long beach unified school district

OFFICE OF CURRICULUM, INSTRUCTION, & PROFESSIONAL DEVELOPMENT

HIGH SCHOOL COURSE OUTLINE

(October 2006)

Department	Science	**Course Title**	Earth Science 1-2		**Course Code**	4008	
Abbreviation	Earth Sci 1-2	**Grade Level**	9-12	**Grad Requirement**		Yes	
Course Length	2 semesters	**Credits/Semester**	5	**Required**	X	**Elective**	
Prerequisites	None						
Articulated with LBCC	No	**Articulated with CSULB**				No	
Meets UC "a-f" Requirement	No	**Meets NCAA Requirement**				Yes	

COURSE DESCRIPTION:

Earth Science 1-2 is laboratory-based approach to the California high school Earth Science Content Standards. Students should spend approximately forty percent (40%) of their class time engaged in hands-on activities. Introductory principles of astronomy and Earth sciences will be explored, including the solar system, cosmology, plate tectonics, energy, biogeochemical cycles, the atmosphere, and California geology. Constructivist methods of teaching are employed to ensure the best possible comprehension and retention of science concepts. Science activities will be based on the California Science Content Standards as delineated in the California Science Framework and will apply the skills and techniques outlined in the Investigation and Experimentation Strand of the Content Standards. Successful completion of one year of Earth Science 1-2 meets the high school graduation requirement for physical sciences.

GOALS: (Student needs the course is intended to meet)

- Students will learn all of the California State Content Standards for high school Earth science. The use of well-designed, memorable experiences and the application of scientific knowledge and methodology are essential in helping students achieve appropriate comprehension of the content.
- Students will improve their ability to learn independently by drawing generalizations from science related articles, books, graphs, charts, and diagrams. Regular opportunities are provided for students to clearly communicate their understanding through oral and written explanations of science concepts.
- Students will study the applications of science in everyday life to inspire them to consider pursuing advanced studies in science and explore the wide variety of related career choices available.

CA CONTENT STANDARDS

Grade 9-12 Earth Sciences:

Standards without asterisks represent those that all students are expected to achieve in the course of their studies. Standards with asterisks represent those that all students should have the opportunity to learn.

Earth's Place in the Universe..... (20.0% of CST)

1. Astronomy and planetary exploration reveal the solar system's structure, scale, and change 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. (CST)
    b. the evidence from Earth and moon rocks indicates that the solar system was formed from a nebular cloud of dust and gas approximately 4.6 billion years ago. (CST)
    c. the evidence from geological studies of Earth and other planets suggest that the early Earth was very different from Earth today. (CST)
    d. the evidence indicating that the planets are much closer to Earth than the stars are. (CST)
    e. the Sun is a typical star and is powered by nuclear reactions, primarily the fusion of hydrogen to form helium. (CST)
    f. the evidence for the dramatic effects that asteroid impacts have had in shaping the surface of planets and their moons and in mass extinctions of life on Earth. (CST)
    g. the evidence for the existence of planets orbiting other stars.*
2. Earth-based and space-based astronomy reveal the structure, scale, and changes in stars, galaxies, and the universe over time. As a basis for understanding this concept, students know:
    a. the solar system is located in an outer edge of the disc-shaped Milky Way galaxy, which spans 100,000 light years. (CST)
    b. galaxies are made of billions of stars and comprise most of the visible mass of the universe. (CST)
    c. the evidence indicating that all elements with an atomic number greater than that of lithium have been formed by nuclear fusion in stars. (CST)
    d. that stars differ in their life cycles and that visual, radio, and X-ray telescopes may be used to collect data that reveal those differences. (CST)
    e.* accelerators boost subatomic particles to energy levels that simulate conditions in the stars and in the early history of the universe before stars formed.
    f.* the evidence indicating that the color, brightness, and evolution of a star are determined by a balance between gravitational collapse and nuclear fusion.
    g.* how the red-shift from distant galaxies and the cosmic background radiation provide evidence for the "big bang" model that suggests that the universe has been expanding for 10 to 20 billion years.

Dynamic Earth Processes ..... (15.0% of CST)

3. Plate tectonics operating over geologic time has changed the patterns of land, sea, and mountains on Earth's surface. As the basis for understanding this concept, students know:
    a. features of the ocean floor (magnetic patterns, age, and sea-floor topography) provide evidence of plate tectonics. (CST)
    b. the principal structures that form at the three different kinds of plate boundaries. (CST)
    c. how to explain the properties of rocks based on the physical and chemical conditions in which they formed, including plate tectonic processes. (CST)
    d. why and how earthquakes occur and the scales used to measure their intensity and magnitude. (CST)
    e. 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. (CST)
    f. 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.*

Energy in the Earth System ..... (30.0% of CST)

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. (CST)
    b. the fate of incoming solar radiation in terms of reflection, absorption, and photosynthesis. (CST)
    c. the different atmospheric gases that absorb the Earth's thermal radiation and the mechanism and significance of the greenhouse effect. (CST)
    d. the differing greenhouse conditions on Earth, Mars, and Venus; the origins of those conditions; and the climatic consequences of each.*

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 Earth results in circulation patterns in the atmosphere and oceans that globally distribute the heat. (CST)
    b. the relationship between the rotation of Earth and the circular motions of ocean currents and air in pressure centers. (CST)
    c. the origin and effects of temperature inversions. (CST)
    d. properties of ocean water, such as temperature and salinity, can be used to explain the layered structure of the oceans, the generation of horizontal and vertical ocean currents, and the geographic distribution of marine organisms. (CST)
    e. rain forests and deserts on Earth are distributed in bands at specific latitudes. (CST)
    f.* the interaction of wind patterns, ocean currents, and mountain ranges results in the global pattern of latitudinal bands of rain forests and deserts.
    g. features of the ENSO (El Niño southern oscillation) cycle in terms of sea-surface and air temperature variations across the Pacific and some climatic results of this cycle.*

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 into and out of the atmosphere. (CST)
    b. the effects on climate of latitude, elevation, topography, and proximity to large bodies of water and cold or warm ocean currents. (CST)
    c. how Earth's climate has changed over time, corresponding to changes in Earth's geography, atmospheric composition, and other factors, such as solar radiation and plate movement. (CST)
    d.* how computer models are used to predict the effects of the increase in greenhouse gases on climate for the planet as a whole and for specific regions.

Biogeochemical Cycles ..... (8.3% of CST)

7. Each element on Earth moves among reservoirs, which exist in the solid earth, in oceans, in the atmosphere, and within and among 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. (CST)
    b. 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. (CST)
    c. the movement of matter among reservoirs is driven by Earth's internal and external sources of energy. (CST)
    d. the relative residence times and flow characteristics of carbon in and out of its different reservoirs.*

Structure and Composition of the Atmosphere ..... (8.3% of CST)

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. (CST)
    b. how the composition of Earth's atmosphere has evolved over geologic time and know the effect of outgassing, the variations of carbon dioxide concentration, and the origin of atmospheric oxygen. (CST)
    c. the location of the ozone layer in the upper atmosphere, its role in absorbing ultraviolet radiation, and the way in which this layer varies both naturally and in response to human activities. (CST)

California Geology ..... (8.3% of CST)

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:
    a. the resources of major economic importance in California and their relation to California's geology. (CST)
    b. the principal natural hazards in different California regions and the geologic basis of those hazards. (CST)
    c. the importance of water to society, the origins of California's fresh water, and the relationship between supply and need. (CST)
    d.* 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.

Investigation and Experimentation ..... (10.0% of CST)

1. 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:
    a. select and use appropriate tools and technology (such as computer-linked probes, spreadsheets, and graphing calculators) to perform tests, collect data, analyze relationships, and display data. (CST)
    b. identify and communicate sources of unavoidable experimental error. (CST)
    c. identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions. (CST)
    d. formulate explanations by using logic and evidence. (CST)
    e. solve scientific problems by using quadratic equations and simple trigonometric, exponential, and logarithmic functions. (CST)
    f. distinguish between hypothesis and theory as scientific terms. (CST)
    g. recognize the usefulness and limitations of models and theories as scientific representations of reality. (CST)
    h. read and interpret topographic and geologic maps. (CST)
    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). (CST)
    j. recognize the issues of statistical variability and the need for controlled tests. (CST)
    k. recognize the cumulative nature of scientific evidence. (CST)
    l. analyze situations and solve problems that require combining and applying concepts from more than one area of science. (CST)
    m. investigate a science-based societal issue by researching the literature, analyzing data, and communicating the findings. Examples of issues include irradiation of food, cloning of animals by somatic cell nuclear transfer, choice of energy sources, and land and water use decisions in California. (CST)
    n. know that when an observation does not agree with an accepted scientific theory, the observation is sometimes mistaken or fraudulent (e. g., the Piltdown Man fossil or unidentified flying objects) and that the theory is sometimes wrong (e.g., the Ptolemaic model of the movement of the Sun, Moon, and planets). (CST)

STATE PERFORMANCE STANDARDS:

The California State Board of Education has identified the following performance levels for the California Standards Test (CST) in Earth Sciences. The objective of Long Beach Unified School District is to have all students achieve at or above the Proficient Performance Standard (Level). The table below indicates the estimated percent correct (based on 2003 LBUSD data) and the Scaled Score (SS) on the Content Standards Test.

Far Below Basic	Below Basic	Basic	Proficient	Advanced Proficient
Less than 32%	**32% - 42%**	**43% - 64%**	**65% - 79%**	**80% - 100%**
SS 150 – 276	**SS 277 – 299**	**SS 300 – 349**	**SS 350 – 392**	**SS 393 – 600**

DISTRICT PERFORMANCE STANDARDS:

The Long Beach Unified School District has common assessments and assignments that are required for Earth Science. The Performance Standard Criteria are shown in the table below. The objective is to have all students achieve at or above the Proficient Level and receive a C or better in the course. Performance level is determined by the average of the assessments or assignments.

Science Performance Standard Criteria

	Not Proficient	Partial Proficient	Proficient	Advanced Proficient
Graded Student Work	Average is a 1 or less than 60%	Average is a 2 or 60% - 69%	Average is a 3 or 70% - 84%	Average is a 4 or 85% - 100%
Standards-Based Classroom Monitoring (Formative) Assessments	Less than 60%	60% - 69%	70% - 84%	85% - 100%
Essay / Lab Report / OES / PT (6 point scale)	1-2	3	4	5-6
Essay / Lab Report / OES / PT (4 point scale)	1	2	3	4
Teacher/Department-developed Quarter, Midterm, and Final Exams	Less than 45%	45% - 59%	60% - 84%	85% - 100%
District End-Of-Course Exam	Less than 45%	45% - 59%	60% - 84%	85% - 100%

OUTLINE OF CONTENT AND RECOMMENDED TIME ALLOTMENT:

The Task Analysis and Key Vocabulary presented here are drawn from the 2003 Science Framework for California Public Schools, which defines the intent and scope of the Science Content Standards. For additional information on the context and the benchmark standards to assess, refer to the Blueprints for the Earth Science Content Standards Test (CST). Content sequencing, Labs/Demos, and time allocations are only suggestions and may be adjusted to suit school site curriculum plans, available materials, and student needs.

