



South-Western
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Correlation of

CORD Biology,
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(0538681667)

to

California's Standards for Science,
Grades 9-12

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STANDARDS	PAGE REFERENCES
PHYSICS	
MOTION AND FORCES	
1. Newton’s laws predict the motion of most objects. As a basis for understanding this concept students know:	
e. the relationship between the universal law of gravitation and the effect of gravity on an object at the surface of the Earth.	Unit 1: 86 Unit 3: 609-13
CONSERVATION OF ENERGY AND MOMENTUM	
HEAT AND THERMODYNAMICS	
3. Energy cannot be created or destroyed although in many processes energy is transferred to the environment as heat. As a basis for understanding this concept students know:	
a. heat flow and work are two forms of energy transfer between systems.	Unit 1: 9-10, 84-85, LM: 33-37
c. thermal energy (commonly called heat) consists of random motion and the vibrations and rotations of atoms and molecules. The higher the temperature, the greater the atomic or molecular motion.	Unit 1: 9-10, 84-85
f.* the statement “entropy tends to increase” is a law of statistical probability that governs all closed systems (Second Law of Thermodynamics).	Unit 1: 85-91 Unit 6: 772-75
WAVES	
4. Waves have characteristic properties that do not depend on the type of wave. As a basis for understanding this concept students know:	
a. waves carry energy from one place to another.	Unit 1: 92-99, LM: 38-41 Unit 6: 802

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<p>e. radio waves, light and X-rays are different wavelength bands in the spectrum of electromagnetic waves whose speed in vacuum is approximately 3×10^8 m/s (186,000 miles/second).</p>	<p>Unit 1: 178, 183-84 Unit 3: 544, 546</p>
ELECTRONIC AND MAGNETIC PHENOMENA	
<p>5. Electric and magnetic phenomena are related and have many practical applications. As a basis for understanding this concept students know:</p>	
<p>e. charged particle are sources of electric fields and experience forces due to the electric fields from other charges.</p>	<p>Unit 3: 502-03</p>
CHEMISTRY	
ATOMIC AND MOLECULAR STRUCTURE	
<p>1. The Periodic Table displays the elements in increasing atomic number and shows how periodicity of the physical and chemical properties of the elements relates to atomic structure. As a basis for understanding this concept students know:</p>	
<p>a. how to relate the position of an element in the Periodic Table to its atomic number and atomic mass.</p>	<p>Unit 1: 11-12, Appendix: (A-7)-(A-8),</p>
<p>b. how to use the Periodic Table to identify metals, semimetals, nonmetals, and halogens.</p>	<p>Unit 1: 11-12, Appendix: (A-7)-(A-8),</p>
<p>e. the nucleus is much smaller in size than the atom yet contains most of its mass.</p>	<p>Unit 1: 11-12</p>
CHEMICAL BONDS	
<p>2. The enormous variety of biological, chemical and physical properties of matter result from the ability of atoms to form bonds. This ability results from the electrostatic forces between electrons and protons and between atoms and molecules. As a basis for understanding this concept students know:</p>	
<p>a. atoms combine to form molecules by sharing electrons to form covalent or metallic bonds, or by exchanging electrons to form ionic bonds.</p>	<p>Unit 1: 11-16, 18, 27-29</p>

