Niagara Falls City School District

Learning For All...Whatever It Takes

Grade 6 and 7

Science Scope and Sequence

2021

Below are the units of study for each grade level.

GRADE 6

- Structure, Function and Information Processing
- History of Earth
- Earth's Systems

GRADE 7

- Growth, Development and Reproduction of Organisms
- Natural Selection and Adaptations
- Matter and Energy in Ecosystems
- Interdependent Relationships in Ecosystems
- Human Impacts

GRADE 7ACC

- All grade 7 topics and...
- Structure and Properties of Matter
- Chemical Reactions

Understanding the New York State P-12 Science Learning Standards

The New York State P-12 Science Learning Standards are a series of performance expectations that define what students should understand and be able to do as a result of their study of science. The New York State P-12 Science Learning Standards are based on the Framework for K–12 Science Education developed by the National Research Council and the Next Generation Science Standards . The framework outlines three dimensions that are needed to provide students a high-quality science education. The integration of these three dimensions provides students with a context for the content of science, how science knowledge is acquired and understood, and how the sciences are connected through concepts that have universal meaning across the disciplines.

Grade 6	STRUCTURE, FUNCTION AND INFORMATION PROCESSING	Trimester 1

UNIT 1 - MICROBIOME

11 Lessons

Students' experiences in the ***Microbiome*** **unit** will support progress toward the Performance Expectations listed below. Specifically, students conduct investigations in which they learn about single-celled organisms and analyze data in order to make explanations about the role that bacteria play in the human microbiome. Students learn that organisms in the microbiome require resources to thrive and that competition between different species of bacteria causes changes in the microbiome.

MS-LS1-1. Plan and conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells. [Clarification Statement: Emphasis is on developing evidence that living things are made of cells, distinguishing between living and non-living things, and understanding that living things may be made of one cell or many and varied cells.]

MS-LS1-2. Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function. [Clarification Statement: Emphasis is on the cell functioning as a whole system and the primary role of identified parts of the cell, specifically the nucleus, chloroplasts, mitochondria, cell membrane, and cell wall.] [Assessment Boundary: Assessment of organelle structure/function relationships is limited to the cell wall and cell membrane. Assessment of the function of the other organelles is limited to their relationship to the whole cell. Assessment does not include the biochemical details related to the functions of cells or cell parts.]

MS-LS1-3. Construct an explanation supported by evidence for how the body is composed of interacting systems consisting of cells, tissues, and organs working together to maintain homeostasis. [Clarification Statement: Emphasis should be on the function and interactions of the major body systems (e.g. circulatory, respiratory, nervous, musculoskeletal).] [Assessment Boundary: Assessment is focused on the interactions between systems not on the functions of individual systems.]

MS-LS2-1. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. [Clarification Statement: Emphasis is on cause and effect relationships between resources and growth of individual organisms and the numbers of organisms in ecosystems during periods of abundant and scarce resources.]

MS-LS2-2. Construct an explanation that predicts patterns of interactions among organisms in a variety of ecosystems. [Clarification Statement: Emphasis is on predicting patterns of interactions such as competition, predation, mutualism, and parasitism in different ecosystems in terms of the relationships among and between organisms.]

UNIT 2 - METABOLISM

19 Lessons (including pre/post assessment)

Students' experiences in the ***Metabolism* unit** will support progress toward the Performance Expectations listed below. Specifically, students construct arguments and use models to explain how body systems work together to bring molecules to our bodies' cells. They use models to describe how these molecules are used in cellular respiration (which takes place in the mitochondria inside each cell) as well as for growth and repair. They also read about sensory receptors.

MS-LS1-1. Plan and conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells. [Clarification Statement: Emphasis is on developing evidence that living things are made of cells, distinguishing between living and non-living things, and understanding that living things may be made of one cell or many and varied cells.]

