A

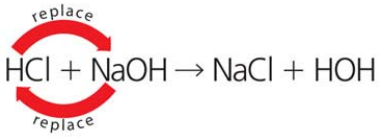
abiotic factor any of the non-living components of an ecosystem; a non-living environmental factor; such factors include the physical and chemical components in the environment (p. 22)

acceleration the rate of change of velocity; a vector quantity with both a magnitude and direction; symbol is $\vec{a}$ (p. 373)

accuracy how close a value is to its accepted value (p. 551)

acid a substance that releases H^+ ions in solution (p. 203)

acid–base neutralization reaction a chemical reaction in which an acid completely reacts with a base resulting in a neutral solution; products of this reaction are a salt and water (p. 243)

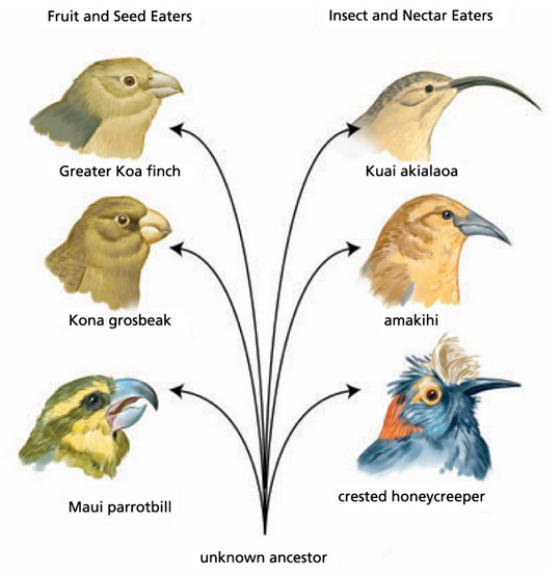


acidity a measure of the relative amounts of H^+ and OH^- in a solution; the higher the relative number of H^+ ions, the higher the acidity (the lower the pH) (p. 205)

acid precipitation results from air-borne pollutants, particularly sulfur dioxide and nitrogen monoxide, reacting with water vapour in the atmosphere to form acidic compounds that return to Earth in precipitation (p. 114)

adaptation any genetic trait that improves an organism's chance of surviving and reproducing (p. 61)

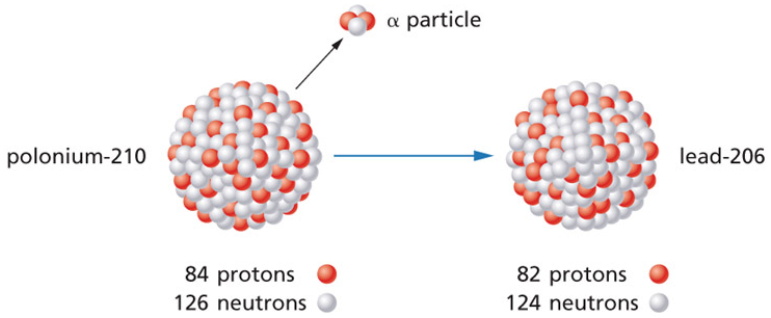
adaptive radiation occurs when species adapt differently to changes in the environment, and become specialized in order to exploit smaller parts of the ecological niche (p. 68)



aerobic respiration respiration that uses oxygen to release the energy in carbohydrates (p. 90)

albedo [al-BEE-doh] the degree to which a surface reflects light (p. 419)

alpha particle consists of two protons and two neutrons; emitted during alpha decay of a radioactive atom; symbol is α (p. 285)

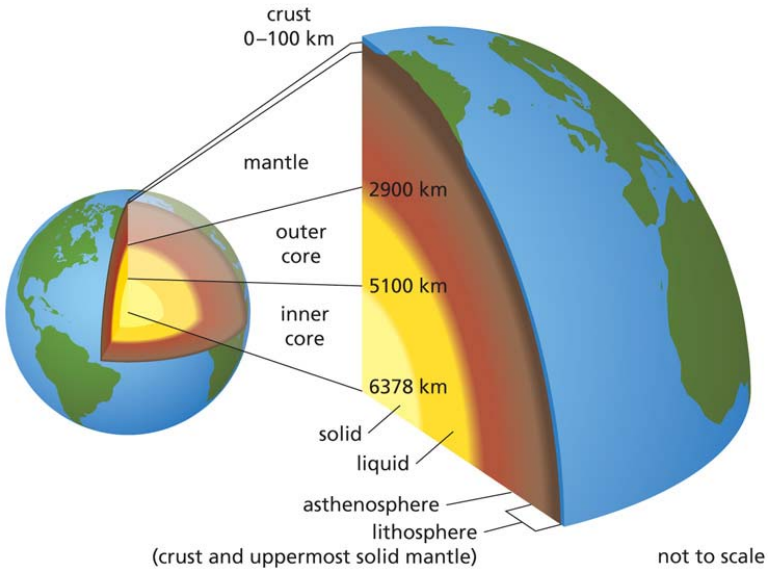


anaerobic respiration respiration that does not require oxygen to release the energy in carbohydrates; respiration that occurs in the absence of oxygen; a process used by certain bacteria; also called fermentation (p. 90)

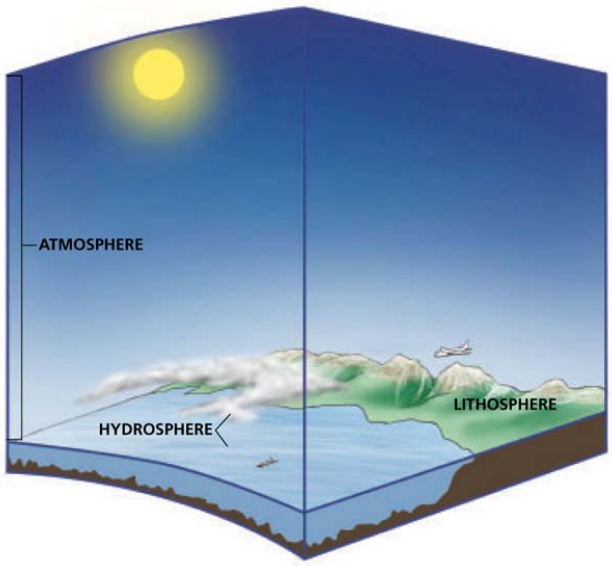
applied research research that is primarily focused on developing new and better solutions to practical problems (p. 13)

aqueous [AY-kwee-uhs] the term used to describe substances dissolved in water; such substances are given the designation (aq) (p. 203)

asthenosphere [as-THEN-uh-sfeer] the fluid-like layer of mantle over which the lithosphere drifts (p. 493)

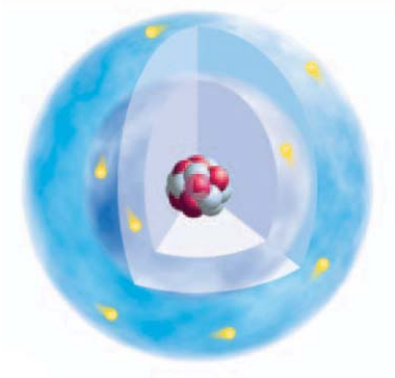


atmosphere the layer of gases enveloping Earth (p. 417)

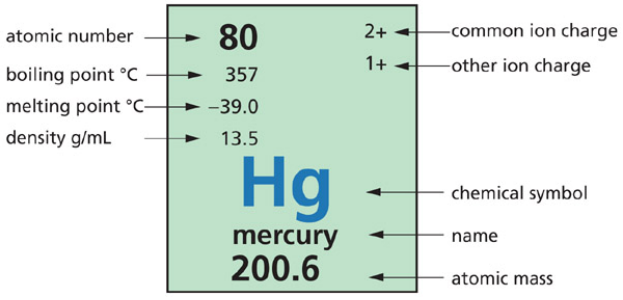


atmospheric pressure the pressure exerted by a column of air above any point; measured in pascals; also called air pressure (p. 431)

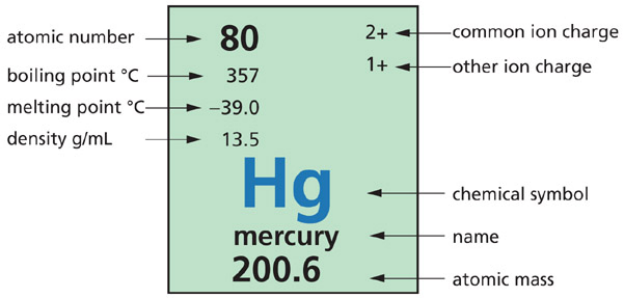
atom the smallest particle of an element that can exist by itself (p. 150)



atomic mass the average mass of the atoms of an element (p. 153)



atomic number the number of protons in the nucleus of an element; each element has a unique number (p. 153)



autotroph see **producer**

average speed the total distance an object travels divided by the total time taken (p. 346)

B

balanced equation a chemical equation in which the atoms are conserved; the number of atoms of each element is equal on both sides of the equation (p. 236)

base a substance that releases OH^- ions in solution (p. 203)

base units the seven SI units that can be used to express all physical quantities (p. 546)

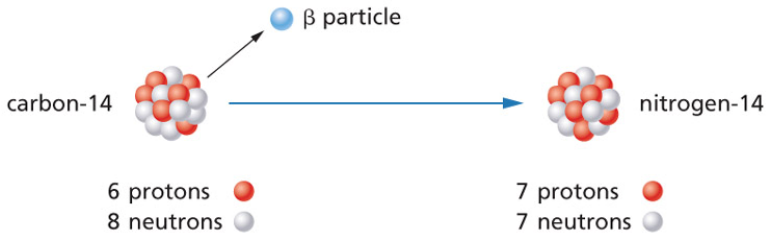
Quantity name	Unit name	Unit symbol
length	metre	m
mass	kilogram	kg*
time	second	s
electric current	ampere	A
temperature	kelvin	K**
amount of substance	mole	mol
light intensity	candela	cd

* The kilogram is the only base unit that contains a prefix.

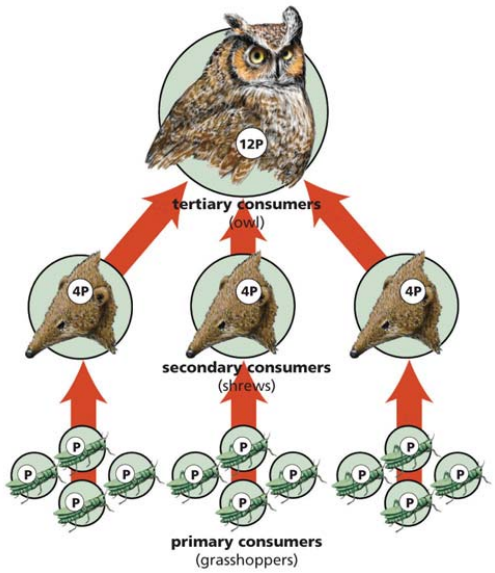
** Although the base unit for temperature (T) is a kelvin (K), the common unit for temperature (t) is a degree Celsius (°C).

basic research research that helps people learn more about how the natural world works (p. 13)

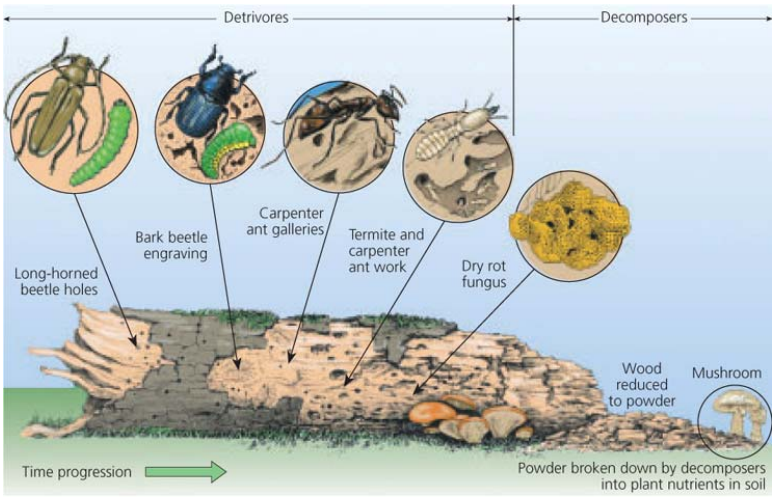
beta particle an electron emitted during beta decay of a radioactive atom; symbol is β (p. 286)



bioaccumulation the buildup of a substance within the tissues of organisms over time (p. 120)

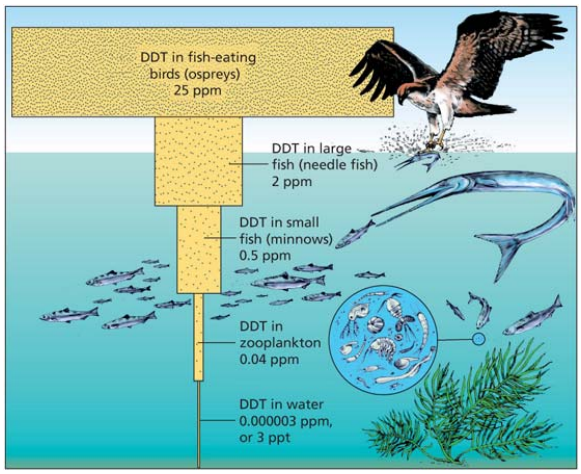


biodegradation the decay process that makes the nutrients contained in waste and dead matter available to producers once again (p. 27)

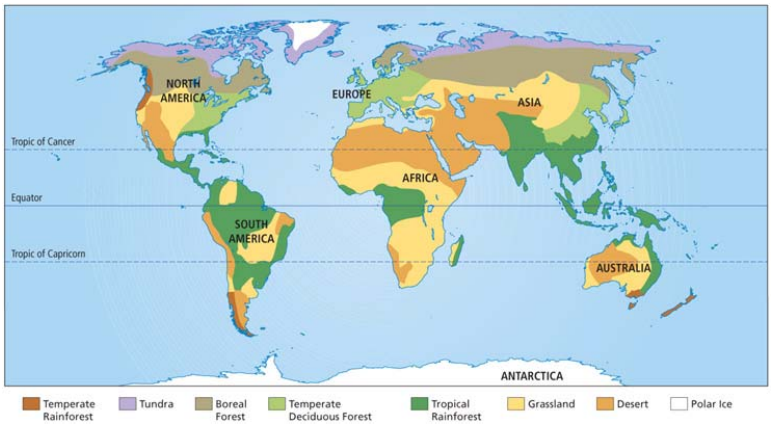


biodiversity the variety of, and the variation among, organisms within a given ecosystem, biome, or the entire Earth (p. 64)

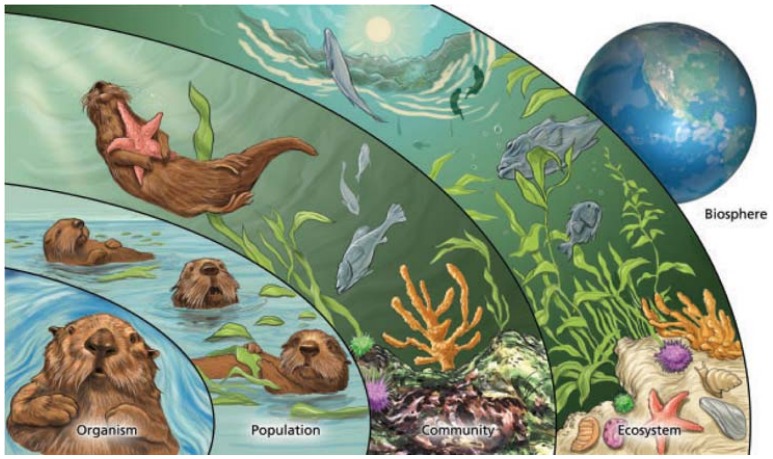
biomagnification the increase in concentration of a substance within the tissues of organisms that are at higher levels of the food chain (p. 120)



biome a large ecosystem with a specific range of abiotic and biotic factors such as temperature, precipitation, and characteristic organisms (including plants and animals) (p. 54)

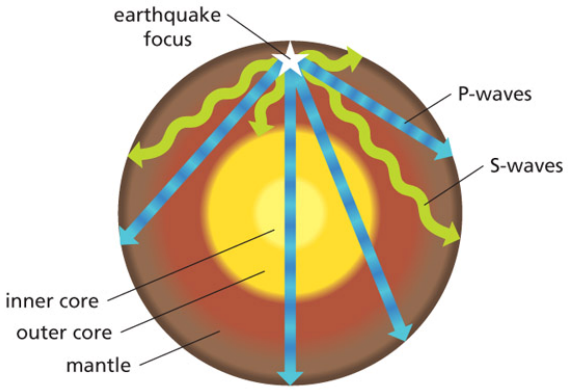


biosphere the total area of Earth where living things are found; the narrow zone around Earth that supports life (p. 22)



biotic factor any of the living components of an ecosystem; such factors include organisms like bacteria, plants, and animals, as well as the interactions between them (p. 22)

body wave a type of seismic wave that travels through Earth, including primary (P) and secondary (S) waves (p. 526)



bond to join together; atoms have the tendency to bond with other atoms (p. 170)

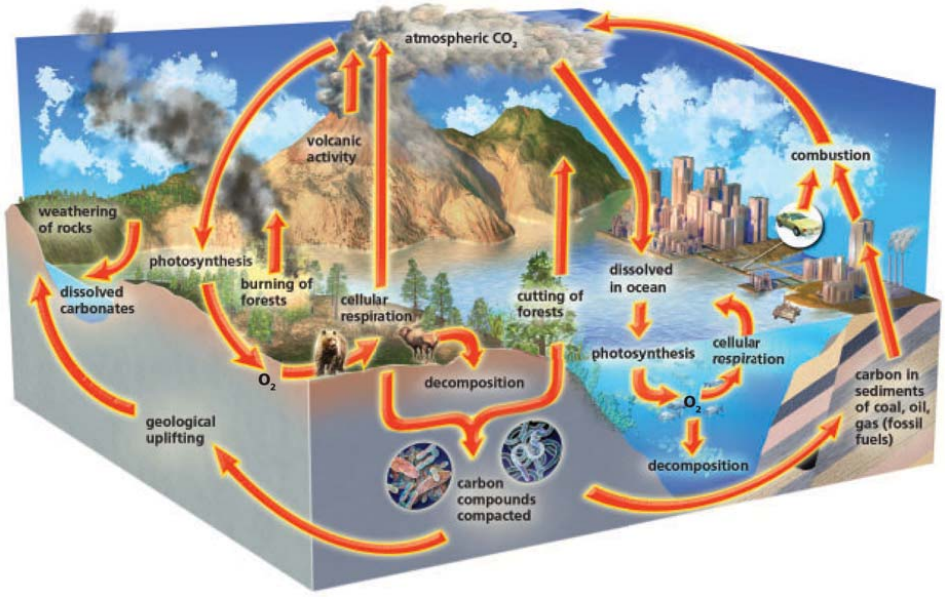
bonding pair a single valence electron from an atom paired with a single valence electron from another atom; also called a shared pair (p. 210)

boreal forest the biome characterized by acidic soils, dry winters, moderate precipitation, and the growth of conifers; stretches across the northern parts of North America, Asia, and Europe; also known as taiga (p. 56)

C

canopy the upper layer of vegetation in a forest; often creates a dense layer, or cover, that prevents most sunlight from reaching the forest floor (p. 56)

carbon cycle the cycling of carbon through ecosystems (p. 86)



carbon dioxide equivalent (CO_2 eq.) the values used to compare the warming potential of other GHGs to the warming potential of carbon dioxide (p. 456)