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b. chemical bonds between atoms in molecules such as H ₂ , CH ₄ , NH ₃ , H ₂ CCH ₂ , N ₂ , Cl ₂ and many large biological molecules are covalent.	Unit 1: 11-12, 18
c. salt crystals such as NaCl are repeating patterns of positive and negative ions held together by electrostatic attraction.	Unit 1: 11-12, 18
h.* how to identify solids and liquids held together by Van der Waals forces or hydrogen bonding, and relate these forces to volatility and boiling/melting point temperatures.	Unit 1: 13-14; LM:18-22
CONSERVATION OF MATTER AND STOICHIOMETRY	
3. The conservation of atoms in chemical reactions leads to the principle of conservation of matter and the ability to calculate the mass of products and reactants. As a basis for understanding this concept students know:	
a. how to describe chemical reactions by writing balanced equations.	Unit 1: 11-12, 101, LM: 38, 42-45
g.* how to identify reactions that involve oxidation and reduction and how to balance oxidation-reduction reactions.	Unit 1: 85-87
GASES AND THEIR PROPERTIES	
4. The Kinetic Molecular theory describes the motion of atoms and molecules and explains the properties of gases. As a basis for understanding this concept students know:	
a. the random motion of molecules and their collisions with a surface create the observable pressure on that surface.	Unit 3: 447-49
b. the random motion of molecules explains the diffusion of gases.	Unit 3: 429, 444-50
ACIDS AND BASES	
5. Acids, bases, and salts are three classes of compounds that form ions in water solutions. As a basis for understanding this concept students know:	
a. the observable properties of acids, bases and salt solutions.	Unit 1: 27-29
b. acids are hydrogen ion donating and bases are hydrogen ion accepting substances.	Unit 1: 27-29
c. strong acids (and bases) fully dissociate and weak acids (and bases) partially dissociate.	Unit 1: 27-29 Unit 6: 812, LM: 246-49

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d. how to use the pH scale to characterize acid and base solutions.	Unit 1: 27-29, LM: 246-49, 250-54
e.* the Arrhenius, Bronsted Lowery, and Lewis acid base definitions.	Unit 1: 27-29
f.* how to calculate pH from the hydrogen ion concentration.	Unit 1: 27-29
g.* buffers stabilize pH in acid base reactions.	Unit 1: 27-29, LM: 246-49
SOLUTIONS	
6. Solutions are homogenous mixtures of two or more substances. As a basis for understanding this concept students know:	
a. the definition of solute and solvent.	Unit 1: 18
b. how to describe the dissolving process as a result of random molecular motion.	Unit 1: 18-19, 48-50
c. temperature, pressure, and surface area effect the dissolving process.	Unit 1: 66-67, LM: 23-28
f.* how molecules in solution are separated or purified by the methods of chromatography and distillation.	Unit 1: LM: 46-49
CHEMICAL THERMODYNAMICS	
7. Energy is exchanged or transformed in all chemical reactions and physical changes of matter. As a basis for understanding this concept students know:	
a. how to describe temperature and heat flow in terms of the motion of molecules (or atoms).	Unit 6: 772-775
b. chemical processes can either release (exothermic) or absorb (endothermic) thermal energy.	Unit 1: 13-14, 103-11 Unit 4: 610-11
c. energy is released when a material condenses or freezes and absorbed when a material evaporates or melts.	Unit 3: 548
REACTION RATES	
8. Chemical reaction rates depend on factors that influence the frequency of collision of reactant molecules. As a basis for understanding this concept students know:	
a. the rate of reaction is the decrease in concentration of reactants or the increase in concentration of products with time.	Unit 1: 11-19

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b. how reaction rates depend on such factors as concentration, temperature, and pressure.	Unit 1: 14-19 Unit 3: : 474-75, LM: 153-57
c. the role a catalyst plays in speeding up the reaction rate.	Unit 1: 14-17 Unit 3: 474-75, LM: 153-57
CHEMICAL EQUILIBRIUM	
9. Chemical equilibrium is a dynamic process at the molecular level. As a basis for understanding this concept students know:	
b. equilibrium is established when forward and reverse reaction rates are equal.	Unit 1: 49-50
ORGANIC AND BIOCHEMISTRY	
10. The bonding characteristics of carbon lead to the possibility of many different molecules of many sizes, shapes, and chemical properties. This provides the biochemical basis of life. As a basis for understanding this concept students know:	
a. large molecules (polymers) such as proteins, nucleic acids, and starch are formed by repetitive combinations of simple sub-units.	Unit 1: 12-16, LM: 18-22
b. the bonding characteristics of carbon lead to a large variety of structures ranging from simple hydrocarbons to complex polymers and biological molecules.	Unit 1: 11-16, 214-19
c. that amino acids are the building blocks of proteins.	Unit 1: 11-16, 214-19 Unit 3: 472-73, 487
d.* the system for naming the ten simplest linear hydrocarbons and isomers containing single bonds, simple hydrocarbons with double and triple bonds, and simple molecules containing a benzene ring.	Unit 3: 490-91
NUCLEAR PROCESSES	
11. Nuclear processes are those in which an atomic nucleus changes; they include radioactive decay of naturally occurring and man-made isotopes and nuclear fission and fusion processes. As a basis for understanding this concept students know:	

