

**Part One**

# **Developing Scientific Literacy**

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# Chapter One

# Building a Scientific Vocabulary

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## For the Teacher

During the fourteenth century, sailors and traders on the Mediterranean Sea learned a variety of Italian, Turkish, French, Spanish, Greek, and Arabic phrases so they could communicate with one another. Eventually an international language of trade developed, known as *lingua franca*, borrowing words and sounds from each people. The term *lingua franca* has come to mean any language used by a group of people whose first languages are different. Today scientists from around the world communicate in English, and English has therefore become the *lingua franca* of science. The English lexicon (the entire stock of words belonging to the language) is much greater than any other due in part to the scientific words that are added daily. The English scientific vocabulary is increasingly rich and complex, allowing scientists and others to express themselves more precisely than ever before. Unfortunately the growing vocabulary of scientific English makes it increasingly difficult for students to master, particularly for those who learn it as a

second language. This chapter presents resources and activities to make this task easier.

Scientists give names to new discoveries, concepts, theories, and inventions using classical Latin and Greek roots, prefixes, and suffixes. Since these languages are no longer spoken (they were replaced by modern Italian and Greek), the meanings of words never change. For example, the ancient Greeks used the word *therme* to describe heat, and today we use the root *therm* to mean “heat” in a variety of English words, such as *homeotherm*, *thermometer*, *thermistor*, *ectotherm*, *poikilotherm*, *thermophilic*, *thermoregulation*, *thermochemistry*, *endothermic*, *exothermic*, *thermite*, *thermodynamics*, *thermoelectric*, *thermocouple*, *thermonuclear*, *thermal*, *isotherm*, and *thermocline*. A simple science root word can provide clues to numerous other words, greatly reducing the amount of memorization necessary to master this new vocabulary and making it easier for people speaking different first languages to understand.

A knowledge of Greek and Latin root words can greatly enhance student understanding of

scientific terms and provide a better understanding of English and other European languages. Approximately 50 percent of all words in English have Latin roots, many of them shared by Spanish, French, Portuguese, and Italian words. Learning scientific root words thereby helps us understand the vocabulary of a variety of languages, particularly English. The activities in this chapter focus on scientific terms, but the roots are used in other words as well. For example, the prefix *anti-* means “against” or “opposite” as in the following scientific terms: *antiseptic*, *antibiotic*, *antigen*, *antibody*, *antibacterial*, *antioxidant*, *anticodon*, *antacid*, *antinode*, *antimatter*, *antiquark*, *antiparticle*, *anticline*, and *anticyclone*. This same prefix is used in many nonscientific terms as well, such as *anticlimactic*, *antifreeze*, *antiperspirant*, *antidepressant*, and *antiterrorism*. Thus, an understanding of the roots introduced in this chapter helps us all master both scientific and nonscientific terms and become more proficient in the use of language.

I suggest that teachers provide their students with copies of the relevant root word lists that follow in this chapter to keep in the back of their notebooks alongside the glossaries that they develop. Each time a new term is introduced in class, students should analyze its prefixes, suffixes, and roots and add the entry to their personal glossaries as described in the activities that follow.

## 1.1 Biology Vocabulary

Biology has a larger vocabulary than any other branch of science, but fortunately nearly all biological terms contain roots, prefixes, and suffixes with predictable meanings, many of which appear in Table 1.1. Knowing these roots greatly simplifies the acquisition of new terms, and the following activities will help in memorizing and understanding these roots.

**Table 1.1** Roots, Prefixes, and Suffixes in Biology

a, an	<b>not, without:</b> asymptomatic, aphasia, anemia, aseptic, amorphous, asexual, anhydrous, anaerobic A patient is asymptomatic if he or she does <b>not</b> have symptoms.
ab	<b>away from:</b> abductor, absent, aberrant, abstain, abnormal, abscission, abscissic acid An abductor is a muscle that moves a limb <b>away</b> from the body.
acu	<b>sharp:</b> acute, acupuncture, accurate, acumen Acute pains are <b>sharp</b> pains.
ad	<b>toward:</b> adductor, addiction, adhesion, additive, adhere Adductor muscles brings limbs <b>toward</b> the body.
ag, act	<b>do, move, cause:</b> agent, reaction, reagent, agitate, action Disease agents <b>cause</b> diseases.
-al	<b>relating to, at:</b> nocturnal, diurnal, arboreal, terrestrial, biological Nocturnal animals are active <b>at</b> night.
alb	<b>white:</b> albino, albacore, albedo, albumin, linea alba Albinos appear <b>white</b> due to an absence of pigmentation.
ambul	<b>to walk:</b> ambulatory, amble, ambulance, somnambulist Ambulatory patients can <b>walk</b> .
amph	<b>double, both:</b> amphibian, amphoteric, amphibious, Amphipoda Amphibians live <b>both</b> on land and in the water.
amyl	<b>starch:</b> amylase, amylose, amylopectin, amyloplast Amylase is an enzyme that converts <b>starch</b> to simple sugars.

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an	<b>upward, apart:</b> anaphase, anode, analysis, anabolism During anaphase, chromosomes are pulled <b>apart</b> .
andr, anth	<b>male, man:</b> androgen, anthropology, anther, antheridia, anthropomorphic Androgens are <b>male</b> hormones.
ann, enni	<b>circle, year:</b> perennial, annelid, annular rings, annual, biennial Perennial plants stay alive through all seasons of the <b>year</b> .
ante	<b>before, front:</b> antenna, anterior, antedate, antebrachium The antennae are located on the <b>front</b> of the organism.
anti	<b>against, opposite:</b> antiseptic, antibiotic, antigen, antibody, antibacterial, antioxidant, anticodon Antibodies protect <b>against</b> antigens.
arbor	<b>tree:</b> arboreal, arboretum, arborvitae, arborist Arboreal species live in <b>trees</b> .
-arium	<b>place:</b> aquarium, terrarium, planetarium, vivarium Aquariums are <b>places</b> for aquatic organisms.
arth	<b>joint:</b> arthritis, arthropod, arthroscope, arthrograph, Arthropoda Arthritis is an inflammation of the <b>joints</b> .
aud	<b>sound:</b> auditory meatus, audible, audiologist, audiogram, audience <b>Sound</b> waves travel through the auditory meatus to the eardrum.
auto	<b>self:</b> autotrophic, autoimmune, autocatalytic, autonomic nervous system, automatic, autonomous Autotrophic organisms are considered <b>self</b> -feeders because they produce their own food.
av, avi	<b>bird:</b> Aves, aviary, aviation, avian flu, aviculture Aves is the class of animals composed of <b>birds</b> .
bio	<b>life:</b> biology, biochemistry, biometrics, biome, biosphere, antibiotic Biology is the study of <b>living</b> systems.
blast	<b>germ, embryo:</b> blastula, blastocoel, blastocyst, cytotblast, erythroblast The blastula is an early stage of <b>embryonic</b> development.
bol	<b>clod:</b> bolus, anabolism, catabolism, metabolism A bolus is a <b>clod</b> of food in the digestive tract.
brachi	<b>arm:</b> biceps brachii, brachial artery, brachial plexus, triceps brachii The biceps brachii is a two-headed muscle of the <b>arm</b> .
calor	<b>heat:</b> calorie, caloric, calorimeter, kilocalorie A calorie is a unit of <b>heat</b> energy.
cap, cep	<b>head:</b> triceps, cephalopod decapitate, capital, cap, captain The triceps is a muscle with three <b>heads</b> .
cardi	<b>heart:</b> pericardium, tachycardia, cardiac arrest, bradycardia, electrocardiogram The pericardium is the sac around the <b>heart</b> .
carp	<b>wrist:</b> carpal bones, carpus, metacarpal, carpal tunnel syndrome The <b>wrist</b> is made up of carpal bones.
cep, cept	<b>take:</b> receptor, intercept, forceps, except, accept Receptors <b>take</b> and transmit information on the environment.
cephal	<b>head, brain:</b> electroencephalogram, Cephalopoda, hydrocephaly, cephalothorax, encephalitis An electroencephalogram is a record of <b>brain</b> wave activity.

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**Table 1.1** *(Continued)*

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chlor	<b>green:</b> chlorophyll, chloroplast, chlorine, chlorella, chlorosis Chlorophyll is the <b>green</b> pigment in plant cells.
chond	<b>cartilage, granular:</b> mitochondria, chondroblast, chondrocyte, chondrichthyes Mitochondria appear as <b>granular</b> objects in the cell.
chord	<b>a chord, string:</b> Chordata, Hemichordata, notochord, chordae tendineae Chordata is the phylum of animals with dorsal nerve <b>chords</b> .
chrom	<b>color:</b> chromosome, chromatic, monochrome, chromatophore, chromatography Chromosomes appear as <b>colorful</b> bodies when stained appropriately.
cide, cis	<b>to kill, to cut:</b> pesticide, herbicide, fungicide, incision, excision, germicide Pesticides are used to <b>kill</b> agricultural pests.
cili	<b>a small hair:</b> ciliary muscle, cilia, Ciliophora, aciliate Ciliary muscles are <b>small hairlike</b> muscles in the eye.
circ	<b>ring, around:</b> circulatory system, circa, circulation, circumflex artery The circulatory system conducts blood <b>around</b> the body.
co, com	<b>together:</b> community, commensalism, conjugal, communicate, conjugation A community is a group of organisms that live <b>together</b> in the same environment.
coel	<b>hollow:</b> coelenterate, coelenteron, blastocoel, pseudocoelomate, Coelenterata Coelenterates have <b>hollow</b> bodies.
cogn	<b>know, think:</b> prognosis, diagnosis, recognize, cognitive Physicians make prognoses about what they <b>think</b> will happen to a patient.
corp	<b>body:</b> corpus callosum, corpse, corpulent, corpus luteum, blood corpuscle, pacinian corpuscle The corpus callosum is the <b>body</b> that unites the two cerebral hemispheres.
crani	<b>skull:</b> craniotomy, cranium, cranial nerve, epicranium, cranial artery Craniotomy surgery involves opening the <b>skull</b> .
crypt	<b>hidden:</b> cryptic, encrypted, cryptic coloration, cryptozoa, cryptogrammic Cryptically colored animals are easily <b>hidden</b> in the environment.
cyan	<b>dark blue:</b> anthocyanin, hemocyanin, cyan, cyanosis, cyanide Anthocyanin is the <b>dark blue</b> pigment found in blue and purple flowers.
cyst	<b>bladder, sac:</b> cyst, sporocyst, blastocyst, cystic fibrosis, nematocyst, oocyst A cyst is a membranous <b>sac</b> in the body.
cyt	<b>cell:</b> cytology, erythrocyte, chondrocyte, cytokinin, phagocyte, cytoplasm Erythrocytes are red blood <b>cells</b> .
de	<b>without:</b> denature, decomposition, dehydrate, deciduous, defibrillate, deforestation, DNA Denatured proteins are <b>without</b> the structure necessary to function.
dem	<b>people:</b> demography, epidemic, pandemic, epidemiology An epidemic is a widespread disease among <b>people</b> .
dendr	<b>tree, bush:</b> dendrites, dendritic, dendrology, rhododendron, dendrochronology Dendrites are <b>tree-shaped</b> extensions on a neuron.
dent, dont	<b>tooth:</b> dentin, dentist, dentifrice, orthodontist, periodontal, dentate Dentin is the hard part of the <b>tooth</b> beneath the enamel.
derm	<b>skin:</b> dermatology, epidermis, hypodermic, ectoderm, endoderm Dermatology is the study of the <b>skin</b> .
dis, dys	<b>away, not:</b> dystrophy, disease, dysfunction, distemper, disinfect, dyslexia, dislocation Muscular dystrophy results in a wasting <b>away</b> of muscles.

