LE | Living Environment

LE | Unit 1 Scientific Inquiry

RECOMMENDED TIME: 10 DAYS

Unit Overview:

Science relies on logic and creativity. Science is both a body of knowledge and a way of knowing—an intellectual and social process that applies human intelligence to explaining how the world works. Scientific explanations are developed using both observations (evidence) and what people already know about the world (scientific knowledge). All scientific explanations are tentative and subject to change. Good science involves questioning, observing and inferring, experimenting, finding evidence, collecting and organizing data, drawing valid conclusions, and undergoing peer review. Understanding the scientific view of the natural world is an essential part of personal, societal, and ethical decision making. Scientific literacy involves internalizing the scientific critical attitude so that it can be applied in everyday life, particularly in relation to health, commercial, and technological claims. *[Refer to Appendix A for the Humane Treatment of Animals and Conservation Day]*

Essential Question:

How do scientists pose questions, seek answers, and develop solutions?

Key Ideas:

This unit is focused on all of the key ideas in Standard 1: Students will use mathematical analysis, scientific inquiry, and engineering designs, as appropriate, to pose questions, seek answers, and develop solutions.

Key Idea 1: The central purpose of scientific inquiry is to develop explanations of natural phenomena in a continuing and creative process.

Key Idea 2: Beyond the use of reasoning and consensus, scientific inquiry involves the testing of proposed explanations involving the use of conventional techniques and procedures and usually requiring considerable ingenuity.

Key Idea 3: The observations made while testing proposed explanations, when analyzed using conventional and invented methods, provide new insights into natural phenomena.

NYS SCIENCE STANDARDS
http://www.p12.nysed.gov/ciai/mst/sci/documents/livingen.pdf

Major Understandings:

Quoted from the New York State Performance Indicators (Standard 1:1.1a-c, 1.2a, b, 1.3a, b, 1.4a, 2.1, 2.2a, 2.3a-c, 2.4, 3.1, 3.2, 3.3, 3.4a-c, 3.5a, b)

- Scientific explanations are built by combining evidence that can be observed with what people already know about the world. **(1.1a)**

continued

MST STANDARDS
http://www.p12.nysed.gov/ciai/mst/pub/mststa1_2.pdf
http://www.p12.nysed.gov/ciai/mst/pub/mststa6_7.pdf

Standard 2: Information Systems

Students will access, generate, process, and transfer information using appropriate technologies.

Key Idea 1: Information technology is used to retrieve, process, and communicate information as a tool to enhance learning.

continued

NGSS CROSS-CUTTING CONCEPTS
http://www.nextgenscience.org/sites/ngss/files/Appendix%20G%20-%20Crosscutting%20Concepts%20FINAL%20edited%204.10.13.pdf

Patterns:

Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them.

continued

NYS SCIENCE STANDARDS http://www.p12.nysed.gov/ciai/mst/sci/documents/livingen.pdf	MST STANDARDS http://www.p12.nysed.gov/ciai/mst/pub/mststa1_2.pdf http://www.p12.nysed.gov/ciai/mst/pub/mststa6_7.pdf	NGSS CROSS-CUTTING CONCEPTS http://www.nextgenscience.org/sites/ngss/files/Appendix%20G%20-%20Crosscutting%20Concepts%20FINAL%20edited%204.10.13.pdf
■ Learning about the historical development of scientific concepts or about individuals who have contributed to scientific knowledge provides a better understanding of scientific inquiry and the relationship between science and society. **(1.1b)** ■ Science provides knowledge, but values are also essential to making effective and ethical decisions about the application of scientific knowledge. **(1.1c)** ■ Interpretation of data leads to development of additional hypotheses, the formulation of generalizations, or explanations of natural phenomena. **(3.1a)** ■ Apply statistical analysis techniques when appropriate to test if chance alone explains the results. **(3.2)** ■ Assess correspondence between the predicted result contained in the hypothesis and actual result, and reach a conclusion as to whether the explanation on which the prediction was based is supported. **(3.3)** ■ Inquiry involves asking questions and locating, interpreting, and processing information from a variety of sources. **(1.2a)** ■ Inquiry involves making judgments about the reliability of the source and relevance of information. **(1.2b)** ■ Scientific explanations are accepted when they are consistent with experimental and observational evidence and when they lead to accurate predictions. **(1.3a)** ■ All scientific explanations are tentative and subject to change or improvement. Each new bit of evidence can create more questions than it answers. This leads to increasingly better understanding of how things work in the living world. **(1.3b)** ■ Devise ways of making observations to test proposed explanations. **(2.1)** *continued*	**Standard 6: Interconnectedness: Common Themes** **Key Idea 3:** The grouping of magnitudes of size, time, frequency, and pressures or other units of measurement into a series of relative order provides a useful way to deal with the immense range and the changes in scale that affect the behavior and design of systems. **Key Idea 4:** Equilibrium is a state of stability due either to a lack of changes (static equilibrium) or a balance between opposing forces (dynamic equilibrium). **Key Idea 5:** Identifying patterns of change is necessary for making predictions about future behaviors and conditions.	■ Classifications or explanations used at one scale may fail or need revision when information from smaller or larger scales is introduced; thus requiring improved investigations and experiments. ■ Mathematical representations are needed to identify some patterns. ■ Empirical evidence is needed to identify patterns. **Cause and Effect: Mechanism and Prediction:** Events have causes, sometimes simple, sometimes multifaceted. Deciphering causal relationships, and the mechanisms by which they are mediated, is a major activity of science and engineering. ■ Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. **Scale, Proportion, and Quantity:** In considering phenomena, it is critical to recognize what is relevant at different size, time, and energy scales, and to recognize proportional relationships between different quantities as scales change. ■ Algebraic thinking is used to examine scientific data and predict the effect of a change in one variable on another (e.g., linear growth vs. exponential growth). **Stability and Change:** For both designed and natural systems, conditions that affect stability and factors that control rates of change are critical elements to consider and understand. ■ Much of science deals with constructing explanations of how things change and how they remain stable.

NYS SCIENCE STANDARDS

http://www.p12.nysed.gov/ciai/mst/sci/documents/livingen.pdf

- Development of a research plan involves researching background information and understanding the major concepts in the area being investigated. Recommendations for methodologies, use of technologies, proper equipment, and safety precautions should also be included. **(2.2a)**
- Hypotheses are predictions based upon both research and observation. **(2.3a)**
- Hypotheses are widely used in science for determining what data to collect and as a guide for interpreting the data. **(2.3b)**
- Development of a research plan for testing a hypothesis requires planning to avoid bias (e.g., repeated trials, large sample size, and objective data-collection techniques). **(2.3c)**
- Carry out a research plan for testing explanations, including selecting and developing techniques, acquiring and building apparatus, and recording observations as necessary. **(2.4)**
- Hypotheses are valuable, even if they turn out not to be true, because they may lead to further investigation. **(3.4a)**
- Claims should be questioned if the data are based on samples that are very small, biased, or inadequately controlled or if the conclusions are based on the faulty, incomplete, or misleading use of numbers. **(3.4b)**
- Claims should be questioned if fact and opinion are intermingled, if adequate evidence is not cited, or if the conclusions do not follow logically from the evidence given. **(3.4c)**
- One assumption of science is that other individuals could arrive at the same explanation if they had access to similar evidence. Scientists make the results of their investigations public; they should describe the investigations in ways that enable others to repeat the investigations. **(3.5a)**
- Scientists use peer review to evaluate the results of scientific investigations and the explanations proposed by other scientists. They analyze the experimental procedures, examine the evidence, identify faulty reasoning, point out statements that go beyond the evidence, and suggest alternative explanations for the same observations. **(3.5b)**
- Well-accepted theories are ones that are supported by different kinds of scientific investigations often involving the contributions of individuals from different disciplines. **(1.4a)**
- Also see Laboratory Checklist in NYSED Core Curriculum Appendix A.

COMMON CORE STATE STANDARDS

http://www.corestandards.org/wp-content/uploads/ELA_Standards.pdf
http://www.corestandards.org/wp-content/uploads/Math_Standards.pdf

ELA/Literacy

RST.9-10.1: Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

RST.9-10.3: Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

RST.9-10.7: Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

RST.9-10.8: Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.

RST.9-10.9: Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.

WHST.9-10.1: Write arguments focused on discipline-specific content.

WHST.9-10.2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.

WHST.9-10.4: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 1–3 above.)

WHST.9-10.5: Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.

WHST.9-10.6: Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.