MS-LS1-2. Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function. [Clarification Statement: Emphasis is on the cell functioning as a whole system and the primary role of identified parts of the cell, specifically the nucleus, chloroplasts, mitochondria, cell membrane, and cell wall.] [Assessment Boundary: Assessment of organelle structure/function relationships is limited to the cell wall and cell membrane. Assessment of the function of the other organelles is limited to their relationship to the whole cell. Assessment does not include the biochemical details related to the functions of cells or cell parts.]

MS-LS1-3. Construct an explanation supported by evidence for how the body is composed of interacting systems consisting of cells, tissues, and organs working together to maintain homeostasis. [Clarification Statement: Emphasis should be on the function and interactions of the major body systems (e.g. circulatory, respiratory, nervous, musculoskeletal).] [Assessment Boundary: Assessment is focused on the interactions between systems not on the functions of individual systems.]

MS-LS1-8. Gather and synthesize information that sensory receptors respond to stimuli, resulting in immediate behavior and/or storage as memories. [Assessment Boundary: Assessment does not include mechanisms for the transmission of this information.]

MS-LS1-7. Develop a model to describe how food molecules are rearranged through chemical reactions to release energy during cellular respiration and/or form new molecules that support growth as this matter moves through an organism. [Clarification Statement: Emphasis is on describing that molecules are broken apart and put back together and that in this process, energy is released.] [Assessment Boundary: Assessment does not include details of the chemical reactions for respiration or synthesis.]

SCIENCE AND ENGINEERING PRACTICES	DISCIPLINARY CORE IDEAS	CROSS-CUTTING CONCEPTS
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. (MS-LS1-2) • Develop a model to describe unobservable mechanisms. (MS-LS1-7) **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 provide evidence for phenomena. (MS-LS2-1) **Planning and Carrying Out Investigations** Planning and carrying out investigations in 6-8 builds on K5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or solutions. • Conduct an investigation to produce data to serve as the basis for evidence that	**LS1.A: Structure and Function** • All living things are made up of cells, which is the smallest unit that can be said to be alive. An organism may consist of one single cell (unicellular) or many different numbers and types of cells (multicellular). (MS-LS1-1) • Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell. (MS-LS1-2) • In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues and organs that are specialized for particular body functions. (MS-LS1-3) **LS1.C: Organization for Matter and Energy Flow in Organisms** • Within individual organisms, food moves through a series of chemical reactions in which it is broken down and rearranged to form new molecules, to support growth, or to release energy. (MS-LS1-7)	**Patterns** • Patterns can be used to identify cause and effect relationships. (MS-LS2-2) **Cause and Effect** • Cause and effect relationships may be used to predict phenomena in natural systems. (MS-LS1-8) (MS-LS2-1) **Scale, Proportion, and Quantity** • Phenomena that can be observed at one scale may not be observable at another scale. (MS-LS1-1) **Systems and System Models** • Systems may interact with other systems; they may have sub-systems and be a part of larger complex systems. (MS-LS1-3) **Structure and Function** • Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the relationships among its parts, therefore complex natural structures/systems can be analyzed to determine how they function. (MS-LS1-2)

meet the goals of an investigation. (MS-LS1-1) **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 knowledge, 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 the natural world operate today as they did in the past and will continue to do so in the future. (MS-LS1-3) • Construct an explanation that includes qualitative or quantitative relationships between variables that predict phenomena. (MS-LS2-2) **Obtaining, Evaluating, and Communicating Information** Obtaining, evaluating, and communicating information in 6-8 builds on K-5 experiences and progresses to evaluating the merit and validity of ideas and methods. Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and	**LS1.D: Information Processing** • Each sense receptor responds to different inputs (electromagnetic, mechanical, chemical), transmitting them as signals that travel along nerve cells to the brain. (MS-LS1-8) • (NYSED) Plants respond to stimuli such as gravity (geotropism) and light (phototropism). (MS-LS1-8) **LS2.A: Interdependent Relationships in Ecosystems** • Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. (MS-LS2-1) • In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction. (MS-LS21) • Growth of organisms and population increases are limited by access to resources. (MS-LS2-1) • Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each	**Energy and Matter** • Matter is conserved because atoms are conserved in physical and chemical processes. (MS-LS1-7) **Connections to Engineering, Technology, and Applications of Science Interdependence of Science, Engineering, and Technology** • 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. (MS-LS11) **Connections to Nature of Science Science is a Human Endeavor** • Scientists and engineers are guided by habits of mind such as intellectual honesty, tolerance of ambiguity, skepticism, and openness to new ideas. (MS-LS1-3)