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dors	<b>back:</b> latissimus dorsi, dorsal fin, dorsal lip, dorsiflexor, dorsiflexion The latissimus dorsi is a large, lateral muscle of the <b>back</b> .
dura	<b>hard, lasting:</b> dura matter, durable, duration, endure The dura matter is a <b>hard</b> , tough membrane protecting the brain.
e, ex, ef	<b>out, without, from:</b> exocytosis, efferent, exchange, exoskeleton, exogenous During exocytosis, contents of vacuoles go <b>out</b> of a cell.
echino	<b>spiny:</b> echinoderm, Echinodermata, echinate, echinoid Echinoderms have <b>spiny</b> skin.
eco	<b>house, environment:</b> ecology, ecosystem, ecophysiology, ecocline Ecologists study the interaction of organisms with their <b>environments</b> .
ecto	<b>outside, external:</b> ectoparasite, ectoderm, ectoplasm, ectopic, ectothermal A flea is an ectoparasite because it lives <b>outside</b> its host.
ectomy	<b>cut out:</b> appendectomy, tonsillectomy, lumpectomy, hysterectomy, mastectomy During appendectomy surgery, the physician <b>cuts out</b> the patient's appendix.
endo, en	<b>within:</b> endoskeleton, endosperm, endocrine, endometrium, endothermic, endemic, endoparasite Vertebrates have endoskeletons, which support their bodies from <b>within</b> .
epi	<b>upon:</b> epidermis, epithelial, epicotyl, epicondyle, epiglottis, epiphyte The epidermis is the top layer of the skin and rests <b>upon</b> the dermis.
eryth	<b>reddish:</b> erythrocyte, erythroblastosis fetalis, erythropoiesis, erythroblast Erythrocytes, or red blood cells, have a <b>reddish</b> color due to their iron content.
eu	<b>good, true:</b> eukaryote, eugenics, eubacteria, euphoria Eukaryotes are organisms with <b>true</b> nuclei.
ex, exo	<b>outside of:</b> exoskeleton, exocrine, exotic, extraterrestrial, extinct Crustaceans, like crabs and lobsters, have exoskeletons on the <b>outside</b> of their bodies.
fer	<b>to carry, bear:</b> conifer, porifera, transfer, infer, refer Conifers, such as pines and firs, are cone- <b>bearing</b> trees.
flex, flect	<b>bend:</b> flexor, flex, reflex, flexible, inflexibility, circumflex, dorsiflex Flexor muscles, such as the biceps, <b>bend</b> limbs at the joints.
foramen	<b>hole, perforation:</b> foramen magnum, Foraminifera, optic foramen The foramen magnum is the largest <b>hole</b> in the cranium.
form	<b>form, shape:</b> fusiform, coliform, form, uniform, conform, formal Fusiform cells are spindle <b>shaped</b> , while coliform bacteria are rod <b>shaped</b> .
gam	<b>marriage, sex cell:</b> gametes, monogamy, gametogenesis, gametocyte, gametophyte Gametes are the <b>sex cells</b> that combine in fertilization to yield a zygote.
gastr	<b>stomach:</b> gastritis, gastric, gastronomic, gastropod, gastrointestinal system Gastritis is the inflammation of the <b>stomach</b> .
gen	<b>origin:</b> genetics, gene, generate, antigen, pathogen Genetics gives us an understanding of the <b>origin</b> of phenotypic traits.
germ	<b>sprout:</b> germination, germ, germ cell, germ layer, germicide During germination, the seed <b>sprouts</b> , and the plant grows.
gest	<b>carry, bear:</b> gestation, congest, digest, indigestion Gestation is the period during which a mother <b>carries</b> the developing offspring.
gloss, glot	<b>tongue:</b> glossopharyngeal nerve, glossary, polyglot, epiglottis The glossopharyngeal nerve innervates the <b>tongue</b> and pharynx.

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(Continued)

**Table 1.1** (Continued)

glu, glo	<b>lump, bond:</b> glomerulus, glue, agglutinate, conglomerate Glomeruli contain <b>lumps</b> of vessels.
glyc	<b>sugar:</b> hypoglycemia, glycogen, glycolysis, glycolipid, glycerin, glycerides The blood <b>sugar</b> of people with hypoglycemia is too low.
gnath	<b>jaw:</b> Agnatha, gnathostomata, gnaw, orthognathous, gnathic Members of Agnatha, such as the lamprey, have no <b>jaws</b> .
gram	<b>writing, picture:</b> electrocardiogram, radiogram, thermogram, mammogram, electroencephalogram An electrocardiogram gives a <b>picture</b> of the electrical activity of the heart.
gyn	<b>woman:</b> gynecologist, gynecology, gynarchy, monogynous, epigynous Gynecologists specialize in medical issues specific to <b>women</b> .
hal	<b>breathe:</b> inhalation, exhalation, inhale, exhale, halitosis, inhalant Inhalation is the process of <b>breathing</b> air in, and exhalation is the process of <b>breathing</b> out.
hem	<b>blood:</b> hematology, hemorrhage, hemoglobin, hemophilia, hematocrit, heme, hemocyte Hematology is the study of the physiology of the <b>blood</b> .
hemi	<b>half:</b> hemiplegia, hemisphere, Hemichordata, hemicellulose, hemiparasite Hemiplegia is paralysis of the right or left <b>half</b> of the body.
hepat	<b>liver:</b> hepatitis, hepatic artery, hepatocyte, hepatoma Hepatitis is a disease characterized by an inflammation of the <b>liver</b> .
herb	<b>plants:</b> herbivore, herbaceous, herbs, herbarium Herbivores feed on <b>plants</b> .
hetero	<b>other, different:</b> heterotroph, heterogeneous, heterosexual, heterozygous Heterotrophs get their energy from <b>other</b> organisms.
histo	<b>tissue:</b> histology, histochemical, histogenic, histologist Histology is the study of <b>tissues</b> .
hom	<b>same, alike:</b> homologous, homeostasis, homogeneous, homogenize, homeostatic, homeotherm Homologous chromosomes have the <b>same</b> structural features and patterns of genes.
hyper	<b>over, above:</b> hypertensive, hypersensitive, hyperventilate, hyperextension, hyperglycemia Hypertensive patients exhibit <b>above</b> -normal blood pressure.
hypo	<b>below, beneath:</b> hypodermic, hypotension, hypoglycemia, hypoallergenic, hypothermia, hypoxia Hypodermic needles are used to inject medicine <b>beneath</b> the skin.
ichth	<b>fish:</b> Chondrichthyes, ichthyology, Osteichthyes, ichthyosaurus, ichthyologist The Chondrichthyes are bony <b>fish</b> .
-ile	<b>quality, state:</b> juvenile hormones, mobile, contractile, fertile, flexible Juvenile hormones maintain the larval <b>state</b> .
im, in	<b>not:</b> independent variable, immiscible, immobile, innocuous, invalid, insane The independent variable does <b>not</b> depend on dependent variables.
immun	<b>safe:</b> immunization, immunology, immunoglobulin, immunosuppressor, immunity Immunizations are administered to keep patients <b>safe</b> from diseases.
inter	<b>between:</b> intercostals, internal, interface, intercellular, interbreed, interneurons, interact, interbreed Intercostal muscles are found <b>between</b> the ribs.
intra	<b>within, into:</b> intracellular, intracranial, intravenous, intravascular, intramuscular Intravenous injections go directly <b>into</b> veins.



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-ion	<b>process:</b> respiration, reproduction, decomposition, abscission, addiction Respiration, reproduction, and decomposition are important biological <b>processes</b> .
-ist	<b>one who studies:</b> biologist, biochemist, ecologist, geneticist, radiologist, cardiologist A biologist is <b>one who studies</b> living systems.
-itis	<b>inflammation:</b> tendonitis, hepatitis, appendicitis, bursitis, arthritis Bursitis is <b>inflammation</b> of the bursa in the knee, elbow, or shoulder.
junct	<b>join:</b> conjunctive tissue, nondisjunction, conjunctiva, disjunction, gap junction Conjunctive tissue <b>joins</b> tissues together.
juven	<b>young:</b> juvenile diabetes, juvenile, rejuvenate, juvenile hormones Juvenile diabetes is expressed when one is <b>young</b> .
kilo	<b>thousand:</b> kilocalorie, kilogram, kilojoule, kilometer, kilobase A kilocalorie is one <b>thousand</b> calories.
kine	<b>motion:</b> kinesiology, kinetochore, cytokinesis, kinesthetic, kinetic energy Kinesiology is the study of human <b>motion</b> .
lact	<b>milk:</b> lactase, lactic acid, lactose, lactate, lactobacillus, lactoglobulin Lactase is an enzyme that breaks down <b>milk</b> sugar (lactose).
lip	<b>fat:</b> lipoprotein, lipid, lipase, liposuction, lipoid, liposphere Lipoproteins are proteins that combine with <b>fat</b> in the blood.
loc	<b>place, position:</b> dislocate, locale, allocate, locomotion, location Dislocated limbs are not in the correct <b>position</b> .
lys	<b>loose, break:</b> lysosome, plasmolysis, lyse, paralysis, analysis Lysosomes are organelles that contain enzymes that <b>break</b> down materials.
macro	<b>large:</b> macromolecule, macronutrient, macroscopic, macromere, macrophage, macrostructure Macromolecules are <b>large</b> molecules, such as proteins and nucleic acids.
mal	<b>bad, badly:</b> malignant, malformation, malady, malodorous, malaise, malaria, malfunction Malignant tumors are <b>bad</b> because they are metastatic and invasive.
mamm	<b>breast:</b> mammary gland, mammal, mammogram, Mammalia Mammary glands, or <b>breasts</b> , are found in mammals and provide milk to the young.
man	<b>hand:</b> manipulate, manual, manage, manufacture, maneuver We can manipulate tools with our <b>hands</b> .
medi	<b>middle, between:</b> mediastinum, medial, medial artery, gluteus medius, mediate, median nerve The mediastinum is the membrane <b>between</b> the lungs.
medic	<b>physician:</b> medical doctor, medicine, medic, medicate, medicinal Medical doctors are <b>physicians</b> .
mes	<b>middle, between:</b> mesoderm, mesencephalon, mesoglea, mesophyll, mesoplankton, mesenteron Mesoderm is located <b>between</b> the endoderm and ectoderm.
meta	<b>change, between:</b> metamorphosis, metabolism, metathorax, metacognition, metacarpal, metastasis Metamorphosis is the <b>change</b> in insects or amphibians from an immature form to an adult form.
meter	<b>measure:</b> metric system, thermometer, millimeter, multimeter, calorimeter, sphygmomanometer The metric system is a standardized system of <b>measurement</b> .
micro	<b>small:</b> microvilli, microscope, micrometer, microbiology, microbe, microclimate, microtubule Microvilli are <b>small</b> , finger-like projections that increase cell surface area.

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(Continued)

**Table 1.1** (Continued)

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migra	<b>wander:</b> migratory, migrate, emigrate, immigrate, immigrant Migratory mammals <b>wander</b> from one habitat to another.
mis	<b>bad, wrong:</b> misidentify, miscarriage, misnomer, mistake, misalign, misdiagnose, mislabel Misidentification of symptoms can lead to a <b>wrong</b> diagnosis.
moll	<b>soft:</b> mollusk, Mollusca, emolliate, emollient, mollify Mollusks, such as snails and slugs, have <b>soft</b> bodies.
mono	<b>single:</b> monocot, monotremes, monocotyledon, monecious, monogamy Monocots, such as grasses and palms, have only a <b>single</b> cotyledon.
morph	<b>form:</b> morphogen, metamorphosis, morphology, isomorphic, morphogenesis Morphogens are chemicals that stimulate a change in <b>form</b> or shape.
mort	<b>mortal, death:</b> postmortem, mortality, mortal, mortician, mortuary Postmortem exams are used to determine the cause of <b>death</b> .
mut	<b>change:</b> mutagen, mutant, mutability, mutate, mutation Mutagens cause <b>changes</b> in genetic composition.
myo	<b>muscle:</b> myocardium, myofibril, myositis, myoglobin, myology, myopathic The myocardium is the <b>muscular</b> tissue of the heart.
nas, nos	<b>nose:</b> nasal, nostril, nasopharynx, nasal cavity, nasal concha The nasal bone provides structure for the <b>nose</b> .
nat	<b>born, birth:</b> innate, natal, native, prenatal, postnatal, nature, natural Innate reflexes, such as grasping or rooting reflexes, are present at <b>birth</b> .
neo	<b>new, recent:</b> neoplasm, neotropics, neophyte, neonate, neonatology, neolith Neoplasms are <b>new</b> , abnormal growths associated with cancer.
neph	<b>kidney:</b> nephritis, epinephrine, nephrectomy, nephron, nephridia Nephritis is an inflammation of the kidney.
neur	<b>nerve:</b> neuritis, neuropathology, neurologist, neural, neurula, neuron, neuroma, neurosis, neurobiology Neuritis is an inflammation of peripheral <b>nerves</b> .
nom	<b>name, order:</b> taxonomy, binomial nomenclature, autonomic, autonomy Taxonomy is the branch of science concerned with classification and <b>naming</b> .
nuc	<b>center:</b> nucleus, nuclear, nucleic acid, nucleotide, enucleate, nucleolus The nucleus is the control <b>center</b> of the cell.
ocu	<b>eye:</b> ocular lens, binocular, ocular nerve, interocular The ocular lens of a microscope is the one closest to the <b>eye</b> .
-oid	<b>resemble, like:</b> amoeboid, haploid, diploid, steroid, deltoid, thyroid, thylakoid, trapezoid Organisms that <b>resemble</b> amoebas are said to be amoeboid.
olfact	<b>to smell:</b> olfactory nerve, olfactory, olfaction, olfactory cell The olfactory nerve is involved in the sense of <b>smell</b> .
ology	<b>study of:</b> biology, physiology, pathology, pharmacology, ecology, embryology, zoology, ecology Biology is the <b>study of</b> living systems.
oo	<b>egg:</b> oocyte, oogonium, oocyst, oogenesis, oospore An oocyte is an <b>egg</b> cell.
oper	<b>work:</b> operon, operate, cooperate, operator, operation, operant conditioning An operon controls the <b>work</b> of genes responsible for protein synthesis.