WHST.9-10.7: Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

continued

ENVIRONMENTAL GUIDELINES FOR LEARNING

http://resources.spaces3.com/89c197bf-e630-42b0-ad9a-91f0bc55c72d.pdf

Strand 1: Questioning, Analysis, and Interpretation Skills

- Guideline A—Questioning—Learners are able to develop, modify, clarify, and explain questions that guide environmental investigations of various types. They understand factors that influence the questions they pose.
- Guideline B—Designing investigations—Learners know how to design investigations to answer particular questions about the environment. They are able to develop approaches for investigating unfamiliar types of problems and phenomena.
- Guideline C—Collecting information—Learners are able to locate and collect reliable information for environmental investigations of many types. They know how to use sophisticated technology to collect information, including computer programs that access, gather, store, and display data.
- Guideline D—Evaluating accuracy and reliability—Learners can apply basic logic and reasoning skills to evaluate completeness and reliability in a variety of information sources.
- Guideline E—Organizing information—Learners are able to organize and display information in ways appropriate to different types of environmental investigations and purposes.
- Guideline F—Working with models and simulations—Learners are able to create, use, and evaluate models to understand environmental phenomena.
- Guideline G—Drawing conclusions and developing explanations—Learners are able to use evidence and logic in developing proposed explanations that address their initial questions and hypotheses.

COMMON CORE STATE STANDARDS http://www.corestandards.org/wp-content/uploads/ELA_Standards.pdf http://www.corestandards.org/wp-content/uploads/Math_Standards.pdf	
WHST.9-10.9 : Draw evidence from informational texts to support analysis, reflection, and research. **WHST.9-10.10:** Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences. **Mathematics** **HSN.Q.A.1:** Use units as a way to understand problems and to guide the solution of multistep problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. **HSN.Q.A.2:** Define appropriate quantities for the purpose of descriptive modeling. **HSN.Q.A.3:** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.	

LE | Unit 2 Ecology

RECOMMENDED TIME: 25 DAYS

Unit Overview:

The fundamental concept of ecology is that living organisms interact with and are dependent on their environment and each other. These interactions result in a flow of energy and a cycling of materials that are essential for life. Competition can occur between members of different species for an ecological niche. Competition can also occur within species. Competition may be for abiotic resources, such as space, water, air, and shelter, and for biotic resources, such as food and mates. Students should be familiar with the concept of food chains and webs. *[Refer to Appendix A for the Humane Treatment of Animals and Conservation Day]*

Essential Question:

Why doesn't any one type of living thing take over the world?

Key Ideas:

Key Idea 1: Living things are both similar to and different from each other and from nonliving things.

Key Idea 6: Plants and animals depend on each other and their physical environment.

NYS SCIENCE STANDARDS
http://www.p12.nysed.gov/ciai/mst/sci/documents/livingen.pdf

Major Understandings:

Quoted from the New York State Performance Indicators (1.1a-f, 6.1a-g, 6.2a, b, 6.3a-c)

- In all environments, organisms compete for vital resources. The linked and changing interactions of populations and the environment compose the total ecosystem. **(1.1c)**
- The interdependence of organisms in an established ecosystem often results in approximate stability over hundreds and thousands of years. For example, as one population increases, it is held in check by one or more environmental factors or another species. **(1.1d)**

continued

MST STANDARDS
http://www.p12.nysed.gov/ciai/mst/pub/mststa1_2.pdf
http://www.p12.nysed.gov/ciai/mst/pub/mststa6_7.pdf

Standard 6: Interconnectedness: Common Themes

Key Idea 1: Through systems thinking, people can recognize the commonalities that exist among all systems and how parts of a system interrelate and combine to perform specific functions.

Key Idea 2: Models are simplified representations of objects, structures, or systems used in analysis, explanation, interpretation, or design.

Key Idea 3: The grouping of magnitudes of size, time, frequency, and pressures or other units of measurement into a series of relative order provides a useful way to deal with the immense range and the changes in scale that affect the behavior and design of systems.

continued

NGSS CROSS-CUTTING CONCEPTS
http://www.nextgenscience.org/sites/ngss/files/Appendix%20G%20-%20Crosscutting%20Concepts%20FINAL%20edited%204.10.13.pdf

Patterns:

Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them.

- Empirical evidence is needed to identify patterns.

Scale, Proportion, and Quantity:

In considering phenomena, it is critical to recognize what is relevant at different size, time, and energy scales, and to recognize proportional relationships between different quantities as scales change.

- The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs.

continued

NYS SCIENCE STANDARDS http://www.p12.nysed.gov/ciai/mst/sci/documents/livingen.pdf	MST STANDARDS http://www.p12.nysed.gov/ciai/mst/pub/mststa1_2.pdf http://www.p12.nysed.gov/ciai/mst/pub/mststa6_7.pdf	NGSS CROSS-CUTTING CONCEPTS http://www.nextgenscience.org/sites/ngss/files/Appendix%20G%20-%20Crosscutting%20Concepts%20FINAL%20edited%204.10.13.pdf
■ Relationships between organisms may be negative, neutral, or positive. Some organisms may interact with one another in several ways. They may be in a producer/consumer, predator/prey, or parasite/host relationship; or one organism may cause disease in, scavenge, or decompose another. **(6.1g)** ■ As a result of evolutionary processes, there is a diversity of organisms and roles in ecosystems. This diversity of species increases the chance that at least some will survive in the face of large environmental changes. Biodiversity increases the stability of the ecosystem. **(6.2a)** ■ Biodiversity also ensures the availability of a rich variety of genetic material that may lead to future agricultural or medical discoveries with significant value to humankind. As diversity is lost, potential sources of these materials may be lost with it. **(6.2b)** ■ The interrelationships and interdependencies of organisms affect the development of stable ecosystems. **(6.3a)** ■ Populations can be categorized by the function they serve. Food webs identify the relationships among producers, consumers, and decomposers carrying out either autotropic or heterotropic nutrition. **(1.1a)** ■ An ecosystem is shaped by the nonliving environment as well as its interacting species. The world contains a wide diversity of physical conditions, which creates a variety of environments. **(1.1b)** ■ The interdependence of organisms in an established ecosystem often results in approximate stability over hundreds and thousands of years. For example, as one population increases, it is held in check by one or more environmental factors or another species. **(1.1d)** *continued*	**Key Idea 4:** Equilibrium is a state of stability due either to a lack of change (static equilibrium) or a balance between opposing forces (dynamic equilibrium). **Key Idea 5:** Identifying patterns of change is necessary for making predictions about future behavior and conditions.	■ Algebraic thinking is used to examine scientific data and predict the effect of a change in one variable on another (e.g., linear growth vs. exponential growth). **Systems and System Models:** A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems. ■ Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales. **Energy and Matter: Flows, Cycles, and Conservation:** Tracking energy and matter flows into, out of, and within systems helps one understand their system's behavior. ■ Energy cannot be created or destroyed—only moved between one place and another place, between objects and/or fields, or between systems. ■ Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system. ■ Energy drives the cycling of matter within and between systems. **Stability and Change:** For both designed and natural systems, conditions that affect stability and factors that control rates of change are critical elements to consider and understand. ■ Much of science deals with constructing explanations of how things change and how they remain stable.

NYS SCIENCE STANDARDS
http://www.p12.nysed.gov/ciai/mst/sci/documents/livingen.pdf

- Ecosystems, like many other complex systems, tend to show cyclic changes around a state of approximate equilibrium. **(1.1e)**
- Every population is linked, directly or indirectly, with many others in an ecosystem. Disruptions in the numbers and types of species and environmental changes can upset ecosystem stability. **(1.1f)**
- Energy flows through ecosystems in one direction, typically from the Sun, through photosynthetic organisms including green plants and algae, to herbivores to carnivores and decomposers. **(6.1a)**
- The atoms and molecules on the Earth cycle among the living and nonliving components of the biosphere. For example, carbon dioxide and water molecules used in photosynthesis to form energy-rich organic compounds are returned to the environment when the energy in these compounds is eventually released by cells. Continual input of energy from sunlight keeps the process going. This concept may be illustrated with an energy pyramid. **(6.1b)**
- The chemical elements, such as carbon, hydrogen, nitrogen, and oxygen, that make up the molecules of living things pass through food webs and are combined and recombined in different ways. At each link in a food web, some energy is stored in newly made structures but much is dissipated into the environment as heat. **(6.1c)**
- The number of organisms any habitat can support (carrying capacity) is limited by the available energy, water, oxygen, and minerals, and by the ability of ecosystems to recycle the residue of dead organisms through the activities of bacteria and fungi. **(6.1d)**
- In any particular environment, the growth and survival of organisms depend on the physical conditions including light intensity, temperature range, mineral availability, soil/rock type, and relative acidity (pH). **(6.1e)**
- Living organisms have the capacity to produce populations of unlimited size, but environments and resources are finite. This has profound effects on the interactions among organisms. **(6.1f)**
- Through ecological succession, all ecosystems progress through a sequence of changes during which one ecological community modifies the environment, making it more suitable for another community. These long-term gradual changes result in the community reaching a point of stability that can last for hundreds or thousands of years. **(6.3b)**
- A stable ecosystem can be altered, either rapidly or slowly, through the activities of organisms (including humans), or through climatic changes or natural disasters. The altered ecosystem can usually recover through gradual changes back to a point of long-term stability. **(6.3c)**

COMMON CORE STATE STANDARDS

http://www.corestandards.org/wp-content/uploads/ELA_Standards.pdf
http://www.corestandards.org/wp-content/uploads/Math_Standards.pdf

ELA/Literacy

RST.9-10.1: Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

RST.9-10.2: Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.

