

# Glossary

## How to Use This Glossary

This Glossary provides the definitions of the key terms that are shown in boldface type in the text. Definitions for other important terms are included as well. The Glossary entries also show the sections where you can find the boldface words. A pronunciation guide, using the key below, appears in square brackets after selected words.

a = mask, back  
ae = same, day  
ah = car, farther  
aw = dawn, hot  
e = met, less

ee = leaf, clean  
i = simple, this  
ih = idea, life  
oh = home, loan  
oo = food, boot

u = wonder, Sun  
uh = taken, travel  
uhr = insert, turn

## A

**abiotic** [ae-bih-AW-tik] the non-living parts of an ecosystem (1.1)

**absolute magnitude** the magnitude of a star that we would observe if the star were 32.6 light-years from Earth (8.3)

**acid precipitation** rain, snow, or fog that is unnaturally acidic (pH less than 5.6) due to gases in the atmosphere that react with water to form acids (1.3)

**aerial insectivore** an organism that consumes flying insects (2.4)

**alien species** a species that is accidentally or deliberately introduced to a new location, usually as a result of human activity (3.3)

**alpha particle** a positively charged particle emitted from the nuclei of some radioactive elements (5.1)

**alternating current (AC)** a current in which electrons move back and forth in a circuit (12.1)

**ammeter** a device that measures the current in one location in a circuit (11.2)

**ampere (A)** [AM-pir] the unit of electric current, equivalent to one coulomb per second (11.2)

**apparent magnitude** the brightness of a star as seen from Earth (7.2)

**aquatic ecosystem** an ecosystem that is water-based, either fresh water or salt water (1.1)

**asterism** a smaller group of stars that form patterns within a constellation (7.2)

**asteroid** an object in space that ranges in size from a tiny speck, like a grain of sand, to 500 km wide; most asteroids originate in the asteroid belt between Mars and Jupiter (7.5)

**astronomer** [uh-STRON-uh-mer] a scientist who studies astronomy (7.1)

**astronomical unit** [as-truh-NOM-i-kuhl YOO-nit] the average distance between Earth and the Sun, about  $150 \times 10^6$  km (7.4)

**astronomy** the study of the night sky (7.1)

**atmosphere** the layer of gases above Earth's surface (1.1)

**atom** the smallest particle of an element that retains the identity of the element (5.1)

**atomic mass** [uh-TOM-ik mas] the average mass of the naturally occurring isotopes of an element (5.3)

**atomic number** [uh-TOM-ik NUM-ber] the number of protons in the nucleus of an atom (5.2)

**atomos** [A-toh-mohs] a word used by Greek philosophers, over 2500 years ago, to describe the smallest piece of matter (5.1)

## B

**base load** the continuous minimum demand for electrical power (12.3)

**battery** a connection of two or more cells (11.1)

**big bang** the event that may have triggered the expansion of the universe 14 billion years ago (9.2)

**binary stars** two stars that orbit each other (8.3)

**bioaccumulation** [bih-oh-uh-KYU-myuh-lae-shuhn] a process in which an organism ingests materials, especially toxins, faster than it eliminates them (1.2, 4.2)

**bioaugmentation** [bih-oh-awg-mun-TAE-shuhn] the use of organisms to add essential nutrients to depleted soils (3.4)

**biocontrol** the use of a species to control the population growth or spread of an undesirable species (3.4)

**biodiversity** the number and variety of organisms found in a specific region (3.1)

**biodiversity crisis** the current accelerated rate of extinctions on Earth (3.3)

**biodiversity hotspot** a place where there is an exceptionally large number of species in a relatively small area (3.1)

**biomagnification** [bih-oh-mag-nuh-fi-KAE-shuhn] a process in which the concentration of ingested toxins increases as it moves from one trophic level to the next (1.2, 4.2)

