



COLORADO
Science Content Standards Grades 9-12
Earth Science: Geology, the Environment,
***and the Universe* © 2005**

STANDARDS	PAGE REFERENCES
STANDARD 1: Students understand the processes of scientific investigation and design, conduct, communicate about, and evaluate such investigations. As students in grades 9-12 extend their knowledge, what they know and are able to do includes	
<ul style="list-style-type: none"> • asking questions and stating hypotheses, using prior scientific knowledge to help guide their development; 	SE: <i>Design Your Own GeoLab</i> 92-93, 378-379, 570-571 <i>Skill Review</i> 321, 351, 363 <i>Internet GeoLab</i> 352-353, 642-643 <i>GeoLab</i> 618-619 TWE: P 13
<ul style="list-style-type: none"> • creating and defending a written plan of action for a scientific investigation; 	SE: <i>Design Your Own GeoLab</i> 92-93, 378-379, 570-571, 676-677, 704-705 <i>Skill Review</i> 377 TWE: P 13, 213 A 114, 587
<ul style="list-style-type: none"> • selecting and using appropriate technologies to gather, process, and analyze data and to report information related to an investigation; 	SE: <i>Internet</i> 22 <i>Activity</i> 324 <i>Internet GeoLab</i> 352-353, 488-489, 642-643 TWE: A 41 P 82 E 90 R 158 ITI 305
<ul style="list-style-type: none"> • identifying major sources of error or uncertainty within an investigation (<i>for example, particular measuring devices and experimental procedures</i>); 	SE: <i>GeoLab</i> 20-21, 140-141, 174-175, 826-827 <i>Problem-Solving Lab</i> 110 TWE: D 15 A 21, 423 P 213 T 676
<ul style="list-style-type: none"> • constructing and revising scientific explanations and models, using evidence, logic, and experiments that include identifying and controlling variables; 	SE: <i>GeoLab</i> 20-21, 70-71, 114-115, 140-141, 174-175, 232-233, 406-407 <i>Design Your Own GeoLab</i> 798-799 TWE: CL 215 CFU 227
<ul style="list-style-type: none"> • communicating and evaluating scientific thinking that leads to particular conclusions; 	SE: 11-13, 17-19 <i>Discovery Lab</i> 5 <i>Design Your Own GeoLab</i> 92-93, 378-379 <i>GeoLab</i> 232-233, 292-293 <i>Internet GeoLab</i> 488-489 TWE: TPK 11 DI 13

STANDARDS	PAGE REFERENCES
<ul style="list-style-type: none"> recognizing and analyzing alternative explanations and models; and 	SE: <i>Science in the News</i> 596 TWE: CB 442C, 624D A 588, 593, 634 CFU 593 P 631 DIS 632 AC 633
<ul style="list-style-type: none"> explaining the difference between a scientific theory and a scientific hypothesis. 	SE: 11, 19, 24#10 TWE: IM 4D TPK 17 CFU 19
STANDARD 4: Earth and Space Science: Students know and understand the processes and interactions of Earth's systems and the structure and dynamics of Earth and other objects in space. (Focus: <i>Geology, Meteorology, Astronomy, Oceanography</i>)	
4.1 Students know and understand the composition of Earth, its history, and the natural processes that shape it. As students in grades 9-12 extend their knowledge, what they know and are able to do includes	
<ul style="list-style-type: none"> describing the composition and structure of Earth's interior; 	SE: 450, 502-504, 521#25 TWE: CB 442D, 503 DI 503 A 504
<ul style="list-style-type: none"> using the theory of plate tectonics to explain relationships among earthquakes, volcanoes, mid-ocean ridges, and deep-sea trenches; 	SE: 455-459, 480-487, 495-499, 509-510 <i>Skill Review</i> 459 TWE: AC 457 CB 457 ITI 485, 509 R 549
<ul style="list-style-type: none"> using evidence (<i>for example, fossils, rock layers, ice cores, radiometric dating</i>) to investigate how Earth has changed or remained constant over short and long periods of time (<i>for example, Mount St. Helens' eruption</i>); 	SE: 444-446, 553-556, 557-561, 562-565, 566-569 <i>MiniLab</i> 558 <i>Problem-Solving Lab</i> 560 <i>Design Your Own GeoLab</i> 570-571 TWE: CB 552C-D UST 567
<ul style="list-style-type: none"> evaluating the feasibility of predicting and controlling natural events (<i>for example, earthquakes, floods, landslides</i>); and 	SE: 181-190, 219-221, 514-515 <i>Earth Science Online</i> 220 <i>Internet GeoLab</i> 352-353 <i>Science & Technology</i> 354 TWE: TPK 182 D 187 CB 339, 343
<ul style="list-style-type: none"> analyzing the costs, benefits, and consequences of natural resource exploration, development, and consumption. 	SE: 89-91, 376-377, 655-658, 659-633, 664-668 <i>Science & Math</i> 380 TWE: E 78, 90 A 91 AC 112