RST.9-10.7: Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

WHST.9-10.2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.

WHST.9-10.5: Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.

WHST.9-10.6: Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.

WHST.9-10.7: Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

WHST.9-10.9: Draw evidence from informational texts to support analysis, reflection, and research.

Mathematics

HSN.Q.A.1: Use units as a way to understand problems and to guide the solution of multistep problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

HSN.Q.A.2: Define appropriate quantities for the purpose of descriptive modeling.

HSN.Q.A.3: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

ENVIRONMENTAL GUIDELINES FOR LEARNING

http://resources.spaces3.com/89c197bf-e630-42b0-ad9a-91f0bc55c72d.pdf

Strand 1: Questioning, Analysis, and Interpretation Skills

- Guideline A—Questioning—Learners are able to develop, modify, clarify, and explain questions that guide environmental investigations of various types. They understand factors that influence the questions they pose.
- Guideline F—Working with models and simulations—Learners are able to create, use, and evaluate models to understand environmental phenomena.
- Guideline G—Drawing conclusions and developing explanations—Learners are able to use evidence and logic in developing proposed explanations that address their initial questions and hypotheses.

Strand 2: Knowledge of Environmental Processes and Systems

Strand 2.2: The Living Environment

- Guideline A—Organisms, populations, and communities—Learners understand basic population dynamics and the importance of diversity in living systems.
- Guideline C—Systems and connections—Learners understand the living environment to be comprised of interrelated, dynamic systems.
- Guideline D—Flow of matter and energy—Learners are able to account for environmental characteristics based on their knowledge of how matter and energy interact in living systems.

LE | Unit 3 Organization and Patterns in Life

RECOMMENDED TIME: 20 DAYS

Unit Overview:

Living things are similar in that they rely on many of the same processes to stay alive, yet are different in the ways that these processes are carried out. Nonliving things lack certain features of living organisms, such as the ability to maintain a cellular organization, carry out metabolic processes while maintaining internal stability (homeostasis), and pass on hereditary information through reproduction. Different organisms have different regulatory mechanisms that function to maintain the level of organization necessary for life. Life is dependent upon availability of an energy source and raw materials that are used in the basic enzyme-controlled biochemical processes of living organisms. These biochemical processes occur within a narrow range of conditions. *[Refer to Appendix A for the Humane Treatment of Animals and Conservation Day]*

Essential Question:

How is a single-celled organism similar to and different from a human?

Key Ideas:

Key Idea 1: Living things are both similar to and different from each other and from nonliving things.

Key Idea 4: The continuity of life is sustained through reproduction and development.

Key Idea 5: Organisms maintain a dynamic equilibrium that sustains life.

NYS SCIENCE STANDARDS
http://www.p12.nysed.gov/ciai/mst/sci/documents/livingen.pdf

Major Understandings:

Quoted from the New York State Performance Indicators (1.2a, c, e-j, 1.3a, 4.1a, b, 5.1a-g)

- Important levels of organization for structure and function include organelles, cells, tissues, organs, organ systems, and whole organisms. **(1.2a)**
- The organs and systems of the body help to provide all the cells with their basic needs. The cells of the body are of different kinds and are grouped in ways that enhance how they function together. **(1.2e)**

continued

MST STANDARDS
http://www.p12.nysed.gov/ciai/mst/pub/mststa1_2.pdf
http://www.p12.nysed.gov/ciai/mst/pub/mststa6_7.pdf

Standard 2: Information Systems

Key Idea 1: Information technology is used to retrieve, process, and communicate information and as a tool to enhance learning.

Standard 6: Interconnectedness: Common Themes

Key Idea 1: Through systems thinking, people can recognize the commonalities that exist among all systems and how parts of a system interrelate and combine to perform specific functions.

continued

NGSS CROSS-CUTTING CONCEPTS
http://www.nextgenscience.org/sites/ngss/files/Appendix%20G%20-%20Crosscutting%20Concepts%20FINAL%20edited%204.10.13.pdf

Cause and Effect: Mechanism and Prediction:

Events have causes, sometimes simple, sometimes multifaceted. Deciphering causal relationships, and the mechanisms by which they are mediated, is a major activity of science and engineering.

- Cause and effect relationships can be suggested and predicted for complex natural and human-designed systems by examining what is known about smaller scale mechanisms within the system.
- Changes in systems may have various causes that may not have equal effects.

continued

NYS SCIENCE STANDARDS
http://www.p12.nysed.gov/ciai/mst/sci/documents/livingen.pdf

- Each cell is covered by a membrane that performs a number of important functions for the cell. These include: separation from its outside environment, controlling which molecules enter and leave the cell, and recognition of chemical signals. The processes of diffusion and active transport are important in the movement of materials in and out of cells. **(1.2g)**
- Inside the cell a variety of specialized structures, formed from many different molecules, carry out the transport of materials (cytoplasm), extraction of energy from nutrients (mitochondria), protein building (ribosomes), waste disposal (cell membrane), storage (vacuole), and information storage (nucleus). **(1.2i)**
- The components of the human body, from organ systems to cell organelles, interact to maintain a balanced internal environment. To successfully accomplish this, organisms possess a diversity of control mechanisms that detect deviations and make corrective actions. **(1.2c)**
- Cells have particular structures that perform specific jobs. These structures perform the actual work of the cell. Just as systems are coordinated and work together, cell parts must also be coordinated and work together. **(1.2f)**
- The structures present in some single-celled organisms act in a manner similar to the tissues and systems found in multicellular organisms, thus enabling them to perform all of the life processes needed to maintain homeostasis. **(1.3a)**

continued

MST STANDARDS
http://www.p12.nysed.gov/ciai/mst/pub/mststa1_2.pdf
http://www.p12.nysed.gov/ciai/mst/pub/mststa6_7.pdf

Key Idea 2: Models are simplified representations of objects, structures, or systems used in analysis, explanation, interpretation, or design.

Key Idea 3: The grouping of magnitudes of size, time, frequency, and pressures or other units of measurement into a series of relative order provides a useful way to deal with the immense range and the changes in scale that affect the behavior and design of systems.

Key Idea 5: Identifying patterns of change is necessary for making predictions about future behavior and conditions.

Standard 7: Interdisciplinary Problem Solving

Key Idea 2: Solving interdisciplinary problems involves a variety of skills and strategies, including effective work habits; gathering and processing information; generating and analyzing ideas; realizing ideas; making connections among the common themes of mathematics, science, and technology; and presenting results.

NGSS CROSS-CUTTING CONCEPTS
http://www.nextgenscience.org/sites/ngss/files/Appendix%20G%20-%20Crosscutting%20Concepts%20FINAL%20edited%204.10.13.pdf

Scale, Proportion, and Quantity:

In considering phenomena, it is critical to recognize what is relevant at different size, time, and energy scales, and to recognize proportional relationships between different quantities as scales change.

- The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs.
- Some systems can only be studied indirectly as they are too small, too large, too fast, or too slow to observe directly.
- Patterns observable at one scale may not be observable or exist at other scales.

Systems and System Models:

A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.

- Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales.
- Models can be used to predict the behavior of a system, but these predictions have limited precision and reliability due to the assumptions and approximations inherent in models.

Structure and Function:

The way an object is shaped or structured determines many of its properties and functions.