**biomass** the total mass of living organisms in a defined group or area (1.2)

**bioremediation** the use of living organisms to clean up contaminated areas naturally (3.4)

**biosphere** the regions of Earth where living organisms exist (1.1)

**biotic** [bih-AW-tik] the living parts of an ecosystem (1.1)

**black hole** the remnant of a supernova explosion with a gravitational field so strong that nothing can escape its pull (8.3)

**blueshift** the effect in which objects moving toward an observer have their wavelengths shortened, toward the blue end of the visible spectrum (9.2)

**bog** a type of wetland in which the water is acidic and low in nutrients (2.2)

**Bohr-Rutherford model** a model of the atom in which a central positive nucleus is surrounded by electrons in energy levels (5.1, 10.1)

**boiling point** the temperature at which a liquid turns into a gas (4.2)

**bottom-up regulation** a process in which the abundance of organisms in lower trophic levels affects the abundance of organisms in higher trophic levels (2.2)

## C

**calendar** a way of showing days, organized into a schedule of larger units of time such as weeks, months, seasons, or years; usually a table or a chart (7.1)

**captive breeding** the breeding of rare or endangered wildlife in controlled settings to increase the population size (3.2)

**carrying capacity** the size of a population that can be supported indefinitely by the available resources and services of an ecosystem (2.1)

**celestial object** [suh-LES-chuhl AWB-jekt] any object that exists in space, such as a planet, a star, or the Moon (7.1)

**cell** *See voltaic cell*

**cellular respiration** a process that releases energy from organic molecules, especially carbohydrates, in the presence of oxygen (1.3)

**charging by contact** generating a net charge on a neutral object by touching it with a charged object (10.2)

**charging by friction** a process in which objects made from different materials rub against each other, producing a net static charge on each object (10.1)

**charisma** [ku-RIZ-mah] the ability to attract or keep interest (3.2)

**charismatic species** [kaer-iz-MA-tik SPEE-sees] an appealing organism used to help draw attention to an environmental problem (3.2)

**chemical bond** a chemical link between two atoms, which holds the atoms together (6.1)

**chemical property** the ability of a substance to change or react, and to form new substances (4.3)

**chemiluminescence** [kem-uh-loo-muh-NES-uhns] the emission of light resulting from a chemical reaction (4.3)

**circuit breaker** a safety device that is placed in series with other circuits that lead to appliances and outlets (12.1)

**circuit diagram** a diagram that uses standard symbols to represent the components in an electric circuit and their connections (11.3)

**colony collapse disorder** the disappearance of mature worker bees that is leaving hives empty, or with only a few young worker bees that cannot maintain the hives alone (2.4)

**combustibility** the ability of a substance to burn in air (4.3)

**comet** an object composed of rocky material, ice, and gas; comes from the Kuiper Belt or Oort Cloud (7.5)

**community** all the populations of the different species that interact in a specific area or ecosystem (3.2)

**competition** when two or more organisms compete for the same resource in the same location at the same time (1.1)

**compound** a pure substance made of two or more different elements that are chemically combined (4.1)

**conduction** the movement or transmission of thermal or electrical energy through a substance (10.1)

**conductor** a material in which electrons can move easily between atoms (10.1)

**connectivity** the collection of links and relationships between ecosystems that are separated geographically (2.4)

**constellation** a group of stars that seem to form a distinctive pattern in the sky (7.2)

**consumer** an organism that cannot make its own food, so it eats other organisms to survive (1.2)

**cosmic microwave background (CMB) radiation** the radiation left over from the big bang, which fills the universe (9.2)

**cosmology** [koz-MAWL-uh-jee] the study of the universe (9.2)

**coulomb (C)** [KOO-lohm] the quantity of charge that is equal to the charge of  $6.25 \times 10^{18}$  electrons (11.2)

