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 Middle School 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 curriculum 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 technological and engineering 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.

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Grade 6-8 Earth Science

The Universe and Its Stars							
Big Idea	**Essential Question**	**Standard**	**Science and Engineering Processes**	**Disciplinary Core Ideas**	**Crosscutting Concepts**	**Vocabulary**	**2007 Assessment Anchors Eligible Content**
We can infer information about stars based on observations we make from Earth.	What is the universe, and what is Earth's place in it?	**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.	Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models. 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.	**Patterns** Patterns can be used to identify cause-and-effect relationships. **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.	astronomy satellite milky way galaxy expansion big bang composition spectra radiation solar energy reflection illuminate orbital plane solar system universe	S8.A.1.1 S8.A.1.2 S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2 S8.A.3.3 S8.D.3.1.1
We can infer information about stars based on observations we make from Earth.	What is the universe, and what goes on in stars?	**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	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	**Systems and System Models** Models can be used to represent systems and their interactions.	solar system galaxy orbit gravity axis	S8.A.1.1 S8.A.1.2 S8.A.1.3 S8.A.2.1 S8.A.2.2

			describe, test, and predict more abstract phenomena and design systems. Develop and use a model to describe phenomena.	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.	**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.	cyclical pattern revolution rotation	S8.A.3.1 S8.A.3.2 S8.A.3.3 S8.D.3.1.1
Earth and the Solar System							
Big Idea	**Essential Question**	**Standard**	**Science and Engineering Processes**	**Disciplinary Core Ideas**	**Crosscutting Concepts**	**Vocabulary**	**2007 Assessment Anchors Eligible Content**
Observations of the sky can be explained by predictable patterns of the movement of Earth, moon, sun and planets.	What are the predictable patterns caused by Earth's movement in the solar system?	**3.3.6-8.C** **Analyze and interpret data to determine scale properties of objects in the solar system.**	**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. Analyze and interpret data to determine	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.	**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. **Connections to Engineering, Technology, and Applications of Science** Interdependence of Science, Engineering, and Technology Engineering advances have led to important	surface feature orbital radii diameter distance composition scale ratio proportion	S8.A.1.1 S8.A.1.2 S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2 S8.A.3.3 S8.D.3.1.1 S8.D.3.1.2 S8.D.3.1.3

			similarities and differences in findings.		discoveries in virtually every field of science and scientific discoveries have led to the development of entire industries and engineered systems.		
The History of Planet Earth							
Big Idea	**Essential Question**	**Standard**	**Science and Engineering Processes**	**Disciplinary Core Ideas**	**Crosscutting Concepts**	**Vocabulary**	**2007 Assessment Anchors Eligible Content**
We can infer Earth's planetary history by features we observe today.	How do people reconstruct and date events in Earth's planetary history?	**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.	geologic time scale strata relative age superposition unconformity uniformitarianism weathering erosion geosphere igneous rock metamorphic rock sedimentary rock rock cycle	S8.A.1.1 S8.A.1.2 S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2 S8.A.3.3 S8.D.1.1.2 S8.D.1.1.4

Earth Materials and Systems							
Big Idea	**Essential Question**	**Standard**	**Science and Engineering Processes**	**Disciplinary Core Ideas**	**Crosscutting Concepts**	**Vocabulary**	**2007 Assessment Anchors Eligible Content**
Changes we observe on Earth are the result of energy flowing and matter cycling between interconnected systems (the geosphere, hydrosphere, atmosphere, and biosphere).	How and why is Earth constantly changing?	**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	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.	weathering erosion deposition sediment geoscience processes (eg: earthquakes, volcanoes, meteor impacts, etc.)	S8.A.1.1 S8.A.1.2 S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2 S8.A.3.3 S8.D.1.1.1 S8.D.1.1.2 S8.D.1.1.3 S8.D.1.1.4 S8.D.2.1.2

			continue to do so in the future.				
Changes we observe on Earth are the result of energy flowing and matter cycling between interconnected systems (the geosphere, hydrosphere, atmosphere, and biosphere).	How do Earth's major systems interact?	**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.	chemical/ physical changes melting crystallization weathering deformation sedimentation	S8.A.1.1 S8.A.1.2 S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2 S8.A.3.3 S8.D.1.1.1 S8.D.1.1.2 S8.D.1.1.3 S8.D.1.1.4 S8.D.2.1.2
Plate Tectonics and Large-Scale System Interactions							
Big Idea	**Essential Question**	**Standard**	**Science and Engineering Processes**	**Disciplinary Core Ideas**	**Crosscutting Concepts**	**Vocabulary**	**2007 Assessment Anchors Eligible Content**
Plate tectonics explains the past and current movements and features of the rocks at Earth's surface.	Why do the continents move, and what causes earthquakes and volcanoes?	**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**	Tectonic processes continually generate new ocean seafloor at ridges and destroy old seafloor at trenches. (secondary) Maps of ancient land and water patterns, based on investigations of rocks and fossils,	**Patterns** Patterns in rates of change and other numerical relationships can provide information about natural systems.	fossils ridge trench Pangea seafloor spreading	S8.A.1.1 S8.A.1.2 S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2

