

California Science Teachers Association
In collaboration with the California Department of Education

INTEGRATED SCIENCE:

Level 1

**A Logic and Sequence
for Meaningful Instruction**



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Acknowledgment

The publishers and editors would like to thank
Phil Lafontaine, Manager, Mathematics and Science Leadership Office,
California Department of Education,
for his assistance with this project.

Forward

In October, 2003, the California State Board of Education established sets of standards for each of four levels of high school integrated science. These standards are identical to the Grade 9-12 content standards in biology, chemistry, earth science, physics, and investigation and experimentation. By “successfully meeting the challenge [of these standards] . . . high school graduates can attain the highest level of science literacy . . .” (2003 Science Framework, Pg.154).

The 2003 Science Framework for California Public Schools states, “that no sequence or emphasis is prescribed” for structuring the high school science program (p.154) but leaves each high school and district the flexibility to design their own course structure. This document, developed collaboratively by the California Science Teachers Association and the California Department of Education, recognizes the autonomy of schools and districts and offers an instructional organization of standards that supports student learning in a four year integrated science program. The instructional models for the four levels of integrated science, as contained in this document, are provided as *examples* of how high school instruction in integrated science might be organized. There are alternative ways in which an integrated science curriculum might be organized and, therefore, this document does not represent a mandate for instruction.

The four models provide for the integration of each of the disciplines of science, as well as the process of science, contained in the investigation and experimentation standards. They include narrative information that describes the overarching concepts for each level. Each level, excluding level IV, is developed into two semesters. Each semester is then developed into possible units. Specific standards are listed for each unit, and narrative is provided to facilitate the reader’s understanding of why specific standards are clustered together. The narrative also gives teachers a design for scaffolding the standards to enhance student understanding of the science concepts contained in the standards. Additionally, flowcharts are presented for one or two concepts in each level to graphically illustrate both the instructional sequence and the “integrated relationships” between the standards clustered in a particular unit of instruction. These visual tools provide teachers with a quick overview of the connections and probable sequences in their curriculum. Teachers are encouraged to review each level and make appropriate modifications to best match their students’ needs and their school context. The reader will also find the investigation and experimentation topics placed at the beginning of each course, as these standards should be embedded and covered throughout the entire course.

It is important to note that the standards sets for the four levels of integrated science are aligned to the blueprints for the California Standards Tests (CSTs). Schools are advised not to rearrange standards from one level to another for this reason. Each high school standard appears once in the four levels of integrated science. However, some standards may be introduced and not tested or may need to be reintroduced to facilitate complete understanding at a particular level.

In January, 2004, the State Board of Education approved a set of blueprints that will be used to design a high school assessment mandated by the No Child Left Behind (NCLB) act. This exam will be administered in 10th grade and will be assess the high school biology and middle school

life science standards. Schools/districts that are implementing integrated science in both 9th and 10th grade should recognize that 57 percent of the standards defined on the blueprint are covered in years one and two of the integrated science blueprints. Districts are encouraged to offer a comprehensive 7th grade standards-based science course so that students entering high school will have mastery of the life science standards which form the foundation for the high school biology standards.

This document is designed primary for science teachers who are responsible for implementing the science standards. The document is also useful for designers of science materials and professional development, who will be able to familiarize themselves with what is expected from our California students in the integrated/coordinated sequence. Parents, guardians, and students will find this document useful to see the overall coverage of the Science Content Standards for California Public Schools grade 9-12.

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INTEGRATED SCIENCE- LEVEL 1 PROPOSED INSTRUCTIONAL SEQUENCE

COURSE CONCEPT—The science curriculum in the first year of integrated science emphasizes how Earth is a unique system that supports life. Earth's biotic and abiotic systems are defined by the interaction of matter and energy through dynamic processes. These processes impact the biosphere over time. The standards in Integrated Science 1 present the foundations of physics, chemistry, biology, and earth science. These standards build the knowledge base that prepares the student for the next three years of integrated science where the rest of the California Science Standards will be addressed. The Integrated Science 1 concepts will be further enhanced by having students perform careful scientific investigations.

