Louisiana Believes

# Crosswalk for Louisiana Student Standards for Science and NGSS: 8th grade

This document provides guidance to assist teachers, schools, and systems with determining alignment to Louisiana Student Standards for Science for resources designed for the Next Generation Science Standards. This guidance document is considered a "living" document, as we believe that teachers and other educators will find ways to improve the document as they use it. Please send feedback to STEM@la.gov so that we may use your input when updating this guide.

Updated September 19, 2021

DEPARTMENT of EDUCATION
Louisiana Believes

| MATTER AND ITS INTERACTIONS | MS-PS1-1 |
|---|---|
| **LSSS** | **NGSS** |
| Develop models to describe the atomic composition of simple molecules and extended structures. | |
| **Clarification Statement** | |
| Emphasis is on developing models of molecules that vary in complexity. Examples of extended structures could include minerals such as but not limited to halite, agate, calcite, or sapphire. Examples of molecular-level models could include drawings, 3-D models, or computer representations showing different molecules with different types of atoms. | Emphasis is on developing models of molecules that vary in complexity. Examples of simple molecules could include ammonia and methanol. Examples of extended structures could include sodium chloride or diamonds. Examples of molecular-level models could include drawings, 3D ball and stick structures, or computer representations showing different molecules with different types of atoms. |
| **Science and Engineering Practice:** | Developing and using models |
| **Disciplinary Core Ideas:** | Structure and properties of matter |
| Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms. (MS.PS1A.a)<br><br>Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). (MS.PS1A.e) | |
| **Crosscutting Concepts:** | Scale, proportion, and quantity |
| Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. | |

**Underlined sections denote **wording differences or additional information** that appear in the Louisiana Student Standards for Science.*

| MATTER AND ITS INTERACTIONS | MS-PS1-3 |
|---|---|
| **LSSS** | **NGSS** |
| Gather and make sense of information to describe that synthetic materials came from natural resources and impact society. | |
| **Clarification Statement** | |
| Emphasis is on natural resources that undergo a chemical process to form synthetic materials. These natural resources may or may not be pure substances. Examples of new materials could include new medicine, foods, or alternative fuels, and focus is on qualitative as opposed to quantitative information. | Emphasis is on natural resources that undergo a chemical process to form the synthetic material. Examples of new materials could include new medicine, foods, or alternative fuels. |
| **Science and Engineering Practice:** | Obtaining, evaluating, and communicating information |
| **Disciplinary Core Ideas:** | Structure and properties of matter |
| Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) under normal conditions that can be used to identify it (MS.PS1A.b) | Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it (MS.PS1A.b) |
| **Disciplinary Core Ideas:** | Chemical reactions |
| Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substance have different properties from those of the reactants (MS.PS1B.a) | |
| **Crosscutting Concepts:** | Structure and function |
| Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. | |

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| **MATTER AND ITS INTERACTIONS** | **MS-PS1-6** |
|---|---|
| **LSSS** | **NGSS** |
| Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes. | |
| **Clarification Statement** | |
| Emphasis is on the design, controlling the transfer of energy to the environment, and modification of a device using factors such as type and concentration of a substance. Examples of designs could involve chemical reactions such as dissolving ammonium chloride, calcium chloride or a citric acid and baking soda (sodium bicarbonate) reaction in order to warm or cool an object. | Emphasis is on the design, controlling the transfer of energy to the environment, and modification of a device using factors such as type and concentration of a substance. Examples of designs could involve chemical reactions such as dissolving ammonium chloride or calcium chloride. |
| **Science and Engineering Practices:** | Constructing explanations and designing solutions |
| **Disciplinary Core Ideas:** | Chemical reactions |
| Some chemical reactions release energy (exothermic reactions), others store energy (endothermic reactions). (MS.PS1B.c) | Some chemical reactions release energy, others store energy (endothermic reactions). (MS.PS1B.c) |
| **Disciplinary Core Ideas:** | Developing possible solutions |
| THIS DISCIPLINARY CORE IDEA DOES NOT APPEAR IN THE LOUISIANA STANDARD | A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. |
| **Disciplinary Core Ideas:** | Optimizing the design solution |
| Although one design may not perform the best across all tests, identifying the characteristics of the design that performs 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.ETS 1.C.a) | |
| THIS DISCIPLINARY CORE IDEA DOES NOT APPEAR IN THE LOUISIANA STANDARD | 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. (MS.ETS 1.C.b) |
| **Crosscutting Concepts:** | Energy and matter |
| The transfer of energy can be tracked as energy flows through a designed or natural system. | |