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b. the energy release per gram of material interacting is much larger in nuclear fusion or fission reactions than in chemical reactions: change in mass (calculated by $E=mc^2$) is small but significant in nuclear reactions.	Unit 6: 802
c. many naturally occurring isotopes of elements are radioactive, as are isotopes formed in nuclear reactions.	Unit 6: 808
BIOLOGY/LIFE SCIENCES	
CELL BIOLOGY	
1. Fundamental life processes of plants and animals depend on a variety of chemical reactions, that are carried out in specialized areas of the organism’s cells. As a basis of understanding this concept, students know:	
a. that cells are enclosed within semi-permeable membranes that regulate their interaction with their surroundings.	Unit 1: 45-52, 66-67, LM: 23-28
b. that enzymes are proteins that serve as catalysts to increase the rate of biochemical reactions, without altering the reaction equilibrium, and that the activity of enzymes depends on the temperature, ionic conditions and pH of the surroundings.	Unit 1: 14-16, 27-29 Unit 3: 472-75, LM: 153-57
c. how prokaryotic and eukaryotic cells, and viruses, differ in complexity, and how plant and animal cells and bacteria differ in their general structure.	Unit 1: 53-64, 220-27 Unit 2: 238-42, 244-45, 249-53, 278-82, 316-21, 348, 355-56, LM:88-92 Unit 4: 642, LM: 197-99
d. the Central Dogma of molecular biology outlines the flow of information, from transcription of RNA in the nucleus to translation of proteins on ribosomes in the cytoplasm.	Unit 1: 165-71, 173-81
e. the role of the endoplasmic reticulum and Golgi apparatus in secretion of proteins.	Unit 1: 59-60
f. that usable energy is captured from sunlight by chloroplasts, and stored via the synthesis of sugar from carbon dioxide.	Unit 1: 58, 88-91, 92-99 Unit 4: 697-99 Unit 5: 772-75
g. the role of the mitochondria, in making stored chemical bond energy available to cells, through completing the breakdown of glucose to carbon dioxide.	Unit 1: 57, 105-06

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h. most macromolecules (polysaccharides, nucleic acids, proteins, lipids) in cells and organisms are synthesized from a small collection of simple precursors.	Unit 1: 13-16, 88-92, 98-101, 159-60, 216-18 Unit 3: 479-88
i.* how chemiosmotic gradients in the mitochondria and chloroplast store energy for ATP production.	Unit 1: 94-97, 105-106
j.* how eukaryotic cells are given shape and internal organization by a cytoskeleton and/or cell wall.	Unit 1: 60-61
GENETICS	
2. Mutation and sexual reproduction lead to genetic variation in a population. As a basis for understanding this concept, students know:	
a. meiosis is an early step in sexual reproduction in which the pairs of chromosomes separate and are segregated randomly during cell division to produce gametes containing only one chromosome of each type.	Unit 1: 129-35, 141-42, 191-92 Unit 3: 579-80, 587-90
b. that only certain cells in a multicellular organism undergo meiosis.	Unit 3: 579-80, 587-90
c. how random chromosome segregation explains the probability that a particular allele will be in a gamete.	Unit 1: 131-35, 139-42
d. new combinations of alleles may be generated in a zygote through fusion of male and female gametes (fertilization).	Unit 1: 132-33, 139-47 Unit 3: 590
e. why approximately half of an individual’s DNA sequence comes from each parent.	Unit 1: 124-27, 129-41, 191-92
f. the role of chromosomes in determining an individual’s sex.	Unit 1: 120-21, TE: 120, 143-44
g. how to predict the possible new combinations of alleles in the zygote, given the genetic makeup of the parents.	Unit 1: 133-155, LM: 50-52, 75-78
3. A multicellular organism develops from single zygote—its phenotype depends on its genotype, which is established at fertilization. As a basis for understanding this concept, students know:	
a. how to predict the probable outcome of phenotypes in a genetic cross, given the genotypes of the parents and mode of inheritance (autosomal or X-linked, dominant or recessive).	Unit 1: 133-55, LM: 50-52, 75-78
b. the genetic basis for Mendel’s laws of segregation and independent assortment.	Unit 1: 133-35, 139-42

