

# Glossary

## How to Use This Glossary

This Glossary provides the definitions of the key terms that are shown in boldface type in the text. (Instructional boldfaced words such as “observe” and “explain” are not included.) The Glossary entries also show the sections where you can find the boldfaced 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  
ih = idea, life  
i = simple, this  
oh = home, loan  
oo = food, boot

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

### A

- abiotic** [ae-bih-AW-tik] relating to non-living parts of an environment such as sunlight, soil, moisture, and temperature (1.1)
- acceleration** the rate at which an object changes its velocity (9.1)
- acceleration due to gravity ( $g$ )** acceleration due to gravity in the absence of air resistance; the value of acceleration due to gravity near the surface of the Earth is approximately  $9.8 \text{ m/s}^2$  downward (9.2)
- accuracy** the difference between a measurement and its accepted value (Science Skill 13)
- acids** compounds containing hydrogen that produce a solution with a pH of less than 7 when they dissolve in water and that produce a salt and water when they react with ionic compounds containing hydroxide ions (5.1)
- adaptations** characteristics that enable organisms to better survive and reproduce (1.1)
- adaptive radiation** the development of a number of new species from a common ancestor; the new species are adapted to inhabit different niches (3.1)
- aeration** mixing with air; one method used to reduce run-off is to mechanically remove small plugs of soil to improve air and water flow through the soil (3.2)
- air mass** a large body of air with similar temperature and humidity throughout its length (10.2)
- air resistance** a friction-like force that opposes the motion of objects that move through the air (9.2)
- albedo** [al-BEE-doh] the amount of radiation reflected by a surface (10.2)
- alcohol** one kind of organic compound that contains C, H, and O, such as methanol and ethanol (5.3)
- alpha decay** the process in which an alpha particle is emitted from a nucleus (7.1)
- alpha particle** ( ${}^4_2\alpha$ ,  ${}^4_2\text{He}$ ) a positively charged atomic particle that is much more massive than either a beta particle or gamma radiation and is relatively slow moving; has same combination of particles as the nucleus of a helium atom (7.1)
- angle of incidence** the angle between a ray reaching a surface and a line perpendicular to that surface (10.2)
- anions** [AN-ih-uhnz] negative ions (4.1)
- asthenosphere** [uhs-THEN-uhs-feer] a partly molten layer in Earth's upper mantle just below the lithosphere (12.2)
- atmospheres** layers of gases that extend above a planet's surface (10.2)
- atmospheric pressure** the pressure exerted by the mass of air above any point on Earth's surface; also called air pressure (10.2)
- atom** the smallest particle of any element that retains the properties of the element (4.1)
- atomic number** the number of protons in the nucleus of an atom, which identifies the element to which the atom belongs (4.1)
- average acceleration** average rate at which an object changes its velocity; shown by the slope of a velocity-time graph (9.2)
- average velocity** the rate of change in position for a time interval (8.2)

**B**

**balanced chemical equation** a chemical equation that identifies each pure substance in the equation as well as showing the matching number of atoms of each element on both sides (4.3)

**barometer** an instrument used to measure atmospheric pressure (10.2)

**bases** chemical compounds containing hydroxide that produce a solution with a pH of more than 7 when they dissolve in water, and produce a salt and water when they react with ionic compounds containing positive hydrogen ions (5.1)

**behavioural adaptation** what an organism does to survive in the unique conditions of its environment (1.1)

**best-fit line** a smooth curve or straight line that most closely fits the general shape outlined by the points on a graph; shows the trend of the data. Also called the line of best fit (8.1, Science Skill 5)

**beta decay** the process in which a neutron changes into a proton, which remains in the nucleus, and an electron, which is emitted from the nucleus along with energy (7.1)

**beta particle** ( ${}^0_{-1}\beta$ ,  ${}^0_{-1}e$ ) a high speed electron; emitted by a radioactive nucleus in beta decay (7.1)

**binary covalent compound** a compound that contains two non-metal elements joined together by one or more covalent bonds (4.2); *see also* covalent compound

**bioaccumulation** the gradual build-up of synthetic and organic chemicals in living organisms (2.3)

**biodegradation** the breaking down of dead organic matter by living organisms such as bacteria (2.1)

**biodiversity** the variety of all living species of plants, animals, and micro-organisms on Earth (Unit 1 opener)

**biogeoclimatic zone** a region with a certain type of plant life, soil, geography, and climate (11.1)

**biomagnification** the process in which chemicals not only accumulate but become more concentrated at each trophic level in a food pyramid (2.3)

**biomass** the total mass of living plants, animals, fungi, and bacteria in a given area (2.1)

**biome** [BIH-ohm] the largest division of the biosphere, which includes large regions with similar biotic components (e.g., similar plants and animals) and similar abiotic components (e.g., similar temperature and amount of rainfall) (1.1)

**bioremediation** [bih-oh-re-mee-dee-AE-shuhn] the use of organisms—usually micro-organisms or plants—to break down chemical pollutants in water or soil to reverse or lessen environmental damage (2.3)

**biosphere** the thin layer of air, land, and water on or near Earth's surface in which all living things on Earth exist (1.1)