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<table>
<tr><th colspan="2">ENERGY — MS-PS3-3</th></tr>
<tr><th>LSSS</th><th>NGSS</th></tr>
<tr><td colspan="2">Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.</td></tr>
<tr><th colspan="2">Clarification Statement</th></tr>
<tr><td>Emphasis is on the ability to maximize or minimize thermal energy transfer as it relates to devices used when an area loses electricity after a natural disaster. Examples of devices could include an insulated box or a solar cooker. Testing of the device relies on performance and not direct calculation of the total amount of thermal energy transferred.</td><td>Examples of devices could include an insulated box, a solar cooker, and a Styrofoam cup.</td></tr>
<tr><td colspan="2">Science and Engineering Practices: Constructing explanations and designing solutions</td></tr>
<tr><td colspan="2">Disciplinary Core Ideas: Definitions of energy</td></tr>
<tr><td colspan="2">Temperature is a measure of the average kinetic energy; the relationship between the temperature and the total energy of the system depends on the types, states, and amounts of matter present. (MS.PS3A.d)</td></tr>
<tr><td colspan="2">Disciplinary Core Ideas: Conservation of energy and energy transfer</td></tr>
<tr><td colspan="2">Energy is spontaneously transferred out of hotter regions or objects and into colder ones. (MS.PS3B.c)</td></tr>
<tr><td colspan="2">Disciplinary Core Ideas: Defining and delimiting an engineering problem</td></tr>
<tr><td colspan="2">The 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 is likely to limit possible solutions. (MS.ETS1A.a)</td></tr>
<tr><td>A solution needs to be tested,to prove the validity of the design and then modified on the basis of the test results in order to improve it. There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. Models of all kinds are important for testing solutions. (MS.ETS1B.a)</td><td>A solution needs to be tested,to prove the validity of the design and then modified on the basis of the test results in order to improve it. There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem.</td></tr>
<tr><td colspan="2">Crosscutting Concepts: Energy and matter: flows, cycles, and conservation</td></tr>
<tr><td colspan="2">The transfer of energy can be tracked as energy flows through a designed or natural system.</td></tr>
</table>

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| **ENERGY** | **MS-PS3-5** |
| --- | --- |
| **LSSS** | **NGSS** |
| Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object. | |
| **Clarification Statement** | |
| Examples of empirical evidence used in arguments could include an inventory or other representation of the energy (i.e. mechanical, thermal, or other forms of energy) before and after the transfer in the form of temperature changes or motion of object. This does not include the quantification of the energy transferred in the system. | Examples of empirical evidence used in arguments could include an inventory or other representation of the energy before and after the transfer in the form of temperature changes or motion of object. |
| **Science and Engineering Practices:** | Engaging in argument from evidence |
| **Disciplinary Core Ideas:** | Conservation of energy and energy transfer |
| When the kinetic energy of an object changes, there is inevitably some other change in energy at the same time. (MS.PS3B.a) | When the motion energy of an object changes, there is inevitably some other change in energy at the same time. (MS.PS3B.a) |
| **Crosscutting Concepts:** | Energy and matter |
| Energy may take different forms (e.g. energy in fields, thermal energy, energy of motion). | |

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| EARTH'S PLACE IN THE UNIVERSE | MS-ESS1-4 |
|---|---|
| **LSSS** | **NGSS** |
| Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's geologic history. | Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6 billion-year-old history. |
| **Clarification Statement** | |
| Emphasis is on analyses of rock formations and fossils they contain to establish relative ages of major events in Earth's history. Major events could include the formation of mountain chains and ocean basins, adaptation and extinction of particular living organisms, volcanic eruptions, periods of massive glaciation, and the development of watersheds and rivers through glaciation and water erosion. The events in Earth's history happened in the past continue today. Scientific explanations can include models. | Emphasis is on how analyses of rock formations and the fossils they contain are used to establish relative ages of major events in Earth's history. Examples of Earth's major events could range from being very recent (such as the last Ice Age or the earliest fossils of homo sapiens) to very old (such as the formation of Earth or the earliest evidence of life). Examples can include the formation of mountain chains and ocean basins, the evolution or extinction of particular living organisms, or significant volcanic eruptions. |
| **Science and Engineering Practices:** | Constructing explanations and designing solutions |
| **Disciplinary Core Ideas:** | The history of planet Earth |
| The geologic time scale interpreted from rock strata provides a way to organize Earth's history. Analyses of rock strata and the fossil record provide only relative dates, not an absolute scale. (MS.ESS1C.a)<br><br>Scientists use data from radioactive dating techniques to estimate the age of Earth's materials. (MS.ESS1C.b) | The geologic time scale interpreted from rock strata provides a way to organize Earth's history. Analyses of rock strata and the fossil record provide only relative dates, not an absolute scale. (MS.ESS1C.a) |
| **Crosscutting Concepts:** | Scale, proportion, and quantity |
| Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. | |