- The functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials.

continued

NYS SCIENCE STANDARDS

http://www.p12.nysed.gov/ciai/mst/sci/documents/livingen.pdf

- Many organic and inorganic substances dissolved in cells allow necessary chemical reactions to take place in order to maintain life. Large organic food molecules such as proteins and starches must initially be broken down (digested to amino acids and simple sugars respectively), in order to enter cells. Once nutrients enter a cell, the cell will use them as building blocks in the synthesis of compounds necessary for life. **(1.2h)**
- Receptor molecules play an important role in the interactions between cells. Two primary agents of cellular communication are hormones and chemicals produced by nerve cells. If nerve or hormone signals are blocked, cellular communication is disrupted and the organism's stability is affected. **(1.2j)**
- In all organisms, organic compounds can be used to assemble other molecules such as proteins, DNA, starch, and fats. The chemical energy stored in bonds can be used as a source of energy for life processes. **(5.1c)**
- Biochemical processes, both breakdown and synthesis, are made possible by a large set of biological catalysts called enzymes. Enzymes can affect the rates of chemical change. The rate at which enzymes work can be influenced by internal environmental factors such as pH and temperature. **(5.1f)**
- Enzymes and other molecules, such as hormones, receptor molecules, and antibodies, have specific shapes that influence both how they function and how they interact with other molecules. **(5.1g)**
- The energy for life comes primarily from the Sun. Photosynthesis provides a vital connection between the Sun and the energy needs of living systems. **(5.1a)**
- Plant cells and some one-celled organisms contain chloroplasts, the site of photosynthesis. The process of photosynthesis uses solar energy to combine the inorganic molecules carbon dioxide and water into energy-rich organic compounds (e.g., glucose) and release oxygen to the environment. **(5.1b)**
- In all organisms, the energy stored in organic molecules may be released during cellular respiration. This energy is temporarily stored in ATP molecules. In many organisms, the process of cellular respiration is concluded in mitochondria, in which ATP is produced more efficiently, oxygen is used, and carbon dioxide and water are released as wastes. **(5.1d)**
- The energy from ATP is used by the organism to obtain, transform, and transport materials, and to eliminate wastes. **(5.1e)**
- Reproduction and development are necessary for the continuation of any species. **(4.1a)**
- Some organisms reproduce asexually with all the genetic information coming from one parent. Other organisms reproduce sexually with half the genetic information typically contributed by each parent. Cloning is the production of identical genetic copies. **(4.1b)**

NGSS CROSS-CUTTING CONCEPTS

http://www.nextgenscience.org/sites/ngss/files/Appendix%20G%20-%20Crosscutting%20Concepts%20FINAL%20edited%204.10.13.pdf

Stability and Change:

For both designed and natural systems, conditions that affect stability and factors that control rates of change are critical elements to consider and understand.

- Much of science deals with constructing explanations of how things change and how they remain stable.

COMMON CORE STATE STANDARDS http://www.corestandards.org/wp-content/uploads/ELA_Standards.pdf http://www.corestandards.org/wp-content/uploads/Math_Standards.pdf	ENVIRONMENTAL GUIDELINES FOR LEARNING http://resources.spaces3.com/89c197bf-e630-42b0-ad9a-91f0bc55c72d.pdf
ELA/Literacy **RST.9-10.1:** Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. **RST.9-10.4:** Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to Grades 9–10 texts and topics. **WHST.9-10.2:** Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes. **WHST.9-10.5:** Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. **WHST.9-10.9:** Draw evidence from informational texts to support analysis, reflection, and research. **Mathematics** **HSN.Q.A.2:** Define appropriate quantities for the purpose of descriptive modeling. **HSN.Q.A.3:** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.	**Strand 2: Knowledge of Environmental Processes and Systems** **Strand 2.2: The Living Environment** ■ Guideline C—Systems and connections—Learners understand the living environment to be comprised of interrelated, dynamic systems. ■ Guideline D—Flow of matter and energy—Learners are able to account for environmental characteristics based on their knowledge of how matter and energy interact in living systems.

LE | Unit 4 Homeostasis and Immunity

RECOMMENDED TIME: 25 DAYS

Unit Overview:

The components of living systems, from a single cell to an ecosystem, interact to maintain balance. Different organisms have different regulatory mechanisms that function to maintain the level of organization necessary for life. Because organisms are continually exposed to changes in their external and internal environments, they must continually monitor and respond to these changes. Responses to change can range in complexity from simple activation of a cell chemical process to elaborate learned behavior. The result of these responses is called homeostasis, a "dynamic equilibrium" or "steady state" that keeps the internal environment within certain limits. Organisms have a diversity of homeostatic feedback mechanisms that detect deviations from normal and take corrective actions to return their systems to the normal range. These mechanisms maintain the internal environment within narrow limits that are favorable for cell activities. *[Refer to Appendix A for the Humane Treatment of Animals and Conservation Day]*

Essential Question:
How do we survive?

Key Ideas:

Key Idea 1: Living things are both similar to and different from each other and from nonliving things.

Key Idea 5: Organisms maintain a dynamic equilibrium that sustains life.

NYS SCIENCE STANDARDS
http://www.p12.nysed.gov/ciai/mst/sci/documents/livingen.pdf

Major Understandings:

Quoted from the New York State Performance Indicators (1.2a-e, j, 1.3a, 5.2a-h, j, 5.3a, b)

- The organs and systems of the body help to provide all the cells with their basic needs. The cells of the body are of different kinds and are grouped in ways that enhance how they function together. **(1.2e)**
- Important levels of organization for structure and function include organelles, cells, tissues, organs, organ systems, and whole organisms. **(1.2a)**

continued

MST STANDARDS
http://www.p12.nysed.gov/ciai/mst/pub/mststa1_2.pdf
http://www.p12.nysed.gov/ciai/mst/pub/mststa6_7.pdf

Standard 2: Information Systems

Key Idea 1: Information technology is used to retrieve, process, and communicate information and as a tool to enhance learning.

Standard 6: Interconnectedness: Common Themes

Key Idea 1: Through systems thinking, people can recognize the commonalities that exist among all systems and how parts of a system interrelate and combine to perform specific functions.

continued

NGSS CROSS-CUTTING CONCEPTS
http://www.nextgenscience.org/sites/ngss/files/Appendix%20G%20-%20Crosscutting%20Concepts%20FINAL%20edited%204.10.13.pdf

Patterns:

Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them.

- Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena.

continued

NYS SCIENCE STANDARDS http://www.p12.nysed.gov/ciai/mst/sci/documents/livingen.pdf	MST STANDARDS http://www.p12.nysed.gov/ciai/mst/pub/mststa1_2.pdf http://www.p12.nysed.gov/ciai/mst/pub/mststa6_7.pdf	NGSS CROSS-CUTTING CONCEPTS http://www.nextgenscience.org/sites/ngss/files/Appendix%20G%20-%20Crosscutting%20Concepts%20FINAL%20edited%204.10.13.pdf
■ Humans are complex organisms. They require multiple systems for digestion, respiration, reproduction, circulation, excretion, movement, coordination, and immunity. The systems interact to perform the life functions. **(1.2b)** ■ The components of the human body, from organ systems to cell organelles, interact to maintain a balanced internal environment. To successfully accomplish this, organisms possess a diversity of control mechanisms that detect deviations and make corrective actions. **(1.2c)** ■ The structures present in some single-celled organisms act in a manner similar to the tissues and systems found in multicellular organisms, thus enabling them to perform all of the life processes needed to maintain homeostasis. **(1.3a)** ■ If there is a disruption in any human system, there may be a corresponding imbalance in homeostasis. **(1.2d)** ■ Homeostasis in an organism is constantly threatened. Failure to respond effectively can result in disease or death. **(5.2a)** ■ Viruses, bacteria, fungi, and other parasites may infect plants and animals and interfere with normal life functions. **(5.2b)** ■ Disease may also be caused by inheritance, toxic substances, poor nutrition, organ malfunction, and some personal behavior. Some effects show up right away; others may not show up for many years. **(5.2h)** ■ Biological research generates knowledge used to design ways of diagnosing, preventing, treating, controlling, or curing diseases of plants and animals. **(5.2j)** *continued*	**Key Idea 4:** Equilibrium is a state of stability due either to a lack of change (static equilibrium) or a balance between opposing forces (dynamic equilibrium). **Standard 7: Interdisciplinary Problem Solving** **Key Idea 2:** Solving interdisciplinary problems involves a variety of skills and strategies, including effective work habits; gathering and processing information; generating and analyzing ideas; realizing ideas; making connections among the common themes of mathematics, science, and technology; and presenting results.	**Cause and Effect: Mechanism and Prediction:** Events have causes, sometimes simple, sometimes multifaceted. Deciphering causal relationships, and the mechanisms by which they are mediated, is a major activity of science and engineering. ■ Cause and effect relationships can be suggested and predicted for complex natural and human-designed systems by examining what is known about smaller scale mechanisms within the system. ■ Changes in systems may have various causes that may not have equal effects. **Scale, Proportion, and Quantity:** In considering phenomena, it is critical to recognize what is relevant at different size, time, and energy scales, and to recognize proportional relationships between different quantities as scales change. ■ The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs. ■ Some systems can only be studied indirectly as they are too small, too large, too fast, or too slow to observe directly. ■ Patterns observable at one scale may not be observable or exist at other scales. **Systems and System Models:** A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems. ■ Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales. *continued*

