6th Grade Topics:

Earth & Space Science
ESS1: Earth's Place in the Universe
ESS2: Earth's Systems
ESS3: Earth and Human Activity

Engineering & Technology
ETS1: Engineering Design
ETS2: Links Among Engineering, Technology, Science, and Society

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Marking Period	Unit(s)
1 (August 24-November 2)	**Unit 1: Space Systems** (29 blocks) Module G
2 (November 3-January 26)	**Finish Unit 1** **Unit 2: Earth's Systems** (29.5 blocks) Module E
3 (January 30-March 31)	**Finish Unit 2** **Unit 3: Weather and Climate** (37 blocks) Module F
4 (April 3-June 15)	**Finish Unit 3** **Unit 4: Human Impacts**

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Marking Periods 1 and 2

Book: Space Science (Module G)

Total Number of Blocks: 29

Performance Expectation (What the Student Will Have to Do)	**MS-ESS1-2. Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.** Clarification Statement: Emphasis for the model is on gravity as the force that holds together the solar system and Milky Way galaxy and controls orbital motions within them. Examples of models can be physical (such as the analogy of distance along a football field or computer visualizations of elliptical orbits) or conceptual (such as mathematical proportions relative to the size of familiar objects such as students' school or state). Assessment Boundary: Assessment does not include Kepler's Laws of orbital motion or the apparent retrograde motion of the planets as viewed from Earth.
Disciplinary Core Ideas (What the Student Will Have to Know)	***ESS1.A: The Universe and Its Stars*** • *Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe.* ***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.* • *The solar system appears to have formed from a disk of dust and gas, drawn together by gravity.*

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Performance Expectation (What the Student Will Have to Do)	**MS-ESS1-3. Analyze and interpret data to determine scale properties of objects in the solar system.** Clarification Statement: Emphasis is on the analysis of data from Earth-based instruments, space-based telescopes, and spacecraft to determine similarities and differences among solar system objects. Examples of scale properties include the sizes of an object's layers (such as crust and atmosphere), surface features (such as volcanoes), and orbital radius. Examples of data include statistical information, drawings and photographs, and models. Assessment Boundary: Assessment does not include recalling facts about properties of the planets and other solar system bodies.
Disciplinary Core Ideas (What the Student Will Have to Know)	***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.*

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Performance Expectation MS-ESS1-1 has been selected to incorporate 3-Dimensional Learning.

Performance Expectation (What the Student Will Have to Do)	**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.** Clarification Statement: Examples of models can be physical, graphical, or conceptual.
Disciplinary Core Ideas (What the Student Will Have to Know)	***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.* ***ESS1.B: Earth and the Solar System*** • *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.*

Science & Engineering Practice (What Skills the Student Will Be Required to Use)	**Crosscutting Concept** (What Connections the Student Will Make to Other Disciplines or to the Real World)
Developing and Using Models	Patterns

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Unit 2: Earth's Systems

Marking Periods 2 and 3

Book: The Dynamic Earth (Module E)

Total Number of Blocks: 29.5

Performance Expectation (What the Student Will Have to Do)	**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.** [Clarification Statement: Emphasis is on how analyses of rock formations and the fossils they contain are used to establish relative ages of major events in Earth's history. Examples of Earth's major events could range from being very recent (such as the last Ice Age or the earliest fossils of homo sapiens) to very old (such as the formation of Earth or the earliest evidence of life). Examples can include the formation of mountain chains and ocean basins, the evolution or extinction of particular living organisms, or significant volcanic eruptions.] [Assessment Boundary: Assessment does not include recalling the names of specific periods or epochs and events within them.]
Disciplinary Core Ideas (What the Student Will Have to Know)	***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.*

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Performance Expectation (What the Student Will Have to Do)	**MS-ESS2-1. Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.** [Clarification Statement: Emphasis is on the processes of melting, crystallization, weathering, deformation, and sedimentation, which act together to form minerals and rocks through the cycling of Earth's materials.] [Assessment Boundary: Assessment does not include the identification and naming of minerals.]
Disciplinary Core Ideas (What the Student Will Have to Know)	***ESS2.A: Earth's Materials and Systems*** • *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.*

