

Grades 6-8

Earth & Space Science Curriculum Framework

Introduction

Science, Technology & Engineering, and Environmental Literacy & Sustainability (STEELS) Standards guide the study of the natural and human-made world through inquiry, problem-solving, critical thinking, and authentic exploration. This document displays a curriculum framework for **Grades 6-8 Earth & Space Science**. It is designed to focus curriculum and teaching, provide guidance for multiple approaches to curriculum development, encourage less reliance on textbooks as curriculum, and avoid activity-oriented teaching without focus/purpose.

Science Long Term Transfer Goals

In support of the Curriculum Framework, Long Term Transfer Goals (LTTG) provide the overarching practices that ground the foundation for a robust curriculum; thus, all curricula should relate to one or more of the LTTGs detailed below – as they highlight the effective uses of understanding, knowledge, and skill that we seek in the long run; i.e., what we want students to be able to do when they confront new challenges – both in and outside of school.

Students will be able to engage as scientifically literate members of a global society, using their learning to:

1. Approach science as a reliable and tentative way of knowing and explaining the natural world and designed world.
2. Weigh evidence and use scientific approaches to ask questions, investigate, and make informed decisions.
3. Make and use observations to analyze relationships and patterns in order to explain phenomena, develop models, and make predictions.
4. Evaluate systems, in order to connect how form determines function and how any change to one component affects the entire system.
5. Explain how the natural and designed worlds are interrelated and the application of scientific knowledge and technology can have beneficial, detrimental, or unintended consequences.

The Universe and Its Stars						
Key Understanding	Driving Question	Standard	Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts	Vocabulary
The predictable movements and positions of the Earth, Moon, and Sun create patterns we observe from Earth, including seasons, lunar phases, and eclipses.	Why do moon phases, eclipses and seasons happen in predictable patterns?	3.3.6-8.A Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.	Developing and Using Models Develop and use a model to describe phenomena.	<p>Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models.</p> <p>This model of the solar system can explain eclipses of the sun and the moon. Earth’s spin axis is fixed in direction over the short-term but tilted relative to its orbit around the sun. The seasons are a result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year.</p>	<p>Patterns Patterns can be used to identify cause-and-effect relationships.</p> <p>Connections to Nature of Science Scientific Knowledge Assumes an Order and Consistency in Natural Systems Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation.</p>	<p>axis</p> <p>Earth's tilt</p> <p>eclipse</p> <p>lunar phases</p> <p>revolution</p> <p>rotation</p>

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Gravity drives the motion of objects within galaxies and the solar system.	How does gravity affect how things move in our solar system and beyond?	3.3.6-8.B Develop and use a model to describe the role of gravity in the motion within galaxies and the solar system.	Developing and Using Models Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. Develop and use a model to describe phenomena.	Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe. The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them. The solar system appears to have formed from a disk of dust and gas, drawn together by gravity.	Systems and System Models Models can be used to represent systems and their interactions. Connections to Nature of Science Scientific Knowledge Assumes an Order and Consistency in Natural Systems Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation.	galaxy gravity orbit solar system

Earth and the Solar System						
Key Understanding	Driving Question	Standard	Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts	Vocabulary
The sizes of and distances between objects in the solar system vary greatly, and scale helps us make sense of those differences.	How do images, measurements, and models help us compare objects in the solar system?	3.3.6-8.C Analyze and interpret data to determine scale properties of objects in the solar system.	<p>Analyzing and Interpreting Data Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.</p> <p>Analyze and interpret data to determine similarities and differences in findings.</p>	The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them.	<p>Scale, Proportion, and Quantity Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.</p> <p>Connections to Engineering, Technology, and Applications of Science Interdependence of Science, Engineering, and Technology</p> <p>Engineering advances have led to important discoveries in virtually every field of science and scientific discoveries have led to the development of entire industries and engineered systems.</p>	

The History of Planet Earth						
Key Understanding	Driving Question	Standard	Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts	Vocabulary
Earth's history is organized using rock layers and fossils that provide evidence of changes over time across billions of years.	How do scientists use evidence from rock layers to organize Earth's timeline?	3.3.6-8.D Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.	Constructing Explanations and Designing Solutions Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.	The geologic time scale interpreted from rock strata provides a way to organize Earth's history. Analyses of rock strata and the fossil record provide only relative dates, not an absolute scale.	Scale, Proportion, and Quantity Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.	fossil record geologic time scale relative age strata
Earth Materials and Systems						
Key Understanding	Driving Question	Standard	Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts	Vocabulary
Earth's surface is constantly reshaped by geologic processes that act in different ways and over different amounts of time, from quick events to slow changes over millions of years.	How do slow and fast Earth processes work together to change Earth's surface over time and at different scales?	3.3.6-8.E Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.	Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe nature operate today as they did in the past and will continue to do so in the future.	The planet's systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth's history and will determine its future. Water's movements—both on the land and underground—cause weathering and erosion, which change the land's surface features and create underground formations.	Scale Proportion and Quantity Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.	deposition earthquake erosion geoscience processes volcano weathering