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c.* how to predict the probable mode of inheritance from a pedigree diagram that indicates phenotypes.	Unit 1: 138, 145, 154
d.* how to use data on frequency of recombination at meiosis, to estimate genetic distances between loci, and to interpret genetic maps of chromosomes.	Unit 1: 142, 158
4. Genes are a set of instructions, encoded in the DNA sequence of each organism, specifying the sequence of amino acids in proteins characteristic of that organism. As a basis for understanding this concept, students know:	
a. the general pathway by way in which ribosomes synthesize proteins, using tRNAs to translate genetic information in mRNA.	Unit 1: 165-72
b. how to apply the genetic coding rules to predict the sequence of amino acids from a sequence of codons in RNA.	Unit 1: 165-72, 179-81, 185-87
c. how changes in or mutations in the DNA sequence of a gene may (or may not) affect the sequence of amino acids in the encoded protein, or the expression of the gene.	Unit 1: 177-81, LM: 57-61
d. specialization of cells in multicellular organisms is usually due to different patterns in gene expression rather than to differences in the genes themselves.	Unit 1: 182-87 Unit 3: 369-70
e. various proteins differ from one another in the number and sequence of amino acids.	Unit 1: 13-16, 168-72, 178-81 Unit 3: 487
f.* why proteins having different amino acid sequences typically have different shapes and chemical properties.	Unit 1: 13-16
5. The genetic composition of cells can be altered by incorporation of exogenous DNA into the cells. As a basis for understanding this concept, students know:	
a. the general structures and functions of DNA, RNA, and protein.	Unit 1: 13-16, 22-23, 157-87 Unit 3: 487
b. how to apply base-pairing rules to explain precise copying of DNA during semi-conservative replication, and transcription of information from DNA into mRNA.	Unit 1: 159-64, 165-70, 172, 173-76, 178-81, 185-87, LM: 62-68
c. how genetic engineering (biotechnology) is used to produce useful biomedical and agricultural products.	Unit 2: 254-59, 268-70, LM: 93-97

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e.* how basic DNA technology (restriction digestion by endonucleases, gel electrophoresis, ligation, and transformation) is used to construct recombinant DNA molecules.	Unit 1: 167-68, 173-75, 182-85, LM: 46-49, 62-68, 69-74 Unit 2: 254-59, 268-70, LM: 93-97
f.* how exogenous DNA can be inserted into bacterial cells in order to alter their genetic makeup and support expression of new protein products.	Unit 2: 254-59, 268-70
ECOLOGY	
6. Stability in an ecosystem is a balance between competing effects. As a basis for understanding this concept, students know:	
a. biodiversity is the sum total of different kinds of organisms, and is affected by alterations of habitats.	Unit 1: 191-99 Unit 5: 750, 766-71, 773-80, 810-12, LM: 230-34
b. how to analyze changes in an ecosystem as a result of changes in climate, human activity, or introduction of non-native species.	Unit 5: 750-56, 757-61, 766-71, 772-97, 810-23 LM: 230-34, 250-54
c. how to analyze the effects that changes in population size have on the ecological balance of a community.	Unit 5: 737-49, 750-61, 766-70, 777-80
d. how fluctuations in population size in an ecosystem are determined by the relative rates of birth, immigration, emigration, and death.	Unit 1: 192-93 Unit 5: 738-49, 751
e. how water, carbon, and nitrogen cycle between abiotic resources and organic matter in the ecosystem and how oxygen cycles via photosynthesis and respiration.	Unit 1: 88-93, 98, 106-07 Unit 4: 657, 693-94, 697-99 Unit 5: 803-07
f. a vital part of an ecosystem is the stability of its producers and decomposers.	Unit 1: 88-91 Unit 2: 334-336 Unit 5: 772-775
g. at each link in a food web, some energy is stored in newly made structures but much is dissipated into the environment as heat and this can be represented in a food pyramid.	Unit 1: 9-10, TE: 10 Unit 5: 772-775
h.* how to distinguish between the accommodation of an individual organism to its environment, and the gradual adaptation of a lineage of organisms through genetic change.	Unit 1: 6-7, 30, 190-94, 195-99, 201, 203-13, LM: 75-78 Unit 5: 767-71

