



EARTH SCIENCE

*Geology, the Environment,
and the Universe*

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STANDARDS		PAGE REFERENCES
<u>I. Content Standards</u>		
1. Matter and Energy in the Earth System		
<i>Broad Concepts:</i> The entire Earth system and its various cycles are driven by energy. Earth has both internal and external sources of energy. Two fundamental energy concepts included in the Earth system are gravity and electromagnetism.		
1.1	Identify Earth's principal sources of internal and external energy, such as, radioactive decay, gravity, and solar energy.	<p>Student Edition: 211-212, 275, 460-463, 578-579, 657, 683-684 <i>Discovery Lab</i> 683 <i>GeoDigest</i> 741</p> <p>Teacher Wraparound Edition: A 683; ACT 432; CB 442C; DIS 694; IM 682D; R 579; TPK 578</p>
1.2	Describe the characteristics of electromagnetic radiation and give examples of its impact on life and Earth's systems.	<p>Student Edition: 37-41, 747-752</p> <p>Teacher Wraparound Edition: A 41; ACT 40; CB 726; CFU 41; CL 38; CON 38; D 37; EC 39; ITI 38, 39, 748</p>
1.3	Explain how the transfer of energy through radiation, conduction, and convection contributes to global atmospheric processes, such as, storms, winds, and currents.	<p>Student Edition: 275-277, 297 #18</p> <p>Teacher Wraparound Edition: A 277; CB 270C, 300; CFU 277; TPK 306</p>

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1.4 Provide examples of how the unequal heating of Earth and the Coriolis effect influence global circulation patterns, and show how they impact Massachusetts weather and climate, such as, global winds, convection cells, land/sea breezes, and mountain/valley breezes.	Student Edition: 299-304, 305-311, 327 #18 <i>GeoDigest</i> 436 Teacher Wraparound Edition: A 405; CB 298C, 308; CON 306, 330, 437; ITI 305; TPK 306
1.5 Explain how the revolution of Earth around the Sun and the inclination of Earth on its axis cause Earth's seasonal variations (equinoxes and solstices).	Student Edition: 370, 759-762 <i>MiniLab</i> 761 Teacher Wraparound Edition: A 761; AES 760; E 370, 762; ITI 760; M 760
1.6 Describe the various conditions associated with frontal boundaries and cyclonic storms (such as, thunderstorms, winter storms [nor'easters], hurricanes, and tornadoes) and their impact on human affairs, including storm preparations.	Student Edition: 305-311, 329-333, 334-340, 341-346, 347-351 <i>Discovery Lab</i> 299 <i>Earth Science Online</i> 309 Teacher Wraparound Edition: A 309, 311, 346; ACT 310; CL 308; E 336; R 311, 340
1.7 Explain the dynamics of oceanic currents, including upwelling, deep-water currents, the Labrador Current and the Gulf Stream, and their relationship to global circulation within the marine environment and climate.	Student Edition: 362, 370-371, 403-405, 411 #21, #23 Teacher Wraparound Edition: CB 358C-D; CFU 405; CON 371; E 438; ESJ 404; R 405; SF 436
1.8 Read, interpret, and analyze a combination of ground-based observations, satellite data, and computer models to demonstrate Earth systems and their interconnections.	Student Edition: 312-316, 317-321 <i>Mapping GeoLab</i> 322-323, 768-769 <i>Internet GeoLab</i> 352-353 Teacher Wraparound Edition: A 316; CL 38; CON 38; DI 38, 317; E 673; M 28; R 41; TPK 219
2. Energy Resources in the Earth System	
<i>Broad Concept:</i> Energy resources are used to sustain human civilization. The amount and accessibility of these resources influences their use and their impact on the environment.	
2.1 Recognize, describe, and compare renewable energy resources (such as, solar, wind, water, and biomass) and nonrenewable energy resources (such as, fossil fuels and nuclear energy.)	Student Edition: 656-658, 683-689, 690-697 <i>Earth Science Online</i> 694 <i>Science & the Environment</i> 736 Teacher Wraparound Edition: A 656; AC 686, 692; CB 682C-D, 684, 696; CL 695; M 692, 695; P 685