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ortho	<b>straight, correct:</b> Orthoptera, orthodontist, orthopedic, orthoptics, orthotic Orthoptera, including grasshoppers and crickets, have <b>straight</b> wings.
-osis	<b>process, condition:</b> metamorphosis, neurosis, thrombosis, mitosis, halitosis Metamorphosis is the <b>process</b> of changing shape.
oss, osteo	<b>bone:</b> osteoblast, osteocyte, ossify, osteology, osteoporosis, osteoclast Osteoblasts secrete the matrix for <b>bone</b> formation.
oto	<b>ear:</b> otolith, otology, otoscope, otopathology, ototoxic, otologist Otoliths in the inner <b>ear</b> are used in the detection of gravity.
ov	<b>egg:</b> ovum, oviduct, ovary, ovulate, ova, ovulation, oviparous The ovum, or <b>egg</b> , passes through the oviduct during ovulation.
para	<b>alongside:</b> parasympathetic, paramedic, paraphrase, parallel, parapodia, parasite The parasympathetic nervous system works <b>alongside</b> the sympathetic nervous system.
pariet	<b>wall:</b> parietal lobe, parietal bone, parietal cell, parietal The parietal bones comprise the side <b>walls</b> of the skull.
pater, pat	<b>father:</b> sympatry, paternal, paternity, allopatry, patriarch, sympatric Sympatric species are from the same " <b>fatherland</b> ."
path	<b>disease:</b> pathology, pathologist, allelopathy, sympathetic nervous system, allopathy Pathologists study the causes and effects of <b>diseases</b> .
ped, pod	<b>foot:</b> arthropod, cephalopod, gastropod, millipede, centipede, podiatry, bipedal, tripod, orthopedics Arthropods, such as insects, spiders, and crustaceans, have jointed <b>feet</b> .
phag	<b>eat:</b> phagocytosis, macrophage, bacteriophage, esophagus, phagocyte Phagocytosis occurs when amoeboid protozoa <b>eat</b> bacteria and other material.
phob	<b>fear:</b> arachnophobia, hydrophobic, phobia, claustrophobia, acrophobia, aquaphobia Arachnophobia is an irrational <b>fear</b> of spiders.
photo	<b>light:</b> photoperiodism, photosynthesis, photomicrograph, photon, photoreceptor Photoperiodism is the response of plants to seasonal changes in the amount of day <b>light</b> .
phyll	<b>leaf:</b> phylloquinone, mesophyll, chlorophyll, xanthophyll, phyllopod Phylloquinone is one of the K vitamins found in <b>leafy</b> green vegetables.
phys	<b>body, nature:</b> physiology, biophysics, physical medicine, physician, physique Physiology is the study of the <b>body</b> .
phyt	<b>plant:</b> epiphyte, phytochemistry, phytoplankton, sporophyte, gametophyte, phytonutrient, phytotoxin Epiphytes, such as orchids, are nonparasitic plants that live on other <b>plants</b> .
pneum	<b>lung:</b> pneumococcus, pneumatic, pneumonia, pneumocystis, pneumothorax Pneumococcus is a spherical-shaped bacterium found in some <b>lung</b> infections.
pole, polar	<b>end of axis:</b> vegetal pole, animal pole, polar bear, polarize, depolarize The vegetal pole is at the <b>end of one axis</b> of an embryo.
poly	<b>many:</b> polysaccharide, polyploid, polymerize, polymerase, polydactyl, polymer Polymerization is the binding together of <b>many</b> subunits.
pop	<b>people, inhabitants:</b> population, populous, populace, depopulate, populate, repopulate A population is a group of interbreeding organisms that <b>inhabit</b> the same region.
port	<b>carry:</b> transport, portable, export, import, report Electron transport chains <b>carry</b> electrons across membranes during phosphorylation.

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(Continued)

**Table 1.1** (Continued)

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post	<b>after:</b> postpartum, posterior, posthumous, posterity, postnasal, postsurgery The postpartum period is the period <b>after</b> birth.
pre	<b>before:</b> prefix, prefrontal, precede, preborn, predict, presynaptic Prefixes appear <b>before</b> root words and modify meanings.
prim	<b>first:</b> primary succession, primitive, primal, primary consumer, primordial Primary succession occurs <b>first</b> following retreating glaciers or volcanic eruptions.
pseudo	<b>not true, false:</b> pseudopodia, pseudocoel, Pseudotsuga, pseudoscience Pseudopodia are <b>not true</b> feet, but they have footlike characteristics.
psych	<b>mind:</b> neuropsychiatry, psychology, psychiatry, psychobiology, psychosis Neuropsychiatry is concerned with the organic aspects of disorders of the <b>mind</b> .
pter	<b>wing:</b> Orthoptera, Archaeopteryx, Pterodactyl The Pterodactyl had “ <b>winged</b> fingers.”
pulmo	<b>lung:</b> pulmonary, cardiopulmonary system, pulmonary cavity, pulmonary artery The pulmonary cavity contains the <b>lungs</b> .
re	<b>back, again:</b> retract, reforest, repopulate, regrow, return, react Reforestation is necessary to bring <b>back</b> forests following logging and erosion.
rhiz	<b>root:</b> rhizome, rhizoid, rhizobium, mycorrhizae Rhizomes are <b>rootlike</b> underground stems.
sacchar	<b>sugar:</b> monosaccharide, disaccharide, polysaccharide, Saccharomyces Monosaccharides, such as glucose and fructose, are <b>sugars</b> .
saur	<b>lizard:</b> dinosaur, brontosaurus, ichthyosaurus, stegosaurus, tyrannosaurus Dinosaurs had some <b>lizard</b> -like characteristics.
sci	<b>know:</b> science, conscious, unconscious, scientific Science is one way of <b>knowing</b> things.
scop	<b>see, monitor:</b> arthroscope, stethoscope, microscope, endoscope, bronchoscope Physicians use arthroscopes to <b>see</b> inside joints.
script	<b>to write:</b> transcription, prescription, reverse transcriptase, description, superscript, subscript Transcription is the process in which DNA code is <b>written</b> as RNA code.
sect	<b>cut:</b> section, dissect, transect, intersect, vivisection, bisect A longitudinal section requires a <b>cut</b> from the top to bottom of a structure.
sed, sess	<b>seated, fixed:</b> sedentary, sessile, residue, sedate, sedative Kelp are sessile because holdfasts keep them <b>fixed</b> to the rocks on the ocean floor.
semi	<b>half:</b> semitendinosus, semipermeable, semilunar valve, semimembranosus, semicircular canal The semitendinosus muscle is <b>half</b> muscle and <b>half</b> tendon.
sens	<b>feel:</b> sensory, sense, sensation, sensitive, sensor, sensorimotor Without sensory neurons, you would not be able to <b>feel</b> anything.
serv	<b>save:</b> conservationist, preserve, conserve, reservation, conservation, preservation Conservationists work to <b>save</b> resources for the future.
sperm	<b>seed:</b> angiosperm, sperm, gymnosperm, endosperm, spermatozoa In angiosperms (flowering plants), <b>seeds</b> are found within fruits.
sphere	<b>ball, sphere:</b> biosphere, cerebral hemisphere, troposphere, hydrosphere, atmosphere The biosphere is the <b>spherical</b> zone around the Earth in which life exists.

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spir	<b>breathe:</b> spiracles, inspire, respiration, perspiration, respirometer Insects <b>breathe</b> through pores known as spiracles.
stom	<b>mouth, pore:</b> stomata, stoma, stomach, protostome, deuterostome Stomata are tiny <b>pores</b> that regulate the flow of gases in and out of leaves.
sub	<b>under, below:</b> subclavian, subalpine, subarctic, subcortical, subcutaneous, subgenus, subspecies The subclavian artery is located <b>below</b> the clavicle.
super	<b>above, over:</b> superior vena cava, superior, superior oblique muscle, superior rectus muscle The superior vena cava is located <b>above</b> the heart.
syn	<b>together, with:</b> synapse, photosynthesis, synchronize, syndrome, chemosynthesis The synapse is where two neurons come <b>together</b> .
tact, tag	<b>touch:</b> contagious, tactile, contact, intact, geotactic Many contagious diseases spread by <b>touch</b> .
taxis	<b>movement response:</b> phototactic, geotaxis, phototaxis, chemotaxis, barotaxis Phototactic bacteria <b>move in response</b> to light.
tele, telo	<b>far, end:</b> telophase, telomere, telodendrion, telescope During telophase, the chromosomes are <b>far</b> apart.
ten, tin	<b>hold:</b> tendon, extension, retention, abstention, contents, tension, tentacle Tendons <b>hold</b> muscles to bones.
therm	<b>heat:</b> homeotherm, thermometer, thermistor, ectotherm, poikilotherm, thermophilic, thermoregulation Homeotherms regulate internal <b>heat</b> to maintain constant body temperature.
tom	<b>cut:</b> microtome, atom, appendectomy, tonsillectomy, dichotomy, anatomy, tomography Microtomes are used to <b>cut</b> extremely thin tissue sections for examination under a microscope.
tox	<b>poison:</b> toxemia, toxic, intoxicate, antitoxin, cytotoxic, detoxification Toxemia is blood <b>poisoning</b> by toxins from a local bacterial infection.
trans	<b>across:</b> neurotransmitter, transfusion, tranferase, translation, transcription, transect, transpiration Neurotransmitters carry signals <b>across</b> synapses.
trop	<b>turning, change:</b> tropomyosin, geotropism, phototropism, troposphere, troponin, tropics Tropomyosin is a muscle protein that <b>changes</b> direction, causing muscles to contract.
trich	<b>hair:</b> trichome, trichocyst, Trichoptera, trichotomy Trichomes are small <b>hairs</b> in the epidermis of plants.
troph	<b>nutrition, food:</b> autotroph, atrophy, hypertrophy, heterotroph, trophic layers, chemotroph Autotrophs produce their own <b>food</b> through photosynthesis or chemosynthesis.
ultra	<b>beyond:</b> ultrasound, ultracentrifuge, ultrafiltrate, ultraviolet, ultrastructure Ultrasound is a frequency <b>beyond</b> the range of human hearing.
ur	<b>urine:</b> urea, urologist, urinary, ureter, urethra, urinalysis Urea is a nitrogenous waste product found in <b>urine</b> .
vas	<b>vessel:</b> cardiovascular, vascular bundle, vascularity, vasoconstrictor, vasodilator, vas deferens The cardiovascular system is the system of the heart and blood <b>vessels</b> .
ven	<b>vein:</b> venule, vena cava, venous, intravenous, vein Venules are tiny <b>veins</b> that collect blood from capillaries.

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(Continued)

**Table 1.1** (Continued)

vid, vis	<b>see:</b> visible, video, evident, evidence, revise, vision We <b>see</b> visible light, while other organisms see ultraviolet or infrared light.
viv, vita	<b>alive, life:</b> vitamin, vital, revitalize, survive, revive, vivisection Vitamins are essential for normal <b>life</b> functions.
vor	<b>eat:</b> herbivorous, voracious, carnivorous, omnivorous, devour Herbivorous animals <b>eat</b> plant material.
zoo, zoa	<b>animal:</b> zoo, zoology, protozoan, spermatozoa, zooplankton Zoology is the study of the anatomy, physiology, classification, and behavior of <b>animals</b> .

**ACTIVITY 1.1.1 Understanding Biology****Root Words**

Table 1.1 lists the most common roots, prefixes, and suffixes in biology. Following each definition in the table is a series of biological terms that share this root. For example, *cyt-* means cell. *Cytology* is therefore the study of cells, *erythrocytes* are red blood cells, *chondrocytes* are cartilage cells, *cytokinin* is a plant hormone that stimulates cell division, *phagocytes* are cells that engulf particles, and *cytoplasm* is the liquid of the cell. By knowing the meanings of a few roots, one can determine the meanings of many terms. Construct a sentence for

each biology vocabulary word provided by your teacher. These may come from readings, lectures, or Table 1.1. Show the relationship between these biology words and their roots by **highlighting** root word meanings as illustrated in the sentences of Table 1.1.