**biotic** relating to living organisms such as plants, animals, fungi, and bacteria (1.1)

**Bohr diagram** a diagram that shows the arrangement of an element's subatomic particles and the number of electrons in each shell surrounding the nucleus of an atom (4.1)

**bonding pair** a pair of electrons involved in a covalent bond (4.1)

**bromothymol blue** an acid-base indicator named after its colour change from yellow to blue over a pH range of 6.0 to 7.6 (5.1)

**C**

**carbon cycle** the nutrient cycle in which carbon is moved through the biosphere; maintains the balance of CO<sub>2</sub> in the atmosphere (2.2, 11.1)

**carbon offset** an emission-reduction credit that people buy to help make up for their greenhouse gas emissions (11.2)

**carbon sink** a body or process (e.g., plants, oceans, and soil) that removes carbon dioxide from the atmosphere and stores it (11.1)

**carbon source** a body or process (e.g., burning fossil fuels or trees) that releases carbon dioxide into the atmosphere (11.1)

**carbonate** a combination of carbon and oxygen (CO<sub>3</sub><sup>-2</sup>) that is dissolved in ocean water (2.2)

**carnivores** secondary consumers that eat primary consumers and often other secondary consumers. They are often at the tertiary level of a food chain; also known as top carnivores (2.1)

**catalyst** a substance that speeds up the rate of a chemical reaction without being changed or used up itself (6.2)

**catalytic converter** a stainless steel pollution-control device, shaped like a muffler and located under the frame of a vehicle; converts poisonous gases from the vehicle's exhaust into less harmful substances (6.2)

**catastrophic events** large-scale disasters (11.1)

**cations** [KAT-ih-uhnz] positive ions (4.1)

**caustic** harsh; describes solutions made from highly reactive bases, such as drain cleaner and oven cleaner (5.1)

**cellular respiration** the process in which both plants and animals release carbon dioxide back into the atmosphere by converting carbohydrates and oxygen into carbon dioxide and water (2.2)

**chain reaction** an ongoing process in which one fission reaction initiates the next reaction (7.3)

**change in velocity** ( $\Delta\vec{v}$ ) change that occurs when the speed of an object changes, or its direction of motion changes, or both; calculated by subtracting the initial velocity from the final velocity (9.1)

**chemical changes** changes in how the atoms and molecules in a pure substance are arranged and interconnected (4.1)

**chemical equation** the representation of a chemical reaction in words or symbols (4.3)

**chemical reaction** one or more chemical changes that occur at the same time (4.3)

**climate** the average conditions of the atmosphere (e.g., precipitation, temperature, and humidity) in a large region over 30 years or more (1.1, 11.1)

**climate change** changes in long-term weather patterns in certain regions (11.2)

**climatograph** a graph of climate data for a specific region; the data are usually obtained over 30 years from local weather observation stations (1.1)

**climax community** a mature community, such as a boreal forest, tropical rainforest, grassland, or desert, that continues to change over time (3.1)

**closed system** a system that does not exchange matter with its surroundings, although energy in the form of radiation can leave or enter the system (11.1)

**coefficients** numbers placed in front of a chemical formula or a chemical symbol for an element that show the ratios between the various compounds in a chemical reaction (4.3)

**combustion** the rapid reaction of a compound or element with oxygen to form an oxide and to produce heat (6.1)

**commensalism** [kuh-MEN-suhl-ism] a symbiotic relationship in which one species benefits and the other species is neither helped nor harmed (1.2)

**community** all the populations of the different species that interact in a specific area or ecosystem (1.2)

**competition** a harmful interaction between two or more organisms that can occur when organisms compete for the same resource (e.g., food) in the same location at the same time (1.2)

**composite volcano** a large, cone-shaped volcanic mountain; the cone shape is the result of repeated eruptions of ash and lava (12.2)

**compound** a pure substance that is composed of two or more atoms chemically combined in a specific way (4.1)

**concentration** the amount of substance dissolved in a given volume of solution—for example, the number of hydrogen ions in a specific volume of solution (5.1)

**conclusion** the explanation of the results of an experiment as it applies to the hypothesis being tested (Science Skill 2)

**conduction** the transfer of thermal energy from one substance to another or within a solid by direct contact of particles (10.2)

**conservation of mass** the preservation of mass in a chemical reaction: the total mass of the products is always equal to the total mass of the reactants (4.3)

**constant acceleration** velocity changing at a constant rate (9.2)

**consumer** an organism that eats other organisms (2.1)

**contamination** the introduction of chemicals, toxins, wastes, or microorganisms into the environment in concentrations that are harmful to living things (3.2)

**continental drift theory** the theory that the continents have not always been in their present locations but have moved there over millions of years (12.1)

**convection** the transfer of thermal energy within a fluid and with the movement of fluid from one place to another (10.2)

**convection current** the movement of a fluid caused by density differences (10.2)

**convergent plate boundary** a region where tectonic plates are colliding (12.2)

**converging plates** tectonic plates that are colliding (12.2)

**Coriolis effect** [kor-ee-OH-lis] a change in the direction of moving air, water, or objects due to Earth's rotation (10.2)

