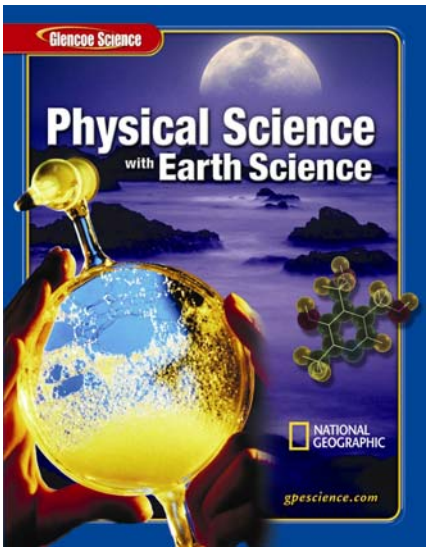
Glencoe

Grades Nine Through Twelve – Physics, Earth Sciences, and Investigation & Experimentation



Physical Science with Earth Science

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STANDARDS	PAGE REFERENCES
Physics **Science Content Standards** *Standards that all students are expected to achieve in the course of their studies are unmarked. Standards that all students should have the opportunity to learn are marked with an asterisk (*).*	
Motion and Forces	
1. Newton's laws predict the motion of most objects. As a basis for understanding this concept:	
a. *Students know* how to solve problems that involve constant speed and average speed.	**Student Edition:** 72, 81-83 *Applying Math* 72 *Design Your Own Physics Lab* 88-89 *LAB* 87 *MiniLAB* 71 **Teacher Wraparound Edition:** DI 72; IM 74, 82; R 75
b. *Students know* that when forces are balanced, no acceleration occurs; thus an object continues to move at a constant speed or stays at rest (Newton's first law).	**Student Edition:** 82-83, 98-101 **Teacher Wraparound Edition:** FYI 99; IM 82

Codes used for Teacher Wraparound Edition pages are the initial caps of headings on that page.

STANDARDS	PAGE REFERENCES
c. *Students know* how to apply the law F=ma to solve one-dimensional motion problems that involve constant forces (Newton's second law).	**Student Edition:** 101-103, 106 *Applying Math* 102 **Teacher Wraparound Edition:** DI 116; QD 102
d. *Students know* that when one object exerts a force on a second object, the second object always exerts a force of equal magnitude and in the opposite direction (Newton's third law).	**Student Edition:** 113-114 *National Geographic* 115 **Teacher Wraparound Edition:** FF 115; SJ 114
e. *Students know* the relationship between the universal law of gravitation and the effect of gravity on an object at the surface of Earth.	**Student Edition:** 104-107, 108-109 *Integrate Astronomy* 105 **Teacher Wraparound Edition:** FF 105; IL 109; QD 106, 107
f. *Students know* applying a force to an object perpendicular to the direction of its motion causes the object to change direction but not speed (e.g., Earth's gravitational force causes a satellite in a circular orbit to change direction but not speed).	**Student Edition:** 110-111 *MiniLAB* 110 **Teacher Wraparound Edition:** DI 110
g. *Students know* circular motion requires the application of a constant force directed toward the center of the circle.	**Student Edition:** 110-111 *MiniLAB* 110 **Teacher Wraparound Edition:** DI 110
h. * *Students know* Newton's laws are not exact but provide very good approximations unless an object is moving close to the speed of light or is small enough that quantum effects are important.	**Student Edition:** *Science and History* 478 **Teacher Wraparound Edition:** HS 478
i. * *Students know* how to solve two-dimensional trajectory problems.	**Student Edition:** 108-109 **Teacher Wraparound Edition:** DI 109; IL 109; USW 108
j. * *Students know* how to resolve two-dimensional vectors into their components and calculate the magnitude and direction of a vector from its components.	This standard falls outside the scope of this text and can be met during teacher/class discussion.

