Middle School Life Science

Essential Standards Extended Guide

MIDDLE SCHOOL LIFE SCEINCE

Background information about this document:

In response to requests from schools and districts for guidance on essential standards, committees of educators from around Idaho collaborated in the summer of 2024 to categorize Science standards into two groups:

1. **Essential standards** are explicitly taught, assessed multiple times, and receive targeted interventions for students who have not yet reached proficiency.
2. **Supporting standards** are taught to reinforce essential standards and may or may not be formally assessed.

This guidance helps LEAs prioritize the most critical standards, recognizing that not all standards are of equal importance. This document serves as a resource—not a mandate—to assist local efforts. Importantly, this work did not remove or revise any of the adopted Idaho Content Standards and is intended to refocus time and effort.

The committees developed instructional grouping models to demonstrate how standards can be combined into focused units. However, this is just one approach, and other combinations are possible. Educators can use this guide to begin developing scope and sequence for their instructional time and district-specific courses. It also provides a useful starting point for creating formative and summative assessments aligned with the standards.

Instructional Grouping 1: Cells

Essential Standards **Standards are to be explicitly taught, assessed more than once, and intervened upon in this cluster of standards.**	Supporting Standards and Content **Taught to support the learning of essential standards and may or may not be formally assessed.**
MS-LS-1.1 Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.	All living things are made up of cells, which is the smallest unit that can be said to be alive. An organism may consist of one single cell (unicellular) or many different numbers and types of cells (multicellular). (MS-LS-1.1)
MS-LS-1.2 Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function	Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell. (MS-LS-1.2)

Further explanation:

1. 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.
2. 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. These are visible with a light microscope.

Assessment limits:

1. Assessment of organelle structure/function relationships is limited to the cell wall and cell membrane. Assessment of the function of the other organelles is limited to their relationship to the whole cell. Assessment does not include the biochemical function of cells or cell parts.

Instructional Grouping 2: Characteristics of Living Things

Essential Standards Standards are to be explicitly taught, assessed more than once, and intervened upon in this cluster of standards.	Supporting Standards and Content Taught to support the learning of essential standards and may or may not be formally assessed.
MS-LS-1.3 Make a claim supported by evidence for how a living organism is a system of interacting subsystems composed of groups of cells.	In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues and organs that are specialized for particular body functions. (MS-LS-1.3)
MS-LS-1.4 Construct a scientific argument based on evidence to defend a claim of life for a specific object or organism.	Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring. (MS-LS-1.4) Living things share certain characteristics. (These include response to environment, reproduction, energy use, growth and development, life cycles, made of cells, etc.) (MS-LS1.4)

Further explanation:

1. 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.
2. Examples should include both biotic and abiotic items, and should be defended using accepted characteristics of life.

Assessment limits:

1. Assessment does not include the mechanism of one body system independent of others. Assessment is not focused on human body systems.
2. Assessment does not include specific conclusions regarding the living status of viruses, or other disputed examples.

Instructional Grouping 3: Photosynthesis

Essential Standards **Standards are to be explicitly taught, assessed more than once, and intervened upon in this cluster of standards.**	Supporting Standards and Content **Taught to support the learning of essential standards and may or may not be formally assessed.**
MS-LS-1.5 Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.	Plants, algae (including phytoplankton), and many microorganisms use the energy from light to make sugars (food) from carbon dioxide from the atmosphere and water through the process of photosynthesis, which also releases oxygen. These sugars can be used immediately or stored for growth or later use. (MS-LS-1.5)
MS-LS-1.6 Develop a conceptual model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as matter moves through an organism.	Within individual organisms, food moves through a series of chemical reactions (cellular respiration) in which it is broken down and rearranged to form new molecules, to support growth, or to release energy. (MS-LS-1.6)

Further explanation:

1. Emphasis is on tracing movement of matter and flow of energy.
2. Emphasis is on describing that molecules are broken apart and put back together and that in this process, energy is released and on understanding that the elements in the products are the same as the elements in the reactants

Assessment limits:

1. Assessment does not include the biochemical mechanisms of photosynthesis.
2. Assessment does not include details of the chemical reactions for photosynthesis or respiration.

Instructional Grouping 4: Ecosystem Interactions

Essential Standards **Standards are to be explicitly taught, assessed more than once, and intervened upon in this cluster of standards.**	Supporting Standards and Content **Taught to support the learning of essential standards and may or may not be formally assessed.**
MS-LS-2.1 Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.	Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. (MS-LS-2.1) In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction. (MS-LS-2.1) Growth of organisms and population increases are limited by access to resources. (MS-LS-2.1)
MS-LS-2.2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.	Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared. (MS-LS-2.2)

Further explanation:

1. 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.
2. 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.

Instructional Grouping 5: Cycling of Matter and Energy In Ecosystems

Essential Standards **Standards are to be explicitly taught, assessed more than once, and intervened upon in this cluster of standards.**	Supporting Standards and Content **Taught to support the learning of essential standards and may or may not be formally assessed.**
MS-LS-2.3 Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.	Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem. (MS-LS-2.3)
	Supporting Standard: MS-LS-2.4 Develop a model to describe the flow of energy through the trophic levels of an ecosystem.