**correlation** a mutual relation between two or more things (11.2)

**corrosive** biting; describes some acids and bases that can burn or eat away many materials, such as metals and human tissue (5.1)

**covalent bonding** the formation of a chemical bond between atoms through the sharing of one or more pairs of electrons (4.1)

**covalent compound** a compound formed when non-metallic atoms share electrons to form covalent bonds (4.1); *see also* binary covalent compound

**crust** Earth's outermost layer formed by lighter materials, such as silicon and oxygen, floating to the top during Earth's early cooling period (12.2)

**D**

**daughter isotope** the stable product of radioactive decay (7.2)

**DDT (dichlorodiphenyl trichloroethane)** [dih-KLOR-oh-dih-FEN-uhl trih-KLOR-oh-ETH-aen] an insecticide and well-known persistent organic pollutant, now banned in many countries (2.3)

**decay curve** a curved line on a graph that shows the rate at which radioisotopes decay (7.2)

**deceleration** acceleration that is opposite to the direction of motion; a decrease in the speed of an object (9.1)

**decomposers** organisms (e.g., bacteria and fungi) that break down wastes and dead organisms and change them into usable nutrients available to other organisms (2.1)

**decomposition** in biology, the breaking down of organic wastes and dead organisms (2.1); in chemistry, a chemical reaction in which a compound is broken down into two or more elements or simpler compounds (6.1)

**deforestation** the clearing or logging of forests without replanting (3.2)

**denitrification** [DEE-nih-tri-fi-KAY-shuhn] the process in which nitrogen is returned to the atmosphere (2.2)

**denitrifying bacteria** bacteria that convert nitrate ( $\text{NO}_3^-$ ) back into nitrogen gas ( $\text{N}_2$ ) (2.2)

**dependent variable** in an experiment, the factor that changes in response to a change in the independent variable; also called the responding variable (Science Skill 2)

**detritivores** consumers that feed at every trophic level, obtaining their energy and nutrients by eating dead organic matter (2.2)

**dew point** the temperature at which water vapour condenses (10.2)

**diatomic molecule** a pair of atoms of the same element that are joined by covalent bonds (4.1)

**displacement** the straight-line distance and direction from one point to another (8.1)

**distance (*d*)** a scalar quantity that describes the length of a path between two points or locations (8.1)

**divergent plate boundary** a region where tectonic plates are spreading apart (12.2)

**diverging plates** tectonic plates that are spreading apart (12.2)

**double replacement** describing a chemical reaction that usually involves two ionic solutions reacting to produce two other ionic compounds, either or both of which produce a precipitate (6.1)

**E**

**earthquake** a sudden, ground-shaking release of built-up energy at or under Earth's surface (12.1)

**ecological hierarchy** the order of biotic interactions and relationships in an ecosystem: organism, population, community, ecosystem (1.2)

**ecological pyramid** a food pyramid. There are three types of ecological pyramids: pyramid of biomass, pyramid of numbers, and pyramid of energy. (2.1)

**ecological succession** changes that take place over time in the types of organisms that live in an area (3.1)

**ecosystem** a part of a biome in which abiotic components interact with biotic components (1.2)

**El Niño** [el NEEN-yoh] an unusually warm ocean current that develops periodically off the coast of Ecuador and Peru, often producing unusually mild weather along the coast of British Columbia and in eastern Canada (11.1)

**El Niño-Southern Oscillation (ENSO)** a system of ocean and atmosphere changes in the tropical Pacific region, including El Niño and La Niña events (11.1)

**electromagnetic radiation** the transfer of energy by waves travelling outward in all directions from a source (10.1)

**electrons** subatomic particles that have a 1− (negative) electric charge (4.1)

**elevation** the height of a land mass above sea level (1.1)

**energy flow** the flow of energy from an ecosystem to an organism and from one organism to another (2.1)

**enhanced greenhouse effect** the increased capacity of the atmosphere to trap thermal energy because of an increase in greenhouse gases (11.2)

**epicentre** the point on Earth's surface directly above the focus where an earthquake starts (12.2)

**estimating** making an informed judgement about a measurement (Science Skill 7)

**eutrophication** [YOO-tri-fi-KAY-shun] the process by which excess nutrients in aquatic ecosystems result in increased plant production and decay (1.2)

**exosphere** the fifth layer of Earth's atmosphere (10.2)

**extinction** the dying out of a species; species become extinct when their numbers are reduced to zero (3.2)

**F**

**fair test** an investigation (experiment) carried out under strictly controlled conditions to ensure accuracy and reliability of results. In a fair test, all variables are controlled except the one variable under investigation. (Science Skill 2)

**faults** large breaks in rock layers (12.2)

**fission** a nuclear reaction in which a large nucleus breaks apart, producing two or more smaller nuclei, subatomic particles, and energy (7.3)

**fluids** substances in which the particles can flow freely (10.1)

**focus** in geology, the location inside Earth where an earthquake starts (plural: foci) (12.2)

**food chain** a model that shows the flow of energy from plant to animal and from animal to animal (2.1)

**food pyramid** a model that shows the loss of energy from one trophic level to another; often called an ecological pyramid (2.1)