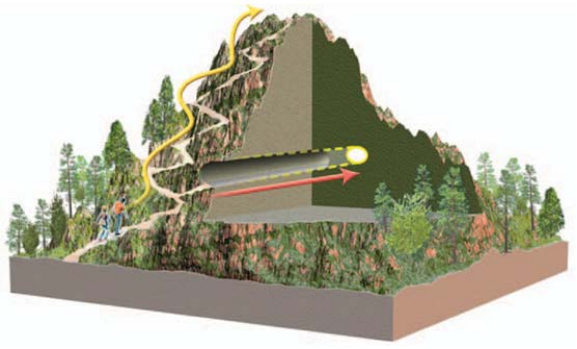
carbon reservoir refers to locations on Earth that store and release organic carbon slowly (p. 86)

carbon sink a carbon reservoir that stores carbon for long periods or absorbs more carbon than it releases (p. 86; 456)

carbon source a carbon reservoir that releases more carbon than it stores (p. 86)

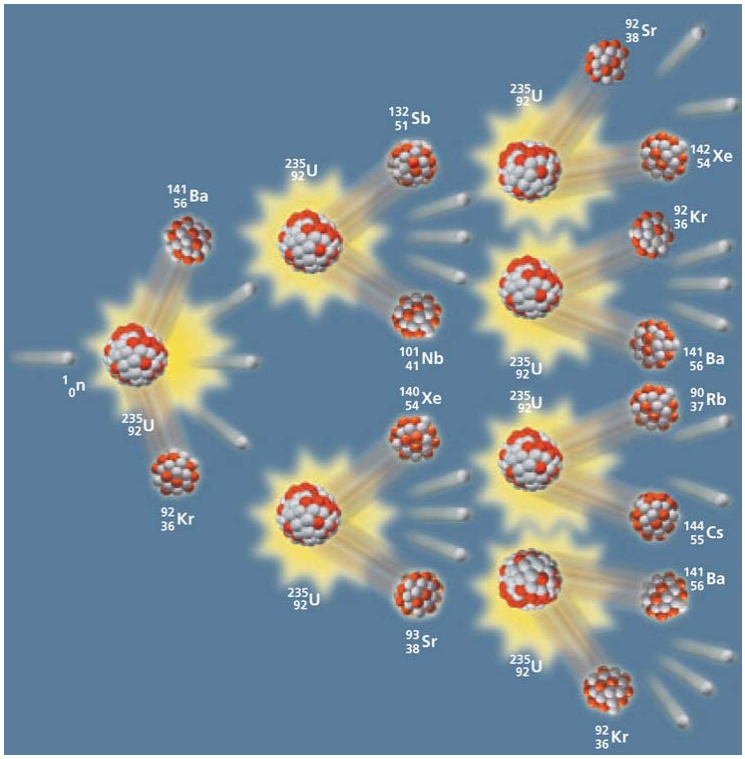
carnivore an organism (consumer) that eats other animals (consumers) (p. 26)

catalyst [KAT-uh-list] a substance that, when added to a reaction, increases the reaction rate without being consumed in the reaction (p. 255)



cellular respiration the reaction between carbohydrates and oxygen that produces energy, carbon dioxide, and water (p. 83)

chain reaction a reaction that initiates its own repetition (p. 318)

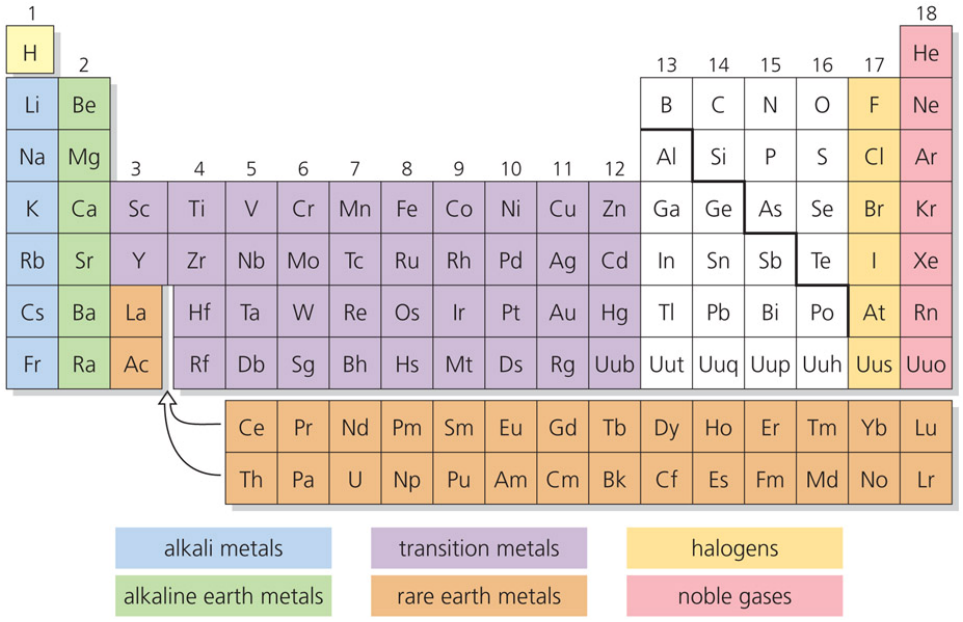


chemical bond any of several physical forces that join or connect atoms together (p. 176)

chemical equation a symbolic representation that uses chemical formulas to describe the reactants and the products in a chemical reaction (p. 233)

$$\underset{\text{reactants}}{2H_2 + O_2} \rightarrow \underset{\text{products}}{2H_2O}$$

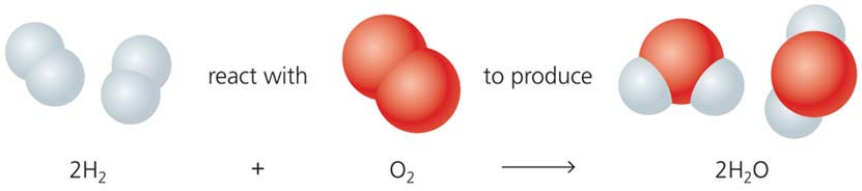
chemical family a group of elements that have a characteristic set of common physical and chemical properties (p. 157)



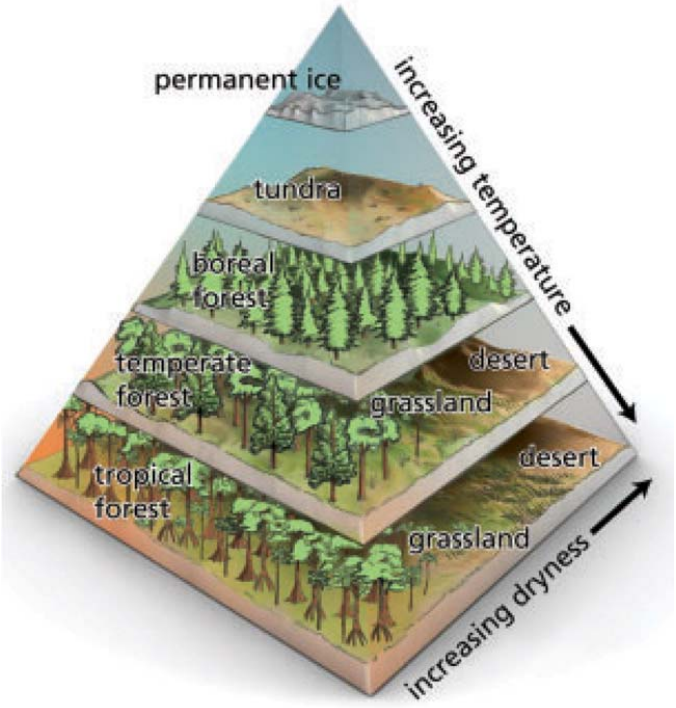
chemical formula describes the proportions of elements in a compound using chemical symbols (p. 183)

chemical property a property that describes a possible chemical change that a substance may undergo (e.g., reacts with water) (p. 149)

chemical reaction a process that involves a chemical change; a process in which a new substance(s) is/are formed (p. 232)

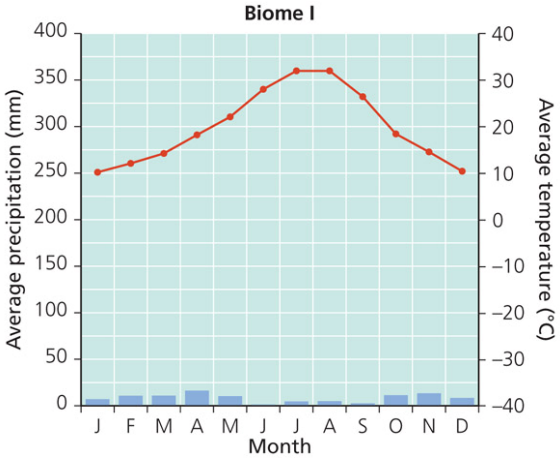


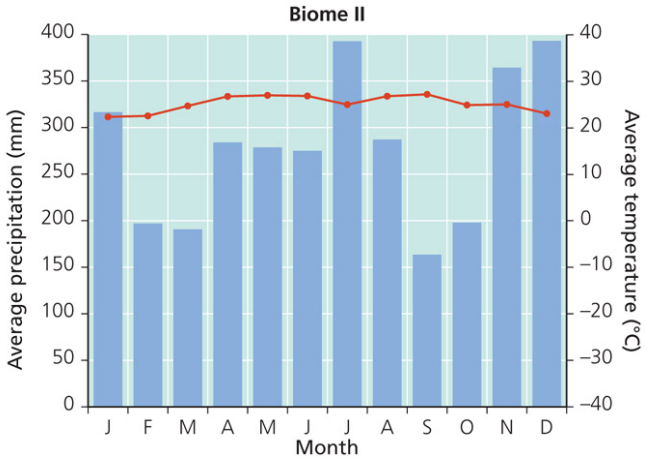
climate the long-term pattern of temperature and precipitation (p. 51)



climate change a shift in long-term average weather patterns, which includes changes in temperature, precipitation, and the frequency of extreme weather events such as hurricanes and tornadoes (p. 455)

climatograph a graph showing the monthly changes in temperature and precipitation throughout a year (p. 53)

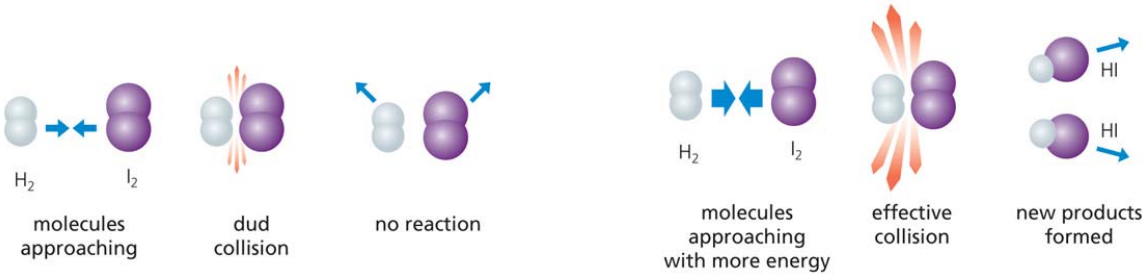




climax community a complex, stable ecosystem reached during late successional stages (p. 71)

coevolution a type of interaction involving the adaptation of two species in response to each other (p. 63)

collision theory a theory that states that in order for moving particles to react, they must first collide with a certain minimum amount of energy (p. 251)

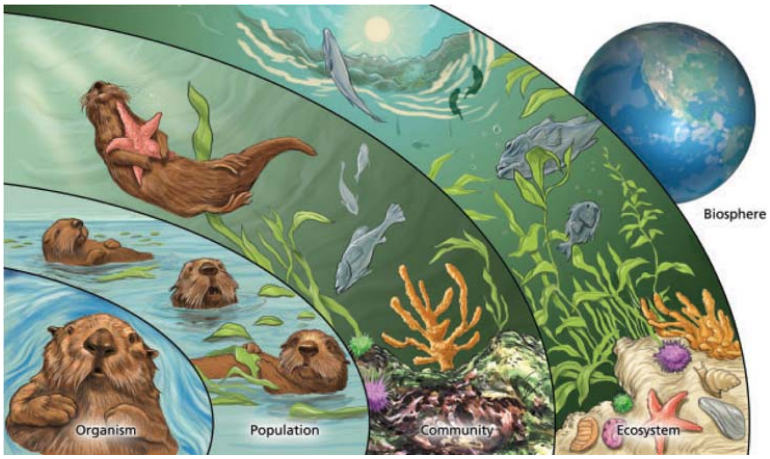


combustion reaction a chemical reaction in which an organic (carbon–hydrogen) substance reacts with oxygen to release heat and perhaps light energy (p. 244)

$$C_xH_y + O_2 \rightarrow CO_2 + H_2O$$

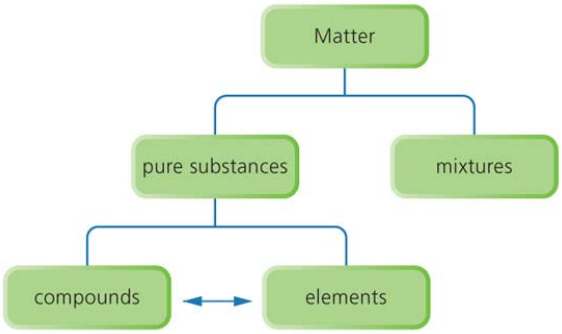
commensalism [kuh-MEN-suhl-IZ-uhm] a symbiotic interaction in which one organism benefits while the other is unaffected (p. 30)

community all of the different populations in a particular area that interact with one another; the third level of organization that ecologists study (p. 22)



competition when two organisms make use of the same resource so that their niches overlap (p. 68)

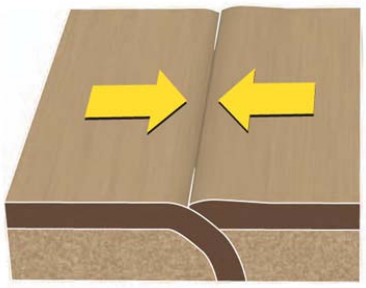
compound a substance formed from two or more elements, in which the elements are always combined in the same fixed proportions (p. 150)



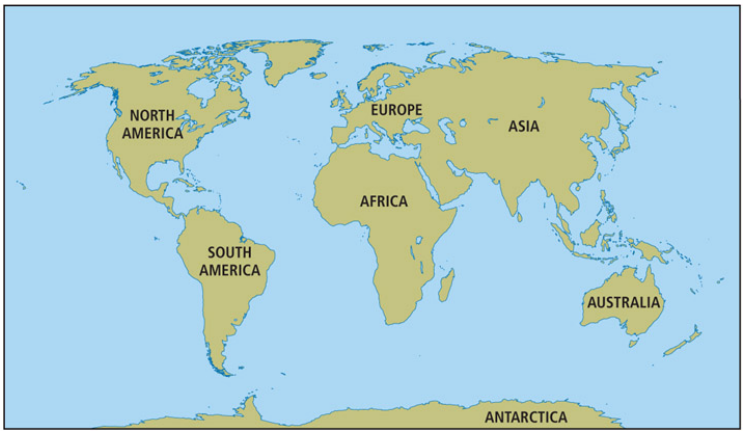
conduction the transfer of thermal energy by direct particle-to-particle contact (p. 411)

consumer an organism that consumes other organisms or biotic waste in order to survive; also called a heterotroph (p. 26)

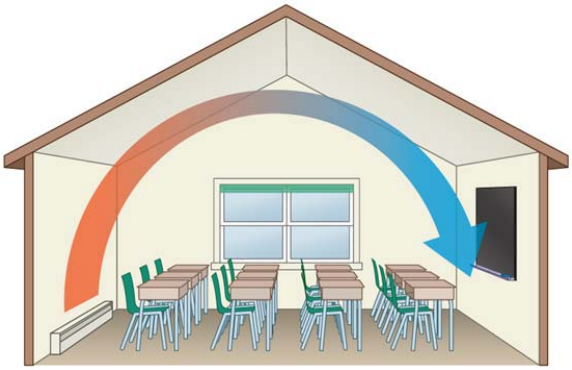
continental–continental convergent boundary a convergent boundary where the continental portions of two tectonic plates meet (p. 506)



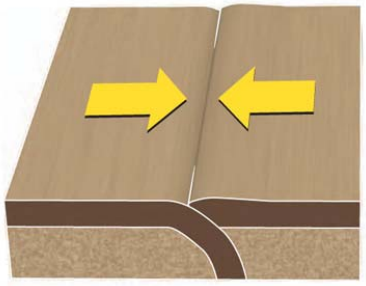
continental drift theory the theory that explains the movement of continents over Earth since it was formed (p. 498)



convection the transfer of thermal energy through the movement of particles in fluids; caused by differences in the density of particles in the fluid (p. 413)



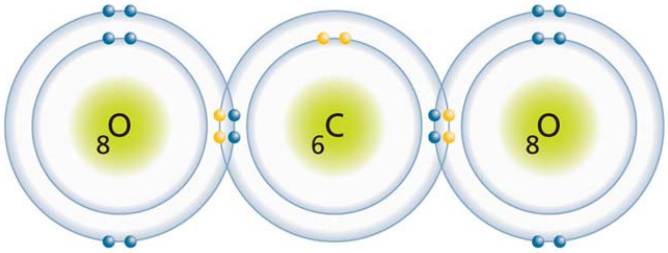
convergent boundary the point of collision between two tectonic plates that are moving toward each other (p. 506)



core centre of Earth's internal structure; see also **outer core** and **inner core** (p. 493)

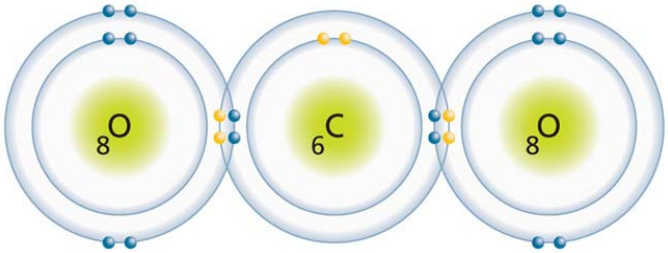
Coriolis [KOH-ree-OH-liss] effect explains a moving object's apparent change in horizontal direction due to the rotation of Earth (p. 442)

covalent bonding chemical bonding that results from a sharing of valence electrons; occurs when non-metals share their valence electrons with other non-metals to complete their valence shells (p. 177)

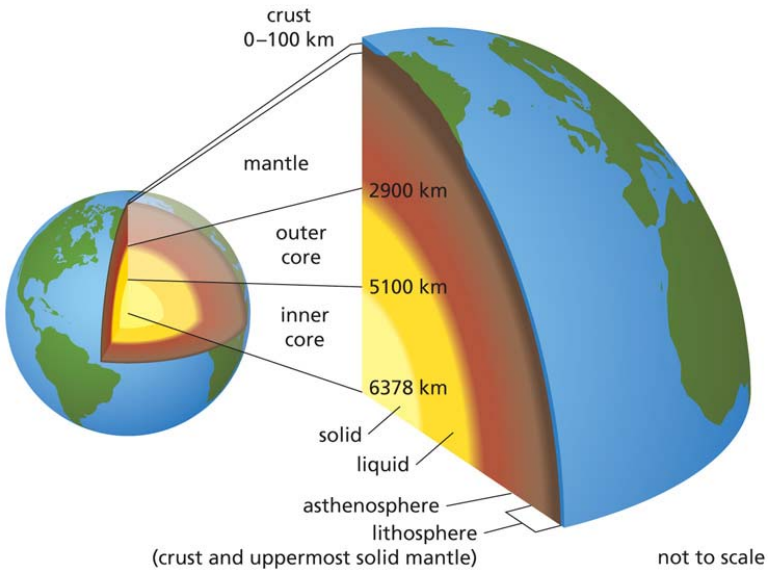


covalent chemical bond the type of bond formed by a bonding pair of electrons (p. 212)

covalent compound a compound formed when atoms join together through covalent bonding; also called a molecular compound (p. 177)

