versus the number of protons in nuclei; nuclei that have the neutron-to-proton ratios located in this band do not undergo radioactive decay

barometer an instrument that measures atmospheric pressure, used in weather forecasting and in determining elevation above sea level

base any substance that is a proton acceptor when dissolved in water; generally considered a solution that forms hydroxide ions in water that can neutralize an acid, forming a salt and water

basin a large, bowl-shaped fold in the land into which streams drain; also a small enclosed or partly enclosed body of water

batholith a large volume of magma that has cooled and solidified below the surface, forming a large mass of intrusive rock

beat rhythmic increases and decreases of volume from constructive and destructive interference between two sound waves of slightly different frequencies

beta particle a high-energy electron emitted as ionizing radiation from a decaying nucleus; also known as a beta ray

big bang theory the current model of galactic evolution in which the universe was created from an intense and brilliant explosion from a primeval fireball

binding energy the energy required to break a nucleus into its constituent protons and neutrons; also the energy equivalent released when a nucleus is formed

black hole the theoretical remaining core of a supernova that is so dense that even light cannot escape

blackbody radiation the electromagnetic radiation emitted by an ideal material (the blackbody) that perfectly absorbs and perfectly emits radiation

body wave a seismic wave that travels through Earth's interior, spreading outward from a disturbance in all directions

Bohr model a model of the structure of the atom that attempted to correct the deficiencies of the solar system model and account for the Balmer series

boiling point the temperature at which a phase change of liquid to gas takes place

through boiling; the same temperature as the condensation point

boundary the division between two regions of differing physical properties

Bowen's reaction series a crystallization series that occurs as a result of the different freezing point temperatures of various minerals present in magma

breaker a wave whose front has become so steep that the top part has broken forward of the wave, breaking into foam, especially against a shoreline

British thermal unit the amount of energy or heat needed to increase the temperature of 1 pound of water 1 degree Fahrenheit (abbreviated Btu)

C

calorie the amount of energy (or heat) needed to increase the temperature of 1 gram of water 1 degree Celsius

Calorie the dieter's "calorie"; equivalent to 1 kilocalorie

carbohydrates organic compounds that include sugars, starches, and cellulose; carbohydrates are used by plants and animals for structure, protection, and food

carbon film a type of fossil formed when the volatile and gaseous constituents of a buried organic structure are distilled away, leaving a carbon film as a record

carbonation in chemical weathering a reaction that occurs naturally between carbonic acid (H₂CO₃) and rock minerals

cast sediments deposited by groundwater in a mold, taking the shape and external features of the organism that was removed to form the mold, then gradually changing to sedimentary rock

cathode rays negatively charged particles (electrons) that are emitted from a negative terminal in an evacuated glass tube

celestial equator the line of the equator of Earth directly above Earth; the equator of Earth projected on the celestial sphere

celestial meridian an imaginary line in the sky directly above you that runs north through the north celestial pole, south through the south celestial pole, and back around the other side to make a big circle around Earth

celestial sphere a coordinate system of lines used to locate objects in the sky by imagining a huge turning sphere surrounding Earth with the stars and other objects attached to the sphere; the latitude and longitude lines of Earth's surface are projected to the celestial sphere

cellulose a polysaccharide abundant in plants that forms the fibers in cell walls that preserve the structure of plant materials

- Celsius scale** the referent scale that defines numerical values for measuring hotness or coldness, defined as degrees of temperature; based on the reference points of the freezing point of water and the boiling point of water at sea-level pressure, with 100 degrees between the two points
- cementation** a process by which spaces between buried sediment particles under compaction are filled with binding chemical deposits, binding the particles into a rigid, cohesive mass of a sedimentary rock
- Cenozoic** one of four geologic eras; the time of recent life, meaning the fossils of this era are identical to the life found on Earth today
- centigrade** an alternate name for the Celsius scale
- centrifugal force** an apparent outward force on an object following a circular path that is a consequence of the third law of motion
- centripetal force** the force required to pull an object out of its natural straight-line path and into a circular path; centripetal means “center seeking”
- Cepheid variable** a bright variable star that can be used to measure distance
- chain reaction** a self-sustaining reaction where some of the products are able to produce more reactions of the same kind; in a nuclear chain reaction, neutrons are the products that produce more nuclear reactions in a self-sustaining series
- chemical bond** an attractive force that holds atoms together in a compound
- chemical change** a change in which the identity of matter is altered and new substances are formed
- chemical energy** a form of energy involved in chemical reactions associated with changes in internal potential energy; a kind of potential energy that is stored and later released during a chemical reaction
- chemical equation** a concise way of describing what happens in a chemical reaction
- chemical equilibrium** occurs when two opposing reactions happen at the same time and at the same rate
- chemical reaction** a change in matter where different chemical substances are created by forming or breaking chemical bonds
- chemical sediments** ions from rock materials that have been removed from solution—for example, carbonate ions removed by crystallization or organisms to form calcium carbonate chemical sediments
- chemical weathering** the breakdown of minerals in rocks by chemical reactions with water, gases of the atmosphere, or solutions
- chemistry** the science concerned with the study of the composition, structure, and properties of substances and the transformations they undergo
- Chinook** a warm wind that has been warmed by compression; also called Santa Ana
- chondrites** a subdivision of stony meteorites containing small, spherical lumps of silicate minerals or glass
- chondrules** small, spherical lumps of silicate minerals or glass found in some meteorites
- cinder cone volcano** a volcanic cone that formed from cinders, sharp-edged rock fragments that cooled from frothy blobs of lava as they were thrown into the air
- cirque** a bowl-like depression in the side of a mountain, usually at the upper end of a mountain valley, formed by glacial erosion
- clastic sediments** weathered rock fragments that are in various states of being broken down from solid bedrock; boulders, gravel, sand, and silt
- climate** the general pattern of weather that occurs in a region over a number of years
- climate change** a departure from the expected average pattern of climate for a region over time
- coalescence process (meteorology)** the process by which large raindrops form from the merging and uniting of millions of tiny water droplets
- cold front** the front that is formed as a cold air mass moves into warmer air
- combination reaction** a chemical reaction in which two or more substances combine to form a single compound
- comets** celestial objects originating from the outer edges of the solar system that move about the Sun in highly elliptical orbits; solar heating and pressure from the solar wind form a tail on the comet that points away from the Sun
- compaction** the process of pressure from a depth of overlying sediments squeezing the deeper sediments together and squeezing water out
- composite volcano** a volcanic cone that formed from a buildup of alternating layers of cinders, ash, and lava flows
- compound** a pure chemical substance that can be decomposed by a chemical change into simpler substances with a fixed mass ratio
- compressive stress** a force that tends to compress the surface as Earth’s plates move into one another
- concentration** an arbitrary description of the relative amounts of solute and solvent in a solution; a larger amount of solute makes a concentrated solution, and a small amount of solute makes a dilute concentration
- condensation (sound)** a compression of gas molecules; a pulse of increased density and pressure that moves through the air at the speed of sound
- condensation (water vapor)** where more vapor or gas molecules are returning to the liquid state than are evaporating
- condensation nuclei** tiny particles such as tiny dust, smoke, soot, and salt crystals that are suspended in the air on which water condenses
- condensation point** the temperature at which a gas or vapor changes back to a liquid
- conduction** the transfer of heat from a region of higher temperature to a region of lower temperature by increased kinetic energy moving from molecule to molecule
- consistent law principle** one of two basic principles of the special theory of relativity; the laws of physics are the same in all reference frames that move at a constant velocity with respect to one another
- constancy of speed** one of two basic principles of the special theory of relativity; the speed of light in empty space has the same value for all observers regardless of their velocity
- constructive interference** the condition in which two waves arriving at the same place, at the same time and in phase, add amplitudes to create a new wave
- continental air mass** a dry air mass that forms over a large land area
- continental climate** a climate influenced by air masses from large land areas; hot summers and cold winters
- continental drift** a concept that continents shift positions on Earth’s surface, moving across the surface rather than being fixed, stationary landmasses
- continental glaciers** glaciers that cover a large area of a continent, for example, Greenland and the Antarctic
- continental shelf** a feature of the ocean floor; the flooded margins of the continents that form a zone of relatively shallow water adjacent to the continents
- continental slope** a feature of the ocean floor; a steep slope forming the transition between the continental shelf and the deep ocean basin
- control rods** rods inserted between fuel rods in a nuclear reactor to absorb neutrons and thus control the rate of the nuclear chain reaction
- controlled experiment** an experiment that allows for a comparison of two events that are identical in all but one respect
- convection** the transfer of heat from a region of higher temperature to a region of lower temperature by the displacement of high-energy molecules—for example, the displacement of warmer, less dense air (higher kinetic energy) by cooler, denser air (lower kinetic energy)
- convection cell** a complete convective circulation pattern; also, slowly turning regions in the plastic asthenosphere that might drive the motion of plate tectonics

convection zone (of a star) a part of the interior of a star according to a model; the region directly above the radiation zone where gases are heated by the radiation zone below and move upward by convection to the surface, where they emit energy in the form of visible light, ultraviolet radiation, and infrared radiation

conventional current opposite to electron current—that is, considers an electric current to consist of a drift of positive charges that flow from the positive terminal to the negative terminal of a battery

convergent boundaries boundaries that occur between two plates moving toward each other

Copernican system heliocentric, or Sun-centered solar system model developed by Nicholas Copernicus in 1543

core (of Earth) the center part of Earth, which consists of a solid inner part and liquid outer part, making up about 15 percent of Earth's total volume and about one-third of its mass

core (of a star) a dense, very hot region of a star where nuclear fusion reactions release gamma and X-ray radiation