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EVOLUTION	
7. The frequency of an allele in a gene pool of a population depends on many factors, and may be stable or unstable over time. As a basis for understanding this concept, students know:	
a. why natural selection acts on the phenotype rather than the genotype of an organism.	Unit 1: 29-30, 190-93, 195-200, 201-13, 231, LM: 75-78
b. why alleles that are lethal in a homozygous individual may be carried in a heterozygote, and thus maintained in a gene pool.	Unit 1: 133-35, 137, 139-47, 190-94
c. new mutations are constantly being generated in a gene pool.	Unit 1: 177-84, 192-93, 231, LM: 57-61
d. variation within a species increases the likelihood that at least some members of a species will survive under changed environmental conditions.	Unit 1: 190-93, 195-99, 201, 203, 231
e.* the conditions for Hardy-Weinberg equilibrium in a population, and why these conditions are not met in nature.	Unit 1: 192-94
f.* how to solve the Hardy-Weinberg equation to determine the predicted frequency of genotypes in a population, given the frequency of phenotypes.	Unit 1: 192-94, LM: 75-78
8. Evolution is the result of genetic changes that occur in constantly changing environments. As a basis for understanding this concept, students know:	
a. how natural selection determines the differential survival of groups of organisms.	Unit 1: 196-200, 201-07, 231
b. a great diversity of species increase the chance that at least some organisms survive large changes in the environment.	Unit 1: 190-93, 195-99, 201, 203
c. the effects of genetic drift on the diversity of organisms in a population.	Unit 1: 203-04
d. reproductive or geographic isolation affects speciation.	Unit 1: 205-06
e. how to analyze fossil evidence with regard to biological diversity, episodic speciation, and mass extinction.	Unit 1: 208-09
f.* how to analyze evidence from independent sources (including comparative embryology, and comparison of DNA or protein sequences), and summarize the probable evolutionary relationships among several organisms using a branching diagram (cladogram).	Unit 1: 208-13, 226 Unit 3: 369-71 Unit 4: 649-50

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g.* how several independent molecular clocks, calibrated against each other and using evidence from the fossil record, can help to estimate how long ago various groups of organisms diverged evolutionarily from each other.	Unit 1: 215 Unit 5: 808
PHYSIOLOGY	
9. As a result of the coordinated structures and functions of organ systems, the internal environment of the human body remains relatively stable (homeostatic), despite changes in the outside environment. As a basis for understanding this concept, students know:	
a. how the complementary activity of major body systems provides cells with oxygen and nutrients, and removes toxic waste products such as carbon dioxide.	Unit 3: 356-62, 365-66, 428-42, 443-50, 451-61, 469-78
b. how the nervous system mediates communication between different parts of the body and interactions with the environment.	Unit 3: 356-57, 362-63, 500-05, 506-11, 512-18, LM: 162-64
c. how feedback loops involving the nervous and endocrine systems maintain overall regulation of optimal conditions within the body.	Unit 3: 504, 509-11, 513-14, 521-27, 532-33
d. how the nervous system functions, and the role of neurons in transmitting electrochemical impulses.	Unit 3: 362, 501-05, 506, 509-11
e. the roles of sensory neurons, interneurons, and motor neurons in sensation, thought, and response.	Unit 3: 501, 507, 509-11
f.* the individual functions and sites of secretion of digestive enzymes (amylases, proteases, nucleases, lipases), stomach acid, and bile salts.	Unit 1: 15-16 Unit 3: 471-78, 491-92, LM: 153-57
g.* the homeostatic role of the kidneys in the removal of nitrogenous wastes, and of the liver in blood detoxification and glucose balance.	Unit 3: 361-62, 451-54
h.* the cellular and molecular basis of muscle contraction, including the roles of actin, myosin, Ca ⁺² , and ATP.	Unit 3: 396-403
i.* how hormones (including digestive, reproductive, osmoregulatory) provide internal feedback mechanisms in the maintenance of homeostasis, at the cellular level and in whole organisms.	Unit 3: 363, 521-30, 532-337, 585-90, 592-94, 596, 598
10. Organisms have a variety of mechanisms to combat disease. As a basis for understanding the human immune response, students know:	
a. the role of the skin in providing nonspecific defenses against infection.	Unit 3: 363-64, 546-48