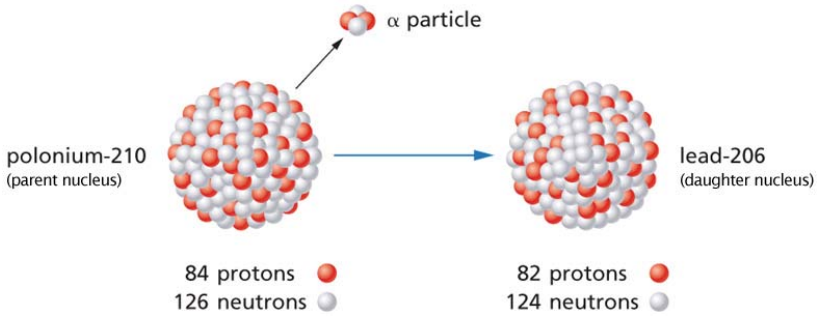


crust the rigid outer rock layer of Earth's internal structure, making up the sea floors and continents (p. 493)



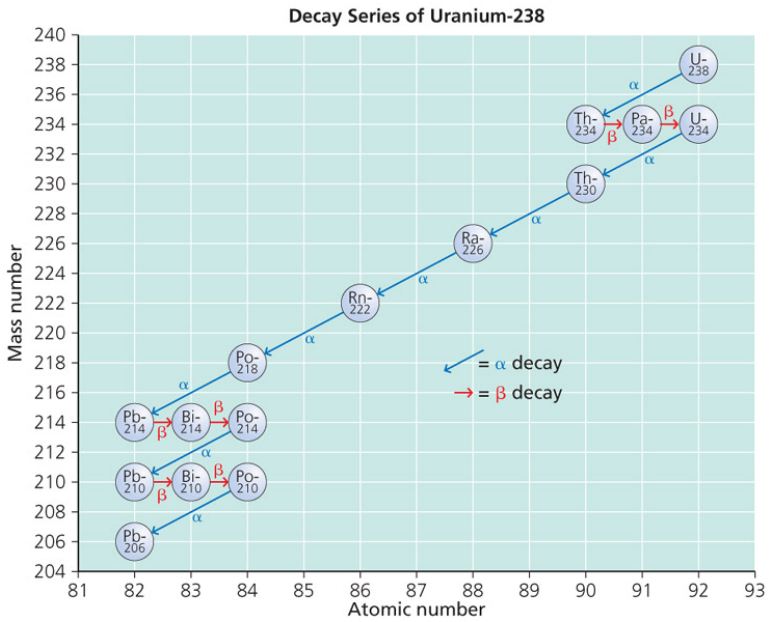
D

daughter nucleus refers to the nucleus produced as a result of radioactive decay (p. 284)

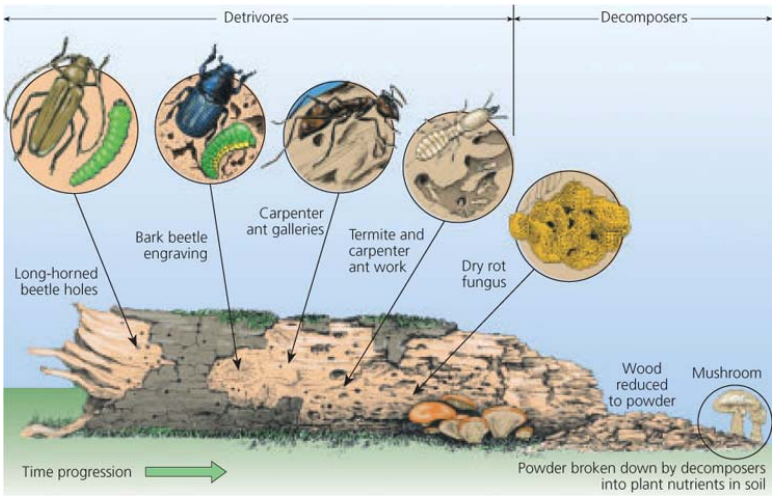


DDT (dichloro-diphenyl-trichloroethane) a synthetic pesticide that was widely used to control insect pests up until the 1970s, when it was discovered to have harmful effects on organisms (p. 121)

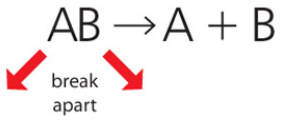
decay series occurs when a radioactive parent nucleus produces a daughter nucleus that is also unstable and the unstable daughter nucleus decays; process continues until a stable daughter nucleus is produced (p. 294)



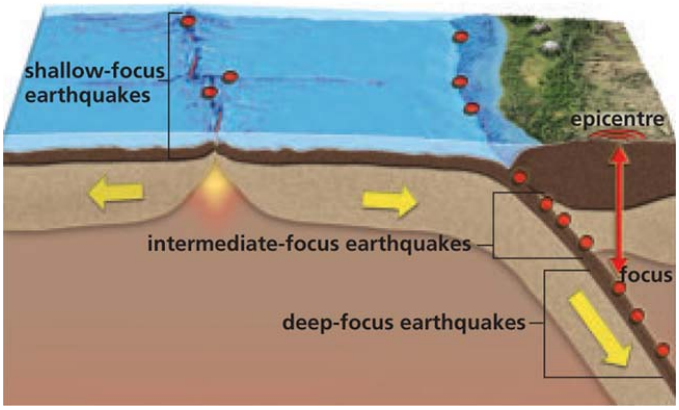
decomposer a consumer that breaks down the complex molecules found in dead organisms and waste matter into simpler molecules (p. 27)



decomposition reaction a chemical reaction in which a compound breaks into its component parts (p. 241)



deep-focus earthquake an earthquake with a focus located at a relatively deep point (300–700 km) beneath Earth's surface (p. 526)



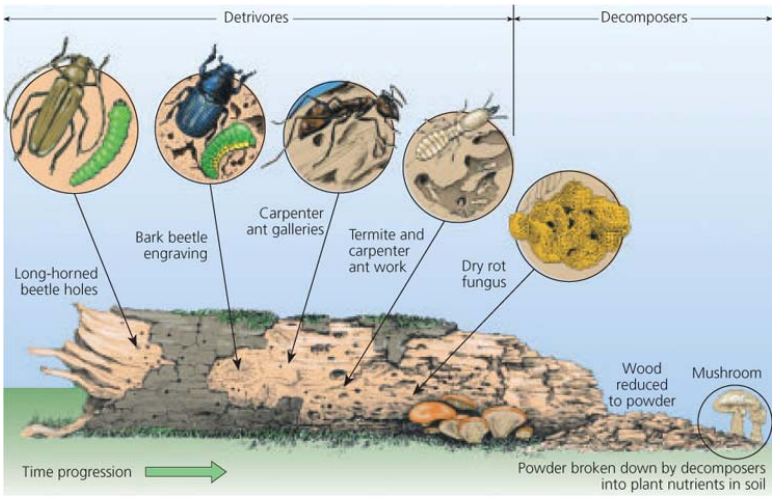
deforestation occurs when more trees are cut down than are replaced (p. 128)

denitrification the process that converts ammonia and nitrate back to nitrogen gas (p. 94)

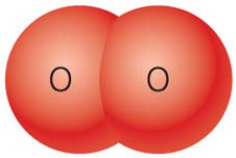
derived units units of measurement that are formed using two or more base units (p. 546)

desert the biome characterized by less than 25 cm of precipitation annually and sparse vegetation of small plants specialized to conserve water; occurs in North Africa, central Australia, southwestern North America, eastern Asia, and the southeast tip of South America (p. 58)

detrivore a decomposer that feeds on the waste material in an ecosystem, including the bodies of other organisms that have died, plant debris, and animal feces (p. 27)



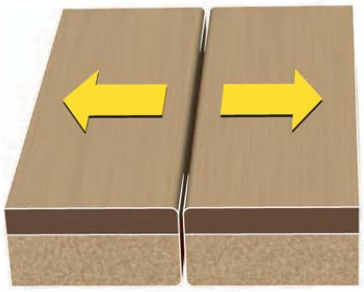
diatomic molecule a set of paired atoms; a small number of elements that only exist in pairs of atoms (p. 178)



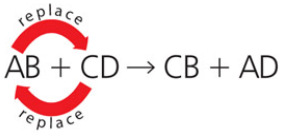
discovery an observation of nature that no one has made before, or that no one has made in the same way before (p. 4)

displacement a vector quantity that indicates the change in position of an object; symbol is $\vec{d}$ (p. 359)

divergent boundary the area between two tectonic plates that are moving away from each other (p. 506)



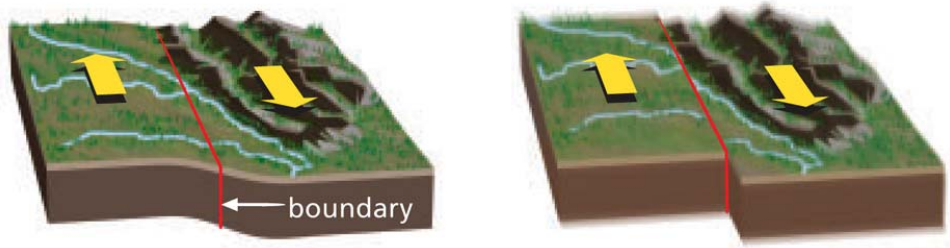
double replacement reaction a chemical reaction in which two compounds (containing elements) react and two of the elements replace each other (p. 242)



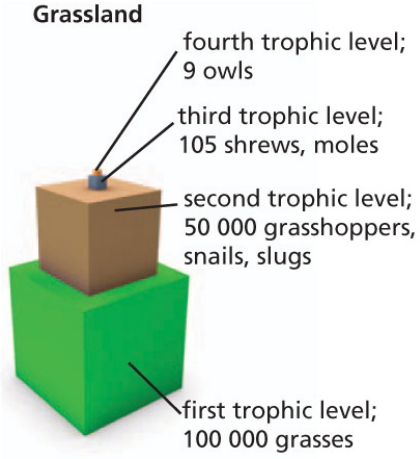
dynamic equilibrium any system with constant change in which the components can adjust to the changes without disturbing the entire system (p. 23)

E

earthquake vibrations through Earth's crust caused by volcanoes or movement at tectonic plate boundaries (p. 525)



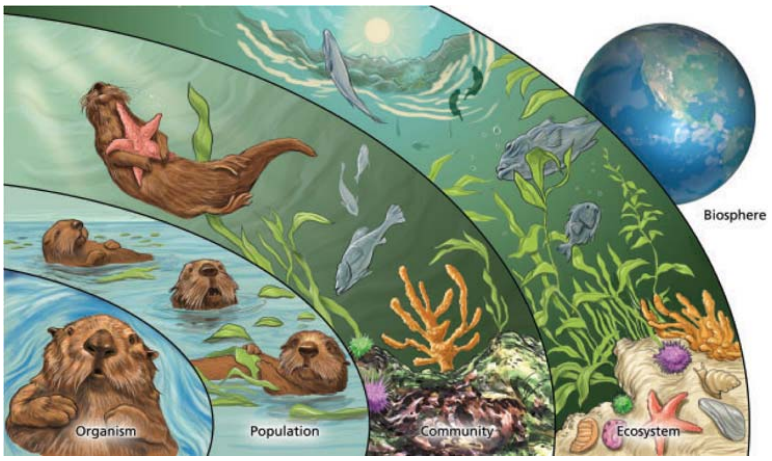
ecological pyramid a representation of energy flow in food chains and webs; also called a food pyramid (p. 39)



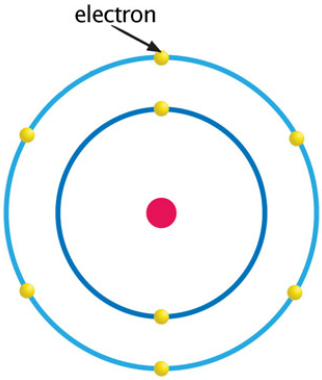
ecological succession a gradual change in the types of plants that represent the structure of a community (p. 71)

ecology the study of how organisms interact with each other and with their physical environment (p. 21)

ecosystem includes the living community as well as the physical environment in which the organisms live; the fourth and most complex level of organization that ecologists study (p. 22)

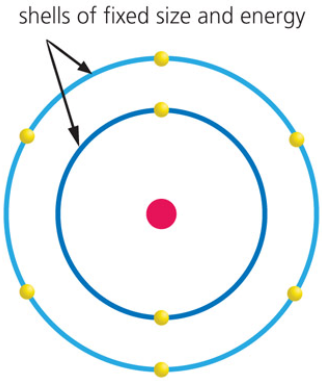


electron a negatively charged subatomic particle located outside the nucleus of an atom; has an electric charge of –1 (p. 154)

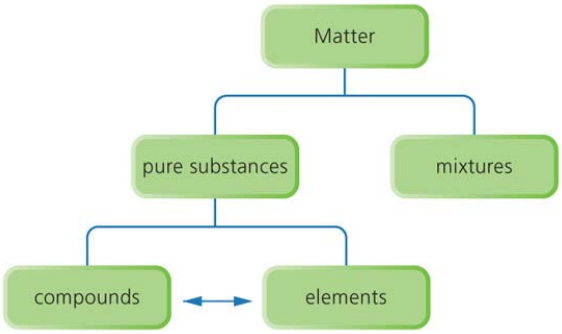


electron dot diagram see **Lewis diagram**

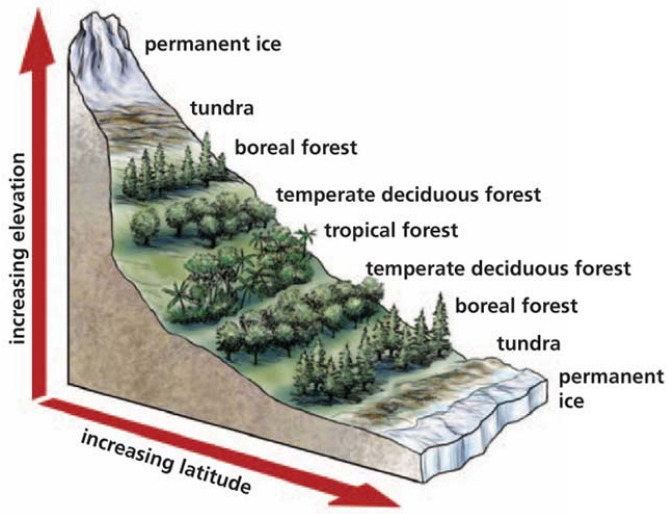
electron shell a specific region around the nucleus in which electrons are arranged; also called an orbital or an energy level (p. 154)



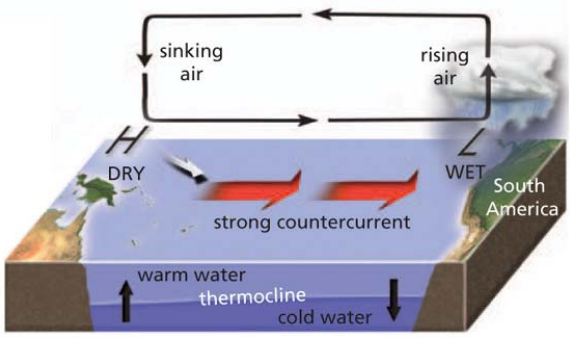
element a substance that cannot be broken down into simpler materials (p. 150)



elevation refers to height above (or below) sea level (p. 51)



El Niño [el NEEN-yo] a periodic shift in ocean currents, temperature, and atmospheric conditions in the tropical southern Pacific Ocean (p. 464)

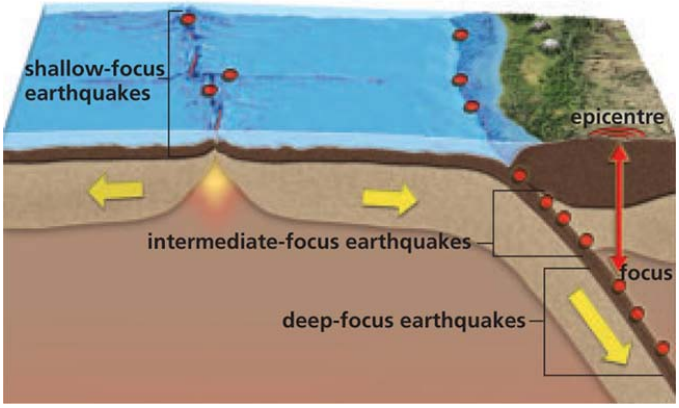


empirical knowledge knowledge gained through observation and experimentation (p. 3)

endocrine-disrupting compounds (EDCs) chemicals that either mimic or disrupt the normal functioning of certain hormones; these chemicals often bioaccumulate and include DDT, PCBs, chlordanes, and PBDEs (polybrominated diphenyl ethers) (p. 124)

enhanced greenhouse effect caused by an increase in the concentration of GHGs above normal levels; leads to more heat being trapped in the atmosphere (p. 455)

epicentre the spot at Earth's surface directly above an earthquake's focus (p. 525)



extinction when a species is gone completely from Earth, or when so few individuals remain that reproduction is not possible (p. 64)

extirpation [EK-stur-PAY-shun] the phenomenon of local extinction, which occurs when a species ceases to exist in one area but still exists elsewhere in the world (p. 64)

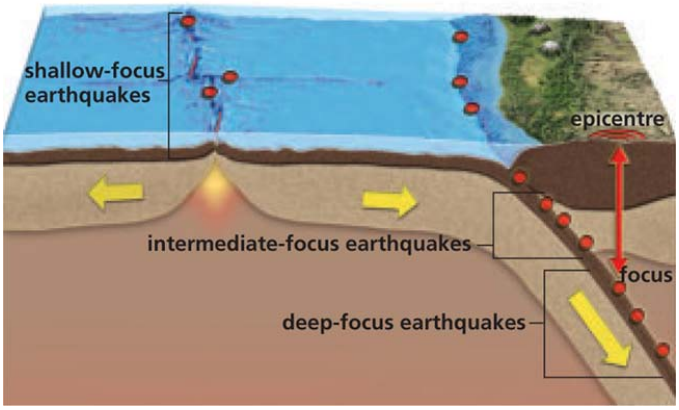
extrapolation the prediction of values that lie outside known values (p. 555)

F

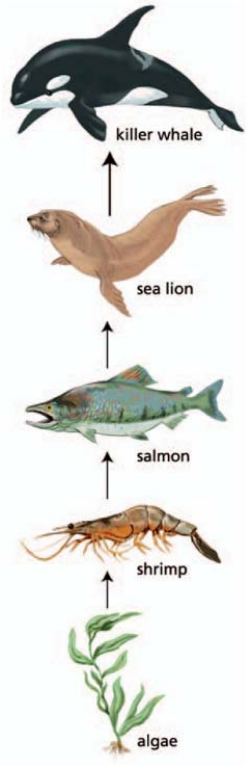
fault a displacement of the lithosphere (vertically, horizontally, or both) created by the movement of tectonic plates (p. 525)

fermentation see **anaerobic respiration**

focus the location of an earthquake's origin within the lithosphere (p. 525)

