

Grade 8 Science



Priority Standards and Instructional Units 2020-2021

Unit 1: Energy

(3 weeks = 15 days)

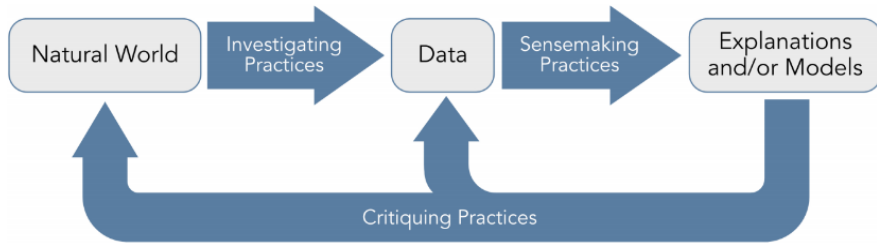
Essential Questions:

Core Idea PS3: Energy

How is energy transferred and conserved?

- What is energy?
- What is meant by conservation of energy? How is energy transferred between objects or systems?
- How are forces related to energy?

Possible Phenomena: Coming Soon



| | Investigating Practices | Sensemaking Practices | Critiquing Practices |
|-------------------|--|------------------------------------|---|
| Science Practices | 1. Asking questions | 2. Developing and using models | 7. Engaging in argument from evidence |
| | 3. Planning and carrying out investigations | 4. Analyzing and interpreting data | 8. Obtaining, evaluating, and communication information |
| | 5. Using mathematical and computational thinking | 6. Constructing explanations | |

MS-PS3-1

Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.

[Clarification Statement: Emphasis is on descriptive relationships between kinetic energy and mass separately from kinetic energy and speed. Examples could include riding a bicycle at different speeds, rolling different sizes of rocks downhill, and getting hit by a wiffle ball versus a tennis ball.]

Priority Standard

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.

Supporting Standard

Science and Engineering Practices:

Planning and Carrying Out Investigations

Planning and carrying out investigations to answer questions or test solutions to problems in 6–8 builds on K–5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or design solutions

Analyzing and Interpreting Data

Analyzing data in 6–8 builds on K–5 and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.

Construct and interpret graphical displays of data to identify linear and nonlinear relationships. (08-PS3-1)

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 ideas, principles, and theories

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 worlds

Crosscutting concepts:

Scale, Proportion, and Quantity

Proportional relationships (e.g. speed as the ratio of distance traveled to time taken) among different types of quantities provide information about the magnitude of properties and processes. (08-PS3-1),(07- PS3-4)

Disciplinary Core Ideas:

PS3.A: Definitions of Energy

Motion energy is properly called kinetic energy; it is proportional to the mass of the moving object and grows with the square of its speed. (08-PS3-1)

Unit 2: History of Earth (4.5 weeks = 23 days)

Essential Questions:

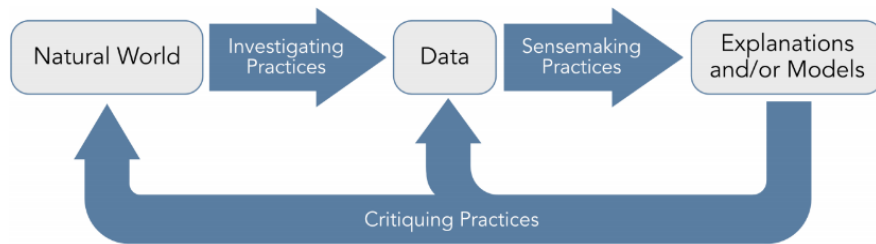
Core Idea LS4: Biological Evolution: Unity and Diversity

How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms?

How does biodiversity affect humans?

- What evidence shows that different species are related?
- How does genetic variation among organisms affect survival and reproduction?
- What is biodiversity, how do humans affect it, and how does it affect humans?

Possible Phenomena: Coming Soon



| | Investigating Practices | Sensemaking Practices | Critiquing Practices |
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| Science Practices | 1. Asking questions | 2. Developing and using models | 7. Engaging in argument from evidence |
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MS-LS4-1

Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.