LABORATORY EARTH SCIENCE 1-2

Earth's Place in the Universe (Solar System)

1. Astronomy and planetary exploration reveal the solar system's structure, scale, and change over time.

Standards and Assessments "Students know…"	Task Analysis "Students are able to …"	Adopted Textbook Correlation(s)	Connections	Appx Time (per 180 days)
… 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. **(1,a)** **DISTRICT ASSESSMENTS:** OES: pending PT: pending	• Explain that the Nebula Theory is our best current model of how the solar system was formed. ° Recognize a nebula as the aftermath of a star exploding, a supernova. ° Explain that gravity pulls to the center of mass, not just "down". ° Explain how a gas nebula contracts by gravity pulling all the pieces to the middle. ° Explain that the gases begin to spin as they condense (like water going down a sink drain), heat up, and flatten out. This hypothesis is supported by observations that planetary orbits are in the same direction on the same plane. • Model how the planets form as clumps of matter collide and gather together. • Explain how the center gathers enough matter and heats up until nuclear fusion starts, forming the sun. • Construct ellipses to model orbits of planets and other objects orbiting around the sun. • Identify the components of the solar system and their orbits: ° Planets / Satellites ° Moons ° Asteroids ° Comets • Construct a scaled model of the solar system labeling orbital distances in km, AU, and light-minutes or hours.	**Glen ES**, Ch 24:1 PH ES ('97), Ch 3:1,2,3 PH ES ('93), Ch 3:1,3,4	***KEY VOCABULARY:*** gravity, force, massive, inertia, density, nebula, solar, fusion, condensation, vacuum, revolve, orbit, elliptical, radius, planet, satellite, moon, asteroid, comet, terrestrial, gas, solar wind, light speed, light hour, astronomical unit ***SKILLS FOCUS:*** Model, Analyze Formulate explanations by using logic and evidence. **(I&E 1.d)** ***LABS / DEMOS:*** • **Nebula Clay Activity** Small pieces of circular clay are placed on desk and the students rub their hand over them simulating formations of heavenly bodies. (As more clay sticks together, larger pieces collect more clay simulating larger pull of gravity.) • **Scaled Model of the Solar System Activity** Use diameters: Sun 1m, Mercury 3.4mm, Venus 1 cm, Earth 1 cm, etc… Have students calculate the diameters (in km) and distances (in km, AU, and light minutes or hours), and then demonstrate the distances on a football field. (Refer to Glen ES, p 726-7; PH ES ('97), p 104; PH ES ('93), p 74) • **Science Online** Glen ES, p 675 • **Activity – Planetary Orbits** Glen ES, p 707 • **Mini Lab – Modeling Planets** Glen ES, p 716 • **Elipses – Discovering Activity** PH ES ('97), p 96 or p 777 • **Doing Act. – Solar System IQ** PH ES ('97), TE, p 124 • **Measuring the Diameter of the Sun** PH ES ('93), Lab. Manual, p 37-40 • **Characteristics of Elliptical Orbits** PH ES ('93), Lab. Manual, p 41-44	4 Days

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… the evidence from Earth and moon rocks indicates that the solar system was formed from a nebular cloud of dust and gas approximately 4.6 billion years ago. **(1,b)** **DISTRICT ASSESSMENTS:** OES: pending PT: pending	• Describe how scientists date objects using indirect relative (superposition) and absolute dating (using radioactive decay as a "clock" to the past). • Explain why relative dating methods are insufficient to identify actual dates for events in the deep past. • Recall that radioactive dating of rock samples from Earth, the Moon, and meteoroids indicate that the solar system formed from a nebula (a cloud of gas and debris) about 4.6 billion years ago. • Explain that the nebula that formed into the solar system was composed primarily of hydrogen and helium formed during the big bang. • Explain why the presence of heavier elements indicates that the supernova of an ancient star must have formed the nebula from which our solar system developed. • Create a method to model how the solar wind at the ignition of the Sun blew most the lighter gases to the outer parts of the solar system, so that outer planets are condensations of lighter elements.	**Glen ES**, Ch 13:3 PH ES ('97), Ch 3:1, 19:2, & 20:1,3 PH ES ('93), Ch's 3:1, 20:1,3 & 21:1	***KEY VOCABULARY:*** radioactive decay absolute dating half-life radiation isotopes relative dating sedimentary layers superposition fossil meteorites billion planet collapse impact theory supernova ***SKILLS FOCUS:*** Deduct, Differentiate 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). **(I&E 1.i)** Recognize the cumulative nature of scientific evidence. **(I&E 1.k)** ***LABS / DEMOS:*** • **Mini Lab: Modeling Carbon-14 Dating** Glen ES, p 384 • **Calculating Activity** PH ES ('97), p 601 • **Sharpen Your Skills** PH ES ('93), p 525 • **Solar Wind Blowing Gases into Deep Space Activity** Blow on some dry dirt and note how the heavier pieces stay close to the blower (representing the Sun's fusion lighting up) as the lighter (gas-like pieces) blow further out. Relate this to the differences between inner and outer planets.	4 Days

Earth's Place in the Universe (Solar System)

1. Astronomy and planetary exploration reveal the solar system's structure, scale, and change over time.

Standards and Assessments "Students know…"	Task Analysis "Students are able to …"	Adopted Textbook Correlation(s)	Connections	Appx Time (per 180 days)
…the evidence from geological studies of Earth and other planets suggest that the early Earth was very different from Earth today. **(1,c)** **DISTRICT ASSESSMENTS:** OES: pending PT: pending	• Describe how the planet Earth accumulated more mass as debris and planetoids collided and joined. • Explain how density caused heavier elements like iron to sink towards the center of the earth and lighter elements to rise to the surface. • Recall how the Earth has been slowly cooling since its formation and formed into layers: ° Atmosphere – low density gases ° Hydrosphere – water ° Crust ° Mantle ° Core • Cite evidence that reveals that early earth was different from today in distribution of water, composition of the atmosphere, and the shapes, sizes, and positions of landmasses. • Restate that the oldest fossils are of anaerobic organisms, which were established 3.5 billion years ago. • Explain how continents have differentiated through the partial melting of rocks, with the lightest portions floating to the top. • Explain how the inclusion of iron oxide (rust) in "banded iron formations" indicates that the atmosphere gained enough oxygen for multicellular, aerobic organisms to flourish between one and three billion years ago.	**Glen ES**, Ch 14:1,2 PH ES ('97), Ch 5:2, & 12:1-3 PH ES ('93), Ch 12:1, 11:1, & 8:1-3	***KEY VOCABULARY:*** atmosphere, hydrosphere, crust, mantle, core, lithosphere, composition, ozone, magnetosphere, dissolve, geologic, continents, multicellular, anaerobic, convection ***SKILLS FOCUS:*** Infer, Interpret, Compare Distinguish between hypothesis and theory as scientific terms. **(I&E 1.f)** ***LABS / DEMOS:*** • **Density Demos** Container of three different types of liquids (shake) Container of 3 different types of solids (shake) • **Density Inquiry Activity** Have students place wax on water and then drill hole into it, make observations, try to make it sink. • **Buoyancy Predictions** Students make predictions on the buoyancy of different objects of the same size based on the mass of the objects. Predict and then measure the mass of the same volume of water. Use this to justify buoyancy observations. • **Determining Density** Glen ES, p 52 • **Index Fossils** Glen ES, TE, p 373 PH ES (97), Writing Activity: p 596 PH ES ('93), p 515 Students research Index Fossils in cross sections of sedimentary rock layers and determine the relative age of the fossil and the environmental conditions necessary to sustain the organism. • **Going to Rust** Students investigate or research why iron turns to rust.	5 Days

Earth's Place in the Universe (Solar System)

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Standards and Assessments "Students know…"	Task Analysis "Students are able to …"	Adopted Textbook Correlation(s)	Connections	Appx Time (per 180 days)
…the evidence indicating that the planets are much closer to Earth than the stars are. **(1,d)** **DISTRICT ASSESSMENTS:** OES: pending PT: pending	• Describe how to determine that the planets in the solar system are closer than the stars. • Draw and label the visible electromagnetic spectrum. • Describe the Doppler Effect. ° Recall instances where sounds of cars, sirens, radios, etc. changed in pitch as they moved past. ° Diagram and explain how the motion of a source of waves affects wavelengths. ° Diagram a specific example of how the Doppler Effect explains the change in pitch heard in one of the instances cited above. ° Show the application of the same principles in light waves to explain why blue and red shifts indicate if an object in space is moving toward us or away from us.	**Glen ES**, Ch 25:4 PH ES ('97), Ch 2:2 PH ES ('93), Ch 2:1	***KEY VOCABULARY:*** wavelength, frequency, spectrum, Doppler Effect, Doppler radar, red shift, blue shift, expansion, diameter, angle, parallax, trigonometry, extragalactic, Inverse Square Law ***SKILLS FOCUS:*** Differentiate, Measure Solve scientific problems by using quadratic equations and simple trigonometric, exponential, and logarithmic functions. **(I&E 1.e)** ***LABS / DEMOS:*** • **Doppler Demos** Take students to a busy road and have them listen to the sounds that cars make as they pass. Take a vacuum hose and twirl it above your head and listen to the sound (pitch) changes. Draw a before, during, and after diagram of a car with a siren passing a person. Draw the sound waves path to the persons ear and associate those changes to the blue or red shift. Students are given 2 "slinky"s and asked to hold one end (student in the middle holds two ends). Student in the middle makes a wave pulse. Then repeat this while jumping toward one of the other students to model how motion of the source alters the waves. • **Thinking Activity: "Red or Blue Shift?"** PH ES ('97), p 60 • **Sharpen Your Skills: "Red or Blue Shift?"** PH ES ('93), p 34 • **Parallax Book Activity** Glen ES, pp 758-759 PH ES ('97), p 71 • **Quick Demo: Absolute & Apparent Magnitudes** Glen ES, TE, p 25 • **Discovering Activity: "Absolutely Apparent"** PH ES ('93), p 69 • **Sharpen Your Skills: "Comparing Absolute Magnitude with Apparent Magnitude"** PH ES ('93), p 48	5 Days

Earth's Place in the Universe (Solar System)

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Standards and Assessments "Students know…"	Task Analysis "Students are able to …"	Adopted Textbook Correlation(s)	Connections	Appx Time (per 180 days)
… the Sun is a typical star and is powered by nuclear reactions, primarily the fusion of hydrogen to form helium. **(1,e)** **DISTRICT ASSESSMENTS:** OES: pending PT: pending	• Define fusion (nucleosynthesis) in their own words. • Explain how very high temperatures (particles moving fast) and pressures (particles packed close together) are needed to combine nuclei. • Show how scientists compare and contrast spectra from different stars to determine what elements are present. • Explain that the Sun is composed mainly of hydrogen, and helium fused from hydrogen nuclei. • Explain that only nuclear reactions can account for the enormous energy output (luminosity) of the Sun. • Explain how four hydrogen atoms come together to form 1 helium atom, releasing huge amounts of energy. The Sequence of fusion reactions in the sun occur as follows: **1st:** $_1{}^1H + {}_1{}^1H \rightarrow {}_1{}^2H$ **2nd:** $_1{}^1H + {}_1{}^2H \rightarrow {}_2{}^3He$ **3rd:** $_2{}^3He + {}_2{}^3He \rightarrow {}_2{}^4He + {}_1{}^1H + {}_1{}^1H$ A large amount of energy is produced each time a new, larger nucleus is formed as tiny portion of matter is converted to energy according to Einstein's equation, $E=mc^2$ (Energy = mass x speed of light squared). • Diagram how fusion in stars creates heavier elements, up to iron.	**Glen ES**, Ch 25:2,5 & 5:1 PH ES ('97), Ch 21:4 & 2:4 PH ES ('93), Ch 2:1 & 3:2	***KEY VOCABULARY:*** atom, elements, pressure, nuclear reaction, fusion, nucleosynthesis, abundant, energy, luminosity, sunspot ***SKILLS FOCUS:*** Diagram, Balance Equations Formulate explanations by using logic and evidence. **(I&E 1.d)** ***LABS / DEMOS:*** • **Spectroscope Activity** Use diffraction gratings to observe hydrogen, neon, mercury, sodium, and other elemental light sources to show the quantum energy "fingerprints" produced by various elements. • **Make a Model: Fusion** Glen ES, TE, p 748	5 Days

Earth's Place in the Universe (Solar System)

1. Astronomy and planetary exploration reveal the solar system's structure, scale, and change over time.

Standards and Assessments "Students know…"	Task Analysis "Students are able to …"	Adopted Textbook Correlation(s)	Connections	Appx Time (per 180 days)
… the evidence for the dramatic effects that asteroid impacts have had in shaping the surface of planets and their moons and in mass extinctions of life on Earth. **(1,f)** **DISTRICT ASSESSMENTS:** OES: pending PT: pending	• Define what an asteroid is. • Describe how craters are created on heavenly bodies by impact asteroids. • Explain why the Moon and Mercury have many more visible craters than the earth. • Describe how active recycling has a role in reshaping the earth's surface. • Describe how the iridium-rich layer of rock found between the Cretaceous and Tertiary periods could possibly explain the extinction of the dinosaurs. • Predict what would occur from a large asteroid impact with the Earth.	**Glen ES**, Ch 4:3 & 23:2,3 PH ES ('97), Ch 17:3 PH ES ('93), Ch 4:3 & 3:4	***KEY VOCABULARY:*** extinction, crater, impact, asteroid, debris, collision, velocity, iridium, energy, heavenly body, active recycling, cretaceous, tertiary, superposition ***SKILLS FOCUS:*** Analyze, Predict, Model Distinguish between hypothesis and theory as scientific terms. **(I&E 1.f)** ***LABS / DEMOS:*** • **Creating Craters** Drop marbles of different masses and sizes at different velocities into soft clay or flour to observe the impact results. Use observations to inform predictions about major asteroid or comet impacts with the Earth, past and future.	3 Days
… the evidence for the existence of planets orbiting other stars. ***(1,g*)*** **DISTRICT ASSESSMENTS:** OES: pending PT: pending	• *Demonstrate different ways to change the intensity of light seen from a steady light source.* • *Create (or generate using computer sensors) logical graphs showing the variation of light intensity created by the methods used above.* • *Observe photo and graphical evidence acquired by scientists to prove the existence of planets orbiting hundreds of other stars.* • *Explain why most stars with planets orbiting them would not be visible to us using the technique modeled above.*	**Glen ES**, no reference PH ES ('97), no ref PH ES ('93), no ref	***KEY VOCABULARY:*** oscillation, intensity ***SKILLS FOCUS:*** Brainstorm, Model, Graph Select and use appropriate tools and technology (such as computer-linked probes, spreadsheets, and graphing calculators) to perform tests, collect data, analyze relationships, and display data. **(I&E 1.a)** ***LABS / DEMOS:*** **Pictures and support can be found on the following websites.** **Harvard Center for Astrophysics:** http://cfa-www.harvard.edu/planets http://cfa-www.harvard.edu/afoe.espd.html **Planetary Science Institute:** http://www.psi.edu/~esquerdo/asp/transit.jpg http://www.psi.edu/~esquerdo/asp/vardepth.jpg	3 Days

Earth's Place in the Universe (Stars, Galaxies, and the Universe)

2. Earth-based and space-based astronomy reveal the structure, scale, and changes in stars, galaxies, and the universe over time.