describe how they are supported or not supported by evidence. (MS-LS1-8)	organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared. (MS-LS2-2)	
ASSESSMENT End of unit assessment: • Metabolism	**VOCABULARY** Refer to glossary in the back of the student investigation notebook.	**OTHER SUGGESTED ACTIVITIES/RESOURCES** Generation Genius: • Plant and Animal Cells • Multicellular Organisms • Food Webs • Competition in Ecosystems • Symbiosis *Evidence Statements for Life Science NGSS Evidence Statements provide educators with additional detail on what students should know and be able to do.

Grade 6	STRUCTURE, FUNCTION AND INFORMATION PROCESING continued HISTORY OF EARTH	2^{nd} Trimester

UNIT 3 – METABOLISM ENGINEERING INTERNSHIP

10 Lessons

Students' experiences in the ***Metabolism Engineering Internship*** **unit** will support progress toward the Performance Expectations listed below. Specifically, students will learn about food engineering practices and deepen their understanding about how the body uses proteins for growth and repair and carbohydrates for energy release. Students apply this understanding to design a health bar that will best meet the metabolic needs of either rescue workers or patients. Students complete several tasks and run tests by using the Futura RecipeTest Design Tool to collect data. They analyze data, run iterative tests, and prepare final proposals for their optimal recipe designs.

MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

MS-LS1-7. Develop a model to describe how food molecules are rearranged through chemical reactions to release energy during cellular respiration and/or form new molecules that support growth as this matter moves through an organism.
[Clarification Statement: Emphasis is on describing that molecules are broken apart and put back together and that in this process, energy is

released.] [Assessment Boundary: Assessment does not include details of the chemical reactions for respiration or synthesis.]

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UNIT 4 – PLATE MOTION

19 Lessons (including pre/post assessment)

Students' experiences in the ***Plate Motion* unit** will support progress toward the Performance Expectations listed below. Specifically, students use models and construct explanations about plate motion. They conduct investigations and analyze evidence as they connect ideas about plates, plate-mantle interactions, patterns of geologic activity, and the rate of plate motion in order to build an understanding of how plates move.

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 or evidence could include very recent events or evidence (such as the last Ice Age or the earliest fossils of Homo sapiens) to very old events or evidence (such as the formation of Earth or the earliest evidence of life). Examples of evidence could 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, radiometric dating using half-lives, and defining index fossils.]

MS-ESS2-2. Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying temporal and spatial scales. [Clarification Statement: Emphasis is on how processes change Earth's surface at temporal 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 could 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.]

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 could 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.]

