

Publisher:	Glencoe/McGraw-Hill
Program Title:	<i>Earth Science: Geology, the Environment, and the Universe</i> © 2005
Components:	Student Edition (SE) Teacher Wraparound Edition (TWE)
Grade Level(s):	
Intended Audience:	Science 9-12th Grade Standards Map for the Discipline <b>EARTH SCIENCE</b> , pages 27-36. Discipline <b>INVESTIGATION AND EXPERIMENTATION</b> , pages 37-41.

**Standards Map - Basic Comprehensive Program  
Grades Nine Through Twelve - Science**

Pursuant to the State Board approved, *Science Content Standards for California Public Schools, Kindergarten Through Grade Twelve*  
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 (\*).

Grade	Standard #	Text of Standard	PUBLISHER CITATIONS**			Meets Standard		FOR LEA USE ONLY
			Introduced	Practiced	Taught to Mastery	Y	N	Local Education Agency Evaluator Notes
<b>DISCIPLINE</b>		<b>EARTH SCIENCES</b>						
		<b>Earth's Place in the Universe</b> Astronomy and planetary exploration reveal the solar system's structure, scale, and change over time. As a basis for understanding this concept:						
9-12	1a	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.	SE: 793-797 TWE: 794	SE: 793-797 TWE: 794, 795, 796	SE: 793-797, 803 TWE: 794, 795			
9-12	1b	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.	SE: 793-797 TWE: 774D, 793	SE: 793-797 TWE: 774D, 793, 797	SE: 793-797 TWE: 774D, 793, 797			

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9-12	1c	Students know the evidence from geological studies of Earth and other planets suggest that the early Earth was very different from Earth today.	SE: 387-388, 553-556, 570-571, 577-579, 580-583, 584-588, 589-593 TWE: 576C-D, 581	SE: 387-388, 553-556, 570-571, 577-579, 580-583, 584-588, 589-593 TWE: 571, 583	SE: 387-388, 553-556, 570-571, 577-579, 580-583, 584-588, 589-593 TWE: 581, 583, 755			
9-12	1d	Students know the evidence indicating that the planets are much closer to Earth than the stars are.	SE: 775-779, 798-799, 815-820, 921 TWE: 776, 815, 834	SE: 775-779, 798-799, 815-820, 921 TWE: 776, 777, 799, 815	SE: 775-779, 798-799, 815-820 TWE: 777, 799, 815, 860			
9-12	1e	Students know the Sun is a typical star and is powered by nuclear reactions, primarily the fusion of hydrogen to form helium.	SE: 809-810, 821-825, 859 TWE: 822, 824	SE: 809-810, 812, 821-825, 831 TWE: 811, 822, 824	SE: 809-810, 812, 821-825, 831 TWE: 822, 824			
9-12	1f	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.	SE: 633-634, 754, 780-781 TWE: 754	SE: 633-634, 754, 757, 768-769, 780-781 TWE: 634, 754, 755	SE: 633-634, 754, 768-769, 780-781 TWE: 634, 755, 782			
9-12	1g*	Students know the evidence for the existence of planets orbiting other stars.	SE: 800 TWE: 800	SE: 800 TWE: 800	SE: 800 TWE: 800			

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								Evaluator Notes	
9-12	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:							
9-12	2a	Students know the solar system is located in an outer edge of the disc-shaped Milky Way galaxy, which spans 100,000 light years.	SE: 833-838	SE: 833-838 TWE: 835, 838	SE: 833-838 TWE: 835				
9-12	2b	Students know galaxies are made of billions of stars and comprise most of the visible mass of the universe.	SE: 833-838, 839-846	SE: 833-838, 839-846 TWE: 841	SE: 833-838, 839-846 TWE: 836				
9-12	2c	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.	SE: 821-825, 859 TWE: 823, 824, 859	SE: 821-825 TWE: 825	SE: 821-825 TWE: 825				
9-12	2d	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.	SE: 813-820, 821-825 TWE: 804D, 818, 819, 821	SE: 813-820, 821-825 TWE: 816, 819, 821	SE: 813-820, 821-825 TWE: 820, 821, 823, 825				
9-12	2e*	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.	SE: 854 TWE: 854	SE: 854 TWE: 854	SE: 854 TWE: 854				
9-12	2f*	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.	SE: 821-825 TWE: 822	SE: 821-825, 831 TWE: 822, 825	SE: 821-825, 831 TWE: 822, 825				
9-12	2g*	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.	SE: 842-846, 847-851, 860 TWE: 842	SE: 842-846, 847-851, 856-857 TWE: 843, 845, 846	SE: 842-846, 847-851, 856-857 TWE: 843, 845, 846				