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2.2 Describe the effects on the environment and on the carbon cycle of using both renewable and nonrenewable sources of energy.	Student Edition: 375-377, 411 #24, 664, 725-726 <i>Problem-Solving Lab</i> 18 <i>Science & Math</i> 380 <i>Earth Science Online</i> 725 Teacher Wraparound Edition: A 729; P 725
3. Earth Processes and Cycles	
<i>Broad Concepts</i> Earth is a dynamic interconnected system. The evolution of Earth has been driven by interactions between the lithosphere, hydrosphere, atmosphere, and biosphere. Over geologic time the internal motions of Earth have continuously altered the topography and geography of the continents and ocean basins by both constructive and destructive processes.	
3.1 Explain how physical and chemical weathering leads to erosion and the formation of soils and sediments, and creates the various types of landscapes. Give examples that show the effects of physical and chemical weathering on the environment.	Student Edition: 153-161, 162-166, 167-173, 181-190, 191-197, 198-203, 244-248 <i>Discovery Lab</i> 153, 181 <i>MiniLab</i> 163 <i>GeoLab</i> 174-175 Teacher Wraparound Edition: CB 223; DI 155; DIS 155; M 183
3.2 Describe the carbon cycle.	Student Edition: 664 Also see Glencoe's <i>Life Science</i> © 2005. Student Edition: 725 <i>National Geographic</i> 724
3.3 Describe the nitrogen cycle.	Student Edition: 665 Also see Glencoe's <i>Life Science</i> © 2005. Student Edition: 722-723
3.4 Explain how water flows into and through a watershed. Explain the role of aquifers, wells, porosity, permeability, water table, and runoff.	Student Edition: 211-221, 222-227, 239-243, 249-257 <i>Discovery Lab</i> 211, 239 <i>MiniLab</i> 254 Teacher Wraparound Edition: A 243; ACT 241; CB 210C-D; CL 215; DIS 216; M 214, 250; P 213

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<p>3.5 Describe the processes of the hydrologic cycle including evaporation, condensation, precipitation, surface runoff and groundwater percolation, infiltration, and transpiration.</p>	<p>Student Edition: 211-212, 239-240, 289-291 <i>MiniLab</i> 290</p> <p>Teacher Wraparound Edition: A 240, 377; CB 210C-D, 270D; CL 289; IM 212; R 243, 291; TPK 392</p>
<p>3.6 Describe the rock cycle, and the processes that are responsible for the formation of igneous, sedimentary, and metamorphic rocks. Compare the physical properties of these rock types and the physical properties of common rock-forming minerals.</p>	<p>Student Edition: 80-83, 99-106, 107-113, 121-127, 128-132, 133-139 <i>Discovery Lab</i> 99, 121 <i>MiniLab</i> 108 <i>Problem-Solving Lab</i> 110 <i>GeoLab</i> 114-115, 140-141</p> <p>Teacher Wraparound Edition: A 139; DIS 135; TPK 125</p>
<p>3.7 Describe the absolute and relative dating methods used to measure geologic time, such as, index fossils, radioactive dating, law of superposition, and crosscutting relationships.</p>	<p>Student Edition: 557-561, 562-564, 566-569 <i>MiniLab</i> 558 <i>Problem-Solving Lab</i> 560</p> <p>Teacher Wraparound Edition: A 565; CB 552C-D, 563; CFU 565; CL 568; EC 568; ESJ 564; M 559; R 561, 569</p>
<p>3.8 Trace the development of a lithospheric plate from its growth at a divergent boundary (mid-ocean ridge) to its destruction at a convergent boundary (subduction zone). Recognize that alternating magnetic polarity is recorded in rock at mid-ocean ridges.</p>	<p>Student Edition: 448-454, 455-459 <i>Using Math</i> 452 <i>Problem-Solving Lab</i> 458 <i>Mapping GeoLab</i> 464-465</p> <p>Teacher Wraparound Edition: A 459; CB 442C-D; CFU 459; DI 453, 457; ITI 451, 453, 455; M 452; R 459</p>
<p>3.9 Explain the relationship between convection currents in Earth's mantle and the motion of the lithospheric plates.</p>	<p>Student Edition: 460-463, 469 #16</p> <p>Teacher Wraparound Edition: A 461; CB 442C; CFU 463; D 460; ESJ 462; ITI 461; R 463</p>
<p>3.10 Relate earthquakes, volcanic activity, tsunamis, mountain building and tectonic uplift to plate movements.</p>	<p>Student Edition: 455-459, 469 #26, 484-487, 509-510, 528-534, 535-539 <i>GeoLab</i> 516-517</p> <p>Teacher Wraparound Edition: CFU 487, 534; ITI 485, 509, 533; R 534, 549; TPK 531</p>

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3.11	Explain how seismic data are used to reveal Earth's interior structure and to locate earthquake epicenters.	Student Edition: 500-504 Teacher Wraparound Edition: A 504; CB 494C, 503; CFU 504; R 504
3.12	Describe the Richter scale of earthquake magnitude and the relative damage that is incurred by earthquakes of a given magnitude.	Student Edition: 505-507, 521 #27 <i>Science in the News</i> 518 Teacher Wraparound Edition: A 510; CB 494C-D; CFU 510; E 506; ESJ 513; TL 514
4. The Origin and Evolution of the Universe		
<i>Broad Concept:</i> The origin of the universe, between 14 and 15 billion years ago, still remains one of the greatest questions in science. Gravity influences the formation and life cycles of galaxies, including our own Milky Way Galaxy, stars, planetary systems, and residual material left from the creation of the solar system.		
4.1	Explain the Big Bang Theory and discuss the evidence that supports it, such as, background radiation, and relativistic Doppler effect ~ "red shift".	Student Edition: 842-846, 847-851 <i>Problem-Solving Lab</i> 843 <i>MiniLab</i> 845 <i>Using Math</i> 850 Teacher Wraparound Edition: A 843; AC 314; ACT 848; CB 850; CFU 851; DIS 848
4.2	Describe the influence of gravity and inertia on the rotation and revolution of orbiting bodies. Explain the sun-Earth-moon relationships, such as, day, year, solar/lunar eclipses and tides.	Student Edition: 758-767, 778-779 <i>Earth Science Online</i> 765 <i>Problem-Solving Lab</i> 766 Teacher Wraparound Edition: A 767, 779; ACT 765; CB 763; CFU 767, 779; D 764; DI 759, 763; E 764; R 767
4.3	Explain how the sun, Earth, and solar system formed from a nebula of dust and gas in a spiral arm of the Milky Way Galaxy about 4.6 billion years ago.	Student Edition: 793-797 Teacher Wraparound Edition: AC 794; CB 774D; CFU 797; ITI 795; R 797; TPK 793, 794; UAA 794