Coriolis effect the apparent deflection due to the rotation of Earth; it is to the right in the Northern Hemisphere

correlation the determination of the equivalence in geologic age by comparing the rocks in two separate locations

coulomb the unit used to measure quantity of electric charge; equivalent to the charge resulting from the transfer of 6.24 billion billion particles such as the electron

Coulomb's law a relationship between charge, distance, and magnitude of the electrical force between two bodies

covalent bond a chemical bond formed by the sharing of a pair of electrons

covalent compound a chemical compound held together by a covalent bond or bonds

creep the slow downhill movement of soil down a steep slope

crest the high mound of water that is part of a wave; also refers to the condensation, or high-pressure part, of a sound wave

critical angle limit to the angle of incidence when all light rays are reflected internally

critical mass mass of fissionable material needed to sustain a chain reaction

crude oil petroleum pumped from the ground that has not yet been refined into usable products

crust the outermost part of Earth's interior structure; the thin, solid layer of rock that rests on top of the Mohorovicic discontinuity

curie the unit of nuclear activity defined as 3.70×10^{10} nuclear disintegrations per second

cycle a complete vibration

cyclone a low-pressure center where the winds move into the low-pressure center and are forced upward; a low-pressure center with clouds, precipitation, and stormy conditions

D

data measurement information used to describe something

data points points that may be plotted on a graph to represent simultaneous measurements of two related variables

daylight saving time setting clocks ahead one hour during the summer to more effectively utilize the longer days of summer, then setting the clocks back in the fall

decibel scale a nonlinear scale of loudness based on the ratio of the intensity level of a sound to the intensity at the threshold of hearing

decomposition reaction a chemical reaction in which a compound is broken down into the elements that make up the compound, into simpler compounds, or into elements and simpler compounds

deep-focus earthquakes earthquakes that occur in the lower part of the upper mantle, between 350 and 700 km below the surface of Earth

deflation the widespread removal of base materials from the surface by the wind

degassing a process whereby gases and water vapor were released from rocks heated to melting during the early stages of the formation of a planet

delta a somewhat triangular deposit at the mouth of a river formed where a stream flowing into a body of water slowed and lost its sediment-carrying ability

density the compactness of matter described by a ratio of mass (or weight) per unit volume

density current an ocean current that flows because of density differences in seawater

destructive interference the condition in which two waves arriving at the same point at the same time out of phase add amplitudes to create zero total disturbance

dew the condensation of water vapor into droplets of liquid on surfaces

dew point the temperature at which condensation begins

diastrophism an all-inclusive term that means any and all possible movements of Earth's plates, including drift and any other process that deforms or changes Earth's surface by movement

diffuse reflection light rays reflected in many random directions, as opposed to the parallel rays reflected from a perfectly smooth surface such as a mirror

dike a tabular-shaped intrusive rock that formed when magma moved into joints or faults that cut across other rock bodies

direct current an electrical current that always moves in one direction

direct proportion when two variables increase or decrease together in the same ratio (at the same rate)

disaccharides two monosaccharides joined together with the loss of a water molecule; examples of disaccharides are sucrose (table sugar), lactose, and maltose

dispersion the effect of spreading colors of light into a spectrum with a material that has an index of refraction that varies with wavelength

divergent boundaries boundaries that occur between two plates moving away from each other

divide a line separating two adjacent watersheds

dome a large, upwardly bulging, symmetrical fold that resembles a dome

Doppler effect an apparent shift in the frequency of sound or light due to relative motion between the source of the sound or light and the observer

double bond a covalent bond formed when two pairs of electrons are shared by two atoms

dune a hill, low mound, or ridge of wind-blown sand or other sediments

dwarf planet an object that is orbiting the Sun, is nearly spherical, but has not cleared matter from its orbital zone and is not a satellite

E

earthflow a mass movement of a variety of materials such as soil, rocks, and water with a thick, fluidlike flow

earthquake a quaking, shaking, vibrating, or upheaval of Earth's surface

earthquake epicenter the point on Earth's surface directly above an earthquake focus

earthquake focus the place where seismic waves originate beneath the surface of Earth

echo a reflected sound that can be distinguished from the original sound, which usually arrives 0.1 s or more after the original sound

eclipse when the shadow of a celestial body falls on the surface of another celestial body

elastic rebound the sudden snap of stressed rock into new positions; the recovery from elastic strain that results in an earthquake

elastic strain an adjustment to stress in which materials recover their original shape after a stress is released

electric circuit consists of a voltage source that maintains an electrical potential, a

- continuous conducting path for a current to follow, and a device where work is done by the electrical potential; a switch in the circuit is used to complete or interrupt the conducting path
- electric current** the flow of electric charge
- electric field** a force field produced by an electrical charge
- electric field lines** a map of an electric field representing the direction of the force that a positive test charge would experience; the direction of an electric field shown by lines of force
- electric generator** a mechanical device that uses wire loops rotating in a magnetic field to produce electromagnetic induction in order to generate electricity
- electric potential energy** potential energy due to the position of a charge near other charges
- electrical conductors** materials that have electrons that are free to move throughout the material—for example, metals
- electrical energy** a form of energy from electromagnetic interactions; one of five forms of energy—mechanical, chemical, radiant, electrical, and nuclear
- electrical force** a fundamental force that results from the interaction of electrical charge and is billions and billions of times stronger than the gravitational force; sometimes called the *electromagnetic force* because of the strong association between electricity and magnetism
- electrical insulators** electrical nonconductors, or materials that obstruct the flow of electric current
- electrical nonconductors** materials that have electrons that are not moved easily within the material—for example, rubber; electrical nonconductors are also called electrical insulators
- electrical resistance** the property of opposing or reducing electric current
- electrolyte** a water solution of ionic substances that conducts an electric current
- electromagnet** a magnet formed by a solenoid that can be turned on and off by turning the current on and off
- electromagnetic force** one of four fundamental forces; the force of attraction or repulsion between two charged particles
- electromagnetic induction** a process in which current is induced by moving a loop of wire in a magnetic field or by changing the magnetic field
- electron** a subatomic particle that has the smallest negative charge possible, usually found in an orbital of an atom, but gained or lost when atoms become ions
- electron configuration** the arrangement of electrons in orbitals and suborbitals about the nucleus of an atom
- electron current** opposite to conventional current; that is, considers electric current to consist of a drift of negative charges that flows from the negative terminal to the positive terminal of a battery
- electron dot notation** a notation made by writing the chemical symbol of an element with dots around the symbol to indicate the number of outer orbital electrons
- electronegativity** the comparative ability of atoms of an element to attract bonding electrons
- electron pair** a pair of electrons with different spin quantum numbers that may occupy an orbital
- electron volt** the energy gained by an electron moving across a potential difference of 1 volt; equivalent to 1.60×10^{-19} J
- electrostatic charge** an accumulated electric charge on an object from a surplus or deficiency of electrons; also called *static electricity*
- element** a pure chemical substance that cannot be broken down into anything simpler by chemical or physical means; there are over 100 known elements, the fundamental materials of which all matter is made
- El Niño** changes in atmospheric pressure systems, ocean currents, water temperatures, and wind patterns that seem to be linked to worldwide changes in the weather
- empirical formula** identifies the elements present in a compound and describes the simplest whole number ratio of atoms of these elements with subscripts
- energy** the ability to do work
- English system** a system of measurement that originally used sizes of parts of the human body as referents
- entropy** the measure of disorder in thermodynamics
- eons** major blocks of time in Earth's geologic history
- epochs** subdivisions of geologic periods
- equation** a statement that describes a relationship in which quantities on one side of the equal sign are identical to quantities on the other side
- equation of time** the cumulative variation between the apparent local solar time and the mean solar time
- equinoxes** Latin meaning “equal nights”; time when daylight and night are of equal length, which occurs during the spring equinox and the autumnal equinox
- eras** the major blocks of time in Earth's geologic history; the Cenozoic, Mesozoic, Paleozoic, and Precambrian
- erosion** the process of physically removing weathered materials—for example, rock fragments are physically picked up by an erosion agent such as a stream or a glacier
- esters** the class of organic compounds with the general structure of RCOOR' , where R is one of the hydrocarbon groups—for example, methyl or ethyl; esters make up fats, oils, and waxes, and some give fruit and flowers their taste and odor
- ether** the class of organic compounds with the general formula ROR' , where R is one of the hydrocarbon groups—for example, methyl or ethyl; mostly used as industrial and laboratory solvents
- excited states** as applied to an atom, describes the energy state of an atom that has electrons in a state above the minimum energy state for that atom; as applied to a nucleus, describes the energy state of a nucleus that has particles in a state above the minimum energy state for that nuclear configuration
- exfoliation** the fracturing and breaking away of curved, sheetlike plates from bare rock surfaces via physical or chemical weathering, resulting in dome-shaped hills and rounded boulders
- exosphere** the outermost layer of the atmosphere where gas molecules merge with the diffuse vacuum of space
- experiment** a re-creation of an event in a way that enables a scientist to gain valid and reliable empirical evidence
- external energy** the total potential and kinetic energy of an everyday-sized object
- extrusive igneous rocks** fine-grained igneous rocks formed as lava cools rapidly on the surface