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		<b>Dynamic Earth Processes</b> 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:						
9-12	3a	Students know features of the ocean floor (magnetic patterns, age, and sea-floor topography) provide evidence of plate tectonics.	SE: 448-454, 455-459, 546 TWE: 442C-D, 448, 454	SE: 448-454, 455-464, 465 TWE: 449, 450, 451, 452, 453, 454, 455	SE: 448-454, 455-464, 465, 469 TWE: 450, 451, 452, 453, 454			
9-12	3b	Students know the principal structures that form at the three different kinds of plate boundaries.	SE: 455-459, 460-463, 478-479, 480-487, 528-534, 535-539 TWE: 457	SE: 455-459, 460-463, 478-479, 480-487, 528-534, 535-539 TWE: 457, 459	SE: 455-459, 460-463, 478-479, 480-487, 528-534, 535-539 TWE: 458, 459			
9-12	3c	Students know how to explain the properties of rocks based on the physical and chemical conditions in which they formed, including plate tectonic processes.	SE: 99-106, 107-113, 121-127, 128-132, 133-139, 147-148 TWE: 101, 104, 133, 147	SE: 99-106, 107-113, 114-115, 118-119, 121-127, 128-132, 133-139, 140-141, 144-145	SE: 99-106, 107-113, 114-115, 118-119, 121-127, 128-132, 133-139, 140-141, 144-145			
9-12	3d	Students know why and how earthquakes occur and the scales used to measure their intensity and magnitude.	SE: 455-459, 495-499, 500-504, 505-510 TWE: 494C-D, 498, 506, 508	SE: 455-459, 469, 495-499, 500-504, 505-510 TWE: 496, 497, 499, 506, 509	SE: 455-459, 495-499, 500-504, 505-510 TWE: 457, 497, 499, 507, 510			

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9-12	3e	Students know there are two kinds of volcanoes: one kind with violent eruptions producing steep slopes and the other kind with voluminous lava flows producing gentle slopes.	SE: 471-475, 480-487, 488-489, 490, 547 TWE: 481, 482	SE: 471-475, 480-487, 488-489, 490, 492-493 TWE: 481, 483, 484, 485	SE: 471-475, 480-487, 488-489, 490, 492-493 TWE: 481, 483, 484, 485			
9-12	3f*	Students know the explanation for the location and properties of volcanoes that are due to hot spots and the explanation for those that are due to subduction.	SE: 457, 484-487 TWE: 457	SE: 484-487 TWE: 487	SE: 484-487, 492			
		<b>Energy in the Earth System</b> Energy enters the Earth system primarily as solar radiation and eventually escapes as heat. As a basis for understanding this concept:						
9-12	4a	Students know the relative amount of incoming solar energy compared with Earth's internal energy and the energy used by society.	SE: 275-277, 578-579, 683-689, 690-697, 698 TWE: 682C-D	SE: 275-277, 578-579, 683-689, 690-697, 698 TWE: 579	SE: 275-277, 578-579, 683-689, 690-697, 698 TWE: 682D			
9-12	4b	Students know the fate of incoming solar radiation in terms of reflection, absorption, and photosynthesis.	SE: 275-277, 683-684 TWE: 281	SE: 275-277, 296-297, 683-684 TWE: 276, 277, 282	SE: 275-277, 296-297, 683-684 TWE: 277			
9-12	4c	Students know the different atmospheric gases that absorb the Earth's thermal radiation and the mechanism and significance of the greenhouse effect.	SE: 272, 375-377, 380, 725-726 TWE: 272, 380, 474	SE: 272, 375-377, 380 TWE: 380, 474, 726	SE: 272, 375-377, 380 TWE: 375, 376, 377, 380			

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						Y	N	
9-12	4d*	Students know the differing greenhouse conditions on Earth, Mars, and Venus; the origins of those conditions; and the climatic consequences of each.	SE: 375-377, 380, 725-726, 782-785 TWE: 380, 474, 782, 783	SE: 375-377, 380, 725-726, 782-785 TWE: 380, 474, 725, 782	SE: 375-377, 380, 725-726, 729, 782-785, 803 TWE: 380, 446, 725			
9-12	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:						
9-12	5a	Students know how differential heating of Earth results in circulation patterns in the atmosphere and oceans that globally distribute the heat.	SE: 299-301, 305-307, 403-405 TWE: 306, 404	SE: 299-301, 305-307, 311, 403-405 TWE: 302, 305, 404, 405	SE: 299-301, 305-307, 403-405, 411 TWE: 404, 405, 408			
9-12	5b	Students know the relationship between the rotation of Earth and the circular motions of ocean currents and air in pressure centers.	SE: 305-311, 341-343, 404 TWE: 341, 343	SE: 305-311, 326, 341-343, 404	SE: 305-311, 341-343, 404 TWE: 405			
9-12	5c	Students know the origin and effects of temperature inversions.	SE: 281	SE: 281, 296 TWE: 281	SE: 281, 284 TWE: 281			
9-12	5d	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.	SE: 392-398, 404-405 TWE: 384C-D, 392, 396, 397, 412D	SE: 392-398, 404-405, 406-407 TWE: 393, 397, 398, 405	SE: 392-398, 404-405, 406-407 TWE: 398			
9-12	5e	Students know rain forests and deserts on Earth are distributed in bands at specific latitudes.	SE: 364-365	SE: 364-365	SE: 364-365			