**covalent bond** [koh-VAE-lent bond] a chemical bond in which two atoms share one or more pairs of electrons (6.2)

**covalent compound** *See molecular compound*

**crystal lattice** [KRIS-tul LAT-is] a solid arrangement of a regular repeating pattern of ions (6.1)

## D

**dark energy** a form of energy that makes up nearly three quarters of the universe; has the effect of increasing the expansion of the universe (9.3)

**dark matter** the most abundant form of matter in the universe; invisible to telescopes (9.3)

**daylighting** the process of redirecting an underground body of water, such as a creek, to an above-ground channel (3.4)

**decomposer** an organism that breaks down nutrients in decaying bodies and wastes of organisms, and returns nutrients to abiotic parts of an ecosystem (1.2)

**deforestation** the practice of clearing forests for logging or other human uses, and never replanting them (3.3)

**density** the ratio of the mass of a substance to the volume it occupies (4.2)

**deposition** [dep-uh-ZISH-uhn] the direct change of state from a gas to a solid (4.2)

**desertification** the change of non-desert land into a desert, which may result from climate change or from unsustainable farming or water use (2.4)

**dioxide** [dih-OK-sihd] two oxygen atoms (6.2)

**direct current (DC)** current in which charged particles travel through a circuit in only one direction (12.1)

**dominant species** a species that is so abundant that it has the biggest biomass of any community member (3.2)

**Doppler effect** the change in pitch of a sound due to the motion of the source relative to an observer; also, the change in frequency of a light source due to its motion relative to an observer (9.2)

**doubling time** the period of time that is required for a population to double in size (2.3)

**dry cell** a cell that contains an electrolyte made of a paste (11.1)

**dwarf planet** a round, celestial body that orbits the Sun; it may share its orbit with another celestial body, but it is not a satellite (7.5)

## E

**eclipse** the phenomenon in which one celestial object moves directly in front of another celestial object, as viewed from Earth (7.3)

**ecological footprint** a measure of the impact of an individual or a population on the environment in terms of energy consumption, land use, and waste production (2.3)

**ecological niche** the way in which an organism occupies a position in an ecosystem, including all the necessary biotic and abiotic factors (2.2)

**ecosystem** all the interacting parts of a biological community and its environment (1.1)

**ecosystem engineer** a species that causes such dramatic changes to landscapes that it creates a new ecosystem (3.2)

**ecosystem services** the benefits experienced by organisms, including humans, that are provided by sustainable ecosystems (2.4)

**ecotourism** a form of tourism that is sensitive to the health of an ecosystem and involves recreational activities provided by sustainable ecosystems (2.4)

**efficiency** the ratio of useful energy output to total energy input, expressed as a percentage (12.2)

**electric circuit** a closed path along which electrons that are powered by an energy source can flow (11.1)

**electric current** a measure of the number of charged particles that pass by a point in an electric circuit each second (11.2)

**electric field** a property of the space around a charged object, where the effect of its charge can be felt by other objects (10.2)

**electrical energy** the energy that is used by an appliance at a given setting; is determined by multiplying its power rating by the length of time it is used (12.2)

**electrical power** the rate at which an appliance uses electrical energy (12.2)

**electrical resistance** the property of a substance that hinders electric current and converts electrical energy to other forms of energy (11.2)

**electrical source** a source of electrical energy that creates potential difference in a circuit (11.2)

**electricity** a form of energy that results from the interaction of charged particles, such as electrons or protons (10.1)

**electrode** one of two metal terminals in a cell or battery (11.1)

**electrolyte** a solution or paste that conducts charge (11.1)

**electromagnetic radiation** radiation consisting of electromagnetic waves that travel at the speed of light (such as visible light, radio waves, and X rays) (8.1)

**electron** a negatively charged particle within the atom (5.1)

**electroscope** a device for detecting the presence of an electric charge (10.2)

**electrostatic precipitator** a type of cleaner that removes unwanted particles and liquid droplets from a flow of gas (10.3)

**electrostatic series** a list of materials that have been arranged according to their ability to hold on to electrons (10.1)