Key Understanding	Driving Question	Standard	Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts	Vocabulary
Earth's materials are constantly recycled as energy flows through Earth's systems, driving changes in rocks, water, air, and living things.	How does energy movement through Earth's materials drive the formation of minerals and rocks?	3.3.6-8.F Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.	Developing and Using Models Develop and use a model to describe phenomena.	All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. This energy is derived from the sun and Earth's hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth's materials and living organisms.	Stability and Change Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and processes at different scales, including the atomic scale.	crystallization deformation melting sedimentation weathering
Plate Tectonics and Large-Scale System Interactions						
Key Understanding	Driving Question	Standard	Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts	Vocabulary
Patterns in fossils, rocks, continents, and the seafloor provide evidence that Earth's tectonic plates have moved over time.	What does evidence tell us about the history of tectonic plate motion?	3.3.6-8.G Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of past plate motions.	Analyzing and Interpreting Data Analyze and interpret data to provide evidence for phenomena. Connections to Nature of Science Science findings are frequently revised and/or reinterpreted based on new evidence.	Tectonic processes continually generate new ocean seafloor at ridges and destroy old seafloor at trenches. Maps of ancient land and water patterns, based on investigations of rocks and fossils, make clear how Earth's plates have moved great distances, collided, and spread apart.	Patterns Patterns in rates of change and other numerical relationships can provide information about natural systems.	ridge seafloor spreading tectonic plate trench

The Roles of Water in Earth's Surface Processes						
Key Understanding	Driving Question	Standard	Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts	Vocabulary
Water changes its state as it cycles through Earth's systems driven by the Sun's energy and gravity.	How do the Sun's energy and gravity work together to move water through Earth's systems?	3.3.6-8.H Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.	Developing and Using Models Develop a model to describe unobservable mechanisms.	Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land. Global movements of water and its changes in form are propelled by sunlight and gravity.	Energy and Matter Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter.	condensation crystallization evaporation gravity hydrologic cycle precipitation transpiration
Unequal heating of Earth and its rotation create patterns in winds and ocean currents that shape climates around the world.	How does the motion of Earth help to determine climate?	3.3.6-8.I Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.	Developing and Using Models Develop and use a model to describe phenomena.	Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents. Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. The ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean	Systems and System Models Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy, matter, and information flows within systems.	altitude circulation Coriolis effect density latitude salinity thermal energy

				currents.		
Weather and Climate						
Key Understanding	Driving Question	Standard	Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts	Vocabulary
Weather conditions can change due to the motion and complex interactions of air masses.	How can we use data about air masses and their movement to explain and predict changes in weather conditions?	3.3.6-8.J Collect data to provide evidence for how the motion and complex interactions of air masses result in changes in weather conditions.	Planning and Carrying Out Investigations Collect data to produce data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions.	The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. Because these patterns are so complex, weather can only be predicted probabilistically.	Cause and Effect Cause and effect relationships may be used to predict phenomena in natural or designed systems.	air mass high pressure humidity low pressure pressure temperature weather conditions

Earth's global surface temperature has risen over the past century, and evidence can be used to identify factors that have contributed to this increase.	Why have global temperatures increased over the past 100 years?	3.3.6-8.O Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.	Asking Questions and Defining Problems Ask questions to identify and clarify evidence of an argument.	Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth's mean surface temperature (global warming). Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely in decisions and activities.	Stability and Change Stability might be disturbed either by sudden events or gradual changes that accumulate over time.	carbon dioxide climate greenhouse gas human activity natural processes
Natural Resources						
Key Understanding	Driving Question	Standard	Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts	Vocabulary

<p>The uneven distributions of earth's mineral, energy, and groundwater resources are the result of ongoing geoscience processes and human consumption.</p>	<p>Why are earth's mineral, energy, and groundwater resources unevenly distributed?</p>	<p>3.3.6-8.K Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.</p>	<p>Constructing Explanations and Designing Solutions Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.</p>	<p>Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes.</p>	<p>Cause and Effect Cause and effect relationships may be used to predict phenomena in natural or designed systems.</p> <p>Connections to Engineering, Technology, and Applications of Science All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment.</p>	<p>biosphere geoscience processes nonrenewable resource renewable resource</p>
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Natural Hazards						
Key Understanding	Driving Question	Standard	Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts	Vocabulary
Natural hazard data can be analyzed and interpreted to forecast future catastrophic events and inform the development of technologies to mitigate their effects.	How can studying natural hazards assist scientists in forecasting future events and drive development of technologies?	3.3.6-8.L Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects	Analyzing and Interpreting Data Analyze and interpret data to determine similarities and differences in findings.	Mapping the history of natural hazards in a region, combined with an understanding of related geologic forces can help forecast the locations and likelihoods of future events.	<p>Patterns Graphs, charts, and images can be used to identify patterns in data.</p> <p>Connections to Engineering, Technology, and Applications of Science Influence of Science, Engineering, and Technology on Society and the Natural World</p> <p>The uses of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time.</p>	geological forces natural hazard

Human Impact on Earth Systems						
Key Understanding	Driving Question	Standard	Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts	Vocabulary
Human activities affect the environment, and scientific principles can be used to monitor and reduce those impacts.	How can we design methods to monitor and minimize the human impact on our environment?	3.3.6-8.M Apply scientific principles to design a method for monitoring and minimizing human impact on the environment.	Constructing Explanations and Designing Solutions Apply scientific principles to design an object, tool, process or system.	Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things. Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise	<p>Cause and Effect Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation.</p> <p>Connections to Engineering, Technology, and Applications of Science The uses of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time.</p>	extinction land usage natural habitat pollution water usage

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Increases in human population and per capita consumption of natural resources impact Earth's systems.	How does an increase in human population and per capita consumption of natural resources impact Earth's systems?	3.3.6-8.N Construct an argument supported by evidence for how increases in human population and per capita consumption of natural resources impact Earth's systems.	Engaging in Argument from Evidence Construct an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.	Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.	<p>Cause and Effect Cause and effect relationships may be used to predict phenomena in natural or designed systems.</p> <p>Connections to Engineering, Technology, and Applications of Science All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment.</p> <p>Connections to Nature of Science Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes.</p>	natural resources per-capita consumption population