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| EARTH'S SYSTEMS | MS-ESS2-1 |
|---|---|
| **LSSS** | **NGSS** |
| Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process. | |
| **Clarification Statement** | |
| Emphasis is on the processes of melting, crystallization, weathering, deformation, and sedimentation, which act together to form minerals and rocks through the cycling of Earth's materials. | |
| **Science and Engineering Practices:** | Developing and using models |
| **Disciplinary Core Ideas:** | Earth's materials and systems |
| All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. This energy is derived from the sun and Earth's hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth's materials and living organisms. (MS.ESS2A.a) | |
| **Crosscutting Concepts:** | Stability and change |
| Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales, including the atomic scale. | |

| EARTH'S SYSTEMS | MS-ESS2-2 |
|---|---|
| **LSSS** | **NGSS** |
| Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. | |
| **Clarification Statement** | |
| Emphasis is on how processes change Earth's surface at time and spatial scales that can be large (such as slow plate motions or the uplift of a large mountain ranges) or small (such as rapid landslides on microscopic geochemical reactions), and how many geosciences processes usually behave gradually but are punctuated by catastrophic events (such as earthquakes, volcanoes, and meteor impacts). Examples of geoscience processes include surface weathering and deposition by the movements of water, ice, and wind. Emphasis is on geoscience processes that shape local geographic features, where appropriate. | |
| **Science and Engineering Practices:** | Construction explanations and designing solutions |
| **Disciplinary Core Ideas:** | Earth's materials and systems |
| The planet's systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth's history and will determine its future. (MS.ESS2A.b) | |
| **Disciplinary Core Ideas:** | The role of water in earth's surface processes |
| Water's movements—both on the land and underground—cause weathering and erosion, which change the land's surface features and create underground formations. (MS.ESS2C.e) | |
| **Crosscutting Concepts:** | Scale, proportion, and quantity |
| Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. | |

| EARTH'S SYSTEMS | MS-ESS2-3 |
|---|---|
| **LSSS** | **NGSS** |
| Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and sea-floor structures to provide evidence of the past plate motions. | |
| **Clarification Statement** | |
| Examples of data include similarities of rock and fossil types on different continents, the shapes of the continents (including continental shelves), and the locations of ocean structures (such as ridges, fracture zones, and trenches). | |
| **Science and Engineering Practices:** | Analyzing and interpreting data |
| **Disciplinary Core Ideas:** | The history of planet earth |
| Tectonic processes continually generate new ocean sea floor at ridges and destroy old seafloor at trenches. (MS.ESS1C.c) | |
| **Disciplinary Core Ideas:** | Plate tectonics and large-scale system interactions |
| Maps of ancient land and water patterns, based on investigations of rocks and fossils, make clear how Earth's plates have moved great distances, collided, and spread apart. (MS.ESS2B.a) | |
| **Crosscutting Concepts:** | Patterns |
| Patterns in rates of change and other numerical relationships can provide information about natural systems. | |

| EARTH AND HUMAN ACTIVITY | MS-ESS3-1 |
|---|---|
| **LSSS** | **NGSS** |
| Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes. | |
| **Clarification Statement** | |
| Emphasis is on how these resources are limited and typically non-renewable, and how their distributions are significantly changing as a result of removal by humans. Examples of uneven distributions of resources as a result of past processes include but are not limited to petroleum (locations of the burial of organic marine sediments and subsequent geologic traps), metal ores (locations of past volcanic and hydrothermal activity associated with subduction zones), and soil (locations of active weathering and/or deposition of rock). | |
| **Science and Engineering Practices:** | Constructing explanations and designing solutions |
| **Disciplinary Core Ideas:** | Natural resources |
| Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes. (MS.ESS3A.a) | |
| | Louisiana's natural resources |
| Non-renewable resources such as our state's fossil fuels are vast but limited. (MS.EVS1A.b) | NONE PROVIDED IN NGSS |
| **Crosscutting Concepts:** | Cause and effect |
| Cause and effect relationships may be used to predict phenomena in natural or designed systems. | |