Standards and Assessments "Students know…"	Task Analysis "Students are able to …"	Adopted Textbook Correlation(s)	Connections	Appx Time (per 180 days)
… the solar system is located in an outer edge of the disc-shaped Milky Way galaxy, which spans 100,000 light years. **(2,a)** **DISTRICT ASSESSMENTS:** OES: pending PT: pending	• Explain that the solar system is one star system in a much larger system of a billion stars called the Milky Way galaxy. • Draw the basic shape of the Milky Way from "side view" and "top view" perspectives, showing that it is a spiral galaxy. ° Label the edge-to-edge distance of the Milky Way as 100,000 light years. ° Locate the approximate position of the solar system within the Milky Way. ° Explain how our position within the Milky Way determines how stars appear to us at night. ° *Convert distances from light years to astronomic units and/or kilometers to show the utility of measuring in large units (optional).*	**Glen ES**, Ch 24:1 & 25:1,2,4 PH ES ('97), Ch 2:1-3 PH ES ('93), Ch 2:1,2 & 3:1	***KEY VOCABULARY:*** solar system, constellation, magnitude, photosphere, chromosphere, corona, sunspot, galaxy, big bang ***SKILLS FOCUS:*** Visualize 3-D Perspective Recognize the cumulative nature of scientific evidence. **(I&E 1.k)** ***LABS / DEMOS:*** • **Problem Solving: "Are Distance and Brightness Related?"** Glen ES, p 738 • **Measuring Parallax** Glen ES, p 758 • **Designer Constellations** PH ES ('97), p 50 • **Activity:** PH ES ('93), p.	2 Days
… galaxies are made of billions of stars and comprise most of the visible mass of the universe. **(2,b)** **DISTRICT ASSESSMENTS:** OES: pending PT: pending	• Explain that the visible universe consists of stars found by the billions in galaxies. • Explain that there are billions of galaxies in the universe separated from each other by great distances and are found in groups of varying numbers called clusters. • Explain that scientists catalog galaxies and stars according to their coordinate location in the sky, their brightness, temperature, color, and other physical characteristics. • Explain that most of the visible matter in the universe is found in stars. • Explain that most matter in the universe is invisible (sometimes called "dark matter"), which is inferred from the effect of its gravity on visible matter.	**Glen ES**, Ch 25:4 PH ES ('97), Ch 2:1 PH ES ('93), Ch 2:3,4	***KEY VOCABULARY:*** galaxy, big bang, cluster, light year, Doppler shift, dark matter ***SKILLS FOCUS:*** Classify, Compare Recognize the usefulness and limitations of models and theories as scientific representations of reality. **(I&E 1.g)** ***LABS / DEMOS:*** • **Spiral Galaxies** http://www.nasa.gov/missions/science/f_chandra010703.html • **How and Why Galaxies Collide!** http://herschel.jpl.nasa.gov/science/galaxies03.html • **Image of Dark Matter!** http://www.bell-labs.com/org/physicalsciences/projects/darkmatter/darkmatter.html • **Brief History about Studies about Dark Matter** http://www.astro.ucla.edu/~agm/darkmtr.html	2 Days

Earth's Place in the Universe (Stars, Galaxies, and the Universe)

2. Earth-based and space-based astronomy reveal the structure, scale, and changes in stars, galaxies, and the universe over time.

Standards and Assessments "Students know…"	Task Analysis "Students are able to …"	Adopted Textbook Correlation(s)	Connections	Appx Time (per 180 days)
…the evidence indicating that all elements with an atomic number greater than that of lithium have been formed by nuclear fusion in stars. **(2,c)** **DISTRICT ASSESSMENTS:** OES: pending PT: pending	• Define nucleosynthesis as the fusion of two or more atomic nuclei to form a larger nucleus. ° Recall that atomic nuclei are positive and naturally repel each other. ° Explain why very high speeds are needed overcome the natural repulsion of nuclei so that they can collide and fuse. ° Define high temperature as fast motion at the atomic level. ° Explain that fusion requires very high temperatures found only in the cores of stars, research particle accelerators, or hydrogen bombs. • Recall that hydrogen, helium, and lithium (atomic numbers 1, 2, and 3) are believed to be the only elements formed during the big bang. • Explain that the heavy elements were created by the fusion of light elements. • Explain that all elements heavier than lithium must have been formed by fusion reactions in the cores of stars. • Explain that elements heavier than iron needed the extreme conditions of a supernova to form.	**Glen ES**, Ch 2:1 & 25:2,3 PH ES ('97), Ch 2:3 & 21:4 PH ES ('93), Ch 2:4	***KEY VOCABULARY:*** temperature pressure core nucleus particle accelerator ***SKILLS FOCUS:*** Justify Recognize the usefulness and limitations of models and theories as scientific representations of reality. **(I&E 1.g)** ***LABS / DEMOS:*** • **Searching for Elements** Glen ES, p 35 • **Spectral Analysis** Glen ES, Ch 25 Resources, p 13 **Light Elements and the Big Bang:** http://map.gsfc.nasa.gov/m_uni/uni_101bbtest2.html	4 Days

Earth's Place in the Universe (Stars, Galaxies, and the Universe)

2. Earth-based and space-based astronomy reveal the structure, scale, and changes in stars, galaxies, and the universe over time.

Standards and Assessments "Students know…"	Task Analysis "Students are able to …"	Adopted Textbook Correlation(s)	Connections	Appx Time (per 180 days)
…that stars differ in their life cycles and that visual, radio, and X-ray telescopes may be used to collect data that reveal those differences. **(2,d)** **DISTRICT ASSESSMENTS:** OES: pending PT: pending	• Explain that stars differ in size, color, chemical composition, surface gravity, and temperature. • Recall the visible and invisible types of electromagnetic radiation. • Show what scientists can learn about the characteristics of stars by studying radiation such as x-rays and radio waves. • Connect hands-on experience with a simple spectroscope to the way scientists separate and study visible and invisible light (electromagnetic radiation) to study the composition and behavior of stars. • Explain that stars go through a "life cycle" during which they are "born" (begin fusion) and eventually "die" (fusion ends as small, fusible nuclei are used up). • Show how the Hertzsprung-Russell (H-R) Diagram classifies stars according to temperature and luminosity, from which they can infer star processes and age.	**Glen ES**, Ch 25:1,3 PH ES ('97), Ch 2:5 PH ES ('93), Ch 2:3,4	***KEY VOCABULARY:*** nebula — main sequence white dwarf — radio telescope neutron star — x-ray telescope giant — reflecting telescope supergiant — refracting telescope black hole — constellation electromagnetic spectrum ***SKILLS FOCUS:*** Classify, Read Graphs Formulate explanations by using logic and evidence. **(I&E 1.d)** ***LABS / DEMOS:*** • **"Star Search"** Given temperatures and corresponding magnitude numbers (use the sun = 1, for reference), have students identify the type of star and predict what the future holds for that star. (Refer to H-R diagram on Glen ES, p 746; PH ES ('97), p 70; PH ES ('93), p 49) • **Distance & Brightness of Stars** Glen ES, p 738 • **Absolute and Apparent Magnitudes** Glen ES, Ch 25 Resources, p 9 **Class Activity: Life Cycle of a Star** http://students.itec.sfsu.edu/edad728/stargaze.html/project.html **Life Cycle of Stars with a Chart:** http://www.enchantedlearning.com/subjects/astronomy/stars/lifecycle/ **Activities on Life Cycles of Stars:** http://btc.montana.edu/ceres/html/stars1.html#activity2 **Evolution and Death of Stars:** http://observe.arc.nasa.gov/nasa/space/stellardeath/stellardeath_intro.html **How to Build a Spectroscope:** http://www.exploratorium.edu/spectroscope/ **How Hot is That Star?:** http://cse.ssl.berkeley.edu/SegwayEd/lessons/StarTemp/student.htm	4 Days

Earth's Place in the Universe (Stars, Galaxies, and the Universe)

2. Earth-based and space-based astronomy reveal the structure, scale, and changes in stars, galaxies, and the universe over time.

Standards and Assessments "Students know…"	Task Analysis "Students are able to …"	Adopted Textbook Correlation(s)	Connections	Appx Time (per 180 days)
… the evidence indicating that the color, brightness, and evolution of a star are determined by a balance between gravitational collapse and nuclear fusion. ***(2,f*)*** **DISTRICT ASSESSMENTS:** OES: pending PT: pending	• *Explain that temperature is the measure of the underlying energy of a system (how fast the particles are moving, on average).* • *Explain that thermal energy can be radiated away into space as electromagnetic radiation including visible light.* • *Explain that as surface temperature of a star increases, the spectrum of radiation shifts towards higher energy, shorter wavelengths (blue or violet).* • *Conclude that a blue-white star is hotter than a red star.* • *Explain that stars are so hot that nuclei and electrons bounce around independently – a state of matter known as plasma.* • *Explain that gravity acts to collapse the hot plasma of the Sun.* • *Explain that the energy released by nuclear fusion in the core of a star creates an outward, expansion force that counteracts the gravitational force and prevents the collapse of the stellar core.*	**Glen ES**, Ch 25:1-3 PH ES ('97), Ch 2:3-5 PH ES ('93), Ch 2:1	***KEY VOCABULARY:*** thermal energy — spectrum radiation — wave length plasma — collapse expansion ***SKILLS FOCUS:*** Infer, Conclude Formulate explanations by using logic and evidence. **(I&E 1.d)** ***LABS / DEMOS:*** • **Energy Balance Diagram** Diagram a cutaway view of the Sun showing its structure, and labeling the direction of heat energy transfer. Also, indicate how the expansion force created by the heat of the core is balanced by the gravity force holding the star together. • **Interpreting Diagrams: "Critical Thinking" question 3** PH ES ('97), p 89	4 Days

… how the red-shift from distant galaxies and the cosmic background radiation provide evidence for the "big bang" model that suggests that the universe has been expanding for 10 to 20 billion years. ***(2,g*)***
 	
DISTRICT ASSESSMENTS:
OES: pending
PT: pending
	• *Explain that the "big bang" theory is the most accepted explanation for the origin of the universe.*
	  ° *Explain that according to the big bang theory, the universe began as a point about 10 to 20 billion years ago.*
	  ° *This point underwent an enormous explosion, from which matter, energy, and space itself have been expanding ever since.*
	• *Explain, as a review, the Doppler effect as it applies to electromagnetic radiation.*
	• *Analyze the significance of the red shift as it applies to distant galaxies.*
		Glen ES, Ch 25:4
		
		PH ES ('97), Ch 2:2
		PH ES ('93), Ch 2:1
			KEY VOCABULARY:
			universe — background
			expand
			
			SKILLS FOCUS:
			Distinguish between hypothesis and theory as scientific terms. **(I&E 1.f)**
			
			LABS / DEMOS:
			• **Balloon Universe** Draw dots on a half-filled balloon. Note how the dots all become farther apart as the balloon is blown up (expanded), in the same way that galaxies are moving farther away from each other according to red shift evidence.
			