I. **Semester 1—The interaction of matter and energy define the Earth's systems**

The periodicity of elements is a method of organizing the components of matter. This periodicity allows scientists to predict and/or demonstrate how chemicals will react when combined together with the absorption or release of energy. Following from an understanding of atomic structure and interaction, the ideas of electromagnetism and wave mechanics are introduced. The vibration of electrons gives rise to the entire electromagnetic spectrum. The movement of the electrons is the foundation of electricity and magnetism. The same principles of wave mechanics in electromagnetic waves hold true for those waves that are mechanical in nature. The earthquakes in California are a result of the motion of large plates of land and emit waves and energy that are responsible for natural hazards. A knowledge of atomic and molecular structure will provide understanding of the chemical and physical characteristics of rocks that comprise the lithosphere.

A. **Unit Concept #1**—The characteristics of matter are defined by its composition and structure. A key component to earth's systems is the structure and composition of matter. The investigation of atomic behavior through the study of the Periodic Table will provide the foundation to understand various topics in earth science. The physical and chemical properties of rocks is determined by the atomic make up of the matter. The formation and composition of molecules determines the characteristics of matter. With this knowledge, the study of California geology and how it is shaped by plates, in the earth, will be investigated.

1. Chemistry 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.
 - a. Chemistry 1a- Students know how to relate the position of an element in the Periodic Table to its atomic number and atomic mass.
 - b. Chemistry 1b- Students know how to use the Periodic Table to identify metals, semimetals, non-metals, and halogens.

- c. Chemistry 1c- Students know how to use the Periodic Table to identify alkali metals, alkaline earth metals and transition metals, trends in ionization energy, electronegativity, and the relative sizes of ions and atoms.
 - d. Chemistry 1d- Students know how to use the Periodic Table to determine the number of electrons available for bonding.
 - e. Chemistry 1e- Students know the nucleus of the atom is much smaller than the atom yet contains most of its mass.
 - f. Chemistry 1f*- Students know how to use the Periodic Table to identify the lanthanide, actinide, and transactinide elements and know that the transuranium elements were synthesized and identified in laboratory experiments through the use of nuclear accelerators.
 - g. Chemistry 2a – Students know atoms combine to form molecules by sharing electrons to form covalent or metallic bonds or by exchanging electrons to form ionic bonds
2. Earth 3c- Students know how to explain the properties of rocks based on the physical and chemical conditions in which they formed, including plate tectonic processes.
- a. Earth 3b- Students know the principal structures that form at the three different kinds of plate boundaries. (types of boundaries only)
 - b. Earth 9b- Students know the principal natural hazards in different California regions and the geologic basis of those hazards. (introductory exposure only)

B. Unit Concept #2—The characteristics of energy transmission explain electricity, magnetism and wave phenomena. Transmission of energy has an important role in earth's processes. Waves and electricity occur as a result of energy transmission. The dynamics of how waves are produced and propagated will be investigated. This provides an understanding of the principles of sound and seismic wave transmission. Electric and magnetic fields are examples of energy transmission. Electricity is the result of a moving electric field caused by the movement of electrons. A moving electric field causes a change in the magnetic field. The relationship between an electric field and magnetic field shall be investigated. Natural and applied examples of these fields will be explained.

- 1. Physics 4- Waves have characteristic properties that do not depend on the type of wave.
 - a. Physics 4a- Students know waves carry energy from one place to another.
 - b. Physics 4b- Students know how to identify transverse and longitudinal waves in mechanical media, such as springs and ropes, and on the earth (seismic waves).