[Clarification Statement: Emphasis is on finding patterns of changes in the level of complexity of anatomical structures in organisms and the chronological order of fossil appearance in the rock layers.] [Assessment Boundary: Assessment does not include the names of individual species or geological eras in the fossil record.]

Priority Standard

MS-LS4-2

Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.

[Clarification Statement: Emphasis is on explanations of the evolutionary relationships among organisms in terms of similarity or differences of the gross appearance of anatomical structures.]

Priority Standard

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| <p style="text-align: center;"><u>MS-ESS1-4</u></p> <p style="text-align: center;">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.</p> <p>[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.]</p> | <p>Supporting Standard</p> |
| <p style="text-align: center;"><u>MS-LS4-3</u></p> <p style="text-align: center;">Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy.</p> <p>[Clarification Statement: Emphasis is on inferring general patterns of relatedness among embryos of different organisms by comparing the macroscopic appearance of diagrams or pictures.] [Assessment Boundary: Assessment of comparisons is limited to gross appearance of anatomical structures in embryological development.]</p> | <p>Supporting Standard</p> |
| <p>Science and Engineering Practices:</p> | |
| <p>Analyzing and Interpreting Data Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. Analyze displays of data to identify linear and nonlinear relationships. (08-LS4-3) Analyze and interpret data to determine similarities and differences in findings. (08-LS4-1)</p> <p>Using Mathematics and Computational Thinking Mathematical and computational thinking in 6–8 builds on K–5 experiences and progresses to identifying patterns in large data sets and using mathematical concepts to support explanations and arguments.</p> <p>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. Apply scientific ideas to construct an explanation for real-world phenomena, examples, or events. (08-LS4-2) 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. (08-ESS1-4),</p> <p>Connections to Nature of Science Scientific Knowledge is Based on Empirical Evidence Science knowledge is based upon logical and conceptual connections between evidence and explanations. (08-LS4-1)</p> | |
| <p>Crosscutting concepts:</p> | |
| <p>Patterns Patterns can be used to identify cause and effect relationships. (08-LS4-2)</p> | |

Graphs, charts, and images can be used to identify patterns in data. (08-LS4-1), (08-LS4-3)

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. (08-LS4-1),(08-LS4-2)

Disciplinary Core Ideas:

LS4.A: Evidence of Common Ancestry and Diversity

The collection of fossils and their placement in chronological order (e.g., through the location of the sedimentary layers in which they are found or through radioactive dating) is known as the fossil record. It documents the existence, diversity, extinction, and change of many life forms throughout the history of life on Earth. (08-LS4-1)

Anatomical similarities and differences between various organisms living today and between them and organisms in the fossil record enable the reconstruction of evolutionary history and the inference of lines of evolutionary descent. (08-LS4-2)

Comparison of the embryological development of different species also reveals similarities that show relationships not evident in the fully-formed anatomy. (08-LS4-3)

LS4.C: Adaptation

Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes. (08-LS4-6)

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. (08-ESS1-4) Tectonic processes continually generate new ocean sea floor at ridges and destroy old sea floor at trenches. (HS.ESS1.C GBE) (secondary to 06-ESS2-3)

Unit 3: Reproduction, Unity and Diversity (4.5 weeks = 5 days Term 1 & 18 days in Term 2)

Essential Questions:

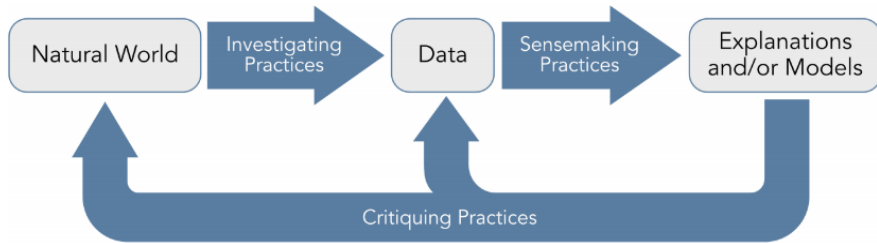
Core Idea LS3: Heredity: Inheritance and Variation of Traits

How are characteristics of one generation passed to the next?

