7th Grade Life Science

Inquiry and Process Skills within the Content:

- Learn and apply safe laboratory techniques.
- Apply and analyze all components of the scientific method. (For example: Experimental Design Lab Outline and Vocabulary)
- Integrate science process skills (asking questions, predicting, observing, describing, measuring, classifying, making generalizations, inferring and communicating).
- Select and use the appropriate tools and technology. (For example: calculators, computers, balance scales, microscopes, probe ware, and graduated cylinders.)
- Apply the appropriate SI measurements (metric system) in a lab setting.
- Differentiate between scientific hypothesis, theories, and laws.
- Recognize and investigate the contributions of diverse individuals in advancing science and technology.
- Develop, use, and revise models to describe, test, or predict interactions and scientific phenomena.
- Differentiate between science and engineering approaches.
- Evaluate multiple solutions based on scientifically obtained evidence.
- Recognize that scientific knowledge is refined over time as new evidence emerges.
- Identify and evaluate the sources used to support scientific statements.

Structure, Function, and Information Processing

Link to Crosscutting Concepts: Next Generation Science Standards

Standard	Objective	Examples/Evidence Statements
MS-LS1-1. Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.	Students will: • Understand all living things are made of cells, which is the smallest unit that can be said to be alive. • Recognize an organism may consist of one single cell (unicellular) or many different numbers and types of cells (multicellular). • Conduct an investigation to produce data to serve as the basis for evidence that meet the goals of an investigation.	• Emphasis is on developing evidence that living things are made of cells, distinguishing between living and non-living things, and understanding that living things may be made of one cell or many and varied cells.
MS-LS1-2. Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function.	Students will: • Understand the special structures within cells, are responsible for particular functions. • Create a model of the cell membrane that demonstrates how it forms the boundary that controls what enters and leaves the cell. • Develop and use a model to describe phenomena.	• Emphasis is on the cell functioning as a whole system and the primary role of identified parts of the cell, specifically the nucleus, chloroplasts, mitochondria, cell membrane, and cell wall.
MS-LS1-3. Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.	Students will: • Identify the multiple interacting subsystems of the human body. • Describe how groups of cells work together to form tissues and organs which form body systems that are specialized for particular body functions. • Use an oral and written argument supported by evidence to support or refute an explanation or a model for a phenomenon.	• Emphasis is on the conceptual understanding that cells form tissues and tissues form organs specialized for particular body functions. • Examples could include the interaction of subsystems within a system and the normal functioning of those systems.

MS-LS1-8. Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories. **MS-LS1.D**	Students will: • Describe how each sense receptor responds to different inputs (electromagnetic, mechanical, chemical), transmitting them as signals that travel along nerve cells to the brain. The signals are then processed in the brain, resulting in immediate behaviors or memories. • Gather, read, and synthesize information from multiple appropriate sources.	• Emphasis is on the nervous system and the five senses (sight, hearing, taste, touch, and smell).
Growth, Development and Reproduction of Organisms		
Standard	**Objective**	**Examples/Evidence Statements**
MS-LS1-4. Use empirical evidence and scientific reasoning to explain how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction. **MS-LS1.B**	Students will: • Identify how animals engage in characteristic behaviors that increase the odds of reproduction. • Explain how plants reproduce in a variety of ways. • Use an oral and written argument to support or refute an explanation or a model for a phenomenon or a solution to a problem.	• Examples of behaviors that affect the probability of animal reproduction could include nest building to protect young from cold, herding of animals to protect young from predators, and vocalization of animals and colorful plumage to attract mates for breeding. • Examples of animal behaviors that affect the probability of plant reproduction could include transferring pollen or seeds, and creating conditions for seed germination and growth. • Examples of plant structures could include bright flowers attracting butterflies that transfer pollen, flower nectar and odors that attract insects that transfer pollen, and hard shells on nuts that squirrels bury.
MS-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms. **MS-LS1-B**	Students will: • Recognize that genetic factors as well as local conditions affect the growth of the adult plant. • Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments).	• Examples of local environmental conditions could include availability of food, light, space, and water. • Examples of genetic factors could include large breed cattle and species of grass affecting growth of organisms. • Examples of evidence could include drought decreasing plant growth, fertilizer increasing plant growth, different varieties of plant seeds growing at different rates in different conditions, and fish growing larger in large ponds than they do in small ponds.
MS-LS3-1 Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism. **MS-LS3.A, MS-LS3.B**	Students will: • Understand genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes. Each distinct gene chiefly controls the production of specific proteins, which in turn affects the traits of the individual. Changes (mutations) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits. • Understand in addition to variations that arise from sexual reproduction, genetic information can be altered because of	• Emphasis is on conceptual understanding that changes in genetic material may result in making different proteins.