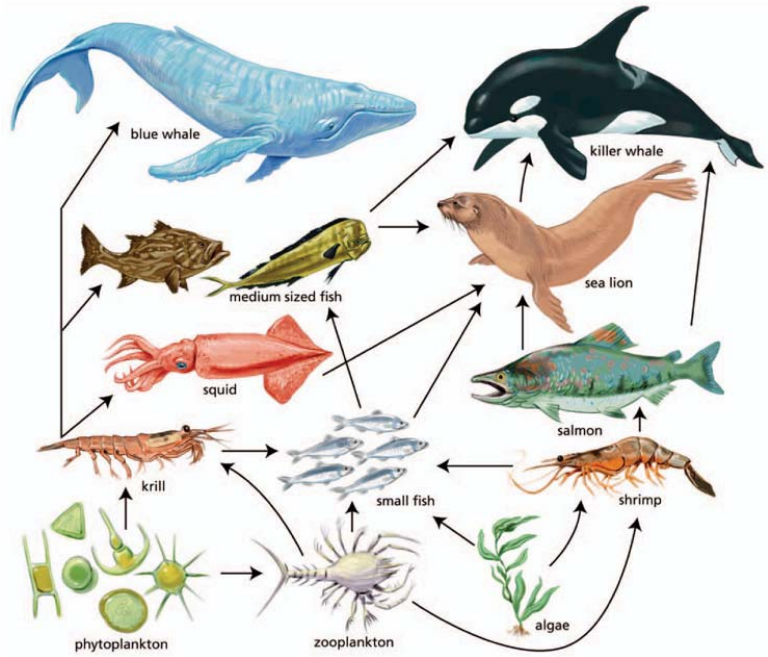


food chain a representation of the pathway taken by nutrients and energy through the trophic levels of an ecosystem (p. 34)



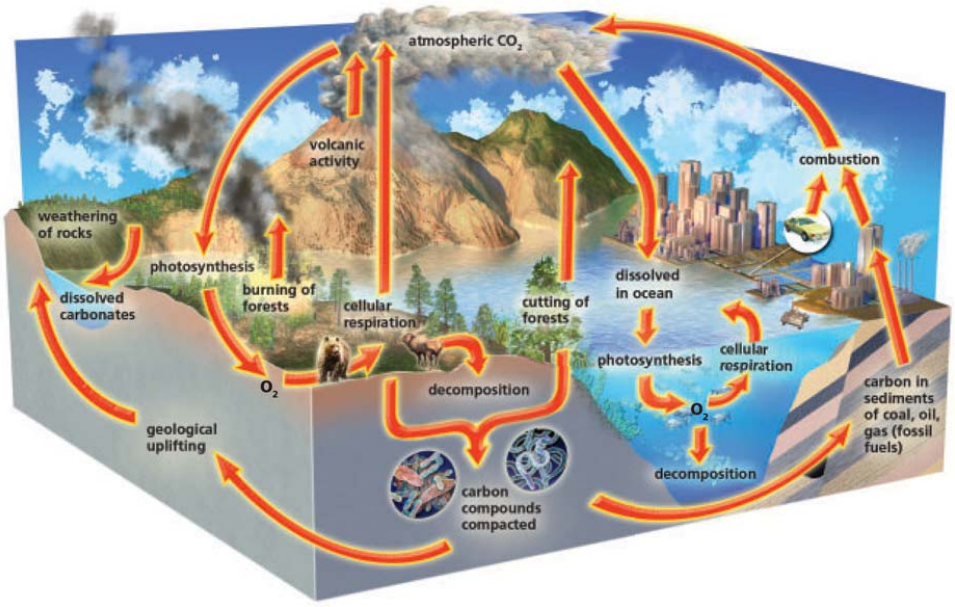
food pyramid see **ecological pyramid**

food web a representation of the nutrient and energy pathways in an ecosystem showing many cross-linked food chains (p. 36)



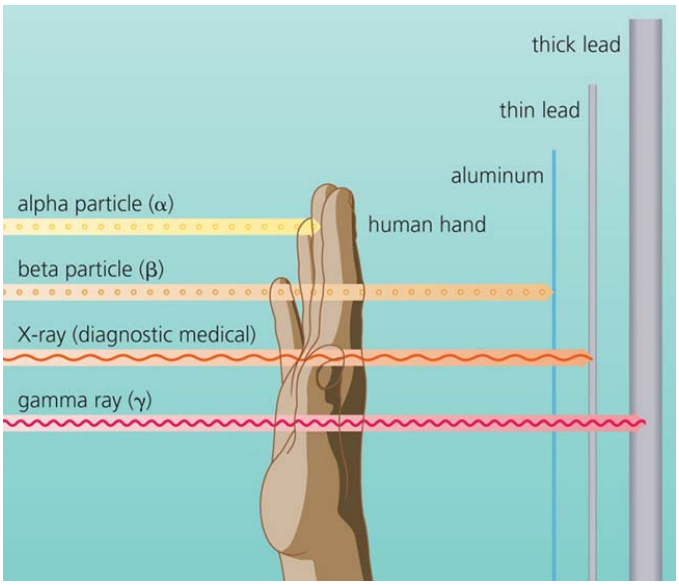
foreign species species that are not native to a particular ecosystem; they are often able to out compete the existing native species for a particular niche (p. 69)

fossil fuels hydrocarbons found within the top layer of Earth's crust; include coal, oil, and gas (p. 86)



G

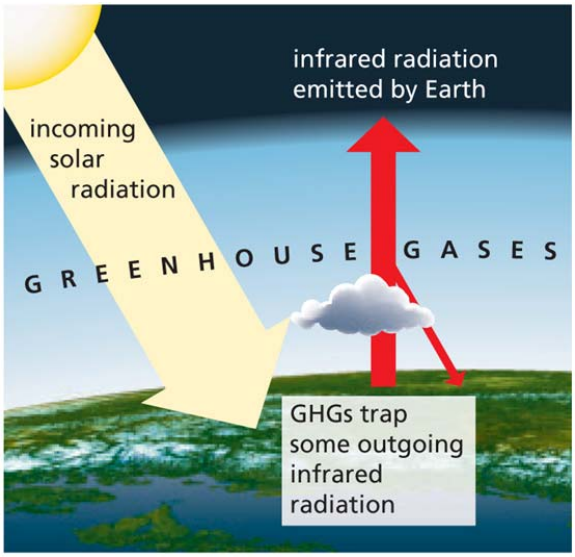
gamma ray a very high-energy type of electromagnetic radiation emitted during gamma decay of a radioactive atom; symbol is γ (p. 287)



global warming an increase in the long-term average temperature of Earth's surface and lower atmosphere (p. 455)

grassland the biome characterized by rainfall between 25 and 75 cm per year supporting the growth of grasses (p. 57)

greenhouse effect the warming effect created by the ability of Earth's atmosphere to trap thermal energy (p. 88; 455)



greenhouse gases (GHGs) gases in the atmosphere that allow solar radiation to pass through the atmosphere and be absorbed by Earth's surface, and then absorb and trap any thermal energy radiated from Earth; include carbon dioxide and methane (p. 88)

H

habitat the region in which an organism lives (p. 21)

half-life the average length of time for half of the parent nuclei in a sample to decay (p. 290)

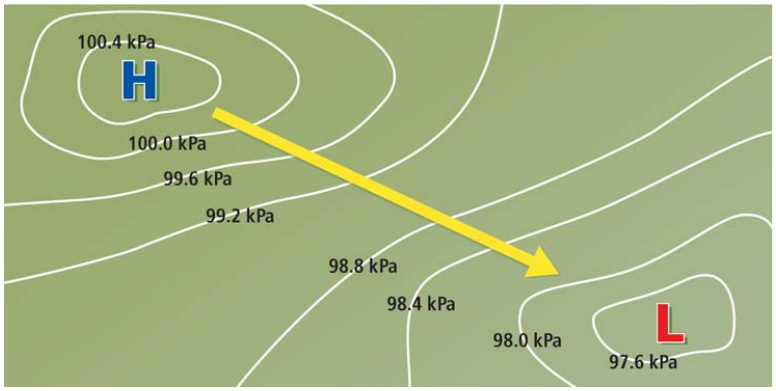
heat the transfer of thermal energy from a cooler substance to a warmer substance because of temperature differences (p. 411)

heavy metals elements that are found in the middle of the periodic table and have relatively high densities; commonly used in industry; toxic or poisonous to organisms in relatively low concentrations (p. 123)

herbivore an organism (consumer) that eats plants (producers); also called a primary consumer (p. 26)

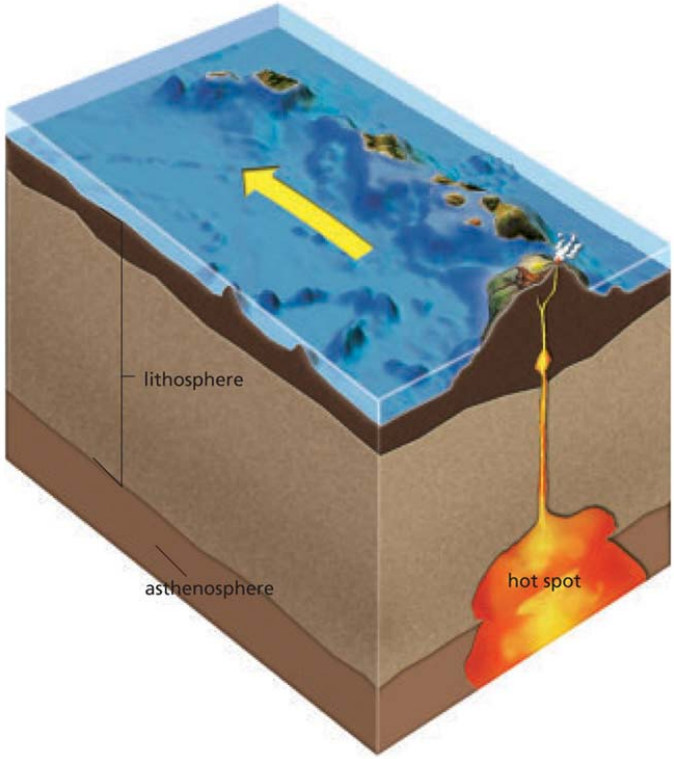
heterotroph see **consumer**

high-pressure cell a region of high-pressure at Earth's surface produced by the sinking of denser air (p. 433)



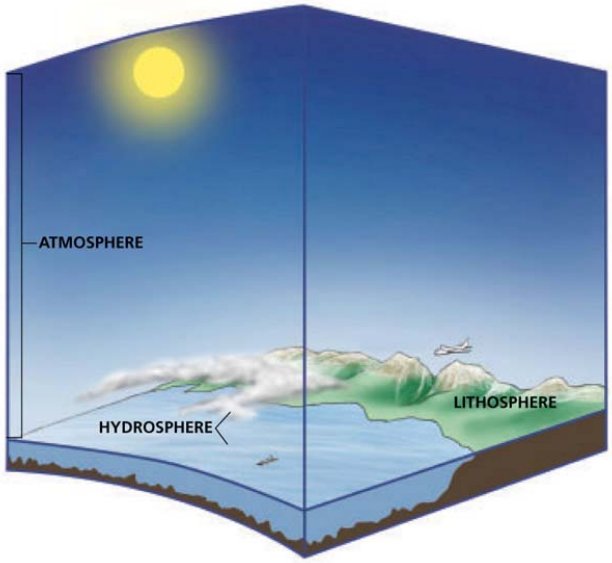
host the organism that is harmed in a symbiotic parasitic relationship; the other organism (parasite) benefits (p. 30)

hot spot a small region of very hot mantle heated by a concentration of radioactive substances near Earth's core (p. 523)



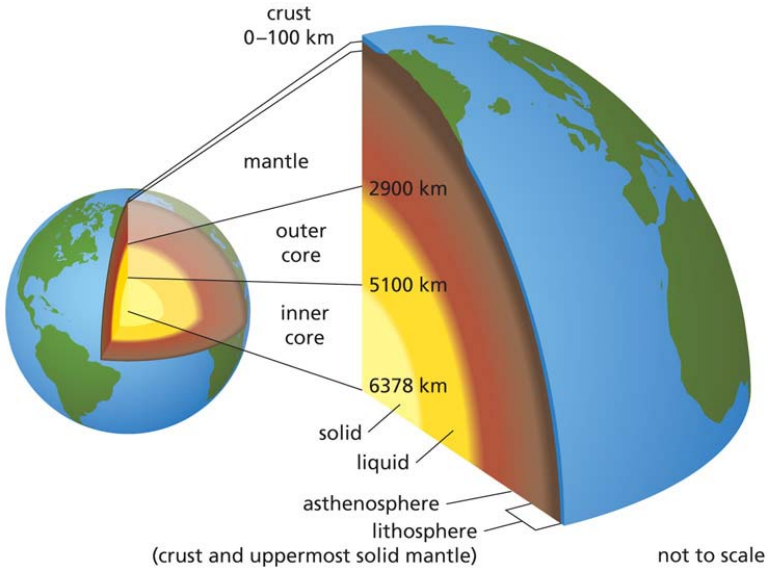
hydrocarbon an organic compound that contains only the elements hydrogen and carbon; the simplest of all organic compounds (p. 218)

hydrosphere all of the water, in all of its states, found in, on, or near Earth (p. 418)



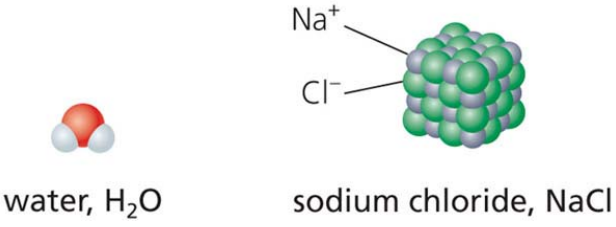
I

inner core the solid centre of Earth, consisting mostly of very dense iron (p. 493)

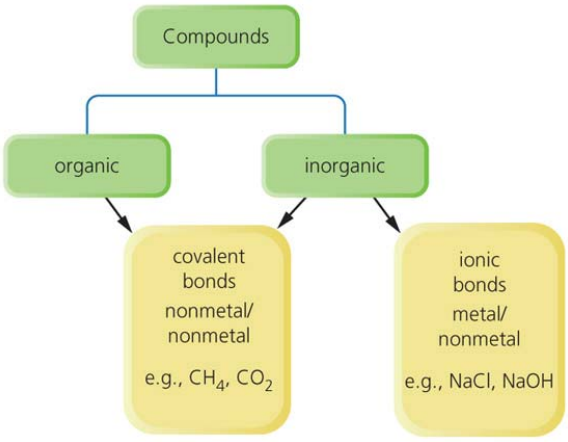


innovation the modification of an existing technology to serve a new purpose (p. 6)

inorganic matter that is not of biological origin; it may or may not contain carbon and is often of mineral origin (p. 83)



inorganic compound any compound that is not an organic compound (p. 201)

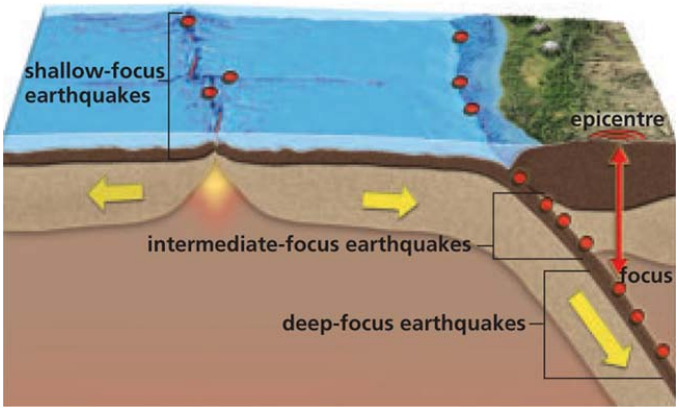


instantaneous acceleration the acceleration of an object at a particular instant in time (p. 383)

instantaneous speed the speed of an object at a particular instant in time (p. 349)

insulator material that limits thermal energy transfer (p. 414)

intermediate-focus earthquake an earthquake with a focus located at a relatively intermediate point (70–300 km) beneath Earth's surface (p. 526)



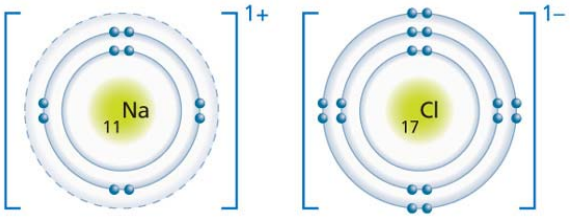
interpolation the prediction of values that lie between known values (p. 555)

interspecific competition competition between different species (p. 68)

intraspecific competition competition between organisms of the same species (p. 68)

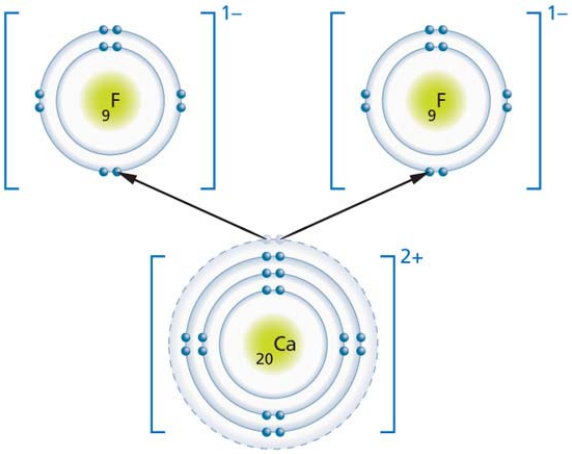
invention the creative development of a new device or process that helps people meet their needs or satisfy their wants (p. 6)

ion a charged atom; does not have an equal number of protons and electrons (p. 171)

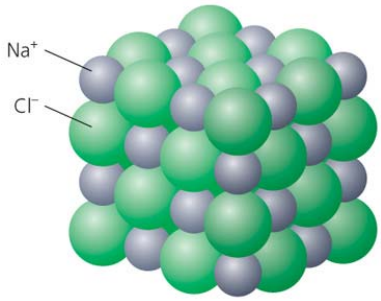


ion charge balance in ionic compounds, the total positive ion charge is equal to or cancels the total negative ion charge; the total ion charge for the compound is zero (p. 183)

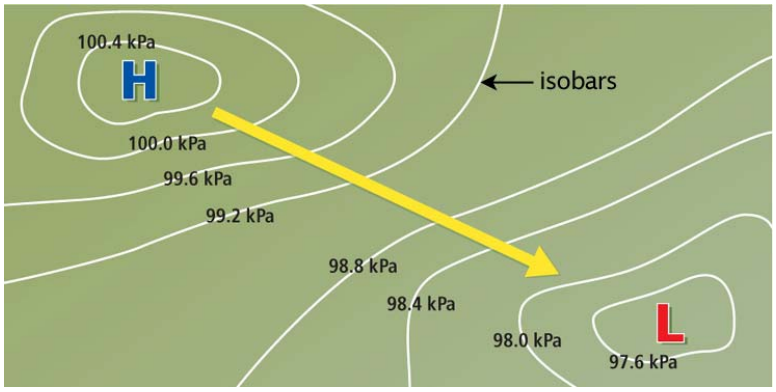
ionic bonding chemical bonding that results from a transfer of valence electrons; occurs when oppositely charged ions (metals and non-metals) strongly attract one another and are held tightly together (p. 176)



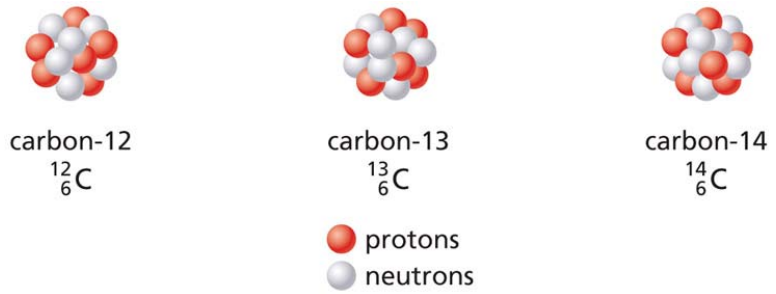
ionic compound a compound formed when atoms join together through ionic bonding (p. 176)



isobars lines on a weather map that join locations of equal atmospheric pressure (p. 433)



isotopes atoms of the same element that have different mass numbers; isotopes have the same number of protons, but a different number of neutrons (p. 281)