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b. the role of antibodies in the body’s response to infection.	Unit 3: 363-64, 551-557, 558-68, LM: 172-75
c. how vaccination protects an individual from infectious diseases.	Unit 1: 255 Unit 3: 554-555
d. that there are important differences between bacteria and viruses, with respect to their requirements for growth and replication, the primary defense of the body against them, and effective treatment of infections they cause.	Unit 1: 54-56, 62-64 Unit 2: 238-48, 249-56, 268-72 Unit 3: 540, 554-55, LM: 168-71
e. why an individual with a compromised immune system (for example, a person with AIDS), may be unable to fight off and survive infections of microorganisms that are usually benign.	Unit 3: 543, 552-56
f.* the roles of phagocytes, B-lymphocytes, and T-lymphocytes in the immune system.	Unit 3: 552-57, 558-62, 564-71, LM: 139-44, 172-75
EARTH SCIENCES	
EARTH’S PLACE IN THE UNIVERSE	
1. Astronomy and planetary exploration reveal the structure, scale, and change of the solar system over time. As a basis for understanding this concept, students know:	
a. how the differences and similarities among the sun, the terrestrial planets, and the gas planets may have been established during the formation of the solar system.	Unit 1: 214-16
b. evidence from Earth and moon rocks for the solar system’s formation from a nebular cloud of dust and gas approximately 4.6 billion years ago.	Unit 1: 214-16
c. evidence from geological studies of the Earth and other planets that the early Earth was very different from today.	Unit 1: 214-16
d. evidence that the planets are much closer than the stars.	Unit 1: 3, 7
2. Earth-based and space-based astronomy reveal the structure, scale, and change over time of stars, galaxies and the universe. As a basis for understanding this concept, students know:	
DYNAMIC EARTH PROCESSES	

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3. Plate tectonics operating over geologic time has changed the patterns of land, sea, and mountains on the Earth’s surface. As the basis for understanding this concept, students know:	
c. how to explain the properties of rocks based on the physical and chemical conditions in which they formed, including plate tectonic processes.	Unit 1: 208-09 Unit 2: 287, LM: 98-101
ENERGY IN THE EARTH SYSTEM	
4. Energy enters the Earth system primarily as solar radiation and eventually escapes as heat. As a basis for understanding this concept, students know:	
a. the relative amount of incoming solar energy compared with Earth’s internal energy and the energy used by society.	Unit 1: 9-10, 88-91, 92-93 Unit 5: 772-75, 800-803, 806, 813
b. the fate of incoming solar radiation in terms of reflection, absorption, and photosynthesis.	Unit 1: 9-10, 88-91, 92-93 Unit 2: 284-285
c. the different atmospheric gases that absorb the Earth’s thermal radiation, and the mechanism and significance of the greenhouse effect.	Unit 5: 810-812
d.* the different greenhouse conditions on Earth, Mars, and Venus, their origins and climatic consequences.	Unit 1: 3 Unit 5: 810-812
5. Heating of Earth’s surface and atmosphere by the sun drives convection within the atmosphere and oceans, producing winds and ocean currents. As a basis for understanding this concept, students know:	
a. how differential heating of the Earth results in circulation patterns in the atmosphere and oceans that globally distribute the heat.	Unit 2: 284-85 Unit 5: 766-77, 784-93
d. properties of ocean water such as temperature and salinity can be used to explain the layered structure of the oceans, generation of horizontal and vertical ocean currents, and the geographic distribution of marine organisms.	Unit 2: 284-85 Unit 5: 766-67
e. the distribution of rain forests and deserts on Earth in bands at specific latitudes.	Unit 5: 783-84, 786
f.* the interaction of wind patterns, ocean currents, and mountain ranges that results in the global pattern of latitudinal bands of rain forests and deserts.	Unit 5: 783-84, 785-86