**ACTIVITY 1.1.2 Developing a Biology Glossary**

Construct a three-column chart with the headings used in Table 1.2. Each time you encounter an unfamiliar term in class or in your reading, enter its meaning and roots as shown in the examples. Add to this table for the duration of the class,

**Table 1.2** Biology Glossary

Term	Meaning	Roots (Meanings)
Biology	The study of living systems	Bio- (life); -ology (study of)
Autotrophic	An organism that makes its own food	Auto- (self); -troph (food)
Cytoplasm	The liquid of the cell	Cyto- (cell); -plasm (liquid)
↓ New words	↓	↓

**Table 1.3** Deciphering Biology Terms: Classification

	Term	Definitions and Examples
↓	1 Annelida	a Class of animals with large head and “foot”: <i>octopus, squid</i>
	2 Arthropoda	b Class of <i>birds, seagulls, eagles, pigeons</i>
	3 Aves	c Class of the cartilaginous fish: <i>sharks, rays</i>
	4 Cephalopoda	d Order of insects with straight wings: <i>wasps, grasshoppers</i>
	5 Chondrichthyes	e Phylum of organisms with cordlike backbone: <i>humans</i>
	6 Chordata	f Phylum with jointed feet: <i>insects, spiders, crustaceans</i>
	7 Ciliphora	g Phylum with soft bodies: <i>snails, slugs</i>
	8 Echinodermata	h Phylum with spiny skin: <i>sea stars, urchins</i>
	9 Mollusca	i Phylum with circular, segmented bodies: <i>earthworms</i>
	10 Orthoptera	j Protozoans propelled by hairlike structures: <i>paramecia</i>



referring to the list of biology roots (Table 1.1) whenever necessary.

### ACTIVITY 1.1.3 *Deciphering Biology Terms: Taxonomy and Classification*

Once you know basic root words for a science, you can determine the meanings of new terms. Table 1.3 has a list of animal classifications, many of which you may find unfamiliar or even unpronounceable. Analyze the roots using Table 1.1, and match each phylum, class, or order to a likely definition (the first term is done as an example). Do not consult a dictionary or glossary; rather, draw conclusions based on your analysis of the root words.

## 1.2 Chemistry Vocabulary

The periodic table of elements is a central feature of introductory chemistry classes. Many students memorize the names of the elements but do not realize that these names are descriptive. For

example, *helium* derives its name from the Greek word *helios*, meaning “sun,” because the first evidence of its existence was obtained by analyzing the spectrum of sunlight. The word *hydrogen* comes from the Greek words *hydro*, meaning “water” (as in *hydroelectric* and *hydrolysis*) and *gen*, meaning “beginning” (as in *Genesis*, *gene*, and *genetics*). Thus, the word *hydrogen* means “water former,” an appropriate name for a substance that forms water when it combusts. Examine Table 1.4, and note that every element has a meaningful name.

### ACTIVITY 1.2.1 *Understanding Chemistry Root Words*

Table 1.5 lists the most common roots, prefixes, and suffixes used in chemistry. Following each definition is a series of chemical terms that share this root. For example, *ferr-* means “iron.” *Ferromagnetism* is the type of magnetism displayed by iron, *ferrous* refers to materials containing iron (II), *ferric* refers to materials containing iron (III), *ferrite* is a form of pure iron occurring in

**Table 1.4** Meaning of Element Names

Element	Symbol	Number	Date Discovered	Meaning of Name
Actinium	Ac	89	1900	Greek: <i>aktis</i> , ray
Aluminum	Al	13	1825	Latin: <i>alumen</i> , substance with astringent taste
Americium	Am	95	1944	English: <i>America</i>
Antimony	Sb	51	1400s	Greek: <i>antimonos</i> , opposite to solitude
Argon	Ar	18	1894	Greek: <i>argos</i> , inactive
Arsenic	As	33	1200s	Greek: <i>arsenikon</i> , valiant
Astatine	At	85	1940	Greek: <i>astatos</i> , unstable
Barium	Ba	56	1808	Greek: <i>barys</i> , heavy
Berkelium	Bk	97	1949	English: University of California, <i>Berkeley</i>
Beryllium	Be	4	1797	Greek: <i>beryllos</i> , a mineral
Bismuth	Bi	83	1400s	German: <i>bisemutum</i> , white mass
Boron	B	5	1808	Arabic: <i>bawraq</i> , white, borax
Bromine	Br	35	1826	Greek: <i>bromos</i> , a stench
Cadmium	Cd	48	1817	Latin: <i>cadmia</i> , calamine, a zinc ore
Calcium	Ca	20	1808	Latin: <i>calcis</i> , lime
Californium	Cf	98	1950	English: State and University of <i>California</i>
Carbon	C	6	prehistoric	Latin: <i>carbo</i> , coal
Cerium	Ce	58	1804	English: The asteroid <i>Ceres</i> , discovered 1803
Cesium	Cs	55	1860	Latin: <i>caesius</i> , sky blue
Chlorine	Cl	17	1808	Greek: <i>chloros</i> , grass green

(Continued)

**Table 1.4** (Continued)

Element	Symbol	Number	Date Discovered	Meaning of Name
Chromium	Cr	24	1797	Greek: <i>chroma</i> , color
Cobalt	Co	27	1735	Greek: <i>kobolos</i> , a goblin
Copper	Cu	29	prehistoric	Latin: <i>cuprum</i> , copper
Curium	Cm	96	1944	French: Marie and Pierre <i>Curie</i>
Dysprosium	Dy	66	1886	Greek: <i>dysprositos</i> , hard to get at
Einsteinium	Es	99	1952	German: <i>Albert Einstein</i>
Erbium	Er	68	1843	Swedish: <i>Ytterby</i> , town where discovered
Europium	Eu	63	1900	English: <i>Europe</i>
Fermium	Fm	100	1953	Italian: Enrico <i>Fermi</i>
Fluorine	F	9	1886	Latin: <i>fluere</i> , to flow
Francium	Fr	87	1939	French: <i>France</i>
Gadolinium	Gd	64	1886	Finnish: Johan <i>Gadolin</i> , Finnish chemist
Gallium	Ga	31	1875	Latin: <i>Gaul</i> , or France
Germanium	Ge	32	1886	German: <i>Germany</i>
Gold	Au	79	prehistoric	Anglo-Saxon: for gold; <i>aurum</i> , gold
Hafnium	Hf	72	1922	Latin: <i>Hafnia</i> , the city of Copenhagen, Denmark
Helium	He	2	1895	Greek: <i>helios</i> , the Sun
Holmium	Ho	67	1879	Latin: <i>Holmia</i> , the city Stockholm, Sweden
Hydrogen	H	1	1766	Greek <i>hydro genes</i> , water former
Indium	In	49	1863	Latin: <i>indicum</i> , produces an indigo-blue spectrum
Iodine	I	53	1811	Greek: <i>iodes</i> , produces a violet-like <i>spectrum line</i>
Iridium	Ir	77	1804	Latin: <i>iridis</i> , rainbow
Iron	Fe	26	prehistoric	Anglo Saxon: <i>iren</i> , symbol from Latin <i>ferrum</i>
Krypton	Kr	36	1898	Greek: <i>kryptos</i> , hidden
Lanthanum	La	57	1839	Greek: <i>lanthanien</i> , to be concealed
Lawrencium	Lw	103	1961	English: Ernest <i>Lawrence</i> , inventor of cyclotron
Lead	Pb	82	prehistoric	Anglo Saxon: <i>lead</i> ; symbol from Latin: <i>plumbum</i>
Lithium	Li	3	1817	Greek: <i>lithos</i> , stone
Lutetium	Lu	71	1905	Latin: <i>Lutetia</i> , ancient name of Paris
Magnesium	Mg	12	1774	Latin: <i>magnes</i> , magnet
Mendelevium	Md	101	1955	Russian: Dmitri <i>Mendeleev</i> , devised periodic table
Mercury	Hg	80	prehistoric	Latin: <i>Mercury</i> , messenger; symbol <i>Hydrarygus</i>
Molybdenum	Mo	42	1782	Greek: <i>molybdos</i> , lead
Neodymium	Nd	60	1885	Greek: <i>neos</i> , new, and <i>didymos</i> , twin
Neon	Ne	10	1898	Greek: <i>neos</i> , new
Neptunium	Np	93	1940	English: planet <i>Neptune</i>
Nickel	Ni	28	1750	German: <i>kupfernickel</i> , false copper
Niobium	Nb	41	1801	Greek: <i>Niobe</i> , mythological daughter of Tantalus
Nitrogen	N	7	1772	Latin: <i>nitro</i> , native soda, and <i>gen</i> , born
Nobelium	No	102	1957	Swedish: Alfred <i>Nobel</i> , discoverer of dynamite
Osmium	Os	76	1804	Greek: <i>osme</i> , odor of volatile tetroxide



Element	Symbol	Number	Date Discovered	Meaning of Name
Oxygen	O	8	1774	Greek: <i>oxys</i> , sharp, and <i>gen</i> , born
Palladium	Pd	46	1803	English: planetoid <i>Pallas</i> , discovered 1801
Phosphorus	P	15	1669	Greek: <i>phosphoros</i> , light bringer
Platinum	Pt	78	1735	Spanish: <i>plata</i> , silver
Plutonium	Pu	94	1940	English: <i>Pluto</i> , the planet
Polonium	Po	84	1898	Polish: <i>Poland</i> , country of codiscoverer Marie Curie
Potassium	K	19	1807	English: <i>potash</i> ; symbol Latin <i>kalium</i>
Praseodymium	Pr	59	1885	Greek: <i>Praseos</i> , leek green, and <i>didymos</i> , a twin
Promethium	Pm	61	1947	Greek: <i>Prometheus</i> , fire bringer
Protactinium	Pa	91	1917	Greek: <i>protos</i> , first
Radium	Ra	88	1898	Latin: <i>radius</i> , ray
Radon	Rn	86	1900	Latin: from <i>radium</i> , to radiate energy
Rhenium	Re	75	1924	Latin: <i>Rhenus</i> , Rhine province of Germany
Rhodium	Rh	45	1804	Greek: <i>rhodon</i> , a rose
Rubidium	Rb	37	1860	Latin: <i>rubidus</i> , red
Ruthenium	Ru	44	1845	Latin: <i>Ruthenia</i> , Russia
Samarium	Sm	62	1879	Russian: <i>Samarski</i> , a Russian engineer
Scandium	Sc	21	1879	Scandinavian: <i>Scandinavia</i>
Selenium	Se	34	1817	Greek: <i>selene</i> , moon
Silicon	Si	14	1823	Latin: <i>silex</i> , flint
Silver	Ag	47	prehistoric	Anglo-Saxon: <i>siolfu</i> ; symbol Latin: <i>argentum</i>
Sodium	Na	11	1807	Latin: <i>sodanum</i> for headache remedy; Na: <i>natrium</i>
Strontium	Sr	38	1808	Scottish: town of <i>Strontian</i> , Scotland
Sulfur	S	16	prehistoric	Latin: <i>sulphur</i> ; sulfur
Tantalum	Ta	73	1802	Greek: <i>Tantalus</i> of Greek mythology
Technetium	Tc	43	1937	Greek: <i>technetos</i> , artificial
Tellurium	Te	52	1782	Latin: <i>tellus</i> , the Earth
Terbium	Tb	65	1843	Swedish: <i>Ytterby</i> , town in Sweden
Thallium	Tl	81	1862	Greek: <i>thallos</i> , a young shoot
Thorium	Th	90	1819	Scandinavian: <i>Thor</i> from Scandinavian mythology
Thulium	Tm	69	1879	Latin: <i>Thule</i> , northerly part of the habitable world
Tin	Sn	50	prehistoric	Latin: Etruscan god <i>Tinia</i> ; symbol Latin: <i>stannum</i>
Titanium	Ti	22	1791	Greek: mythology, <i>Titans</i> , first sons of the Earth
Tungsten	W	74	1783	Swedish: <i>tung sten</i> , heavy stone, W: German:
Uranium	U	92	1789	English: Planet <i>Uranus</i>
Vanadium	V	23	1830	Scandinavian: goddess <i>Vanadis</i> of mythology
Xenon	Xe	54	1898	Greek: <i>xenos</i> , strange
Ytterbium	Yb	70	1905	Scandinavian: Ytterby, a town in Sweden
Yttrium	Y	39	1843	Scandinavian: Ytterby, a town in Sweden
Zinc	Zn	30	prehistoric	German: <i>Zink</i> , akin to <i>Zinn</i> , tin
Zirconium	Zr	40	1824	named for the mineral <i>zircon</i>

low-carbon steel, and a *ferroalloy* is an alloy of iron with one or more metals. When you know the meanings of a few roots, you can determine the meanings of many terms. Construct a sentence for each chemistry vocabulary word that your teacher has selected from Table 1.5. Illustrate the relationship between these words and their roots by **highlighting** root word meanings, as illustrated in the sentences of Table 1.5.

### ACTIVITY 1.2.2 *Developing a Chemistry Glossary*

Construct a three-column chart with the headings used in Table 1.6. Each time you encounter an

unfamiliar term in class or in your reading, enter its meaning and roots as shown. Contribute to this table for the duration of the class, referring to Table 1.5 whenever there is an unfamiliar root, prefix, or suffix.

### ACTIVITY 1.2.3 *Eciphering Chemistry Terms*

Once you know the basic roots, you can determine the meanings of new chemistry terms. Table 1.7 contains a list of random chemistry words, many of which may be unfamiliar to you. Analyze the roots using Table 1.5, matching each term to a likely definition (the first term is done as an example). Do not consult a dictionary or glossary; rather, draw conclusions based on your analysis of the words.