NYS SCIENCE STANDARDS http://www.p12.nysed.gov/ciai/mst/sci/documents/livingen.pdf		NGSS CROSS-CUTTING CONCEPTS http://www.nextgenscience.org/sites/ngss/files/Appendix%20G%20-%20Crosscutting%20Concepts%20FINAL%20edited%204.10.13.pdf
■ Dynamic equilibrium results from detection of and response to stimuli. Organisms detect and respond to change in a variety of ways both at the cellular level and at the organismal level. **(5.3a)** ■ Feedback mechanisms have evolved that maintain homeostasis. Examples include the changes in heart rate or respiratory rate in response to increased activity in muscle cells, the maintenance of blood sugar levels by insulin from the pancreas, and the changes in openings in the leaves of plants by guard cells to regulate water loss and gas exchange. **(5.3b)** ■ Receptor molecules play an important role in the interactions between cells. Two primary agents of cellular communication are hormones and chemicals produced by nerve cells. If nerve or hormone signals are blocked, cellular communication is disrupted and the organism's stability is affected. **(1.2j)** ■ The immune system protects against antigens associated with pathogenic organisms or foreign substances and some cancer cells. **(5.2c)**	■ Some white blood cells engulf invaders. Others produce antibodies that attack them or mark them for killing. Some specialized white blood cells will remain, able to fight off subsequent invaders of the same kind. **(5.2d)** ■ Vaccinations use weakened microbes (or parts of them) to stimulate the immune system to react. This reaction prepares the body to fight subsequent invasions by the same microbes. **(5.2e)** ■ Some viral diseases, such as AIDS, damage the immune system, leaving the body unable to deal with multiple infectious agents and cancerous cells. **(5.2f)** ■ Some allergic reactions are caused by the body's immune responses to usually harmless environmental substances. Sometimes the immune system may attack some of the body's own cells or transplanted organs. **(5.2g)**	■ Models can be used to predict the behavior of a system, but these predictions have limited precision and reliability due to the assumptions and approximations inherent in models. **Structure and Function:** The way an object is shaped or structured determines many of its properties and functions. ■ The functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials. **Stability and Change:** For both designed and natural systems, conditions that affect stability and factors that control rates of change are critical elements to consider and understand. ■ Much of science deals with constructing explanations of how things change and how they remain stable. ■ Feedback (negative or positive) can stabilize or destabilize a system.

COMMON CORE STATE STANDARDS http://www.corestandards.org/wp-content/uploads/ELA_Standards.pdf http://www.corestandards.org/wp-content/uploads/Math_Standards.pdf	ENVIRONMENTAL GUIDELINES FOR LEARNING http://resources.spaces3.com/89c197bf-e630-42b0-ad9a-91f0bc55c72d.pdf
ELA/Literacy **RST.9-10.1:** Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. **RST.9-10.2:** Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text. **RST.9-10.4:** Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to Grades 9–10 texts and topics. **WHST.9-10.2 :** Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes. **WHST.9-10.5:** Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. **WHST.9-10.9:** Draw evidence from informational texts to support analysis, reflection, and research. **Mathematics** **HSN.Q.A.1:** Use units as a way to understand problems and to guide the solution of multistep problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. **HSN.Q.A.2:** Define appropriate quantities for the purpose of descriptive modeling. **HSN.Q.A.3:** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.	**Strand 1: Questioning, Analysis, and Interpretation Skills** ■ Guideline A—Questioning—Learners are able to develop questions that help them learn about the environment and do simple investigations. ■ Guideline B—Designing investigations—Learners are able to design simple investigations. ■ Guideline C—Collecting information—Learners are able to locate and collect information about the environment and environmental topics. ■ Guideline D—Evaluating accuracy and reliability—Learners understand the need to use reliable information to answer their questions. They are familiar with some basic factors to consider in judging the merits of information. ■ Guideline E—Organizing information—Learners are able to describe data and organize information to search for relationships and patterns concerning the environment and environmental topics. ■ Guideline G—Drawing conclusions and developing explanations—Learners can develop simple explanations that address their questions about the environment.

LE | Unit 5 Reproduction and Development

RECOMMENDED TIME: 20 DAYS

Unit Overview:

Species transcend individual life spans through reproduction. Asexual reproduction produces genetically identical offspring. Sexual reproduction produces offspring that have a combination of genes inherited from each parent's specialized sex cells (gametes). The processes of gamete production, fertilization, and development follow an orderly sequence of events. Zygotes contain all the information necessary for growth, development, and eventual reproduction of the organism. Development is a highly regulated process involving mitosis and differentiation. Reproduction and development are subject to environmental impact. Human development, birth, and aging should be viewed as a predictable pattern of events. Reproductive technology has medical, agricultural, and ecological applications. *[Refer to Appendix A for the Humane Treatment of Animals and Conservation Day]*

Essential Question:
How does life create life?

Key Ideas:

Key Idea 2: Organisms inherit genetic information in a variety of ways that result in continuity of structure and function between parents and offspring.

Key Idea 4: The continuity of life is sustained through reproduction and development.

NYS SCIENCE STANDARDS
http://www.p12.nysed.gov/ciai/mst/sci/documents/livingen.pdf

Major Understandings:

Quoted from the New York State Performance Indicators (2.1d, e; 4.1a-h)

- The processes of meiosis and fertilization are key to sexual reproduction in a wide variety of organisms. The process of meiosis results in the production of eggs and sperm which each contain half of the genetic information. During fertilization, gametes unite to form a zygote, which contains the complete genetic information for the offspring. **(4.1c)**
- In asexually reproducing organisms, all the genes come from a single parent. Asexually produced offspring are normally genetically identical to the parent. **(2.1d)**

continued

MST STANDARDS
http://www.p12.nysed.gov/ciai/mst/pub/mststa1_2.pdf
http://www.p12.nysed.gov/ciai/mst/pub/mststa6_7.pdf

Standard 6: Interconnectedness: Common Themes

Key Idea 1: Through systems thinking, people can recognize the commonalities that exist among all systems and how parts of a system interrelate and combine to perform specific functions.

Key Idea 2: Models are simplified representations of objects, structures, or systems used in analysis, explanation, interpretation, or design.

NGSS CROSS-CUTTING CONCEPTS
http://www.nextgenscience.org/sites/ngss/files/Appendix%20G%20-%20Crosscutting%20Concepts%20FINAL%20edited%204.10.13.pdf

Cause and Effect: Mechanism and Prediction:

Events have causes, sometimes simple, sometimes multifaceted. Deciphering causal relationships, and the mechanisms by which they are mediated, is a major activity of science and engineering.

- Cause and effect relationships can be suggested and predicted for complex natural and human-designed systems by examining what is known about smaller scale mechanisms within the system.
- Changes in systems may have various causes that may not have equal effects.

continued

NYS SCIENCE STANDARDS http://www.p12.nysed.gov/ciai/mst/sci/documents/livingen.pdf		NGSS CROSS-CUTTING CONCEPTS http://www.nextgenscience.org/sites/ngss/files/Appendix%20G%20-%20Crosscutting%20Concepts%20FINAL%20edited%204.10.13.pdf
■ Reproduction and development are necessary for the continuation of any species. **(4.1a)** ■ Human reproduction and development are influenced by factors such as gene expression, hormones, and the environment. The reproductive cycle in both males and females is regulated by hormones such as testosterone, estrogen, and progesterone. **(4.1e)** ■ The structures and functions of the human female reproductive system, as in almost all other mammals, are designed to produce gametes in ovaries, allow for internal fertilization, support the internal development of the embryo and fetus in the uterus, and provide essential materials through the placenta, and nutrition through milk for the newborn. **(4.1f)** ■ The structures and functions of the human male reproductive system, as in other mammals, are designed to produce gametes in testes and make possible the delivery of these gametes for fertilization. **(4.1g)** ■ In sexually reproducing organisms, the new individual receives half of the genetic information from its mother (via the egg) and half from its father (via the sperm). Sexually produced offspring often resemble, but are not identical to, either of their parents. **(2.1e)**	■ The processes of meiosis and fertilization are key to sexual reproduction in a wide variety of organisms. The process of meiosis results in the production of eggs and sperm which each contain half of the genetic information. During fertilization, gametes unite to form a zygote, which contains the complete genetic information for the offspring. **(4.1c)** ■ The zygote may divide by mitosis and differentiate to form the specialized cells, tissues, and organs of multicellular organisms. **(4.1d)** ■ In humans, the embryonic development of essential organs occurs in early stages of pregnancy. The embryo may encounter risks from faults in its genes and from its mother's exposure to environmental factors such as inadequate diet, use of alcohol/drugs/tobacco, other toxins, or infections throughout her pregnancy. **(4.1h)**	**Systems and System Models:** A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems. ■ Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales. ■ Models can be used to predict the behavior of a system, but these predictions have limited precision and reliability due to the assumptions and approximations inherent in models. **Structure and Function:** The way an object is shaped or structured determines many of its properties and functions. ■ The functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials.

