New York Science Standards (Grades 6-8)

New York State P-12 Science Learning Standards

*The performance expectations marked with an asterisk integrate traditional science content with engineering through a Practice or Disciplinary Core Idea. The text in the "Disciplinary Core Ideas" section is reproduced verbatim from A Framework for K-12 Science Education: Practices, Cross-Cutting Concepts, and Core Ideas unless it is preceded by (NYSED).

MS. Matter and Energy in Organisms and Ecosystems

Students who demonstrate understanding can:

MS-LS1-6. Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms. [Clarification Statement: Emphasis is on tracing movement of matter and flow of energy.] [Assessment Boundary: Assessment does not include the biochemical mechanisms of photosynthesis.]

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.]

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-LS2-3. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. [Clarification Statement: Emphasis is on describing the conservation of matter and flow of energy associated with ecosystem, and on defining the boundaries of the ecosystem.] [Assessment Boundary: Assessment does not include the use of chemical reactions to describe the processes.]

MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. [Clarification Statement: Emphasis is on recognizing patterns in data and making warranted inferences about shifts in populations due to changes in the ecosystem.]

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 a model to describe phenomena. (MS-LS2-3)
- 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)

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-LS1-6)

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. (MS-LS2-4)

Connections to Nature of Science

- **Scientific Knowledge is Based on Empirical Evidence**
    - Science knowledge is based upon logical connections between evidence and explanations. (MS-LS1-6)
    - Science disciplines share common rules of obtaining and evaluating empirical evidence. (MS-LS2-4)

Disciplinary Core Ideas

LS1.C: Organization for Matter and Energy Flow in Organisms

- Plants, algae (including phytoplankton), and many microorganisms use the energy from light to make sugars (food) from carbon dioxide from the atmosphere and water through the process of photosynthesis, which also releases oxygen. These sugars can be used immediately or stored for growth or later use.(MS-LS1-6)
- 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)

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)

LS2.B: Cycle of Matter and Energy Transfer in Ecosystems

- Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem. (MS-LS2-3)

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

- 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. (MS-LS2-4)

PS3.D: Energy in Chemical Processes and Everyday Life

- The chemical reaction by which plants produce complex food molecules (sugars) requires an energy input (i.e., from sunlight) to occur. In this reaction, carbon dioxide and water combine to form carbon-based organic molecules and release oxygen. (secondary to MS-LS1-6)
- Cellular respiration in plants and animals involves chemical reactions with oxygen that release stored energy. In these processes, complex molecules containing carbon react with oxygen to produce carbon dioxide and other materials. (secondary to MS-LS1-7)

Crosscutting Concepts

Cause and Effect

- Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-LS2-1)

Energy and Matter

- Matter is conserved because atoms are conserved in physical and chemical processes.(MS-LS1-7)
- Within a natural system, the transfer of energy drives the motion and/or cycling of matter. (MS-LS1-6)
- The transfer of energy can be tracked as energy flows through a natural system. (MSLS2-3)

Stability and Change

- Small changes in one part of a system might cause large changes in another part. (MSLS2-4)

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. (MS-LS2-3)

Connections to other DCIs in this g rade - band : MS.PS1.B (MS-LS1-6),(MS-LS1-7),(MS-LS2-3); MS.LS4.C (MS-LS2-4); MS.LS4.D (MS-LS2-4); MS.ESS2.A (MS-LS1-6),(MS-LS23),(MS-LS2-4); MS.ESS3.A (MS-LS2-1),(MS-LS2-4); MS.ESS3.C (MS-LS2-1),(MS-LS2-4) **Articulation across g rade - bands:** 3.LS2.C (MS-LS2-1),(MS-LS2-4); 3.LS4.D (MS-LS2-1),(MS-LS2-4); 5.PS3.D (MS-LS1-6),(MS-LS1-7); 5.LS1.C (MS-LS1-6),(MS-LS1-7); 5.LS2.A (MSLS1-6),(MS-LS2-1),(MS-LS2-3); 5.LS2.B (MS-LS1-6),(MS-LS1-7),(MS-LS2-3); HS.PS1.B (MS-LS1-6),(MS-LS1-7); HS.PS3.B (MS-LS2-3); HS.LS1.C (MS-LS1-6),(MS-LS1-7),(MS-LS23); HS.LS2.A (MS-LS2-1); HS.LS2.B (MS-LS1-6),(MS-LS1-7),(MS-LS2-3); HS.LS2.C (MS-LS2-4); HS.LS4.C (MS-LS2-1),(MS-LS2-4) ; HS.LS4.D (MS-LS2-1),(MS-LS2-4); HS.ESS2.A (MS-LS2-3); HS.ESS2.D (MS-LS1-6); HS.ESS2.E (MS-LS2-4); HS.ESS3.A (MS-LS2-1); HS.ESS3.B (MS-LS2-4); HS.ESS3.C (MS-LS2-4)

Common Core State Standards Connections:

ELA/Literacy –

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (MS-LS1-6),(MS-LS2-1),(MS-LS2-4)

RST.6-8.2 Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions. (MS-LS1-6)

RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-LS2-1)

RI.8.8 Trace and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient to support the claims. (MS-LS2-4)

WHST.6-8.1 Write arguments to support claims with clear reasons and relevant evidence. (MS-LS2-4)

WHST.6-8.2 Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (MS-LS1-6)

WHST.6-8.9 Draw evidence from informational texts to support analysis, reflection, and research. (MS-LS1-6),(MS-LS2-4)

SL.8.5 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-LS1-7),(MS-LS2-3)

Mathematics –

6.EE.C.9 Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. (MS-LS1-6),(MS-LS2-3)

MS. Interdependent Relationships in Ecosystems

Students who demonstrate understanding can:

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.]