			The Big Bang:
			http://www.tufts.edu/as/wright_center/cosmic_evolution/docs/splash.html
				3 Days

Dynamic Earth Processes

3. Plate tectonics operating over geologic time has changed the patterns of land, sea, and mountains on Earth's surface.

Standards and Assessments "Students know…"	Task Analysis "Students are able to …"	Adopted Textbook Correlation(s)	Connections	Appx Time (per 180 days)
…features of the ocean floor (magnetic patterns, age, and sea-floor topography) provide evidence of plate tectonics. **(3,a)** **DISTRICT ASSESSMENTS:** OES: pending PT: pending	• Identify seafloor topographic features (midocean ridges volcanoes, rift valleys, seamounts, etc.). • Relate the topographic features to one another and to the geologic forces that formed them. • Explain that the midocean ridge system is the longest topographic feature on Earth and that it provides some of the best evidence for continental drift. ° Recall that absolute dating shows that the ridge is made of the youngest rock on the ocean floor. ° Explain why as you move away from the ridge, on either side, the rock becomes older, the sediment covering the rock thickens, and the fossils found in the sediment are progressively older. ° Explain that the Earth's magnetic field is recorded in the ocean floor rock as they cool from lava. ° *Describe how scientists detect the magnetic bands by looking at the total magnetic field near the rocks. In areas where the Earth's magnetic field and the rock's magnetic field align, the total field is strong. Where the rock's field opposes the Earth's magnetic field, the total magnetic field measured is low.* ° Create a model to explain how alternating magnetic bands on both sides of the midocean ridge help support the plate tectonic theory. • Illustrate how the process of continental drift is driven by the convection of the mantle and asthenosphere. • Describe the convective cycle where the youngest rock is being formed at the midocean ridges and the oldest rock is returned to the mantle at deep ocean trenches and subduction zones.	**Glen ES**, Ch 10:2 & 19:1 PH ES ('97), Ch 6:3,5 12:2,3 PH ES ('93), Ch 11:3 19:2,3 & 23:1	***KEY VOCABULARY:*** continental drift, midocean ridge, plate tectonics, polarity, topography, composition, sea-floor spreading, convective cycle, convection, mantle, asthenosphere ***SKILLS FOCUS:*** Model, Justify Formulate explanations by using logic and evidence. **(I&E 1.d)** ***LABS / DEMOS:*** • **Make a Model (Sea Floor Spreading)** Glen ES, TE, p 290 • **Activity: Mapping the Ocean Floor** Glen ES, p 556 • **Mini Lab: Modeling the Mid-Atlantic Ridge** Glen ES, p 553 • **Doing Activity: Ocean Floor Model** PH ES ('97), p 221 • **Discovering Activity: Give it a Spin** PH ES ('97), p 382 • **Sharpen Your Skills: Plate Tectonics** PH ES ('93), p 488	4 Days

Dynamic Earth Processes

3. Plate tectonics operating over geologic time has changed the patterns of land, sea, and mountains on Earth's surface.

Standards and Assessments "Students know…"	Task Analysis "Students are able to …"	Adopted Textbook Correlation(s)	Connections	Appx Time (per 180 days)
…the principal structures that form at the three different kinds of plate boundaries. **(3,b)** **DISTRICT ASSESSMENTS:** OES: pending PT: pending	• Define and model the three types of plate boundary interactions (convergent boundaries, divergent boundaries, and transform (also known as parallel slip or strike slip) boundaries). • Describe specific topographical features caused by the interactions at plate boundaries (trenches, rift valleys, mountain ranges, volcanoes). • Illustrate the different results that may occur at a convergent boundary when two different density plates collide and when two similar density plates collide, citing specific examples. • Locate the San Andreas Fault on a map and identify which parts of California and Mexico are on the Pacific Plate and which are on the North American Plate. • Identify evidence of plate interactions on maps or geographic globes.	**Glen ES**, Ch 10:2,3 & 11:1 PH ES ('97), 12:3 PH ES ('93), 19:3	***KEY VOCABULARY:*** boundary, plates, convergent, lithosphere, subduction, trench, divergent, rift valley, transform boundary, fault (a.k.a. parallel slip or strike slip boundary) ***SKILLS FOCUS:*** Illustrate Read and interpret topographic and geologic maps. **(I&E 1.h)** ***LABS / DEMOS:*** • **Activity (Expert Groups)** Glen ES, TE, p 290 • **Make a Model** Glen ES, TE, p 291 • **Discovering Activity: Slipping Away** PH ES ('97), p 384 • **Sharpen Your Skills: Traveling Cities** PH ES ('93), p 487 • **Sharpen Your Skills: Prefixes** PH ES ('93), p 489	4 Days

Dynamic Earth Processes

3. Plate tectonics operating over geologic time has changed the patterns of land, sea, and mountains on Earth's surface.

Standards and Assessments "Students know…"	Task Analysis "Students are able to …"	Adopted Textbook Correlation(s)	Connections	Appx Time (per 180 days)

… how to explain the properties of rocks based on the physical and chemical conditions in which they formed, including plate tectonic processes. **(3,c)**
 	
DISTRICT ASSESSMENTS:
OES: pending
PT: pending
	• Explain that rocks are classified according to chemical composition and texture.
	• Describe how rock characteristics tell the history of processes the rock has been through.
	  ° Explain why composition tells what chemicals were present when the rock formed.
	  ° Explain how texture indicates the pressure and temperature conditions the rock has experienced.
	  ° Identify textures common to igneous, sedimentary, and metamorphic rocks.
	• Describe the processes involved in the rock cycle citing where and how these processes occur.
	• Explain how plate tectonic subduction and uplift processes affect the distribution and characteristics of rocks.
		Glen ES, Ch 4:1-4 (3:1 & 13:2,3 somewhat)
		
		PH ES ('97), Ch 13:4-7 (and 13:2 somewhat)
		PH ES ('93), Ch 7:1-4 (and 6:1 somewhat)
			KEY VOCABULARY:
			rock, igneous rock, lava, basaltic, granitic, intrusive, extrusive, foliated, metamorphic rock, non-foliated, sediment, sedimentary rock, compaction, cementation, superposition, unconformity, relative age
			
			SKILLS FOCUS:
			Classify, Compare and Contrast
			
			Analyze the locations, sequences, or time intervals that are characteristic of natural phenomena. **(I&E 1.i)**
			
			LABS / DEMOS:
			• **Activity: Travel Brochure to Famous Geologic Formations** Glen ES, TE, p 92
			• **Extension: Collect / Identify Rocks in the Community** Glen ES, TE, p 96
			• **Discovering Activity: Rock Around the Town** PH ES ('97), p 413
			• **Discovering Activity: Between a Rock and a Hard Place** PH ES ('97), p 427
			• **Sharpen Your Skills: Sedimentation** PH ES ('93), p 178
			• **Sharpen Your Skills: Famous Rock Formations** PH ES ('93), p 182
				5 Days

Dynamic Earth Processes

3. Plate tectonics operating over geologic time has changed the patterns of land, sea, and mountains on Earth's surface.

Standards and Assessments "Students know…"	Task Analysis "Students are able to …"	Adopted Textbook Correlation(s)	Connections	Appx Time (per 180 days)
… why and how earthquakes occur and the scales used to measure their intensity and magnitude. **(3,d)** **DISTRICT ASSESSMENTS:** OES: pending PT: pending	• Describe and model how earthquakes occur when plate tectonic pressures overcome frictional forces and release the energy stored as elastic strain. • Explain that the magnitude of earthquakes depends on the amount of energy released. • Explain the logarithmic nature of the Richter magnitude scale means that 7.0 earthquake has ten times greater amplitude (ground movement) than a 6.0 earthquake. An 8.0 earthquake would a hundred times more amplitude than a 6.0 earthquake. • Apply the modified Mercalli scale to (subjectively) determine earthquake magnitude based on the effects observed. • *Explain how earthquake energy travels in fast-moving Primary, P (compression), and slower-moving Secondary, S (transverse) seismic waves. (LBUSD)* • *Apply the speed differences between P and S waves to triangulate an earthquake epicenter. (LBUSD)*	**Glen ES**, Ch. 11:1-3 PH ES ('97), 10:1 & 11:1,3 PH ES ('93), 17:1,2 & 18:1	***KEY VOCABULARY:*** normal fault reverse fault strike-slip fault seismic waves focus primary wave secondary wave surface wave epicenter seismograph magnitude liquefaction tsunami ***SKILLS FOCUS:*** Read Graphs, Measure, Model Select and use appropriate tools and technology to perform tests, collect data, analyze relationships, and display data. **(I&E 1.a)** ***LABS / DEMOS:*** • **Seismic Mapping** Have students monitor daily seismic activity from the United States Geological Survey (USGS) website and design a way to display the information on a map and/or graphically. • ***Epicenter Triangulation*** *Create theoretical P and S wave data for three different hypothetical seismic stations and have students use triangulation to locate the epicenter on a map.* • **Activity: Stressing Taffy** Glen ES, TE, p 306 • **Activity: Slinky Seismic Waves** Glen ES, TE, p 310	5 Days

Dynamic Earth Processes

3. Plate tectonics operating over geologic time has changed the patterns of land, sea, and mountains on Earth's surface.

Standards and Assessments "Students know…"	Task Analysis "Students are able to …"	Adopted Textbook Correlation(s)	Connections	Appx Time (per 180 days)
… 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. **(3,e)** **DISTRICT ASSESSMENTS:** OES: pending PT: pending	• Describe and explain the characteristics of volcanoes with high viscosity lava. ° Identify low temperature, silica-rich lava as very viscous. ° Explain that viscous lava traps gases until pressures build up enough to produce explosive eruptions. ° Explain that explosive eruptions scatter tephra (ash and volcanic fragments) widely. ° Describe or model how viscous lava flows poorly and therefore piles up into steep-sided volcanoes. • Describe and explain the characteristics of volcanoes with low viscosity lava. ° Identify high temperature, iron-rich lava as being very fluid. ° Explain that fluid lava allows gases to easily escape, without building up pressure. ° Describe or model how fluid lava flows well and therefore builds gently sloping shield volcanoes.	**Glen ES**, Ch. 12:1-3 PH ES ('97), Ch 11:2,3 PH ES ('93), Ch 18:2,3	***KEY VOCABULARY:*** viscosity (n.) viscous (adj.) fluid (adj.) lava volcano shield volcano cinder cone volcano composite volcano hot spot vent crater ash tephra ***SKILLS FOCUS:*** Modeling, Contrasting Formulate explanations by using logic and evidence. **(I&E 1.d)** ***LABS / DEMOS:*** • **Viscosity Demo** Have identical, sealed jars filled with colored, transparent liquids of different viscosities. (i.e., water, mineral oil, liquid soap and honey). Leave a little space for air. Invert the jars to show how the movement of gas is impeded by high viscosity. • **Mini (Home) Lab: Modeling Magma Movement** Glen ES, p 338 • **Mini Lab: Modeling Volcanic Cones** Glen ES, p 344 • **Activity: Identifying Types of Volcanoes** Glen ES, p 348 • **Activity – Design Your Own Experiment: How Do Calderas Form?** Glen ES, p 354 **Types of Volcanoes:** http://volcano.und.nodak.edu/vwdocs/vwlessons/volcano_types/index.html	3 Days

Dynamic Earth Processes

3. Plate tectonics operating over geologic time has changed the patterns of land, sea, and mountains on Earth's surface.

Standards and Assessments "Students know…"	Task Analysis "Students are able to …"	Adopted Textbook Correlation(s)	Connections	Appx Time (per 180 days)
… 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. ***(3,f*)*** **DISTRICT ASSESSMENTS:** OES: pending PT: pending	• *Recall that rocks from the upper crust are high in silica content (granitic).* • *Explain that subduction zones that cause upper crustal rocks to melt form volcanoes in which violent eruptions are common.* • *Recall that rocks from the lower crust are high in iron content (basaltic).* • *Explain that where lower crustal rocks melt, such as at midocean spreading zones, quiet, fluid eruptions are common.* • *Explain how long-lived hot spots deep in the mantle heat magma that can rise up through the crust to create volcanoes.* • *Explain that the type of crustal rock that gets melted into the rising magma determines whether it will erupt quietly (as in Hawaii) or explosively (as at the Yellowstone Caldera Complex).* • *Describe how the Hawaiian Islands provide proof for the theory of plate tectonics.*	**Glen ES**, Ch. 12:1-3 PH ES ('97), Ch 11:2,3 PH ES ('93), Ch 18:2,3	***KEY VOCABULARY:*** viscosity granitic caldera basaltic ***SKILLS FOCUS:*** Recognize Cause and Effect Formulate explanations by using logic and evidence. **(I&E 1.d)** ***LABS / DEMOS:*** • **Volcanic Personality Skits** Have students find a way to dramatically contrast the behaviors of basaltic and granitic volcanoes. **Hawaiian Volcanoes:** http://geopubs.wr.usgs.gov/fact-sheet/fs074-97/index.html **Hawaii and Yellowstone:** http://www.math.montana.edu/~nmp/materials/ess/geosphere/advanced/activities/hotspots/indexlow.html **Yellowstone:** http://www.montana.edu/webquest/socialstudies/grades6to12/maki/index.html	3 Days

Energy in the Earth System (Solar Energy Enters, Heat Escapes)