- (i) Earth 3d- Students know why and how earthquakes occur and the scales used to measure their intensity and magnitude.
 - c. Physics 4d- Students know sound is a longitudinal wave whose speed depends on the properties of the medium in which it propagates.
 - d. Physics 4e- Students know radio waves, light, and X-rays are different wavelength bands in the spectrum of electromagnetic waves whose speed in a vacuum is approximately 3×10^8 m/s (186,000 miles/second).
 - e. Physics 4f- Students know how to identify the characteristic properties of waves: interference (beats), diffraction, refraction, Doppler effect, and polarization.
2. Physics 5- Electric and magnetic phenomena are related and have many practical applications.
- a. Physics 5a- Students know how to predict the voltage or current in simple direct (DC) electric circuits constructed from batteries, wires, resistors, and capacitors.
 - (i) Physics 5d- Students know the properties of transistors and the role of transistors in electric circuits.
 - b. Physics 5e- Students know charged particles are sources of electric fields and are subject to the forces of the electric fields from other charges.
 - c. Physics 5i- Students know plasmas, the fourth state of matter, contains ions or free electrons or both and conduct electricity.
 - d. Physics 5h- Students know changing magnetic fields produce electric fields, thereby inducing currents in nearby conductors.
 - (i) Earth 3a- Students know features of the ocean floor (magnetic patterns, age, and sea-floor topography) provide evidence of plate tectonics.
 - (a) Earth 3e- Students know there are two kinds of volcanoes: one kind with violent eruptions producing steep slopes and the other kind with voluminous lava flows producing gentle slopes.
 - (b) Earth 3f*- Students know the explanation for the location and properties of volcanoes that are due to hot spots and the explanation for those that are due to subduction.
 - e. Physics 5j*- Students know electric and magnetic fields contain energy and act as vector force fields.
 - f. Physics 5m*- Students know static electric fields have as their source some arrangement of electric charges.
 - g. Earth 3b- Students know the principal structures that form at the three different kinds of plate boundaries. (more detail)

- h. Earth 9d- Students know how to analyze published geologic hazard maps of California and know how to use the map's information to identify evidence of geologic events of the past and predict geologic changes in the future.
- i. Earth 9b- Students know the principal natural hazards in different California regions and the geologic basis of those hazards. (more detail)

II. **Semester 2—Systems of the Earth impact the biosphere**

Biogeochemical cycles impact life on Earth. To understand these impacts, an examination of the biological, physical, and chemical properties of matter in the biogeochemical cycles needs to be established. The stability of life on earth is closely linked to the water, oxygen, carbon, and nitrogen cycles. Knowledge of these chemical cycles will assist in assessing changes that can affect the dynamic equilibrium of the Earth's biotic community. Organic evolution and shifts in biotic communities occur in the context of the Earth's constantly changing environments.

- A. **Unit Concept #1—**Biogeochemical cycles support the Earth's biotic systems, and important abiotic influences help to govern these biogeochemical cycles. Understanding how chemical bonds form supports the study of these influences. Water, the universal solvent, can produce acidic and alkaline environments within its cycles. Further study will examine how specific molecules affect the water, carbon, and nitrogen cycles. Examples of these molecules are those of oxygen as it forms bonds with either carbon or nitrogen as it flows through the ecosystem.
 - 1. Chemistry 2- Biological, chemical, and physical properties of matter result from the ability of atoms to form bonds from electrostatic forces between electrons and protons and between atoms and molecules.
 - a. Chemistry 2a- Students know atoms combine to form molecules by sharing electrons to form covalent or metallic bonds or by exchanging electrons to form ionic bonds. (Review)
 - b. Chemistry 2b- Students know chemical bonds between atoms in molecules such as H₂, CH₄, NH₃, H₂CCH₂, N₂, Cl₂, and many large biological molecules are covalent.
 - c. Chemistry 2c- Students know salt crystals, such as NaCl, are repeating patterns of positive and negative ions held together by electrostatic attraction.
 - 2. Biology 6d- Students know how water, carbon, and nitrogen cycle between abiotic resources and organic matter in the ecosystem and how oxygen cycles through photosynthesis and respiration.
 - a. Chemistry 7c- Students know energy is released when a material condenses or freezes and is absorbed when a material evaporates or melts.

- b. Physics 4e- Students know radio waves, light, and X-rays are different wavelength bands in the spectrum of electromagnetic waves whose speed in a vacuum is approximately 3×10^8 m/s (186,000 miles/second). (Focus here is on infrared and visible light spectra.)
 - c. Earth 7a- Students know the carbon cycle of photosynthesis and respiration and the nitrogen cycle.
 - d. Earth 7b- Students know the global carbon cycle: the different physical and chemical forms of carbon in the atmosphere, oceans, biomass, fossil fuels, and the movement of carbon among these reservoirs.
 - e. Earth 7c- Students know the movement of matter among reservoirs is driven by Earth's internal and external sources of energy.
 - f. Earth 7d*- Students know the relative residence times and flow characteristics of carbon in and out of its different reservoirs.
 - g. Earth 9c- Students know the importance of water to society; the origins of California's fresh water, and the relationship between supply and need.
 - h. Biology 6d (water cycle only)- Students know how water, carbon, and nitrogen cycle between abiotic resources and organic matter in the ecosystem and how oxygen cycles through photosynthesis and respiration.
3. Chemistry 5- Acids, bases and salts are three classes of compounds that form ions in water solutions.
- a. Chemistry 5a- Students know the observable properties of acids, bases, and salt solutions.
 - b. Chemistry 5c- Students know strong acids and bases fully dissociate and weak acids and bases partially dissociate.