F

- Fahrenheit scale** the referent scale that defines numerical values for measuring hotness or coldness, defined as degrees of temperature; based on the reference points of the freezing point of water and the boiling point of water at sea-level pressure, with 180 degrees between the two points
- family** vertical columns of the periodic table consisting of elements that have similar properties
- fats** organic compounds of esters formed from glycerol and three long-chain carboxylic acids that are also called *triglycerides*; called fats in animals and oils in plants
- fault** a break in the continuity of a rock formation along which relative movement has occurred between the rocks on either side
- fault plane** the surface along which relative movement has occurred between the rocks on either side; the surface of the break in continuity of a rock formation
- ferromagnesian silicates** silicates that contain iron and magnesium; examples include the dark-colored minerals olivine, augite, hornblende, and biotite

first law of motion every object remains at rest or in a state of uniform straight-line motion unless acted on by an unbalanced force

first law of thermodynamics a statement of the law of conservation of energy in the relationship between internal energy, work, and heat

first quarter the moon phase between the new phase and the full phase when the Moon is perpendicular to a line drawn through Earth and the Sun; one-half of the lighted Moon can be seen from Earth, so this phase is called the first quarter

floodplain the wide, level floor of a valley built by a stream; the river valley where a stream floods when it spills out of its channel

fluids matter that has the ability to flow or be poured; the individual molecules of a fluid are able to move, rolling over or by one another

focus the place beneath the surface where the waves of an earthquake originate

folds bends in layered bedrock as a result of stress or stresses that occurred when the rock layers were in a ductile condition, probably under considerable confining pressure from deep burial

foliation the alignment of flat crystal flakes of a rock into parallel sheets

force a push or pull capable of changing the state of motion of an object; a force has magnitude (strength) as well as direction

force field a model describing action at a distance by giving the magnitude and direction of force on a unit particle; considers a charge or a mass to alter the space surrounding it and a second charge or mass to interact with the altered space with a force

formula describes what elements are in a compound and in what proportions

formula weight the sum of the atomic weights of all the atoms in a chemical formula

fossil any evidence of former prehistoric life

fossil fuels organic fuels that contain the stored radiant energy of the Sun converted to chemical energy by plants or animals that lived millions of years ago; coal, petroleum, and natural gas are the common fossil fuels

Foucault pendulum a heavy mass swinging from a long wire that can be used to provide evidence about the rotation of Earth

fracture strain an adjustment to stress in which materials crack or break as a result of the stress

free fall when objects fall toward Earth with no forces acting upward; air resistance is neglected when considering an object to be in free fall

freezing point the temperature at which a phase change of liquid to solid takes place;

the same temperature as the melting point for a given substance

frequency the number of cycles of a vibration or of a wave occurring in 1 second, measured in units of cycles per second (hertz)

freshwater water that is not saline and is fit for human consumption

front the boundary, or thin transition zone, between air masses of different temperatures

frost ice crystals formed by water vapor condensing directly from the vapor phase; frozen water vapor that forms on objects

frost wedging the process of freezing and thawing water in small rock pores and cracks that become larger and larger, eventually forcing pieces of rock to break off

fuel rod a long zirconium alloy tube containing fissionable material for use in a nuclear reactor

full moon the moon phase when Earth is between the Sun and the Moon and the entire side of the Moon facing Earth is illuminated by sunlight

functional group the atom or group of atoms in an organic molecule that is responsible for the chemical properties of a particular class or group of organic chemicals

fundamental charge the smallest common charge known; the magnitude of the charge of an electron and a proton, which is 1.60×10^{-19} coulomb

fundamental forces four forces that cannot be explained in terms of any other force; gravitational, electromagnetic, weak nuclear, and strong nuclear

fundamental frequency the lowest frequency (longest wavelength) that can set up standing waves in an air column or on a string

fundamental properties a property that cannot be defined in simpler terms other than to describe how it is measured; the fundamental properties are length, mass, time, and charge

G

g the symbol representing the acceleration of an object in free fall due to the force of gravity; its magnitude is 9.8 m/s^2 (32 ft/s^2)

galactic clusters gravitationally bound subgroups of as many as 1,000 stars that move together within the Milky Way galaxy

galaxy a group of billions and billions of stars that form the basic unit of the universe; for example, Earth is part of the solar system, which is located in the Milky Way galaxy

gamma ray very short-wavelength electromagnetic radiation emitted by decaying nuclei

gases a phase of matter composed of molecules that are relatively far apart moving freely in a constant, random motion and

having weak cohesive forces acting between them, resulting in the characteristic indefinite shape and indefinite volume of a gas

gasohol a solution of ethanol and gasoline

Geiger counter a device that indirectly measures ionizing radiation (beta and/or gamma) by detecting “avalanches” of electrons that are able to move because of the ions produced by the passage of ionizing radiation

general theory of relativity Einstein’s geometric theory of gravity; gravity is an interaction between a mass and the space and time geometry of space

geologic time scale a “calendar” of geologic history based on the appearance and disappearance of particular fossils in the sedimentary rock record

geomagnetic time scale a time scale established from the number and duration of magnetic field reversals during the past 6 million years

geosynchronous satellite a satellite that turns with Earth and does not appear to move across the sky

geothermal energy heat from beneath Earth’s surface, usually reaching the surface in the form of geysers, steam, or hot water

giant planets the large outer planets Jupiter, Saturn, Uranus, and Neptune that all have similar densities and compositions

glacier a large mass of ice on land that is formed from compacted snow and slowly moves under its own weight

globular clusters symmetrical and tightly packed clusters of as many as a million stars that move together as subgroups within the Milky Way galaxy

glycerol an alcohol with three hydroxyl groups per molecule—for example, glycerin (1,2,3-propanetriol)

glycogen a highly branched polysaccharide synthesized by the human body and stored in the muscles and liver; serves as a direct reserve source of energy

glycol an alcohol with two hydroxyl groups per molecule—for example, ethylene glycol that is used as an antifreeze

gram-atomic weight the mass in grams of 1 mole of an element that is numerically equal to its atomic weight

gram-formula weight the mass in grams of 1 mole of a compound that is numerically equal to its formula weight

gram-molecular weight the gram-formula weight of a molecular compound

granite a light-colored, coarse-grained igneous rock common on continents; igneous rocks formed by blends of quartz and feldspars, with small amounts of micas, hornblende, and other minerals

greenhouse effect the process of increasing the temperature of the lower parts of the atmosphere through redirecting energy back toward the surface; the absorption and reemission of infrared radiation by carbon dioxide, water vapor, and a few other gases in the atmosphere

ground state the energy state of an atom with electrons at the lowest energy state possible for that atom

groundwater water from a saturated zone beneath the surface; water from beneath the surface that supplies wells and springs

gyre a great circular system of moving water found in each ocean

H

hail a frozen form of precipitation, sometimes with alternating layers of clear and opaque, cloudy ice

hair hygrometer a device that measures relative humidity from changes in the length of hair

half-life the time required for one-half of the unstable nuclei in a radioactive substance to decay into a new element

halogen member of family VIIA of the periodic table, having common properties of very reactive nonmetallic elements common in salt compounds

hard water water that contains relatively high concentrations of dissolved salts of calcium and magnesium

heat the total internal energy of molecules, which is increased by gaining energy from a temperature difference (conduction, convection, radiation) or by gaining energy from a form conversion (mechanic, chemical, radiant, electrical, nuclear)

heat of formation energy released in a chemical reaction

Heisenberg uncertainty principle you cannot measure both the exact momentum and the exact position of a subatomic particle at the same time; the more exactly one of the two is known, the less certain you are of the value of the other

hertz unit of frequency; equivalent to 1 cycle per second

Hertzsprung-Russell diagram a diagram to classify stars with a temperature-luminosity graph

high short for high-pressure center (anticyclone), which is associated with clear, fair weather

high latitudes the latitudes close to the poles; those that sometimes receive no solar radiation at noon

high-pressure center another term for anticyclone

horsepower a measurement of power defined as a power rating of 550 ft-lb/s

hot spots sites on Earth's surface where plumes of hot rock materials rise from deep within the mantle

humid the moist climate classification; receives more than 50 cm (20 in) of precipitation per year

humidity the amount of water vapor in the air; see *relative humidity*

hurricane a tropical cyclone with heavy rains and winds exceeding 120 km/h (75 mi/h)

hydration the attraction of water molecules for ions; a reaction that occurs between water and minerals that make up rocks

hydrocarbon an organic compound consisting of only the two elements hydrogen and carbon

hydrocarbon derivatives organic compounds that can be thought of as forming when one or more hydrogen atoms on a hydrocarbon have been replaced by an element or a group of elements other than hydrogen

hydrogen bond a weak to moderate bond between the hydrogen end (+) of a polar molecule and the negative end (−) of a second polar molecule

hydrologic cycle water vapor cycling into and out of the atmosphere through continuous evaporation of liquid water from the surface and precipitation of water back to the surface

hydronium ion a molecule of water with an attached hydrogen ion, H_3O^+

hypothesis a tentative explanation of a phenomenon that is compatible with the data and provides a framework for understanding and describing that phenomenon

ice-crystal process a precipitation-forming process that brings water droplets of a cloud together through the formation of ice crystals

ice-forming nuclei small, solid particles suspended in air; ice can form on the suspended particles

igneous rocks rocks that formed from magma, which is a hot, molten mass of melted rock materials

impulse a change of motion is brought about by an impulse; the product of the size of an applied force and the time the force is applied

incandescent matter emitting visible light as a result of high temperature—for example, a lightbulb, a flame from any burning source, and the Sun are all incandescent sources because of high temperature

incident ray a line representing the direction of motion of incoming light approaching a boundary

inclination of Earth's axis the tilt of Earth's axis measured from the plane of the ecliptic (23.5°); considered to be the same throughout the year

index fossils distinctive fossils of organisms that lived only a brief time; used to compare the age of rocks exposed in two different locations

index of refraction the ratio of the speed of light in a vacuum to the speed of light in a material

inertia a property of matter describing the tendency of an object to resist a change in its state of motion; an object will remain in unchanging motion or at rest in the absence of an unbalanced force

infrasonic sound waves having too low a frequency to be heard by the human ear; sound having a frequency of less than 20 Hz

inorganic chemistry the study of all compounds and elements in which carbon is not the principal element