Performance Expectation MS-ESS2-3 has been selected to incorporate 3-Dimensional Learning.	
Performance Expectation (What the Student Will Have to Do)	**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.** [Clarification Statement: Examples of data include similarities of rock and fossil types on different continents, the shapes of the continents (including continental shelves), and the locations of ocean structures (such as ridges, fracture zones, and trenches).] [Assessment Boundary: Paleomagnetic anomalies in oceanic and continental crust are not assessed.]
Disciplinary Core Ideas (What the Student Will Have to Know)	***ESS1.C: The History of Planet Earth*** • *Tectonic processes continually generate new ocean sea floor at ridges and destroy old sea floor at trenches. (HS.ESS1.C GBE),(secondary)* ***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.*

Science & Engineering Practice (What Skills the Student Will Be Required to Use)	**Crosscutting Concept** (What Connections the Student Will Make to Other Disciplines or to the Real World)
Analyzing and Interpreting Data	Patterns

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Performance Expectation (What the Student Will Have to Do)	**MS-ESS2-2. Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.** [Clarification Statement: Emphasis is on how processes change Earth's surface at time and spatial scales that can be large (such as slow plate motions or the uplift of large mountain ranges) or small (such as rapid landslides or microscopic geochemical reactions), and how many geoscience processes (such as earthquakes, volcanoes, and meteor impacts) usually behave gradually but are punctuated by catastrophic events. Examples of geoscience processes include surface weathering and deposition by the movements of water, ice, and wind. Emphasis is on geoscience processes that shape local geographic features, where appropriate.]
Disciplinary Core Ideas (What the Student Will Have to Know)	***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.* ***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.*

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Unit 3: Weather and Climate

Marking Periods 3 and 4

Book: Earth's Water and Atmosphere (Module F)

Total Number of Blocks: 37

Performance Expectation (What the Student Will Have to Do)	**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.** [Clarification Statement: Emphasis is on the ways water changes its state as it moves through the multiple pathways of the hydrologic cycle. Examples of models can be conceptual or physical.] [Assessment Boundary: A quantitative understanding of the latent heats of vaporization and fusion is not assessed.]
Disciplinary Core Ideas (What the Student Will Have to Know)	***ESS2.C: The Roles of Water in Earth's Surface Processes*** • *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.*

Any Performance Expectation highlighted in yellow has been selected to appear on the Maryland Integrated Science Assessment (MISA).

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Performance Expectation (What the Student Will Have to Do)	**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.** [Clarification Statement: Emphasis is on how patterns vary by latitude, altitude, and geographic land distribution. Emphasis of atmospheric circulation is on the sunlight-driven latitudinal banding, the Coriolis effect, and resulting prevailing winds; emphasis of ocean circulation is on the transfer of heat by the global ocean convection cycle, which is constrained by the Coriolis effect and the outlines of continents. Examples of models can be diagrams, maps and globes, or digital representations.] [Assessment Boundary: Assessment does not include the dynamics of the Coriolis effect.]
Disciplinary Core Ideas (What the Student Will Have to Know)	***ESS2.C: The Roles of Water in Earth's Surface Processes*** • *Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents.* ***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.* • *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.*

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Performance Expectation MS-ESS2-5 has been selected to incorporate 3-Dimensional Learning.		
Performance Expectation (What the Student Will Have to Do)	**MS-ESS2-5. Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.** [Clarification Statement: Emphasis is on how air masses flow from regions of high pressure to low pressure, causing weather (defined by temperature, pressure, humidity, precipitation, and wind) at a fixed location to change over time, and how sudden changes in weather can result when different air masses collide. Emphasis is on how weather can be predicted within probabilistic ranges. Examples of data can be provided to students (such as weather maps, diagrams, and visualizations) or obtained through laboratory experiments (such as with condensation).] [Assessment Boundary: Assessment does not include recalling the names of cloud types or weather symbols used on weather maps or the reported diagrams from weather stations.]	
Disciplinary Core Ideas (What the Student Will Have to Know)	***ESS2.C: The Roles of Water in Earth's Surface Processes*** • *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.* ***ESS2.D: Weather and Climate*** • *Because these patterns are so complex, weather can only be predicted probabilistically.*	
Science & Engineering Practice (What Skills the Student Will Be Required to Use)		**Crosscutting Concept** (What Connections the Student Will Make to Other Disciplines or to the Real World)
Planning and Carrying Out Investigations		Cause and Effect