Further explanation:

1. 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.

Assessment Limit:

1. Assessment does not include the use of chemical reactions to describe the processes.

Instructional Grouping 6: Populations

Essential Standards Standards are to be explicitly taught, assessed more than once, and intervened upon in this cluster of standards.	Supporting Standards and Content Taught to support the learning of essential standards and may or may not be formally assessed.
MS-LS-2.5 Construct an argument supported by evidence that changes to physical or biological components of an ecosystem affect populations.	Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem. (MS-LS-2.3)
MS-LS-2.6 Design and evaluate solutions for maintaining biodiversity and ecosystem services.	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. (MS-LS-2.6) Changes in biodiversity can influence humans' resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on—for example, water purification and recycling. (MS-LS-2.6) There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MS-LS-2.6)

Further explanation:

1. 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.
2. 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.

Instructional Grouping 7: Mutations

Essential Standards **Standards are to be explicitly taught, assessed more than once, and intervened upon in this cluster of standards.**	Supporting Standards and Content **Taught to support the learning of essential standards and may or may not be formally assessed.**
MS-LS-3.1 Develop and use a model to describe why mutations may result in harmful, beneficial, or neutral effects to the structure and function of the organism.	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. Structural changes to genes (mutations) can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits. (MS-LS-3.1) In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations. Though rare, mutations may result in significant changes to the structure and function of proteins. Changes can be beneficial, harmful, or neutral to the organism. (MS-LS-3.1)

Further explanation:

1. Emphasis is on conceptual understanding that changes in genetic material may result in making different proteins.

Assessment Limit:

1. Assessment does not include specific changes at the molecular level, mechanisms for protein synthesis, or specific types of mutations.

Instructional Grouping 8: Reproduction

Essential Standards **Standards are to be explicitly taught, assessed more than once, and intervened upon in this cluster of standards.**	Supporting Standards and Content **Taught to support the learning of essential standards and may or may not be formally assessed.**
MS-LS-3.2 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.	Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring. (MS-LS-3.2) Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited. (MS-LS-3.2) In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring. Individuals have two of each chromosome and hence two alleles of each gene, one acquired from each parent. These versions may be identical or may differ from each other. (MS-LS-3.2)

Further explanation:

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

Instructional Grouping 9: Change Over time

Essential Standards Standards are to be explicitly taught, assessed more than once, and intervened upon in this cluster of standards.	Supporting Standards and Content Taught to support the learning of essential standards and may or may not be formally assessed.
MS-LS-4.1 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.	The collection of fossils and their placement in chronological order is known as the fossil record and documents the change of many life forms throughout the history of the Earth. Anatomical similarities and differences between various organisms living today and between living and once living organisms in the fossil record enable the classification of living things. (MS-LS-4.1, MS-LS-4.2)
MS-LS-4.2 Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer relationships.	The collection of fossils and their placement in chronological order is known as the fossil record and documents the change of many life forms throughout the history of the Earth. Anatomical similarities and differences between various organisms living today and between living and once living organisms in the fossil record enable the classification of living things. (MS-LS-4.1, MS-LS-4.2)
	Supporting Standard: MS-LS-4.3 Analyze visual evidence to compare patterns of similarities in the anatomical structures across multiple species of similar classification levels to identify relationships.

Further explanation:

1. 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.
2. Emphasis is on explanations of the relationships among organisms in terms of similarity or differences of the gross appearance of anatomical structures.

Assessment Limit:

1. Assessment does not include the names of individual species or geological eras in the fossil record.

Instructional Grouping 10: Inheritance and Traits

Essential Standards **Standards are to be explicitly taught, assessed more than once, and intervened upon in this cluster of standards.**	Supporting Standards and Content **Taught to support the learning of essential standards and may or may not be formally assessed.**
MS-LS-4.5 Obtain, evaluate, and communicate information about how technologies allow humans to influence the inheritance of desired traits in organisms.	In artificial selection, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed to offspring. (MS-LS-4.5)

Further explanation:

1. Emphasis is on identifying and communicating 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 influence these technologies have on society as well as the technologies leading to these scientific discoveries.

Instructional Grouping 11: Inheritance and Traits

Essential Standards **Standards are to be explicitly taught, assessed more than once, and intervened upon in this cluster of standards.**	Supporting Standards and Content **Taught to support the learning of essential standards and may or may not be formally assessed.**
MS-LS-4.4 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.	Natural selection leads to the predominance of certain traits in a population, and the suppression of others. (MS-LS-4.4)
MS-LS-4.6 Use mathematical models to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.	Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes. (MS-LS-4.6)

Further explanation:

1. Emphasis is on using concepts of natural selection, including overproduction of offspring, passage of time, variation in a population, selection of favorable traits, and heritability of traits.
2. Emphasis is on using mathematical models, probability statements, and proportional reasoning to support explanations of trends in changes to populations over time. Examples could include Peppered Moth population changes before and after the industrial revolution.

Assessment Limit:

2. Assessment does not include Hardy-Weinberg calculations.