6th Grade Science

UNIT 1: Earth in Space

ESSENTIAL QUESTION	BIG IDEAS
What is Earth's place in the Universe? **How can motion in our solar system explain Earth's seasons and eclipses?**	• Students examine the Earth's place in relation to the solar system, Milky Way galaxy, and universe. • Students will develop models of the solar system to explain astronomical and other observations of the cyclic patterns of the eclipses and seasons. • Students will explore instruments and technologies that have allowed us to explore the objects in our solar system. • Students will obtain and analyze data that supports the theories that explain the formation and evolution of the universe. • Students will create models to show patterns, scale, and portions of objects in the solar system.

GUIDING QUESTIONS

Content

- What makes up our solar system?
- How can data be analyzed to show scale properties such as size and distance of objects within our solar system?
- What role did gravity play in the formation of our solar system from a disk of dust and gas?
- How does gravity hold together the solar system, Milky Way galaxy, and controls orbital motions within them.
- How does mass and distance of objects, including planets, their moons, and asteroids that are held in orbit, affect the strength of gravity?
- How do the positions of the moon, Earth and Sun result in lunar phases, solar and lunar eclipses, and seasons?
- How does Earth's tilt on its axis cause seasons?

Process

- Can you create a scale model demonstrating size and distance within our solar system?
- Can you develop a model to describe the role of gravity and how mass and distance affect the strength of gravitational force?
- Can you develop a model explaining the patterns of lunar phases, solar and lunar eclipses, and seasons?
- Can you argue a claim using evidence and reasoning that Earth's axial tilt causes the seasons?

Reflective

- What would happen if gravity didn't exist?
- If Earth had no tilt, how would the seasons and life on Earth be different?
- What would happen to our solar system if the Sun's mass increased?

Focus Standards

Mastered and Assessed in this Unit:

- MS-ESS1-1. 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.
- MS-ESS1-2. Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.
- MS-ESS1-3. Analyze and interpret data to determine scale properties of objects in the solar system
- MS-ESS1-4. 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.

Performance Expectations (PEs) above integrate the following 3-Dimensions of NGSS:

- ESS1.A: The Universe and Its Stars Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models. (MS-ESS1-1) Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe. (MS-ESS1-2)
- ESS1.B: Earth and the Solar System 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. (MS-ESS1-2), (MSESS1-3) 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.(MS-ESS1-1) The solar system appears to have formed from a disk of dust and gas, drawn together by gravity. (MS-ESS1-2)
- ESS1.C: The History of Planet Earth The geologic time scale interpreted from rock strata provides a way to organize Earth's history . Analysis of rock strata and the fossil record.

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UNIT 2: Earth's System

ESSENTIAL QUESTIONS	BIG IDEAS
How do Earth's systems cause it to change over time? **How does water influence weather, circulate in the oceans, and shape Earth's surface?** **How have Earth's changing conditions impacted living organisms and how have living organisms changed Earth?**	• Students will analyze data to understand the processes, patterns, scale, proportions, quantity, systems and events in Earth's history. • Students will understand how Earth's geosystems operate by modeling the flow of energy and cycling of matter among different systems. • Students will investigate the properties of important materials and construct explanations based on the analysis of real geoscience data. • Students will understand different ways that geoscience processes provide resources needed by society. • Students will understand the ways geoscience processes cause natural hazards that present risks to society. • Students will develop an understanding of the factors that control weather. • Students will analyze the feedback between systems as energy from the Sun transfers between systems.

GUIDING QUESTIONS

Content

- How is Earth's 4.6 billion year history organized using evidence from rock strata?
- How does the flow of energy drive the cycling of Earth's material?
- How do geoscience processes change the Earth's surfaces over time?
- How do we know that Earth's plates move based on evidence from rocks and fossils found on different continents?
- How does the energy from the Sun and the force of gravity drive the cycling of water through Earth's systems?
- How do the motions and interactions of air masses result in changes in weather?
- How does unequal heating and rotation of the Earth cause patterns of circulation that determine regional climates?

Process

- Can you construct a scientific explanation, using rock strata, to organize Earth's history?
- Can you develop a model to describe how the flow of energy cycles produces changes in Earth's materials and organisms?
- Can you construct an explanation for how Earth's systems have shaped Earth's past, present and future?
- Can you construct an explanation for how water's movements have changed Earth's surfaces both above and underground?

- Can you analyze and interpret data to prove that Earth's seafloor is generated and destroyed?
- Can you analyze and interpret data to prove that Earth's plates have moved great distances, collided and spread apart?
- Can you develop a model to demonstrate how sunlight and gravity drives water to continuously cycle on land, in the ocean and in the atmosphere?
- Can you collect data to provide evidence for how the movement and changes of water in the atmosphere are major determinants of local weather patterns?
- Can you develop and use a model to explain how variations of temperature and salinity drive global patterns of ocean currents?
- Can you model how weather and climate are influenced by multiple factors, (sunlight, the ocean, the atmosphere, ice, landforms, and living things) based on latitude, altitude, and geography?