B. Unit Concept #2—The biotic systems of the Earth exist in a dynamic equilibrium. The biotic composition of the Earth has changed over time. The evolution of species and the ecosystems to which they belong occurs as a result of the Earth's constantly changing environments. The composition and stability of the Earth's ecosystems are affected by the dynamic interactions among many factors, including changes in climate and human activity. Over time, the species composition of ecosystems evolves as a result of genetic changes that occur in changing environments. A large diversity of species within an ecosystem increases the probability that at least some members will survive major environmental changes.

- 1. Biology 6- Stability in an ecosystem is a balance between competing effects.
 - a. Biology 6a- Students know biodiversity is the sum total of different kinds of organism and is affected by alterations of habitats.

- b. Biology 6b- Students know how to analyze changes in an ecosystem resulting from changes in climate, human activity, introduction of nonnative species, or changes in population size.
 - c. Biology 6c- Students know how fluctuations in population size in an ecosystem are determined by the relative rates of birth, immigration, emigration, and death.
 - d. Biology 6e- Students know a vital part of an ecosystem is the stability of its producers and decomposers.
 - e. Biology 6g*- Students know 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.
 - f. Biology 6f- Students know at each link in a food web some energy is stored in newly made structures but much energy is dissipated into the environment as heat. This dissipation may be represented in an energy pyramid.
 - (i.) Biology 6d- Students know how water, carbon, and nitrogen cycle between abiotic resources and organic matter in the ecosystem and how oxygen cycles through photosynthesis and respiration. (review nitrogen cycle)
 - (ii.) Chemistry 7b- Students know chemical processes can either release (exothermic) or absorb (endothermic) thermal energy.
 - (iii) Physics 3f*- Students know the statement “Entropy tends to increase” is a law of statistical probability that governs all closed systems (second law of thermodynamics).
2. Biology 8- Evolution is the result of genetic changes that occur in constantly changing environments.
- a. Biology 8a- Students know how natural selection determines the differential survival of groups of organisms.
 - b. Biology 8b- Students know a great diversity of species increases the chance that at least some organisms survive major changes in the environment.
 - i. Earth 3c- Students know how to explain the properties of rocks based on the physical and chemical conditions in which they formed, including plate tectonic processes. (review of sedimentary rocks)
 - ii. Biology 8e- Students know how to analyze fossil evidence with regard to biological diversity, episodic speciation, and mass extinction.

ESSENTIAL QUESTIONS:

Year question: In what ways does the Earth support life?

Semester 1: What interactions occur within matter and energy that are found in earth systems?

Semester 2: How do different earth systems affect the biosphere?

Integrated Science- Year 1
Sample Flowchart for Concept Instructional Sequence

The Earth is a unique system that supports life within an ever-changing and complex universe.

The interaction of matter and energy determine the characteristics of our Earth's system.

The interaction of matter and energy results in a dynamic Earth system.

The interaction of matter and energy determine the characteristics of life.

The chemical structure of inorganic and organic matter forms the basis of life on Earth.

The chemical structure of inorganic and organic determine the structures and functions of cells.

The unique properties of carbon and water contribute to the fundamental structures and functions of cells.

The structure and function of cells rely on the self-replicating properties of DNA.

The self-replication property of DNA forms the basis for continuity and change in the reproduction of cells.

Continuity and change in the reproduction of cells rely on inherited genotype.

The inherited genotype determines an organism's phenotype.

Integrated Science- Year 1

Sample Flowchart for Concept Instructional Sequence

The Earth is a unique system that supports life.

IA

What is the structure of the atom?

Atomic and molecular structure determines physical characteristics of rocks in lithosphere. (C1e)

Composition and structure of matter determine characteristics.

Instruction will include:
 Subatomic particles
 Nuclear symbols (reading cells in the Periodic Table)
 Bohr models
 Atomic dimensions (relate atoms → nucleus → electrons)

How does the atomic structure affect the organization of the Periodic Table?