**Table 1.5** Roots, Prefixes, and Suffixes in Chemistry

a, an	<b>not, without:</b> amorphous, anhydrous, anaerobic, atypical Amorphous carbon does <b>not</b> display crystalline structure.
acid, acri	<b>sour, sharp:</b> acid, acidity, acrid, acidify, acidophilus Acids, such as those in lemons and other citrus fruits, produce a <b>sour</b> taste.
ag, act	<b>move, proceed:</b> reagent, action, reaction, agent, activity Chemical reagents are necessary for a reaction to <b>proceed</b> .
al, allo	<b>other, different:</b> allotrope, alloy, alter, allosteric, alias, alien Graphite, charcoal, and diamond are allotropes ( <b>different</b> forms) of carbon.
alpha	<b>first:</b> alpha particle, alpha helix, alpha ray, alpha position, alpha test Alpha radiation was the <b>first</b> radiation characterized by Ernest Rutherford.
amin	<b>amine:</b> amine, amino acid, vitamin, acetaminophen, deaminate, ammonia At the center of amino acids are <b>amine</b> groups.
amph	<b>double, both:</b> amphoteric, amphibolite, amphibole Amphoteric species can act as <b>both</b> acids and bases.
an	<b>apart:</b> analytical, analysis, anode, anabolism, anabolic Analytical chemists break compounds <b>apart</b> to determine chemical structure.
-ane	<b>single covalent bond:</b> methane, alkane, ethane, propane, butane, pentane, hexane, octane Methane, ethane, propane, and butane have only <b>single</b> bonds.
-ate	<b>negatively charged ion:</b> carbonate, phosphate, sulfate, hydrate, bromate, chlorate, iodate Carbonate, phosphate, and sulfate are <b>negatively charged ions</b> .
anti	<b>against, opposite, inhibit:</b> antioxidant, antifreeze, antacid, antinodes, antimatter Antioxidants, such as vitamins C and E, <b>inhibit</b> oxidation.
aqu	<b>water:</b> aqueous, aqua regia, aquamarine, aquatic In aqueous solutions, the solute is dissolved in <b>water</b> .
baro	<b>pressure:</b> barometer, bar, barometry, barometric pressure, hyperbaric chamber Barometers are used to measure air <b>pressure</b> .
beta	<b>second:</b> beta particle, beta decay, beta ray, betatron Beta radiation was the <b>second</b> type of radiation that Ernest Rutherford characterized.

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bi	<b>two:</b> bivalent, binary compounds, bicarbonate, bimetallic Bivalent (divalent) elements have a valence of <b>two</b> .
bio	<b>life, living:</b> biochemistry, bioassay, biocatalyst, biodegradable Biochemistry is the chemistry of <b>living</b> systems.
calor	<b>heat:</b> calorimeter, calorie, caloric, kilocalorie, calorimetry Calorimeters measure <b>heat</b> released or absorbed in reactions.
carb	<b>coal, carbon:</b> carbohydrate, carbonic acid, bicarbonate, carbon dioxide, carbide, carboxylic acid Carbohydrates are <b>carbon</b> -based molecules, including sugars, starch, and cellulose.
cat	<b>down, negative:</b> cathode, catalyst, catabolism, catastrophe Cathodes are <b>negatively</b> charged electrodes.
cau, caus	<b>burn, heat:</b> caustic, cauldron, cauterize, caustic soda Caustic substances, such as sodium hydroxide, can <b>burn</b> organic tissues.
chem	<b>chemical:</b> chemisorption, chemistry, biochemistry, chemoautotroph, chemoreceptor, chemist In chemisorption, the adsorbed substance is held by <b>chemical</b> bonds.
chrom	<b>color:</b> chromium, chromosphere, chromatography, monochrome, dichromate Chromium compounds are very <b>colorful</b> .
co, com	<b>with, together:</b> conjugate, composition, coefficient, colligative, compress, conduction, convection Conjugate acids and bases exist <b>with</b> each other, differing only by the presence of a proton.
cry	<b>cold:</b> crystal, cryogenic, crystalline, liquid crystal, crystallize, cryoprecipitate Crystals form when supersaturated solutions are <b>cooled</b> .
de	<b>down, lack, from:</b> denature, decomposition, dehydrate, decant, deformation Denatured proteins <b>lack</b> the critical three-dimensional structure required to function.
dens	<b>thick:</b> density, dense, condense, condenser, densimeter Density is a measure of " <b>thickness</b> " (amount of mass per unit volume).
di	<b>double:</b> disaccharide, dipeptide, dichloride, dioxide, dibromide, disulfide, dichroic Disaccharides are formed by the bonding of <b>two</b> monosaccharides.
dis, dif	<b>separate, apart:</b> dissociation, discontinuity, disperse, dispersion, differentiate Salts dissociate when component ions <b>separate</b> in solution.
duc, -t	<b>led, pulled:</b> ductile, product, conduct, induce, deduce, deduction Metals are ductile and can be <b>pulled</b> to produce wires.
e, ex, ef	<b>out, without, from:</b> emit, evaporation, explosion, exothermic, effervescence, effect, effuse Thermochemists measure the amount of heat emitted <b>from</b> reactions.
electr	<b>electricity:</b> electrolyte, electricity, electrode, electromotive force, dielectric, electron <b>Electricity</b> flows in solutions containing electrolytes.
elem	<b>basic:</b> elements, elemental, elementary particle Elements cannot be broken down into more <b>basic</b> substances by normal chemical means.
en	<b>in, into:</b> endothermic, endergonic, energy, enthalpy Endothermic reactions take heat energy <b>in</b> from the environment.
-ene	<b>double covalent bond:</b> benzene, alkene, ethene, propene, butene, pentene, polypropylene, toluene Benzene forms a six-carbon ring with three <b>double covalent bonds</b> .

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(Continued)

**Table 1.5** (Continued)

equ	<b>equal:</b> equilibrium, equate, equation, equal, equidistant Equilibrium is a dynamic condition in which two opposing reactions occur at <b>equal</b> rates.
erg	<b>work:</b> energy, erg, bond energy, energetics Energy is the capacity to perform <b>work</b> .
ex, exo	<b>out, outside:</b> exothermic, extrinsic, exterior, extrapolate, external Exothermic reactions release heat to the <b>outside</b> environment.
ferr, ferro	<b>iron:</b> ferromagnetism, ferrous, ferric, ferricyanide, ferrite, ferroalloy Ferromagnetic materials, such as <b>iron</b> , are strongly attracted to magnets.
fiss	<b>cleft, split:</b> nuclear fission, fissionable, fission bomb Nuclei <b>split</b> during nuclear fission.
fix	<b>fix, fasten:</b> fixation, fixture, affix, prefix, suffix, fix During carbon fixation, atmospheric carbon is <b>fixed</b> into molecules of glucose.
flu	<b>flow:</b> fluids, reflux, fluctuate, influx, flux, flux density Liquids and gases are classified as fluids because they <b>flow</b> .
fract	<b>break, broken:</b> fractional distillation, fraction, refract, fractionate During fractional distillation, mixtures are <b>broken</b> down and separated by different boiling points.
glyc	<b>sweet, sugar:</b> glycolysis, glycogen, glycolipid, glyceride, glycol During glycolysis, glucose <b>sugar</b> is broken down, and pyruvic acid and energy are released.
graph	<b>writing, printing:</b> graphite, chromatography, crystallography, thermography, photography Graphite is a planar form of carbon that makes gray marks when <b>writing</b> with pencils.
halo	<b>salt:</b> halogens, halocline, halite, halogenate Halogens (group VII) often combine with metals to form <b>salts</b> .
here, hes	<b>stick to:</b> cohesive, cohesion, cohere, adhere, adhesive, adhesive, coherent Cohesive substances <b>stick to</b> each other, and adhesive substances <b>stick to</b> other substances.
hybrid	<b>combination:</b> hybrid orbital, hybridize, sp <sup>3</sup> hybridization, hybrid bond, hyperon Hybrid orbitals are produced by the <b>combination</b> of two or more orbitals of the same atom.
hydr	<b>water:</b> hydrazine, hydrolysis, dehydrate, hydrogen, rehydrate, dehydration synthesis Although very different chemically, hydrazine resembles <b>water</b> in that both are colorless liquids.
hyper	<b>over, above:</b> (hy)perchloric acid, hypertonic solution, (hy)perchlorate, hyperbaric, hyperacidic The oxidation state of chlorine in perchloric acid is <b>above</b> the oxidation state in chloric acid.
hypo	<b>under, beneath:</b> hypochlorous acid, hypotonic, hypothesis The oxidation state of chlorine in hypochlorous acid is <b>lower</b> than in chlorous acid.
-ic	<b>higher valence:</b> sulfuric, hydrochloric, phosphoric, nitric, bromic, ferric Sulfur in sulfuric acid has a <b>higher valence</b> than in sulfurous acid.
-ide	<b>derived from:</b> bromide, chloride, fluoride, iodide, oxide, dioxide, monoxide, sulfide, hydride Bromides <b>are derived from</b> bromine.
ign	<b>fire:</b> ignite, lignite, ignition, ignitable, igneous Sulfur can be ignited with a hot <b>flame</b> .
-ile	<b>describing:</b> ductile, volatile, tensile, percentile, mobile Volatility <b>describes</b> a substance's vapor pressure.

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-ion	<b>process:</b> fusion, fission, dilution, solution, adhesion Fusion is the <b>process</b> of combining (fusing) nuclei to form a heavier nucleus.
iso	<b>equal, same:</b> isomers, isotonic, isometric, isotope, isosceles Isomers are compounds that have the <b>same</b> molecular formula but different structures.
-ist	<b>one who studies:</b> chemist, biochemist, organic chemist, geomorphologist, metallurgist A chemist is <b>one who studies</b> chemistry.
-ite	<b>negatively charged ion:</b> nitrite, chlorite, bromite, flourite, sulfite Nitrite is a <b>negatively charged ion</b> .
kilo	<b>thousand:</b> kilogram, kilocalorie, kilojoule, kilopascal, kiloton, kilowatt A kilogram is one <b>thousand</b> grams.
liqu	<b>fluid, liquid:</b> deliquescence, liquefy, liquid, liquefaction Deliquescence is the tendency to become <b>liquid</b> .
lys, lyz	<b>loosening, breaking:</b> electrolysis, hydrolysis, catalysis, hydrolyze, acidolysis Electrolysis is the <b>breaking</b> apart of a substance by an electric current.
malle	<b>hammer:</b> malleable, mallet, malleability Malleability is the ability to bend when hit by a <b>hammer</b> .
mer	<b>a part:</b> dimer, polymer, polymerization, monomer, dimerize Dimers, such as O <sub>2</sub> or C <sub>12</sub> , are made of two identical <b>parts</b> .
meter	<b>measure:</b> meter, voltmeter, thermometer, metric system, calorimeter, colorimeter, eudiometer Thermometers are used to <b>measure</b> the intensity of heat energy.
mill	<b>one thousand:</b> milliliter, milligram, millibar, milliamp, millimole A milliliter is <b>one-thousandth</b> of a liter.
misc, mix	<b>mix:</b> miscible, immiscible, mix, mixer, mixture Oil and water are immiscible, unable to <b>mix</b> to form a homogeneous mixture.
mon	<b>single:</b> monomer, monosodium glutamate, monoglyceride, monobasic, monochromatic, monoxide Monomers are <b>single</b> molecular units that can join to form polymers.
morph	<b>form, shape:</b> amorphous sulfur, dimorphic, geomorphology Amorphous sulfur does not have a consistent <b>shape</b> .
neg	<b>no:</b> negligible, negate, negative, negligence, negate A negligible measurement error will have <b>no</b> effect.
neutr	<b>neither:</b> neutral, neutron, neutralize, neutrality Neutrons are <b>neither</b> positive nor negative.
nitro	<b>nitrogen:</b> nitrogen dioxide, nitroglycerin, nitride, nitric, nitrogen, nitrile, nitrite, nitrosyl, nitrous Nitrogen dioxide is composed of one <b>nitrogen</b> and two oxygen atoms
non	<b>not:</b> nonpolar, nonferrous, nonabrasive, nonenzymatic Nonpolar substances, such as butane, do <b>not</b> demonstrate polarity.
oct	<b>eight:</b> octet rule, octane, octanol, octyl, octagonal The octet rule describes the tendency of atoms to establish a full set of <b>eight</b> valence electrons.
-on	<b>unit:</b> electron, proton, lepton, baryon, fermion, photon, boson The electron is the smallest <b>unit</b> of electricity.
-ous	<b>lower valence:</b> sulfurous, nitrous, bromous, ferrous Iron in ferrous oxide has a <b>lower valence</b> than in ferric oxide.

