EARTH AND SPACE Science
Scope and Sequence

National Science Standards	Unit 1 Geology	Unit 2 Geologic Changes	Unit 3 The Dynamic Earth	Unit 4 Water and Water Systems	Unit 5 Meteorology	Unit 6 The Environment	Unit 7 Astronomy	Unit 8 The Great Expanse
Unifying Concepts and Processes								
• Systems, order, and organization	•	•	•	•	•	•	•	•
• Evidence, models, and explanation	•	•	•	•	•	•	•	•
• Change, constancy, and measurement	•	•	•	•	•	•	•	•
• Form and function	•	•	•	•	•	•	•	•
Science as Inquiry								
Abilities Necessary to Do Scientific Inquiry								
• Identify questions that can be answered through scientific investigations.		•	•	•	•	•	•	•
• Design and conduct a scientific investigation.		•	•	•	•	•		•
• Use appropriate tools and techniques to gather, analyze, and interpret data.	•	•	•	•	•	•	•	•
• Develop descriptions, explanations, predictions, and models using evidence.	•	•	•	•	•	•	•	•
• Think critically and logically to make the relationships between evidence and explanations.	•	•	•	•	•	•	•	•
• Recognize and analyze alternative explanations and predictions.	•		•	•	•	•	•	•
• Communicate scientific procedures and explanations.	•	•	•	•	•	•	•	•
• Use mathematics in all aspects of scientific inquiry.	•	•	•		•	•	•	•

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	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8
Understandings About Scientific Inquiry								
• Different kinds of questions suggest different kinds of scientific investigations.	•	•		•		•	•	•
• Current scientific knowledge and understanding guide scientific investigations.	•	•	•	•	•	•	•	•
• Mathematics is important in all aspects of scientific inquiry.	•	•	•		•	•	•	•
• Technology used to gather data enhances accuracy and allows scientists to analyze and quantify results of investigations.	•	•	•	•	•		•	•
• Scientific explanations emphasize evidence, have logically consistent arguments, and use scientific principles, models, and theories.	•	•	•		•	•	•	•
• Science advances through legitimate skepticism. Asking questions and querying other scientists' explanations is part of scientific inquiry.	•	•					•	
• Scientific investigations sometimes result in new ideas and phenomena for study, generate new methods or procedures for an investigation, or develop new technologies to improve the collection of data.		•	•			•	•	
Grades 5 – 8 Earth and Space Science Content Standards								
Structure of the Earth System								
• The solid earth is layered with a lithosphere; hot, convecting mantle; and dense, metallic core.	•							
• Lithospheric plates on the scales of continents and oceans constantly move at rates of centimeters per year in response to movement in the mantle. Major geological events, such as earthquakes, volcanic eruptions, and mountain building, result from these plate motions.			•					
• Land forms are the result of a combination of constructive and destructive forces. Constructive forces include crustal deformation, volcanic eruption, and deposition of sediment, while destructive forces include weathering and erosion.		•	•					
• Some changes in the solid earth can be described as the "rock cycle." Old rocks at the earth's surface weather, forming sediments that are buried, then compacted, heated, and often recrystallized into new rock. Eventually, those new rocks may be brought to the surface by the forces that drive plate motions, and the rock cycle continues.	•							

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8
• Soil consists of weathered rocks and decomposed organic material from dead plants, animals, and bacteria. Soils are often found in layers, with each having a different chemical composition and texture.		•						
• Water, which covers the majority of the earth's surface, circulates through the crust, oceans, and atmosphere in what is known as the "water cycle." Water evaporates from the earth's surface, rises and cools as it moves to higher elevations, condenses as rain or snow, and falls to the surface where it collects in lakes, oceans, soil, and in rocks underground.				•				
• Water is a solvent. As it passes through the water cycle it dissolves minerals and gases and carries them to the oceans.				•				
• The atmosphere is a mixture of nitrogen, oxygen, and trace gases that include water vapor. The atmosphere has different properties at different elevations.		•			•	•		
• Clouds, formed by the condensation of water vapor, affect weather and climate.				•	•			
• Global patterns of atmospheric movement influence local weather. Oceans have a major effect on climate, because water in the oceans holds a large amount of heat.				•	•			
• Living organisms have played many roles in the earth system, including affecting the composition of the atmosphere, producing some types of rocks, and contributing to the weathering of rocks.		•						
Earth's History								
• The earth processes we see today, including erosion, movement of lithospheric plates, and changes in atmospheric composition, are similar to those that occurred in the past. Earth history is also influenced by occasional catastrophes, such as the impact of an asteroid or comet.		•	•				•	
• Fossils provide important evidence of how life and environmental conditions have changed.		•						
Earth in the Solar System								
• The earth is the third planet from the sun in a system that includes the moon, the sun, seven other planets and their moons, and smaller objects, such as asteroids and comets. The sun, an average star, is the central and largest body in the solar system.							•	
• Most objects in the solar system are in regular and predictable motion. Those motions explain such phenomena as the day, the year, phases of the moon, and eclipses.							•	