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9-12	5f*	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.	SE: 361-363	SE: 361-363 TWE: 363	SE: 361-363			
9-12	5g*	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.	SE: 370 TWE: 358C-D, 370, 371	SE: 370, 374, 382 TWE: 374	SE: 370, 383, 411 TWE: 342, 371			
9-12	6	Climate is the long-term average of a region's weather and depends on many factors. As a basis for understanding this concept:						
9-12	6a	Students know weather (in the short run) and climate (in the long run) involve the transfer of energy into and out of the atmosphere.	SE: 275-277, 299-304, 305-311, 359-363 TWE: 358C	SE: 275-277, 299-304, 305-311, 359-363	SE: 275-277, 299-304, 305-311, 359-363			
9-12	6b	Students know the effects on climate of latitude, elevation, topography, and proximity to large bodies of water and cold or warm ocean currents.	SE: 361-363, 364-368	SE: 361-363, 364-368 TWE: 363	SE: 361-363, 364-368, 411 TWE: 362, 366			
9-12	6c	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.	SE: 369-374, 375-377, 380 TWE: 358D, 369, 372, 373	SE: 369-374, 375-377, 380, 382 TWE: 373	SE: 369-374, 375-377, 380 TWE: 371, 374, 377			
9-12	6d*	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.	TWE: 320					

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		<b>Biogeochemical Cycles</b> 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:						
9-12	7a	Students know the carbon cycle of photosynthesis and respiration and the nitrogen cycle.	SE: 377, 664-665 TWE: 585	SE: 377, 668	SE: 377			
9-12	7b	Students know the global carbon cycle: the different physical and chemical forms of carbon in the atmosphere, oceans, biomass, fossil fuels, and the movement of carbon among these reservoirs.	SE: 272, 375-377, 380, 686-688, 696-697, 725-726 TWE: 585, 696	SE: 375-377, 380, 725-726 TWE: 725, 726	SE: 375-377, 380, 729 TWE: 725			
9-12	7c	Students know the movement of matter among reservoirs is driven by Earth's internal and external sources of energy.	SE: 290-291 TWE: 270D	SE: 290-291	SE: 290-291			
9-12	7d*	Students know the relative residence times and flow characteristics of carbon in and out of its different reservoirs.	See Glencoe's <i>Earth Science</i> © 2005 pages 120-123 for discussion of the carbon cycle.					

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		<b>Structure and Composition of the Atmosphere</b> Life has changed Earth's atmosphere, and changes in the atmosphere affect conditions for life. As a basis for understanding this concept:						
9-12	8a	Students know the thermal structure and chemical composition of the atmosphere.	SE: 271-274, 278-284 TWE: 272, 273, 274, 275	SE: 271-274, 277, 278-284, 297 TWE: 275, 277	SE: 271-274, 277, 278-284 TWE: 272, 274			
9-12	8b	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.	SE: 375-377, 380, 584-588, 725-726 TWE: 270C, 576C-D, 585	SE: 375-377, 380, 584-588, 725-726 TWE: 725	SE: 375-377, 380, 584-588, 725-726			
9-12	8c	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.	SE: 273-274, 294, 726 TWE: 272, 273, 726	SE: 273-274, 294, 297, 588, 726, 729 TWE: 729	SE: 273-274, 294, 726 TWE: 294			
		<b>California Geology</b> 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:						
9-12	9a	Students know the resources of major economic importance in California and their relation to California's geology.	SE: 89-91, 111-113, 659-663, 673, 690-697 TWE: 78, 82, 112, 657	SE: 89-91, 111-113, 659-663, 690-697 TWE: 82, 657	SE: 89-91, 111-113, 659-663, 690-697 TWE: 78, 82, 112			