Position on periodic table corresponds with atomic number and mass (C1a)

Periodicity of physical and chemical properties and atomic structure.

* Identification of lanthanide, actinide, transactinide; use of nuclear accelerators in synthesis (C1f)

Identification of alkali metals, alkaline earth metals, transition metals; ionization energy, electronegativity, relative sizes of ions and atoms (C1c)

Instruction will include:
 Periodic Table: families, groups, periods
 Specific periodic families
 Periodic trends (atomic size, metallic character, valence electrons, ionization energy, electronegativity)

Identification of metals, semimetals, non-metals, halogens (C1b)

How does the location of an element of Periodic Table affect its interactions with other elements?

Periodic table: number of electrons available for bonding (C1d)

Bonds, electrostatic forces determine biological, chemical, and physical properties of matter.

Formation of molecules through covalent and ionic bonds (C2a)

Instruction will include:
 Types of bonds (ionic, covalent, metallic)
 Number of valence electrons → bonding
 Electronegativity differences and type of bond

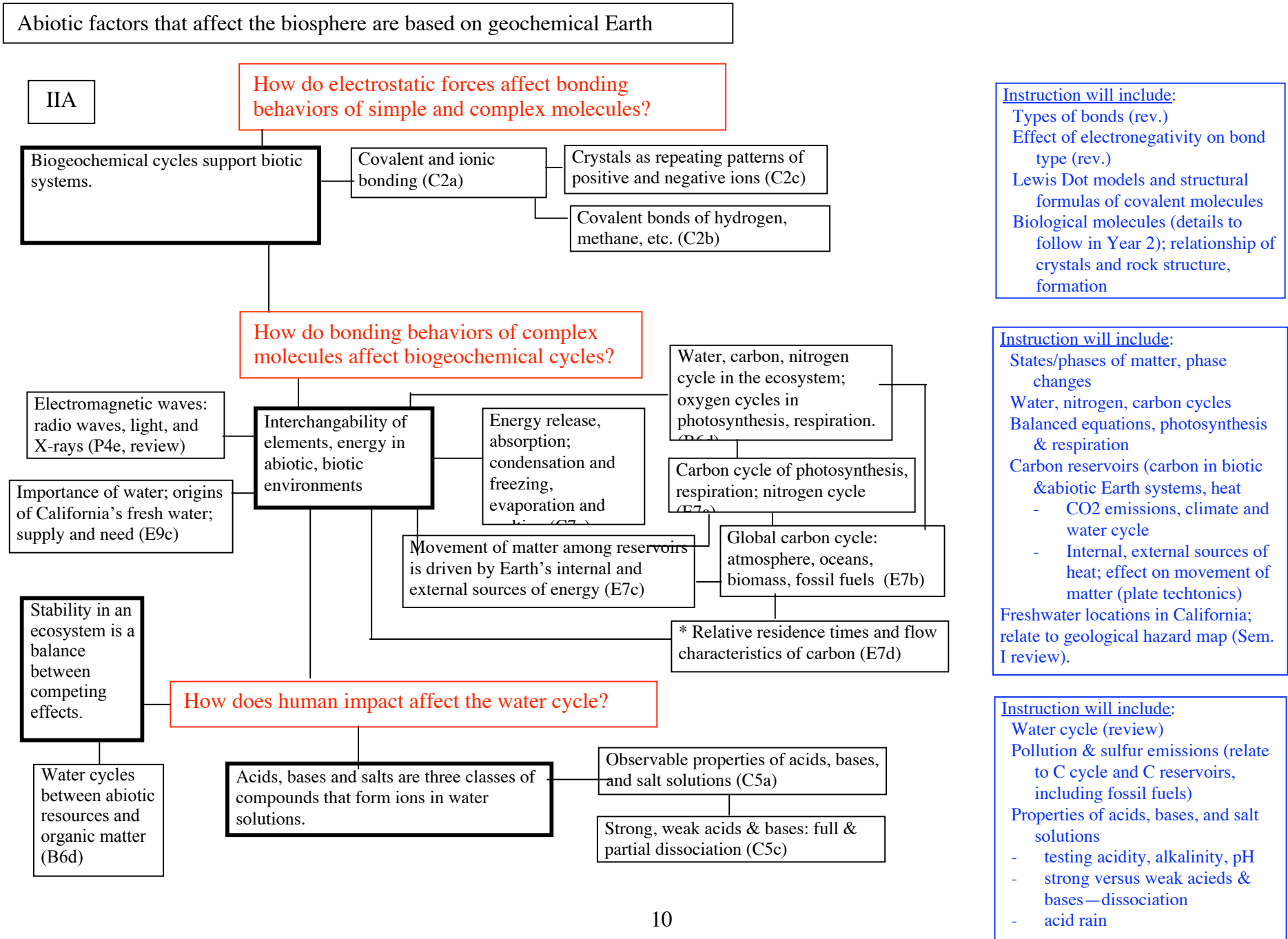
How do interactions between elements affect the physical and chemical properties of more complex systems (e.g., rocks)?