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8
• Gravity is the force that keeps planets in orbit around the sun and governs the rest of the motion in the solar system. Gravity alone holds us to the earth's surface and explains the phenomena of the tides.							•	
• The sun is the major source of energy for phenomena on the earth's surface, such as growth of plants, winds, ocean currents, and the water cycle. Seasons result from variations in the amount of the sun's energy hitting the surface, due to the tilt of the earth's rotation on its axis and the length of the day.					•		•	
Grades 9 – 12 Earth and Space Science Content Standards								
Energy in the Earth System								
• Earth systems have internal and external sources of energy, both of which create heat. The sun is the major external source of energy. Two primary sources of internal energy are the decay of radioactive isotopes and the gravitational energy from the earth's original formation.					•	•	•	
• The outward transfer of Earth's internal heat drives convection circulation in the mantle that propels the plates comprising Earth's surface across the face of the globe.			•					
• Heating of Earth's surface and atmosphere by the sun drives convection within the atmosphere and oceans, producing winds and ocean currents.			•		•			
• Global climate is determined by energy transfer from the sun at and near the earth's surface. This energy transfer is influenced by dynamic processes such as cloud cover and the earth's rotation, and static conditions such as the position of mountain ranges and ocean.					•			
Geochemical Cycles								
• The earth is a system containing essentially a fixed amount of each stable chemical atom or element. Each element can exist in several different chemical reservoirs. Each element on Earth moves among reservoirs in the solid earth, oceans, atmosphere, and organisms as part of geochemical cycles.					•	•		
• Movement of matter between reservoirs is driven by the earth's internal and external sources of energy. These movements are often accompanied by a change in the physical and chemical properties of the matter. Carbon, for example, occurs in carbonate rocks such as limestone, in the atmosphere as carbon dioxide gas, in water as dissolved carbon dioxide, and in all organisms as complex molecules that control the chemistry of life.				•	•	•	•	

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Origin and Evolution of the Earth System								
• The sun, the earth, and the rest of the solar system formed from a nebular cloud of dust and gas 4.6 billion years ago. The early earth was very different from the planet we live on today.								
• Geologic time can be estimated by observing rock sequences and using fossils to correlate the sequences at various locations. Current methods include using the known decay rates of radioactive isotopes present in rocks to measure the time since the rock was formed.	•	•						
• Interactions among the solid earth, the oceans, the atmosphere, and organisms have resulted in the ongoing evolution of the earth system. We can observe some changes such as earthquakes and volcanic eruptions on a human time scale, but many processes such as mountain building and plate movements take place over hundreds of millions of years.			•					
• Evidence for one-celled forms of life – the bacteria – extends back more than 3.5 billion years. The evolution of life caused dramatic changes in the composition of the earth's atmosphere, which did not originally contain oxygen.								
Origin and Evolution of the Universe								
• The origin of the universe remains one of the greatest questions in science. The "big bang" theory places the origin between 10 and 20 billion years ago, when the universe began in a hot dense state; according to this theory, the universe has been expanding ever since.							•	•
• Early in the history of the universe, matter, primarily the light atoms hydrogen and helium, clumped together by gravitational attraction to form countless trillions of stars. Billions of galaxies, each of which is a gravitationally bound cluster of billions of stars, now form most of the visible mass in the universe.							•	•
• Stars produce energy from nuclear reactions, primarily the fusion of hydrogen to form helium. These and other processes in stars have led to the formation of all the other elements.								•
Science and Technology								
Abilities of Technological Design								
• Identify appropriate problems for technologic design					•	•	•	•
• Design a solution or product					•	•	•	•

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8
• Implement a proposed design						•		
• Evaluate completed technological designs or products						•		•
• Communicate the process of technological design					•	•	•	
Understandings About Science and Technology								
• Scientific inquiry and technological design have similarities and differences.						•	•	
• Many different people in different cultures have made and continue to make contributions to science and technology.	•	•	•	•	•	•	•	•
• Science and technology are reciprocal.						•	•	
• Perfectly designed solutions do not exist.		•		•	•			•
• Technological designs have constraints.	•	•	•	•	•	•	•	•
• Technological solutions have intended benefits and unintended consequences.		•	•	•	•	•	•	•
Science in Personal and Social Perspectives								
Personal Health								
• The potential for accidents and the existence of hazards imposes the need for injury prevention.		•						
• Natural environments may contain substances (for example, radon and lead) that are harmful to human beings. Maintaining environmental health involves establishing or monitoring quality standards related to use of soil, water, and air.			•	•	•	•		
Populations, Resources, and Environments								
• When an area becomes overpopulated, the environment will become degraded due to the increased use of resources.				•		•		
• Causes of environmental degradation and resource depletion vary from region to region and from country to country.		•		•	•	•		