SCIENCE AND ENGINEERING PRACTICES	DISCIPLINARY CORE IDEAS	CROSS-CUTTING CONCEPTS

Asking Questions and Defining Problems Asking questions and defining problems in grades 6–8 builds on grades K–5 experiences and progresses to specifying relationships between variables, and clarifying arguments and models. • Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions. (MS-ETS1-1) **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 a model to generate data to test ideas about designed systems, including those representing inputs and outputs. (MSETS1-4) • Develop a model to describe unobservable mechanisms. (MS-LS1-7) **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.	**ETS1.A: Defining and Delimiting Engineering Problems** • The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions. (MS-ETS11) **ETS1.B: Developing Possible Solutions** • A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. (MS-ETS1-4) • There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MS-ETS1-2), (MS-ETS1-3) • Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. (MS-ETS1-3) • Models of all kinds are important for testing solutions. (MSETS1-4) **ETS1.C: Optimizing the Design Solution** • Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of those	**Influence of Science, Engineering, and Technology on Society and the Natural World** • 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. (MSETS1-1) • The uses of technologies and 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. (MS-ETS1-1) **Energy and Matter** • Matter is conserved because atoms are conserved in physical and chemical processes. (MS-LS1-7) **Patterns** • Patterns in rates of change and other numerical relationships can provide information about natural systems. (MS-ESS2-3) 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. (MS-ESS14),(MS-ESS2-2)

• Analyze and interpret data to determine similarities and differences in findings. (MS-ETS1-3) • Analyze and interpret data to provide evidence for phenomena. (MS-ESS2-3) **Engaging in Argument from Evidence** Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world. • Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (MS-ETS1-2) **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 the natural world operate today as they did in the past and will continue to do so in the future. (MSESS1-4),(MS-ESS2-2)	characteristics may be incorporated into the new design. (MS-ETS1-3) • The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. (MS-ETS1-4) **LS1.C: Organization for Matter and Energy Flow in Organisms** • Within individual organisms, food moves through a series of chemical reactions in which it is broken down and rearranged to form new molecules, to support growth, or to release energy. (MS-LS1-7) **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-ESS14) • Tectonic processes continually generate new ocean sea floor at ridges and destroy old sea floor 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	

Connections to Nature of Science **Scientific Knowledge is Open to Revision in Light of New Evidence** • Science findings are frequently revised and/or reinterpreted based on new evidence. (MS-ESS2-3)	and will determine its future. (MS-ESS2-2) **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)	
ASSESSMENT	**VOCABULARY**	**OTHER SUGGESTED ACTIVITIES/RESOURCES**
End of unit assessment: • Plate Motion	Refer to glossary in the back of the student investigation notebook.	Generation Genius: • Engineering Design Process • Rock Layers (Geologic Time) • Tectonic Plates *Evidence Statements for Earth Science. *Evidence Statements for Engineering. NGSS Evidence Statements provide educators with additional detail on what students should know and be able to do.

Grade 6	HISTORY OF EARTH continued EARTH'S SYSTEMS	3rd Trimester

UNIT 5 – PLATE MOTION ENGINEERING INTERNSHIP

10 Lessons

Students' experiences in the ***Plate Motion Engineering Internship* unit** will support progress toward the Performance Expectations listed below. Students focus on using a model and analyzing data from that model in order to design a system of sensors that will detect dangerous tsunamis and warn people when they need to evacuate. Specifically, students will learn about geohazards engineering practices and deepen their understanding about plate motion and Earth's systems. Students strive to meet the design criteria: maximize average warning time, minimize false alarms, and keep costs low. Students complete several tasks and run tests by using the Futura TsunamiAlert Design Tool to collect data. They analyze data, noting how changes to their models affect the warning system's performance; run iterative tests; and prepare final proposals for their optimal tsunami warning system designs.

MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved

MS-ESS2-2. Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying temporal and spatial scales. [Clarification Statement: Emphasis is on how processes change Earth's surface at temporal 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 could 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.]

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 could 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.]

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 could include those resulting from interior processes (such as earthquakes and volcanic eruptions) and surface processes (such as mass wasting and tsunamis), or from severe weather events (such as blizzards, hurricanes, tornadoes, floods, and droughts). Examples of data could include the locations, magnitudes, and frequencies of the natural hazards. Examples of technologies could include global technologies (such as satellite images to monitor hurricanes or forest fires) or local technologies (such as building basements in tornado-prone regions or reservoirs to mitigate droughts).]