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(Continued)

**Table 1.5** (Continued)

oxid, oxy	<b>oxygen:</b> oxidizer, oxide, dioxide, oxidize, oxidation, oxidize Oxidizers resemble <b>oxygen</b> , removing electrons from other substances.
pent	<b>five:</b> pentahydrate, pentane, pentose, pentoxide, pentachloride Copper sulfate pentahydrate binds <b>five</b> water molecules per copper sulfate unit.
phil	<b>love:</b> hydrophilic, nucleophilic, acidophilic, basophilic Hydrophilic substances are “water <b>loving</b> ” and dissolve rapidly in water.
photo	<b>light:</b> photochemical smog, photon, photolysis, photocatalysis, photochemistry Photochemical smog contains pollutants that are synthesized in the presence of sun <b>light</b> .
polar	<b>end of axis:</b> polar covalent, polar, dipole, polarimeter, nonpolar In polar molecules, the <b>ends of the axes</b> carry partial charges.
poly	<b>many:</b> polyester, polymer, polysaccharide, polyacrylic, polyvinyl chloride, polyacrylamide Polyester is a polymer made by bonding <b>many</b> ester groups.
pre	<b>before:</b> precursor, precaution, predict, preheat, precede Precursors are substances that arise <b>before</b> products form.
pyr	<b>fire, heat:</b> pyrolysis, pyrotechnics, pyrite, pyroclastic, pyrometer Pyrolysis is decomposition by <b>heat</b> at high temperatures.
quant	<b>amount:</b> quantum, quantity, quantify, quantitative A quantum is a discrete <b>amount</b> of energy.
radi, ray	<b>ray, radius:</b> radioactive, radius, ray, radiant, gamma ray Radioactive materials emit <b>rays</b> of electromagnetic energy.
re	<b>back, again:</b> reflux, reabsorb, reaction, reactant, reactive, rehydrate, remove, reduction, reheat During reflux, vapor condenses, returns, and is vaporized <b>again</b> .
sacchar	<b>sugar:</b> monosaccharide, disaccharide, polysaccharide, Saccharomyces Monosaccharides, such as glucose and fructose, are <b>sugars</b> .
sat	<b>full, maximum:</b> saturate, satisfy, polyunsaturated, supersaturated, unsaturated Saturated solutions contain the <b>maximum</b> amount of solute that can be held in solution.
semi	<b>half, partial:</b> semiconductor, semipermeable, semisolid, semicrystalline Semiconductors are <b>partially</b> conductive.
sol	<b>dissolve:</b> solubility, solution, dissolve, soluble, solvent Solubility is a measure of a substance’s potential to <b>dissolve</b> in a specific solvent.
spec	<b>look:</b> spectator ions, specimen, specific, spectrum, specifications Spectator ions “ <b>look on</b> ” but are not involved in reactions.
sub	<b>under, below:</b> subscript, subatomic, submerge, subtract, subscale, sublimation, sublimate, substrate Subscripts are numbers or letters placed <b>below</b> a term, such as the “2” in H <sub>2</sub> O.
super	<b>above, beyond:</b> supersaturate, superheat, supercool, superscript, superfluid, supernatant, superoxide A solution is supersaturated when its concentration is increased <b>beyond</b> the saturation point.
therm	<b>heat:</b> thermochemistry, thermometer, therm, endothermic, exothermic, thermite Thermochemistry studies changes in <b>heat</b> energy accompanying chemical and physical changes.
thesis	<b>statement, arranging:</b> hypothesis, synthesis, thesis, photosynthesis, chemosynthesis A hypothesis is a testable <b>statement</b> and proposed explanation.



trans	<b>across, through:</b> trans-fatty acid, transition elements, transaminase, trans-, transfer, transmutation In trans-fatty acids, carbons are situated <b>across</b> from each other at the double bonds.
un	<b>not:</b> unsaturated, unbonded, untested, unheated, undissociated, unstable, unfavorable Unsaturated bonds have <b>not</b> been saturated with hydrogen.
vac	<b>empty:</b> vacuum, vacate, evacuate, vacant, vacuous A vacuum is an <b>empty</b> place, void of matter.
val	<b>strength, worth:</b> equivalence point, equivalent, validate, validity, evaluate, value At the equivalence point, the <b>strength</b> of the base is equal to the strength of the acid.
-yne	<b>triple covalent bond:</b> alkyne, ethyne, butyne, propyne Alkynes have one or more <b>triple covalent bonds</b> .

Table 1.6 Chemistry Glossary

Term	Meaning	Roots (Meanings)
Exothermic	Reaction that releases heat	Exo (out), therm (heat)
Photocatalysis	Light stimulated breakdown	Photo (light), cat (down), lys (break)
Calorimeter	Measures heat of reaction	Calor (heat), meter (measure)
↓new words	↓	↓

Table 1.7 Deciphering Chemistry Terms

Term	Definitions
↓	
1 <i>aqua regia</i>	a A binary carbon compound
2 <i>barometer</i>	b A device that records air pressure
3 <i>carbide</i>	c A mixture used for dissolving platinum and gold
4 <i>conduction</i>	d An instrument that measures the absorbed dose of radiation
5 <i>cryogen</i>	e Atoms with same atomic number but different mass
6 <i>deliquesce</i>	f Capable of having its nucleus split
7 <i>dosimeter</i>	g Carbohydrates made of many joined monosaccharides
8 <i>effluent</i>	h Having or exhibiting many colors or wavelengths
9 <i>electrophoresis</i>	i Iron-containing plant proteins that act as electron carriers
10 <i>ferredoxin</i>	j Large enough to be examined by the unaided eye
11 <i>fissionable</i>	k Liquid waste from industrial processes
12 <i>hypoxia</i>	l Low levels of oxygen in the blood
13 <i>isotope</i>	m Measurement of temperature
14 <i>macroscopic</i>	n Process of adding a phosphate group into a molecule
15 <i>microradiography</i>	o Refrigerants used to obtain very low temperatures
16 <i>phosphorylation</i>	p Study of the relationships between heat and other energy
17 <i>polychromatic</i>	q The migration of molecules in an electric field
18 <i>polysaccharide</i>	r Transmission through a medium or passage
19 <i>thermodynamics</i>	s To become liquid by absorbing moisture from the air
20 <i>thermometry</i>	t X-ray photography showing minute internal structure

## 1.3 Physics Vocabulary

### ACTIVITY 1.3.1 *Understanding Physics Root Words*

Table 1.8 lists the most common roots, prefixes, and suffixes used in physics. Following each definition is a series of physics terms that share this root. For example, *vect-* means “to carry, convey, or move.” Velocity

*vectors* are arrows that indicate the magnitude and direction of motion, and are used to show how objects move. *Convection* is the movement of heat as a gas warms and rises, and *advection* is the horizontal movement of heat within an ocean or atmospheric current. When you know the meanings of a few roots, you can determine the meanings of many terms. Construct a sentence for each physics vocabulary

**Table 1.8** Roots, Prefixes, and Suffixes in Physics

acceler	<b>faster:</b> accelerate, accelerometer, angular acceleration, centripetal acceleration To accelerate is to go progressively <b>faster</b> .
aero	<b>air:</b> aerodynamics, aeronautics, aerosol, aeroballistics Aerodynamics studies the properties of moving air and the forces it exerts.
alter	<b>other:</b> alternating current, alternator, alternate interior angle, alterable An alternating current switches from one polarity to the <b>other</b> .
anti	<b>against, opposite:</b> antiquark, antimatter, antiparticle, antilogarithm The antiquark is an <b>opposite</b> , or antiparticle, of the quark.
astr, aster	<b>star:</b> astronomy, asteroid, astrophysics, astronaut, astronomical Astronomy is the study of the <b>stars</b> .
avi	<b>bird, flight:</b> avionics, aviation, circumnavigation Avionics are the electronics that control <b>flight</b> in airplanes.
calor	<b>heat:</b> calorie, caloric, calorimeter, kilocalorie A calorie is the amount of <b>heat</b> to raise 1 gram of water by 1 degree Celsius.
capac	<b>amount:</b> capacitor, capacity, capacitance A capacitor stores an <b>amount</b> of charge.
centr	<b>center:</b> centripetal, concentric, centrifugal, eccentric Centripetal acceleration is always toward the <b>center</b> .
circ	<b>ring, around:</b> circuit, circumference, integrated circuit, short circuit An electrical circuit is a closed <b>ring</b> or path.
co, com	<b>together:</b> condensation, compression, conduction, convection, collinear Molecules come <b>together</b> during condensation.
cosm	<b>universe:</b> cosmology, cosmos, cosmonaut, cosmic rays Cosmology is the study of the <b>universe</b> .
counter	<b>against, opposite:</b> counterforce, counterflow, counterbalance, countercurrent A counterforce <b>opposes</b> another force.
cur, curs	<b>run, flow:</b> current, recur, occur, cursor, precursor Current is the <b>flow</b> of electricity or fluid.
de	<b>down, without:</b> depolarize, decelerate, detach, declination, deduce A depolarized surface is <b>without</b> charge.
dec	<b>tenth:</b> decibel, decimal, decimeter, decade A decibel has the sound intensity of one- <b>tenth</b> of a bel.
di, dia	<b>across:</b> diameter, dielectric, diagnoal, diagram, diamagnetic The diameter is the distance <b>across</b> an object.



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duc, -t	<b>to lead, carry:</b> transducer, conduct, deduct, induce, induce, deduce A transducer <b>carries</b> energy from one system to another.
dyn	<b>power, force:</b> dyne, dynamometer, dynamic, dynamite, dynamo, aerodynamics, hydrodynamics A dyne is a unit of <b>force</b> .
electr	<b>electricity:</b> electrode, electricity, electromotive force, electronics, dielectric, electron, electroscope An electrode is a conductor through which <b>electricity</b> enters or leaves an object.
empir	<b>experience:</b> empirical, empiricist, unempirical An empirical study is based on <b>experience</b> and observation.
erg	<b>work:</b> energy, erg, kinetic energy, potential energy, energetics Energy is the capacity to do <b>work</b> .
fin	<b>end, finish, boundary:</b> finite, final, finish, confine, infinite, define, definite A finite object has <b>boundaries</b> .
flect, flex	<b>to bend:</b> reflection, flexible, deflect, reflect Reflected rays <b>bend</b> away from the reflecting surface.
flu	<b>flow:</b> flux, fluids, fluctuate, influx, reflux, magnetic flux Flux is the <b>flow</b> of radiant or magnetic energy.
fract	<b>break, broken:</b> refraction, diffraction, fraction, fracture, refractive Refracted rays appear <b>broken</b> .
fus	<b>melt, join:</b> fusion, fuse, fusion bomb, nuclear fusion, fusible, heat of fusion During nuclear fusion, nuclei <b>join</b> together.
grav	<b>heavy, weighty:</b> gravity, gravitational, microgravity, graviton The greater the gravity, the <b>heavier</b> an object is.
gyr	<b>circle, rotation:</b> gyroscope, gyration, gyro stabilizer, gyrocompass Gyroscopes are stabilized by <b>rotational</b> inertia.
infra	<b>beneath, lower:</b> infrared, infrastructure, near-infrared, infrasonic Infrared light has <b>lower</b> energy than red light.
inter	<b>between:</b> interference, interferometry, Internet, intersect, interpolate Interference patterns form due to the interaction <b>between</b> waves.
-ion	<b>process:</b> fusion, revolution, extension, compression, fission Nuclear fusion is the <b>process</b> in which two hydrogen atoms fuse into one helium atom.
-ist	<b>one who studies:</b> physicist, astrophysicist, empiricist, cosmologist A physicist is <b>one who studies</b> physics.
ject	<b>to throw:</b> trajectory, reject, eject, project, projectile The path of a <b>thrown</b> object is its trajectory.
kilo	<b>thousand:</b> kilopascal, kilogram, kilometer, kilojoule, kilohertz, kilovolt, kiloton, kilowatt A kilopascal has one <b>thousand</b> times the pressure of a pascal.
kine	<b>motion:</b> kinetic energy, kinetics, hydrokinetics, kinetic friction Kinetic energy is the energy of <b>motion</b> .
lu, lum	<b>light:</b> luminescence, translucent, luster, luminosity, luminous, lux, lumen Luminescence is the emission of <b>light</b> from an unheated object.