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Natural Hazards								
• Internal and external processes of the earth system cause natural hazards, events that change or destroy human and wildlife habitats, damage property, and harm or kill humans.		•	•		•	•		
• Human activities also can induce hazards through resource acquisition, urban growth, land-use decisions, and waste disposal.		•	•	•	•	•		
• Natural hazards can present personal and societal challenges.		•	•	•	•	•		
Risks and benefits								
• Students should understand the risks associated with natural hazards, chemical hazards, biological hazards, social hazards, and personal hazards.		•	•	•	•	•		
• Individuals can use a systematic approach to thinking critically about risks and benefits.		•	•	•	•	•		
Science and technology in society								
• Science influences society through its knowledge and world view.	•	•	•		•		•	•
• Societal challenges often inspire questions for scientific research, and social priorities often influence research.				•	•	•		•
• Technology influences society through its products and processes.		•					•	•
• Science and technology have advanced through contributions of many different people, in different cultures, at different times in history.	•	•	•		•	•	•	•
• Scientists and engineers work in many different settings.	•	•	•	•	•	•	•	•
• Scientists and engineers have ethical codes.		•	•	•	•			•
• Science cannot answer all questions and technology cannot solve all human problems.	•	•	•	•	•		•	•
History and Nature of Science								
Science as a human endeavor								
• Women and men of various social and ethnic backgrounds engage in the activities of science, engineering, and related fields.	•	•	•		•	•	•	•
• Science requires different abilities.	•	•	•		•	•	•	•

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8
Nature of Science								
• Scientists formulate and test their explanations of nature using observation, experiments, and theoretical and mathematical models.	•	•	•	•	•	•	•	•
• It is normal for scientists to differ with one another about the interpretation of the evidence or theory being considered.	•	•	•	•	•		•	•
• It is part of scientific inquiry to evaluate the results of scientific investigations, experiments, observations, theoretical models, and the explanations proposed by other scientists.	•	•	•	•	•		•	•
History of Science								
• Many individuals have contributed to the traditions of science.	•		•		•	•	•	
• In historical perspective, science has been practiced by different individuals in different cultures.	•		•			•	•	•
• Tracing the history of science can show how difficult it was for scientific innovators to break through the accepted ideas of their time to reach the conclusions that we currently take for granted.			•				•	

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Skills	Unit 1 Geology	Unit 2 Geologic Changes	Unit 3 The Dynamic Earth	Unit 4 Water and Water Systems	Unit 5 Meteorology	Unit 6 The Environment	Unit 7 Astronomy	Unit 8 The Great Expanse
Science Process Skills								
• Observing	•	•	•	•	•	•	•	•
• Inferring	•	•	•		•	•	•	•
• Predicting	•	•	•	•	•		•	•
• Measuring	•	•	•	•	•	•	•	•
• Calculating	•		•		•	•	•	•
• Classifying	•	•	•		•	•	•	•
• Using tables and graphs	•	•	•		•		•	•
• Developing and using models	•	•	•		•	•	•	•
• Posing questions	•	•	•	•	•	•	•	•
• Designing experiments (investigations)	•	•	•	•	•	•	•	•
• Formulating hypotheses	•	•	•	•	•	•	•	•
• Forming operational definitions			•	•	•			
• Controlling variables		•	•	•	•		•	•
• Analyzing data	•	•	•	•	•	•	•	•
• Making conclusions	•	•	•	•	•	•	•	•
• Communicating results	•		•	•	•	•	•	•
◦ Construct and present arguments using evidence to support the claim				•			•	
◦ Integrate qualitative scientific and technical information to support the claim			•	•			•	
• Evaluating and revising the experimental design							•	•

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	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8
Critical Thinking Skills								
• Comparing and contrasting	•	•	•	•	•	•	•	•
• Applying concepts and scientific principles to design, construct, and test a device					•	•	•	•
• Interpreting data, diagrams, and photographs	•	•	•	•	•	•	•	•
• Making judgments		•	•		•	•	•	•
• Problem solving	•	•	•				•	•
• Using analogies		•	•	•		•	•	•
• Relating cause and effect	•	•	•		•	•	•	•
• Making generalizations	•		•		•			•
• Using mathematical representations	•						•	
Graphic Organizers								
• Concept maps and web diagrams	•						•	
• Compare and contrast tables			•		•	•	•	•
• Venn diagrams	•			•			•	
• Flow charts	•					•	•	•
• Cycle diagrams	•			•	•	•	•	
• Outlines						•		
• Tables	•		•		•		•	•