How can individuals of the same species and even siblings have different characteristics?

- How are the characteristics of one generation related to the previous generation?
- Why do individuals of the same species vary in how they look, function, and behave?

Possible Phenomena: Coming Soon



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MS-LS3-2

Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.

[Clarification Statement: Emphasis is on using models such as Punnett squares, diagrams, and simulations to describe the cause and effect relationship of gene transmission from parent(s) to offspring and resulting genetic variation.]

Priority Standard

MS-LS3-1

Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.

[Clarification Statement: Emphasis is on conceptual understanding that changes in genetic material may result in making different proteins.] [Assessment Boundary: Assessment does not include specific changes at the molecular level, mechanisms for protein synthesis, or specific types of mutations.]

Priority Standard

MS-LS4-3

Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy. [Clarification Statement: Emphasis is on inferring general patterns of relatedness among embryos of different organisms by comparing the macroscopic appearance of diagrams or pictures.] [Assessment Boundary: Assessment of comparisons is limited to gross

Supporting Standard

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| appearance of anatomical structures in embryological development.] | |
| <u>MS-LS4-4</u> Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment. [Clarification Statement: Emphasis is on using simple probability statements and proportional reasoning to construct explanations.] | Supporting Standard |
| <u>MS-LS4-6</u> Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time. [Clarification Statement: Emphasis is on using mathematical models, probability statements, and proportional reasoning to support explanations of trends in changes to populations over time.] [Assessment Boundary: Assessment does not include Hardy Weinberg calculations.] | Supporting Standard |
| <u>MS-ETS1-4</u> 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. | Supporting Standard |

Science and Engineering Practices:

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. (08-LS3-1),(08- LS3-2)

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 knowledge, principles, and theories.

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(s)

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 describe how they are supported or not supported by evidence. (08-LS4-5)

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 displays of data to identify linear and nonlinear relationships. (08-LS4-3)

Using Mathematics and Computational Thinking
Mathematical and computational thinking in 6–8 builds on K–5 experiences and progresses to identifying patterns in large data sets and using mathematical concepts to support explanations and arguments.
Use mathematical representations to support scientific conclusions and design solutions. (08-LS4-6)

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 an explanation that includes qualitative or quantitative relationships between variables that describe phenomena. (08-LS4- 4)

Crosscutting concepts:**Cause and Effect**

Cause and effect relationships may be used to predict phenomena in natural systems.(08- LS3-2)
Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability.
(07-LS1-4),(07-LS1-5),(08-LS4-5)

Structure and Function

Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the shapes, composition, and relationships among its parts, therefore complex natural and designed structures/systems can be analyzed to determine how they function. (08- LS3-1)

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. (08-LS4-5)

Connections to Nature of Science

Science Addresses Questions About the Natural and Material World

Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes. (08-LS4-5)

Patterns

Graphs, charts, and images can be used to identify patterns in data. (08-LS4-1), (08-LS4- 3)

Disciplinary Core Ideas:**LS1.B: Growth and Development of Organisms**

Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring. (secondary to 08-LS3-2)

LS3.A: Inheritance of Traits

Genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes. Each distinct gene chiefly controls the production of specific proteins, which in turn affects the traits of the individual. Changes (mutations)to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits. (08-LS3-1)

Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited. (08-LS3-2)

LS3.B: Variation of Traits

In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring. Individuals have two of each chromosome and hence two alleles of each gene, one acquired from each parent. These versions may be identical or may differ from each other. (08-LS3-2)

In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations.