STANDARDS	PAGE REFERENCES
k. * *Students know* how to solve two-dimensional problems involving balanced forces (statics).	**Student Edition:** 82-83 *LAB* 87 **Teacher Wraparound Edition:** IM 82
l. * *Students know* how to solve problems in circular motion by using the formula for centripetal acceleration in the following form: $a=v^2/r$.	**Student Edition:** 77-79, 110-111
m. * *Students know* how to solve problems involving the forces between two electric charges at a distance (Coulomb's law) or the forces between two masses at a distance (universal gravitation).	**Student Edition:** 104-107, 393-394 **Teacher Wraparound Edition:** FF 105; FYI 107
Conservation of Energy and Momentum	
2. The laws of conservation of energy and momentum provide a way to predict and describe the movement of objects. As a basis for understanding this concept:	
a. *Students know* how to calculate kinetic energy by using the formula $E=(1/2)mv^2$.	**Student Edition:** 130 *Applying Math* 130 **Teacher Wraparound Edition:** QD 130
b. *Students know* how to calculate changes in gravitational potential energy near Earth by using the formula (change in potential energy) = mgh (h is the change in the elevation).	**Student Edition:** 132-133 *Applying Math* 132 *LAB* 134 **Teacher Wraparound Edition:** QD 132
c. *Students know* how to solve problems involving conservation of energy in simple systems, such as falling objects.	**Student Edition:** 135-137, 140, 163 *LAB* 134 *National Geographic* 138 **Teacher Wraparound Edition:** IM 137; LD 138; QD 136
d. *Students know* how to calculate momentum as the product mv.	**Student Edition:** 116-117 *Applying Math* 116 *LAB* 118-119 **Teacher Wraparound Edition:** DI 116

STANDARDS	PAGE REFERENCES
e. *Students know* momentum is a separately conserved quantity different from energy.	**Student Edition:** 117 **Teacher Wraparound Edition:** VL 117
f. *Students know* an unbalanced force on an object produces a change in its momentum.	**Student Edition:** 116 *Applying Math* 116 *LAB* 118-119 **Teacher Wraparound Edition:** D 116; VL 117
g. *Students know* how to solve problems involving elastic and inelastic collisions in one dimension by using the principles of conservation of momentum and energy.	**Student Edition:** 117, 136-140 *LAB* 118-119, 134 **Teacher Wraparound Edition:** DI 116
h. * *Students know* how to solve problems involving conservation of energy in simple systems with various sources of potential energy, such as capacitors and springs.	**Student Edition:** 135-140 *Design Your Own Physics Lab* 144-145 *MiniLAB* 140 **Teacher Wraparound Edition:** IL 141
Heat and Thermodynamics	
3. Energy cannot be created or destroyed, although in many processes energy is transferred to the environment as heat. As a basis for understanding this concept:	
a. *Students know* heat flow and work are two forms of energy transfer between systems.	**Student Edition:** 266-267, 269, 272-276 *LAB* 271, 278-279 *National Geographic* 268 **Teacher Wraparound Edition:** DI 274; MM 276; QD 268, 273; R 270
b. *Students know* that the work done by a heat engine that is working in a cycle is the difference between the heat flow into the engine at high temperature and the heat flow out at a lower temperature (first law of thermodynamics) and that this is an example of the law of conservation of energy.	**Student Edition:** 275-276 **Teacher Wraparound Edition:** FF 275; MM 276