**element** a pure substance that cannot be broken down into simpler parts by chemical methods (4.1)

**ellipse** a curve that is generally referred to as being oval or the shape of an egg (7.3)

**elliptical galaxy** a type of galaxy that ranges in shape from a perfect sphere to a stretched-out ellipse (9.1)

**EnerGuide label** a label that gives details about how much energy an appliance uses in one year of normal use (12.2)

**energy level** a possible level of energy an electron can have in an atom (5.1)

**environmental farm plan** a volunteer-membership program in which farmers examine and make plans to reduce environmental impacts of farms (1.1)

**equilibrium** the balance between opposing forces (2.1)

**ethics** the set of moral principles and values that guide a person's activities and help him or her decide what is right and what is wrong (8.1)

**eutrophication** [yoo-troh-fi-KAE-shun] a process in which nutrient levels in aquatic ecosystems increase, leading to an increase in the populations of primary producers (1.1)

**evaporation** the change of state from a liquid to a gas (4.2)

**exponential growth** accelerating growth that produces a J-shaped curve when the population is graphed against time (2.1)

**extinction** the death of all of the individuals of a species (3.3)

**extrasolar planet** a planet that is orbiting a star other than the Sun (8.2)

## F

**fermentation** a process that releases energy from organic molecules, especially carbohydrates, in the absence of oxygen (1.3)

**fuel cell** a cell that generates electricity through the chemical reactions of fuel that is stored outside the cell (11.1)

**fuse** a safety device that is found in older buildings and some appliances; like a circuit breaker, it is placed in series with other circuits that lead to appliances and outlets (12.1)

## G

**galaxy** a huge collection of stars, planets, gas, and dust that is held together by gravity (9.1)

**geocentric model** [jee-oh-SEN-trik MAW-duhl] a model of the solar system stating that Earth is the centre of all planetary motion, with the planets and the Sun travelling in perfect circles around Earth (7.4)

**geothermal energy** energy produced from naturally occurring steam and hot water trapped under Earth's surface (12.4)

**globular cluster** [GLOB-yuh-ler KLUHS-ter] a collection of 100 000 to a million stars that is arranged in a distinctive spherical shape; globular clusters are around the centre of the Milky Way (9.1)

**gravitational force** the force of attraction between all masses in the universe; the strength of the gravitational force between two objects depends on the masses of the objects and the distance between them (7.3)

**greenhouse effect** the warming of Earth as a result of greenhouse gases, which trap some of the energy that would otherwise leave Earth (1.3)

**greenhouse gas** an atmospheric gas that prevents heat from leaving the atmosphere, thus increasing the temperature of the atmosphere (1.3)

**ground** an object that can supply a very large number of electrons to, or can remove a very large number of electrons from, a charged object, thus neutralizing that object (10.1)

**group** a vertical column of elements in the periodic table (5.3)

## H

**habitat loss** the destruction of habitats, which usually results from human activities (3.3)

**hardness** the ability of a substance to be scratched (4.2)

**HDPE** high-density polyethylene (6.2)

**heliocentric model** [hee-lee-oh-SEN-trik MAW-duhl] a model of the solar system in which the Sun is in the centre with the planets orbiting it (7.4)

**Hertzsprung-Russell (H-R) diagram** a graph that compares the properties of stars (8.3)

**host** an organism in a symbiotic relationship that usually provides nourishment and/or shelter (2.2)

**Hubble constant** the rate at which the universe is expanding (9.2)

**Hubble law** the speed of a galaxy is proportional to the galaxy's distance from Earth (9.2)

**hydroelectric power generation** the production of electricity using a source of moving water (12.3)

**hydrosphere** all the water found on Earth, including lakes, oceans, and ground water (1.1)

## I

**incandescence** a light emitted from a material because of the high temperature of that material (11.2)

**induced charge separation** the movement of electrons in a substance, caused by the electric field of a nearby charged object that is not in direct contact with the substance (10.2)