**food web** a model of the feeding relationships within an ecosystem; formed from interconnected food chains (2.1)

**force** a push or pull that acts on an object (10.2)

**foreign species** introduced species (3.3)

**front** the boundary between two air masses (10.2)

**fusion** a process in which two low mass nuclei join together to make a more massive nucleus (7.3)

**G**

**gamma decay** a process in which an isotope falls from a high energy state to a lower energy state, giving off a high energy gamma ray; the result of a redistribution of energy within the nucleus (7.1)

**gamma radiation** ( $\gamma$ ) rays of high-energy, short-wavelength radiation emitted from the nuclei of atoms (7.1)

**General Circulation Models (GCMs)** computer models designed to study climate (11.2)

**geologic uplift** the process of mountain building in which Earth's crust folds and deeply buried rock layers rise and are exposed (2.2)

**global warming** the increase in global average temperature (11.2)

**global warming potential (GWP)** the ability of a substance to warm the atmosphere by trapping thermal energy (11.2)

**gravity** attractive force between two or more masses; causes objects to be pulled toward the centre of Earth (9.2)

**greenhouse gases** gases in Earth's atmosphere that absorb and trap radiation as thermal energy (e.g., carbon dioxide) (11.1)

**H**

**habitat** the place in which an organism lives (e.g., a nest or a burrow) (1.2)

**habitat fragmentation** the division of habitats into smaller, isolated fragments (3.2)

**habitat loss** the destruction of habitats that usually results from human activities (3.2)

**half-life** in biology, the time it takes for a living tissue, organ, organism, or ecosystem to eliminate one half of a substance that has been introduced into it (2.3); in physics, the time required for half the nuclei in a sample of a radioactive isotope to decay, which is a constant for any radioactive isotope (7.2)

**heat** the amount of thermal energy that transfers from an area or object of higher thermal energy to an area or object of lower thermal energy (10.1)

**heavy metals** metallic elements with a high density that are toxic to organisms at low concentrations (2.3)

**herbivores** primary consumers that eat plants (2.1)

**hot spot** an area where molten rock rises to Earth's surface (12.1)

**humidity** a measurement that describes the amount of water vapour in air (10.2)

**hurricanes** tropical cyclones; the name for these violent storms used by people living near the Atlantic Ocean (10.2)

**hydrocarbon** an organic compound that contains only the elements carbon and hydrogen (5.3)

**hydrogen ions** electrically charged hydrogen atoms ( $H^+$ ); can be produced when acids are dissolved in solution (5.1)

**hydroxide ions** negative ions of  $OH^-$ ; can be produced when bases are dissolved in solution (5.1)

**hypothesis** [hih-PAW-thuh-sis] a testable proposal used to explain an observation or to predict the outcome of an experiment; often expressed in the form of an "If ..., then ..." statement (Science Skill 2)

**I**

**ice cores** cylinders of ice drilled from thick glaciers to determine the types and amounts of gases that existed in the atmosphere when the ice was formed (11.1)

**independent variable** in an experiment, the factor that is selected or adjusted to see what effect the change will have on the dependent variable; also called the manipulated variable (Science Skill 2)

**indigo carmine** an acid-base indicator named after its colour change from blue to yellow over a pH range of 11.2 to 13.0 (5.1)

**infrared radiation** heat radiation (10.1)

**inner core** Earth's solid centre (12.2)

**inorganic** refers to compounds that generally do not contain carbon; the few exceptions include carbon dioxide, carbon monoxide, and ionic carbonates (5.3)

**insolation** the amount of solar radiation that reaches a certain area (10.2)

**introduced species** plants, animals, or micro-organisms that are transported intentionally or by accident into regions in which they did not exist previously (3.3)

**invasive species** introduced organisms that can take over the habitats of native species or invade their bodies (3.3)

**ionic bonding** the bond that forms as a result of the attraction between positively and negatively charged ions (4.1)

**ionic compounds** compounds that are composed of positive ions and negative ions (4.2)

**ions** electrically charged particles created when atoms gain or lose electrons (4.1)

**isotopes** different atoms of a particular element that have the same number of protons but a different numbers of neutrons (7.1)

## J

**jet stream** narrow band of fast flowing air moving west to east in the upper troposphere at boundaries between cold and warm air (10.2)

## K

**keystone species** species (e.g., salmon) that can greatly affect population numbers and the health of an ecosystem (2.3)

**kilopascal (kPa)** the SI unit that measures the vertical force of atmospheric pressure per unit area (10.2)

**kinetic energy** the energy of a particle or object due to its motion (10.1)

**kinetic molecular theory** the theory that all matter is composed of particles (atoms and molecules) moving constantly in random directions (10.1)

## L

**La Niña** [lah NEEN-yuh] cooler-than-normal water coming to the surface in the eastern Pacific Ocean due to upwelling; as a result, winter temperatures are often unusually warm in southeastern North America and unusually cold in the northwest (11.1)

**land use** the ways in which we use land, such as for urban development, agriculture, industry, mining, and forestry (3.2)