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(Continued)

**Table 1.8** (Continued)

mega	<b>great, million:</b> megahertz, megabyte, megawatt, megavolt, megaton, megajoule A megahertz wave oscillates at 1 <b>million</b> times the frequency of a 1 hertz wave.
meter	<b>measure:</b> ammeter, meter, barometer, thermometer, metric system, interferometer An ammeter <b>measures</b> electric current in amps.
micro	<b>small, one-millionth:</b> microwave, micrometer, microgram, micron, microfarad, microprocessor Microwaves are <b>smaller</b> (shorter wavelength) than normal radio waves.
milli	<b>thousandth:</b> millisecond, millivolt, millirem, milliamp, milliwatt A millisecond is one- <b>thousandth</b> of a second.
min	<b>small:</b> minor, minuscule, minute, minimum, minority Minor forces are <b>smaller</b> than major forces.
mit, miss	<b>to send:</b> transmit, emit, emission, transmission, missile Transmitting antennas <b>send</b> radio signals.
mot, mov	<b>move:</b> locomotion, electromotive force (emf), motion, motility, movement Electromotive force is the difference in potential that <b>moves</b> electrons and creates a current.
multi	<b>many:</b> multiply, multiplex, multistage, multitude, multiple star Multiplexing allows the simultaneous transmission of <b>many</b> messages through one medium.
nano	<b>billionth:</b> nanosecond, nanotechnology, nanogram, nanoscale A nanogram is one- <b>billionth</b> of a gram.
numer	<b>number:</b> numeral, numeration, enumerate, innumerable, numerator, numerous To enumerate is to determine the <b>number</b> of something.
-on	<b>unit:</b> photon, electron, proton, lepton, baryon, fermion, boson Photons are the smallest <b>units</b> of light.
pel, puls	<b>drive, push:</b> propulsion, expel, repel, pulse, impulse, pulsate, repulsion, propel Rockets must have propulsion to <b>push</b> forward.
pend, pens	<b>hang, weigh:</b> pendulum, suspend, pending, suspension, pendant A pendulum is a swinging, <b>hanging weight</b> .
photo	<b>light:</b> photon, photoelectric effect, photoemission, photoluminescence A photon is a particle of <b>light</b> with zero rest mass.
phys	<b>body/nature:</b> physics, physical science, Newtonian physics, particle physics, geophysics, astrophysics Physics is the study of the <b>nature</b> of matter and energy.
polar	<b>end of axis:</b> polar, dipole, polarization, polarized, polarity, polar coordinates, monopole Polar molecules have positive and negative <b>ends</b> .
pot	<b>power:</b> electrical potential, potential energy, potentiometer, potential difference, action potential Potential energy is the <b>power</b> to perform work.
prim	<b>first:</b> primary coil, primary colors, primary pigments, prime A magnetic field forms <b>first</b> in the primary coil before a current is induced in the secondary coil.
pro	<b>before, positive:</b> proton, progress, projectile, propel Protons carry a <b>positive</b> charge.
radi, ray	<b>ray, radius:</b> radioactive, radius, ray, radiant, radiate, irradiate, X-ray, radiator, radiation <b>Rays</b> of radiation emanate from radioactive sources.

re	<b>back, again:</b> reflect, reactance, rebound, react, reflection, refraction, resonance Reflected light bounces <b>back</b> toward the source.
rect	<b>straight:</b> rectifier, rectify, direct current, erect, directrix A rectifier changes, or “ <b>straightens</b> ,” an AC current into a DC current.
scop	<b>see, watch:</b> spectroscope, telescope, oscilloscope, microscopic, galvanoscope Spectroscopes allow physicists to <b>see</b> and analyze the spectrum of light.
sign	<b>sign, mark:</b> signal, signature, design, significant, designate Radio signals are used to <b>mark</b> a satellite’s position.
sim	<b>same, like:</b> simulation, similar, assimilate, simulate, simultaneous Good physics simulations behave <b>like</b> the phenomena they model.
son	<b>sound:</b> ultrasonic, sonic, sonar, resonate, unison, ultrasound, resonance Ultrasonic waves have a frequency higher than <b>sound</b> waves.
stat	<b>stay, position:</b> stationary, static electricity, statics, station, thermostat, rheostat Thermostats ensure that temperatures remain in the <b>same</b> range.
sub	<b>under, below:</b> subscript, subsonic, submerge, subscript, subtend, subtract, subzero Subscripts are placed <b>below</b> the line (e.g., v <sub>1</sub> , v <sub>2</sub> ).
super	<b>above, over:</b> superposition, superpose, superimpose, superheat, superior, supersonic Superposition is the addition of one wave <b>over</b> another to determine the final pattern.
therm	<b>heat:</b> thermodynamics, therm, thermoelectric, thermocouple, thermonuclear, thermistor Thermodynamics is the science of <b>heat</b> energy.
tort, tors	<b>twist:</b> torque, torsion, distort, contort, torque converter, torsion balance Torque can be described as a <b>twisting</b> force.
tract	<b>to draw or drag:</b> abstract, attract, traction, extract, retract, subtract, contract, extract, protractor Abstract ideas may be <b>drawn</b> from careful observations.
trans	<b>across:</b> transmitter, transducer, transformer, transceiver, transistor, translucent, transmission Radio transmitters send messages <b>across</b> long distances.
ultra	<b>beyond:</b> ultraviolet, ultrasound, ultrahigh frequency (UHF), ultrahigh vacuum Ultraviolet radiation has a frequency <b>beyond</b> violet radiation.
uni	<b>one, same:</b> uniform, unit, unify, universal, universe Uniform techniques are employed to keep controls the <b>same</b> .
vect	<b>to carry:</b> vector, convection, convect, advection, vector product Heat and smoke are <b>carried</b> away from a fire by convection.

word provided by your teacher. These may come from readings, lectures, or Table 1.8. Illustrate the relationship between these words and their roots by **highlighting** root word meanings as illustrated in the sentences in Table 1.8.

unfamiliar term in class or in your reading, enter its meaning and roots as shown. Contribute to this table for the duration of the class, referring to Table 1.8 whenever you encounter an unfamiliar root, prefix, or suffix.

### ACTIVITY 1.3.2 *Developing a Physics Glossary*

Construct a three-column chart with the headings used in Table 1.9. Each time you encounter an

### ACTIVITY 1.3.3 *Deciphering Physics Terms*

Once you know basic roots, you can determine the meanings of new physics terms. Table 1.10

**Table 1.9** Physics Glossary

Term	Meaning	Roots (Meanings)
Fusion	Joining of nuclei	Fus (melt, join), -ion (process)
Infrasonic	Below audible frequency	Infra (below), son (sound)
Astrophysics	Study of the nature of stars	Astro (star), phys (nature)
↓new words	↓	↓

**Table 1.10** Deciphering Physics Terms

	Term	Definitions
↓	1 thermodynamics	a Producing electricity from a difference of temperatures
	2 electrodynamics	b Flow in the opposite direction
	3 dynamometer	c Instrument that measures the power output of an engine
	4 aerodynamics	d Interaction of electric currents and fields
	5 thermoelectric	e The production of electricity using energy from light
	6 electromotive	f Produces an electric current
	7 countercurrent	g Light resulting from absorption of electromagnetic radiation
	8 photoluminescence	h Study of the relation of heat, energy, and power
	9 photoelectric	i The loss of electrons when light strikes a surface
	10 photoemission	j The properties of moving air and the forces it exerts

contains a list of physics words, many of which may be unfamiliar to you. Analyze the roots (using Table 1.8), and match each term to a likely definition (the first term is done as an example). Do not consult a dictionary or glossary; rather, draw conclusions based on your analysis of the roots.

## 1.4 Earth and Space Science Vocabulary

### ACTIVITY 1.4.1 *Understanding Earth and Space Science Root Words*

Table 1.11 lists the most common roots, prefixes, and suffixes in the earth and space sciences. Following each definition is a series of earth and space science terms that share this root. For example, *iso-* means “same.” An *isosceles* triangle has equal sides, an *isobar* is a line on a map that connects points having the same atmospheric pressure, an *isotherm* is a line connecting

all points of the same temperature, an *isocline* connects all points with the same slope, and *isotopes* are forms of the same element. By knowing the meanings of a few roots, you can determine the meanings of many terms. Construct a sentence for each earth or space science vocabulary word your teacher uses. These may come from readings, lectures, or Table 1.11. Illustrate the relationship between these words and their roots by **highlighting** root word meanings as illustrated in the sentences in Table 1.11.

### ACTIVITY 1.4.2 *Developing an Earth and Space Science Glossary*

Construct a three-column chart with the headings used in Table 1.12. Each time you encounter an unfamiliar term in class or in your reading, enter its meaning and roots as shown in Table 1.11. Add to this table for the duration of the course, referring to Table 1.11 whenever there is an unfamiliar root.

**Table 1.11** Roots, Prefixes, and Suffixes in Earth and Space Science

-al	<b>relating to:</b> geological, alluvial, astronomical, terrestrial, altitudinal The U.S. Geological Survey examines issues <b>related to</b> the topography and resources of the Earth.
alt	<b>high:</b> altocumulus, altitude, altimeter, altiplano, altostratus Altocumulus are <b>high</b> cumulus cloud formations.
anti	<b>against, opposite:</b> anticline, anticyclone, antilogarithm, antitrades An anticline is characterized by slopes angled <b>opposite</b> directions down from the crest.
aqu	<b>water:</b> aquifer, aqueous, aquarium, aquatic, aqueduct, aquaculture An <b>aquifer</b> is a body of permeable rock that contains water.
baro	<b>pressure:</b> barometer, bar, barometry, barometric pressure, hyperbaric chamber Barometers are used to measure air <b>pressure</b> .
bi	<b>two:</b> binary star, bimetallic, bifurcate, bimetallic, bicarbonate Binary stars occur in <b>twos</b> .
benth	<b>bottom of the sea:</b> benthos, benthic, zoobenthos The benthos refers to the environment or the flora and fauna on the <b>bottom</b> of the sea.
calci	<b>lime:</b> calcium oxide, calcified, calcium, calcite, decalcified, calcium carbonate <b>Lime</b> is composed of calcium oxide, obtained by heating limestone.
calor	<b>heat:</b> calorimeter, calorie, caloric, kilocalorie, calorimetry Calorimeters are used to measure the <b>heat</b> energy in oil-bearing rocks.
carb	<b>coal, carbon:</b> carbon dioxide, carbonic acid, bicarbonate, carboniferous, calcium carbonate Carbon dioxide and carbonic acid are <b>carbon</b> -based chemicals.
cent	<b>hundred, hundredth:</b> centigrade, centimeter, centigram, percent There are one <b>hundred</b> degrees between freezing and boiling on the centigrade scale.
chrom	<b>color:</b> chromium, chromosphere, chromatography, monochrome, dichromate Chromium compounds are very <b>colorful</b> .
chron	<b>time:</b> geochronologist, geochronology, chronology, chronic, chronicle, chronometer, synchronize Geochronologists try to determine the <b>time</b> rocks were formed.
circ	<b>ring, around:</b> circumference, circumlunar, circulate, circumpolar, circumsolar The equatorial circumference of the Earth is the distance <b>around</b> the Earth at the equator.
clin	<b>slope:</b> clinometer, incline, decline, halocline, anticline, syncline, thermocline A clinometer measures the <b>slope</b> .
clud, clus	<b>to close:</b> occluded front, exclude, exclusive, conclude, cluster, star cluster An occluded front occurs when a cold front <b>closes</b> in on a warm front.
co, com	<b>with, together:</b> cogeneration, conglomerate, condense, compress, confluence Cogeneration plants produce electricity and heat <b>together</b> .
cosm	<b>universe, world:</b> cosmic dust, cosmos, cosmology, cosmonaut, cosmic rays, cosmography Cosmic dust is composed of small particles distributed throughout the <b>universe</b> .
crust	<b>shell:</b> crust, encrusted, crustose, crustal The Earth's crust is the hard rocky <b>shell</b> above the mantle.
cycl	<b>circle, cycle:</b> cyclone, cyclical, cycle, rock cycle, anticyclone, cyclotron, nitrogen cycle Cyclones are strong wind systems flowing in <b>circles</b> around low-pressure zones.