**insulator** a material in which electrons cannot move easily from one atom to another (10.1)

**intensification** the creation of high-density residential areas and compact development (2.1)

**intermediate load** a demand for electricity that is greater than the base load and is met by burning coal and natural gas (12.3)

**invasive species** a species that can take over the habitat of native species or invade their bodies (3.3)

**ion** [IH-awn] a positively or negatively charged atom or group of atoms (6.1, 10.3)

**ion charge** the resulting charge of an atom, positive or negative, after the gain or loss of electrons (5.3)

**ionic bond** a chemical bond that forms between oppositely charged ions (6.1)

**ionic compound** a compound made of oppositely charged ions (6.1)

**irregular galaxy** a galaxy that has an irregular shape (9.1)

**isotope** one of two or more forms of an element that have the same number of protons but a different number of neutrons (5.2)

## J

**jagged path** the path often followed by lightning as it travels from a cloud to the ground or a tall structure, resulting from air currents and turbulence (10.3)

**joule (J)** the SI unit of energy; quantities of energy are often expressed in kilojoules (kJ); 1 kJ = 1000 J (12.2)

## K

**keystone species** a species that can greatly affect population numbers and the health of an ecosystem (3.2)

**kilowatt (kW)** a practical unit of electrical power; 1 kW = 1000 W (12.2)

**kilowatt-hour (kW•h)** the practical unit of electrical energy (12.2)

## L

**lander** a spacecraft designed to land on a celestial object (8.1)

**latitude** the location above or below the equator (7.2)

**laws of electric charges** laws that describe how two objects interact electrically when one or both are charged (10.2)

**lightning rod** a metal sphere or point that is attached to the highest part of a building and connected to ground (10.3)

**light-year** the distance that light travels in one year, about  $9.5 \times 10^{12}$  km (7.2)

**limiting factor** a factor that limits the growth, distribution, or amount of a population in an ecosystem (2.1)

**lithosphere** the hard part of Earth's surface (1.1)

**load** a resistor or any other device that transforms electrical energy into heat, motion, sound, or light (11.2)

**Local Group** the small group of about 40 galaxies that includes the Milky Way (9.1)

**luminosity** a star's total energy output per second; its power in joules per second (J/s) (8.3)

**lunar eclipse** the phenomenon in which the full Moon passes into Earth's shadow (7.3)

## M

**main sequence** a narrow band of stars on the H-R diagram that runs diagonally from the upper left (bright, hot stars) to the lower right (dim, cool stars); about 90 percent of stars, including the Sun, are in the main sequence (8.3)

**mass number** the sum of the number of protons and the number of neutrons in the nucleus of an atom (5.2)

**matter** anything that has mass and occupies space (4.1)

**megawatt (MW)** a unit of electrical power; 1 MW = 1 000 000 W (12.3)

**melting** the change of state from solid to liquid (4.2)

**melting point** the temperature at which a solid turns into a liquid (4.2)

**metal** typically, an element that is hard, shiny, malleable, and ductile, and is a good conductor of heat and electricity (5.3)

**metalloid** an element that shares some properties with metals and some properties with non-metals (5.3)

**meteor** [MEE-tee-uhr] a meteoroid that hits Earth's atmosphere and burns up (7.5)

**meteorite** [MEE-tee-uhr-ihht] a meteoroid that is large enough to pass through Earth's atmosphere and reach the ground, without being totally burned up (7.5)

**meteoroid** [MEE-tee-uhr-oid] a piece of rock moving through space (7.5)

**Milky Way** the galaxy that includes the solar system; appears as a hazy white band in the night sky (9.1)

**mixture** matter that contains more than one kind of particle (4.1)

**molecular compound** [muh-LEK-yuh-ler KAWM-pound] a compound with particles made up of atoms held together by covalent bonds (6.2)