MS-LS2-5. Evaluate competing design solutions for maintaining biodiversity and protecting ecosystem stability.*

[Clarification Statement: Examples of ecosystem protections could include water purification, waste management, nutrient recycling, prevention of soil erosion, and eradication of invasive species. Examples of design solution constraints could include scientific, economic, and social considerations.]

Science and Engineering Practices

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 predict phenomena. (MS-LS2-2)

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(s).

- Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (MS-LS2-5)

Disciplinary Core Ideas

LS2.A: **Interdependent Relationships in Ecosystems**

- 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 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)

LS2.C: **Ecosystem Dynamics, Functioning, and Resilience**

- (NYSED) Biodiversity describes the variety of species found in Earth's ecosystems. The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health. (MS-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 (MS-LS2-5)
- (NYSED) Humans impact biodiversity both positively and negatively. (secondary to MS-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 MS-LS2-5)

Crosscutting Concepts

Patterns

- Patterns can be used to identify cause and effect relationships. (MS-LS2-2)

Stability and Change

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

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. (MSLS2-5)

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. (MS-LS2-5)

Connections to other DCIs in this g rade - band : MS.LS1.B (MS-LS2-2); MS.ESS3.C (MS-LS2-5)
Articulation across g rad e - band: 1.LS1.B (MS-LS2-2); HS.LS2.A (MS-LS2-2),(MS-LS2-5); HS.LS2.B (MS-LS2-2); HS.LS2.C (MS-LS2-5); HS.LS2.D (MS-LS2-2);.LS4.D (MS-LS2-5); HS.ESS3.A (MS-LS2-5); HS.ESS3.C (MS-LS2-5); HS.ESS3.D (MS-LS2-5)

Common Core State Standards Connections:

ELA/Literacy –

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (MS-LS2-2)

RST.6-8.8 Distinguish among facts, reasoned judgment based on research findings, and speculation in a text. (MS-LS2-5)

RI.8.8 Trace and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient to support the claims. (MS-LS2-5)

WHST.6-8.2 Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (MS-LS2-2)

WHST.6-8.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. (MS-LS2-2)

SL.8.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly. (MS-LS2-2)

SL.8.4 Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation. (MS-LS2-2)

Mathematics –

MP.4 Model with mathematics. (MS-LS2-5)

6.RP.A.3 Use ratio and rate reasoning to solve real-world and mathematical problems. (MS-LS2-5)

6.SP.B.5 Summarize numerical data sets in relation to their context. (MS-LS2-2)

MS. Human Impacts

Students who demonstrate understanding can:

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).]

MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.* [Clarification Statement: Examples of the design process could 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 could 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).]

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 could 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 could 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.]

Science and Engineering Practices

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. (MSESS3-2)

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.

- Apply scientific principles to design an object, tool, process or system.(MS-ESS3-3)

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(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. (MS-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. (MS-ESS3-2)

ESS3.C: **Human Impacts on Earth Systems**

- Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things. (MS-ESS3-3)
- Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise. (MSESS3-3),(MS-ESS3-4)

Crosscutting Concepts

Patterns

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

Cause and Effect

- Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation.(MS-ESS3-3)
- Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-ESS3-4)

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.(MS-ESS3-4)
- The uses of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time. (MS-ESS3-2),(MS-ESS3-3)

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. (MSESS3-4)

Connections to other DCIs in this grade - band: MS.PS3.C (MS-ESS3-2); MS.LS2.A (MS-ESS3-3),(MS-ESS3-4); MS.LS2.C (MS-ESS3-3),(MS-ESS3-4); MS.LS4.D (MS-ESS3-3),(MS-ESS3-4) Articulation of DCIs across g rad e - bands: 3.LS2.C (MS-ESS3-3),(MS-ESS3-4); 3.LS4.D (MS-ESS3-3),(MS-ESS3-4); 3.ESS3.B (MS-ESS3-2); 4.ESS3.B (MS-ESS3-2); 5.ESS3.C (MS-ESS33),(MS-ESS3-4); HS.LS2.A (MS-ESS3-4); HS.LS2.C (MS-ESS3-3),(MS-ESS3-4); HS.LS4.C (MS-ESS3-3),(MS-ESS3-4); HS.LS4.D (MS-ESS3-3),(MS-ESS3-4); HS.ESS2.B (MS-ESS3-2); HS.ESS2.C (MS-ESS3-3); HS.ESS2.D (MS-ESS3-2),(MS-ESS3-3); HS.ESS2.E (MS-ESS3-3),(MS-ESS3-4); HS.ESS3.A (MS-ESS3-4); HS.ESS3.B (MS-ESS3-2); HS.ESS3.C (MS-ESS33),(MS-ESS3-4); HS.ESS3.D (MS-ESS3-2),(MS-ESS3-3)

Common Core State Standards Connections:

ELA/Literacy –

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (MS-ESS3-2), (MS-ESS3-4)

RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-ESS3-2)

WHST.6-8.1 Write arguments focused on discipline content. (MS-ESS3-4)

WHST.6-8.7 Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. (MS-ESS3-3)

WHST.6-8.8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation. (MS-ESS3-3)

WHST.6-8.9 Draw evidence from informational texts to support analysis, reflection, and research. (MS-ESS3-4) Mathematics – MP.2 Reason abstractly and quantitatively. (MS-ESS3-2)

6.RP.A.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. (M S - ESS 3 - 3),(M S - ESS 3 - 4)

7.RP.A.2 Recognize and represent proportional relationships between quantities. (MS-ESS3-3),(MS-ESS3-4)

6.EE.B.6 Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (MS-ESS3-2),(MS-ESS3-3),(MS-ESS3-4)

7.EE.B.4 Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. (MS-ESS3-2),(MS-ESS3-3),(MS-ESS3-4)