			Science findings are frequently revised and/or reinterpreted based on new evidence.	make clear how Earth's plates have moved great distances, collided, and spread apart.			S8.A.3.3 S8.D.1.1.2 S8.D.1.1.4
The Roles of Water in Earth's Surface Processes							
Big Idea	**Essential Question**	**Standard**	**Science and Engineering Processes**	**Disciplinary Core Ideas**	**Crosscutting Concepts**	**Vocabulary**	**2007 Assessment Anchors Eligible Content**
Water's presence and properties impact Earth's ecosystems and surface features.	How do the properties and movements of water shape Earth's surface and affect its 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.	hydrologic cycle transpiration respiration glaciers aquafers	S8.A.1.1 S8.A.1.2 S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2 S8.A.3.3 S8.D.1.3.1 S8.D.1.3.2 S8.D.1.3.4
Water's presence and properties impact Earth's ecosystems and surface features.	How do the properties and movements of water shape Earth's surface and affect its systems?	**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**	**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	**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.	latitude altitude coriolis effect thermal energy radiation input output	S8.A.1.1 S8.A.1.2 S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2

		determine regional climates.		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 currents.		salinity density climate	S8.A.3.3 S8.D.1.3.1 S8.D.1.3.2 S8.D.1.3.4

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Weather and Climate							
Big Idea	**Essential Question**	**Standard**	**Science and Engineering Processes**	**Disciplinary Core Ideas**	**Crosscutting Concepts**	**Vocabulary**	**2007 Assessment Anchors Eligible Content**
Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things.	What regulates weather and climate?	**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.	high/low pressure temperature pressure humidity precipitation wind air mass	S8.A.1.1 S8.A.1.2 S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2 S8.A.3.3 S8.D.2.1.1 S8.D.2.1.2 S8.D.2.1.3
Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things.	What regulates weather and climate?	**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 gasses 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	**Stability and Change** Stability might be disturbed either by sudden events or gradual changes that accumulate over time.	human activities (e.g.: fossil fuel combustion, cement production, and agricultural activity) natural processes (e.g.: solar radiation or volcanic activity) greenhouse gas carbon dioxide	S8.A.1.1 S8.A.1.2 S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2 S8.A.3.3 S8.D.2.1.1 S8.D.2.1.2

				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.			S8.D.2.1.3
Natural Resources							
Big Idea	**Essential Question**	**Standard**	**Science and Engineering Processes**	**Disciplinary Core Ideas**	**Crosscutting Concepts**	**Vocabulary**	**2007 Assessment Anchors Eligible Content**
All materials, energy, and fuels that humans use are derived from natural sources, some of which are renewable over time and others are not.	How do Earth's surface processes and human activities affect each other? How do humans depend on Earth's resources?	**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.**	**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.	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.	**Cause and Effect** Cause and effect relationships may be used to predict phenomena in natural or designed systems. **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.	per-capita consumption nonrenewable resources renewable resources earth's resources (e.g. minerals, energy, groundwater, etc.) geologic processes (e.g., volcanic activity, sedimentary processes)	S8.A.1.1 S8.A.1.2 S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2 S8.B.3.2 S8.B.3.3 S8.D.1.1.2 S8.D.1.2.1 S8.D.1.2.2

Natural Hazards							
Big Idea	**Essential Question**	**Standard**	**Science and Engineering Processes**	**Disciplinary Core Ideas**	**Crosscutting Concepts**	**Vocabulary**	**2007 Assessment Anchors Eligible Content**
Natural processes can cause sudden or gradual changes to Earth's systems, some of which may adversely affect humans.	How do natural hazards affect individuals and societies?	**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.	**Patterns** Graphs, charts, and images can be used to identify patterns in data. **Connections to Engineering, Technology, and Applications of Science** Influence of Science, Engineering, and Technology on Society and the Natural World 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.	ecosystem natural hazards geologic processes (e.g., volcanic activity, sedimentary processes)	S8.A.1.1 S8.A.1.2 S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2 S8.A.3.3 S8.D.1.1.2

Human Impact on Earth Systems							
Big Idea	**Essential Question**	**Standard**	**Science and Engineering Processes**	**Disciplinary Core Ideas**	**Crosscutting Concepts**	**Vocabulary**	**2007 Assessment Anchors Eligible Content**
Human activities in agriculture, industry, and everyday life has an impact on the land, rivers, ocean, and air.	How do humans change the planet?	**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.	**Cause and Effect** Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation. **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.	water usage land usage pollution	S8.A.1.1 S8.A.1.2 S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2 S8.A.3.3 S8.D.1.1.4
Human activities in agriculture, industry, and everyday life has an impact on the land, rivers, ocean,	How do humans change the planet?	**3.3.6-8.N** **Construct an argument supported by evidence for how increases in human population and**	**Engaging in Argument from Evidence** Construct an oral and written argument supported by empirical	Typically as human populations and per-capita consumption of natural resources increase, so do the	**Cause and Effect** Cause and effect relationships may be used to predict	per-capita consumption population natural resources	S8.A.1.1 S8.A.1.2 S8.A.1.3

and air.		**per capita consumption of natural resources impact Earth's systems.**	evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.	negative impacts on Earth unless the activities and technologies involved are engineered otherwise.	phenomena in natural or designed systems. **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. **Connections to Nature of Science** Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes.		S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2 S8.A.3.3 S8.D.1.1.4