COMMON CORE STATE STANDARDS http://www.corestandards.org/wp-content/uploads/ELA_Standards.pdf http://www.corestandards.org/wp-content/uploads/Math_Standards.pdf	ENVIRONMENTAL GUIDELINES FOR LEARNING http://resources.spaces3.com/89c197bf-e630-42b0-ad9a-91f0bc55c72d.pdf
ELA/Literacy **RST.9-10.1:** Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. **RST.9-10.5:** Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy). **WHST.9-10.2:** Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes. **WHST.9-10.4:** Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. **WHST.9-10.5:** Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. **WHST.9-10.9:** Draw evidence from informational texts to support analysis, reflection, and research. **Mathematics** **HSN.Q.A.2:** Define appropriate quantities for the purpose of descriptive modeling. **HSN.Q.A.3:** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.	**Strand 2: Knowledge of Environmental Processes and Systems** **Strand 2.4: Environment and Society** ■ Guideline A—Human/environment interactions—Learners understand that humans are able to alter the physical environment to meet their needs and that there are limits to the ability of the environment to absorb impacts or meet human needs.

LE | Unit 6 Genetics and Biotechnology

RECOMMENDED TIME: 25 DAYS

Unit Overview:

Organisms from all kingdoms possess a set of instructions (genes) that determines their characteristics. These instructions are passed from parents to offspring during reproduction. The inherited instructions that are passed from parent to offspring exist in the form of a code. This code is contained in DNA molecules. The DNA molecules must be accurately replicated before being passed on. Once the coded information is passed on, it is used by a cell to make proteins. The proteins that are made become cell parts and carry out most functions of the cell. Throughout recorded history, humans have used selective breeding and other biotechnological methods to produce products or organisms with desirable traits. Our current understanding of DNA extends this to the manipulation of genes leading to the development of new combinations of traits and new varieties of organisms. *[Refer to Appendix A for the Humane Treatment of Animals and Conservation Day]*

Essential Question:

Why do offspring look like their parents?

Key Ideas:

Key Idea 2: Organisms inherit genetic information in a variety of ways that result in continuity of structure and function between parents and offspring.

NYS SCIENCE STANDARDS
http://www.p12.nysed.gov/ciai/mst/sci/documents/livingen.pdf

Major Understandings:

Quoted from the New York State Performance Indicators (2.1a-c, f-k; 2.2a-e; 5.2h, i)

- Genes are inherited, but their expression can be modified by interactions with the environment. **(2.1a)**
- Every organism requires a set of coded instructions for specifying its traits. For offspring to resemble their parents there must be a reliable way to transfer information from one generation to the next. Heredity is the passage of these instructions from one generation to another. **(2.1b)**

continued

MST STANDARDS
http://www.p12.nysed.gov/ciai/mst/pub/mststa1_2.pdf
http://www.p12.nysed.gov/ciai/mst/pub/mststa6_7.pdf

Standard 2: Information Systems

Key Idea 1: Information technology is used to retrieve, process, and communicate information and as a tool to enhance learning.

Standard 6: Interconnectedness: Common Themes

Key Idea 1: Through systems thinking, people can recognize the commonalities that exist among all systems and how parts of a system interrelate and combine to perform specific functions.

Key Idea 2: Models are simplified representations of objects, structures, or systems used in analysis, explanation, interpretation, or design.

continued

NGSS CROSS-CUTTING CONCEPTS
http://www.nextgenscience.org/sites/ngss/files/Appendix%20G%20-%20Crosscutting%20Concepts%20FINAL%20edited%204.10.13.pdf

Patterns:

Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them.

- Empirical evidence is needed to identify patterns.

Cause and Effect: Mechanism and Prediction:

Events have causes, sometimes simple, sometimes multifaceted. Deciphering causal relationships, and the mechanisms by which they are mediated, is a major activity of science and engineering.

- Systems can be designed to cause a desired effect.

continued

NYS SCIENCE STANDARDS

http://www.p12.nysed.gov/ciai/mst/sci/documents/livingen.pdf

- Hereditary information is contained in genes, located in the chromosomes of each cell. An inherited trait of an individual can be determined by one or by many genes, and a single gene can influence more than one trait. A human cell contains many thousands of different genes in its nucleus. **(2.1c)**
- In all organisms, the coded instructions for specifying the characteristics of the organism are carried in DNA, a large molecule formed from subunits arranged in a sequence with bases of four kinds (represented by A, G, C, and T). The chemical and structural properties of DNA are the basis for how the genetic information that underlies heredity is both encoded in genes (as a string of molecular "bases") and replicated by means of a template. **(2.1f)**
- Cells store and use coded information. The genetic information stored in DNA is used to direct the synthesis of the thousands of proteins that each cell requires. **(2.1g)**
- The work of the cell is carried out by the many different types of molecules it assembles, mostly proteins. Protein molecules are long, usually folded chains made from 20 different kinds of amino acids in a specific sequence. This sequence influences the shape of the protein. The shape of the protein, in turn, determines its function. **(2.1i)**
- Offspring resemble their parents because they inherit similar genes that code for the production of proteins that form similar structures and perform similar functions. **(2.1j)**

continued

MST STANDARDS

http://www.p12.nysed.gov/ciai/mst/pub/mststa1_2.pdf
http://www.p12.nysed.gov/ciai/mst/pub/mststa6_7.pdf

Key Idea 4: Equilibrium is a state of stability due either to a lack of changes (static equilibrium) or a balance between opposing forces (dynamic equilibrium).

Key Idea 5: Identifying patterns of change is necessary for making predictions about future behavior and conditions.

Key Idea 6: In order to arrive at the best solution that meets criteria within constraints, it is often necessary to make trade-offs.

Standard 7: Interdisciplinary Problem Solving

Key Idea 1: The knowledge and skills of mathematics, science, and technology are used together to make informed decisions and solve problems, especially those relating to issues of science/ technology/society, consumer decision making, design, and inquiry into phenomena.

NGSS CROSS-CUTTING CONCEPTS

http://www.nextgenscience.org/sites/ngss/files/Appendix%20G%20-%20Crosscutting%20Concepts%20FINAL%20edited%204.10.13.pdf

- Changes in systems may have various causes that may not have equal effects.

Systems and System Models:

A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.

- Systems can be designed to do specific tasks.
- Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales.
- Models can be used to predict the behavior of a system, but these predictions have limited precision and reliability due to the assumptions and approximations inherent in models.

Structure and Function:

The way an object is shaped or structured determines many of its properties and functions.

- The functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials.

Stability and Change:

For both designed and natural systems, conditions that affect stability and factors that control rates of change are critical elements to consider and understand.

- Much of science deals with constructing explanations of how things change and how they remain stable.

continued

NYS SCIENCE STANDARDS http://www.p12.nysed.gov/ciai/mst/sci/documents/livingen.pdf		NGSS CROSS-CUTTING CONCEPTS http://www.nextgenscience.org/sites/ngss/files/Appendix%20G%20-%20Crosscutting%20Concepts%20FINAL%20edited%204.10.13.pdf
■ The many body cells in an individual can be very different from one another, even though they are all descended from a single cell and thus have essentially identical genetic instructions. This is because different parts of these instructions are used in different types of cells, and are influenced by the cell's environment and past history. **(2.1k)** ■ Knowledge of genetics is making possible new fields of health care; for example, finding genes which may have mutations that can cause disease will aid in the development of preventive measures to fight disease. Substances, such as hormones and enzymes, from genetically engineered organisms may reduce the cost and side effects of replacing missing body chemicals. **(2.2e)** ■ Disease may also be caused by inheritance, toxic substances, poor nutrition, organ malfunction, and some personal behavior. Some effects show up right away; others may not show up for many years. **(5.2h)** ■ Genes are segments of DNA molecules. Any alteration of the DNA sequence is a mutation. Usually, an altered gene will be passed on to every cell that develops from it. **(2.1h)** ■ Inserting, deleting, or substituting DNA segments can alter genes. An altered gene may be passed on to every cell that develops from it. **(2.2d)** ■ Gene mutations in a cell can result in uncontrolled cell division, called cancer. Exposure of cells to certain chemicals and radiation increases mutations and thus increases the chance of cancer. **(5.2i)**		■ Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible.

COMMON CORE STATE STANDARDS

http://www.corestandards.org/wp-content/uploads/ELA_Standards.pdf
http://www.corestandards.org/wp-content/uploads/Math_Standards.pdf

ELA/Literacy

RST.9-10.1: Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

RST.9-10.2: Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.