	mutations which may result in changes to the structure and function of proteins. Some changes are beneficial, others harmful, and some neutral to the organism. • Develop and use a model to describe phenomena.	
MS-LS3-2 Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation. **MS-LS1.B, MS-LS3.A, MS-LS3.B**	Students will: • Recognize organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring. • Show how variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited. • Illustrate how offspring acquire half their genes (at random) from each parent through sexual reproduction. Individuals have two of each chromosome and hence two alleles of each gene, one acquired from each parent. These versions may be identical or may differ from each other. • Develop and use a model to describe phenomena.	• Emphasis is on using models such as Punnett squares, diagrams, and simulations to describe the cause and effect relationship of gene transmission from parent(s) to offspring and resulting genetic variation.
MS-LS4-5 Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms. **MS-LS4.B**	• Explain how humans have the capacity to influence certain characteristics of organisms by selective breeding (artificial selection). One can choose desired parental traits determined by genes, which are then passed to offspring. • Construct an explanation that includes qualitative or quantitative relationships between variables that describe phenomena.	• Emphasis is on synthesizing information from reliable sources about the influence of humans on genetic outcomes in artificial selection (such as genetic modification, animal husbandry, gene therapy); and, on the impacts these technologies have on society as well as the technologies leading to these scientific discoveries.
Matter and Energy in Organisms and Ecosystems		
Standard	**Objective**	**Examples/Evidence Statements**
MS-LS1-6. Describe the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms. **MS-LS1-C, PS3.D**	Students will: • Illustrate how producers (plants algae including phytoplankton), and many microorganisms use the energy from light to make sugars (food) from carbon dioxide from the atmosphere and water through the process of photosynthesis, which also releases oxygen. • Describe the chemical reaction by which plants produce complex food molecules (sugars) requires an energy input (i.e., from sunlight) to occur. In this reaction, carbon dioxide and water combine to form carbon-based organic molecules and release oxygen. • Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments).	• Emphasis is on tracing movement of matter and flow of energy.

MS-LS1-7. Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism. **MS-LS1.C, PS3.D**	Students will: • Describe how food moves through a series of chemical reactions in which it is broken down and rearranged to form new molecules, to support growth, or to release energy within an organism. • Describe the chemical reaction by which plants produce complex food molecules (sugars) requires an energy input (i.e., from sunlight) to occur. In this reaction, carbon dioxide and water combine to form carbon-based organic molecules and release oxygen. • Develop a model to describe unobservable mechanisms.	• Emphasis is on describing that molecules are broken apart and put back together and that in this process, energy is released.
MS-LS2-1 Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. **MS-LS2.A**	Students will: • Analyze the relationships of organisms within an ecosystem. • Analyze and interpret data to provide evidence for phenomena.	• Emphasis is on cause and effect relationships between resources and growth of individual organisms and the numbers of organisms in ecosystems during periods of abundant and scarce resources. • In any ecosystem organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction. • Growth of organisms and population increases are limited by access to resources.
MS-LS2-3 Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. **MS-LS2.B**	Students will: • Create food webs to model how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. • Produce an oral written argument supported by evidence to support or refute an explanation or a model for a phenomenon.	• Emphasis is on describing the conservation of matter and flow of energy into and out of various ecosystems, and on defining the boundaries of the system. • Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem.
MS-LS2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. **MS-LS2.C**	Students will: • Understand ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations. • Produce an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.	• Emphasis is on recognizing patterns in data and making warranted inferences about changes in populations, and on evaluating empirical evidence supporting arguments about changes to ecosystems.