STANDARDS	PAGE REFERENCES
c. *Students know* the internal energy of an object includes the energy of random motion of the object's atoms and molecules, often referred to as thermal energy. The greater the temperature of the object, the greater the energy of motion of the atoms and molecules that make up the object.	**Student Edition:** 254-258 *Applying Math* 258 **Teacher Wraparound Edition:** CC 257; TC 252
d. *Students know* that most processes tend to decrease the order of a system over time and that energy levels are eventually distributed uniformly.	**Student Edition:** 275-277
e. *Students know* that entropy is a quantity that measures the order or disorder of a system and that this quantity is larger for a more disordered system.	**Student Edition:** 276-277
f. * *Students know* the statement "Entropy tends to increase" is a law of statistical probability that governs all closed systems (second law of thermodynamics).	**Student Edition:** 277
g. * *Students know* how to solve problems involving heat flow, work, and efficiency in a heat engine and know that all real engines lose some heat to their surroundings.	**Student Edition:** 273-276 *Integrate History* 273 **Teacher Wraparound Edition:** FF 275
Waves	
4. Waves have characteristic properties that do not depend on the type of wave. As a basis for understanding this concept:	
a. *Students know* waves carry energy from one place to another.	**Student Edition:** 288-289, 298-299, 321-322, 326, 456 *Integrate Earth Science* 293 *Launch Lab* 287 **Teacher Wraparound Edition:** FYI 322; TC 286, 318; TPK 288
b. *Students know* how to identify transverse and longitudinal waves in mechanical media, such as springs and ropes, and on the earth (seismic waves).	**Student Edition:** 289-290, 294-295, 298-299 *Integrate Earth Science* 293 *National Geographic* 292 **Teacher Wraparound Edition:** A 290; CU 293; R 299; VL 296

STANDARDS	PAGE REFERENCES
c. *Students know* how to solve problems involving wavelength, frequency, and wave speed.	**Student Edition:** 295-297 *LAB* 300, 310-311 *MiniLAB* 295 **Teacher Wraparound Edition:** CC 297; QD 296; R 299
d. *Students know* sound is a longitudinal wave whose speed depends on the properties of the medium in which it propagates.	**Student Edition:** 320-321 *MiniLAB* 323 **Teacher Wraparound Edition:** FYI 290, 321
e. *Students know* radio waves, light, and X-rays are different wavelength bands in the spectrum of electromagnetic waves whose speed in a vacuum is approximately 3×10^8 m/s (186,000 miles/second).	**Student Edition:** 460, 462-467 *Science and History* 478 *Use the Internet LAB* 476-477 **Teacher Wraparound Edition:** CC 470; DI 471
f. *Students know* how to identify the characteristic properties of waves: interference (beats), diffraction, refraction, Doppler effect, and polarization.	**Student Edition:** 294-299, 301-309, 323-325 **Teacher Wraparound Edition:** CC 307; QD 304, 324; R 299
Electric and Magnetic Phenomena	
5. Electric and magnetic phenomena are related and have many practical applications. As a basis for understanding this concept:	
a. *Students know* how to predict the voltage or current in simple direct current (DC) electric circuits constructed from batteries, wires, resistors, and capacitors.	**Student Edition:** 404-405 *Design Your Own LAB* 414-415 **Teacher Wraparound Edition:** FYI 409; LD 408; R 405
b. *Students know* how to solve problems involving Ohm's law.	**Student Edition:** 405 **Teacher Wraparound Edition:** R 405; SJ 411
c. *Students know* any resistive element in a DC circuit dissipates energy, which heats the resistor. Students can calculate the power (rate of energy dissipation) in any resistive circuit element by using the formula Power = IR (potential difference) × I (current) = I^2R.	**Student Edition:** 403-404, 410-413 **Teacher Wraparound Edition:** D 403; MM 410; SJ 411