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The following series of lessons are designed as a bundle of Performance Expectations put together as a storyline. The bundle includes the following two Performance Expectations that have already been addressed: MS-ESS2-2, MS-ESS2-6. The main focus of the bundle is MS-ESS3-5:

Performance Expectation (What the Student Will Have to Do)	**MS-ESS3-5. Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.** [Clarification Statement: Examples of factors include human activities (such as fossil fuel combustion, cement production, and agricultural activity) and natural processes (such as changes in incoming solar radiation or volcanic activity). Examples of evidence can include tables, graphs, and maps of global and regional temperatures, atmospheric levels of gases such as carbon dioxide and methane, and the rates of human activities. Emphasis is on the major role that human activities play in causing the rise in global temperatures.]
Disciplinary Core Ideas (What the Student Will Have to Know)	***ESS3.D: Global Climate Change*** • *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.*
Performance Expectation (What the Student Will Have to Do)	**MS-PS3-5. Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.** [Clarification Statement: Examples of empirical evidence used in arguments could include an inventory or other representation of the energy before and after the transfer in the form of temperature changes or motion of object.] [*Assessment Boundary: Assessment does not include calculations of energy.*]
Disciplinary Core Ideas (What the Student Will Have to Know)	***PS3.B: Conservation of Energy and Energy Transfer*** • *When the motion energy of an object changes, there is inevitably some other change in energy at the same time.*

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Marking Period: 4

Performance Expectation (What the Student Will Have to Do)	**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.** [Clarification Statement: Emphasis is on how these resources are limited and typically non-renewable, and how their distributions are significantly changing as a result of removal by humans. Examples of uneven distributions of resources as a result of past processes include but are not limited to petroleum (locations of the burial of organic marine sediments and subsequent geologic traps), metal ores (locations of past volcanic and hydrothermal activity associated with subduction zones), and soil (locations of active weathering and/or deposition of rock).]
Disciplinary Core Ideas (What the Student Will Have to Know)	***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.*

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Performance Expectation (What the Student Will Have to Do)	**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.** [Clarification Statement: Emphasis is on how some natural hazards, such as volcanic eruptions and severe weather, are preceded by phenomena that allow for reliable predictions, but others, such as earthquakes, occur suddenly and with no notice, and thus are not yet predictable. Examples of natural hazards can be taken from interior processes (such as earthquakes and volcanic eruptions), surface processes (such as mass wasting and tsunamis), or severe weather events (such as hurricanes, tornadoes, and floods). Examples of data can include the locations, magnitudes, and frequencies of the natural hazards. Examples of technologies can be global (such as satellite systems to monitor hurricanes or forest fires) or local (such as building basements in tornado-prone regions or reservoirs to mitigate droughts).]
Disciplinary Core Ideas (What the Student Will Have to Know)	***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.*

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Performance Expectation (What the Student Will Have to Do)	**MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.*** [Clarification Statement: Examples of the design process include examining human environmental impacts, assessing the kinds of solutions that are feasible, and designing and evaluating solutions that could reduce that impact. Examples of human impacts can include water usage (such as the withdrawal of water from streams and aquifers or the construction of dams and levees), land usage (such as urban development, agriculture, or the removal of wetlands), and pollution (such as of the air, water, or land).]
Disciplinary Core Ideas (What the Student Will Have to Know)	***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.* • *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.*
Performance Expectation (What the Student Will Have to Do)	**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.** [Clarification Statement: Examples of evidence include grade-appropriate databases on human populations and the rates of consumption of food and natural resources (such as freshwater, mineral, and energy). Examples of impacts can include changes to the appearance, composition, and structure of Earth's systems as well as the rates at which they change. The consequences of increases in human populations and consumption of natural resources are described by science, but science does not make the decisions for the actions society takes.]
Disciplinary Core Ideas (What the Student Will Have to Know)	***ESS3.C: Human Impacts on Earth Systems*** • *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.*

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