**latitude** the distance measured in degrees north or south from the equator (1.1)

**leaching** removal by water of substances that have dissolved in moist soil (2.2)

**Lewis diagram** a diagram that illustrates chemical bonding by showing only an atom's valence electrons and its chemical symbol (4.1)

**light** one form of radiation that is visible to humans (7.1)

**line of best fit** *see* best-fit line

**lithosphere** the layer of Earth made up of the crust and uppermost mantle and ranging in thickness from 65 km to 100 km (12.2)

**litmus paper** thin paper strips coated with litmus and used as an acid-base indicator, turning one colour when added to a base, and a different colour when added to an acid. Litmus is a compound extracted from various lichens. (5.1)

**lone pair** a pair of electrons in an atom's valence shell that is not used in bonding (4.1)

## M

**magma** molten rock beneath Earth's surface (12.1)

**magnetic reversal** the process in which Earth's magnetic field, over thousands of years, completely reverses its direction (12.1)

**magnetic striping** a pattern of alternating stripes of different directions of magnetic polarity in rock on the sea floor (12.1)

**magnitude** a number that rates the strength (energy) of an earthquake (12.2)

**mantle** Earth's thickest layer, lying just below the crust and making up 70 percent of Earth's volume (12.1)

**mantle convection** a recurring current in the mantle that occurs when hotter, less dense material rises, cools, and then sinks again. This current is believed to be one of the driving forces behind tectonic plate movement. (12.2)

**mass** the amount of matter in a substance or an object: the more matter, the greater the mass; usually measured in kilograms (kg) (Science Skill 7)

**mass number** the total number of protons and neutrons found in the nucleus of an atom (7.1)

**meniscus** the slight curve at the top of a liquid where the liquid meets the sides of a container (Science Skill 7)

**mesosphere** the third layer of Earth's atmosphere (10.2)

**metal oxide** a compound containing a metal chemically combined with oxygen (5.2)

**methyl orange** an acid-base indicator named after its colour change from red to yellow over a pH range of 3.2 to 4.4 (5.1)

**methyl red** an acid-base indicator named after its colour change from red to yellow over a pH range of 4.8 to 6.0 (5.1)

**Mid-Atlantic Ridge** the longest mountain range on Earth, running north to south down the middle of the Atlantic Ocean (12.1)

**model** a verbal, mathematical, or visual representation of a scientific structure or process, which allows scientists to construct and test inferences and theories (Science Skill 2)

**molecule** a group of atoms in which the atoms are bound together by sharing one or more pairs of electrons (4.1)

**motion diagram** a diagram that gives a picture of motion by showing an object's position at given times (8.1)

**multivalent** describing the ability of an element to form ions in more than one way, depending on the chemical reaction it undergoes (4.1)

**mutualism** a symbiotic relationship between two organisms in which both organisms benefit (1.2)

## N

**native species** plants and animals that naturally inhabit an area (3.3)

**natural background radiation** the stream of high-energy, fast-moving particles or waves that is found in the environment (7.1)

**natural greenhouse effect** absorption of thermal energy by the atmosphere (11.1)

**natural selection** the process in which, over time, the best-adapted members of a species will survive and reproduce. This process makes change in living things possible. (3.1)

**neutral** neither acidic nor basic; describes a solution with a pH of 7 (5.1)

**neutralization (acid-base)** the chemical reaction that occurs when an acid and a base react to form a salt and water (5.2)

**neutrons** subatomic particles that do not have an electric charge (4.1)

**niche** the special role an organism plays in an ecosystem, including the way in which it contributes to and fits into its environment (1.2)

**nitrification** the process in which ammonium ( $\text{NH}_4^+$ ) is converted into nitrate ( $\text{NO}_3^-$ ) (2.2)

**nitrifying bacteria** soil bacteria involved in two stages of nitrification. In the first stage, certain species convert ammonium ( $\text{NH}_4^+$ ) into nitrite ( $\text{NO}_2^-$ ); in the second stage, different species convert nitrite ( $\text{NO}_2^-$ ) into nitrate ( $\text{NO}_3^-$ ). (2.2)

**nitrogen cycle** the nutrient cycle in which nitrogen is moved through the biosphere (2.2)

**nitrogen fixation** the process in which nitrogen gas ( $\text{N}_2$ ) is converted into compounds that contain nitrate ( $\text{NO}_3^-$ ) or ammonium ( $\text{NH}_4^+$ ) (2.2)

**nitrogen-fixing bacteria** bacteria that convert nitrogen gas ( $\text{N}_2$ ) into ammonium ( $\text{NH}_4^+$ ) during decomposition, playing a significant role in nitrogen fixation (2.2)

**non-metal oxide** a chemical compound that contains a non-metal chemically combined with oxygen (5.2)

**nuclear charge** the electric charge on an atom's nucleus, which can be determined by counting the number of protons (4.1)

**nuclear equation** a set of symbols that indicates changes in the nuclei of atoms during a nuclear reaction (7.1)

**nuclear fission** the splitting of a massive nucleus into two less massive nuclei, subatomic particles, and energy (7.3)