STANDARDS	PAGE REFERENCES
d. *Students know* the properties of transistors and the role of transistors in electric circuits.	**Teacher Wraparound Edition:** USW 394
e. *Students know* charged particles are sources of electric fields and are subject to the forces of the electric fields from other charges.	**Student Edition:** 392-394, 396, 398-399 *MiniLAB* 398 *National Geographic* 397 **Teacher Wraparound Edition:** CU 399; IM 396; SJ 393
f. *Students know* magnetic materials and electric currents (moving electric charges) are sources of magnetic fields and are subject to forces arising from the magnetic fields of other sources.	**Student Edition:** 424-426, 428-430, 431-437 *Integrate Life Science* 428 *Launch Lab* 423 *MiniLAB* 427 **Teacher Wraparound Edition:** FYI 432; QD 426; USW 425
g. *Students know* how to determine the direction of a magnetic field produced by a current flowing in a straight wire or in a coil.	**Student Edition:** 426, 431-432 **Teacher Wraparound Edition:** FF 427
h. *Students know* changing magnetic fields produce electric fields, thereby inducing currents in nearby conductors.	**Student Edition:** 431-437, 438-444 *LAB* 445 **Teacher Wraparound Edition:** D 435; DI 436; FYI 443; IL 434; TPK 431
i. *Students know* plasmas, the fourth state of matter, contain ions or free electrons or both and conduct electricity.	**Student Edition:** 500, 803, 827-829 *Integrate Astronomy* 261 **Teacher Wraparound Edition:** FYI 803
j. * *Students know* electric and magnetic fields contain energy and act as vector force fields.	**Student Edition:** 394, 396-399, 424-427, 431-432, 457-458 *National Geographic* 397 **Teacher Wraparound Edition:** IM 396; VL 398
k. * *Students know* the force on a charged particle in an electric field is qE, where E is the electric field at the position of the particle and q is the charge of the particle.	This standard falls outside the scope of this text and can be met during teacher/class discussion.

STANDARDS	PAGE REFERENCES
l. * *Students know* how to calculate the electric field resulting from a point charge.	This standard falls outside the scope of this text and can be met during teacher/class discussion.
m. * *Students know* static electric fields have as their source some arrangement of electric charges.	**Student Edition:** 394 **Teacher Wraparound Edition:** VL 398
n. * *Students know* the magnitude of the force on a moving particle (with charge q) in a magnetic field is qvB sin(a), where a is the angle between v and B (v and B are the magnitudes of vectors v and B, respectively), and students use the right-hand rule to find the direction of this force.	This standard falls outside the scope of this text and can be met during teacher/class discussion.
o. * *Students know* how to apply the concepts of electrical and gravitational potential energy to solve problems involving conservation of energy.	**Student Edition:** 135, 136-140 *Design Your Own Physics Lab* 144-145 *National Geographic* 138 **Teacher Wraparound Edition:** LD 138; QD 132
Earth Sciences **Science Content Standards** *Standards that all students are expected to achieve in the course of their studies are unmarked. Standards that all students should have the opportunity to learn are marked with an asterisk (*).*	
Earth's Place in the Universe	
1. Astronomy and planetary exploration reveal the solar system's structure, scale, and change over time. As a basis for understanding this concept:	
a. *Students know* 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.	**Student Edition:** 223, 231
b. *Students know* 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.	**Student Edition:** 221 **Teacher Wraparound Edition:** A 222; R 222; SCB 216E; VL 221

STANDARDS	PAGE REFERENCES
c. *Students know* the evidence from geological studies of Earth and other planets suggest that the early Earth was very different from Earth today.	**Student Edition:** 187, 354-361, 372 *Integrate Earth Science* 108 *Launch Lab* 353 **Teacher Wraparound Edition:** SCB 352F; VL 206
d. *Students know* the evidence indicating that the planets are much closer to Earth than the stars are.	**Student Edition:** 218-221, 247 #23-#25, 845 #31 *Launch Lab* 217 **Teacher Wraparound Edition:** CFU 189; IM 816F
e. *Students know* the Sun is a typical star and is powered by nuclear reactions, primarily the fusion of hydrogen to form helium.	**Student Edition:** 500, 803, 827-829 **Teacher Wraparound Edition:** CB 280; CFU 500; MM 803; VL 221
f. *Students know* 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.	**Student Edition:** 203-207, 223 *LAB* 230 *National Geographic* 205, 633 **Teacher Wraparound Edition:** ACT 206; QD 203; SCB 184E; V 633; VL 203
g. * *Students know* the evidence for the existence of planets orbiting other stars.	**Student Edition:** 222 **Teacher Wraparound Edition:** IA 74; QD 221
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:	
a. *Students know* the solar system is located in an outer edge of the disc-shaped Milky Way galaxy, which spans 100,000 light years.	**Student Edition:** 834-835 *Science Online* 834 **Teacher Wraparound Edition:** CC 834; CFU 835; QD 834; VL 834
b. *Students know* galaxies are made of billions of stars and comprise most of the visible mass of the universe.	**Student Edition:** 831-832 *Launch Lab* 817 **Teacher Wraparound Edition:** IL 832; R 835