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g.* features of the ENSO cycle (El Niño) in terms of sea-surface and air temperature variations across the Pacific, and some climatic results of this cycle.	Unit 2: 284-85 Unit 5: 766-67
6. Climate is the long term average of a region’s weather and depends on many factors. As a basis for understanding this concept, students know:	
a. weather (in the short run) and climate (in the long run) involve the transfer of energy in and out of the atmosphere.	Unit 2: 284-85 Unit 5: 810-12
b. effects on climate of latitude, elevation, topography, as well as proximity to large bodies of water and cold or warm ocean currents.	Unit 5: 782-89
c. how the Earth’s climate has changed over time, corresponding to changes in the Earth’s geography, atmospheric composition and/or other factors (solar radiation, plate movement, etc.).	Unit 1: 215-18
BIOGEOCHEMICAL CYCLES	
7. Each element on Earth moves among reservoirs in the solid Earth, oceans, atmosphere, and organisms as part of biogeochemical cycles. As a basis for understanding this concept, students know:	
a. the carbon cycle of photosynthesis and respiration and the nitrogen cycle.	Unit 1: 88-93, 98, 106-07 Unit 4: 657, 693-694, 697-699 Unit 5: 803-07
b. the global carbon cycle in terms of the different physical and chemical forms of carbon in the atmosphere, oceans, biomass, and fossil fuels and the movement of carbon among these reservoirs.	Unit 1: 84-93, 98, 106-07 Unit 4: 657, 693-694, 697-699 Unit 5: 803-07
c. movement of matter among reservoirs is driven by the Earth’s internal and external sources of energy.	Unit 1: 84-93, 98, 106-107 Unit 5: 800-801, 803-807
d.* the relative residence times and flows of carbon in and out of its different reservoirs.	Unit 5: 800-802

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STRUCTURE AND COMPOSITION OF THE ATMOSPHERE	
8. Life has changed Earth’s atmosphere and changes in the atmosphere affect conditions for life. As a basis for understanding this concept, students know:	
a. the thermal structure and chemical composition of the atmosphere.	Unit 5: 803
b. how the composition of the Earth’s atmosphere has evolved over geologic time including outgassing, the origin of atmospheric oxygen and variations in carbon dioxide concentration.	Unit 1: 100-101, 215-16, 218 Unit 5: 803-806, 810-812
c. the location of the ozone layer in the upper atmosphere, its role in absorbing ultraviolet radiation and how it varies both naturally and in response to human activities.	Unit 1: 218
CALIFORNIA GEOLOGY	
9. The geology of California underlies the state’s wealth of natural resources as well as its natural hazards. As a basis for understanding this concept, students know:	
c. the importance of water to society, the origins of California’s fresh water, and the relationship between supply and need.	Unit 5: 803-04
INVESTIGATION AND EXPERIMENTATION	
1. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept, and to address the content the other four strands, students should develop their own questions and perform investigations. Students will:	
a. select and use appropriate tools and technology (such as computer linked probes, spread sheets, and graphing calculators) to perform tests, collect data, analyze relationships, and display data.	Unit 1: 5, 56, 62, 66-67, 71, 107, 179, 239, LM: 13-83, Unit 2: 244, 249-50, LM: 98-113, 114-118 Unit 3: 430, 447, 475, 488, 540, 556, 613, 621, LM: 135-161, 168-175, 187-196 Unit 4: 645, 666, 692, 725, LM: 200-208, 224-226 Unit 5: 749, 753, 769, 771, 812, 817, LM: 227-254
b. identify and communicate sources of unavoidable experimental error.	Unit 1: 179, LM: 57-61, 62-68 Unit 2: 298, 321, LM: 98-101, 110-113