**nuclear reaction** the process in which an atom's nucleus changes by gaining or releasing particles or energy (7.3)

**nuclear symbol** the standard atomic symbol for an isotope, including the chemical symbol, atomic number, and mass number (7.1)

**nutrient cycles** the way nutrients are cycled in the biosphere; the continuous flows (exchanges) of nutrients in and out of stores (2.2)

**nutrients** substances such as the chemicals nitrogen and phosphorus that are required by plants and animals for energy, growth, development, repair, or maintenance (1.2); important components of nutrient cycles in the biosphere (2.1)

## O

**offshore breeze** a nighttime sea breeze resulting from warm air over the water rising and drawing in cool air from over the land (10.2)

**omnivores** consumers that eat both plants and animals (2.1)

**onshore breeze** a daytime sea breeze resulting from warm air rising over land and being replaced by cool air drawn in from over the water (10.2)

**organic** refers to almost all carbon-containing compounds; exceptions include carbon dioxide, carbon monoxide, and ionic carbonates (5.3)

**organic chemistry** the study of compounds that contain carbon (5.3)

**outer core** the layer below Earth's mantle (12.2)

**overexploitation** the use or extraction of a resource until it is depleted (3.2)

**oxide** a chemical compound that includes at least one oxygen atom or ion together with one or more other elements (5.2)

**ozone layer** the atmospheric layer that absorbs much of the ultraviolet radiation from the Sun (10.2)

## P

**paleoclimatologists** [pael-ee-oh-klih-muh-TAWL-uh-jists] people who study climates of the geological past (11.1)

**paleoglaciacion** [pael-ee-oh-glae-see-AE-shuhn] the extent of ancient glaciers; also the rock markings they left behind (12.1)

**paleomagnetism** [pael-ee-oh-MAG-nuh-tizm] the study of the magnetic properties of ancient rocks (12.1)

**parasitism** a symbiotic relationship in which one species benefits and another is harmed (1.2)

**parent isotope** the isotope that undergoes radioactive decay (7.2)

**parts per million (ppm)** a measurement of chemical accumulation; 1 ppm means one particle mixed with 999 999 other particles (2.3)

**PCBs (polychlorinated biphenyls)** [pah-lee-KLOR-i-nae-ted bih-FEN-uhls] synthetic chemicals containing chlorine that are used in the manufacture of plastics and other industrial products, become stored in the tissue of animals, and also persist in the environment (2.3)

**period** each row of elements in the periodic table (4.1)

**permafrost** ground that remains frozen year-round (11.2)

**persistent organic pollutants (POPs)** carbon-containing compounds that remain in water and soil for many years (2.3)

**pesticides** a general term for chemicals that are used to eliminate pests, such as insecticides that kill insects and herbicides that kill weeds (2.3)

**pH indicators** chemicals that change colour depending on the pH of the solution they are placed in (5.1)

**pH scale** a number scale for measuring how acidic or basic a solution is (5.1)

**phenolphthalein** a chemical compound that is colourless in acidic or slightly basic solutions but turns pink in moderately basic to highly basic solutions (5.1)

**phosphorus cycle** the nutrient cycle in which phosphorus is moved through the biosphere (2.2)

**photosynthesis** a process in which carbon dioxide enters the leaves of plants and reacts with water in the presence of sunlight to produce carbohydrates and oxygen; photosynthesis also occurs in some micro-organisms (1.2, 2.2)

**physiological adaptation** a physical or chemical event that occurs within the body of an organism and enables survival (1.1)

**pioneer species** organisms such as lichens and other plants that are the first to survive and reproduce in an area; these organisms change the abiotic and biotic conditions of an area so that other organisms can survive there (3.1)

**plate boundary** the region where two tectonic plates are in contact (12.2)

**plate tectonic theory** the theory that the lithosphere is broken up into large plates that move and then rejoin; considered the unifying theory of geology (12.1)

**polyatomic ion** a molecular ion that carries a charge and is composed of more than one type of atom joined by covalent bonds (4.2)

**population** all the members of a particular species within an ecosystem (1.2)

**position ( $\vec{d}$ )** a vector quantity that describes a specific point relative to a reference point (8.1)

**position-time graph** a graph of an object's position during corresponding time intervals; time data are plotted on the horizontal axis ( $x$ -axis), and position data are plotted on the vertical axis ( $y$ -axis) (8.1)

**potential energy** the stored energy of an object or particle due to its position or state (10.1)

**precautionary principle** the principle that a lack of complete scientific certainty should not be used as a reason to postpone cost-effective measures to prevent serious environmental damage (11.2)

**precipitate** an insoluble solid that forms from a solution (6.1)

**predation** predator-prey interactions in which one organism (the predator) eats all or part of another organism (the prey) (1.2)

**prediction** a forecast about what you expect to observe when you do an investigation (Science Skill 2)

**pressure** the amount of force per unit area (10.2)

**prevailing winds** winds that are typical for a certain region (10.2)

**primary consumers** organisms in the second trophic level (e.g., grasshoppers and zooplankton), which obtain their energy by eating primary producers (2.1)