**molecule** [MAWL-uh-kyul] the smallest discrete particle of a molecular compound; has one or more shared pairs of electrons in one or more covalent bonds (6.2)

**monoxide** one oxygen atom (6.2)

**multimeter** a device that measures several different electrical quantities, including voltage, current, and resistance (11.2)

**mutualism** a symbiotic relationship between two species in which both species benefit from the relationship (2.2)

## N

**neutrino** [noo-TREE-noh] an uncharged particle that is much smaller than an atom; it passes easily through most kinds of matter and is extremely difficult to detect (5.1)

**neutron** an uncharged particle that is part of almost every atomic nucleus (5.1)

**neutron star** a star so dense that only neutrons can exist in its core (8.3)

**niche** [NEESH] the role and function of an organism or species within an ecosystem (2.4)

**non-metal** typically, an element that is not shiny, malleable, or ductile, and is a poor conductor of heat and electricity (5.3)

**non-ohmic** not following Ohm's law (11.4)

**non-renewable energy source** a source of energy that cannot be replaced as quickly as it is used (12.3)

**nuclear fusion** [NOO-klee-er FYUSH-uhn] the process of energy production in which hydrogen nuclei combine to form helium nuclei (8.2)

**nucleons** protons and neutrons, because they both exist in the nucleus of an atom (5.2)

**nucleus** in chemistry, the positively charged centre of an atom (5.1)

**nutrient** a chemical that is essential to living things and is cycled through ecosystems (1.1)

## O

**ohm ( $\Omega$ )** [OHM] the unit for resistance, equivalent to one volt per ampere (V/A) (11.4)

**Ohm's law** the ratio of potential difference to current is a constant called resistance (11.4)

**open circuit** a circuit that contains a gap or break (11.2)

**open cluster** a collection of 50 to 1000 stars; open clusters appear along the main band of the Milky Way (9.1)

**orbital radius** the average distance between the Sun and an object that is orbiting the Sun (7.4)

**orbiters** observatories that orbit other celestial objects (8.1)

**overexploitation** the use or extraction of a resource until it is depleted (3.3)

## P

**parallel circuit** a circuit in which there is more than one path along which electrons can flow (11.3)

**parasite** an organism whose niche is dependent on a close association with a larger host organism (2.2)

**peak load** the greatest demand for electricity, which is met by using hydroelectric power and natural gas (12.3)

**period** a horizontal row of elements in the periodic table (5.3)

**periodic table** a system for organizing the elements into columns and rows, so that elements with similar properties are in the same column (5.3)

**phantom load** the electricity that is consumed by an appliance or device when it is turned off (12.2)

**phases of the Moon** the monthly progression of changes in the appearance of the Moon that result from different portions of the Moon's sunlit side being visible from Earth (7.3)

**photosphere** the surface layer of the Sun (8.2)

**photosynthesis** a process that changes solar energy into chemical energy (1.2)

**photovoltaic effect** the generation of a direct current when certain materials are exposed to light (12.4)

**physical property** a characteristic of a substance that can be observed and measured without changing the identity of the substance (4.2)

**planet** an object that orbits one or more stars (and is not a star itself), is spherical, and does not share its orbit with another object (7.4)

**pollination** a process in which male pollen from one flower fertilizes the female ovary in another flower (2.4)

**polymer** [PAWL-uh-mer] a compound composed of repeating sub-units linked together by covalent bonds (6.2)

**population** all the individuals of a species that occupy a particular geographic area at a certain time (2.1)

**potential difference** (voltage) the difference between the electric potential energy per unit of charge at two points in a circuit (11.2)