STANDARDS	PAGE REFERENCES
c. *Students know* the evidence indicating that all elements with an atomic number greater than that of lithium have been formed by nuclear fusion in stars.	**Student Edition:** 598, 824-825
d. *Students know* 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.	**Student Edition:** 818-822, 823-829, 845 #22, 847 #17 **Teacher Wraparound Edition:** DI 826; RS 825; SJ 824; V 826
e. * *Students know* accelerators boost subatomic particles to energy levels that simulate conditions in the stars and in the early history of the universe before stars formed.	**Student Edition:** 580* *Science Online* 579 *This page discusses technology (including accelerators) used to conduct research on subatomic particles.
f.* *Students know* the evidence indicating that the color, brightness, and evolution of a star are determined by a balance between gravitational collapse and nuclear fusion.	**Student Edition:** 823-829 **Teacher Wraparound Edition:** DI 826; PR 828, 839
g.* *Students know* 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.	**Student Edition:** 836-839 *Integrate Astronomy* 324 *Model and Invent Lab* 840-841 **Teacher Wraparound Edition:** ACT 838; CFU 839; R 839; RS 837; SJ 11
Dynamic Earth Processes	
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:	
a. *Students know* features of the ocean floor (magnetic patterns, age, and sea-floor topography) provide evidence of plate tectonics.	**Student Edition:** 356-361, 387 #8, #13 *Applying Math* 357 *LAB* 379 **Teacher Wraparound Edition:** SCB 352E
b. *Students know* the principal structures that form at the three different kinds of plate boundaries.	**Student Edition:** 358-361, 373-378 *Science Online* 82, 374 **Teacher Wraparound Edition:** A 361; CC 377; CFU 361; RS 376; SCB 352E; TFYI 359; VL 356

STANDARDS	PAGE REFERENCES
c. *Students know* how to explain the properties of rocks based on the physical and chemical conditions in which they formed, including plate tectonic processes.	**Student Edition:** 565-566, 617-623, 624-629, 630-635 *Integrate Chemistry* 627 *MiniLAB* 628 **Teacher Wraparound Edition:** ACT 620; LD 627; QD 565, 625; R 623, 629, 635; SCB 606E-F; TFYI 566
d. *Students know* why and how earthquakes occur and the scales used to measure their intensity and magnitude.	**Student Edition:** 293, 362-369, 387 #16-#18 *LAB* 380-381 *Science Online* 293 **Teacher Wraparound Edition:** A 293; IES 292; IL 367; SCB 352E; V 368
e. *Students know* there are two kinds of volcanoes: one kind with violent eruptions producing steep slopes and the other kind with voluminous lava flows producing gentle slopes.	**Student Edition:** 373-378, 385 #15 **Teacher Wraparound Edition:** DI 377; PR 377; QD 374; SCB 352F; VL 378
f. * *Students know* the explanation for the location and properties of volcanoes that are due to hot spots and the explanation for those that are due to subduction.	**Student Edition:** 359, 373-378 *Applying Math* 385 *Science Online* 374 **Teacher Wraparound Edition:** CFU 378; RS 376; SCB 352E
Energy in the Earth System	
4. Energy enters the Earth system primarily as solar radiation and eventually escapes as heat. As a basis for understanding this concept:	
a. *Students know* the relative amount of incoming solar energy compared with Earth's internal energy and the energy used by society.	**Student Edition:** 501-506, 827-829 *Science Stats* 280 **Teacher Wraparound Edition:** SCB 484E-F
b. *Students know* the fate of incoming solar radiation in terms of reflection, absorption, and photosynthesis.	**Student Edition:** 269 *Integrate Astronomy* 139 *Integrate Life Science* 827 **Teacher Wraparound Edition:** CB 280; QD 520; SCB 516E; SJ 139