K

keystone species a species whose presence plays an important ecological role in determining the types and numbers of other species in particular ecosystems; when these species are eliminated, the effects on the ecosystem are dramatic (p. 64)

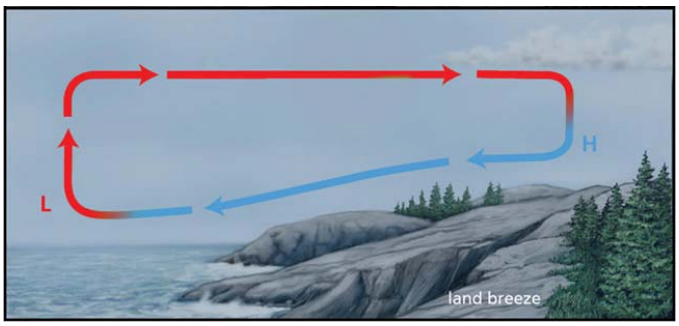
kilopascal (kPa) the unit of measurement for air pressure; 1 kPa = 1000 Pa (p. 431)

kinetic energy the energy that a substance has due to its motion (p. 405)

kinetic molecular theory the theory that matter is made up of tiny particles in constant, random motion; the more energy the particles have, the faster they move (p. 251; 405)

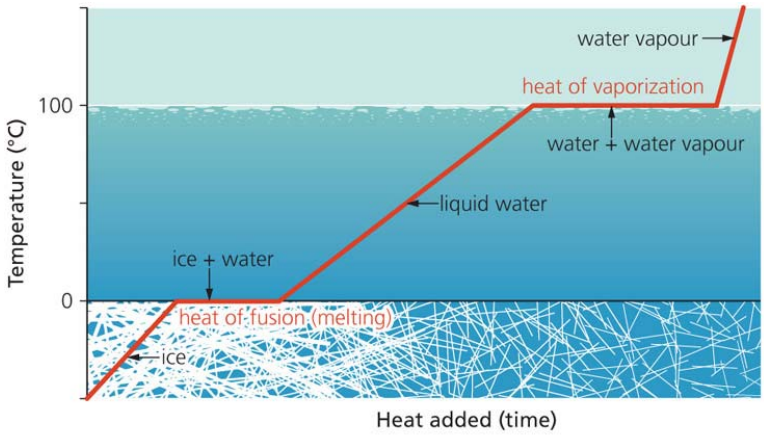
L

land breeze occurs because land cools faster than water overnight, creating higher air pressure over the land and lower air pressure over the water. The less dense air over the water rises, and more dense air blows off from the land to replace it (p. 438)



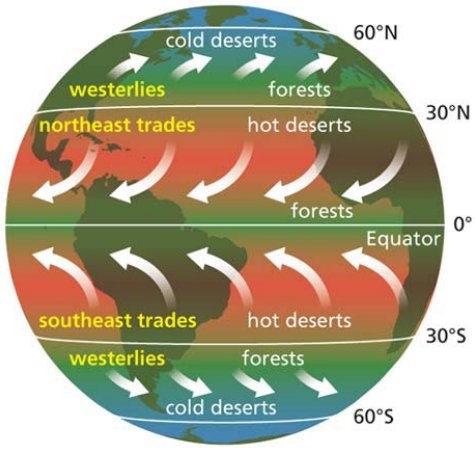
La Niña [lah NEEN-ya] a periodic shift to colder-than-average ocean temperatures in the eastern Pacific Ocean with effects opposite to those of El Niño (p. 466)

latent heat the energy needed to change a substance from one state to another without changing temperature (p. 415)

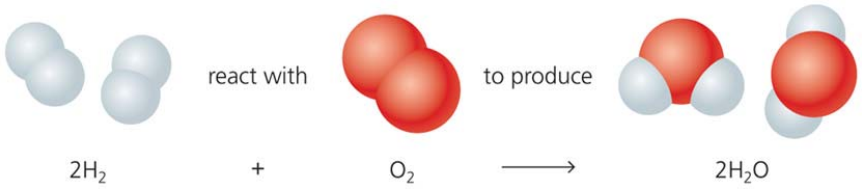


Substance	Specific heat capacity (J/(kg·°C))	Latent heat solid ↔ liquid (J/kg)	Latent heat liquid ↔ gas (J/kg)
water	4186	334 000	2 272 000
ethyl alcohol	2400	104 000	854 000
lead	128	24 500	871 000

latitude the location of a place on Earth north or south of the equator, which is designated as zero (0) degrees (p. 51)

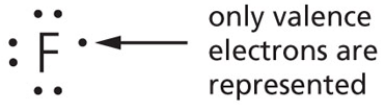


Law of Conservation of Mass the total mass of the reactants in a chemical reaction in a closed system is equal to the total mass of the products (p. 233)



legume [leg-YOOM] a plant whose root nodules host nitrogen-fixing bacteria; includes crops such as peas, peanuts, soybeans, clover, and alfalfa, and wild plants such as alders and lupins (p. 92)

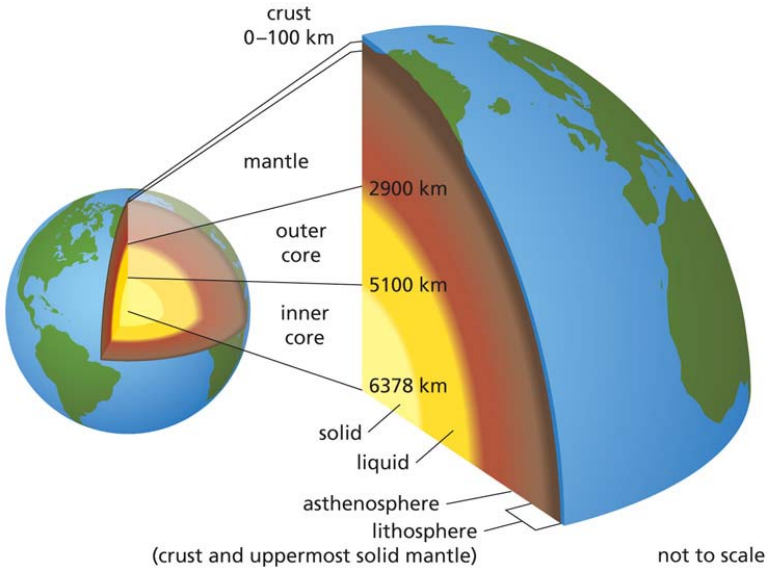
Lewis diagram a simple model of the arrangement of valence electrons in atoms where single or paired dots represent the valence electrons; describes an atom as it prepares to bond with other atoms; also called an electron dot diagram (p. 210)



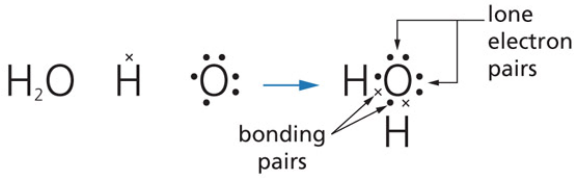
limiting factor the factor that is the most critical in determining the types of organisms that can exist in an ecosystem; an environmental factor that limits the growth, abundance, or distribution of a population of organisms in an ecosystem (p. 23)

line of best fit a smooth line that passes through or between the points on a graph so that there are about the same number of points on each side of the line; attempts to minimize the effect of random measurement errors (p. 555)

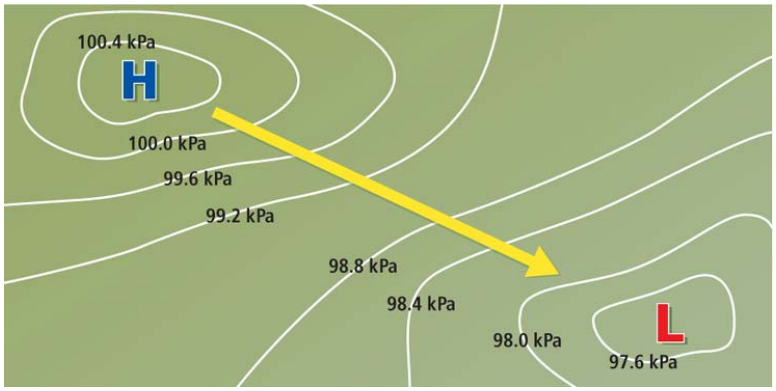
lithosphere [LITH-uh-sfeer] the region of Earth's internal structure formed by the crust and the rigid outer layer of the mantle (p. 417; 493)



lone electron pair a pair of electrons that are not a bonding pair, and thus do not form a chemical bond (p. 212)

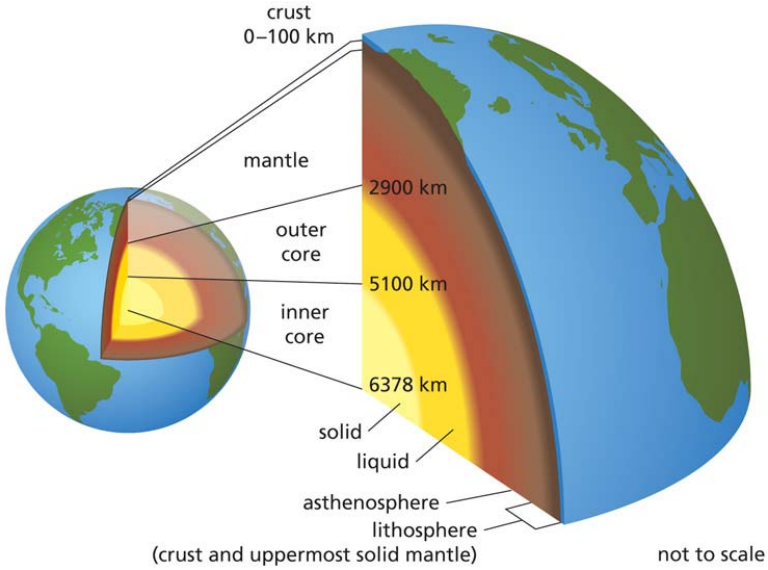


low-pressure cell an area of lower air pressure at Earth's surface formed by a warmed air mass that is expanding and rising (p. 433)

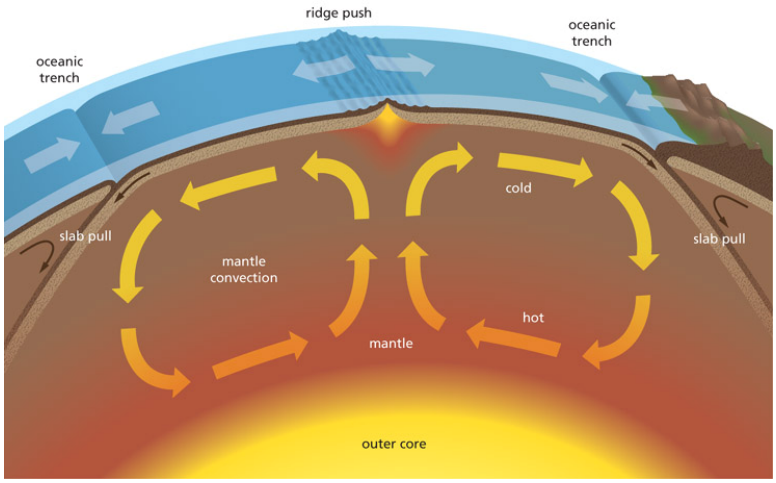


M

mantle the middle, fluid-like layer of Earth's internal structure, nearly 3000 km thick (p. 493)

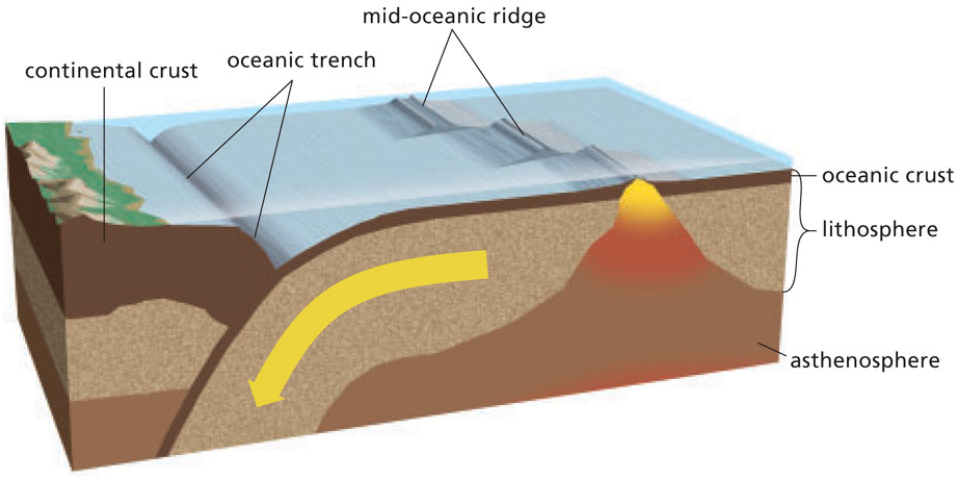


mantle convection convection currents that occur in the mantle because of uneven heat distribution within Earth (p. 517)



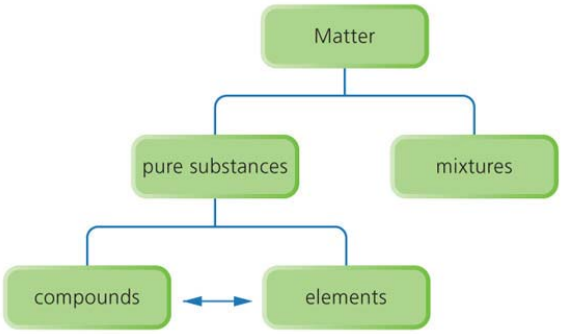
mass number the total number of protons and neutrons in the nucleus of an atom (p. 153)

mid-ocean ridge an undersea mountain range bracketing a divergent boundary; also called a spreading ridge (p. 501)



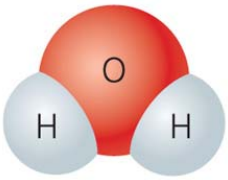
mimicry a strategy whereby one species resembles another that is poisonous, dangerous, or distasteful to avoid predation; also refers to situations where two harmful species have similar coloration (e.g., bees and wasps) (p. 63)

mixture formed when two or more substances are put together but are not chemically combined (p. 150)



molecular compound see **covalent compound**

molecule a neutral particle that consists of two or more atoms that are covalently bonded together (p. 178)



multivalent metal elements that have more than one ion charge (p. 187)

Metal	Ion	Ion name	Metal	Ion	Ion name
chromium	Cr^{2+}	chromium(II)	manganese	Mn^{2+}	manganese(II)
	Cr^{3+}	chromium(III)		Mn^{3+}	manganese(III)
cobalt	Co^{2+}	cobalt(II)	tin	Sn^{2+}	tin(II)
	Co^{3+}	cobalt(III)		Sn^{4+}	tin(IV)
copper	Cu^{+}	copper(I)	lead	Pb^{2+}	lead(II)
	Cu^{2+}	copper(II)		Pb^{4+}	lead(IV)
iron	Fe^{2+}	iron(II)			
	Fe^{3+}	iron(III)			

mutualism [MYOO-choo-uhl-izm] a symbiotic interaction in which both species obtain some benefit from the interaction (p. 30)

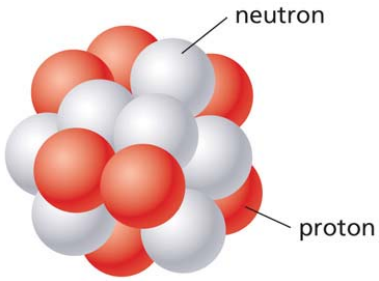
mycorrhizae microscopic fungi that increase the solubility of phosphates in the soil, making them more readily available for plants (p. 99)

N

natural selection a process that favours the survival of organisms with traits that make them better adapted to the environment; tends to eliminate those individuals that are poorly adapted (p. 61)

negative acceleration occurs when an object undergoes a decrease in velocity or the final velocity is less than the initial velocity (p. 376)

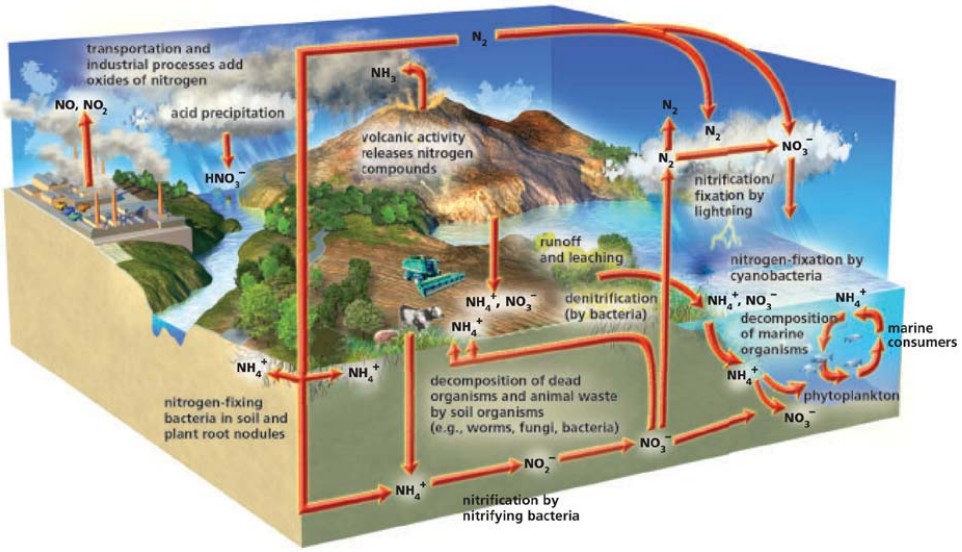
neutron an uncharged subatomic particle contained within the nucleus of an atom; similar in mass to a proton (p. 153; 281)



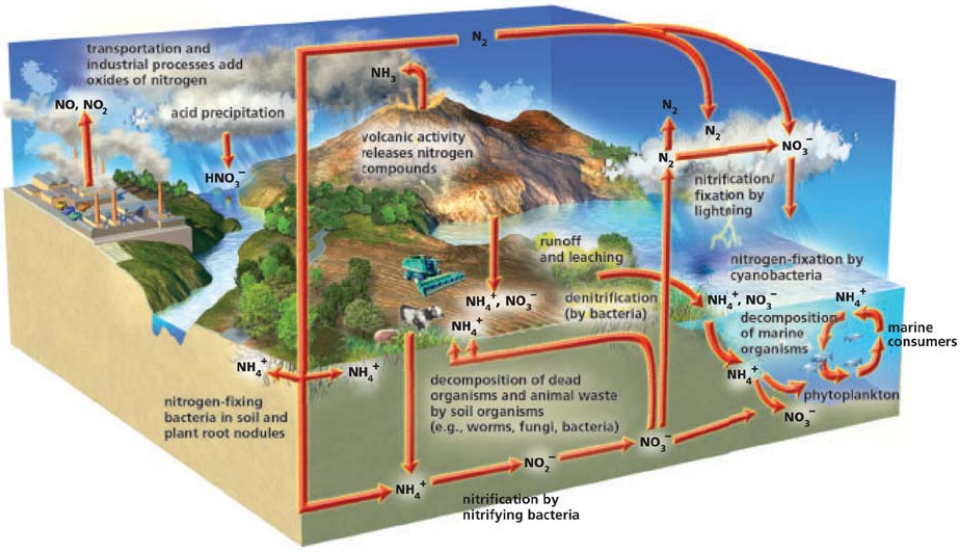
niche [neesh] the overall role of an organism in a community, including the range of biotic and abiotic conditions that the organism can tolerate (p. 68)

nitrate a highly soluble nitrogen compound containing both nitrogen and oxygen; produced from ammonium by bacteria in the soil (p. 93)

nitrification [NYE-trih-fih-CAY-shun] the process that produces nitrate from ammonium (p. 93)