**predation** a relationship between two different species in which one species feeds on another (1.1)

**predator** an organism that kills and consumes other organisms (2.2)

**prey** an organism that is eaten as food by a predator (2.2)

**primary cell** a cell that can be used only once (11.1)

**primary producer** an organism that can make its own food (1.2)

**produce** to generate; to create (1.3)

**protect** to legally guard from harm a species that is listed as endangered, threatened, or of special concern (3.1)

**proton** [PROH-tawn] a positively charged particle that is part of every atomic nucleus (5.1)

**protostar** a hot, condensed object at the centre of a nebula (8.2)

**pulsar** a type of neutron star that sends pulses of radiation toward Earth (8.3)

**pure substance** matter that contains only one kind of particle (4.1)

## Q

**qualitative** can be described but not measured (4.2)

**quantitative** can be measured and assigned a particular value (4.2)

**quantum** a specific amount of energy (5.1)

## R

**radiation dosimeter** [rae-dee-AE-shun doh-SIM-i-tuhr] a small device that detects and measures exposure to radiation (10.3)

**radioactive** the property of some elements to give off rays of energy as the element breaks down (5.1)

**redshift** the effect in which objects moving away from an observer have their wavelengths lengthened, toward the red end of the visible spectrum (9.2)

**reflecting telescope** a telescope that uses a mirror to collect the light from an object (8.1)

**reforestation** the regrowth of a forest, either through the planting of seeds or trees in an area where a forest was cut down (3.4)

**refracting telescope** a telescope that uses a lens to collect the light from an object (8.1)

**renewable energy source** a source of energy that can be replaced in a relatively brief period of time (12.3)

**resistor** a device used in an electric circuit to decrease the current through a component by a specific amount (11.2)

**respiration** breathing; the process of inhaling gases from and exhaling gases into the external environment; not to be confused with cellular respiration (1.3)

**restoration ecology** the renewal of degraded or destroyed ecosystems through active human intervention (3.4)

**retrograde motion** the movement of an object in the sky, usually a planet, from east to west, rather than its normal motion from west to east; this effect is generally produced when Earth is passing the planet in its orbit (7.4)

**revolution** the time it takes for an object to orbit another object; Earth's revolution around the Sun is 365.24 days (7.1)

**rotation** the turning of an object around an imaginary axis running through it; Earth's rotation around its axis is 24 h (7.1)

## S

**satellite** an artificial (human-made) object or vehicle that orbits Earth, the Moon, or other celestial bodies; also, a celestial body that orbits another body of larger size (for example, the Moon is Earth's natural satellite) (8.1)

**secondary cell** a cell that can be recharged (11.1)

**semiconductor** a material in which electrons can move fairly well between atoms (10.1)

**series circuit** a circuit in which there is only one path along which electrons can flow (11.3)

**smart meter** a meter that records the total electrical energy used hour by hour and sends this information to the utility company automatically (12.2)

**solar cell** a cell that converts sunlight into electrical energy (11.1)

**solar eclipse** the phenomenon in which the shadow of the Moon falls on Earth's surface (7.3)

**solar energy** energy that is directly converted from the energy of the Sun into electricity (12.4)

**solar mass** a unit of measurement for the mass of stars and galaxies; the Sun is 1 solar mass (8.3)

**solar nebula theory** the theory that describes how stars and planets form from contracting, spinning disks of gas and dust (8.2)

**solar system** a group of planets that circle one or more stars (7.4)

**solar wind** a stream of fast-moving charged particles ejected by the Sun into the solar system (8.2)

**solidification** the change of state from liquid to solid (4.2)

**solubility** a measure of the ability of a substance to dissolve in another substance (4.2)

**spectral lines** certain specific wavelengths within a spectrum characterized by lines; spectral lines identify specific chemical elements (8.3)

**spectroscope** an optical instrument that produces a spectrum from a narrow beam of light, and usually projects the spectrum onto a photographic plate or a digital detector (8.3)

**spiral galaxy** a type of galaxy that looks like a pinwheel when viewed from above (9.1)

**stability** the ability of a substance to remain unchanged (4.3)

**standard atomic notation** a notation used to represent atoms of elements; it includes the atomic number and mass number of an element (5.2)