RST.9-10.4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to Grades 9–10 texts and topics.

RST.9-10.5: Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).

WHST.9-10.2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.

WHST.9-10.5: Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.

WHST.9-10.9: Draw evidence from informational texts to support analysis, reflection, and research.

Mathematics

HSN.Q.A.2: Define appropriate quantities for the purpose of descriptive modeling.

HSN.Q.A.3: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

ENVIRONMENTAL GUIDELINES FOR LEARNING

http://resources.spaces3.com/89c197bf-e630-42b0-ad9a-91f0bc55c72d.pdf

Strand 2.2: The Living Environment

- Guideline B—Heredity and evolution—Learners understand the basic ideas and genetic mechanisms behind biological evolution.

Strand 2.4: Environment and Society

- Guideline A—Human/environment interactions—Learners understand that humans are able to alter the physical environment to meet their needs and that there are limits to the ability of the environment to absorb impacts or meet human needs.
- Guideline D—Technology—Learners are able to examine the social and environmental impacts of various technologies and technological systems.

LE | Unit 7 Evolution

RECOMMENDED TIME: 15 DAYS

Unit Overview:

Evolution is the change of species over time. This theory is the central unifying theme of biology. This change over time is well documented by extensive evidence from a wide variety of sources. In sexually reproducing organisms, only changes in the genes of sex cells can become the basis for evolutionary change and that these evolutionary changes may occur in structure, function, and behavior over time. Students need to be able to distinguish between evolutionary change and the changes that occur during the lifetime of an individual organism. According to many scientists, biological evolution occurs through natural selection. Natural selection is the result of overproduction of offspring, variations among offspring, the struggle for survival, the adaptive value of certain variations, and the subsequent survival and increased reproduction of those best adapted to a particular environment. Selection for individuals with a certain trait can result in changing the proportions of that trait in a population. The diversity of life on Earth today is the result of natural selection occurring over a vast amount of geologic time for most organisms, but over a short amount of time for organisms with short reproductive cycles such as pathogens in an antibiotic environment and insects in a pesticide environment. *[Refer to Appendix A for the Humane Treatment of Animals and Conservation Day]*

Essential Question:
Is change inevitable for all living things?

Key Ideas:

Key Idea 3: Individual organisms and species change over time.

NYS SCIENCE STANDARDS
http://www.p12.nysed.gov/ciai/mst/sci/documents/livingen.pdf

Major Understandings:

Quoted from the New York State Performance Indicators (3.1a-l, 6.2a)

- The basic theory of biological evolution states that the Earth's present-day species developed from earlier, distinctly different species. **(3.1a)**
- New inheritable characteristics result from new combinations of existing genes or from mutations of genes in reproductive cells. **(3.1b)**

continued

MST STANDARDS
http://www.p12.nysed.gov/ciai/mst/pub/mststa1_2.pdf
http://www.p12.nysed.gov/ciai/mst/pub/mststa6_7.pdf

Standard 6: Interconnectedness—Common Themes

Key Idea 5: Identifying patterns of change is necessary for making predictions about future behavior and conditions.

NGSS CROSS-CUTTING CONCEPTS
http://www.nextgenscience.org/sites/ngss/files/Appendix%20G%20-%20Crosscutting%20Concepts%20FINAL%20edited%204.10.13.pdf

Patterns:

Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them.

- Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena.
- Empirical evidence is needed to identify patterns.

continued

NYS SCIENCE STANDARDS

http://www.p12.nysed.gov/ciai/mst/sci/documents/livingen.pdf

- Mutation and the sorting and recombining of genes during meiosis and fertilization result in a great variety of possible gene combinations. **(3.1c)**
- Mutations occur as random chance events. Gene mutations can also be caused by such agents as radiation and chemicals. When they occur in sex cells, the mutations can be passed on to offspring; if they occur in other cells, they can be passed on to other body cells only. **(3.1d)**
- Natural selection and its evolutionary consequences provide a scientific explanation for the fossil record of ancient life-forms, as well as for the molecular and structural similarities observed among the diverse species of living organisms. **(3.1e)**
- Species evolve over time. Evolution is the consequence of the interactions of (1) the potential for a species to increase its numbers, (2) the genetic variability of offspring due to mutation and recombination of genes, (3) a finite supply of the resources required for life, and (4) the ensuing selection by the environment of those offspring better able to survive and leave offspring. **(3.1f)**
- Some characteristics give individuals an advantage over others in surviving and reproducing, and the advantaged offspring, in turn, are more likely than others to survive and reproduce. The proportion of individuals that have advantageous characteristics will increase. **(3.1g)**
- The variation of organisms within a species increases the likelihood that at least some members of the species will survive under changed environmental conditions. **(3.1h)**
- Behaviors have evolved through natural selection. The broad patterns of behavior exhibited by organisms are those that have resulted in greater reproductive success. **(3.1i)**
- Billions of years ago, life on Earth is thought by many scientists to have begun as simple, single-celled organisms. About a billion years ago, increasingly complex multicellular organisms began to evolve. **(3.1j)**
- Evolution does not necessitate long-term progress in some set direction. Evolutionary changes appear to be like the growth of a bush: Some branches survive from the beginning with little or no change, many die out altogether, and others branch repeatedly, sometimes giving rise to more complex organisms. **(3.1k)**
- Extinction of a species occurs when the environment changes and the adaptive characteristics of a species are insufficient to allow its survival. Fossils indicate that many organisms that lived long ago are extinct. Extinction of species is common; most of the species that have lived on Earth no longer exist. **(3.1l)**
- As a result of evolutionary processes, there is a diversity of organisms and roles in ecosystems. This diversity of species increases the chance that at least some will survive in the face of large environmental changes. Biodiversity increases the stability of the ecosystem. **(6.2a)**

NGSS CROSS-CUTTING CONCEPTS

http://www.nextgenscience.org/sites/ngss/files/Appendix%20G%20-%20Crosscutting%20Concepts%20FINAL%20edited%204.10.13.pdf

Cause and Effect: Mechanism and Prediction:

Events have causes, sometimes simple, sometimes multifaceted. Deciphering causal relationships, and the mechanisms by which they are mediated, is a major activity of science and engineering.

- Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.
- Cause and effect relationships can be suggested and predicted for complex natural and human-designed systems by examining what is known about smaller scale mechanisms within the system.

Stability and Change:

For both designed and natural systems, conditions that affect stability and factors that control rates of change are critical elements to consider and understand.

- Much of science deals with constructing explanations of how things change and how they remain stable.
- Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible.

COMMON CORE STATE STANDARDS

http://www.corestandards.org/wp-content/uploads/ELA_Standards.pdf
http://www.corestandards.org/wp-content/uploads/Math_Standards.pdf

ELA/Literacy

RST.9-10.1: Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

RST.9-10.2: Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.

WHST.9-10.2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.

WHST.9-10.5: Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.

WHST.9-10.9: Draw evidence from informational texts to support analysis, reflection, and research.

Mathematics

HSN.Q.A.1: Use units as a way to understand problems and to guide the solution of multistep problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

HSN.Q.A.2: Define appropriate quantities for the purpose of descriptive modeling.

HSN.Q.A.3: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

ENVIRONMENTAL GUIDELINES FOR LEARNING

http://resources.spaces3.com/89c197bf-e630-42b0-ad9a-91f0bc55c72d.pdf

Strand 2.2: The Living Environment

- Guideline A—Organisms, populations, and communities—Learners understand basic population dynamics and the importance of diversity in living systems.
- Guideline B—Heredity and evolution—Learners understand the basic ideas and genetic mechanisms behind biological evolution.

Strand 2.4: Environment and Society

- Guideline A—Human/environment interactions—Learners understand that humans are able to alter the physical environment to meet their needs and that there are limits to the ability of the environment to absorb impacts or meet human needs.

Strand 3.1: Skills for Analyzing and Investigating Environmental Issues

- Guideline B—Sorting out the consequences of issues—Learners are able to evaluate the consequences of specific environmental changes, conditions, and issues for human and ecological systems.

LE | Unit 8 Human Influences on the Environment

RECOMMENDED TIME: 10 DAYS

Unit Overview:

Population growth has placed new strains on the environment—massive pollution of air and water, deforestation and extinction of species, global warming, and alteration of the ozone shield. Some individuals believe that there will be a technological fix for such problems. Others, concerned with the accelerating pace of change and the ecological concept of finite resources, are far less optimistic. What is certain, however, is that resolving these issues will require increasing global awareness, cooperation, and action. Since the students of today will be the elected officials and informed public of tomorrow, the teacher should encourage a diversity of activities that will allow students to explore, explain, and apply conceptual understandings and skills necessary to be environmentally literate. *[Refer to Appendix A for the Humane Treatment of Animals and Conservation Day]*

Essential Question:
Why do we need to care for our planet?