OBJECTIVES	PAGE REFERENCES
4.2 Students know and understand the general characteristics of the atmosphere and fundamental processes of weather.	
As students in grades 9-12 extend their knowledge, what they know and are able to do includes	
<ul style="list-style-type: none"> analyzing the structure of, and changes in, the atmosphere, and its significance for life on Earth; 	SE: 271-277, 278-284 TWE: CB 270C, 272, 279 EC 270 IM 274 CON 275 ITI 275 A 276
<ul style="list-style-type: none"> explaining and analyzing general weather patterns by collecting, plotting, and interpreting data; 	SE: 285-291, 299-304, 305-311, 312-316, 317-321 <i>MiniLab</i> 290 <i>Problem-Solving Lab</i> 318 <i>Mapping GeoLab</i> 322-323 TWE: A 309 R 311
<ul style="list-style-type: none"> describing how energy transfer within the atmosphere influences weather (<i>for example, the role of conduction, radiation, convection, and heat of condensation in clouds, precipitation, winds, storms</i>); 	SE: 275-277, 285-291 TWE: A 276, 277 M 276 CFU 277 ACT 282 DIS 286 CON 288, 330
<ul style="list-style-type: none"> investigating and explaining the occurrence and effects of storms on human populations and the environment; and 	SE: 334-340, 341-346, 347-351 <i>Earth Science Online</i> 336 TWE: E 336 AES 337 DIS 339 A 340 R 340 DI 342
<ul style="list-style-type: none"> describing and explaining factors that may influence weather and climate (<i>for example, proximity to oceans, prevailing winds, fossil fuel burning, volcanic eruptions</i>). 	SE: 361-362, 364-368, 369-374, 375-377 <i>Science & the Environment</i> 490 TWE: CFU 363 ITI 369 CON 371 A 373 M 373
4.3 Students know major sources of water, its uses, importance, and cyclic patterns of movement through the environment.	
As students in grades 9-12 extend their knowledge, what they know and are able to do includes	
<ul style="list-style-type: none"> identifying and explaining factors that influence the quality of water needed to sustain life; 	SE: 228-231, 254-257, 669-675, 730-733 <i>Mapping GeoLab</i> 258-259 TWE: AES 230 TS 234 ESJ 256 TPK 730 CFU 733

OBJECTIVES	PAGE REFERENCES
<ul style="list-style-type: none"> identifying and analyzing the costs, benefits, and consequences of using water resources; 	SE: 219-221, 228-231, 254-257, 669-675, 730-733 <i>Science & the Environment</i> 234, 260 TWE: AC 218, 671 CL 672
<ul style="list-style-type: none"> explaining interactions between water and other Earth systems (<i>for example, the biosphere, lithosphere, and atmosphere</i>); and 	SE: 155-158, 162-165, 182-183, 244-247, 387-388 <i>MiniLab</i> 163 <i>GeoLab</i> 174-175 <i>Science & the Environment</i> 176 TWE: A 9 R 10
<ul style="list-style-type: none"> explaining interrelationships between the circulation of oceans and weather and climate. 	SE: 361-363, 403-405, 411#23 TWE: CB 358C-D CFU 405, 439 SF 436 E 438
4.4 Students know the structure of the solar system, composition and interactions of objects in the universe, and how space is explored. As students in grades 9-12 extend their knowledge, what they know and are able to do includes	
<ul style="list-style-type: none"> explaining the causes of and modeling the varied lengths of days, seasons, and phases of the Moon; 	SE: 370, 758-767 <i>MiniLab</i> 761 TWE: E 370 D 758 DI 759, 763 M 760 ACT 767 A 767
<ul style="list-style-type: none"> describing the effect of gravitation on the motions observed in the solar system and beyond; 	SE: 402-403, 764, 778-779, 793-797, 803#19, 814 <i>Science in the News</i> 800 TWE: CB 384D, 764 DIS 822
<ul style="list-style-type: none"> describing electromagnetic radiation produced by the Sun and other stars (<i>for example, X-ray, ultraviolet, visible light, infrared, radio</i>); 	SE: 37-41, 747-752, 811-812 TWE: D 37 ITI 38, 748 A 41, 748 CB 746C CFU 812
<ul style="list-style-type: none"> comparing the Sun with other stars (<i>for example, size, color, temperature</i>); and 	SE: 805-812, 813-820, 821-825 <i>Earth Science Online</i> 810 <i>Section Assessment</i> 820, 825 TWE: CB 819 TPK 821 A 825 R 861