Reflective

- How do we know that Earth's tectonic plates have moved?
- What happens when plate movement no longer happens?
- What evidence/artifacts from your life will exist in 100 years? 1000 years? 1 million years? 1 billion years?
- Will you be able to still ski the Rocky Mountains in 1 billion years?
- Will you be able to visit your favorite place in 1 billion years?

Focus Standards

Mastered and Assessed in this Unit:

- MS-ESS1-4. 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.
- MS-ESS2-1. Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.
- MS-ESS2-2. Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.
- MS-ESS2-3. Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.
- MS-ESS2-4. Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.
- MS-ESS2-5. Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.
- MS-ESS2-6. 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.

Performance Expectations (PEs) above integrate the following 3-Dimensions of NGSS:

- ESS1.C: The History of Planet Earth 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. (MS-ESS1- 4) Tectonic processes continually generate new ocean sea floor at ridges and destroy old seafloor at trenches. (HS.ESS1.C GBE) (secondary to MS-ESS2-3)
- ESS2.A: Earth's Materials and Systems 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. (MS-ESS2-2). 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. (MS-ESS2-1)

- ESS2.B: Plate Tectonics and Large-Scale System Interactions 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. (MS-ESS2-3)
- ESS2.C: The Roles of Water in Earth's Surface Processes Water's movements—both on the land and underground—cause weathering and erosion, which change the land's surface features and create underground formations. (MS-ESS2-2). Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land. (MS-ESS2-4) Global movements of water and its changes in form are propelled by sunlight and gravity. (MS-ESS2-4). 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. (MS-ESS2-5) Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents. (MS-ESS2- 6)
- ESS2.D: Weather and Climate 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. (MS-ESS2-6) Because these patterns are so complex, weather can only be predicted probabilistically. (MS-ESS2-5) 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. (MS-ESS2-6)

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UNIT 3: Earth and Human Activity

ESSENTIAL QUESTIONS	BIG IDEAS
How does human activity impact Earth systems? **How are naturally occurring Earth processes related to availability of natural resources?** **How can natural hazards be predicted?** **How do we know our global climate is changing?**	• Students will understand the ways that human activities impact Earth's other systems. • Students will use many different practices to understand the significant and complex issues surrounding human uses of resources and the resulting impacts of their usage. • Students will ask questions, develop and use models, analyze and interpret data, construct explanations, and design solutions in regards to natural resources, natural hazards, human impact on Earth systems, and global climate change.. • Students will be able to discuss these practices and will be able to demonstrate understanding of the core ideas.

GUIDING QUESTIONS

Content

- How does the past and current geoscience processes account for the uneven distribution of renewable and non-renewable resources (mineral, energy, and groundwater)?
- How do increases in human population and per-capita consumption of natural resources impact Earth's systems (appearance, composition, structure)?
- What factors have caused a rise in global temperatures over the past century?
- How do we predict natural hazards and develop mitigation strategies to lessen their impact?
- How do we monitor and minimize human impact on the environment?

Process

- Can you argue that past and current geoscience processes account for the uneven distribution of natural resources?
- Can you argue the claim, from evidence, that human population and per-capita consumption of natural resources, impacts Earth's systems in appearance, composition, structure, and function?
- Can you plan and conduct an investigation to prove the factors that have impacted the rise in global temperature over the past century?
- Can you analyze and interpret data to predict natural hazards?
- Can you create a model that shows mitigation strategies to lessen the impact of natural hazards?
- Can you design a method for monitoring and minimizing a human impact on the environment?

Reflective

- In 100 years how will Earth systems be different?
- How will climate change daily life?

- Will the human population continue to increase?
- Will natural hazards become more or less destructive in the future?
- How are natural resources related to an area's economy, status in the world, or even the wars they fight?

Focus Standards

Mastered and assessed in this unit:

- MS-ESS3-1. 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.
- MS-ESS3-2. Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
- MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.*
- MS-ESS3-4. Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.
- MS-ESS3-5. Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.

Performance Expectations (PEs) above integrate the following 3-Dimensions of NGSS:

- ESS3.A: Natural Resources. 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. (MS-ESS3-1)
- ESS3.B: Natural Hazards. 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. (MS-ESS3-2)
- ESS3.C: Human Impacts on Earth Systems. 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. (MS-ESS3-3). 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. (MS-ESS3-3), (MS-ESS3-4)
- ESS3.D: Global Climate Change. 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 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. (MS-ESS3-5)Students will analyze the history of natural hazards in order to predict future natural hazards.
- Students will examine the ways that humans have altered (negative and positive) Earth's systems.
- Students will analyze the ways human population and consumption of natural resources impacts the Earth.
- Students will create solutions for increased human activity and the resulting impacts on Earth's mean average temperature.