Three kinds of plate boundaries—geological structures that result (E3b)

Properties of rocks based on conditions of formation—including plate tectonics

Instruction will include:
 Chemical and physical properties of each of the three types of rocks (igneous, sedimentary, metamorphic)
 Relationships between properties and formation of each type of rock
 Types of plate boundaries
 Rock types found at each type of plate boundary

Integrated Science- Year 1
Sample Flowchart for Concept Instructional Sequence



Bridge Statements Integrated Science 1

Semester 1

The periodicity of elements is a method of organizing the components of matter.

IA The characteristics of matter are defined by composition and structure.

Movement of tectonic plates and actions at plate boundaries are determined by and can be characterized by wave phenomena.

IB The characteristics of energy transmission explain electricity, magnetism and wave phenomena.

Geochemical Earth systems discussed in Semester I form the basis of the abiotic factors affecting the biosphere.

Semester 2

Biogeochemical cycles impact life on Earth.

IIA Biogeochemical cycles support biotic system.

Acid rain and pollution provide examples of human impact on all biogeochemical cycles and the subsequent effects on ecosystem stability.

IIB The biotic systems of Earth exist in a dynamic equilibrium.

10th GRADE NCLB TEST

COMPARISON OF STANDARDS ADDRESSED IN BIOLOGY WITH INTEGRATED SCIENCE I AND II

	% of Test	Number of Items	Integrated I	Integrated II
CELL BIOLOGY	17	10		
<p>CALIFORNIA CONTENT STANDARDS: Grade 7 1. All living organisms are composed of cells, from just one to many trillions, whose details usually are visible only through a microscope. As a basis for understanding this concept: c. Students <i>know</i> the nucleus is the repository for genetic information in plant and animal cells. d. Students <i>know</i> that mitochondria liberate energy for the work that cells do and that chloroplasts capture sunlight energy for photosynthesis. e. Students <i>know</i> cells divide to increase their numbers through a process of mitosis, which results in two daughter cells with identical sets of chromosomes.</p> <p>CALIFORNIA CONTENT STANDARDS: Grade 8 6. Principles of chemistry underlie the functioning of biological systems. As a basis for understanding this concept: b. Students <i>know</i> that living organisms are made of molecules consisting largely of carbon, hydrogen, nitrogen, oxygen, phosphorus, and sulfur. c. Students <i>know</i> that living organisms have many different kinds of molecules, including small ones, such as water and salt, and very large ones, such as carbohydrates, fats, proteins, and DNA.</p>	<p>X = a match between the Biology Standard and Biology/Life Science Standard in either the Integrated I or II Blueprint</p>			
CALIFORNIA CONTENT STANDARDS: Biology				
1. The fundamental life processes of plants and animals depend on a variety of chemical reactions that occur in specialized areas of the organism's cells. As a basis for understanding this concept:				
a. Students <i>know</i> cells are enclosed within semipermeable membranes that regulate their interaction with their surroundings.				X
c. Students <i>know</i> how prokaryotic cells, eukaryotic cells (including those from plants and animals), and viruses differ in complexity and general structure.				X
f. Students <i>know</i> usable energy is captured from sunlight by chloroplasts and is stored through the synthesis of sugar from carbon dioxide.				