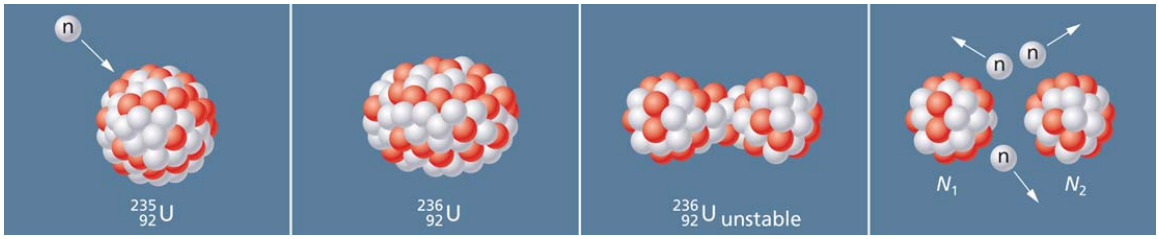


nitrogen cycle the movement of nitrogen between the abiotic and biotic components of the biosphere (p. 92)



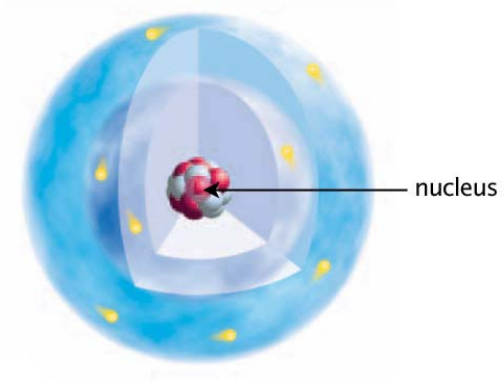
nitrogen fixation the first step in the nitrogen cycle, which occurs when nitrogen from nitrogen gas is “fixed” or combined with hydrogen to produce ammonia (NH_3) (p. 92)

nuclear fission the process of splitting a large atomic nucleus into two smaller nuclei (p. 313)



nuclear fusion the process of fusing or joining of two small nuclei into one large nucleus (p. 327)

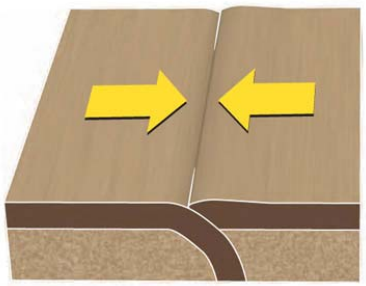
nucleus the dense centre of an atom; part of an atom containing all of the positive charge and almost all of the mass of the atom (p. 153; 280)



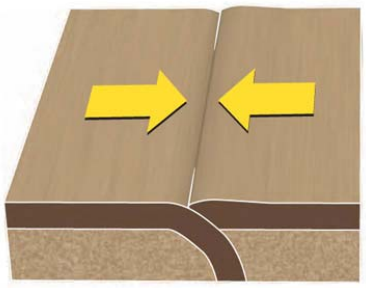
nutrients the elements and compounds that organisms must have in order to grow and live; includes water, oxygen, vitamins, and minerals, as well as foods that provide fats, proteins, and carbohydrates (p. 25)

O

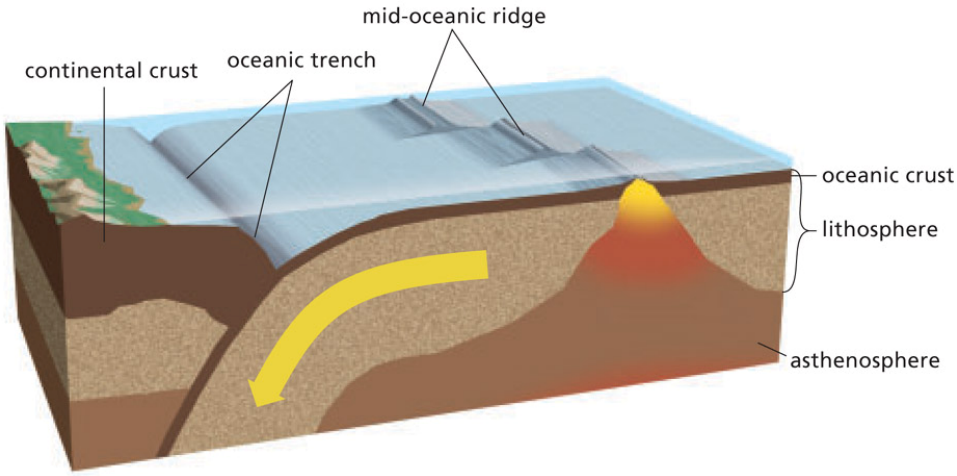
oceanic–continental convergent boundary a convergent boundary where oceanic and continental portions of two tectonic plates meet (p. 506)



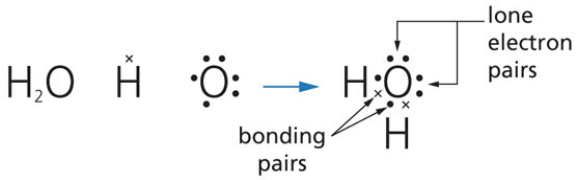
oceanic–oceanic convergent boundary a convergent boundary where the oceanic portion of two tectonic plates meet (p. 506)



ocean trench an extensive elongated depression of the sea floor where two tectonic plates converge (p. 502)

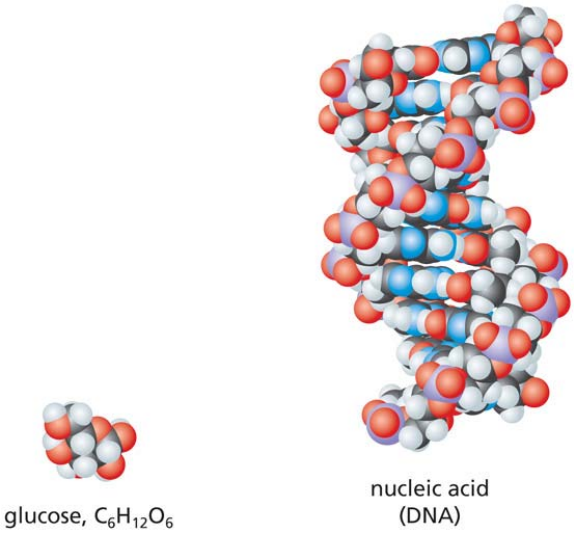


octet rule when bonding, each atom has a tendency to complete its valence shell to match its nearest noble gas (all noble gases have eight valence electrons except helium, which has two) (p. 212)



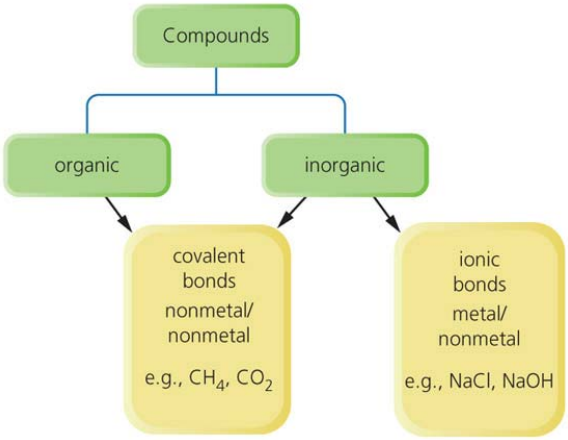
omnivore an organism (consumer) that eats both plants (producers) and animals (consumers) (p. 26)

organic describes matter that consists of compounds that always contain the elements carbon and hydrogen, although other elements may also be present; found in living organisms or the fossils of once living things (p. 83)

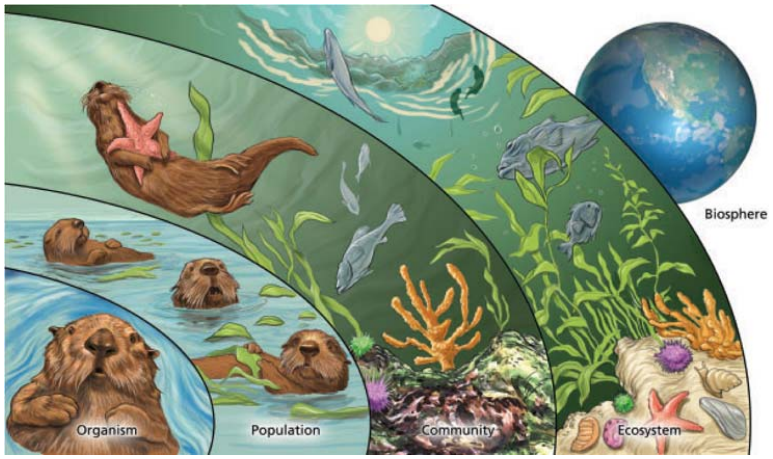


organic chemistry the chemistry of carbon compounds (p. 215)

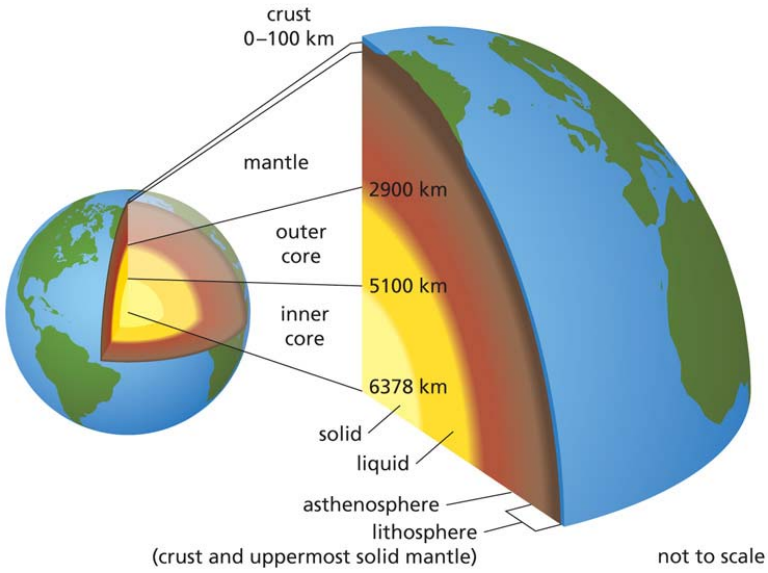
organic compound a compound that has a high percentage of carbon by mass (p. 201)



organism a single living thing; the first and simplest level of organization that ecologists study (p. 21)



outer core the liquid outer portion of Earth's centre, consisting of iron and nickel (p. 493)

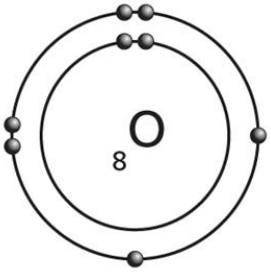


oxygen cycle describes the path of oxygen through ecosystems (p. 90)

ozone layer a layer about 24 km up in the atmosphere that contains a higher concentration of ozone (O_3), which absorbs harmful solar (UV) radiation (p. 457)

P

paired electrons two electrons together in an electron shell (p. 154)

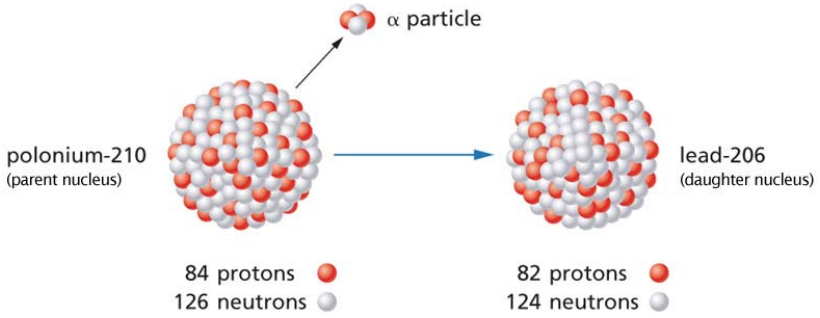


paleoglaciation [PAY-lee-oh-GLAYS-ee-AY-shun] extensive periods in the past in which glaciers covered most of the continents (p. 499)

parasite the organism that benefits in a symbiotic parasitic relationship; the other organism (host) is harmed (p. 30)

parasitism [PEHR-uh-sih-TIZ-uhm] a symbiotic interaction where one organism (the parasite) benefits at the expense of another organism (the host), which is often harmed but usually not killed (p. 30)

parent nucleus refers to the nucleus that produces a daughter nucleus as a result of radioactive decay (p. 284)



parts per million (ppm) a notation used to denote low concentrations of chemical elements; denotes one particle of a given substance for every 999 999 other particles (p. 121)

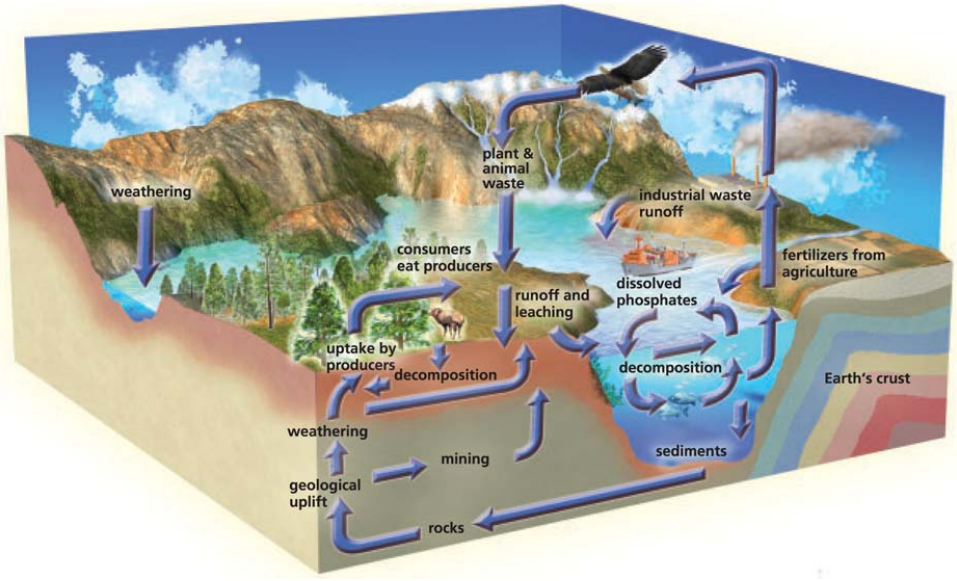
permafrost the layer of permanently frozen subsoil in polar regions (p. 55; 459)

pesticide a chemical substance used to control organisms humans consider to be pests (p. 121)

phase the physical property that describes the form in which matter can usually be found: solid, liquid, or gas; also called state (p. 180)

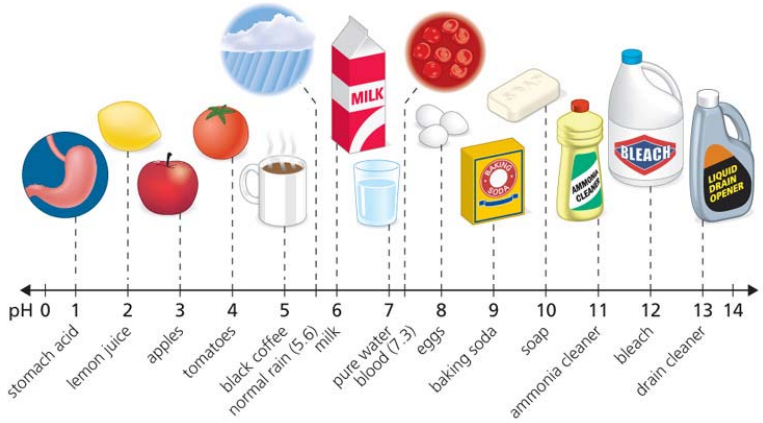
phosphate ions play an important role in the phosphate cycle due to their solubility in water; they can be dissolved out of rock into soil or water through the process of weathering, becoming available to producers and other organisms in the food chain (p. 98)

phosphorus cycle the path of phosphorus through ecosystems (p. 98)



photosynthesis the process whereby plants use the Sun's energy to convert carbon dioxide and water into carbohydrates and oxygen (p. 83)

pH scale a scale developed by chemists for measuring the acidity of solutions (p. 114; 205)



physical property a property of a substance that can be observed through the senses, measured, or calculated (p. 149)

phytoplankton microscopic algae that obtain energy through photosynthesis; they are found at the surface of oceans, seas, and freshwater bodies (p.25)

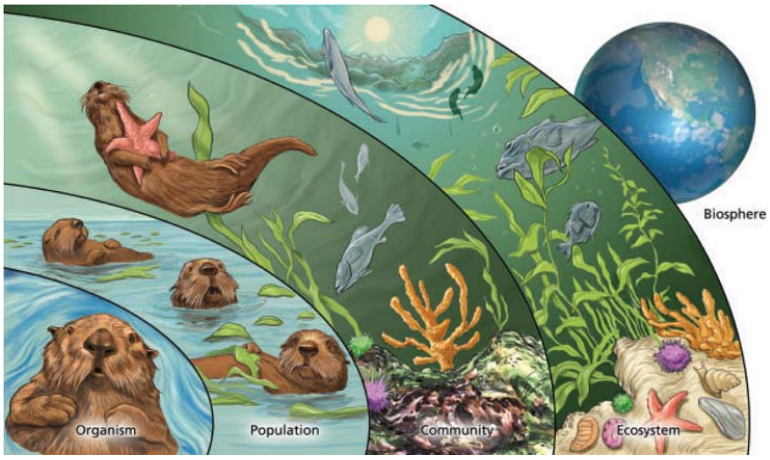
pioneer species refers to the first species to arrive and colonize a new environment; over time, the presence of the pioneer species changes the environment, creating acceptable conditions for other species (p. 71)

polar ice the biome characterized by the presence of permanent ice and the absence of significant terrestrial vegetation; occurs at the North and South Poles (p. 58)

pollutant a substance introduced into the air, water, soil, or food in concentrations that threaten the health or survival of organisms; can affect natural population growth by destroying habitat and food sources or by killing organisms; can be natural or a result of human technology (p. 113)

polyatomic ion a group of atoms bonded together that act as a single ion (p. 189)

population all of the organisms of the same species that share a habitat; the second level of organization that ecologists study (p. 21)

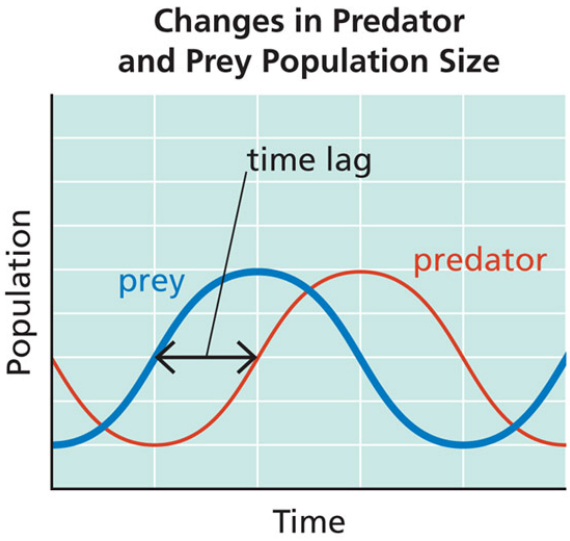


precision the place value of the last measurable digit of a measurement; depends on the gradations of the measuring device being used (p. 551)