Though rare, mutations may result in changes to the structure and function of proteins. Some changes are beneficial, others harmful, and some neutral to the organism.(08-LS3-1)

LS4.B: Natural Selection

In artificial selection, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed onto offspring. (08-LS4-5)

LS4.A: Evidence of Common Ancestry and Diversity

Comparison of the embryological development of different species also reveals similarities that show relationships not evident in the fully-formed anatomy. (08-LS4-3)

LS4.B: Natural Selection

Natural selection leads to the predominance of certain traits in a population, and the suppression of others. (08-LS4-4)

LS4.C: Adaptation

Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in

environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes. (08-LS4-6)

Unit 4: Populations & Response to Change (6 weeks = 25 days in Term 2 & 5 days in Term 3)

Essential Questions:

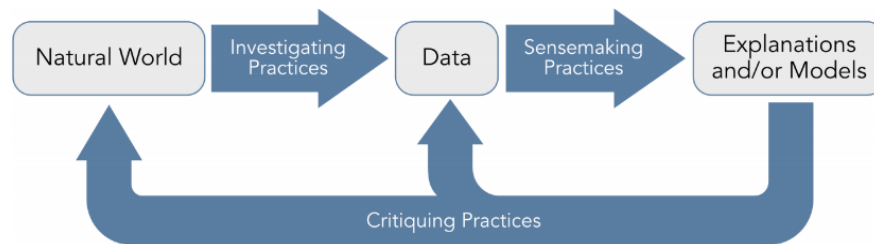
Core Idea LS4: Biological Evolution: Unity and Diversity

How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms?

How does biodiversity affect humans?

- How does genetic variation among organisms affect survival and reproduction?
- How does the environment influence populations of organisms over multiple generations?
- What is biodiversity, how do humans affect it, and how does it affect humans?

Possible Phenomena: Coming Soon



| | Investigating Practices | Sensemaking Practices | Critiquing Practices |
|-------------------|--|------------------------------------|---|
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MS-LS4-4

Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.

[Clarification Statement: Emphasis is on using simple probability statements and proportional reasoning to construct explanations.]

Priority Standard

MS-LS4-6

Use mathematical representations to support explanations of how natural selection may lead to increases and

Priority Standard

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| <p>decreases of specific traits in populations over time.</p> <p>[Clarification Statement: Emphasis is on using mathematical models, probability statements, and proportional reasoning to support explanations of trends in changes to populations over time.] [Assessment Boundary: Assessment does not include Hardy Weinberg calculations.]</p> | |
| <p>MS-LS4-5</p> <p>Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms.</p> <p>[Clarification Statement: Emphasis is on synthesizing information from reliable sources about the influence of humans on genetic outcomes in artificial selection (such as genetic modification, animal husbandry, gene therapy); and, on the impacts these technologies have on society as well as the technologies leading to these scientific discoveries.]</p> | <p>Supporting Standard</p> |
| <p>MS-LS1-8</p> <p>Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.</p> <p>[Assessment Boundary: Assessment does not include mechanisms for the transmission of this information.]</p> | <p>Supporting Standard</p> |
| <p>Science and Engineering Practices:</p> | |
| <p>Analyzing and Interpreting Data Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.</p> <p>Using Mathematics and Computational Thinking Mathematical and computational thinking in 6–8 builds on K–5 experiences and progresses to identifying patterns in large data sets and using mathematical concepts to support explanations and arguments. Use mathematical representations to support scientific conclusions and design solutions. (08-LS4-6)</p> <p>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 an explanation that includes qualitative or quantitative relationships between variables that describe phenomena. (08-LS4- 4)</p> <p>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 describe how they are supported or not supported by evidence. (08-LS4-5) (08-LS1-8)</p> | |
| <p>Crosscutting concepts:</p> | |
| <p>Cause and Effect Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. (08-LS4-4),(08-LS4-6) 908-LS4-5) Cause and effect relationships may be used to predict phenomena in natural systems. (08-LS1-8)</p> <p>Connections to Engineering, Technology, and Applications of Science</p> | |

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. (08-LS4-5)

Connections to Nature of Science

Science Addresses Questions About the Natural and Material World

Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes. (08-LS4-5)