**primary producers** organisms in the first trophic level, such as plants and algae (2.1)

**primary succession** the development of new life in areas where no organisms or soil previously existed, such as on bare rock; the first organisms may be lichen spores carried by wind (3.1)

**primary wave (P-wave)** a type of seismic body (underground) wave that travels at about 6 km/s through Earth's crust, causing the ground to move in the direction of the wave's motion (12.2)

**producers** organisms that produce food in the form of carbohydrates during photosynthesis (2.1)

**products** pure substances formed in a chemical change that have different properties from those of the reactants (4.3)

**protons** subatomic particles that have a 1+ (positive) electric charge (4.1)

**pyramid of biomass** an ecological pyramid that shows the number of organisms at each trophic level multiplied by their mass (2.1)

**pyramid of energy** an ecological pyramid that shows the amount of energy available at each trophic level (2.1)

**pyramid of numbers** an ecological pyramid that shows the number of organisms at each trophic level (2.1)

## R

**radiant energy** the energy carried by electromagnetic waves (10.1)

**radiation** high-energy rays and particles emitted by radioactive sources (7.1)

**radiation budget** Earth's balance of incoming and outgoing energy (10.2)

**radioactive decay** the process in which the nuclei of radioactive parent isotopes emit alpha, beta, or gamma radiation to form decay products (7.1)

**radioactivity** the release of high-energy particles and rays of energy from a substance as a result of changes in the nuclei of its atoms (7.1)

**radiocarbon dating** determining the age of an object by measuring the amount of carbon-14 remaining in it (7.2)

**radioisotopes** isotopes that are capable of radioactive decay (7.1)

**rate of reaction** a measure of how quickly products form, or given amounts of reactants react, in a chemical reaction (6.2)

**reactants** pure substances that react in a chemical change (4.3)

**relative humidity** a comparison between the amount of water vapour in the air and the amount the air *could* hold if it were totally saturated (10.2)

**resource exploitation** resource use (3.2)

**resource use** the ways in which we obtain and use naturally occurring materials such as soil, wood, water, gas, oil, or minerals (3.2)

**ridge push** the process in which new material at a ridge or rift pushes older material aside, moving the tectonic plates away from the ridge (12.2)

**rift eruptions** volcanoes that occur where magma erupts through long cracks in the lithosphere where tectonic plates are spreading apart (12.2)

**rift valley** a steep-sided valley formed on land when magma rises to Earth's surface at a spreading centre (12.2)

## S

**salts** a class of ionic compounds that can be formed during the reaction of an acid and a base (5.2)

**scalars** quantities that have only a magnitude (do not include direction) (8.1)

**sea breezes** local winds caused by the different rates at which land and water respond to heating and cooling (10.2)

**sea floor spreading** the process in which magma rises to Earth's surface at spreading ridges and, as it continues to rise, pushes older rock aside (12.1)

**secondary consumers** organisms in the third trophic level (e.g., frogs and crabs), which obtain their energy by eating primary consumers (2.1)

**secondary succession** the reintroduction of life after a disturbance to an area that already has soil and was once the home of living organisms (3.1)

**secondary wave (S-wave)** a type of seismic body (underground) wave that travels at about 3.5 km/s, causing the ground to move perpendicular to the direction of the wave's motion; also known as a shear wave (12.2)

**sedimentation** the process in which soil particles and decaying organic matter accumulate in layers on the ground or at the bottom of large bodies of water, contributing to the formation of sedimentary rock (2.2)

**seismic waves** [SIHZ-mik] vibrations caused by energy released by an earthquake (12.2)

**seismogram** a record of ground motion (12.2)

**seismology** the study of earthquakes and seismic waves (12.2)

**seismometers** [sihz-MAW-muh-terz] devices that measure the amount of ground motion caused by an earthquake; also called seismographs (12.2)

**shield volcanoes** volcanoes that form over hot spots; the largest volcanoes on Earth (12.2)

**significant digits** the number of all known digits reported in measurements plus one estimated digit (Science Skill 13)

**single replacement** describing a chemical reaction in which a reactive element (a metal or a non-metal) and a compound react to produce another element and another compound (6.1)

**skeleton equation** an equation that shows only the formulas of the reactants and products (4.3)

**slab pull** the pulling of a tectonic plate as its edge subducts deep into the mantle (12.2)

**slope** the direction of a line on a graph, either horizontal (zero), slanting up (positive), or slanting down (negative). Slope is calculated by determining the ratio of rise/run. (8.1)

**soil compaction** the squeezing together of soil particles so that the air spaces between them are reduced (3.2)

**soil degradation** damage to soil—for example, as a result of deforestation or the removal of topsoil from bare land by water and wind erosion (3.2)

**solar radiation** the transfer of radiant energy from the Sun (10.1)

**solvent** a liquid that can dissolve other substances (5.3)

**species** a group of closely related organisms that can reproduce with one another (1.2)

**specific humidity** a measure of the number of grams of water vapour in 1 kg of air (10.2)

**speed (v)** the distance an object travels during a given time interval divided by the time interval (8.2)

**spreading ridge** the region where magma breaks through Earth's surface, continually forcing apart old rock and forming new sea floor (12.1)