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| EARTH AND HUMAN ACTIVITY | MS-ESS3-2 |
|---|---|
| **LSSS** | **NGSS** |
| Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects. | |
| **Clarification Statement** | |
| Emphasis is on how some natural hazards, such as volcanic eruptions and severe weather, are preceded by phenomena that allow for reliable predictions, but others, such as earthquakes, occur suddenly and with no notice, and thus are not yet predictable. Examples of natural hazards can be taken from interior processes (such as earthquakes and volcanic eruptions), surface processes (such as mass wasting and tsunamis), or severe weather events (such as hurricanes, tornadoes, and floods). Examples of data can include the locations, magnitudes, and frequencies of the natural hazards. Examples of technologies can be global (such as satellite systems to monitor hurricanes or forest fires) or local (such as building basements in tornado-prone regions or reservoirs to mitigate droughts). | |
| **Science and Engineering Practices:** | Analyzing and interpreting data |
| **Disciplinary Core Ideas:** | Natural hazards |
| Mapping the history of natural hazards in a region, combined with an understanding of related geologic forces can help forecast the locations and likelihoods of future events. (MS.ESS3B.a) | |
| **Crosscutting Concepts:** | Patterns |
| Graphs, charts, and images can be used to identify patterns in data. | |

| EARTH AND HUMAN ACTIVITY | MS-ESS3-3 |
|---|---|
| **LSSS** | **NGSS** |
| Apply scientific principles to design a method for monitoring and minimizing human impact on the environment. | |
| **Clarification Statement** | |
| Examples of the design process may include examining human environmental impacts, assessing the kinds of solutions that are feasible, and designing and evaluating solutions that could reduce that impact. Examples of human impacts may include water usage (such as the withdrawal of water from streams and aquifers or the construction of dams and levees), land usage (such as urban development, agriculture, or the removal of wetlands), and pollution (such as of the air, water, or land). | |
| **Science and Engineering Practices:** | Constructing explanations and designing solutions |
| **Disciplinary Core Ideas:** | Human impacts on Earth's systems |
| Human activities, globally and locally, have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things. (MS.ESS3C.a)<br>Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise. (MS.ESS3C.b) | Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things. (MS.ESS3C.a)<br>Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise. (MS.ESS3C.b) |
| **Disciplinary Core Ideas:** | Developing possible solutions |
| A solution needs to be tested to prove the validity of the design and then modified on the basis of the test results in order to improve it. There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. Models of all kinds are important for testing solutions. (ETS.MS.1B.a) | NONE PROVIDED IN NGSS |
| **Crosscutting Concepts:** | Cause and effect |
| Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation. | |

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| FROM MOLECULES TO ORGANISMS: STRUCTURES AND PROCESSES | MS-LS1-4 |
|---|---|
| **LSSS** | **NGSS** |
| Construct and use argument(s) based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of survival and successful reproduction of animals and plants respectively. | Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively. |
| **Clarification Statement** | |
| 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, or 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 or 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, or hard shells on nuts that squirrels bury. | |
| **Science and Engineering Practices:** | Engaging in argument from evidence |
| **Disciplinary Core Ideas:** | Growth and development of organisms |
| Animals engage in characteristic behaviors that increase the odds of reproduction. (MS.LS1B.c)<br>Plants (flowering and non-flowering) reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction. (MS.LS1B.d)<br>Group behavior has evolved because membership can increase the chances of survival for individuals and their genetic relatives. (MS.LS2D.a) | Animals engage in characteristic behaviors that increase the odds of reproduction.<br>Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction. |
| **Crosscutting Concepts:** | Cause and effect |
| Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. | |

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| FROM MOLECULES TO ORGANISMS: STRUCTURES AND PROCESSES | MS-LS1-5 |
|---|---|
| **LSSS** | **NGSS** |
| Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms. | |
| **Clarification Statement** | |
| 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, or fish growing larger in large ponds than they do in small ponds. | |
| **Science and Engineering Practices:** | Constructing explanations and designing solutions |
| **Disciplinary Core Ideas:** | Growth and development of organisms |
| Genetic factors as well as local conditions affect the growth of the adult plant. (MS.LS1B.e) | |
| **Crosscutting Concepts:** | Cause and Effect |
| Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. | |