Disciplinary Core Ideas:

LS4.B: Natural Selection

Natural selection leads to the predominance of certain traits in a population, and the suppression of others. (08-LS4-4)

In artificial selection, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed onto offspring. (08-LS4-5)

LS4.C: Adaptation

Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes. (08-LS4-6)

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. The signals are then processed in the brain, resulting in immediate behaviors or memories. (08-LS1-8)

Unit 5: Ecosystem Biodiversity

(4 weeks = 20 days)

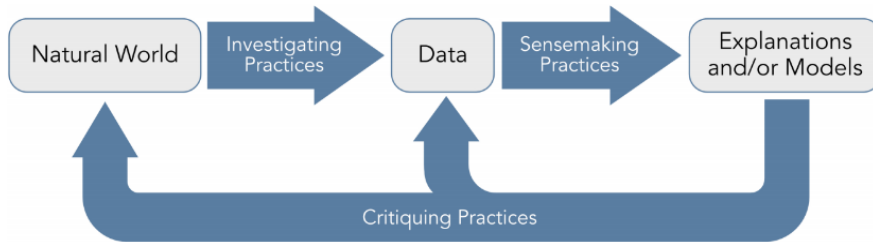
Essential Questions:

Core Idea LS2: Ecosystems: Interactions, Energy, and Dynamics

How and why do organisms interact with their environment and what are the effects of these interactions?

- What happens to ecosystems when the environment changes?

Possible Phenomena: Coming Soon



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| <p align="center">MS-LS2-4</p> <p>Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.</p> <p>[Clarification Statement: Emphasis is on recognizing patterns in data and making warranted inferences about changes in populations, and on evaluating empirical evidence supporting arguments about changes to ecosystems.]</p> | <p align="center">Priority Standard</p> |
| <p align="center">MS-LS2-5</p> <p>Evaluate competing design solutions for maintaining biodiversity and ecosystem services.*</p> <p>[Clarification Statement: Examples of ecosystem services could include water purification, nutrient recycling, and prevention of soil erosion. Examples of design solution constraints could include scientific, economic, and social considerations.]</p> | <p align="center">Supporting Standard</p> |
| <p align="center">MS-ETS1-2</p> <p>Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem</p> | <p align="center">Supporting Standard</p> |
| <p align="center">MS-ETS1-3</p> <p>Analyze data from tests to determine similarities and differences among several design solutions to identify the</p> | <p align="center">Supporting Standard</p> |

best characteristics of each that can be combined into a new solution to better meet the criteria for success.

Science and Engineering Practices:

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(s).
Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (08-LS2-5)
Construct an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. (08-LS2-4)

Connections to Nature of Science

Science disciplines share common rules of obtaining and evaluating empirical evidence. (08-LS2-4)

Crosscutting concepts:

Stability and Change

Small changes in one part of a system might cause large changes in another part. (08-LS2-5) (08-LS2-4)

Connections to Engineering, Technology, and Applications of Science

Influence of Science, Engineering, and Technology on Society and the Natural World
The use 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. (08-LS2-5)

Connections to Nature of Science

Science Addresses Questions About the Natural and Material World
Scientific knowledge can describe the consequence of actions but does not necessarily prescribe the decisions that society takes. (08-LS2-5)

Disciplinary Core Ideas:

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

Biodiversity describes the variety of species found in Earth’s terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem’s biodiversity is often used as a measure of its health. (08-LS2-5)
Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations. (08-LS2-4)

LS4.D: Biodiversity and Humans

Changes in biodiversity can influence humans’ resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on—for example, water purification and recycling. (secondary to 08-LS2-5)

ETS1.B: Developing Possible Solutions

There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (secondary to 08-LS2-5)

Unit 6: Climate & Resources

(4 weeks = 20 days)