Key Ideas:

Key Idea 7: Human decisions and activities have had a profound impact on the physical and living environment.

NYS SCIENCE STANDARDS
http://www.p12.nysed.gov/ciai/mst/sci/documents/livingen.pdf

Major Understandings:

Quoted from the New York State Performance Indicators (7.1a-c, 7.2a-c, 7.3a, c)

- The Earth has finite resources; increasing human consumption of resources places stress on the natural processes that renew some resources and deplete those resources that cannot be renewed. **(7.1a)**
- Natural ecosystems provide an array of basic processes that affect humans. Those processes include but are not limited to: maintenance of the quality of the atmosphere, generation of soils, control of the water cycle, removal of wastes, energy flow, and recycling of nutrients. Humans are changing many of these basic processes and the changes may be detrimental. **(7.1b)**

continued

MST STANDARDS
http://www.p12.nysed.gov/ciai/mst/pub/mststa1_2.pdf
http://www.p12.nysed.gov/ciai/mst/pub/mststa6_7.pdf

Standard 2: Information Systems

Key Idea 1: Information technology is used to retrieve, process, and communicate information as a tool to enhance learning.

Key Idea 2: Knowledge of the impacts and limitations of information systems is essential to its effective and ethical use.

Key Idea 3: Information technology can have positive and negative impacts on society, depending upon how it is used.

Standard 6: Interconnectedness: Common Themes

Key Idea 1: Through systems thinking, people can recognize the commonalities that exist among all systems and how parts of a system interrelate and combine to perform specific functions.

continued

NGSS CROSS-CUTTING CONCEPTS
http://www.nextgenscience.org/sites/ngss/files/Appendix%20G%20-%20Crosscutting%20Concepts%20FINAL%20edited%204.10.13.pdf

Patterns:

Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them.

- Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena.
- Empirical evidence is needed to identify patterns.

Cause and Effect: Mechanism and Prediction:

Events have causes, sometimes simple, sometimes multifaceted. Deciphering causal relationships, and the mechanisms by which they are mediated, is a major activity of science and engineering.

continued

NYS SCIENCE STANDARDS

http://www.p12.nysed.gov/ciai/mst/sci/documents/livingen.pdf

- Human beings are part of the Earth's ecosystems. Human activities can, deliberately or inadvertently, alter the equilibrium in ecosystems. Humans modify ecosystems as a result of population growth, consumption, and technology. Human destruction of habitats through direct harvesting, pollution, atmospheric changes, and other factors is threatening current global stability, and if not addressed, ecosystems may be irreversibly affected. **(7.1c)**
- Human activities that degrade ecosystems result in a loss of diversity of the living and nonliving environment. For example, the influence of humans on other organisms occurs through land use and pollution. Land use decreases the space and resources available to other species, and pollution changes the chemical composition of air, soil, and water. **(7.2a)**
- When humans alter ecosystems either by adding or removing specific organisms, serious consequences may result. For example, planting large expanses of one crop reduces the biodiversity of the area. **(7.2b)**
- Industrialization brings an increased demand for and use of energy and other resources including fossil and nuclear fuels. This usage can have positive and negative effects on humans and ecosystems. **(7.2c)**
- Societies must decide on proposals which involve the introduction of new technologies. Individuals need to make decisions which will assess risks, costs, benefits, and trade-offs. **(7.3a)**
- The decisions of one generation both provide and limit the range of possibilities open to the next generation. **(7.3b)**

MST STANDARDS

http://www.p12.nysed.gov/ciai/mst/pub/mststa1_2.pdf
http://www.p12.nysed.gov/ciai/mst/pub/mststa6_7.pdf

Key Idea 4: Equilibrium is a state of stability due either to a lack of change (static equilibrium) or a balance between opposing forces (dynamic equilibrium).

Key Idea 5: Identifying patterns of change is necessary for making predictions about future behavior and conditions.

Key Idea 6: In order to arrive at the best solution that meets criteria within constraints, it is often necessary to make trade-offs.

Standard 7: Interdisciplinary Problem Solving

Key Idea 1: The knowledge and skills of mathematics, science, and technology are used together to make informed decisions and solve problems, especially those relating to issues of science/ technology/society, consumer decision making, design, and inquiry into phenomena.

Key Idea 2: Solving interdisciplinary problems involves a variety of skills and strategies, including effective work habits; gathering and processing information; generating and analyzing ideas; realizing ideas; making connections among the common themes of mathematics, science, and technology; and presenting results.

- Much of science deals with constructing explanations of how things change and how they remain stable.
- Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible.
- Feedback (negative or positive) can stabilize or destabilize a system.
- Systems can be designed for greater or lesser stability.

NGSS CROSS-CUTTING CONCEPTS

http://www.nextgenscience.org/sites/ngss/files/Appendix%20G%20-%20Crosscutting%20Concepts%20FINAL%20edited%204.10.13.pdf

- Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.
- Cause and effect relationships can be suggested and predicted for complex natural and human-designed systems by examining what is known about smaller scale mechanisms within the system.
- Systems can be designed to cause a desired effect.
- Changes in systems may have various causes that may not have equal effects.

Systems and System Models:

A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.

- When investigating or describing a system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs analyzed and described using models.
- Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales.
- Models can be used to predict the behavior of a system, but these predictions have limited precision and reliability due to the assumptions and approximations inherent in models.

Stability and Change:

For both designed and natural systems, conditions that affect stability and factors that control rates of change are critical elements to consider and understand.

COMMON CORE STATE STANDARDS

http://www.corestandards.org/wp-content/uploads/ELA_Standards.pdf
http://www.corestandards.org/wp-content/uploads/Math_Standards.pdf

ELA/Literacy

RST.9-10.1: Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

RST.9-10.3: Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

RST.9-10.7: Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

WHST.9-10.2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.

WHST.9-10.5: Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.

WHST.9-10.6: Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.

WHST.9-10.8: Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.

WHST.9-10.9: Draw evidence from informational texts to support analysis, reflection, and research.

Mathematics

HSN.Q.A.1: Use units as a way to understand problems and to guide the solution of multistep problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

HSN.Q.A.2: Define appropriate quantities for the purpose of descriptive modeling.

HSN.Q.A.3: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

ENVIRONMENTAL GUIDELINES FOR LEARNING

http://resources.spaces3.com/89c197bf-e630-42b0-ad9a-91f0bc55c72d.pdf

Strand 2: Knowledge of Environmental Processes and Systems

Strand 2.3: Humans and Their Societies

- Guideline A—Individuals and groups—Learners understand the influence of individual and group actions on the environment, and how groups can work to promote and balance interests.

Strand 2.4: Environment and Society

- Guideline A—Human/environment interactions—Learners understand that humans are able to alter the physical environment to meet their needs and that there are limits to the ability of the environment to absorb impacts or meet human needs.
- Guideline D—Technology—Learners are able to examine the social and environmental impacts of various technologies and technological systems.
- Guideline E—Environmental issues—Learners are familiar with a range of environmental issues at scales that range from local to national to global. They understand that these scales and issues are often linked.

Strand 3: Skills for Understanding and Addressing Environmental Issues

Strand 3.1: Skills for Analyzing and Investigating Environmental Issues

- Guideline A—Identifying and investigating issues—Learners apply their research and analytical skills to investigate environmental issues ranging from local issues to those that are regional or global in scope.
- Guideline B—Sorting out the consequences of issues—Learners are able to evaluate the consequences of specific environmental changes, conditions, and issues for human and ecological systems.
- Guideline C—Identifying and evaluating alternative solutions and courses of action—Learners are able to identify and propose action strategies that are likely to be effective in particular situations and for particular purposes.
- Guideline D—Working with flexibility, creativity, and openness—While environmental issues investigations can bring to the surface deeply held views, learners are able to engage each other in peer review conducted in the spirit of open inquiry.

continued

ENVIRONMENTAL GUIDELINES FOR LEARNING

http://resources.spaces3.com/89c197bf-e630-42b0-ad9a-91f0bc55c72d.pdf

Strand 3.2: Decision-Making and Citizenship Skills

- Guideline A—Forming and evaluating personal views—Learners are able to examine and express their own views on environmental issues.
- Guideline B—Evaluating the need for citizen action—Learners are able to think critically about whether they believe action is needed in particular situations and whether they believe they should be involved.
- Guideline C—Planning and taking action—By participating in issues of their choosing—mostly close to home—they learn the basics of individual and collective action.
- Guideline D—Evaluating the results of actions—Learners understand that civic actions have consequences.