Interdependent Relationships in Ecosystems		
Standard	**Objective**	**Examples/Evidence Statements**
MS-LS2-2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. **MS-LS2.A**	Students will: • Explain how similarity, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared. • Develop and use a model to describe phenomena.	• Emphasis is on predicting consistent patterns of interactions in different ecosystems in terms of the relationships among and between organisms and abiotic components of ecosystems • Examples of types of interactions could include competitive, predatory, and mutually beneficial.
MS-LS2-5 Evaluate competing design solutions for maintaining biodiversity and ecosystem services. **MS-LS2.C, MS-LS4.D, ETS1.B**	Students will: • Explain how biodiversity describes the variety of species found in Earth's terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health. • Recognize that changes in biodiversity • Identify systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. • Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments). • Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions.	• Examples of ecosystem services could include water purification, nutrient recycling, and prevention of soil erosion. • Examples of design solution constraints could include scientific, economic, and social considerations.
Natural Selection and Adaptations		
Standard	**Objective**	**Examples/Evidence Statements**
MS-LS4-1 Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past. **MS-LS4.A**	Students will: • Analyze how the fossil record documents the existence, diversity, extinction, and change of many life forms throughout the history of life on Earth. • Analyze and interpret data to determine similarities and differences in findings.	• Emphasis is on finding patterns of changes in the level of complexity of anatomical structures in organisms and the chronological order of fossil appearance in the rock layers. • Fossils and their placement in chronological order (e.g., through the location of the sedimentary layers in which they are found or through radioactive dating) is known as the fossil record.
MS-LS4-2 Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer	Students will: • Categorize anatomical similarities and differences between various organisms living today and organisms in the fossil record inferring lines of evolutionary descent.	• Emphasis is on explanations of the evolutionary relationships among organisms in terms of similarity or differences of the gross appearance of anatomical structures. • Emphasis is on inferring general patterns of relatedness among embryos of different

evolutionary relationships. **MS-LS4.A**	• Examine the embryological development of different species to show relationships not evident in the fully-formed anatomy. • Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence.	organisms-by comparing the macroscopic appearance of diagrams or pictures.
MS-LS4-4 Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment. **MS-LS4.B**	Students will: • Simulate how natural selection leads to the predominance of certain traits in a population, and the suppression of others. • Construct an explanation that includes qualitative or quantitative relationships between variables that describe phenomena.	• Emphasis is on using simple probability statements and proportional reasoning to construct explanations.
MS-LS4-6 Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time. **MS-LS4.C**	Students will: • Develop a model on how adaptation by natural selection acting over generations is one important process by which species change over time in response to changing environmental conditions. • Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence.	• Emphasis is on using mathematical models, probability statements, and proportional reasoning to support explanations of trends in changes to populations over time. • Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes.
MS-ETS1-1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions. **MS-ETS1.A**	Students will: • Develop more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions.	
MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. **MS-ETS1.B**	Students will: • Evaluate that there are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem.	
MS-ETS1-3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success. **MS-ETS1.B, MS-ETS1.C**	Students will: • Evaluate that there are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. • Analyze that some parts of different solutions can be combined to create a solution that is better than any of its predecessors. • Recognize that one design may not perform the best across all tests, identifying the	

	characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of those characteristics may be incorporated into the new design.	
MS-ETS1-4 Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved. **MS-ETS1.B, MS-ETS1.C**	Students will: • Develop a solution needs to be tested, and then modified on the basis of the test results, in order to improve it. • Generate models of all kinds that are important for testing solutions. • Create the iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution.	