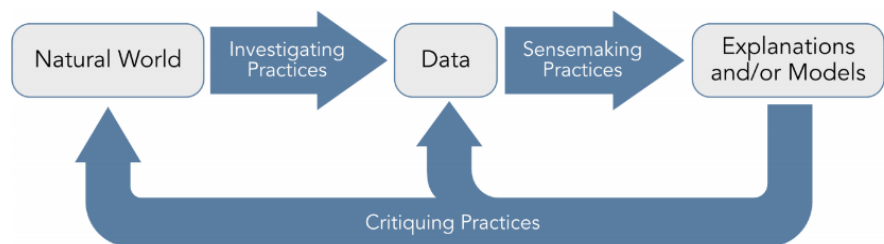
Essential Questions:

Core Idea ESS3: Earth and Human Activity

How do Earth's surface processes and human activities affect each other?

- How do humans depend on Earth's resources?
- How do humans change the planet?
- How do people model and predict the effect of human activities on Earth's climate?

Possible Phenomena: Coming Soon



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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.]

Priority Standard

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| <p style="text-align: center;">MS-ESS3-1</p> <p>Construct a scientific explanation based on evidence for how the uneven distributions of Earth’s mineral, energy, and groundwater resources are the result of past and current geoscience processes.</p> <p>[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).]</p> | <p>Supporting Standard</p> |
| <p style="text-align: center;">MS-ESS3-2.</p> <p>Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.</p> <p>[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).]</p> | <p>Supporting Standard</p> |
| <p style="text-align: center;">MS-ETS1-1</p> <p>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.</p> | <p>Supporting Standard</p> |
| <p>Science and Engineering Practices:</p> | |
| <p>Analyzing and Interpreting Data Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. Analyze and interpret data to determine similarities and differences in findings. (08-ESS3-2)</p> <p>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(s). Construct an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. (08-ESS3-4)</p> <p>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. (08-ESS3-1)</p> | |

Crosscutting concepts:

Patterns

Graphs, charts, and images can be used to identify patterns in data. (08-ESS3-2)

Cause and Effect

Cause and effect relationships may be used to predict phenomena in natural or designed systems. (08-ESS3-4)

Cause and effect relationships may be used to predict phenomena in natural or designed systems. (08-ESS3-1)

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 consequences, positive as well as negative, for the health of people and the natural environment. (08-ESS3-4)

The uses of technologies and limitations on their use are driven by people's 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. (08-ESS3-2),(08-ESS3-3)

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. (08-ESS3-1)

Connections to Nature of Science

Science Addresses Questions About the Natural and Material World

Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes. (08-ESS3-4)

Disciplinary Core Ideas:

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. (08-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. (08-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. (08-ESS3-3),(08-ESS3-4)

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. (08-ESS3-1)

Unit 7: Human Impacts (6 weeks = 30 days)

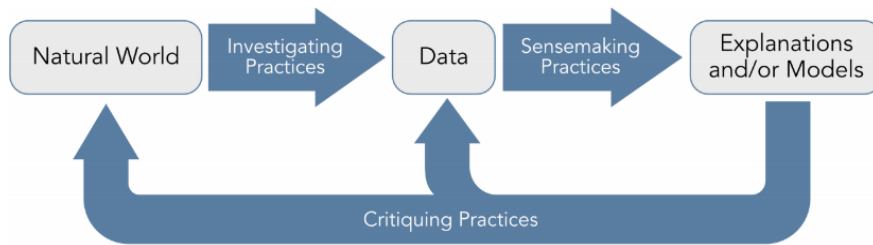
Essential Questions:

Core Idea ESS3: Earth and Human Activity

How do Earth's surface processes and human activities affect each other?

- How do humans depend on Earth's resources?
- How do natural hazards affect individuals and societies?
- How do humans change the planet?
- How do people model and predict the effect of human activities on Earth's climate?

Possible Phenomena: Coming Soon



| | Investigating Practices | Sensemaking Practices | Critiquing Practices |
|-------------------|--|------------------------------------|---|
| | 1. Asking questions | 2. Developing and using models | 7. Engaging in argument from evidence |
| Science Practices | 3. Planning and carrying out investigations | 4. Analyzing and interpreting data | 8. Obtaining, evaluating, and communication information |
| | 5. Using mathematical and computational thinking | 6. Constructing explanations | |

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).]