insulators materials that are poor conductors of heat—for example, heat flows slowly through materials with air pockets because the molecules making up air are far apart; also, materials that are poor conductors of electricity—for example, glass or wood

intensity a measure of the energy carried by a wave

interference a phenomenon of light whereby the relative phase difference between two light waves produces light or dark spots, a result of light's wavelike nature

intermediate-focus earthquakes earthquakes that occur in the upper part of the mantle, between 70 and 350 km (43 and 217 mi) below the surface of Earth

intermolecular forces forces of interaction between molecules

internal energy the sum of all the potential energy and all the kinetic energy of all the molecules of an object

international date line the 180° meridian is arbitrarily called the international date line; used to compensate for cumulative time zone changes by adding or subtracting a day when the line is crossed

intertropical convergence zone a part of the lower troposphere in a belt from 10°N to 10°S of the equator where air is heated, expands, and becomes less dense and rises around the belt

intrusive igneous rocks coarse-grained igneous rocks formed as magma cools slowly deep below the surface

inverse proportion the relationship in which the value of one variable increases while the value of the second variable decreases at the same rate (in the same ratio)

inversion a condition of the troposphere when temperature increases with height

rather than decreasing with height; a cap of cold air over warmer air that results in increased air pollution

ion an atom or a particle that has a net charge because of the gain or loss of electrons; polyatomic ions are groups of bonded atoms that have a net charge

ion exchange reaction a reaction that takes place when the ions of one compound interact with the ions of another, forming a solid that comes out of solution, a gas, or water

ionic bond the chemical bond of electrostatic attraction between negative and positive ions

ionic compounds chemical compounds that are held together by ionic bonds—that is, bonds of electrostatic attraction between negative and positive ions

ionization the process of forming ions from molecules

ionization counter a device that measures ionizing radiation (alpha, beta, gamma, etc.) by indirectly counting the ions produced by the radiation

ionized an atom or a particle that has a net charge because it has gained or lost electrons

ionosphere that part of the atmosphere—parts of the thermosphere and upper mesosphere—where free electrons and ions reflect radio waves around Earth and where the northern lights occur

iron meteorites the meteorite classification group whose members are composed mainly of iron

island arcs curving chains of volcanic islands that occur over belts of deep-seated earthquakes—for example, the Japanese and Indonesian islands

isomers chemical compounds with the same molecular formula but different molecular structures; compounds that are made from the same numbers of the same elements but have different molecular arrangements

isotope atoms of an element with identical chemical properties but with different masses; isotopes are atoms of the same element with different numbers of neutrons

J

jet stream a powerful, winding belt of wind near the top of the troposphere that tends to extend all the way around Earth, moving generally from the west in both hemispheres at speeds of 160 km/h or more

joint a break in the continuity of a rock formation without a relative movement of the rock on either side of the break

joule the metric unit used to measure work and energy; can also be used to measure heat; equivalent to newton-meter

K

Kelvin scale a temperature scale that does not have arbitrarily assigned referent points, and zero means nothing; the zero point on the Kelvin scale (also called absolute scale) is the lowest limit of temperature, where all random kinetic energy of molecules ceases

Kepler's first law describes how each planet of the solar system moves in an elliptical orbit, with the Sun located at one focus

Kepler's laws of planetary motion three laws describing the motion of the planets in the solar system

Kepler's second law describes how an imaginary line between the Sun and a planet moves over equal areas of the ellipse during equal time intervals

Kepler's third law a relationship in planetary motion that the square of the period of an orbit is directly proportional to the cube of the radius of the major axis of the orbit

ketone an organic compound with the general formula RCOR', where R is one of the hydrocarbon groups—for example, methyl or ethyl

kilocalorie the amount of energy required to increase the temperature of 1 kilogram of water 1 degree Celsius: equivalent to 1,000 calories

kilogram the fundamental unit of mass in the metric system of measurement

kinetic energy the energy of motion; can be measured from the work done to put an object in motion, from the mass and velocity of the object while in motion, or from the amount of work the object can do because of its motion

kinetic molecular theory the collection of assumptions that all matter is made up of tiny atoms and molecules that interact physically, that explain the various states of matter, and that have an average kinetic energy that defines the temperature of a substance

Kuiper Belt a disk-shaped region of small icy bodies some 30 to 100 AU from the Sun; the source of short-period comets

L

L-wave seismic waves that move on the solid surface of Earth much as water waves move across the surface of a body of water

laccolith an intrusive rock feature that formed when magma flowed into the plane of contact between sedimentary rock layers, then raised the overlying rock into a blisterlike uplift

lake a large inland body of standing water

landforms the features of the surface of Earth such as mountains, valleys, and plains

landslide general term for rapid movement of any type or mass of materials

last quarter the moon phase between the full phase and the new phase when the Moon is perpendicular to a line drawn through Earth and the Sun; one-half of the lighted Moon can be seen from Earth, so this phase is called the last quarter

latent heat refers to the heat "hidden" in phase changes

latent heat of fusion the heat absorbed when 1 gram of a substance changes from the solid to the liquid phase, or the heat released by 1 gram of a substance when changing from the liquid phase to the solid phase

latent heat of vaporization the heat absorbed when 1 gram of a substance changes from the liquid phase to the gaseous phase, or the heat released when 1 gram of gas changes from the gaseous phase to the liquid phase

laterites highly leached soils of tropical climates; usually red with high iron and aluminum oxide content

latitude the angular distance from the equator to a point on a parallel that tells you how far north or south of the equator the point is located

lava magma, or molten rock, that is forced to the surface from a volcano or a crack in Earth's surface

law of conservation of energy energy is never created or destroyed; it can only be converted from one form to another as the total energy remains constant

law of conservation of mass same as the law of conservation of matter; mass, including single atoms, is neither created nor destroyed in a chemical reaction

law of conservation of matter matter is neither created nor destroyed in a chemical reaction

law of conservation of momentum the total momentum of a group of interacting objects remains constant in the absence of external forces

light ray model a model using lines to show the direction of motion of light to describe the travels of light

light-year the distance that light travels through empty space in 1 year, approximately 9.5×10^{12} km (5.86×10^{12} mi)

linear scale a scale, generally on a graph, where equal intervals represent equal changes in the value of a variable

lines of force lines drawn to make an electric field strength map, with each line originating on a positive charge and ending on a negative charge; each line represents a path on which a charge would experience a constant force, and lines closer together mean a stronger electric field

line spectrum narrow lines of color in an otherwise dark spectrum; these lines can be used as “fingerprints” to identify gases

liquids a phase of matter composed of molecules that have interactions stronger than those found in a gas but not strong enough to keep the molecules near the equilibrium positions of a solid, resulting in the characteristic definite volume but indefinite shape of a liquid

liter a metric system unit of volume usually used for liquids

lithosphere the solid layer of Earth’s structure that is above the asthenosphere and includes the entire crust, the Moho, and the upper part of the mantle

loess a very fine dust or silt that has been deposited by wind over a large area

longitude the angular distance of a point east or west from the prime meridian on a parallel

longitudinal wave a mechanical disturbance that causes particles to move closer together and farther apart in the same direction that the wave is traveling

longshore current a current that moves parallel to the shore, pushed along by waves that move accumulated water from breakers

loudness a subjective interpretation of a sound that is related to the energy of the vibrating source, to the condition of the transmitting medium, and to the distance involved

low latitudes latitudes close to the equator; those that sometimes receive vertical solar radiation at noon

luminosity the total amount of energy radiated into space each second from the surface of a star

luminous an object or objects that produce visible light—for example, the Sun, stars, lightbulbs, and burning materials are all luminous

lunar eclipse occurs when the Moon is full and the Sun, the Moon, and Earth are lined up so the shadow of Earth falls on the Moon

lunar highlands light-colored mountainous regions of the Moon

M

macromolecule a very large molecule, with a molecular weight of thousands or millions of atomic mass units, that is made up of a combination of many smaller, similar molecules

magma a mass of molten rock material either below or on Earth’s crust from which igneous rock is formed by cooling and hardening

magnetic domain tiny physical regions in permanent magnets, approximately 0.01 to

1 mm, that have magnetically aligned atoms, giving the domain an overall polarity

magnetic field the model used to describe how magnetic forces on moving charges act at a distance

magnetic poles the ends, or sides, of a magnet about which the force of magnetic attraction seems to be concentrated

magnetic quantum number from the quantum mechanics model of the atom, one of four descriptions of the energy state of an electron wave; this quantum number describes the energy of an electron orbital as the orbital is oriented in space by an external magnetic field, a kind of energy sub-sublevel

magnetic reversal the flipping of polarity of Earth’s magnetic field as the north magnetic pole and the south magnetic pole exchange positions

main sequence stars normal, mature stars that use their nuclear fuel at a steady rate; stars on the Hertzsprung-Russell diagram in a narrow band that runs from the top left to the lower right

manipulated variable in an experiment, a quantity that can be controlled or manipulated; also known as the independent variable

mantle the middle part of Earth’s interior; a 2,870 km (about 1,780 mi) thick shell between the core and the crust

maria smooth, dark areas on the Moon

marine climate a climate influenced by air masses from over an ocean, with mild winters and cool summers compared to areas farther inland

maritime air mass a moist air mass that forms over the ocean

mass a measure of inertia, which means a resistance to a change of motion

mass defect the difference between the sum of the masses of the individual nucleons forming a nucleus and the actual mass of that nucleus

mass movement erosion caused by the direct action of gravity

mass number the sum of the number of protons and neutrons in a nucleus defines the mass number of an atom; used to identify isotopes—for example, uranium-238

matter anything that occupies space and has mass

matter waves any moving object has wave properties, but at ordinary velocities, these properties are observed only for objects with a tiny mass; term for the wavelike properties of subatomic particles

meanders winding, circuitous turns or bends of a stream

mean solar day is 24 hours long and is averaged from the mean solar time

mean solar time a uniform time averaged from the apparent solar time

measurement the process of comparing a property of an object to a well-defined and agreed-upon referent

mechanical energy the form of energy associated with machines, objects in motion, and objects having potential energy that results from gravity

mechanical weathering the physical breaking up of rocks without any changes in their chemical composition

melting point the temperature at which a phase change of solid to liquid takes place; the same temperature as the freezing point for a given substance