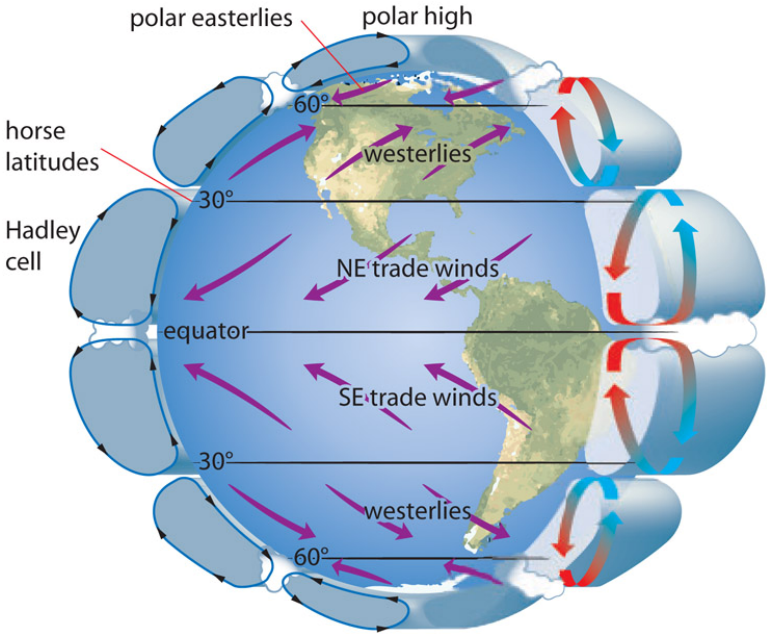
predation an ecological interaction that occurs when a predator captures and consumes prey (p. 28)

predator an organism that lives by preying on other organisms (p. 28)

predator–prey cycle describes the predator–prey relationship in terms of the effects on the size of both populations (p. 28)



prevailing winds dominant wind patterns covering large portions of Earth (p. 440)



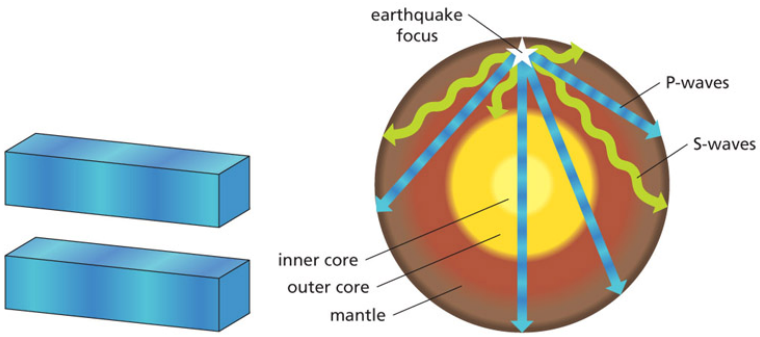
prey an animal consumed for food by a predator (p. 28)

primary consumer see **herbivore**

primary productivity a measure of the available energy provided by the producers in an ecosystem (p. 64)

primary succession one of two types of ecological succession; the occupation by plant life of an area not previously covered by vegetation (p. 71)

primary wave (P–wave) the compression type of body wave that radiates through Earth from the focus of an earthquake (p. 526)



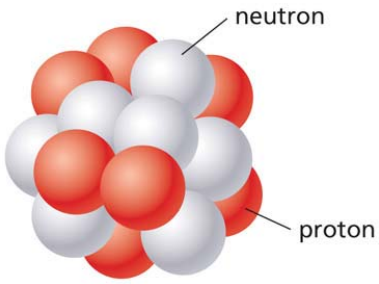
producer an organism that makes its own food, usually using energy from the Sun in a process called photosynthesis; also called an autotroph (p. 25)

product a chemical that is produced in a chemical reaction (p. 233)

$$\underset{\text{reactants}}{2H_2 + O_2} \rightarrow \underset{\text{products}}{2H_2O}$$

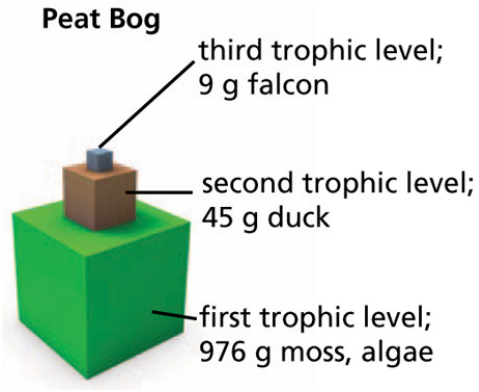
proliferation [pruh-LIFF-uhr-AY-shun] increase in numbers of individuals with new adaptive traits resulting from natural selection; populations with the new adaptations will proliferate until further selective pressure leads to further adaptations (p. 68)

proton a positively charged subatomic particle contained within the nucleus of an atom; has an electric charge of +1; stable when outside of the nucleus (p. 153; 281)

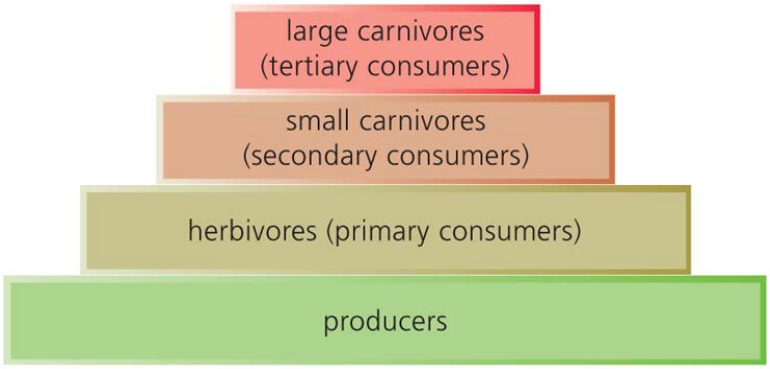


pure substance a substance that has identical properties in every sample; also called a substance (p. 150)

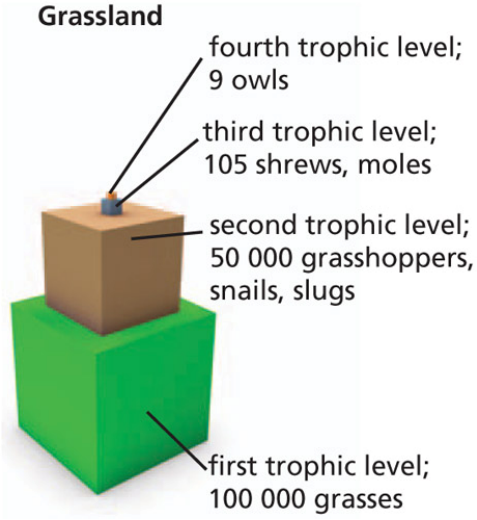
pyramid of biomass an ecological pyramid that represents a snapshot of the total mass of the living things at each trophic level in a community; for most communities, the pyramid of biomass has the standard pyramid shape (p. 40)



pyramid of energy an ecological pyramid that represents how much energy is available in each trophic level; the size of each level represents the amount of energy present in that trophic level (p. 39)



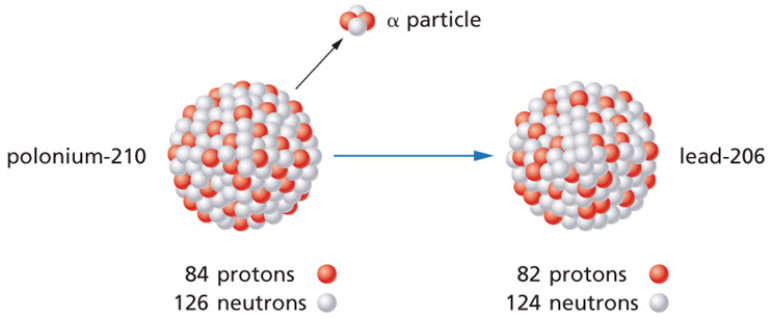
pyramid of numbers an ecological pyramid that represents the actual number of organisms present in each trophic level; the shape of a pyramid of numbers varies widely depending on the physical size of the producers (p. 40)



R

radiation energy that is transmitted in the form of particles (alpha and beta particles) or electromagnetic waves (gamma rays); also refers to the transfer of thermal energy in the absence of matter (thermal radiation) (p. 412)

radioactive decay when an unstable nucleus emits radiation in the form of an alpha particle, a beta particle, or a gamma ray (p. 284)



radioactivity the spontaneous emission of radiation from the nucleus of an atom (p. 278)

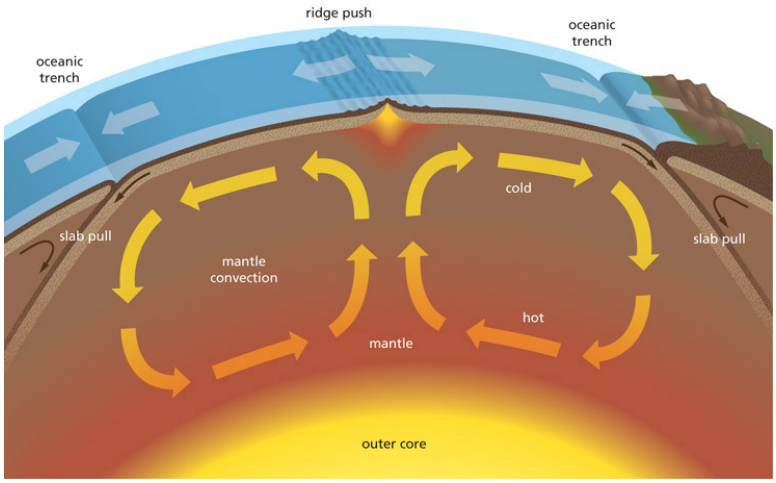
reactant a chemical that reacts in a chemical reaction (p. 233)

$$\underset{\text{reactants}}{2H_2 + O_2} \rightarrow \underset{\text{products}}{2H_2O}$$

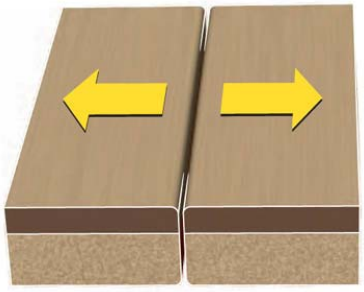
reaction rate the amount of a reactant consumed per unit of time or the amount of a product formed per unit of time in a chemical reaction (p. 250)

resource partitioning a process that reduces or eliminates competition for similar resources by individuals of different species; species develop adaptations that allow them to occupy different non-overlapping ecological niches and partition available resources (p. 68)

ridge push a push originating from the mid-ocean ridge that serves as a mechanism for motion of the tectonic plates (driven by convection currents in the mantle) (p. 518)



rift valley a divergent boundary that cuts across land, where small volcanoes and shallow earthquakes occur (p. 506)



S

salt a substance that releases positive ions and negative ions, other than H^+ and OH^-, in solution (p. 203)

sapwood the younger wood just inside the bark where most of the tree's nutrients are transported (p. 108)

savanna a tropical grassland biome; of all the biomes, savannas support the greatest number and variety of large herbivores (p. 57)

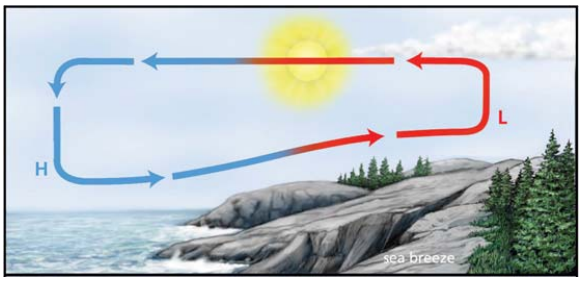
scalar quantity [SKAY-luhr] a quantity that has both a number and a unit; also called magnitude (p. 359)

scientific and technological literacy a combination of the science-related attitudes, skills, and knowledge needed to develop inquiry, problem-solving, and decision-making abilities (p. 17)

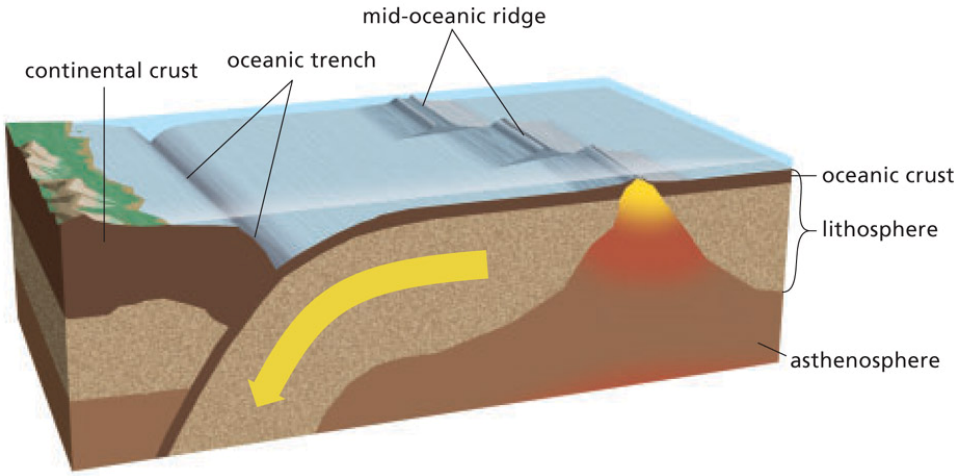
scientific notation expresses a number by writing it in the form $a \times 10^n$, where the letter *a*, referred to as the coefficient, is a value between 1 and 10. The number 10 is the base, and *n* represents the exponent. The base and the exponent are read as "10 to the power of *n*" (p. 548)

Large or small number	Common decimal notation	Scientific notation
124.5 million km	124 500 000 km	1.245×10^8 km
154 thousand nm	154 000 nm	1.54×10^5 nm
753 trillionths of a kg	0.000 000 000 753 kg	7.53×10^{-10} kg
315 billionths of a m	0.000 000 315	3.15×10^{-7} m

sea breeze wind that blows in from the sea to replace a rising (low-pressure) air mass heated by the land during the day. This occurs because the land heats up faster than water, creating a difference in air pressure (p. 438)

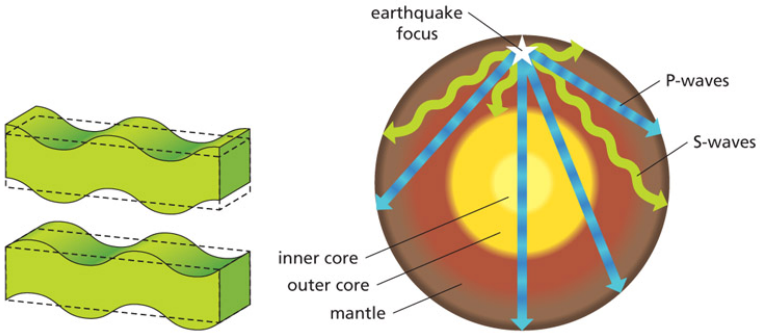


sea-floor spreading the process by which new sea floor is created at a divergent boundary and pushed toward an opposing convergent boundary where it is recycled into the mantle (p. 502)

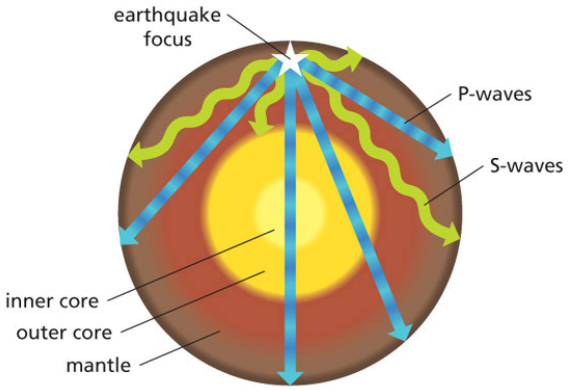


secondary succession one of two types of succession; the occupation by plant life in an area that was previously covered by vegetation but where there has been a significant disturbance such as fire, flooding, landslides, or forest harvesting (p. 72)

secondary wave (S–wave) the shear type of body wave that radiates through Earth from the focus of an earthquake (p. 526)

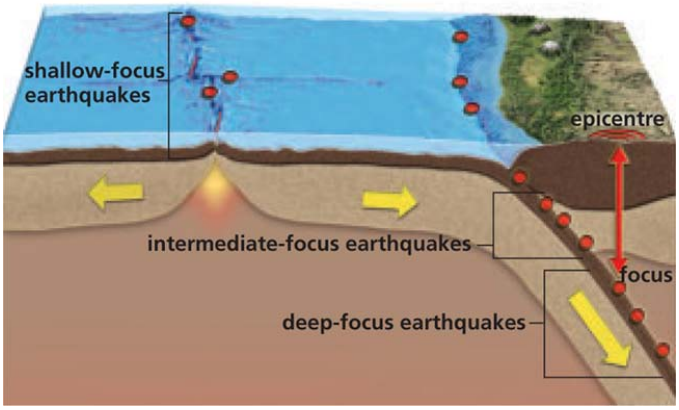


seismic wave [SYE-zmick] a large mechanical wave or vibration through Earth (p. 495; 526)



serendipity [SER-uhn-DIP-uh-tee] the act of discovering or inventing something useful by accident (p. 9)

shallow-focus earthquake an earthquake with a focus located at a relatively shallow point (0–70 km) beneath Earth's surface (p. 526)



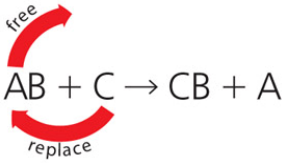
SI a system of measurement where all physical quantities can be expressed as a combination of seven SI base units; stands for Système international d'unités (p. 546)

Quantity name	Unit name	Unit symbol
length	metre	m
mass	kilogram	kg*
time	second	s
electric current	ampere	A
temperature	kelvin	K**
amount of substance	mole	mol
light intensity	candela	cd

* The kilogram is the only base unit that contains a prefix.

** Although the base unit for temperature (T) is a kelvin (K), the common unit for temperature (t) is a degree Celsius (°C).