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						Y	N	
9-12	9b	Students know the principal natural hazards in different California regions and the geologic basis of those hazards.	SE: 162-166, 181-190, 220-221, 495-499, 511-515 TWE: 184, 185	SE: 162-166, 181-190, 220-221, 495-499, 511-515 TWE: 184	SE: 162-166, 181-190, 220-221, 495-499, 511-515 TWE: 184, 186, 187, 497			
9-12	9c	Students know the importance of water to society, the origins of California's fresh water, and the relationship between supply and need.	SE: 228-231, 234, 239-243, 249-257, 260, 669-675 TWE: 234, 260	SE: 228-231, 234, 239-243, 249-257, 260, 669-675 TWE: 260	SE: 228-231, 234, 239-243, 249-257, 260, 669-675 TWE: 218, 221, 260			
9-12	9d*	Students know how to analyze published geologic hazard maps of California and know how to use the map's information to identify evidence of geologic events of the past and predict geologic changes in the future.	SE: 33-36	SE: 33-36, 204-205, 220, 430-431	SE: 33-36, 204-205, 430-431			
<b>DISCIPLINE</b>		<b>INVESTIGATION AND EXPERIMENTATION</b> 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:						
9-12	1a	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.		SE: 20-21, 70-71, 92-93, 114-115, 232-233, 352-353, 378-379 TWE: 41, 305	SE: 92-93, 352-353, 378-379, 488-489, 642-643, 676-677, 704-705			

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9-12	1b	Identify and communicate sources of unavoidable experimental error.		SE: 110	TWE: 110			
9-12	1c	Identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions.	TWE: 15	SE: 141, 175, 826-827 TWE: 15, 20, 213	SE: 826-827 TWE: 20			
9-12	1d	Formulate explanations by using logic and evidence.	TWE: 13	SE: 126, 140-141, 348, 378-379, 474, 587, 618-619	SE: 126, 140-141, 348, 378-379, 474, 587, 618-619			
9-12	1e	Solve scientific problems by using quadratic equations and simple trigonometric, exponential, and logarithmic functions.	SE: 644, 770, 778-779 TWE: 384D, 403, 494C-D, 506, 749, 777	SE: 20-21, 232-233, 644, 770, 778 TWE: 394, 427, 502, 749, 777	SE: 20-21, 232-233, 644, 791, 810, 843 TWE: 844			
9-12	1f	Distinguish between hypothesis and theory as scientific terms.	SE: 11, 19 TWE: 4D	SE: 19, 25 TWE: 17	TWE: 19			
9-12	1g	Recognize the usefulness and limitations of models and theories as scientific representations of reality.	SE: 18	SE: 121, 174-175, 229, 290, 299, 359, 376, 406-407 TWE: 120, 276	SE: 121, 174-175, 359, 406-407, 456, 471, 719, 798-799 TWE: 276			
9-12	1h	Read and interpret topographic and geologic maps.	SE: 32-36 TWE: 258, 422, 430	SE: 32-36, 42-43, 258-259, 430-431, 540-541 TWE: 36, 219, 220, 250, 420	SE: 32-36, 42-43, 258-259, 430-431, 540-541			

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9-12	1i	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).	SE: 329-333, 338-339, 396-398, 553-556, 557-561, 564-565 TWE: 552C, 555	SE: 329-333, 338-339, 396-398, 553-556, 557-561, 564-565, 570-571 TWE: 333, 579	SE: 329-333, 338-339, 396-398, 553-556, 557-561, 564-565, 570-571, 793-797 TWE: 561			
9-12	1j	Recognize the issues of statistical variability and the need for controlled tests.	SE: 11-12, 930-931	SE: 12, 16, 25, 232-233, 378-379	SE: 232-233, 378-379, 704-705			
9-12	1k	Recognize the cumulative nature of scientific evidence.	SE: 17, 443-447, 448-454, 455-459, 460, 463, 775-779	SE: 17, 443-447, 448-454, 455-459, 460, 463, 775-779	SE: 17, 443-447, 448-454, 455-459, 460, 463, 775-779 TWE: 455			
9-12	1l	Analyze situations and solve problems that require combining and applying concepts from more than one area of science.	SE: 44, 380, 678-679 TWE: 52C-D, 56, 61, 816, 824	SE: 44, 380, 642-643, 678-679, 704-705 TWE: 39, 62, 64, 640, 836	SE: 44, 380, 620, 642-643, 678-679, 704-705 TWE: 58, 611			
9-12	1m	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.	SE: 142, 176, 234, 260, 294, 324, 596, 706, 736 TWE: 727	SE: 142, 176, 234, 260, 294, 324, 596, 706, 736 TWE: 727	SE: 142, 176, 234, 260, 294, 324, 596, 706, 736 TWE: 727			

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9-12	1n	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).	SE: 13, 443-447, 775-779 TWE: 774C	SE: 443-447, 775-779 TWE: 13, 447	SE: 443-447, 775-779 TWE: 447			

Publisher Notes/Additional Comments (note to publishers: please include grade level/standard when listing comments):

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 Science 9-12th Grade Standards Map --Approved by the State Board of Education on Feb. 6, 2002.