Mercalli scale expresses the relative intensity of an earthquake in terms of effects on people and buildings, using Roman numerals that range from I to XII

meridians north-south running arcs that intersect at both poles and are perpendicular to the parallels

mesosphere the term means “middle layer”—the solid, dense layer of Earth’s structure below the asthenosphere but above the core; also the layer of the atmosphere below the thermosphere and above the stratosphere

Mesozoic one of four geologic eras; the time of middle life, meaning some of the fossils for this time period are similar to the life found on Earth today, but many are different from anything living today

metal matter having the physical properties of conductivity, malleability, ductility, and luster

metamorphic rocks previously existing rocks that have been changed into a distinctly different rock by heat, pressure, or hot solutions

meteor the streak of light and smoke that appears in the sky when a meteoroid is made incandescent by compression of Earth’s atmosphere

meteorite the solid iron or stony material of a meteoroid that survives passage through Earth’s atmosphere and reaches the surface

meteoroids remnants of comets and asteroids in space

meteorology the science of understanding and predicting weather

meteor shower an event in which many meteorites fall in a short period of time

meter the fundamental metric unit of length

metric system a system of referent units based on invariable referents of nature that have been defined as standards

microclimate a local, small-scale pattern of climate—for example, the north side of a house has a different microclimate than the south side

middle latitudes latitudes equally far from the poles and equator; between the high and low latitudes

mineral a naturally occurring, inorganic solid element or chemical compound with a crystalline structure

miscible fluids fluids that can mix in any proportion

mixture matter made of unlike parts that have a variable composition and can be separated into their component parts by physical means

model a mental or physical representation of something that cannot be observed directly that is usually used as an aid to understanding

moderator a substance in a nuclear reactor that slows fast neutrons so the neutrons can participate in nuclear reactions

Mohorovicic discontinuity the boundary between the crust and mantle that is marked by a sharp increase in the velocity of seismic waves as they pass from the crust to the mantle

molarity a measure of the concentration of a solution; the number of moles of a solute dissolved in 1 liter of solution

mold the preservation of the shape of an organism by the dissolution of the remains of a buried organism, leaving an empty space where the remains were

mole an amount of a substance that contains Avogadro's number of atoms, ions, molecules, or any other chemical unit; 1 mole is thus 6.02×10^{23} atoms, ions, or other chemical units

molecular formula a chemical formula that identifies the actual numbers of atoms in a molecule

molecular weight the formula weight of a molecular substance

molecule from the chemical point of view, a particle composed of two or more atoms held together by an attractive force called a chemical bond; from the kinetic theory point of view, the smallest particle of a compound or gaseous element that can exist and still retain the characteristic properties of a substance

momentum the product of the mass of an object and its velocity

monadnocks hills of resistant rock that are found on peneplains

monosaccharides simple sugars that are mostly 6-carbon molecules such as glucose and fructose

moraines deposits of bulldozed rocks and other mounded materials left behind by a melted glacier

mountain a natural elevation of Earth's crust that rises above the surrounding surface

mudflow a mass movement of a slurry of debris and water with the consistency of a thick milkshake

N

natural frequency the frequency of vibration of an elastic object that depends on the size, composition, and shape of the object

neap tide a period of less pronounced high and low tides: occurs when the Sun and the Moon are at right angles to each other

nebula a diffuse mass of interstellar clouds of hydrogen gas or dust

negative electric charge one of the two types of electric charge; repels other negative charges and attracts positive charges

negative ion an atom or a particle that has a surplus, or imbalance, of electrons and thus a negative charge

net force the resulting force after all vector forces have been added; if a net force is zero, all the forces have canceled one another and there is not an unbalanced force

neutralized acid or base properties have been lost through a chemical reaction

neutron a neutral subatomic particle usually found in the nucleus of an atom

neutron star very small superdense remains of a supernova with a center core of pure neutrons

new crust zone the zone of a divergent boundary where new crust is formed by magma upwelling at the boundary

new moon the moon phase when the Moon is between Earth and the Sun and the entire side of the Moon facing Earth is dark

newton a unit of force defined as $\text{kg}\cdot\text{m}/\text{s}^2$; that is, a 1 newton force is needed to accelerate a 1 kg mass $1 \text{ m}/\text{s}^2$

noble gas members of family VIII of the periodic table, having common properties of colorless, odorless, chemically inert gases; also known as rare gases or inert gases

node region on a standing wave that does not oscillate

noise sounds made up of groups of waves of random frequency and intensity

nonelectrolytes water solutions that do not conduct an electric current; covalent compounds that form molecular solutions and cannot conduct an electric current

nonferromagnesian silicates silicates that do not contain iron or magnesium ions; examples include the minerals of muscovite (white mica), the feldspars, and quartz

nonmetal an element that is brittle (when a solid), does not have a metallic luster, is a poor conductor of heat and electricity, and is not malleable or ductile

nonsilicates minerals that do not have the silicon-oxygen tetrahedra in their crystal structure

noon the event of time when the Sun moves across the celestial meridian

normal a line perpendicular to the surface of a boundary

normal fault a fault where the hanging wall has moved downward with respect to the footwall

north celestial pole a point directly above the North Pole of Earth; the point above the north pole on the celestial sphere

north pole the north pole of a magnet or lodestone is "north-seeking," meaning that the pole of a magnet points northward when the magnet is free to turn

nova a star that explodes or suddenly erupts and increases in brightness

nuclear energy the form of energy from reactions involving the nucleus, the innermost part of an atom

nuclear fission the nuclear reaction of splitting a massive nucleus into more stable, less massive nuclei with an accompanying release of energy

nuclear force one of four fundamental forces, a strong force of attraction that operates over very short distances between subatomic particles; this force overcomes the electric repulsion of protons in a nucleus and binds the nucleus together

nuclear fusion the nuclear reaction of low-mass nuclei fusing together to form more stable and more massive nuclei with an accompanying release of energy

nuclear reactor a steel vessel in which a controlled chain reaction of fissionable materials releases energy

nucleons the name used to refer to both the protons and neutrons in the nucleus of an atom

nucleus the tiny, relatively massive and positively charged center of an atom containing protons and neutrons; the small, dense center of an atom

numerical constant a constant without units; a number

O

oblate spheroid the shape of Earth—a somewhat squashed spherical shape

observed lapse rate the rate of change in temperature compared to change in altitude

occluded front a front that has been lifted completely off the ground into the atmosphere, forming a cyclonic storm

ocean the single, continuous body of salt water on the surface of Earth

ocean basin the deep bottom of the ocean floor, which starts beyond the continental slope

ocean currents streams of water within the ocean that stay in about the same path as they move over large distances; steady and continuous onward movement of a channel of water in the ocean

ocean wave a moving disturbance that travels across the surface of the ocean

oceanic ridges long, high, continuous, sub-oceanic mountain chains—for example, the Mid-Atlantic Ridge in the center of the Atlantic Ocean Basin

oceanic trenches long, narrow, deep troughs with steep sides that run parallel to the edges of continents

octet rule a generalization that helps keep track of the valence electrons in most representative elements; atoms of the representative elements (A families) attempt to acquire an outer orbital with eight electrons through chemical reactions

ohm the unit of resistance; equivalent to volts/amps

Ohm's law the electric potential difference is directly proportional to the product of the current and the resistance

oil field petroleum accumulated and trapped in extensive porous rock structure or structures

oils organic compounds of esters formed from glycerol and three long-chain carboxylic acids that are also called triglycerides; called fats in animals and oils in plants

Oort cloud a spherical “cloud” of small, icy bodies from 30,000 AU out to a light-year from the Sun; the source of long-period comets

opaque materials that do not allow the transmission of any light

orbital the region of space around the nucleus of an atom where an electron is likely to be found

organic acids acids derived from organisms; organic compounds with a general formula of RCOOH, where R is one of the hydrocarbon groups—for example, methyl or ethyl

organic chemistry the study of compounds in which carbon is the principal element

orientation of Earth's axis the direction that Earth's axis points; considered to be the same throughout the year

origin the only point on a graph where both the x and y variables have a value of zero at the same time

overtones higher resonant frequencies that occur at the same time as the fundamental frequency, giving a musical instrument its characteristic sound quality

oxbow lake a small body of water, or lake, that formed when two bends of a stream came together and cut off a meander

oxidation the process of a substance losing electrons during a chemical reaction; a reaction between oxygen and the minerals making up rocks

oxidation reduction reaction a chemical reaction in which electrons are transferred

from one atom to another; sometimes called “redox” for short

oxidizing agents substances that take electrons from other substances

P

Paleozoic one of four geologic eras; time of ancient life, meaning the fossils from this time period are very different from anything living on Earth today

parallel circuit for batteries, all positive terminals are connected and all negative terminals are connected; lightbulbs in a parallel circuit have alternate branches for the current to follow

parallels reference lines on Earth used to identify where in the world you are northward or southward from the equator; east and west running circles that are parallel to the equator on a globe with the distance from the equator called the latitude

parts per billion a concentration ratio of parts of solute in every 1 billion parts of solution (ppb); could be expressed as ppb by volume or as ppb by weight

parts per million a concentration ratio of parts of solute in every 1 million parts of solution (ppm); could be expressed as ppm by volume or as ppm by weight