OBJECTIVES	PAGE REFERENCES
<ul style="list-style-type: none"> identifying and describing the everyday impact of recent space technology (<i>for example, more sophisticated computers, remote sensing, medical imaging</i>). 	SE: 37-41, 753 <i>Science & Technology</i> 466 TWE: CB 7 CL 38 EC 39 ACT 40 CFU 41
STANDARD 5: Students know and understand interrelationships among science, technology, and human activity and how they can affect the world. As students in grades 9-12 extend their knowledge, what they know and are able to do includes	
<ul style="list-style-type: none"> analyzing benefits, limitations, costs, and consequences involved in using technology or resources (<i>for example, X-rays, agricultural chemicals, natural gas reserves</i>); 	SE: 690-697 <i>Science & the Environment</i> 260, 706 <i>Science & Technology</i> 466, 736, 854 <i>Skill Review</i> 697 TWE: CB 682C-D CL 695 TS 736
<ul style="list-style-type: none"> analyzing how the introduction of a new technology has affected or could affect human activity (<i>for example, invention of the telescope, applications of modern telecommunications</i>); 	SE: <i>Science & Technology</i> 72, 116, 354 <i>Internet</i> 466 <i>Science & the Environment</i> 736 TWE: TS 466
<ul style="list-style-type: none"> demonstrating the interrelationships between science and technology (<i>for example, building a bridge, designing a better running shoe</i>); and 	SE: 10, 317-321, 448-454, 747-752 <i>Science & Technology</i> 22, 466, 854 <i>Science in the News</i> 828 <i>National Geographic Expeditions</i> 902-907 TWE: AS 907
<ul style="list-style-type: none"> explaining the use of technology in an occupation. 	SE: 37-41, 312-316, 317-321, 385-387, 448, 747-752 <i>Science & Technology</i> 466 TWE: E 90 CB 298D TS 466
STANDARD 6: Students understand that science involves a particular way of knowing and understand common connections among scientific disciplines. As students in grades 9-12 extend their knowledge, what they know and are able to do includes	
<ul style="list-style-type: none"> evaluating print and visual media for scientific evidence, bias, or opinion; 	TWE: CB 4D TPK 11
<ul style="list-style-type: none"> explaining that the scientific way of knowing uses a critique and consensus process (<i>for example, peer review, openness to criticism, logical arguments, skepticism</i>); 	SE: 17 <i>Design Your Own GeoLab</i> 92-93, 378-379, 676-677, 704-705, 798-799 <i>Internet GeoLab</i> 352-353 <i>GeoLab</i> 826-827 TWE: M 695

OBJECTIVES	PAGE REFERENCES
<ul style="list-style-type: none"> using graphs, equations, or other models to analyze systems involving change and constancy (<i>for example, comparing the geologic time scale to shorter time frames</i>); 	SE: <i>GeoLab</i> 232-233 <i>Design Your Own GeoLab</i> 378-379, 676-677, 798-799 <i>Problem-Solving Lab</i> 401, 560 <i>Mapping GeoLab</i> 464-465 <i>Earth Science Online</i> 555 TWE: DI 554 ACT 557
<ul style="list-style-type: none"> analyzing and comparing models of cyclic change as used within and among scientific disciplines (<i>for example, water cycle, circular motion, sound waves, weather cycles</i>); 	SE: 138-139, 290-291, 347-351, 758-767 <i>MiniLab</i> 290 <i>Problem-Solving Lab</i> 350 TWE: A 139, 351, 377 CB 270D
<ul style="list-style-type: none"> identifying and predicting cause-effect relationships within a system (<i>for example, the effect of temperature on gas volume, effect of carbon dioxide level on the greenhouse effect, effects of changing nutrients at the base of a food pyramid</i>); 	SE: 375-377, 471-475, 610-611, 633-634 <i>GeoLab</i> 140-141 <i>MiniLab</i> 348 <i>Skill Review</i> 611 TWE: A 377, 611 R 475
<ul style="list-style-type: none"> identifying and describing the dynamics of natural systems (<i>for example, weather systems, ecological systems, body systems, systems at dynamic equilibrium</i>); 	SE: 77-83, 214-221, 308-311, 341-346, 453-459, 495-499, 775-779 <i>MiniLab</i> 79 TWE: CL 215 DIS 822
<ul style="list-style-type: none"> identifying and testing a model to analyze systems involving change and constancy (<i>for example, a mathematical expression for gas behavior; constructing a closed ecosystem such as an aquarium</i>); 	SE: 121-127, 133-139 <i>GeoLab</i> 140-141 <i>MiniLab</i> 376 <i>Design Your Own GeoLab</i> 676-677, 704-705 TWE: CL 496 D 498, 693
<ul style="list-style-type: none"> explaining an exponential model (<i>for example, pH scale, population growth, Richter scale</i>); and 	SE: 505, 711-715 <i>Section Assessment</i> 510 TWE: CB 494C-D, 506 A 510 CFU 510 R 510 DIS 713 AC 714
<ul style="list-style-type: none"> refining a hypothesis based on an accumulation of data over time (<i>for example, Alvarez's theory on dinosaur extinction</i>). 	SE: 443-447, 448-454, 455-459, 460-463 TWE: CB 444 AC 445 M 446 R 447 A 447 CFU 447

Codes Used for TWE pages

A	Assessment
AC	Across the Curriculum
ACT	Activity
AES	Applying Earth Science
AS	Assignment
CB	Content Background
CFU	Check for Understanding
CL	Collaborative Learning
CON	Content Development
D	Demo
DI	Differentiated Instruction
DIS	Discussion
E	Enrichment
EC	Environmental Connection
ESJ	Earth Science Journal
IM	Identifying Misconceptions
ITI	Interpreting the Illustration
M	Modeling
P	Project
R	Reteach
SF	Section Focus
T	Troubleshooting
TPK	Tying to Previous Knowledge
TS	Teaching Strategies
UST	Using Scientific Terms