STANDARDS	PAGE REFERENCES
c. *Students know* the different atmospheric gases that absorb the Earth's thermal radiation and the mechanism and significance of the greenhouse effect.	**Student Edition:** 520, 538 **Teacher Wraparound Edition:** CFU 539; DIS 520; PR 522; VL 520
d. * *Students know* the differing greenhouse conditions on Earth, Mars, and Venus; the origins of those conditions; and the climatic consequences of each.	**Student Edition:** 189, 215 #11, 223-229 **Teacher Wraparound Edition:** SCB 216E
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:	
a. *Students know* how differential heating of Earth results in circulation patterns in the atmosphere and oceans that globally distribute the heat.	**Student Edition:** 267-269, 524-525 *LAB* 271 *MiniLAB* 519 *National Geographic* 268 **Teacher Wraparound Edition:** QD 218; RS 268
b. *Students know* the relationship between the rotation of Earth and the circular motions of ocean currents and air in pressure centers.	**Student Edition:** 524-525 *MiniLAB* 525 **Teacher Wraparound Edition:** A 525; CFU 528; IP 525
c. *Students know* the origin and effects of temperature inversions.	**Student Edition:** 519 *LAB* 523 **Teacher Wraparound Edition:** PR 522; TFYI 519
d. *Students know* 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.	**Student Edition:** 239, 291 *National Geographic* 292 **Teacher Wraparound Edition:** RS 292; V 292; VL 291
e. *Students know* rain forests and deserts on Earth are distributed in bands at specific latitudes.	**Student Edition:** 269, 532-534 *National Geographic* 268, 531 **Teacher Wraparound Edition:** ACT 268

STANDARDS	PAGE REFERENCES
f. * *Students know* the interaction of wind patterns, ocean currents, and mountain ranges results in the global pattern of latitudinal bands of rain forests and deserts.	**Student Edition:** 267-269, 532-534 *National Geographic* 268, 531 **Teacher Wraparound Edition:** QD 533; TFYI 532; V 268
g. * *Students know* 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.	**Student Edition:** 539, 545 #31
6. Climate is the long-term average of a region's weather and depends on many factors. As a basis for understanding this concept:	
a. *Students know* weather (in the short run) and climate (in the long run) involve the transfer of energy into and out of the atmosphere.	**Student Edition:** 520-522, 524-528, 529-534, 545 #27, 545 #29 **Teacher Wraparound Edition:** CFU 534
b. *Students know* the effects on climate of latitude, elevation, topography, and proximity to large bodies of water and cold or warm ocean currents.	**Student Edition:** 193-195, 530-534 *Integrate Earth Science* 258 *MiniLAB* 195 **Teacher Wraparound Edition:** CFU 534; DIS 532; PR 534; QD 533; R 534; RS 532; VL 194
c. *Students know* 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.	**Student Edition:** 535-539, 547 #10 *Integrate History* 377, 536 *Science and History* 382, 600 **Teacher Wraparound Edition:** R 539; SCB 516F
d. * *Students know* 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.	**Teacher Wraparound Edition:** SCB 516F