Pauli exclusion principle no two electrons in an atom can have the same four quantum numbers; thus, a maximum of two electrons can occupy a given orbital

penplain a nearly flat landform that is the end result of the weathering and erosion of the land surface

penumbra the zone of partial darkness in a shadow

percent by volume the volume of solute in 100 volumes of solution

percent by weight the weight of solute in 100 weight units of solution

perigee when the Moon's elliptical orbit brings the Moon closest to Earth

period (geologic time) subdivision of geologic era

period (periodic table) horizontal rows of elements with increasing atomic numbers; runs from left to right on the element table

period (wave) the time required for one complete cycle of a wave

periodic law similar physical and chemical properties recur periodically when the elements are listed in order of increasing atomic number

permeability the ability to transmit fluids through openings, small passageways, or gaps

permineralization the process that forms a fossil by alteration of an organism's buried remains by circulating groundwater depositing calcium carbonate, silica, or pyrite

petroleum oil that comes from oil-bearing rock, a mixture of hydrocarbons that is believed to have formed from ancient accumulations of buried organic materials such as remains of algae

Phanerozoic the eon of an abundant fossil records and living organisms

phase change the action of a substance changing from one state of matter to another; a phase change always absorbs or releases internal potential energy that is not associated with a temperature change

phases of matter the different physical forms that matter can take as a result of different molecular arrangements, resulting in characteristics of the common phases of a solid, liquid, or gas

photoelectric effect the movement of electrons in some materials as a result of energy acquired from absorbed light

photon a quantum of energy in a light wave; the particle associated with light

pH scale the scale that measures the acidity of a solution with numbers below 7 representing acids, 7 representing neutral, and numbers above 7 representing bases

physical change a change of the state of a substance but not the identity of the substance

pitch the frequency of a sound wave

Planck's constant the proportionality constant in the relationship between the energy of vibrating molecules and their frequency of vibration; a value of $6.63 \times 10^{-34} \text{ J}\cdot\text{s}$

plane of the ecliptic the plane of Earth's orbit

planet an object that is orbiting the Sun, is nearly spherical, and is large enough to clear all matter from its orbital zone

plasma a phase of matter; a very hot gas consisting of electrons and atoms that have been stripped of their electrons because of high kinetic energies

plastic strain an adjustment to stress in which materials become molded or bent out of shape under stress and do not return to their original shape after the stress is released

plate tectonics the theory that Earth's crust is made of rigid plates that float on the upper mantle

plunging folds synclines and anticlines that are not parallel to the surface of Earth

polar air mass a cold air mass that forms in cold regions

polar climate zone the climate zone of the high latitudes; average monthly temperatures stay below 10°C (50°F), even during the warmest month of the year

polar covalent bond a covalent bond in which there is an unequal sharing of bonding electrons

polarized light whose constituent transverse waves are all vibrating in the same plane; also known as plane-polarized light

polar molecule a molecule with a dipole, with a negative side and a positive side

Polaroid a film that transmits only polarized light

polyatomic ion an ion made up of many atoms

polymers huge, chainlike molecules made of hundreds or thousands of smaller repeating molecular units called monomers

polysaccharides polymers consisting of monosaccharide units joined together in straight or branched chains; starches, glycogen, or cellulose

pond a small body of standing water, smaller than a lake

porosity the ratio of pore space to the total volume of a rock or soil sample, expressed as a percentage; freely admitting the passage of fluids through pores or small spaces between parts of the rock or soil

positive electric charge one of the two types of electric charge; repels other positive charges and attracts negative charges

positive ion an atom or particle that has a net positive charge due to an electron or electrons being torn away

potential energy energy due to position; energy associated with changes in position (e.g., gravitational potential energy) or changes in shape (e.g., compressed or stretched spring)

power the rate at which energy is transferred or the rate at which work is performed; defined as work per unit of time

Precambrian the earliest of the geologic eons before life

Precambrian one of four geologic eras; the time before the time of ancient life, meaning the rocks for this time period contain very few fossils

precession the slow wobble of the axis of Earth similar to the wobble of a spinning top

precipitation water that falls to the surface of Earth in the solid or liquid form

pressure defined as force per unit area—for example, pounds per square inch (lb/in²)

primary coil part of a transformer; a coil of wire that is connected to a source of alternating current

primary loop part of the energy-converting system of a nuclear power plant; the closed pipe system that carries heated water from the nuclear reactor to a steam generator

prime meridian the referent meridian (0°) that passes through the Greenwich Observatory in England

principal quantum number from the quantum mechanics model of the atom, one of four descriptions of the energy state of an electron wave; this quantum number describes the main energy level of an electron in terms of its most probable distance from the nucleus

principle of cross-cutting relationships a frame of reference based on the understanding that any geologic feature that cuts across or is intruded into a rock mass must be younger than the rock mass

principle of faunal succession a frame of reference based on the understanding that life-forms have changed through time as old life-forms disappear from the fossil record and new ones appear, but the same form is never exactly duplicated independently at two different times in history

principle of original horizontality a frame of reference based on the understanding that on a large scale, sediments are deposited in flat-lying layers, so any layers of sedimentary rocks that are not horizontal have been subjected to forces that have deformed Earth's surface

principle of superposition a frame of reference based on the understanding that an undisturbed sequence of horizontal rock layers is arranged in chronological order with the oldest layers at the bottom, with each consecutive layer younger than the one below it

principle of uniformity a frame of reference of slow, uniform changes in Earth's history; the processes changing rocks today are the processes that changed them in the past, or "the present is the key to the past"

proof a measure of ethanol concentration of an alcoholic beverage; proof is double the concentration by volume—for example, 50 percent by volume is 100 proof

properties qualities or attributes that, taken together, are usually unique to an object—for example, color, texture, and size

proportionality constant a constant applied to a proportionality statement that transforms the statement into an equation

proteins macromolecular polymers made of smaller molecules of amino acids, with molecular weight from about 6,000 to 50 million; proteins are amino acid polymers with roles in biological structures or functions; without such a function, they are known as *polypeptides*

Proterozoic the geologic eon before the Phanerozoic, meaning "beginning life"

protogalaxy a collection of gas, dust, and young stars in the process of forming a galaxy

proton the subatomic particle that has the smallest possible positive charge, usually found in the nucleus of an atom

protoplanet nebular model a model of the formation of the solar system that states that the planets formed from gas and dust left over from the formation of the Sun

protostar an accumulation of gases that will become a star

proxy data a natural source used to infer temperature change, rainfall, or some other climate condition of the past

Pseudoscience uses the appearance or language of science to mislead people into thinking that something has scientific validity when it does not

psychrometer a two-thermometer device used to measure the relative humidity

Ptolemaic system geocentric model of the structure of the solar system that uses epicycles to explain retrograde motion

pulsars the source of regular, equally spaced pulsating radio signals believed to be the result of the magnetic field of a rotating neutron star

pure substance material that is the same throughout and has a fixed definite composition

pure tone a sound made by very regular intensities and very regular frequencies from regular repeating vibrations

P-wave a pressure, or compressional, wave in which a disturbance vibrates materials back and forth in the same direction as the direction of wave movement

P-wave shadow zone a region on Earth between 103° and 142° of arc from an earthquake where no P-waves are received; believed to be explained by P-waves being refracted by the core

Q

quad 1 quadrillion Btu (10¹⁵ Btu); used to describe very large amounts of energy

quanta fixed amounts; usually referring to fixed amounts of energy absorbed or emitted by matter (*quanta* is plural, and *quantum* is singular)

quantities measured properties; they include the numerical value of the measurement and the unit used in the measurement

quantum mechanics a model of the atom based on the wave nature of subatomic particles, the mechanics of electron waves; also called *wave mechanics*

quantum numbers numbers that describe energy states of an electron; in the Bohr model of the atom, the orbit quantum numbers could be any whole number 1, 2, 3, and so on out from the nucleus; in the quantum mechanics model of the atom, four quantum numbers are used to describe the energy state of an electron wave

R

rad a measure of radiation received by a material (radiation absorbed dose)

radiant energy the form of energy that can travel through space—for example, visible light and other parts of the electromagnetic spectrum