**stable octet** the arrangement of eight electrons in the outermost shell of an atom (4.1)

**state of matter** the property of a substance describing it as a gas, liquid, or solid; may be shown in a chemical equation by the letters (g) for gas, (ℓ) for liquid, (s) for solid, and (aq) for aqueous (dissolved in water) (4.3)

**stores** nutrients that are accumulated for short or long periods of time in Earth's atmosphere, oceans, and land masses (2.2)

**stratosphere** the second lowest layer of Earth's atmosphere (10.2)

**structural adaptation** a physical feature of an organism's body having a specific function that contributes to the survival of the organism (1.1)

**subatomic particles** the particles that make up an atom (4.1)

**subduction** the action of one tectonic plate pushing underneath another (12.2)

**subduction zones** areas of subduction, which typically experience large earthquakes and volcanic eruptions (12.2)

**subscript** the small number written to the right of the symbol of an element, such as the <sub>3</sub> in Na<sub>3</sub>P (4.2)

**surface area** the measure of how much area of an object is exposed; can affect reaction rate (6.2)

**surface waves (L-waves)** seismic waves that ripple along Earth's surface (12.2)

**sustainability** the ability of an ecosystem to sustain ecological processes and maintain biodiversity over time; using natural resources in a way that maintains ecosystem health now and for future generations (3.2)

**symbiosis** the interaction between members of two different species that live together in a close association (1.2)

**symbolic equation** a set of chemical symbols and formulas that identify the reactants and products in a chemical reaction (4.3)

**synthesis** a chemical reaction in which two or more reactants (A and B) combine to produce a single product (AB); also called a combination reaction (6.1)

**system** a group of parts that interact with one another and function together as a whole (11.1)

## T

**technology** the application of scientific knowledge and everyday experience in solving practical problems by designing and developing devices, materials, systems, and processes (Science Skill 3)

**tectonic plates** the large slabs of rock that form Earth's surface, moving over a layer of partly molten rock (12.1)

**temperature** a measure of the average kinetic energy of all the particles in a sample of matter (10.1, Science Skill 7)

**terrestrial** relating to the land (e.g., land-based biomes) (1.1)

**tertiary consumers** [TUHR-shuh-ree] organisms in the fourth trophic level (e.g., hawks and sea otters), which obtain their energy by eating secondary consumers (2.1)

**theory** an explanation of an event that has been supported by consistent, repeated experimental results and has therefore been accepted by most scientists (Science Skill 2)

**thermal energy** the total energy of all the particles in a solid, liquid, or gas (10.1)

**thermocline** a transition zone that separates the cold, deep ocean waters from the Sun-warmed surface waters (11.1)

**thermosphere** the fourth layer of Earth's atmosphere (10.2)

**thunderstorms** extreme weather occurring when water vapour in rising warm air condenses, releasing thermal energy (10.2)

**time ( $t$ )** when an event occurs (8.1)

**time interval ( $\Delta t$ )** the difference between the final time and the initial time (when the event began) (8.1)

**tornado** a violent, funnel-shaped column of rotating air that touches the ground (10.2)

**traditional ecological knowledge** ecological information, passed down from generation to generation, that reflects human experience with nature gained over centuries (3.2)

**transform fault** a fault that occurs at a transform plate boundary (12.1, 12.2)

**transition metals** the block of elements from groups 3 through 12 in the periodic table (4.1)

**trench** a deep underwater valley that is formed when an oceanic plate collides with a continental plate and is forced to slide beneath it (12.2)

**trophic levels** steps in a food chain that show feeding and niche relationships among organisms (2.1)

**troposphere** the lowest layer of Earth's atmosphere (10.2)

## U

**uniform motion** travelling in equal displacements in equal time intervals; neither speeding up, slowing down, nor changing direction (8.1)

## V

**valence electrons** the electrons in the valence shell of an atom (4.1)

**valence shell** the outermost shell that contains electrons (4.1)

**variable** a factor that can influence the outcome of an experiment (Science Skill 2)

**vectors** quantities that have both a magnitude and a direction (8.1)

**velocity ( $\vec{v}$ )** the displacement of an object during a time interval divided by the time interval (8.2)

**velocity-time graph** a graph of an object's velocity during corresponding time intervals; time data are plotted on the horizontal axis ( $x$ -axis) and velocity data are plotted on the vertical axis ( $y$ -axis) (9.2)

**volcanic belt** a long chain of volcanoes (12.2)

**volcanic island arc** a long chain of volcanic islands (12.2)

**volcano** an opening in Earth's surface that, when active, spews out gases, chunks of rock, and melted rock (12.1)

**volume** the amount of space that an object occupies (Science Skill 7)

## W

**water cycle** the system of water circulation on, above, and below Earth's surface (11.1)

**weather** the condition of the atmosphere in a specific place and at a specific time (10.2)

**weathering** the process in which rock is broken down into smaller fragments (2.2, 11.1)

**wind** the movement of air from an area of higher pressure to an area of lower pressure (10.2)