STANDARDS	PAGE REFERENCES
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. As a basis for understanding this concept:	
a. Students know the carbon cycle of photosynthesis and respiration and the nitrogen cycle.	**Student Edition:** 518-519, 536-537, 545 #28 *Integrate Life Science* 827 **Teacher Wraparound Edition:** RS 537; VL 536
b. Students know the global carbon cycle: the different physical and chemical forms of carbon in the atmosphere, oceans, biomass, fossil fuels, and the movement of carbon among these reservoirs.	**Student Edition:** 518-519 *Applying Math* 537 *Integrate Chemistry* 613 *Integrate Life Science* 586 *LAB* 51 **Teacher Wraparound Edition:** ILS 827; LD 537; PR 539; RS 537; TFYI 537; VL 536
c. Students know the movement of matter among reservoirs is driven by Earth's internal and external sources of energy.	**Student Edition:** 360-361, 387 #14, 520-522, 617-623, 663 *Integrate Life Science* 522 **Teacher Wraparound Edition:** CFU 522, 618; QD 360; TFYI 82
d. * Students know the relative residence times and flow characteristics of carbon in and out of its different reservoirs.	**Student Edition:** *Applying Math* 537
Structure and Composition of the Atmosphere	
8. Life has changed Earth's atmosphere, and changes in the atmosphere affect conditions for life. As a basis for understanding this concept:	
a. Students know the thermal structure and chemical composition of the atmosphere.	**Student Edition:** 518-519 **Teacher Wraparound Edition:** A 519; IL 521; SCB 516E
b. Students know 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.	**Student Edition:** 189, 518-519 **Teacher Wraparound Edition:** R 522; SCB 216E

STANDARDS	PAGE REFERENCES
c. Students know 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.	**Student Edition:** 466, 481 #16, 519, 538, 545 #23, 547 #11 **Teacher Wraparound Edition:** IE 466; PR 467, 539; RS 466; VL 538
California Geology	
9. The geology of California underlies the state's wealth of natural resources as well as its natural hazards. As a basis for understanding this concept:	
a. Students know the resources of major economic importance in California and their relation to California's geology.	**Student Edition:** 486-493, 494-500, 501-506, 650-652 *Science Online* 505, 614 **Teacher Wraparound Edition:** CC 609; CD 632; SCB 484E-F; TFYI 635
b. Students know the principal natural hazards in different California regions and the geologic basis of those hazards.	**Student Edition:** 358-361, 362-369, 545 #31, 662 *Integrate Social Studies* 297 **Teacher Wraparound Edition:** ACT 318; CC 130, 377; PR 369; V 368
c. Students know the importance of water to society, the origins of California's fresh water, and the relationship between supply and need.	**Student Edition:** 663-668, 681 #22 *Applying Math* 665 *Science and Society* 678 *Science Online* 667 **Teacher Wraparound Edition:** A 668; CB 678; CC 667; DI 666, 667; DIS 667; R 668; SCB 644F
d. * Students know how to analyze published geologic hazard maps of California and know how to use the map's information to identify evidence of geologic events of the past and predict geologic changes in the future.	**Student Edition:** 360, 362, 376* *Communicating Your Data* 381 *LAB* 380-381 *These page references include world maps, physical maps of California, and student-generated maps. **Teacher Wraparound Edition:** A 379; CC 377

STANDARDS	PAGE REFERENCES
Investigation & Experimentation Science Content Standards	
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.	**Student Edition:** 14-21, 22-26, 42-45 *Design Your Own Physics Lab* 344-345 *Integrate Earth Science* 11 *Integrate Physics* 30 *LAB* 27 *MiniLAB* 19 *National Geographic* 805 *Science and History* 312, 448, 600 *Use the Internet LAB* 508-509 **Teacher Wraparound Edition:** D 11; QD 41
b. Identify and communicate sources of unavoidable experimental error.	**Student Edition:** 14 *Design Your Own Physics Lab* 88-89, 568-569 *LAB* 118-119, 196, 776-777 *Science and History* 146 **Teacher Wraparound Edition:** CC 39; IM 15
c. Identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions.	**Student Edition:** 8-9, 39 *Accidents in Science* 210 *Communicate Your Data* 89, 119, 243 *Design Your Own Physics Lab* 28-29 *Science Skill Handbook* 854 **Teacher Wraparound Edition:** CC 39; CYD 87; FYI 16; IM 396; QD 10