- radiation** the transfer of heat from a region of higher temperature to a region of lower temperature by greater emission of radiant energy from the region of higher temperature
- radiation zone** part of the interior of a star according to a model; the region directly above the core where gamma and X rays from the core are absorbed and reemitted, with the radiation slowly working its way outward
- radioactive decay** the natural spontaneous disintegration or decomposition of a nucleus
- radioactive decay constant** a specific constant for a particular isotope that is the ratio of the rate of nuclear disintegration per unit of time to the total number of radioactive nuclei
- radioactive decay series** a series of decay reactions that begins with one radioactive nucleus that decays to a second nucleus that decays to a third nucleus and so on until a stable nucleus is reached
- radioactivity** the spontaneous emission of particles or energy from an atomic nucleus as it disintegrates
- radiometric age** the age of rocks determined by measuring the radioactive decay of unstable elements within the crystals of certain minerals in the rocks
- rarefaction** a thinning or pulse of decreased density and pressure of gas molecules
- ratio** a relationship between two numbers, one divided by the other; the ratio of distance per time is speed
- real image** an image generated by a lens or mirror that can be projected onto a screen
- red giant stars** one of two groups of stars on the Hertzsprung-Russell diagram that have a different set of properties than the main sequence stars; bright, low-temperature giant stars that are enormously bright for their temperature
- redox reaction** the short name for oxidation reduction reaction
- reducing agent** supplies electrons to the substance being reduced in a chemical reaction
- referent** referring to or thinking of a property in terms of another, more familiar object
- reflected ray** a line representing direction of motion of light reflected from a boundary
- reflection** the change when light, sound, or other waves bounce backward off a boundary
- refraction** a change in the direction of travel of light, sound, or other waves crossing a boundary
- rejuvenation** the process of uplifting land that renews the effectiveness of weathering and erosion processes
- relative dating** dating the age of a rock unit or geologic event relative to some other unit or event
- relative humidity** the ratio (times 100 percent) of how much water vapor is in the air to the maximum amount of water vapor that could be in the air at a given temperature
- rem** the measure of radiation that considers the biological effects of different kinds of ionizing radiation
- replacement reaction** a chemical reaction in which an atom or a polyatomic ion is replaced in a compound by a different atom or polyatomic ion
- replacement (fossil formation)** a process in which an organism's buried remains are altered by circulating groundwaters carrying elements in solution; the removal of original materials by dissolutions and the replacement of new materials one atom or molecule at a time
- representative elements** the name given to the members of the group A families of the periodic table; also called the main-group elements
- reservoir** a natural or an artificial pond or lake used to store water, control floods, or generate electricity; a body of water stored for public use
- resonance** when the frequency of an external force matches the natural frequency and standing waves are set up
- responding variable** the variable that responds to changes in the manipulated variable; also known as the *dependent* variable because its value depends on the value of the manipulated variable
- reverberation** apparent increase in volume caused by reflections, usually arriving within 0.1 second after the original sound
- reverse fault** a fault where the hanging wall has moved upward with respect to the footwall
- revolution** the motion of a planet as it orbits the Sun
- Richter scale** expresses the intensity of an earthquake in terms of a scale with each higher number indicating 10 times more ground movement and about 30 times more energy released than the preceding number
- ridges** long, rugged mountain chains rising thousands of meters above the abyssal plains of the ocean basin
- rift** a split or fracture in a rock formation, in a land formation, or in the crust of Earth
- rip current** a strong, brief current that runs against the surf and out to sea
- rock** a solid aggregation of minerals or mineral materials that have been brought together into a cohesive solid
- rock cycle** the understanding of igneous, sedimentary, or metamorphic rock as a temporary state in an ongoing transformation of rocks into new types; the process of rocks continually changing from one type to another
- rock flour** rock pulverized by a glacier into powdery, silt-sized sediment
- rockfall** the rapid tumbling, bouncing, or free fall of rock fragments from a cliff or steep slope
- rockslide** a sudden, rapid movement of a coherent unit of rock along a clearly defined surface or plane
- rotation** the spinning of a planet on its axis
- runoff** water moving across the surface of Earth as opposed to soaking into the ground
- S**
- salinity** a measure of dissolved salts in seawater, defined as the mass of salts dissolved in 1,000 g of solution
- salt** any ionic compound except one with hydroxide or oxide ions
- San Andreas fault** in California, the boundary between the North American Plate and the Pacific Plate that runs north-south for some 1,300 km (800 mi) with the Pacific Plate moving northwest and the North American Plate moving southeast
- saturated molecule** an organic molecule that has the maximum number of hydrogen atoms possible
- saturated solution** the apparent limit to dissolving a given solid in a specified amount of water at a given temperature; a state of equilibrium that exists between dissolving solute and solute coming out of solution
- saturation** (of water vapor) an equilibrium condition that occurs when evaporation and condensation are in balance
- scientific law** a relationship between quantities, usually described by an equation in the physical sciences; is more important and describes a wider range of phenomena than a scientific principle
- scientific principle** a relationship between quantities concerned with a specific or narrow range of observations and behavior
- scintillation counter** a device that indirectly measures ionizing radiation (alpha, beta, gamma, etc.) by measuring the flashes of light produced when the radiation strikes a phosphor
- sea** a smaller part of the ocean with characteristics that distinguish it from the larger ocean
- sea breeze** cool, dense air from over water moving over land as part of convective circulation
- seafloor spreading** the process by which hot, molten rock moves up from the interior of Earth to emerge along mid-oceanic rifts, flowing out in both directions to create new rocks
- seamounts** steep, submerged volcanic peaks on the abyssal plain
- second** the standard unit of time in both the metric and English systems of measurement

- secondary coil** part of a transformer, a coil of wire in which the voltage of the original alternating current in the primary coil is stepped up or down by way of electromagnetic induction
- secondary loop** a part of a nuclear power plant; the closed-pipe system that carries steam from a steam generator to the turbines, then back to the steam generator as feedwater
- second law of motion** the acceleration of an object is directly proportional to the net force acting on that object and inversely proportional to the mass of the object
- second law of thermodynamics** a statement that the natural process proceeds from a state of higher order to a state of greater disorder
- sedimentary rocks** rocks formed from particles or dissolved minerals from previously existing rocks
- sediments** accumulations of silt, sand, or gravel that settled out of the atmosphere or out of water
- seismic waves** vibrations that move as waves through any part of the Earth, usually associated with earthquakes, volcanoes, or large explosions
- seismograph** an instrument that measures and records seismic wave data
- semiarid** the climate classification between arid and humid; receives between 25 and 50 cm (10 and 20 in) of precipitation per year
- semiconductors** elements that have properties between those of a metal and those of a nonmetal, sometimes conducting an electric current and sometimes acting as an electrical insulator depending on the conditions and their purity; also called *metalloids*
- series circuit** for batteries, the negative terminal of one cell is connected to the positive terminal of another cell; lightbulbs in a series circuit are connected one after the other
- shallow-focus earthquakes** earthquakes that occur from the surface down to 70 km (43 mi) deep
- shear stress** produced when two plates slide past each other or one plate slides past another plate that is not moving
- shell model of the nucleus** a model of the nucleus that has protons and neutrons moving in energy levels or shells in the nucleus (similar to the shell structure of electrons in an atom)
- shield volcano** a broad, gently sloping volcanic cone constructed of solidified lava flows
- shock wave** a large, intense wave disturbance of very high pressure—for example, the pressure wave created by an explosion
- short circuit** a frayed or broken wire that provides a new path of lesser resistance that could allow a dangerous current
- sidereal day** the interval between two consecutive crossings of the celestial meridian by a particular star
- sidereal month** the time interval between two consecutive crossings of the Moon across any star
- sidereal year** the time interval required for Earth to move around its orbit so that the Sun is again in the same position against the stars
- silicates** minerals that contain silicon-oxygen tetrahedra either isolated or joined together in a crystal structure
- sill** a tabular-shaped intrusive rock that formed when magma moved into the plane of contact between sedimentary rock layers
- simple harmonic motion** the vibratory motion that occurs when there is a restoring force opposite to and proportional to a displacement
- single bond** covalent bond in which a single pair of electrons is shared by two atoms
- slope** the ratio of changes in the y variable to changes in the x variable or how fast the y value increases as the x value increases
- small solar system bodies** all objects other than planets or dwarf planets that are orbiting the Sun
- soil** a mixture of unconsolidated weathered earth materials and humus, which is altered, decay-resistant organic matter
- solar constant** the averaged solar power received by the outermost part of Earth's atmosphere when the sunlight is perpendicular to the outer edge and Earth is at an average distance from the Sun; about 1,370 watts per square meter
- solenoid** a cylindrical coil of wire that becomes electromagnetic when a current runs through it
- solids** a phase of matter with molecules that remain close to fixed equilibrium positions due to strong interactions between the molecules, resulting in the characteristic definite shape and definite volume of a solid
- solstice** the time when the Sun is at its maximum or minimum altitude in the sky, known as the summer solstice or the winter solstice, respectively
- solubility** the dissolving ability of a given solute in a specified amount of solvent; the concentration that is reached as a saturated solution is achieved at a particular temperature
- solute** the component of a solution that dissolves in the other component; the solvent
- solution** a homogeneous mixture of ions or molecules of two or more substances
- solvent** the component of a solution present in the larger amount; the solute dissolves in the solvent to make a solution
- sonic boom** sound waves that pile up into a shock wave when a source is traveling at or faster than the speed of sound
- sound quality** a characteristic of the sound produced by a musical instrument; determined by the presence and relative strengths of the overtones produced by the instrument
- south celestial pole** a point directly above the South Pole of Earth; the point above the south pole on the celestial sphere
- south pole** short for “south seeking”; the pole of a magnet that points southward when it is free to turn
- specific heat** each substance has its own specific heat, which is defined as the amount of energy (or heat) needed to increase the temperature of 1 gram of a substance 1 degree Celsius
- speed** a measure of how fast an object is moving—the rate of change of position per change in time; speed has magnitude only and does not include the direction of change
- spin quantum number** from the quantum mechanics model of the atom, one of four descriptions of the energy state of an electron wave; this quantum number describes the spin orientation of an electron relative to an external magnetic field
- spring equinox** one of two times a year that daylight and night are of equal length; occurs on or about March 21 and identifies the beginning of the spring season
- spring tides** unusually high and low tides that occur every two weeks because of the relative positions of Earth, the Moon, and the Sun
- standard atmospheric pressure** the average atmospheric pressure at sea level, which is also known as normal pressure; the standard pressure is 29.92 in or 760.0 mm of mercury (1,013.25 millibar)
- standard time zones** 15° wide zones defined to have the same time throughout the zone, defined as the mean solar time at the middle of each zone
- standard unit** a measurement unit established as the standard upon which the value of the other referent units of the same type are based
- standing waves** a condition where two waves of equal frequency traveling in opposite directions meet and form stationary regions of maximum displacement due to constructive interference and stationary regions of zero displacement due to destructive interference
- starches** complex carbohydrates (polysaccharides) that plants use as a stored food

source and that serve as an important source of food for animals

stationary front occurs when the edge of a front is not advancing

steam generator a part of nuclear power plant; the heat exchanger that heats feed-water from the secondary loop to steam with the very hot water from the primary loop

step-down transformer a transformer that decreases the voltage of a current

step-up transformer a transformer that increases the voltage of a current

stony-iron meteorites meteorites composed of silicate minerals and metallic iron

stony meteorites meteorites composed mostly of silicate minerals that usually make up rocks on Earth