| HEREDITY: INHERITANCE AND VARIATION OF TRAITS | MS-LS3-1 |
|---|---|
| **LSSS** | **NGSS** |
| Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism. | |
| **Clarification Statement** | |
| Emphasis is on conceptual understanding that changes in genetic material may result in making different proteins. Examples include radiation treated plants, genetically modified organisms (e.g. roundup resistant crops, bioluminescence), or mutations both harmful and beneficial. | Emphasis is on conceptual understanding that changes in genetic material may result in making different proteins. |
| **Science and Engineering Practices:** | Developing and using models |
| **Disciplinary Core Ideas:** | Inheritance of traits |
| Genes are located in the chromosomes of cells, with each chromosome pair containing two variants (alleles) 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. (MS.LS3A.a)<br>Changes (mutations) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits. (MS.LS3A.b) | 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. |
| | Variation of traits |
| In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations. Though rare, mutations may result in changes to the structure and function of proteins. Some changes are beneficial, others harmful, and some neutral to the organism. | |
| **Crosscutting Concepts:** | Structure and function |
| Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the shapes, composition, and relationships among its parts; therefore, complex natural and designed structures/systems can be analyzed to determine how they function. | |

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| BIOLOGICAL EVOLUTION AND DIVERSITY | MS-LS4-1 |
|---|---|
| **LSSS** | **NGSS** |
| Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past. | |
| **Clarification Statement** | |
| Emphasis is on finding patterns of changes in the level of complexity of anatomical structures in organisms and the chronological order of fossil appearance in the rock layers. | |
| **Science and Engineering Practices:** | Analyzing and interpreting data |
| **Disciplinary Core Ideas:** | Evidence of common ancestry and diversity |
| The collection of fossils and their placement in chronological order (e.g., through the location of the sedimentary layers in which they are found or through radioactive dating) is known as the fossil record. It documents the existence, diversity, extinction, and change of many life forms throughout the history of life on Earth. (MS.LS4A.a) | |
| **Crosscutting Concepts:** | Patterns |
| Graphs, charts, and images can be used to identify patterns in data. | |

| BIOLOGICAL EVOLUTION AND DIVERSITY | MS-LS4-2 |
|---|---|
| **LSSS** | **NGSS** |
| Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships. | |
| **Clarification Statement** | |
| Emphasis is on explanations of the evolutionary relationships among organisms in terms of similarity or differences of the gross appearance of anatomical structures. | |
| **Science and Engineering Practices:** | Constructing explanations and designing solutions |
| **Disciplinary Core Ideas:** | Evidence of common ancestry and diversity |
| Anatomical similarities and differences between various organisms living today and between them and organisms in the fossil record, enable the reconstruction of evolutionary history and the inference of lines of evolutionary descent. (MS.LS4A.b)<br><br>Comparison of the embryological development of different species also reveals similarities that show relationships not evident in the fully-formed anatomy. (MS.LS4A.c) | |
| **Crosscutting Concepts:** | Cause and effect |
| Patterns can be used to identify cause and effect relationships. | |

| BIOLOGICAL EVOLUTION AND DIVERSITY | MS-LS4-3 |
|---|---|
| **LSSS** | **NGSS** |
| Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy. | |
| **Clarification Statement** | |
| Emphasis is on inferring general patterns of relatedness among embryos of different organisms by comparing the macroscopic appearance of diagrams or pictures. | |
| **Science and Engineering Practices:** | Analyzing and interpreting data |
| **Disciplinary Core Ideas:** | Evidence of common ancestry and diversity |
| Anatomical similarities and differences between various organisms living today and between them and organisms in the fossil record, enable the reconstruction of evolutionary history and the inference of lines of evolutionary descent. (MS.LS4A.b)<br><br>Comparison of the embryological development of different species also reveals similarities that show relationships not evident in the fully-formed anatomy. (MS.LS4A.c) | Comparison of the embryological development of different species also reveals similarities that show relationships not evident in the fully-formed anatomy. |
| **Crosscutting Concepts:** | Patterns |
| Graphs, charts, and images can be used to identify patterns in data. | |

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| BIOLOGICAL EVOLUTION AND DIVERSITY | MS-LS4-6 |
|---|---|
| **LSSS** | **NGSS** |
| Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations of species over time. | |
| **Clarification Statement** | |
| Emphasis is on using mathematical models, probability statements, and proportional reasoning to support explanations of trends in changes to populations over time. <u>Students should be able to explain trends in data for the number of individuals with specific traits changing over time.</u> | Emphasis is on using mathematical models, probability statements, and proportional reasoning to support explanations of trends in changes to populations over time. |
| **Science and Engineering Practices:** | Using mathematics and computational thinking |
| **Disciplinary Core Ideas:** | Adaptation |
| Adaptation by natural selection acting over generations is one important process by which populations change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment tend to become more common; those that do not become less common. Thus, the distribution of traits in a population changes. (MS.LS4C.a) | |
| **Crosscutting Concepts:** | Cause and effect |
| Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. | |

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