STANDARDS	PAGE REFERENCES
d. Formulate explanations by using logic and evidence.	**Student Edition:** 12-13, 54-57, 836-839 *Design Your Own Physics Lab* 344-345 *LAB* 468, 616, 830 *Model and Invent Lab* 840-841 *Science and History* 120, 478 *Use the Internet LAB* 508-509 **Teacher Wraparound Edition:** CU 26; DI 116
e. Solve scientific problems by using quadratic equations and simple trigonometric, exponential, and logarithmic functions.	**Student Edition:** 105-106, 130-131 *Applying Math* 130 *Math Skill Handbook* 872-878 **Teacher Wraparound Edition:** FF 105; FYI 322
f. Distinguish between hypothesis and theory as scientific terms.	**Student Edition:** 8, 12, 837 *Design Your Own LAB* 28-29, 540-541 *Science Skill Handbook* 853 **Teacher Wraparound Edition:** A 9; FF 8; IL 12; SJ 11
g. Recognize the usefulness and limitations of models and theories as scientific representations of reality.	**Student Edition:** 11, 54-56, 218-219, 400-401, 837 *Accidents in Science* 210 *MiniLAB* 525 *Science and History* 146, 478 **Teacher Wraparound Edition:** A 11; FYI 48; TPK 836
h. Read and interpret topographic and geologic maps.	**Student Edition:** 530-534, 650-651, 654-661, 663-664, 667-668, 670-671, 674-675 *LAB* 676-677 *Reference Handbooks* 898 **Teacher Wraparound Edition:** A 655; AIL 677; IL 659

STANDARDS	PAGE REFERENCES
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).	**Student Edition:** 190-195, 200, 322, 354-361, 376, 436, 458, 466, 490-491, 590-591, 618, 663 *Applying Math* 198, 537 *National Geographic* 292, 397, 488 **Teacher Wraparound Edition:** DI 436; VL 458
j. Recognize the issues of statistical variability and the need for controlled tests.	**Student Edition:** 8-10 *Math Skill Handbook* 874-876 *Science Skill Handbook* 857-858 **Teacher Wraparound Edition:** DI 10, 15
k. Recognize the cumulative nature of scientific evidence.	**Student Edition:** 6-7, 581-583, 588-592, 670-673, 836-839 *Accidents in Science* 744 *Integrate History* 167, 564 *National Geographic* 582 *Science and History* 120, 478, 600 *Science and Society* 778 **Teacher Wraparound Edition:** FF 140; FYI 82, 99, 589; SJ 11
l. Analyze situations and solve problems that require combining and applying concepts from more than one area of science.	**Student Edition:** 39, 45 *Applying Math* 220 *Design Your Own Physics Lab* 540-541, 568-569 *Integrate Life Science* 54 *LAB* 379 *National Geographic* 250-251, 684-685 *Science and History* 120 *Science and Society* 178 **Teacher Wraparound Edition:** D 39; FYI 48, 82; SJ 139; VL 55

STANDARDS	PAGE REFERENCES
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.	**Student Edition:** 12, 39, 45, 46-49, 501-506 *Accidents in Science* 48, 499 *Design Your Own Physics Lab* 344-345 *LAB* 51, 507 *Science and History* 382, 478, 810 *Science and Society* 510, 778 *Use the Internet LAB* 508-509 **Teacher Wraparound Edition:** CD 8; DI 7; FYI 48
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).	**Student Edition:** 38-39, 589 *Accidents in Science* 60 *Science and History* 478 *Science and Society* 510 **Teacher Wraparound Edition:** CB 510; DI 23; FYI 48; IM 163, 401