II. Scientific Inquiry Skills Standards

Scientific literacy can be achieved by supporting students to inquire about geologic, meteorological, oceanographic, and astronomical phenomena. Scientific skills that are developed in Earth and Space Science include the inquiry skills presented below, as well as reading and interpreting maps, keys, and satellite, radar, and telescope imageries; using satellite and radar images and weather maps to illustrate weather forecasts; using seismic data to identify regions of seismic activity, and using data from various instruments that are used to study deep space and the solar system. The science curriculum should include substantial hands-on laboratory and field experiences, as appropriate, for students to develop and use scientific skills in Earth and Space Science.

SIS1. Make observations, raise questions, and formulate hypotheses.

Students will be able to:

- Observe the world around them from a scientific perspective.
- Pose questions and form hypotheses based on personal observations, scientific articles, experiments, and knowledge.
- Read, interpret, and examine the credibility and validity of scientific claims in different sources of information, such as scientific articles, advertisements, or media stories.

Student Edition:

11-16

Design Your Own GeoLab 92-93, 378-379, 570-571

Internet GeoLab 352-353, 488-489

Teacher Wraparound Edition:

A 12, 149; ACT 158; CL 157, 338; DI 13; P 13, 218; TPK 11

SIS2. Design and conduct scientific investigations.

Students will be able to:

- Articulate and explain the major concepts being investigated and the purpose of an investigation.
- Select required materials, equipment, and conditions for conducting an experiment.
- Identify independent and dependent variables.
- Write procedures that are clear and replicable.
- Employ appropriate methods for accurately and consistently
 - making observations;
 - making and recording measurements at an appropriate level of precision and;
 - collecting data or evidence in an organized way.
- Properly use instruments, equipment, and materials (such as scales, probeware, meter sticks, microscopes, computers, etc.) including: set-up, calibration (if required), technique, maintenance, and storage.
- Follow safety guidelines.

Student Edition:

11-16

MiniLab 12

GeoLab 20-21, 70-71, 114-115, 140-141, 174-175, 232-233, 292-293, 406-407

Design Your Own GeoLab 92-93

Teacher Wraparound Edition:

A 71, 115; M 130; P 13

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<p>SIS3. Analyze and interpret results of scientific investigations.</p> <p><i>Students will be able to:</i></p> <ul style="list-style-type: none"> Present relationships between variables in appropriate forms. ○ Represent data and relationships between variables in charts and graphs. ○ Use appropriate technology (such as graphing software, etc.) and other tools. <p>Use mathematical operations to analyze and interpret data results.</p> <p>Identify reasons for inconsistent results, such as sources of error or uncontrolled conditions, and assess the reliability of data.</p> <p>Use results of an experiment to develop a conclusion to an investigation that addresses the initial questions and supports or refutes the stated hypothesis.</p> <p>State questions raised by an experiment that may require further investigation.</p>	<p>Student Edition:</p> <p><i>GeoLab</i> 20-21, 70-71, 114-115, 140-141, 174-175, 232-233, 292-293, 406-407, 618-619</p> <p><i>Design Your Own GeoLab</i> 92-93, 570-571</p> <p><i>Problem-Solving Lab</i> 110</p> <p>Teacher Wraparound Edition:</p> <p>A 21, 110; D 15</p>
<p>SIS4. Communicate and apply the results of scientific investigations.</p> <p><i>Students will be able to:</i></p> <ul style="list-style-type: none"> Develop descriptions and explanations of scientific concepts that an investigation focused on. Review information, explain statistical analysis, and summarize data collected and analyzed from an investigation. Explain diagrams and charts that represent relationships of variables. Construct a reasoned argument and respond appropriately to critical comments and questions. Use language and vocabulary appropriately, speak clearly and logically, and use appropriate technology (such as presentation software, etc.) and other tools to present findings. Use and refine scientific models that simulate physical processes or phenomena. 	<p>Student Edition:</p> <p>17-19</p> <p><i>GeoLab</i> 20-21, 114-115, 140-141, 174-175, 232-233, 292-293, 406-407</p> <p><i>Design Your Own GeoLab</i> 92-93, 378-379, 570-571</p> <p><i>Internet GeoLab</i> 352-353, 488-489, 852-853</p> <p>Teacher Wraparound Edition:</p> <p>A 19</p>