4. Energy enters the Earth system primarily as solar radiation and eventually escapes as heat.

Standards and Assessments "Students know…"	Task Analysis "Students are able to …"	Adopted Textbook Correlation(s)	Connections	Appx Time (per 180 days)
… the relative amount of incoming solar energy compared with Earth's internal energy and the energy used by society. **(4,a)** **DISTRICT ASSESSMENTS:** OES: pending PT: pending	• Describe evidences of Earth's enormous internal energy: plate tectonics, volcanism, and geothermal vents. • Explain that primitive, original heat from the Earth's formation and continuous decay of radioactive elements within the Earth are the only two known sources of Earth's internal energy. • Explain that the insulating properties of the Earth's crust allow only small amounts of the internal energy to reach the surface over short periods of time. • Explain that the vast majority of energy available to us at the Earth's surface comes as infrared, visible, and ultraviolet light (electromagnetic radiation) from the Sun. • Illustrate how the primary source of energy in modern societies originates as solar energy trapped by photosynthesis and stored in the Earth's crust as fossil fuels. • Explain that stored fossil fuel supplies are limited because they are consumed much faster that they are formed. • Recall that 1,000 joules (equivalent to 1 kilowatt) of solar energy reach every square meter of Earth's illuminated surface each second, which is the same rate at which the average U.S. household consumes energy. • Explain that since there is not an average U.S. household on every square meter of the Earth's surface, the total energy used by humans is small compared to the amount of energy received from the Sun. • Explain ways that current technology and costs limit the harvesting of this energy.	**Glen ES**, Ch 5:1,2 & 15:1,2 PH ES ('97), Ch 21:1,2 PH ES ('93), Ch 13:2	***KEY VOCABULARY:*** electromagnetic radiation infrared ultraviolet wavelength kilowatt insulating fossil fuels energy joule ***SKILLS FOCUS:*** Read and interpret topographic and geologic maps. **(I&E 1.h)** Investigate a science-based societal issue by researching the literature, analyzing data, and communicating the findings. Examples of issues include choice of energy sources. **(I&E 1.m)** ***LABS / DEMOS:*** • **Earth Structure Model** Construct a crustal rock formation model showing stored fossil fuels. • **Research Activity** Make a chart to compare the cost of using fossil fuels to the cost of converting solar energy. Include both monetary and non-monetary costs. • **Uses of Fossil Fuels** Refer to Glen ES, p 120, Table 1 Make a table like the one shown. Add a column showing how each fossil fuel is formed. • **Quick Demo: Inexhaustible Energy** Glen ES, TE, p 131 • **Doing Activity: A Solar Oven** PH ES ('97), p 650 • **Use Photovoltaic Cells to Power Small Lights** Refer to PH ES ('97), p 652 • **Sharpen Your Skills: Temperature Changes in the Troposphere** PH ES ('93), p.305	5 Days

Energy in the Earth System (Solar Energy Enters, Heat Escapes)

4. Energy enters the Earth system primarily as solar radiation and eventually escapes as heat.

Standards and Assessments "Students know…"	Task Analysis "Students are able to …"	Adopted Textbook Correlation(s)	Connections	Appx Time (per 180 days)
… the fate of incoming solar radiation in terms of reflection, absorption, and photosynthesis. **(4,b)** **DISTRICT ASSESSMENTS:** OES: pending PT: pending	• Describe how the fate of incoming solar radiation depends on its wavelength. ° Explain that long wavelength light, like infrared, is absorbed by atmospheric gases, while visible light and shorter wavelengths are not absorbed. ° Recall that ultraviolet light is a short wavelength light that is absorbed by the ozone layer in the upper atmosphere. ° Explain that clouds, dust and the Earth's surface reflect some visible radiation back into space, but the rest is absorbed. • Explain that the green appearance of plants indicates that orange, red and blue light are absorbed by plants for photosynthesis, and the green light simply reflects off. • Recall that photosynthesis consumes carbon dioxide and water to produce sugar, storing the solar energy in chemical bonds that represent the primary source of energy for life on Earth. • Explain why carbon dioxide declines slightly during the summer growing season, and increases again in the winter.	**Glen ES**, Ch 15:1,2 & 17:3 PH ES ('97), Ch 21:2 PH ES ('93), Ch 13:2 & 14:1	***KEY VOCABULARY:*** radiation, photosynthesis, absorption, short wave, long wave, spectrum, ozone, carbon dioxide ***SKILLS FOCUS:*** Analyze situations and solve problems that require combining and applying concepts from more than one area of science. **(I&E 1.l)** ***LABS / DEMOS:*** • **Elodea O_2 Production** Observe oxygen production by elodea under varying amounts of light. Relate observations of oxygen production to carbon dioxide consumption. • **Investigating Prism** Students investigate how to use prisms to split light into its component colors. What conclusions do they draw about infrared and ultraviolet wavelengths of light? • **Mini Lab: Modeling Heat Transfer** Glen ES, p 445 • **Radiant Energy and Surface Temperature Lab** PH ES ('97), p 202 • **Diagram of Absorbed and Reflected Light: Fig. 13-2** PH ES ('93), p 325	4 Days

Energy in the Earth System (Solar Energy Enters, Heat Escapes)

4. Energy enters the Earth system primarily as solar radiation and eventually escapes as heat.

Standards and Assessments "Students know…"	Task Analysis "Students are able to …"	Adopted Textbook Correlation(s)	Connections	Appx Time (per 180 days)
…the different atmospheric gases that absorb the Earth's thermal radiation and the mechanism and significance of the greenhouse effect. **(4,c)** **DISTRICT ASSESSMENTS:** OES: pending PT: pending	• Recall that all objects give off electromagnetic radiation according to their temperature called "black body radiation". • Cite examples to prove that the hotter an object is, the shorter the wavelengths of electromagnetic radiation are emitted. *(For instance, a warm piece of iron emits infrared light, hot iron emits red visible light ("red hot"), and extremely hot iron can emit bluish-white light ("white hot").)* • Explain that since the Sun is hotter that the Earth, it emits radiation primarily in the visible range, which is shorter wavelength than the infrared radiation the Earth emits back into space. • Explain that greenhouse gases (including water vapor, carbon dioxide, methane, and some nitrogen oxide pollutants) in the atmosphere transmit visible light, but absorb infrared light. • Explain that Earth is kept warmer because greenhouse gases allow energy from the Sun in, but slow the loss of energy back into space. • Describe ways humans increase the amount of greenhouse gases. • Explain that the buildup of greenhouse gases could affect global temperatures and weather patterns, but predicting long-term effects is difficult because the influence of cloud cover and other factors are poorly understood.	**Glen ES**, Ch 17:3 & Ch 15:2,3 PH ES ('97), Ch 5:2,3 & Ch 16:1 PH ES ('93), 13:2	***KEY VOCABULARY:*** constituent — thermal radiation global warming — greenhouse nitrogen oxide — methane carbon dioxide — water vapor "blackbody" radiation ***SKILLS FOCUS:*** Apply Analogy Identify and communicate sources of unavoidable experimental error. **(I&E 1.b)** ***LABS / DEMOS:*** • **Activity: Greenhouse effect** Glen ES, p 511	4 Days

Energy in the Earth System (Solar Energy Enters, Heat Escapes)

4. Energy enters the Earth system primarily as solar radiation and eventually escapes as heat.

Standards and Assessments "Students know…"	Task Analysis "Students are able to …"	Adopted Textbook Correlation(s)	Connections	Appx Time (per 180 days)
… the differing greenhouse conditions on Earth, Mars, and Venus; the origins of those conditions; and the climatic consequences of each. ***(4,d*)*** **DISTRICT ASSESSMENTS:** OES: pending PT: pending	• *Compare the atmospheric conditions on Mars and Venus to Earth.* ° *Explain that the surface of Venus is extremely hot (hotter than Mercury, which is closer to the Sun), because of its thick atmosphere, rich in greenhouse gases.* ° *Explain that because Mars has a very thin atmosphere, with virtually no greenhouse gases, and no oceans, it cannot store heat and experiences wide temperature swings between night and day.* ° *Explain that Earth's moderate greenhouse effect is important to our climate. Without it, Earth would be much colder and more like Mars.*	Glen ES, Ch 24:2 PH ES ('97), Ch 3:3 PH ES ('93), Ch 3:4 & 13:2	***KEY VOCABULARY:*** contrast astronomy feedback ***SKILLS FOCUS:*** Analyze, Contrast Identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions. **(I&E 1.c)** ***LABS / DEMOS:*** • **Activity: Exploring Exhaust** Put a white sock on the exhaust pipe of an old car and another on the tail pipe of a new car. Let the cars idle for a few minutes. ***CAUTION: Do not perform this in an enclosed area and stay well away from the exhaust fumes.*** Compare the socks after letting the • **Analytic Activity:** Create a triple Venn diagram to compare and contrast atmospheric conditions on Mars, Earth and Venus. • **Build a greenhouse** PH ES ('97), p 106	4 Days

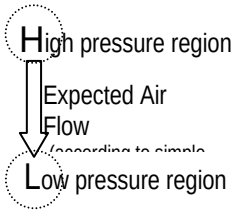
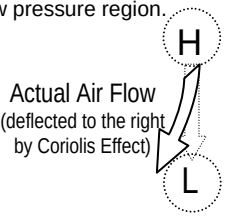
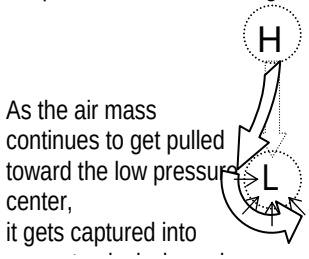
Energy in the Earth System (Ocean and Atmospheric Convection)

5. Heating of Earth's surface and atmosphere by the sun drives convection within the atmosphere and oceans, producing winds and ocean currents.

Standards and Assessments "Students know…"	Task Analysis "Students are able to …"	Adopted Textbook Correlation(s)	Connections	Appx Time (per 180 days)
… how differential heating of Earth results in circulation patterns in the atmosphere and oceans that globally distribute the heat. **(5,a)** **DISTRICT ASSESSMENTS:** OES: pending PT: pending	• Qualitatively explain the concepts of density and buoyancy. • Demonstrate how the Earth's spherical shape causes the equator to be heated more than the poles. • Explain how surface heat is transferred to the atmosphere, creating global circulation cells (atmospheric convection currents). ° Describe how hot, moist air at the equator rises. As the air rises, the pressure decreases causing the air to expand and cool, releasing the moisture as rain. ° Explain that as the air moves away from the equator (north or south), it eventually descends back to lower altitude where the higher pressure compresses and warms the air. ° Explain that to complete the cycle of the circulation cell, the dry, warm flows back to the equator, picking up moisture as it goes. • Describe how the unequal heating of the Earth's surface also causes ocean currents that redistribute heat in significant ways, citing specific examples. • Explain how heat stored in water is released when the water vapor condenses and precipitates. • Describe how all of the heat distribution mechanisms cause the equatorial regions to be somewhat cooler and the poles somewhat warmer than might otherwise be expected. • Review that the Earth's axis is tilted 23.5^{o} with respect to the plane of its orbit around the Sun. • Explain how different amounts of solar energy reach the north and south hemispheres at different times, causing opposite seasons. • Explain that the ocean and the atmosphere form a linked, fluid energy transfer system.	**Glen ES**, Ch 15:2,3 18:2 & 16:2 PH ES ('97), Ch 16:1-3 PH ES ('93), Ch 13:2-4	***KEY VOCABULARY:*** buoyancy density spherical climate bands circulation cells polar equatorial hemispheres ***SKILLS FOCUS:*** Protractor Use Read and interpret topographic and geologic maps. **(I&E 1.h)** ***LABS / DEMOS:*** • **Angle of Incidence Activity** Model angle of suns rays at equator and pole with flashlight. Hold flashlight a few centimeters above paper vertically and then 30 degrees from vertical and trace light outline. How is outline different, and how does that relate to intensity of light at Earth's surface? • **Modeling a Density Current** Glen ES, p 529 • **Convection Currents** PH ES ('97), p 488 • **Activity: Convection Currents** PH ES ('93), p 326	5 Days

Energy in the Earth System (Ocean and Atmospheric Convection)

5. Heating of Earth's surface and atmosphere by the sun drives convection within the atmosphere and oceans, producing winds and ocean currents.

Standards and Assessments "Students know…"	Task Analysis "Students are able to …"	Adopted Textbook Correlation(s)	Connections	Appx Time (per 180 days)
… the relationship between the rotation of Earth and the circular motions of ocean currents and air in pressure centers **(5,b)** **DISTRICT ASSESSMENTS:** OES: pending PT: pending	• Model and explain how the eastward rotation of the Earth causes the Coriolis Effect – a deflection of fluids (air and ocean currents) to the right in the northern hemisphere and a deflection to the left in the southern hemisphere. • Explain and diagram how this causes major, global air and ocean currents to travel counter clockwise in the northern hemisphere and the opposite in the southern hemisphere. • Explain how a region of low pressure (less dense) air interacts with higher pressure (more dense) air to create storm centers that rotate in the opposite direction of the major global currents. ° Describe how air flows naturally from high pressure to low pressure.  ° Diagram how the Coriolis Effect causes air flow to miss the center of the low pressure region.  ° Explain how northern hemisphere storm centers rotate counterclockwise (to the left), when the Coriolis Effect makes wind patterns deflect to the right.  • Explain why this process creates clockwise spinning storm centers in the southern hemisphere.	**Glen ES**, Ch 15:3 PH ES ('97), Ch 16:3 PH ES ('93), Ch 13:4	***KEY VOCABULARY:*** Coriolis Effect deflect frame of reference axis counterclockwise ***SKILLS FOCUS:*** Imagine Different Frames of Reference ***LABS / DEMOS:*** • **Modeling the Coriolis Effect** Using a piece of chalk and a globe, have students draw a ling from the north pole to the equator. Repeat the process while another student slowly spins the globe to the right (toward the east for the globe). The resulting curve demonstrates how a rotating frame of reference make a straight line appear to turn. CA Sci Framework, p 267 • **Quick Demo: Ye Olde Turntable** Glen ES, TE, p 448 • **Activity: Visualizing Global Winds** Glen ES, p 449 • **Activity: The Density of Water** PH ES ('97), p 496	3 Days

Energy in the Earth System (Ocean and Atmospheric Convection)

5. Heating of Earth's surface and atmosphere by the sun drives convection within the atmosphere and oceans, producing winds and ocean currents.