Priority Standard

| | |
|---|---------------------------------|
| <p style="text-align: center;">MS-ESS3-3</p> <p style="text-align: center;">Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment</p> <p>.* [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).]</p> | <p><u>Priority Standard</u></p> |
| <p style="text-align: center;">8-ESS3-5</p> <p>Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.</p> <p>[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.]</p> | <p><u>Priority Standard</u></p> |
| <p style="text-align: center;">MS-LS2-5</p> <p>Evaluate competing design solutions for maintaining biodiversity and ecosystem services.*</p> <p>[Clarification Statement: Examples of ecosystem services could include water purification, nutrient recycling, and prevention of soil erosion. Examples of design solution constraints could include scientific, economic, and social considerations.]</p> | <p>Supporting Standard</p> |
| <p style="text-align: center;">MS-LS4-5</p> <p>Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms.</p> <p>[Clarification Statement: Emphasis is on synthesizing information from reliable sources about the influence of humans on genetic outcomes in artificial selection (such as genetic modification, animal husbandry, gene therapy); and, on the impacts these technologies have on society as well as the technologies leading to these scientific discoveries.]</p> | <p>Supporting Standard</p> |
| <p style="text-align: center;">MS-ETS1-2</p> <p>Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.</p> | <p>Supporting Standard</p> |
| <p style="text-align: center;">MS-ETS1-3</p> <p>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.</p> | <p>Supporting Standard</p> |

| | |
|--|-----------------------------------|
| <p style="text-align: center;">MS-ETS1-1</p> <p style="text-align: center;">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</p> | <p>Supporting Standard</p> |
| <p>Science and Engineering Practices:</p> | |
| <p>Asking Questions and Defining Problems Asking questions and defining problems in 6–8 builds on K–5 experiences and progresses to specifying relationships between variables, clarify arguments and models. Ask questions to identify and clarify evidence of an argument. (08-ESS3-5)</p> <p>Analyzing and Interpreting Data Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. Analyze and interpret data to determine similarities and differences in findings. (08-ESS3-2)</p> <p>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. Apply scientific principles to design an object, tool, process or system. (08-ESS3-3)</p> <p>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(s). Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (08-LS2-5)</p> <p>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 describe how they are supported or not supported by evidence. (08-LS4-5)</p> | |
| <p>Crosscutting concepts:</p> | |
| <p>Patterns Graphs, charts, and images can be used to identify patterns in data. (08-ESS3-2)</p> <p>Cause and Effect Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation. (08- ESS3-3) Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. (07-LS1-4),(07-LS1-5),(08-LS4-5)</p> <p>Stability and Change Stability might be disturbed either by sudden events or gradual changes that accumulate over time. (08-ESS3-5) Small changes in one part of a system might cause large changes in another part. (08-LS2-5)</p> <p>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 limitations on their use are driven by people’s 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. (08-ESS3-2),(08-ESS3-3) (08-LS2-5) 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</p> | |

systems. (08-LS4-5)

Connections to Nature of Science

Science Addresses Questions About the Natural and Material World Scientific knowledge can describe the consequence of actions but does not necessarily prescribe the decisions that society takes. (08-LS2-5)

Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes. (08-LS4-5)

Disciplinary Core Ideas:

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. (08- 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. (08-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. (08-ESS3-3),(08-ESS3-4)

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. (08- ESS3-5)

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

Biodiversity describes the variety of species found in Earth’s terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem’s biodiversity is often used as a measure of its health. (08-LS2-5)

LS4.D: Biodiversity and Humans

Changes in biodiversity can influence humans’ resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on—for example, water purification and recycling. (secondary to 08-LS2-5)

ETS1.B: Developing Possible Solutions

There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (secondary to 08-LS2-5)

LS4.B: Natural Selection

In artificial selection, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed onto offspring. (08-LS4-5)