**star** a celestial body made of hot gases, mainly hydrogen and some helium (8.2)

**star cluster** a collection of stars held together by gravity (9.1)

**static charge (static electricity)** an electric charge that tends to stay on the surface of an object, rather than flowing away quickly (10.1)

**steward** someone who manages someone else's property or affairs (3.4)

**stewardship** the active assumption of responsibility for the welfare of the environment (3.4)

**strong force** the force of attraction between neutrons and protons (5.2)

**subatomic particle** a particle that is smaller than the atom (5.1)

**sublimation** the direct change of state from a solid to a gas (4.2)

**succession** the series of changes in ecosystems that occurs over time following a disturbance (3.2)

**sunspot** an area of strong magnetic fields on the photosphere (8.2)

**supercluster** a gigantic cluster of 4 to 25 clusters of galaxies that is hundreds of millions of light-years in size (9.1)

**superconductor** a material through which electric charge can flow with no resistance (11.4)

**supernova** a massive explosion in which the entire outer portion of a star is blown off (8.3)

**sustain** to endure; to support (1.1)

**sustainability** use of Earth's resources, including land and water, at levels that can continue forever (2.3)

**sustainable ecosystem** an ecosystem that is capable of withstanding pressure and giving support to a variety of organisms (1.1)

**sustainable use** use that does not lead to long-term depletion of a resource or affect the diversity of the ecosystem from which the resource is obtained (2.3)

**switch** a control device that can complete or break the circuit to which it is connected (11.2)

**symbiosis** [sim-BIH-oh-sis] interaction between members of two different species that live together in a close association (1.1)

## T

**tailings** waste material left behind after the extraction of minerals (3.4)

**terminal** a position on a cell that must be connected to other components to form a circuit (11.2)

**terrestrial ecosystem** an ecosystem that is land-based (1.1)

**tides** the rising and falling of ocean waters caused by the Moon's and Earth's gravity (7.3)

**time of use pricing** a system of pricing in which the cost of each kW•h of energy used is different at different times of the day (12.2)

**top-down regulation** a process in which the abundance of organisms in higher trophic levels affects the abundance of organisms in lower trophic levels (2.2)

**toxicity** the ability of a substance to cause harmful effects in plants and animals (4.3)

**transformer** an electrical device that changes the size of the potential difference of an alternating current (12.1)

**trans-Neptunian object** an object that circles the Sun beyond the orbit of Neptune (7.5)

**trophic efficiency** a measure of the amount of energy or biomass transferred from one trophic level to the next higher trophic level (1.2)

**trophic level** a category of organisms that is defined by how the organisms gain their energy (1.2)

## U

**unsustainable** a pattern of activity that leads to a decline in the function of an ecosystem (2.3)

**urban sprawl** the growth of relatively low-density development on the edges of urban areas (2.1)

## V

**valence electron** an electron in the outermost occupied energy level of an atom (5.4)

**Van de Graaff generator** a device that accumulates very large charges (10.3)

**viscosity** the measure of a substance's resistance to flow (4.2)

**volt** the unit for potential difference; equivalent to one joule (J) per coulomb (C) (11.2)

**voltaic cell** [vohl-TAE-ik sell] a source of energy that generates an electric current by chemical reactions involving two different metals or metal compounds separated by a conducting solution (11.1)

**voltmeter** a device for measuring electrical potential difference in volts (11.2)

## W

**watershed** an area of land over which the run-off drains into a body of water (2.4)

**watt (W)** a unit of electrical power; 1 kilowatt = 1000 W (12.2)

**weathering** the breaking down of rocks into smaller pieces caused by atmospheric influences (1.1)

**wet cell** a cell that contains a liquid electrolyte (11.1)

**white dwarf** a small, dim, hot star (8.3)

**wind farm** many large wind turbines at one location (12.4)