storm a rapid and violent weather change with strong winds, heavy rain, snow, or hail

strain adjustment to stress; a rock unit might respond to stress by changes in volume, changes in shape, or breaking

stratopause the upper boundary of the stratosphere

stratosphere the layer of the atmosphere above the troposphere where temperature increases with height

stream a large or small body of running water

stress a force that tends to compress, pull apart, or deform rock; stress on rocks in the earth's solid outer crust results as Earth's plates move into, away from, or alongside one another

strong acid an acid that ionizes completely in water, with all molecules dissociating into ions

strong base a base that is completely ionic in solution and has hydroxide ions

subduction zone the region of a convergent boundary where the crust of one plate is forced under the crust of another plate into the interior of Earth

sublimation the phase change of a solid directly into a vapor or gas

submarine canyons a feature of the ocean basin; deep, steep-sided canyons that cut through the continental slopes

summer solstice in the Northern Hemisphere, the time when the Sun reaches its maximum altitude in the sky, which occurs on or about June 22 and identifies the beginning of the summer season

superconductors some materials in which, under certain conditions, the electrical resistance approaches zero

supercooled water in the liquid phase when the temperature is below the freezing point

supernova a rare catastrophic explosion of a star into an extremely bright but short-lived phenomenon

supersaturated containing more than the normal saturation amount of a solute at a given temperature

surf the zone where breakers occur; the water zone between the shoreline and the outermost boundary of the breakers

surface wave a seismic wave that moves across Earth's surface, spreading across the surface as water waves spread on the surface of a pond from a disturbance

S-wave a sideways, or shear, wave in which a disturbance vibrates materials from side to side, perpendicular to the direction of wave movement

S-wave shadow zone a region of Earth more than 103° of arc away from the epicenter of an earthquake where S-waves are not recorded; believed to be the result of the core of Earth being a liquid, or at least acting as a liquid

swell regular groups of low-profile, long-wavelength waves that move continuously

syncline a trough-shaped fold in layered bedrock

synodic month the interval of time from new moon to new moon (or any two consecutive identical phases)

T

talus steep, conical or apronlike accumulations of rock fragments at the base of a slope

temperate climate zone climate zone of the middle latitudes; average monthly temperatures stay between 10°C and 18°C (50°F and 64°F) throughout the year

temperature how hot or how cold something is; a measure of the average kinetic energy of the molecules making up a substance

tensional stress the opposite of compressional stress; occurs when one part of a plate moves away from another part that does not move

terrestrial planets the planets Mercury, Venus, Earth, and Mars that have similar densities and compositions as compared to the outer giant planets

theory a broad, detailed explanation that guides the development of hypotheses and interpretations of experiments in a field of study

thermometer a device used to measure the hotness or coldness of a substance

thermosphere the thin, high, outer atmospheric layer of Earth where the molecules are far apart and have a high kinetic energy

third law of motion whenever two objects interact, the force exerted on one object is equal in size and opposite in direction to the force exerted on the other object; forces always occur in matched pairs that are equal and opposite

thrust fault a reverse fault with a low-angle fault plane

thunderstorm a brief, intense electrical storm with rain, lightning, thunder, strong winds, and sometimes hail

tidal bore a strong tidal current, sometimes resembling a wave, produced in very long, very narrow bays as the tide rises

tidal currents a steady and continuous onward movement of water produced in narrow bays by the tides

tides the periodic rise and fall of the level of the sea from the gravitational attraction of the Moon and Sun

tornado a long, narrow, funnel-shaped column of violently whirling air from a thundercloud that moves destructively over a narrow path when it touches the ground

total internal reflection the condition where all light is reflected back from a boundary between materials; occurs when light arrives at a boundary at the critical angle or beyond

total solar eclipse an eclipse that occurs when Earth, the Moon, and the Sun are lined up so the new moon completely covers the disk of the Sun; the umbra of the Moon's shadow falls on the surface of Earth

transform boundaries in plate tectonics, boundaries that occur between two plates sliding horizontally by each other along a long, vertical fault; sudden jerks along the boundary result in the vibrations of earthquakes

transformer a device consisting of a primary coil of wire connected to a source of alternating current and a secondary coil of wire in which electromagnetic induction increases or decreases the voltage of the source

transition elements members of the group B families of the periodic table

transparent a term describing materials that allow the transmission of light—for example, glass and clear water are transparent materials

transportation the movement of eroded materials by agents such as rivers, glaciers, wind, or waves

transverse wave a mechanical disturbance that causes particles to move perpendicular to the direction that the wave is traveling

trenches long, relatively narrow, steep-sided troughs that occur along the edges of the ocean basins

triglyceride an organic compound of esters formed from glycerol and three long-chain carboxylic acids; also called fats in animals and oil in plants

triple bond a covalent bond formed when three pairs of electrons are shared by two atoms

tropical air mass a warm air mass from warm regions

tropical climate zone the climate zone of the low latitudes; average monthly temperatures stay above 18°C (64°F), even during the coldest month of the year

tropical cyclone a large, violent circular storm that is born over the warm, tropical ocean near the equator; also called *hurricane* (Atlantic and eastern Pacific) and *typhoon* (in western Pacific)

tropical year the time interval between two consecutive spring equinoxes; used as standard for the common calendar year

tropic of Cancer parallel identifying the northern limit where the Sun appears directly overhead; located at 23.5°N latitude

tropic of Capricorn parallel identifying the southern limit where the Sun appears directly overhead; located at 23.5°S latitude

tropopause the upper boundary of the troposphere, identified by the altitude where the temperature stops decreasing and remains constant with increasing altitude

troposphere the layer of the atmosphere from the surface to where the temperature stops decreasing with height

trough the low mound of water that is part of a wave; also refers to the rarefaction, or low-pressure part, of a sound wave

tsunami a very large, fast, and destructive ocean wave created by an undersea earthquake, landslide, or volcanic explosion; a seismic sea wave

turbidity current a muddy current produced by underwater landslides

typhoon the name for hurricanes in the western Pacific

U

ultrasonic sound waves too high in frequency to be heard by the human ear; frequencies above 20,000 Hz

umbra the inner core of a complete shadow

unconformity a time break in the rock record

undertow a current beneath the surface of the water produced by the return of water from the shore to the sea

unit in measurement, a well-defined and agreed-upon referent

universal law of gravitation every object in the universe is attracted to every other object with a force directly proportional to the product of their masses and inversely proportional to the square of the distance between the centers of the two masses

unpolarized light light consisting of transverse waves vibrating in all conceivable random directions

unsaturated molecule an organic molecule that does not contain the maximum number

of hydrogen atoms; a molecule that can add more hydrogen atoms because of the presence of double or triple bonds

V

valence the number of covalent bonds an atom can form

valence electrons electrons of the outermost orbital; the electrons that determine the chemical properties of an atom and the electrons that participate in chemical bonding

Van Allen belts belts of radiation caused by cosmic-ray particles becoming trapped and following Earth's magnetic field lines between the poles

vapor the gaseous state of a substance that is normally in the liquid state

variable a changing quantity usually represented by a letter or symbol

velocity describes both the speed and direction of a moving object; a change in velocity is a change in speed, in direction of travel, or both

ventifacts rocks sculpted by wind abrasion

vernal equinox another name for the spring equinox, which occurs on or about March 21 and marks the beginning of the spring season

vibration a back-and-forth motion that repeats itself

virtual image an image where light rays appear to originate from a mirror or lens; this image cannot be projected on a screen

volcanism volcanic activity; the movement of magma

volcano a hill or mountain formed by the extrusion of lava or rock fragments from a mass of magma below

volt a unit of potential difference equivalent to J/C

voltage drop the electric potential difference across a resistor or other part of a circuit that consumes power

voltage source a source of electric power in an electric circuit that maintains a constant voltage supply to the circuit

volume how much space something occupies

vulcanism volcanic activity; the movement of magma

W

warm front the front that forms when a warm air mass advances against a cool air mass

watershed the region or land area drained by a stream; a stream drainage basin

water table the boundary below which the ground is saturated with water

watt the metric unit for power; equivalent to J/s

wave a disturbance or an oscillation that moves through a medium

wave equation the relationship of the velocity of a wave to the product of the wavelength and frequency of the wave

wave front a region of maximum displacement in a wave; a condensation in a sound wave

wave height the vertical distance of an ocean wave between the top of the wave crest and the bottom of the next trough

wavelength the horizontal distance between successive wave crests or other successive parts of the wave

wave mechanics an alternate name for quantum mechanics derived from the wavelike properties of subatomic particles

wave period the time required for two successive crests or other successive parts of the wave to pass a given point

weak acid an acid only partially ionized because of an equilibrium reaction with water

weak base a base only partially ionized because of an equilibrium reaction with water

weathering slow changes that result in the breaking up, crumbling, and destruction of any kind of solid rock

white dwarf stars one of two groups of stars on the Hertzsprung-Russell diagram that have a different set of properties than the main sequence stars; faint, white-hot stars that are very small and dense

wind a horizontal movement of air that moves along or parallel to the ground, sometimes in currents or streams

wind abrasion the natural sand-blasting process that occurs when wind particles break off small particles of rock and polish the rock they strike

windchill factor the cooling equivalent temperature that results from the wind making the air temperature seem much lower; the cooling power of wind

winter solstice in the Northern Hemisphere, the time when the Sun reaches its minimum altitude, which occurs on or about December 22 and identifies the beginning of the winter season

work the magnitude of applied force times the distance through which the force acts; can be thought of as the process by which one form of energy is transformed to another

Z

zone of saturation the zone of sediments beneath Earth's surface in which water has collected in all available spaces