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UNIT 6 – ROCK TRANSFORMATIONS

19 Lessons (including pre/post assessment)

Students' experiences in the ***Rock Transformations* unit** will support progress toward the four Performance Expectations listed below. Specifically, students use models and construct explanations about the ways that rock materials can transform. They conduct investigations and analyze evidence as they connect ideas about rock types, intermediary materials such as magma and sediment, the energy needed to transform rocks, transformation processes, and how plate motion allows some rock transformations to happen.

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 could include the sizes of an object's layers (such as crust and atmosphere), surface features (such as volcanoes), and orbital radius. Examples of data could 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.]

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 specific identification and naming of minerals and rocks but could include the general classification of rocks as igneous, metamorphic, or sedimentary.]

MS-ESS2-2. Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying temporal and spatial scales. [Clarification Statement: Emphasis is on how processes change Earth's surface at temporal 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 could 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.]

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 could 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.]

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 geologic 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 could include 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).]

Asking Questions and Defining Problems Asking questions and defining problems in grades 6–8 builds on grades K–5 experiences and progresses to specifying relationships between variables, and clarifying arguments and models. • Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions. (MS-ETS1-1) **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 a model to generate data to test ideas about designed systems, including those representing inputs and outputs. (MSETS1-4) • Develop and use a model to describe phenomena. (MSESS2-1) **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.	**ETS1.A: Defining and Delimiting Engineering Problems** • The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions. (MS-ETS11) **ETS1.B: Developing Possible Solutions** • A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. (MS-ETS1-4) • There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MS-ETS1-2), (MS-ETS1-3) • Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. (MS-ETS1-3) • Models of all kinds are important for testing solutions. (MSETS1-4) **ETS1.C: Optimizing the Design Solution** • Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of those characteristics may be incorporated into the new design. (MS-ETS1-3) • The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. (MS-ETS1-4)	**Influence of Science, Engineering, and Technology on Society and the Natural World** • 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. (MSETS1-1) • The uses of technologies and 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. (MS-ETS1-1) **Patterns** • Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (MS-ESS14), (MS-ESS2-2) • Patterns in rates of change and other numerical relationships can provide information about natural systems. (MS-ESS2-3) • Graphs, charts, and images can be used to identify patterns in data. (MS-ESS3-2)

• Analyze and interpret data to determine similarities and differences in findings. (MS-ETS1-3), (MS-ESS1-3) • Analyze and interpret data to provide evidence for phenomena. (MS-ESS2-3) • Analyze and interpret data to determine similarities and differences in findings. (MSESS3-2) **Engaging in Argument from Evidence** Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world. • Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (MS-ETS1-2) **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	**ESS1.B: Earth and the Solar System** • (NYSED) The solar system consists of the Sun and a collection of objects, including planets, their moons, comets, and asteroids that are held in orbit around the Sun by its gravitational pull on them. (MS-ESS1-3) **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) **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) **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	**Cause and Effect** • Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-ESS3-1) **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. (MSESS2-1) **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. (MS-ESS1-3) -- *Connections to Engineering, Technology, and Applications of Science* **Influence of Science, Engineering, and Technology on Society and the Natural World** • All human activity draws on natural resources and has both short and long-term

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. (MSESS1-4),(MS-ESS2-2) • 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. (MS-ESS3-1)	changes in Earth's materials and living organisms. (MS-ESS2-1) ESS2.C: **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)	consequences, positive as well as negative, for the health of people and the natural environment. (MS-ESS3-1) **Interdependence of Science, Engineering, and Technology** • 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. (MSESS1-3)
ASSESSMENT	**VOCABULARY**	**OTHER SUGGESTED ACTIVITIES/RESOURCES**
End of unit assessment: • Rock Transformations	Refer to glossary in the back of the student investigation notebook.	Generation Genius: • Engineering Design Process • Tectonic Plates • Predicting Natural Disasters • Rocks and Minerals • Natural Resource Distribution *Evidence Statements for Earth Science. *Evidence Statements for Engineering. NGSS Evidence Statements provide educators with additional detail on what students should know and be able to do.