Correlation to California’s Standards for Science, Grades 9-12

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STANDARDS	PAGE REFERENCES
c. identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions.	Unit 1: 179, LM: 57-61, 62-68 Unit 2: 298, 321, LM: 98-101, 110-13
d. formulate explanations using logic and evidence.	Unit 1: LM: 18-83 Unit 2: LM: 84-114, 110-113 Unit 3: LM: 119-196 Unit 4: LM: 197-226 Unit 5: LM: 227-254
e. solve scientific problems using quadratic equations, and simple trigonometric, exponential and logarithmic functions.	Unit 1: 136, 140-41, 146-47, 201 Unit 2: LM: 84-114, 110-113 Unit 3: LM: 139-144, 145-148, 172-175, 180-183, 184-186, 188-192 Unit 5: 749, LM: 227-29, 242-245
f. distinguish between a hypothesis and a theory as these terms are used in science.	Unit 1: 215-19 Unit 2: 305, LM: 102-104 Appendix: (A-4)-(A-5)
g. recognize the use and limitations of models and theories as scientific representations of reality.	Unit 1: 41-42, 162-163, 197-198, 215-219, LM: 75-78 Unit 4: 694, LM: 213-215
h. read and interpret a topographic map, and a geologic map for evidence.	
i. analyze the locations, sequences, or time intervals of natural phenomena (e.g., relative ages of rocks, locations of planets over time, and succession of species in an ecosystem).	Unit 1: 208-213, 215-219 Unit 2: 298, LM: 98-101 Unit 5: 738-39, 740-49, 769-71

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STANDARDS	PAGE REFERENCES
<p>j. recognize the issues of statistical variability and the need for controlled tests.</p>	<p>Unit 1: 136, 140-41, 146-49 Unit 2: LM: 84-114, 110-113 Unit 3: LM: 139-144, 172-175, 180-183, 184-186, 188-192 Unit 5: 738-39, 740-49, LM: 242-245, 250-254</p>
<p>k. recognize the cumulative nature of scientific evidence.</p>	<p>Unit 1: 41-42, 76, 98, 133-135, 162-163, 197-198, 207-208 Unit 2: 98-101, 263-264 Unit 3: 474, 619-620 Unit 4: 703 Unit 5: 740-49, 755-756</p>
<p>l. analyze situations and solve problems that require combining concepts from more than one topic area of science and applying these concepts.</p>	<p>Unit 1: 32-33, 42, 44, 46, 72, 74-75, 112-13, 120-21, 148-49, 158, 162-63, 173-74, 182-84, 229-32, LM: 46-49, 53-73 Unit 2: 98-101, 254-57, 268-70, 284-85, 306-09, 340-42, LM: 93-97 Unit 3: 356, 381-83, 399-401, 418-20, 455-57, 529, 531-34, 564-67, 598-601, 631, LM: 172-175, 180-183 Unit 4: 654-57, 682-85, 693, 697-98, 708-10, 730-33, LM: 200-204 Unit 5: 746, 753-55, 757-60, 790-93, 800-02, 813-14, 819-22, LM: 246-254</p>
<p>m. investigate a science-based societal issue by researching the literature, analyzing data and communicating the findings. Examples include irradiation of food, cloning of animals by somatic cell nuclear transfer, choice of energy sources, and land and water use decisions (in California).</p>	<p>Unit 1: 148-49, 163, 183-84 Unit 2: 256-59, LM: 93-97 Unit 3: 591-92, 595, 599-601, 618-19 Unit 4: 710, 730-33 Unit 5: 757-60, 790-93, 812-13, 817, 819-22</p>
<p>2. Know that when an observation does not agree with an accepted scientific theory, sometimes the observation is mistaken or fraudulent (e.g., Piltdown Man fossil or unidentified flying objects), and sometimes the theory is wrong (e.g., Ptolemaic model of the movement of the sun, moon, and planets).</p>	<p>Unit 1: 22 Unit 4: 684, 710 Unit 5: 782-783 Appendix: (A-4)-(A-5)</p>