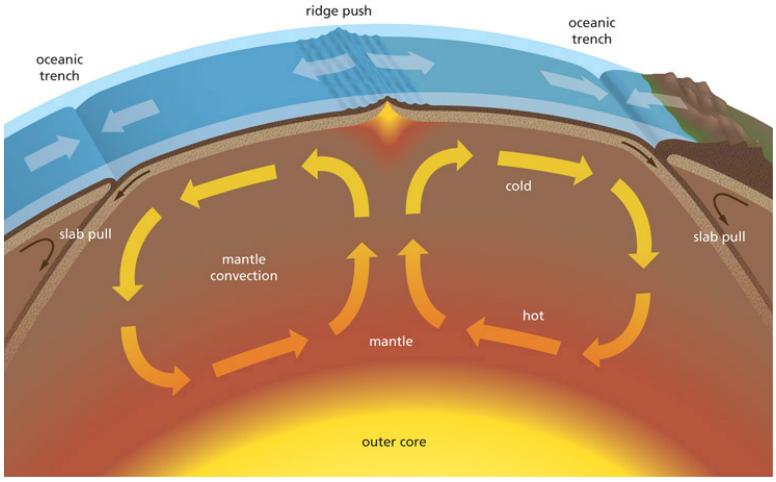
single replacement reaction a chemical reaction in which an element reacts with a compound (containing elements) and one of the elements in the compound is replaced (p. 242)



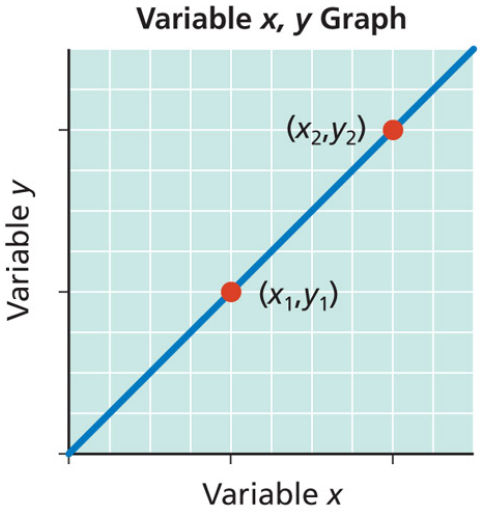
skeleton equation an incomplete chemical equation in which the chemical formulas are correct but the atoms are not conserved (p. 235)

$$\underset{\text{2 H atoms}}{H_2} + \underset{\text{2 O atoms}}{O_2} \rightarrow \underset{\text{2 H atoms, 1 O atom}}{H_2O}$$

slab pull the pull that results when the oceanic portion of a tectonic plate descends into the mantle, pulling the rest of the plate with it (p. 518)



slope the steepness of the line on a graph; represented by the change in the *x*-axis variable divided by the corresponding change in the *y*-axis variable (rise over run) (p. 344)



soil degradation results when fertile topsoil is lost to erosion and when soil nutrients are depleted (p. 127)

specific heat capacity a measure of the amount of energy (joules) needed to raise the temperature of 1 kg of a substance by 1 °C (p. 414)

Substance	Specific heat capacity (J/(kg·°C))
water (pure)	4186
ice (0 °C)	2093
water vapour (100 °C)	2080
sandy clay	1381
dry air (sea level)	1005
aluminum	900
concrete	880
quartz sand	795
lead	128

speed the rate at which an object is travelling; equal to the distance an object travels divided by the time interval taken; symbol is *v* (p. 346)

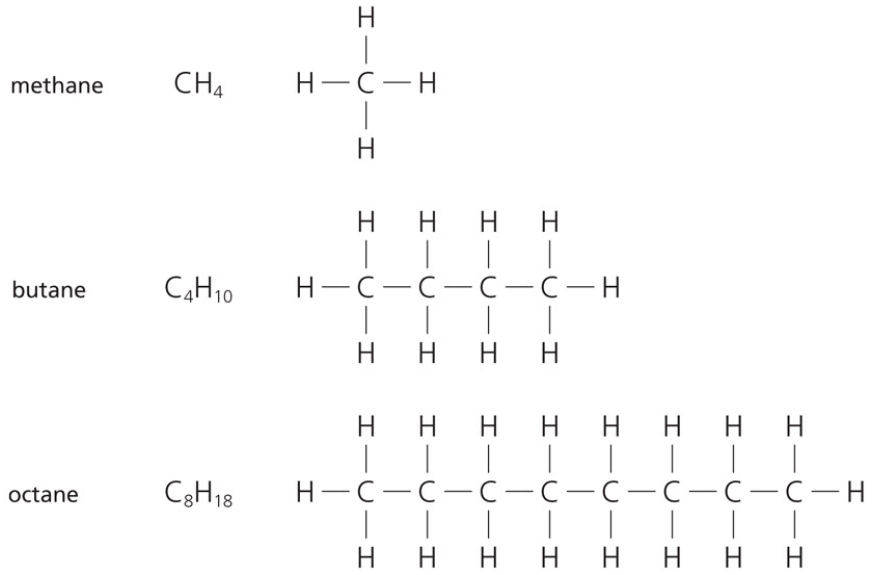
$$\text{speed} = \frac{\text{distance}}{\text{time}} = \frac{\Delta d}{\Delta t}$$

spreading ridge see **mid-ocean ridge**

state see **phase**

strike–slip fault a type of transform boundary at which the land on either side of a fault line is moving in opposite directions parallel to the fault (p. 507)

structural formula a simplified Lewis diagram that shows the number of atoms in each organic molecule plus the arrangement of those atoms (p. 216)



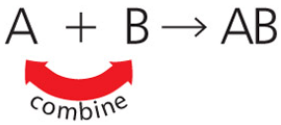
subatomic particle any of the parts that make up the atom; includes electrons, protons, and neutrons (p. 153)

subduction zone the region where tectonic plates overlap and one is pushed down beneath the other (p. 506)

surface wave the type of seismic wave that travels along the outside of Earth, created when a body wave reaches the surface (p. 527)

symbiosis [sim-bye-OH-sis] a specialized form of interaction between two different species; often, each species develops very specialized behaviours, life cycles, or structures; includes mutualism, commensalism, and parasitism (p. 30)

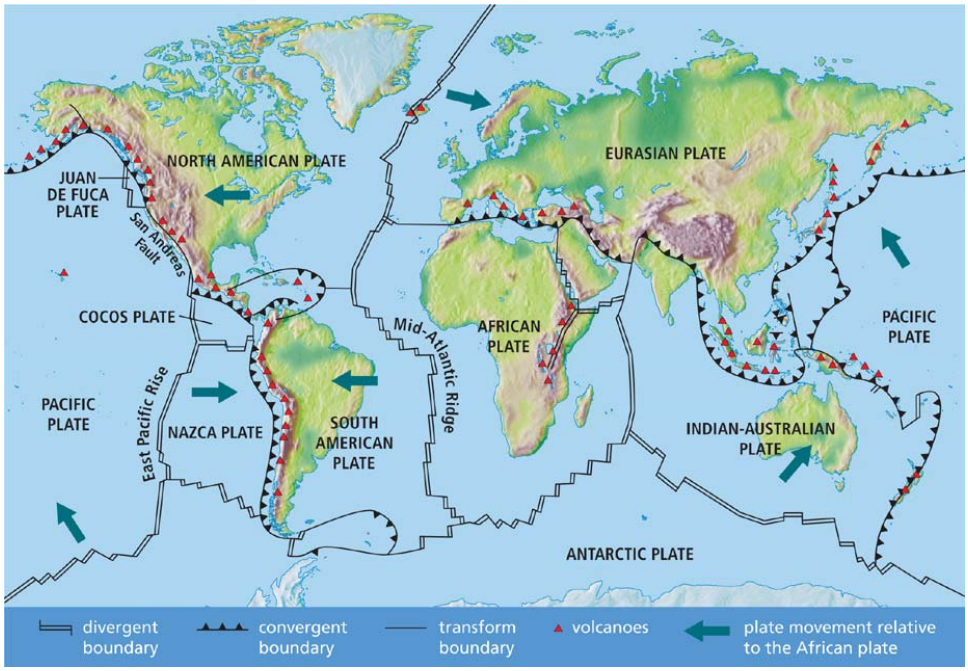
synthesis reaction a chemical reaction in which two elements combine to form a compound; also called a combination reaction (p. 239)



T

technology the process and the products by which humans develop ways to satisfy some of their needs and wants (p. 6)

tectonic plate [teck-TAWN-ick] one of 12 large and 20 smaller sections of Earth's lithosphere that drift on the denser asthenosphere (p. 497)



temperate deciduous [di-SID-yoo-uhs] **forest** the biome characterized by higher temperatures than the boreal forest and 75–220 cm of precipitation per year and that supports the growth of huge forests of broadleaf trees; covers regions in southeastern Canada, the eastern United States, and large areas of Europe and Asia (p. 56)

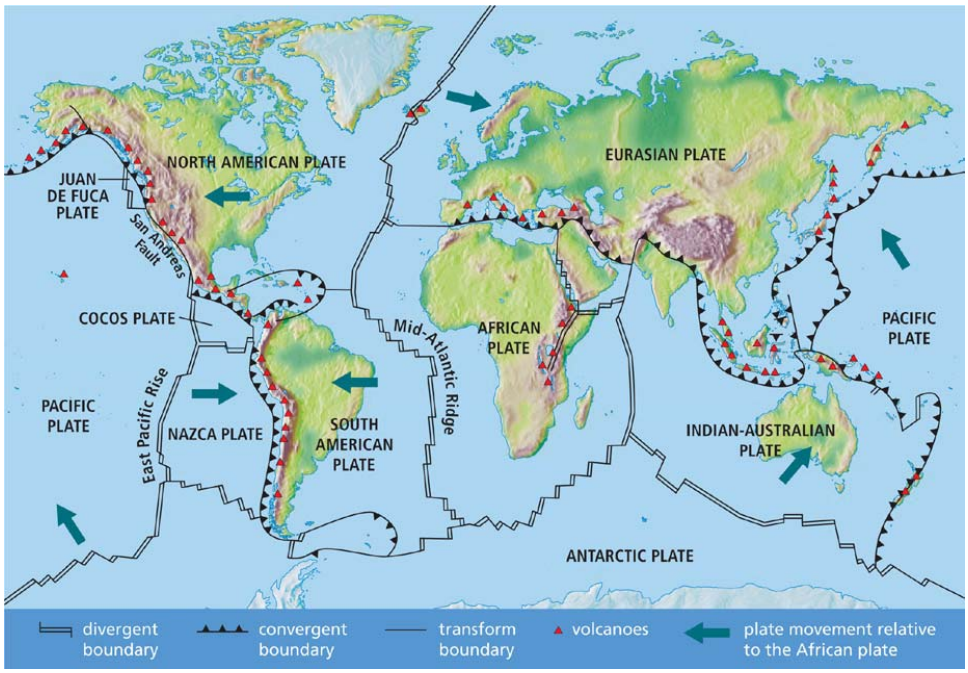
temperate rainforest one of the rarest of the world's biomes; characterized by abundant moisture, mild climate, thick and rich soil, and the growth of shrubs and small trees; currently found only in British Columbia, Alaska, and Chile (p. 57)

temperature an indicator of the average kinetic energy of a substance, measured in SI units of degrees Celsius (°C) or kelvin (K) (p. 405)

Temperature in Celsius (°C)	Temperature in Kelvin (K)	Reference
−273.15	0	absolute zero, no particle motion
0	273.15	freezing point of water
20	293.15	room temperature
100	373.15	boiling point of water

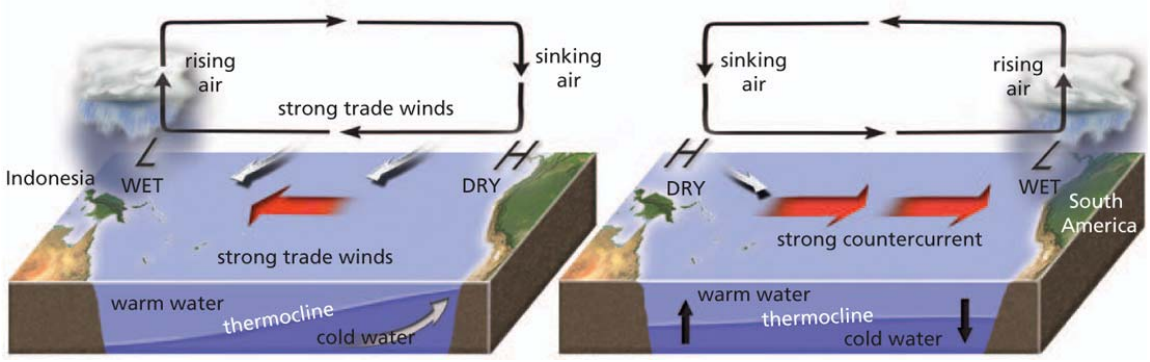
terminal velocity the point at which a falling object travels at a constant velocity (no acceleration) (p. 390)

theory of plate tectonics the theory that the lithosphere is divided into large tectonic plates that drift over the asthenosphere, so that some plates are splitting apart, others are coming together, and some are passing each other in opposite directions (p. 505)



thermal energy the total kinetic and potential energy of all particles in a substance (p. 409)

thermocline a region between the warm top and cold deep layers of the ocean (p. 465)

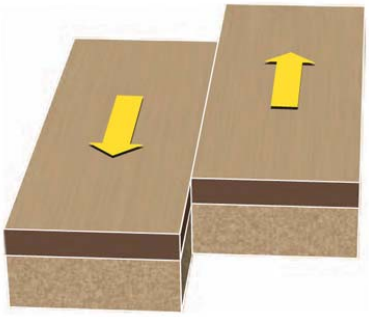


time interval the difference between two times, such as the difference between a start time and an end time; represented by the symbol Δt (p. 342)

tornado a rapidly rotating wind that forms within a thunderstorm (p. 438)

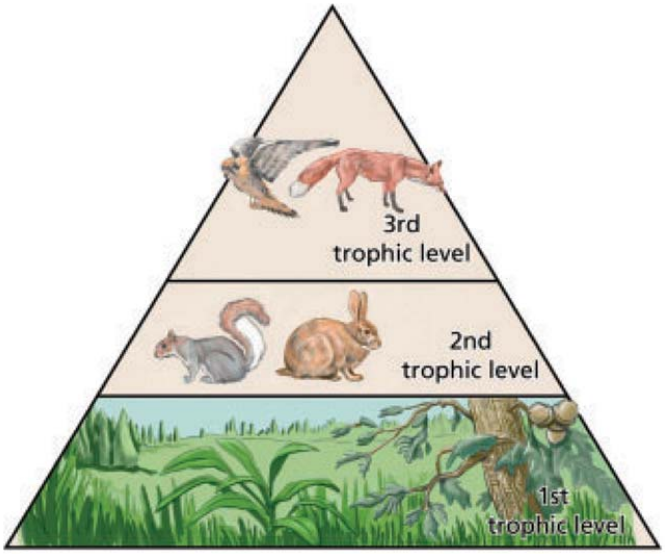
Traditional Ecological Knowledge and Wisdom (TEKW) the knowledge, experiences, and wisdom gained over many generations of close interaction with the living and non-living components of the environment (p. 3)

transform boundary the place where two tectonic plates move past each other in opposite directions (p. 507)



trend a relationship between data that shows a pattern (p. 553)

trophic level [TROH-fick] a category of living things that describes the position of an organism in relation to the order of nutrient and energy transfers in an ecosystem; the first trophic level contains autotrophs and each higher level contains heterotrophs (p. 33)



tropical rainforest the biome characterized by rainfall between 200 and 450 cm annually and temperatures between 20–25 °C throughout the year; believed to contain at least half of Earth's terrestrial organisms (p. 58)

troposphere [TROH-puh-sfeer] the lowest portion of Earth's atmosphere, where weather occurs. 8–15 km thick (p. 417)

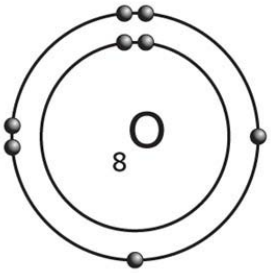
tundra a massive biome that extends in a continuous belt across Canada, Alaska, Asia, and Europe; characterized by very little precipitation (usually < 25 cm annually), permafrost, and small, slow-growing plants such as grasses and mosses; the growing season is limited to a brief period of about eight weeks during the summer, preventing any significant tree growth (p. 55)

U

understorey the flowers, ferns, shrubs, and small trees that grow below the canopy layer in a forest (p. 56)

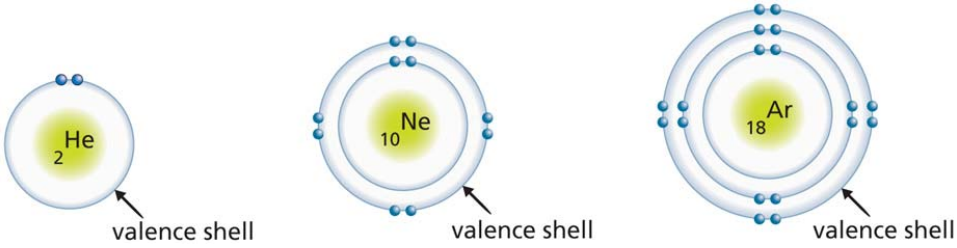
uniform motion a situation where an object is travelling at a constant velocity; travelling at constant speed in a constant direction (p. 363)

unpaired electron a single electron in an electron shell (p. 154)

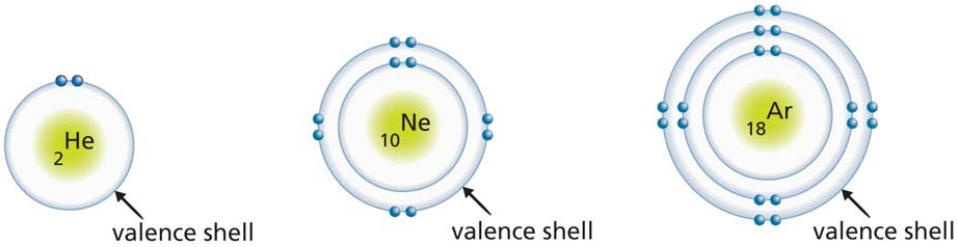


V

valence electron an electron in the outermost shell of an atom (p. 170)



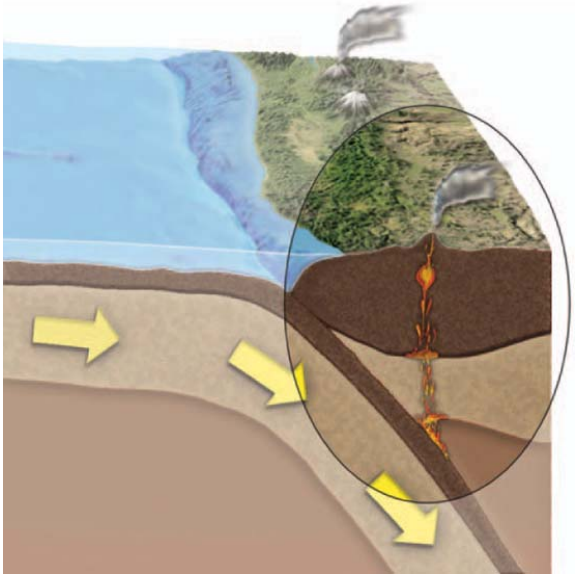
valence shell the outermost shell or orbital of an atom (p. 170)



vector quantity a quantity that has both magnitude (number and unit) and direction (p. 359)

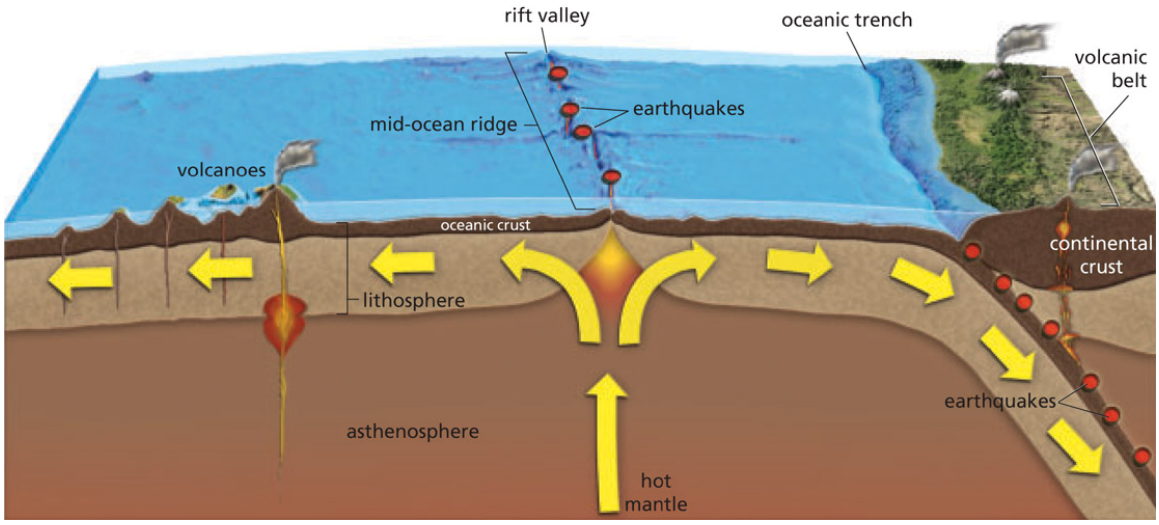
velocity the rate of change of displacement; a vector quantity with both a magnitude and direction; symbol is $\vec{v}$ (p. 361)

volcanic belt a string of volcanoes created on the overriding continent parallel to a convergent boundary (p. 524)



volcanic island arc a chain of volcanic islands that form on the oceanic portion of an overriding tectonic plate near an oceanic–oceanic boundary (p. 524)

volcano the place where magma reaches Earth's surface (p. 522)



Z

zooplankton a type of microscopic plankton that can be found in oceans, seas, and freshwater bodies; feed on phytoplankton (p. 26)