Standards and Assessments "Students know…"	Task Analysis "Students are able to …"	Adopted Textbook Correlation(s)	Connections	Appx Time (per 180 days)
… the origin and effects of temperature inversions. **(5,c)** **DISTRICT ASSESSMENTS:** OES: pending PT: pending	• Explain that normally, the atmosphere is heated from below by the transfer of energy from the Earth's surface, producing a convection current. • Define temperature inversion as an atmospheric condition where lower density warm air trapped over high-density cold air, effectively stopping convection and resulting in stagnant air. • Diagram how temperature inversion in the Los Angeles basin concentrates the smog effects during the spring and summer. ° Illustrate a profile of the LA basin showing the ocean on one side and mountains on the other. ° Draw arrows showing cool, dense air entering the basin from the ocean and warm, less dense air from the high desert forming a stagnant inversion layer which quickly fills with pollutants.	**Glen ES**, Ch 21:2 PH ES ('97), Ch 23:3 PH ES ('93), Ch 22:5	***KEY VOCABULARY:*** convection topography stagnant basin smog temperature inversion ***SKILLS FOCUS:*** Diagram Investigate a science-based societal issue by researching the literature, analyzing data, and communicating the findings. **(I&E 1.m)** ***LABS / DEMOS:*** • **LA Smog** Illustrate a profile view of the LA basin showing the ocean on one side and mountains on the other. Draw arrows showing cool, dense air entering the basin from the ocean and warm, less dense air from the high desert forming a stagnant inversion layer. Show sources of the pollutants that quickly fill the LA basin. • **Quick Demo: Causes of Air Pollution** Glen ES, TE, p 620 • **Activity: Identifying Acid Rain** Glen ES, p 621 & PH ES ('97), p 708 • **Activity: Examining the Content of Air** Glen ES, TE, p 623	2 Days

Energy in the Earth System (Ocean and Atmospheric Convection)

5. Heating of Earth's surface and atmosphere by the sun drives convection within the atmosphere and oceans, producing winds and ocean currents.

Standards and Assessments "Students know…"	Task Analysis "Students are able to …"	Adopted Textbook Correlation(s)	Connections	Appx Time (per 180 days)

… properties of ocean water, such as temperature and salinity, can be used to explain the layered structure of the oceans, the generation of horizontal and vertical ocean currents, and the geographic distribution of marine organisms. **(5,d)**
 	
DISTRICT ASSESSMENTS:
OES: pending
PT: pending
	• Identify temperature and salinity as major properties of ocean water.
	• Explain why the density of water increases as it cools, but decreases as it freezes.
	• Explain that it is the differences in density that causes the cold polar water to sink and flow back to the warm equatorial regions where the warmer, less dense water is rising.
	• Explain that between the poles and the equator the water is layered with the warm water on top and the cold water below.
	• Define specific heat as the ability to hold heat.
	• Explain that the high specific heat of water transport heat from the equator to the poles and acts to buffer the Earth's surface against significant temperature and climate changes.
	• Explain that water is an excellent solvent for many ions and dissolved gases necessary to sustain marine life.
	• Explain how water near the surface is oxygenated by photosynthesis.
	• Explain how dissolved nutrients required by phytoplankton are depleted.
	  ° Describe the process of zooplankton eating phytoplankton, and the remains sinking into deeper waters where they decompose, depleting the oxygen and enriching the nutrients.
	  ° Describe the convective process by which deep water rises to the surface carrying nutrients needed by phytoplankton, starting the process over again.
	• Explain how wind drives surface water.
	• Explain how ocean currents influence regional climates (e.g., the Gulf Stream warming western Europe).
		Glen ES, Ch 18:1,2
		
		PH ES ('97), Ch 6:1,2,4,6
		PH ES ('93), Ch 11:1,2,6
			KEY VOCABULARY:
			salinity phytoplankton
			specific heat zooplankton
			oxygenated
			
			SKILLS FOCUS:
			Analyze Causes and Effects
			
			Analyze situations and solve problems that require combining and applying concepts from more than one area of science. **(I&E 1.l)**
			
			LABS / DEMOS:
			• **Density Currents Demo: Changing Temp. & Salinity**
			CA Sci Framework, p 269
			• **Explore How Currents Work**
			Glen ES, p 521
			• **Doing Activity: Fish for the Table**
			PH ES ('97), p 228
			• **Doing Activity: Fish for the Table**
			PH ES ('97), p 228
			• **Lab Investigation: Observing a Model Thermocline**
			PH ES ('93), p 290
				5 Days

Energy in the Earth System (Ocean and Atmospheric Convection)

5. Heating of Earth's surface and atmosphere by the sun drives convection within the atmosphere and oceans, producing winds and ocean currents.

Standards and Assessments "Students know…"	Task Analysis "Students are able to …"	Adopted Textbook Correlation(s)	Connections	Appx Time (per 180 days)
… rain forests and deserts on Earth are distributed in bands at specific latitudes. **(5,e)** **DISTRICT ASSESSMENTS:** OES: pending PT: pending	• Show on a globe where the bands (or zones) of similar climate encircling the Earth. • Explain how these bands are produced by large-scale convective air patterns, called "Hadley cells". ° Diagram how the Hadley cells are formed by air rising at the equator and 60o (north and south) latitude, and sinking at 30o (north and south) and at the poles. ° Explain how sinking air is compressed because gravity's pull on the overlying air, which warms the air. ° Explain how rising air expands and cools. (This effect can be observed when gases are cooled as they expand rapidly out of an aerosol can or compressed gas cylinder.) ° Explain that because the compressed, warm air can hold more water, it pulls more water off of the land and makes deserts common in bands of sinking air. ° Explain how the expanding and cooling of rising air makes it release its moisture causing high precipitation and rainforests in bands of rising air.	**Glen ES**, Ch 17:1-3 & 6:2 PH ES ('97), Ch 17:1,2 PH ES ('93), Ch 13:4	***KEY VOCABULARY:*** Hadley cell gravity encircle ***SKILLS FOCUS:*** Read and interpret topographic and geologic maps. **(I&E 1.h)** ***LABS / DEMOS:*** • **Modeling a Density Current** Glen ES, p 529 • **Convection Currents** PH ES ('97), p 488 • **Activity: Convection Currents** PH ES ('93), p 326	3 Days

Energy in the Earth System (Climate and Weather)

6. Climate is the long-term average of a region's weather and depends on many factors.

Standards and Assessments "Students know…"	Task Analysis "Students are able to …"	Adopted Textbook Correlation(s)	Connections	Appx Time (per 180 days)
… weather (in the short run) and climate (in the long run) involve the transfer of energy into and out of the atmosphere. **(6,a)** **DISTRICT ASSESSMENTS:** OES: pending PT: pending	• Explain how unequal transmission and absorption of solar energy cause differences in air temperature and pressure, generating winds. • Explain how humidity is determined by evaporation and precipitation of water. • Explain why energy is released when water precipitates (raising surrounding temperature) and is absorbed when water evaporates (cooling the surroundings). • Describe how energy is transferred between atmosphere and oceans through evaporation and precipitation. • Define climate as the long-term, average weather of a region.	**Glen ES**, Ch 15:2,3 16:1 & 17:1 PH ES ('97), Ch 16:1-3 PH ES ('93), Ch 13:1-3	***KEY VOCABULARY:*** weather, humidity, relative humidity, dew point, fog, climate, atmosphere, evaporation, precipitation, condensation ***SKILLS FOCUS:*** Observe Select and use appropriate tools and technology to perform tests, collect data, analyze relationships, and display data. **(I&E 1.a)** ***LABS / DEMOS:*** • **Activity: "The Heat is On"** Glen ES, p 453-54. • **Activity Doing "Fog in a Bottle"** PH ES ('97), pg. 506 • **Sharpening your skill "Heating Land and Sea"** ES PH ('93), p 332.	3 Days
… the effects on climate of latitude, elevation, topography, and proximity to large bodies of water and cold or warm ocean currents. **(6,b)** **DISTRICT ASSESSMENTS:** OES: pending PT: pending	• Explain how temperatures at higher elevations are lower because of the expanding and cooling of air. • Explain examples of how climate is influenced by the presence of mountains, including rain shadow effect, monsoon cycle, and Santa Ana winds. • Explain how the specific heat of water causes regions near large bodies of water to be generally cooler than inland regions during warm weather and warmer during cold weather. • Explain how the proximity of land to large bodies of water influences climate through both warm and cold currents.	**Glen ES**, Ch 17:1 PH ES ('97), Ch 16:1-3 PH ES ('93), Ch 14:1-3	***KEY VOCABULARY:*** latitude, elevation, topography, monsoon, specific heat, polar zone, temperate zone, tropics ***SKILLS FOCUS:*** Research, Interpret Data Investigate a science-based societal issue by researching the literature, analyzing data, and communicating the findings. **(I&E 1.m)** ***LABS / DEMOS:*** • **Explore Activity: Track the Climates of the World** Glen ES, p 491 • **Discovering Activity: "The Density of Water"** PH ES ('97), p 496 • **"Investigating Differences in Climates"** PH ES ('93), Lab Manual, p 165	2 Days

Energy in the Earth System (Climate and Weather)

6. Climate is the long-term average of a region's weather and depends on many factors.

Standards and Assessments "Students know…"	Task Analysis "Students are able to …"	Adopted Textbook Correlation(s)	Connections	Appx Time (per 180 days)
… how Earth's climate has changed over time, corresponding to changes in Earth's geography, atmospheric composition, and other factors, such as solar radiation and plate movement. **(6,c)** **DISTRICT ASSESSMENTS:** OES: pending PT: pending	• Identify geologic eras in which the global climate was warmer and colder that the present global climate. • Explain how changes in the tilt of the earth and the shape of Earth's orbit over thousands of years influence climate. • Identify how the current configuration of land masses influences climate by directing ocean currents (i.e., the Gulf Stream). • Hypothesize how continental drift might impact global climate based on their influence on ocean and air currents and the regional effects of moving through different latitudes. • Explain how dust and volcanic ash from major volcanic eruptions and meteorite impacts can influence climate. • Discuss how human activity might influence climate (i.e., the greenhouse effect).	**Glen ES**, Ch 17:3 PH ES ('97), Ch 17:1,2 PH ES ('93), Ch 14:4	***KEY VOCABULARY:*** radiation axis dynamic global warming era episode astronomical deforestation ***SKILLS FOCUS:*** Cite Evidence, Debate Investigate a science-based societal issue by researching the literature, analyzing data, and communicating the findings. **(I&E 1.m)** ***LABS / DEMOS:*** • **Writing Activity: "Factors Affecting Climate"** PH ES ('97), p 538 • **Lab Investigation: "Graphing Climate Information"** PH ES ('97), p 550	4 Days
… how computer models are used to predict the effects of the increase in greenhouse gases on climate for the planet as a whole and for specific regions. ***(6,d*)*** **DISTRICT ASSESSMENTS:** OES: pending PT: pending	• *Explain that computer models suggest that accumulation of greenhouse gases (including water vapor, carbon dioxide, methane, and some nitrogen oxide pollutants) in the atmosphere will raise global temperatures.* • *Explain that Earth is kept warmer than it would otherwise be, because greenhouse gases allow energy from the Sun in, but slow the loss of heat back into space.* • *Describe ways human activity can increase the amount of greenhouse gases.* • *Explain that the buildup of greenhouse gases could affect global temperatures and weather patterns, but predicting long-term effects is difficult because the Earth has many complicated and sometimes poorly understood feedback mechanisms.*	**Glen ES**, Ch 17:3 PH ES ('97), Ch 16:6 PH ES ('93), Ch 13:7	***KEY VOCABULARY:*** global effects regional effects ***SKILLS FOCUS:*** Compare and Contrast Recognize the cumulative nature of scientific evidence. **(I&E 1.k)** ***LABS / DEMOS:*** • **Activity: Greenhouse effect** Glen ES, p 511 • **Build a greenhouse** PH ES ('97), p 106	2 Days

Biogeochemical Cycles

7. Each element on Earth moves among reservoirs, which exist in the solid earth, in oceans, in the atmosphere, and within and among organisms as part of biogeochemical cycles.