(Continued)

**Table 1.11** (Continued)

de	<b>down, without, from:</b> declination, decomposition, deduce, deform, degenerate, deoxygenate Declination is measured in degrees <b>from</b> the celestial equator.
deci	<b>tenth:</b> decibel, decimeter, decimal, deciliter A decibel has one <b>tenth</b> the sound intensity of a bel.
dia	<b>through, across:</b> diameter, diagonal, diaphragm, diagram Diameter is the measure <b>across</b> a circle or other shape.
e, ec, ex	<b>out, without, from:</b> eclipse, eccentric, ecliptic, elongation, exothermic, effluent The Earth is <b>without</b> direct light from the Sun during total solar eclipses.
epi	<b>upon, above:</b> epicenter, epibenthos, epilimnion, epicycle The epicenter is directly <b>above</b> the focus of an earthquake.
equi	<b>equal:</b> equinox, equidistant, equilateral, equilibrium, equation, equator The length of day and night are <b>equal</b> at the equinoxes.
flu, fluc	<b>flowing:</b> confluence, fluid, flue, fluctuate, effluvium, magnetic flux The confluence of two rivers is the point where they <b>flow</b> together as one.
geo	<b>Earth:</b> geothermal, geology, geode, geocentric, geomorphology, geography, geotropism Geothermal energy comes from the <b>Earth</b> .
glaci	<b>ice:</b> glacier, glaciation, glacial, glaciology, glacial polish, glaze Glaciers are large, slowly moving rivers of <b>ice</b> .
grad	<b>step, go:</b> retrograde, prograde, grade, gradual, graduate, graduated, gradient Planets periodically exhibit retrograde motion and appear to <b>go</b> backward.
graph	<b>writing, drawing:</b> geography, graphite, oceanography, photography, cartography, topography Geographers represent landforms using maps and other <b>drawings</b> .
halo	<b>salt:</b> halite, halogens, halocline, halophyte Halite is rock <b>salt</b> .
helio	<b>Sun:</b> aphelion, perihelion, heliograph, heliocentric, heliostat, heliosphere, heliopause The aphelion is the point in orbit when a planet or comet is farthest from the <b>Sun</b> .
hydr, hydr	<b>water:</b> hydroelectric, hydraulics, hydrate, hydrology, hydrothermal, hydropower, hygrometer Hydroelectric power plants produce electricity from the energy in falling <b>water</b> .
-ic	<b>relating to:</b> benthic, pelagic, atmospheric, acidic, basic The term <i>pelagic</i> <b>relates to</b> the open sea.
ign	<b>fire:</b> ignite, igneous, ignition, igneous fusion, metaigneous Igneous rocks are “born of <b>fire</b> ” in volcanoes or the depth of the Earth.
im, in	<b>not:</b> independent variable, inversion, immobile, immiscible, inversion layer Independent variables do <b>not</b> depend on dependent variables.
-ion	<b>process:</b> erosion, conservation, pollution, decomposition, evolution, liquefaction Erosion is a <b>process</b> in which soil and rock are worn away.
iso	<b>equal:</b> isobar, isotherm, isocline, isostasy, isotope Isobars are lines on meteorological maps that connect points of <b>equal</b> pressure.
-ist	<b>one who studies:</b> meteorologist, geologist, geophysicist, environmentalist, conservationist Meteorologists <b>study</b> the atmosphere and weather.
-ite	<b>ore, rock, crystal:</b> bauxite, bentonite, chalcopyrite, dolomite, granite, rhyolite, graphite Bauxite is an aluminum <b>ore</b> .
kilo	<b>thousand:</b> kilopascal, kilogram, kilometer, kilovolt, kiloton, kilowatt, kilowatt-hour A kilopascal is one <b>thousand</b> pascals of pressure.

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liqu	<b>fluid, liquid:</b> liquefaction, liquefy, liquid, liquid crystal During earthquakes, some soils undergo liquefaction and are more <b>fluid</b> than normal.
lith	<b>rock:</b> lithosphere, batholith, neolithic, Paleolithic, lithify The lithosphere is the <b>rocky</b> crust and outer portion of the mantle.
lu, lum	<b>light:</b> luminous, translucent, luster, luminescence, luminosity Stars are luminous, producing <b>light</b> during nuclear reactions.
magn	<b>great:</b> order of magnitude, magnify, magnitude, magnification Each order of magnitude is ten times <b>greater</b> than the previous one.
mar	<b>sea:</b> Mare Tranquilis, marine, mariner, marsh, maritime, mare Mare Tranquilis, the “ <b>Sea</b> of Tranquility,” is a large, dark, basalt plain on the Moon.
medi	<b>half, middle:</b> medial moraine, Mediterranean, medium, median Medial moraines form in the <b>middle</b> between two adjacent glaciers.
meso	<b>middle, between:</b> mesosphere, mesocyclone, meson, Mesozoic, Mesoamerica The mesosphere is <b>between</b> the stratosphere and thermosphere.
meta	<b>between, change:</b> metamorphic, metastable, metamorphism, metathesis Metamorphic rock has undergone <b>change</b> as a result of heat, pressure, and time.
meter	<b>measure:</b> anemometer, barometer, thermometer, altimeter, diameter, hygrometer Anemometers are used to <b>measure</b> wind speed.
nimb	<b>rain:</b> nimbus, cumulonimbus, nimbostratus Nimbus clouds usually produce <b>rain</b> .
nov	<b>new:</b> nova, supernova, innovation, novice, Nova Scotia, novel, novice Novas are stars that display a <b>new</b> , rapid increase in brilliance.
nox, noc	<b>night:</b> nocturnal, vernal equinox, autumnal equinox, noctilucent clouds At the vernal and autumnal equinoxes, day and <b>night</b> are of equal length.
-oid	<b>like, form:</b> metalloid, colloid, asteroid, meteoroid, crystalloid Metalloids are <b>like</b> metals in many ways.
-ology	<b>study of:</b> seismology, meteorology, petrology, climatology, mineralogy, geology, meteorology Seismology is the <b>study of</b> earthquakes and related phenomena.
orb	<b>circle:</b> orbital velocity, orbit, orbiter, orb Satellites must travel at orbital velocity to continue <b>circling</b> the Earth.
ortho	<b>straight, correct:</b> orthoclase, orthogonal, orthoquartzite, orthoslice Orthoclase crystals are common in granite and exhibit <b>straight</b> planes of cleavage.
-ous, -us	<b>characterized by:</b> aqueous, nebulous, igneous, carboniferous, nimbus, cumulus Aqueous solutions are <b>characterized by</b> water, the “universal solvent.”
paleo	<b>ancient:</b> paleontology, Paleozoic, paleobotany, paleomagnetism Paleobotany is the study of <b>ancient</b> , fossilized plants.
pel, puls	<b>push, pulse:</b> pulsar, pulsate, impulse, propel, repel Pulsars are thought to be rapidly rotating neutron stars that emit <b>pulses</b> of radio waves.
pelag	<b>the sea:</b> pelagic, bathypelagic, abyssalpelagic Fish living in the open <b>sea</b> are known as pelagic fish.
peri	<b>around:</b> perimeter, periscope, perigee, perihelion The perimeter of an island is the length <b>around</b> its shores.

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(Continued)



**Table 1.11** (Continued)

petr	<b>rock:</b> petrified, petrification, petrology, petrochemical, petrography, petroleum Petrified wood was once organic but now is <b>rock</b> .
phys	<b>nature:</b> physicist, physics, physiography, physical geography, physical science, geophysics Physicists study the <b>nature</b> of energy and matter.
plan	<b>flat:</b> altiplano, planar, plains, floodplain, coplanar The high, <b>flat</b> tableland of South America is known as the altiplano.
pole, polar	<b>end of axis:</b> Polaris, circumpolar, North and South Poles, polar cap, polar projection, aurora Polaris Polaris, the pole star, is in line with the Earth's <b>axis</b> .
pos	<b>put, laid:</b> deposit, expose, position, composite, opposite Alluvial deposits have been <b>laid</b> down over time.
quad	<b>four:</b> quadrat, quadrangle, quadrilateral, quadrillion, quadruple A quadrat is a <b>four</b> -sided parcel of land used in field studies.
re	<b>back, again:</b> nonrenewable, renewable, report, retain, research, reaction Once depleted, nonrenewable resources cannot be tapped <b>again</b> .
retro	<b>back, again:</b> retrograde, retrorocket, retrofit, retrogression During retrograde, planets appear to move <b>backward</b> .
rupt	<b>break:</b> eruption, erupt, rupture, interrupt, abrupt, disrupt During eruptions, magma <b>breaks</b> through the Earth's crust.
sal	<b>salt:</b> desalination, salinity, saline, salt, salinization Desalination removes <b>salt</b> from water.
sed, sid	<b>sit, settle:</b> sediment, subside, residue, sedimentary, residual Sediments form when particulates <b>settle</b> out of a mixture.
solar	<b>sun:</b> solar wind, solar cell, solar flare, solar system, solarize Solar wind is a flow of charged particles from the <b>Sun</b> .
sphere	<b>ball, sphere:</b> lithosphere, stratosphere, exosphere, asthenosphere, thermosphere, atmosphere The lithosphere is the outermost <b>spherical</b> layer of the Earth.
struct	<b>build:</b> infrastructure, structure, construct, instruct, obstruct, destruction Infrastructure must be <b>built</b> before superstructures are erected.
sub	<b>under, below:</b> subsoil, subduct, submerge, subduction zone, subscript, subarctic, substrata, substrate Subsoil lies immediately <b>below</b> surface soil.
super	<b>above, over:</b> superstratum, supernova, superheat, supercool, supersaturate, superscript The superstratum lies <b>above</b> other layers.
syn	<b>together, with:</b> syncline, geosynchronous, synthesis, geosyncline Water flowing down the opposite slopes of a syncline will come <b>together</b> .
terr	<b>Earth:</b> subterranean, terrain, territory, terrestrial, extraterrestrial, terrace, terrarium Subterranean structures are located below the surface of the <b>Earth</b> .
therm	<b>heat:</b> thermal, thermometer, geothermal, isotherm, thermocline Thermals are upward currents of <b>heated</b> air.
trans	<b>across, through:</b> translucent, transoceanic, transit, transmit, transect, transparent Light goes <b>through</b> translucent objects.



trib	<b>give:</b> tributary, contribute, attribute, distribute Tributaries <b>give</b> their water to other rivers.
typ	<b>type:</b> prototype, type, typical, typology, typify Prototypes are the first of their <b>type</b> .
ultra	<b>beyond:</b> ultraviolet, ultrasound, ultrahigh frequency (UHF), ultramafic Ultraviolet radiation has a frequency <b>beyond</b> that of violet radiation.
umb	<b>shadow:</b> umbra, penumbra, umbrella The umbra is the darkest <b>shadow</b> in an eclipse.
vert, vers	<b>turn:</b> diversion dam, divert, invert, reverse, convert Diversion dams <b>turn</b> the course of rivers or streams.
volcan	<b>fire, volcano:</b> volcanologist, volcano, vulcanize, volcanology, volcanism Volcanologists study <b>volcanoes</b> .

**Table 1.12** Earth and Space Science Glossary

Term	Meaning	Roots (Meanings)
Barometer	Measures air pressure	Bar (pressure), meter (measure)
Translucent	Allows light through	Trans (through), luc (light)
Heliocentric	Sun centered	Helio (sun), centr (centered)
↓new words	↓	↓

**Table 1.13** Deciphering Terms from Earth and Space Science

	Term	Definitions
↓	1 anticline	a Instrument that measures the moisture or humidity of air
	2 anticyclone	b Instrument that measures slope angle
	3 antitrades	c Process in which organic materials are transformed to rock
	4 clinometer	d Process of becoming liquid or behaving like a liquid
	5 hydrology	e Steady winds that blow opposite the trade winds
	6 hygrometer	f Stratified rock sloping in opposite directions from a crest
	7 liquefaction	g Study of the appearance and classification of rocks
	8 petrification	h Study of the Earth's water
	9 petrography	i Study of the origin, structure, and composition of rocks
	10 petrology	j Winds that move opposite storm winds

### ACTIVITY 1.4.3 *Deciphering Earth and Space Science Terms*

Once you know basic root words, you can determine the meanings of many new terms. Table 1.13 contains a list of earth and space science words, many of which may be unfamiliar to you. Analyze the roots using Table 1.11. and match each term to a likely definition (the first term is done as an example). Do not consult a dictionary or glossary; rather, draw conclusions based on your analysis of the root words.

### *Answers to Chapter Activities*

- 1.1.1 Students develop sentences using the format illustrated in Table 1.3. The teacher is encouraged to select current terms from readings, laboratories, lectures, and discussions.
- 1.1.2 Students maintain a glossary for the course according to the format shown in Table 1.1.
- 1.1.3 1(i), 2(f), 3(b), 4(a), 5(c), 6(e), 7(j), 8(h), 9(g), 10(d).
- 1.2.1 Students develop sentences using the format illustrated in Table 1.7. The teacher is encouraged to select current terms from readings, laboratories, lectures, and discussions.

- 1.2.2 Students maintain a glossary for the course according to the format shown in Table 1.5.
- 1.2.3 1(c), 2(b), 3(a), 4(r), 5(o), 6(s), 7(d), 8(k), 9(q), 10(i), 11(f), 12(l), 13(e), 14(j), 15(t), 16(n), 17(h), 18(g), 19(p), 20(m).
- 1.3.1 Students develop sentences using the format illustrated in Table 1.10. The teacher is encouraged to select current terms from readings, laboratories, lectures, and discussions.
- 1.3.2 Students maintain a glossary for the course according to the format shown in Table 1.8.
- 1.3.3 1(h), 2(d), 3(c), 4(j), 5(a), 6(f), 7(b), 8(g), 9(e), 10(i).
- 1.4.1 Students develop sentences using the format illustrated in Table 1.13. The teacher is encouraged to select current terms from readings, laboratories, lectures, and discussions.
- 1.4.2 Students maintain a glossary for the course according to the format shown in Table 1.11.
- 1.4.3 1(f), 2(j), 3(e), 4(b), 5(h), 6(a), 7(d), 8(c), 9(g), 10(i).