	% of Test	Number of Items	Integrated I	Integrated II
GENETICS	20	12		
CALIFORNIA CONTENT STANDARDS: Grade 7 2. A typical cell of any organism contains genetic instructions that specify its traits. Those traits may be modified by environmental influences. As a basis for understanding this concept: a. Students <i>know</i> the differences between the life cycles and reproduction methods of sexual and asexual organisms. c. Students <i>know</i> an inherited trait can be determined by one or more genes. d. Students <i>know</i> plant and animal cells contain many thousands of different genes and typically have two copies of every gene. The two copies (or alleles) of the gene may or may not be identical, and one may be dominant in determining the phenotype while the other is recessive. e. Students <i>know</i> DNA (deoxyribonucleic acid) is the genetic material of living organisms and is located in the chromosomes of each cell				
CALIFORNIA CONTENT STANDARDS: Biology				
2. Mutation and sexual reproduction lead to genetic variation in a population. As a basis for understanding this concept:				
b. Students <i>know</i> only certain cells in a multicellular organism undergo meiosis.				X
d. Students <i>know</i> new combinations of alleles may be generated in a zygote through the fusion of male and female gametes (fertilization).				
e. Students <i>know</i> why approximately half of an individual's DNA sequence comes from each parent.				X
f. Students <i>know</i> the role of chromosomes in determining an individual's sex.				X
3. A multicellular organism develops from a single zygote, and its phenotype depends on its genotype, which is established at fertilization. As a basis for understanding this concept:				
a. Students <i>know</i> how to predict the probable outcome of phenotypes in a genetic cross from the genotypes of the parents and mode of inheritance (autosomal or Xlinked, dominant or recessive).				X
5. The genetic composition of cells can be altered by incorporation of exogenous DNA into the cells. As a basis for understanding this concept:				
a. Students <i>know</i> the general structures and functions of DNA, RNA, and protein.				

	% of Test	Number of Items	Integrated I	Integrated II
PHYSIOLOGY	17	10		
CALIFORNIA CONTENT STANDARDS: Grade 7 5. The anatomy and physiology of plants and animals illustrate the complementary nature of structure and function. As a basis for understanding this concept: a. Students <i>know</i> plants and animals have levels of organization for structure and function, including cells, tissues, organs, organ systems, and the whole organism. c. Students <i>know</i> how bones and muscles work together to provide a structural framework for movement. 6. Physical principles underlie biological structures and functions. As a basis for understanding this concept: j. Students <i>know</i> that contractions of the heart generate blood pressure and that heart valves prevent backflow of blood in the circulatory system.				
CALIFORNIA CONTENT STANDARDS: Biology				
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: a. Students <i>know</i> how the complementary activity of major body systems provides cells with oxygen and nutrients and removes toxic waste products such as carbon dioxide. b. Students <i>know</i> how the nervous system mediates communication between different parts of the body and the body's interactions with the environment.				
10. Organisms have a variety of mechanisms to combat disease. As a basis for understanding the human immune response: b. Students <i>know</i> the role of antibodies in the body's response to infection. c. Students <i>know</i> how vaccination protects an individual from infectious diseases. d. Students <i>know</i> there are important differences between bacteria and viruses with respect to their requirements for growth and replication, the body's primary defenses against bacterial and viral infections, and effective treatments of these infections.				

	% of Test	Number of Items	Integrated I	Integrated II
ECOLOGY	18	11		
CALIFORNIA CONTENT STANDARDS: Grade 6 5. Organisms in ecosystems exchange energy and nutrients among themselves and with the environment. As a basis for understanding this concept: b. Students <i>know</i> matter is transferred over time from one organism to others in the food web and between organisms and the physical environment. c. Students <i>know</i> populations of organisms can be categorized by the functions they serve in an ecosystem. e. Students <i>know</i> the number and types of organisms an ecosystem can support depends on the resources available and on abiotic factors, such as quantities of light and water, a range of temperatures, and soil composition.				
CALIFORNIA CONTENT STANDARDS: Biology				
6. Stability in an ecosystem is a balance between competing effects. As a basis for understanding this concept:				
a. Students <i>know</i> biodiversity is the sum total of different kinds of organisms and is affected by alterations of habitats.			X	
b. Students <i>know</i> how to analyze changes in an ecosystem resulting from changes in climate, human activity, introduction of nonnative species, or changes in population size.			X	
c. Students <i>know</i> how fluctuations in population size in an ecosystem are determined by the relative rates of birth, immigration, emigration, and death.			X	
d. Students <i>know</i> how water, carbon, and nitrogen cycle between abiotic resources and organic matter in the ecosystem and how oxygen cycles through photosynthesis and respiration.			X	
e. Students <i>know</i> a vital part of an ecosystem is the stability of its producers and decomposers.			X	
f. Students <i>know</i> at each link in a food web some energy is stored in newly made structures but much energy is dissipated into the environment as heat. This dissipation may be represented in an energy pyramid.			X	