Standards and Assessments "Students know…"	Task Analysis "Students are able to …"	Adopted Textbook Correlation(s)	Connections	Appx Time (per 180 days)
… the carbon cycle of photosynthesis and respiration and the nitrogen cycle. **(7,a)** **DISTRICT ASSESSMENTS:** OES: pending PT: pending	• Diagram biological carbon cycles in various habitats. ° Explain how carbon, as CO_2, is brought into the biosphere through photosynthesis and is released again into the atmosphere through respiration. • Describe and explain various geologically linked (biogeochemical) carbon cycles. ° Describe how carbon is dissolved and stored in the ocean as carbonate (CO_3^{2-}) and bicarbonate (HCO_3^-) ions where it is used by certain organisms to make their shells. ° Explain how shells may eventually dissolve back into the ocean or settle to the ocean floor and become part of the sediment, eventually forming a carbonate rock, such as limestone. ° Describe how carbonate rocks may be uplifted over time and dissolved by acid rain or heated so that carbon dioxide reenters the atmosphere. ° Describe how carbonate rocks may be subducted, decomposed by high temperatures, and returned to the atmosphere as volcanic CO_2 gas. ° Identify various ways carbon is stored in the solid Earth: as graphite, methane gas, petroleum, or coal. • Explain how the nitrogen cycle brings the most common element in the atmosphere, N_2, into and out of the biosphere. ° Describe how only certain, specialized bacteria are able to take in atmospheric N_2 and "fix" it by converting it into ammonia (NH_3). ° Recall that other bacteria change the ammonia into nitrite (NO_2^-) and then to nitrate (NO_3^-), which plants are able to use as food and pass along to other organisms in the biosphere. ° Explain how decomposer bacteria reverse this process, returning N_2 to the atmosphere.	**Glen ES**, no reference PH ES ('97), Ch 5:1 PH ES ('93), Ch 12:1	***KEY VOCABULARY:*** atmosphere sediment carbon nitrogen ***SKILLS FOCUS:*** Analyze situations and solve problems that require combining and applying concepts from more than one area of science. **(I&E 1.l)** ***LABS / DEMOS:*** • **"Sharpen Your Skills": Weathering Home Activity** PH ES ('93), p 395 • **Activity: "Diagramming the Nitrogen Cycle"** PH ES ('93), p 185 • **"Observing the Effects of Chemical Weathering on Chalk"** PH ES ('93), Lab #34, p 175	4 Days

Biogeochemical Cycles

7. Each element on Earth moves among reservoirs, which exist in the solid earth, in oceans, in the atmosphere, and within and among organisms as part of biogeochemical cycles.

Standards and Assessments "Students know…"	Task Analysis "Students are able to …"	Adopted Textbook Correlation(s)	Connections	Appx Time (per 180 days)
… 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. **(7,b)** **DISTRICT ASSESSMENTS:** OES: pending PT: pending	• Identify the reservoirs of carbon within the Earth's biological and physical systems. ° Recall that carbon appears primarily as CO_2 in the atmosphere. ° Recall that carbon is found as dissolved CO_2, and as carbonate (CO_3^{2-}) and bicarbonate (HCO_3^-) ions in the oceans. ° Identify how carbon appears in living organisms (biomass) as sugar and many other organic molecules. • Identify biological and physical means of moving carbon from one reservoir to another. • Explain how burning fossil fuels to produce energy has increased the rate of returning CO_2 to the atmosphere, increasing its concentration in the atmosphere. • Explain how the burning of fossil fuels may impact climatic conditions. (Refer to the last bullet point in the Task Analysis for standard 6d*.)	**Glen ES**, no reference PH ES ('97), Ch 5:1 PH ES ('93), Ch 12:1	***KEY VOCABULARY:*** biogeochemical process greenhouse effect climate biomass fossil fuels reservoirs ***SKILLS FOCUS:*** Predict Effects Recognize the issues of statistical variability and the need for controlled tests. **(I&E 1.j)** ***LABS / DEMOS:*** • **Activity: Greenhouse Investigations** Under each of three identical bell jars, place an opened soda can. Fill one of the soda cans with water, leave one empty, and have the third be a freshly opened, ambient temperature soda. Heat by exposing to identical light sources. Using temperature probes or high quality thermometers, record temperature increases at regular time intervals.	4 Days
… the movement of matter among reservoirs is driven by Earth's internal and external sources of energy. **(7,c)** **DISTRICT ASSESSMENTS:** OES: pending PT: pending	• Explain how the movement of carbon between reservoirs requires an input of either solar or geothermal (Earth's internal heat) energy. ° Explain how the Sun's energy drives photosynthesis. ° Explain how energy from Earth's interior drives subduction and volcanic magma upwelling.	**Glen ES**, no reference PH ES ('97), Ch 5:1 PH ES ('93), Ch 12:1	***KEY VOCABULARY:*** reservoir biogeochemical ***SKILLS FOCUS:*** Diagram Formulate explanations by using logic and evidence. **(I&E 1.d)** ***LABS / DEMOS:*** • **Activity: Charting BGC Connections** Have students create a diagram showing the interconnected biogeochemical processes, indicating energy sources and conversions.	2 Days

Structure and Composition of the Atmosphere

8. Life has changed Earth's atmosphere, and changes in the atmosphere affect conditions for life.

Standards and Assessments "Students know…"	Task Analysis "Students are able to …"	Adopted Textbook Correlation(s)	Connections	Appx Time (per 180 days)
… the thermal structure and chemical composition of the atmosphere. **(8,a)** **DISTRICT ASSESSMENTS:** OES: pending PT: pending	• Recall that the atmosphere is a mixture of gases: 78% N_2, 21% O_2, 1% Ar, and traces of other gases including water vapor and CO_2. • Explain that, just as gravity causes water to become denser with under its own weight at depth, so the atmosphere is most dense at the Earth's surface and get less dense as elevation increases. • Identify the four layers of the atmosphere classified according to their temperature gradient. ° Identify the **troposphere**, in which temperature decreases with altitude. ° Identify the **stratosphere**, in which temperature increases with altitude. ° Identify the **mesosphere**, in which temperature decreases again with altitude. ° Identify the **thermosphere** (a.k.a, ionosphere), as the outermost layer in which temperature increases again with altitude. • Describe the properties of each atmospheric layer. ° Explain that all weather occurs in the troposphere. ° Describe how life is sustained by the concentration of gases in the lower troposphere. ° Describe the composition of the stratosphere as similar to the troposphere, except that there is virtually no water. ° Explain that the stratosphere is biologically important in that solar radiation causes O_2 in the stratosphere to break up and form ozone (O_3), which absorbs harmful ultraviolet radiation. ° Describe the mesosphere as very low density and many of the molecules present are ionized by solar radiation. ° Describe the thermosphere as containing almost no air and exposed to the direct rays of the Sun. ° Explain how the thermosphere illustrates the difference between heat and temperature, because although very little heat energy is absorbed, it causes the few molecules of the thermosphere to move extremely fast (have a high temperature).	**Glen ES**, Ch 15:1 PH ES ('97), Ch 5:2,3 PH ES ('93), Ch 12:1,2	***KEY VOCABULARY:*** geologic time scale outgassing — ozone thermosphere — evolution troposphere — stratosphere mesosphere — ionosphere ***SKILLS FOCUS:*** Graph to Scale Recognize the usefulness and limitations of models and theories as scientific representations of reality. **(I&E 1.g)** ***LABS / DEMOS:*** • **Graph & Analysis of Air:** Students graph the relative amounts of the components of air in a method of their choice and use the graph as a basis for developing questions to investigate, such as, "Where did the argon come from?" and "If CO_2 is only a trace component, why is everyone so concerned about it?" and "What would happen if air were mostly O_2?" • **Oxygen Content of Air:** Place a short candle in a shallow pie tin, half filled with water. Light the candle and place an inverted glass beaker or graduated cylinder over the candle. Observe the change in volume, roughly corresponding to the amount of O_2 consumed. *(Note to teacher: Some of the volume loss is caused by thermally expanded air escaping out of the bottom and much of the CO_2 produced is included in the gas volume. SO, it is a very rough correlation. Don't bother calculating a % of O_2 from this.)* • **Activity: Diagram the Layers of Earth's Atmosphere** Glen ES, p 439 • **Activity: Diagram the Layers of Earth's Atmosphere** PH ES ('97), p 196 • **Activity: Diagram the Layers of Earth's Atmosphere** PH ES ('93), p 307	4 Days

Structure and Composition of the Atmosphere

8. Life has changed Earth's atmosphere, and changes in the atmosphere affect conditions for life.

Standards and Assessments "Students know…"	Task Analysis "Students are able to …"	Adopted Textbook Correlation(s)	Connections	Appx Time (per 180 days)
…how the composition of Earth's atmosphere has evolved over geologic time and know the effect of outgassing, the variations of carbon dioxide concentration, and the origin of atmospheric oxygen. **(8,b)** **DISTRICT ASSESSMENTS:** OES: pending PT: pending	• Explain how scientists use a combination of evidences from geological, biological, and astronomical sources to construct models that explain the evolution of Earth's atmosphere. • Explain how, when the Sun's fusion began, strong solar winds would have driven away any early atmosphere on Earth. • Describe how, eventually, an atmosphere formed by a combination of gases released from the Earth (mostly from volcanoes) and from materials brought to Earth by comet and asteroid collisions. • Explain how chemical reactions in the presence of water, over time, changed methane (CH_4) and ammonia (NH_3) into nitrogen (N_2), Hydrogen (H_2), and carbon dioxide (CO_2). • Explain that the hydrogen was lost, because hydrogen gas has so little mass, it gets pushed to the top of the atmosphere and escapes into space. • Explain how the appearance of photosynthetic life removed CO_2 from and added O_2 to the atmosphere. • Recall that the atmosphere is believed to have had roughly the current balance of gases for the last 600 million years. • Explain that while small changes in the amount CO_2 have occurred naturally over time, there appear to be significant increases occurring in modern times attributed to human activities.	**Glen ES**, Ch 15:1 PH ES ('97), Ch 5:2,3 PH ES ('93), Ch 12:1 & 13.2	***KEY VOCABULARY:*** geologic time scale ammonia ozone ultraviolet rays methane ***SKILLS FOCUS:*** Research Distinguish between hypothesis and theory as scientific terms. **(I&E 1.f)** ***LABS / DEMOS:*** • **Atmospheric Time Scale** Create a geologic time scale visual that shows how the life forms or each era changed the Earth's atmosphere. Use evidence from glacial core chemical samples. • **"Finding the % of O_2 in the Atmosphere"** PH ES ('93), Lab #28, p 145	5 Days

Structure and Composition of the Atmosphere

8. Life has changed Earth's atmosphere, and changes in the atmosphere affect conditions for life.

Standards and Assessments "Students know…"	Task Analysis "Students are able to …"	Adopted Textbook Correlation(s)	Connections	Appx Time (per 180 days)
… the location of the ozone layer in the upper atmosphere, its role in absorbing ultraviolet radiation, and the way in which this layer varies both naturally and in response to human activities. **(8,c)** **DISTRICT ASSESSMENTS:** OES: pending PT: pending	• Explain how catalysts modify the rate of reactions without being consumed, in their own words. • Write the chemical equation showing the formation and breakdown of ozone, $3O_2 \rightleftharpoons 2O_3$ (oxygen ⇌ ozone) explaining the causes for each direction. • Explain how the concentrations of ozone and oxygen reach equilibrium in the stratosphere when ozone is formed by incoming radiation as fast as it is broken down by ultraviolet radiation. • Explain that chlorofluorocarbons (CFCs) greatly increase the rate of breaking down ozone to oxygen, and therefore may be causing a change in the equilibrium. • Explain how reducing the ozone in the stratosphere would allow more ultraviolet radiation to reach the surface of the Earth, causing greater damage to plants and animals. • Give evidence supporting the idea that ozone is both beneficial and harmful, depending on where it is found.	**Glen ES**, Ch 15:1 & 21:2 PH ES ('97), Ch 5:2,3 PH ES ('93), Ch 12:1, 2	***KEY VOCABULARY:*** catalyst triatomic diatomic halogens ozone photochemical chlorofluorocarbons (CFC's) ***SKILLS FOCUS:*** Research, Write Complete Eqns Investigate a science-based societal issue by researching the literature, analyzing data, and communicating the findings. **(I&E 1.m)** ***LABS / DEMOS:*** • **Manganese Dioxide reaction** Pour peroxide (H_2O_2) into a test tube containing manganese dioxide (MnO_2) to show how the peroxide quickly decomposes to water and oxygen, while the MnO_2 remains unchanged – and can be used over and over again. [Note: dry the MnO_2, do not discard it.]	3 Days

California Geology

9. The geology of California underlies the state's wealth of natural resources as well as its natural hazards.

Standards and Assessments "Students know…"	Task Analysis "Students are able to …"	Adopted Textbook Correlation(s)	Connections	Appx Time (per 180 days)
… the resources of major economic importance in California and their relation to California's geology. **(9,a)** **DISTRICT ASSESSMENTS:** OES: pending PT: pending	• Explain how tectonic activity in California is responsible for creating valuable economic resources (including, ore deposits, oil, natural gas, and the agricultural abundance of the central valley). • Explain how subduction is responsible for creating valleys, mountain ranges, and geothermal energy release. • List the economically significant material and energy resources in California and explain their relationship to geological processes.	**Glen ES**, no reference PH ES ('97), no ref. PH ES ('93), no ref.	***KEY VOCABULARY:*** ore geothermal economic resource ***SKILLS FOCUS:*** Research, Evaluate Investigate a science-based societal issue by researching the literature, analyzing data, and communicating the findings. Examples of issues include choice of energy sources, and land and water use decisions in California. **(I&E 1.m)** ***LABS / DEMOS:*** **Mineral Resource Mapping:** www.consrv.ca.gov/CGS/geologic_resources/mineral_resource_mapping **Mineral-Forming Processes:** http://marine.usgs.gov/fact-sheets/gorda/index.html **How Yosemite was Formed:** http://www2.nature.nps.gov/geology//usgsnps/you/topobk.html	5 Days
…the principal natural hazards in different California regions and the geologic basis of those hazards. **(9,b)** **DISTRICT ASSESSMENTS:** OES: pending PT: pending	• Describe the different natural hazards present in California including faulting, landslides, coastal erosion, volcanoes, and the potential for seismic sea waves. • Identify regions subject to the various natural hazards on a map of California. • Diagram the geologic processes responsible for the various natural hazards.	**Glen ES**, no reference PH ES ('97), no ref. PH ES ('93), no ref.	***KEY VOCABULARY:*** natural hazards coastal erosion seismic sea waves ***SKILLS FOCUS:*** Research, Evaluate Investigate a science-based societal issue by researching the literature, analyzing data, and communicating the findings. **(I&E 1.m)** ***LABS / DEMOS:*** **California Hazard Zones:** www.consrv.ca.gov/CGS/geologic_hazards/regulatory_hazard_zones **San Andreas Fault:** http://pubs.usgs.gov/gip/earthq3/what.html **Volcano Hazards:** http://vulcan.wr.usgs.gov/Hazards/Publications/FS002-97/framework.html **Hazards of Coastal Erosion:** http://coastal.er.usgs.gov/hurricanes/mappingchange/scale.html	2 Days

California Geology

9. The geology of California underlies the state's wealth of natural resources as well as its natural hazards.

Standards and Assessments "Students know…"	Task Analysis "Students are able to …"	Adopted Textbook Correlation(s)	Connections	Appx Time (per 180 days)
…the importance of water to society, the origins of California's fresh water, and the relationship between supply and need. **(9,c)** **DISTRICT ASSESSMENTS:** OES: pending PT: pending	• Identify the origins of California's water supply: melting snow-pack from the mountain ranges, and precipitation. • Explain how the water supply in California is distributed primarily by diverting water sources in areas of high precipitation (northern California) to areas of low precipitation (southern California). • Identify and locate the California Aqueduct and the Los Angeles Aqueduct, the two major aqueducts in California including their sources and destinations. • Explain that California water is moved for agricultural and industrial purposes.	**Glen ES**, no reference PH ES ('97), no ref. PH ES ('93), no ref.	***KEY VOCABULARY:*** diversion aqueduct agricultural industrial ***SKILLS FOCUS:*** Research, Evaluate Investigate a science-based societal issue by researching the literature, analyzing data, and communicating the findings. Examples of issues include water use decisions in California. **(I&E 1.m)** ***LABS / DEMOS:*** **USGS Water Education:** www.water.usgs.gov/education.html **Measuring the Snow Pack:** http://wsoeb.ladwp.com/Aqueduct/snow/history.htm **Los Angeles Aqueduct:** http://www.polarinertia.com/jan04/aqua00.htm **California Aqueduct:** http://www.vietlawyers.com/worldofwater/California.htm **Aerial Photos of CA Aqueducts:** http://elib.cs.berdeley.edu/air_photos/ **Water Markets Increase Water Supply:** http://www.ecoworld.org/Home/Articles2.cfm?TID=327 **CA Water Supply Fact Sheet:** http://water.usgs.gov/pubs/FS/FS-005-96/index.html#HDR09	3 Days

APPLICATION OF COURSE CONTENT: *Career Connections*

Related Major Skills & Characteristics – objective observation, careful measurement, curiosity, problem solving, organizational skills, numerical reasoning, ability to analyze & interpret data, critical thinking, reading comprehension, concise and accurate communication skills, computer literacy, logical thinking, team skills, testing skills, practical safety awareness, evaluation of evidence

Related Careers – Students who continue in the sciences can prepare for the following careers:

- Aeronautical Engineer *(Rocket Scientist)*
- Agricultural Ecologist
- Analytical Chemist
- Aquatic Microbial Ecologist
- Astronomer
- Biochemist
- Botanist
- Chemical Engineer
- Electrical Engineer
- Energy
- Fire Fighter
- Geologist
- Marine Biologist
- Materials Scientist
- Meteorologist
- Mining Geologist
- National Park Ranger
- Nuclear Physicist
- Paleontologist
- Petroleum Geologist
- Physicist
- Professor / Researcher
- Quality Control Specialist
- Science Fiction Writer
- Seismologist
- Teacher
- Technical Editor
- Wildlife Ecologist

METHODS:

Lesson Design & Delivery: Teachers will incorporate these components of lesson design during both direct instruction and inquiry activities. The order of components is flexible, depending on the teacher's vision for the individual lesson. For instance, the objective and purpose, while present in the teacher's lesson plan, are not made known to the students at the beginning of an inquiry lesson.

Essential **E**lements of **E**ffective **I**nstruction Model for Lesson Design Using Task Analysis	Anticipatory Set Objective Standard Reference Purpose Input Modeling Check for Understanding Guided Practice Closure Independent Practice

Some components may occur once in a lesson, but others will recur many times. Checking for understanding occurs continually; input, modeling, guided practice and closure may occur several times. There may even be more than one anticipatory set when more than one content piece is introduced.

Active Participation: Teachers will incorporate the principles of active participation and specific strategies to ensure consistent, simultaneous involvement of the minds of all learners in the classroom. Teachers should include both covert and overt active participation strategies, incorporating cooperative learning structures and brain research. Some of the possible active participation strategies include:

COVERT	OVERT (Oral)	OVERT (Written)	OVERT (Gestures)
• Recall	• Pair/Share	• Restate in Journals / Notes	• Hand Signals
• Imagine	• Idea Wave	• Response Boards	• Model with Manipulatives
• Observe	• Choral Response	• Graphic Organizers	• Stand Up / Sit Down
• Consider	• Give One, Get One	• Folded Paper	• Point to Examples
	• Socratic Seminar	• Ticket Out of Class	

Baldridge Quality Tools: Students can become more positively involved in their education through goal setting, self-assessment, and data tracking and analysis by making use of the following strategies:

BALDRIDGE TOOL	PURPOSES
Affinity Diagram	– finding consensus, organizing complex information
Flowchart	– describing a process, planning a project, identifying problem steps in a process
Force Field Diagram	– identifying obstacles, finding causes and solutions to problems
Issues / Ideas Bin	– handling individual questions/requests without stopping a group activity, providing anonymous input, obtaining diverse input in specific areas.
Data Folder	– tracking goals and actual results
Plus / Delta	– tracking improvement efforts, identifying opportunities for change, finding out what's working and what's not working in a process, procedure, activity, etc.
Class Data Graphs	– displaying trends for goal setting

Learning styles and learning challenges of your students may be addressed by implementing combinations of the following:

Reading Strategies in Science
- ❑ Learning Logs
- ❑ Pre-teaching
- ❑ Vocabulary
- ❑ Pre-reading
- ❑ Text Structures
- ❑ Trail Markers
- ❑ Reciprocal Teaching
- ❑ Functional Text

SDAIE Strategies for English Learners
- ❑ Tapping/Building Prior Knowledge (Graphic Organizers, Schema)
- ❑ Grouping Strategies
- ❑ Multiple Intelligences
- ❑ Adapt the Text
- ❑ Interactive Learning (Manipulatives, Visuals)
- ❑ Acquisition Levels
- ❑ Language Sensitivity
- ❑ Lower the Affective Filter (including Processing Time)
- ❑ Home/School Connection (including Cultural Aspects)

Differentiation for Advanced Learners
- ❑ Curriculum Compacting
- ❑ Tiered Assignments
- ❑ Flexible Grouping
- ❑ Acceleration
- ❑ Depth and Complexity
- ❑ Independent Study

Significant, Proven Science Strategies for ALL Science Students
- ❑ Hands-On Labs
- ❑ Inquiry Activities
- ❑ Written/Oral Presentations
- ❑ Short/Long-term projects
- ❑ Essential Questions
- ❑ Summarization
- ❑ Current Events
- ❑ Peer Teaching
- ❑ Guest Speakers

Please note that these strategies often overlap and should not be limited to specifically defined courses or student populations.

MATERIALS:

Basic Textbook and Supplementary Materials: Glencoe Science, Earth Science,
Glencoe/McGraw-Hill © 2002

Supplementary Textbooks: Exploring Earth Science,
Prentice Hall © 1997
Earth Science,
Prentice Hall © 1993

eguidance.com web site for exploring careers
safety equipment: goggles, latex gloves, fire extinguisher
glassware: flasks, beakers, test tubes, etc.
measuring devices: triple beam balance, rulers, volumetric containers
chemical reagents
microscopes, microviewers, hand lenses, dissection equipment
appropriate technology

❖ Many items are available through Science/Math Resource Center (SMRC).

RESOURCES:

Documents

- Glencoe Earth Science textbook and supplementary resources
- State Safety Manual for Public Schools (1999)

- LBUSD Approved Chemicals List (2003)
- LBUSD Chemical Hygiene Plan (2003)
- LBUSD District Science Fair Handbook (2000)

  → http://www.lbusd.k12.ca.us/curriculum/Curriculum%20Services/Science/science.htm

- State Science Framework (Content Standards): .....http://www.cde.ca.gov/re/pn/fd/sci-frame-dwnld.asp
- CST / NCLB Test Blueprints .....http://www.cde.ca.gov/ta/tg/sr/blueprints.asp
- CST Reference Sheets .....http://www.cde.ca.gov/ta/tg/sr/cstsciref.asp

- National Science Standards:.....http://www.nap.edu/readingroom/books/nses/html/

District Offices

- Science Curriculum Office (562) 997-8000 (ext. 2963)
  - K-12 science standards, curriculum, professional development, science fair

- Science / Math Resource Center (SMRC) (562) 997-8000 (ext. 2964)
  - hands-on materials, consumable material orders, alternative standards-based curriculum packets

- Instructional Materials Workshop (IMW) (562) 997-8000 (ext. 2965)
  - standards-based instructional materials
  - content integrated instructional materials
  - monthly theme-based literacy supplements for science
  - wood shop / lumber room
  - copying, enlarging, and laminating

- Office of Multimedia Services (OMS) (562) 997-8000 (ext. 7145)
  - videos for check out to fit the curriculum (see your librarian for current catalogs)
  - district TV channels programming

- PALMS Office Program Assistance for Language Minority Students (562) 997-8000 (ext. 8031)
  - technical assistance and professional development for English Language Development (ELD) and Specially Designed Academic Instruction In English (SDAIE)
  - assistance in the implementation and maintenance of programs addressing the needs of English Language Learners (ELLs)

EVALUATION: Student achievement in this course will be measured using multiple assessment tools. Assessments will be used for diagnosing student understanding before instruction, monitoring student learning during instruction, and evaluating student understanding after instruction.

SUGGESTED EVALUATION TOOLS:

Source	Diagnose	Monitor	Evaluate
District Level Assessments	Grade Level Pretest	Open-Ended Science Performance Task	End of Course Exam Open Ended Science
Glencoe Science: Earth Science	Explore Activities Problem Solving Activities Mini Labs	Section Assessments Skill Builder Activities Math Skill Activities Full Period Labs Design Your Own Experiment Chapter Reviews	Chapter & Unit Tests Labs, and Lab Writing Ups
Teacher Developed Assessments	Accessing Prior Knowledge Activities Pre-quiz Pre-Test Vocab. Knowledge Rating	Warm-Up Quiz Proving Behavior Lab	Projects Open-ended Prompts Chapter / Unit Test Practicum Semester Final Exam

SUGGESTED GRADE WEIGHTING:
(with some possible examples)

1. Assessment ~30%
   - objective tests including comprehensive finals
   - practica / performance tasks (rubric scored)
   - open-ended questions (rubric scored)
   - portfolios
   - student self-evaluations
2. Homework not more than 10%
   - discovery assignments
   - assignments reinforcing class lesson
   - essays
   - organization
   - research
3. Labs ~20%
   - lab reports (may be rubric scored)
   - active engagement in group assignment
4. Projects ~20%
   - research-based reports and projects
   - inquiry projects
   - science fair projects
5. Classwork ~20%
   - note taking skills
   - organization skills
   - oral presentations
   - individual and group projects and assessments

STANDARD GRADING SCALE:

Advanced Proficient	A	90 – 100%
	B	80 – 89%
Proficient	C	70 – 79%
Partial Proficient	D	60 – 69%
Not Proficient	F	0 – 59%

Submitted by: Eric Brundin
School: Science Office
Date: 03/02/04