	% of Test	Number of Items	Integrated I	Integrated II
EVOLUTION	18	11		
Biological evolution accounts for the diversity of species developed through gradual processes over many generations. As a basis for understanding this concept:				
a. Students <i>know</i> both genetic variation and environmental factors are causes of evolution and diversity of organisms.				
b. Students <i>know</i> the reasoning used by Charles Darwin in reaching his conclusion that natural selection is the mechanism of evolution.				
c. Students <i>know</i> how independent lines of evidence from geology, fossils, and comparative anatomy provide the bases for the theory of evolution.				
CALIFORNIA CONTENT STANDARDS: Biology				
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:				
a. Students <i>know</i> why natural selection acts on the phenotype rather than the genotype of an organism.				
b. Students <i>know</i> why alleles that are lethal in a homozygous individual may be carried in a heterozygote and thus maintained in a gene pool.				
c. Students <i>know</i> new mutations are constantly being generated in a gene pool.				
d. Students <i>know</i> variation within a species increases the likelihood that at least some members of a species will survive under changed environmental conditions.				
8. Evolution is the result of genetic changes that occur in constantly changing environments. As a basis for understanding this concept:				
a. Students <i>know</i> how natural selection determines the differential survival of groups of organisms.			X	
b. Students <i>know</i> a great diversity of species increases the chance that at least some organisms survive major changes in the environment.			X	
e. Students <i>know</i> how to analyze fossil evidence with regard to biological diversity, episodic speciation, and mass extinction.			X	

	% of Test	Number of Items	Integrated I	Integrated II
INVESTIGATION AND EXPERIMENTATION	10	6		
CALIFORNIA CONTENT STANDARDS: Grade 6 7. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other four strands, students should develop their own questions and perform investigations. Students will: c. Construct appropriate graphs from data and develop qualitative statements about the relationships between variables. e. Recognize whether evidence is consistent with a proposed explanation.				
CALIFORNIA CONTENT STANDARDS: Grade 7 7. Scientific progress is made by asking meaningful questions ... c. Communicate the logical connection among hypotheses, science concepts, tests conducted, data collected, and conclusions drawn from the scientific evidence.				
CALIFORNIA CONTENT STANDARDS: Grade 8 9. Scientific progress is made by asking meaningful questions ... b. Evaluate the accuracy and reproducibility of data. c. Distinguish between variable and controlled parameters in a test.				
CALIFORNIA CONTENT STANDARDS: Grades 9-12				
1. Scientific progress is made by asking meaningful questions and conducting careful investigations. ...				
c. Identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions.			X	X
f. Distinguish between hypothesis and theory as scientific terms.			X	X
i. Analyze the locations, sequences, or time intervals that are characteristic of natural phenomena (e.g., relative ages of rocks, locations of planets over time, and succession of species in an ecosystem).			X	X
j. Recognize the issues of statistical variability and the need for controlled tests.			X	X
TOTALS	100	60		

Comments:

- 61% coverage of Integrated I and II Biology/Life Sciences Standards with Biology Standards in 10th grade NCLB Blueprint. [There is a match of 19 of 31 Biology Standards.]*
- Because Biology Standards in 10th grade NCLB test make up 57% of the test, 78% of the total standards for the 10th Grade NCLB test are addressed in Integrated Science I and II and 6th, 7th and 8th grade Standards.
- Integrated Science I and II do not address any of the area of Physiology in the Biology portion of the 10th grade NCLB test.
- Some Biology standards not addressed in Integrated Science I and II can be incorporated into a review of 7th and 8th grade standards. For example, Biology Standard 1f that is not addressed in either Integrated I or II, can be taught as part of Biology Standard 6d which is addressed in Integrated I. There are numerous other places where Biology Standards that are not components of the Integrated Science I or II Blueprint can be taught in a Chemistry or Earth Science unit or as part of a review of 7th and 8th grade Standards.

*There are 31 Biology Standards in the NCLB 10th grade Blueprint, not 30 as stated by CDE.

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