Louisiana Believes

Crosswalk for Louisiana Student Standards for Science and NGSS: 7th 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 February 16, 2023

DEPARTMENT of EDUCATION
Louisiana Believes

<table>
<tr><th colspan="2">MATTER AND ITS INTERACTIONS — 7-MS-PS1-2</th></tr>
<tr><th>LSSS</th><th>NGSS</th></tr>
<tr><td colspan="2">Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.</td></tr>
<tr><th colspan="2">Clarification Statement</th></tr>
<tr><td>Examples of reactions could include burning sugar or steel wool, fat reacting with sodium hydroxide, or mixing zinc with hydrogen chloride. Examples of chemical and physical properties to analyze include density, melting point, boiling point, solubility, flammability, or odor.</td><td>Examples of reactions could include burning sugar or steel wool, fat reacting with sodium hydroxide, and mixing zinc with hydrogen chloride.</td></tr>
<tr><td>Science and Engineering Practice:</td><td>Analyzing and interpreting data</td></tr>
<tr><td>Disciplinary Core Ideas:</td><td>Structure and properties of matter</td></tr>
<tr><td colspan="2">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)</td></tr>
<tr><td></td><td>Chemical reactions</td></tr>
<tr><td colspan="2">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 substances have different properties from those of the reactants. (MS.PS1B.a)</td></tr>
<tr><td>Crosscutting Concepts:</td><td>Structure and function</td></tr>
<tr><td colspan="2">Macroscopic patterns are related to the nature of microscopic and atomic-level structure.</td></tr>
</table>

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<table>
<tr><th colspan="2">MATTER AND ITS INTERACTIONS 7-MS-PS1-4</th></tr>
<tr><th>LSSS</th><th>NGSS</th></tr>
<tr><td colspan="2">Develop a model that predicts and describes changes in particle motion, temperature, and the state of a pure substance when thermal energy is added or removed.</td></tr>
<tr><th colspan="2">Clarification Statement</th></tr>
<tr><td>Emphasis is on qualitative molecular-level models of solids, liquids, and gases to show that adding or removing thermal energy increases or decreases kinetic energy of the particles until a change of state occurs. Examples of models could include drawings or diagrams. Examples of particles could include molecules or inert atoms such as the noble gases. Examples of pure substances could include water, carbon dioxide, or helium.</td><td>Emphasis is on qualitative molecular-level models of solids, liquids, and gases to show that adding or removing thermal energy increases or decreases kinetic energy of the particles until a change of state occurs. Examples of models could include drawing and diagrams. Examples of particles could include molecules or inert atoms. Examples of pure substances could include water, carbon dioxide, and helium.</td></tr>
<tr><td>Science and Engineering Practice:</td><td>Developing and using models</td></tr>
<tr><td>Disciplinary Core Ideas:</td><td>Structure and properties of matter</td></tr>
<tr><td>Gases and liquids are made of molecules or inert atoms (the noble gases) that are moving about relative to each other. (MS.PS1A.c)

In a liquid, the molecules are constantly in motion and in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but do not change relative locations. (MS.PS1A.d)

The changes of state that occur with variations in temperature or pressure can be described and predicted using temperature and pressure models of matter. (MS.PS1A.f)</td><td>Gases and liquids are made of molecules or inert atoms that are moving about relative to each other.

In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but do not change relative locations.

The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter.</td></tr>
</table>

<table>
<tr><th colspan="2">Definitions of energy</th></tr>
<tr><td>The temperature of a system is proportional to the average internal kinetic energy and potential energy per atom or molecule (whichever is the appropriate building block for the system’s material). The details of that relationship depend on the type of atom or molecule and the interactions among the atoms in the material. Temperature is not a direct measure of a system’s total thermal energy. The total thermal energy (sometimes called the total internal energy) of a system depends jointly on the temperature, the total number of atoms in the system, and the state of the material. (MS.PS.3A.c)

The term “heat” as used in everyday language refers both to thermal energy (the motion of atoms or molecules within a substance) and the transfer of that thermal energy from one object to another. In science, heat is used only for this second meaning; it refers to the energy transferred due to the temperature difference between two objects. (MS.PS3A.e)</td><td>The term “heat” as used in everyday language refers both to thermal energy (the motion of atoms or molecules within a substance) and the transfer of that thermal energy from one object to another. In science, heat is used only for this second meaning; it refers to the energy transferred due to the temperature difference between two objects. (secondary)

The temperature of a system is proportional to the average internal kinetic energy and potential energy per atom or molecule (whichever is the appropriate building block for the system’s material). The details of that relationship depend on the type of atom or molecule and the interactions among the atoms in the material. Temperature is not a direct measure of a system's total thermal energy. The total thermal energy (sometimes called the total internal energy) of a system depends jointly on the temperature, the total number of atoms in the system, and the state of the material. (secondary)</td></tr>
<tr><th>Crosscutting Concepts:</th><th>Cause and effect</th></tr>
<tr><td colspan="2">Cause and effect relationships may be used to predict phenomena in natural or designed systems.</td></tr>
</table>

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<table>
<tr><th>MATTER AND ITS INTERACTIONS</th><th>7-MS-PS1-5</th></tr>
<tr><th>LSSS</th><th>NGSS</th></tr>
<tr><td colspan="2">Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.</td></tr>
<tr><th colspan="2">Clarification Statement</th></tr>
<tr><td>Emphasis is on the law of conservation of matter and on physical models or drawings, including digital forms, that represent atoms. The use of atomic masses, balancing symbolic equations, or intermolecular forces is not the focus of this performance expectation.</td><td>Emphasis is on law of conservation of matter and on physical models or drawings, including digital forms, that represent atoms</td></tr>
<tr><td>Science and Engineering Practice:</td><td>Developing and using models</td></tr>
<tr><td>Disciplinary Core Ideas:</td><td>Chemical reactions</td></tr>
<tr><td colspan="2">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 substances have different properties from those of the reactants. (MS.PS1B.a)
The total number of each type of atom is conserved, and thus the mass does not change. (MS.PS1B.b)</td></tr>
<tr><td>Crosscutting Concepts:</td><td>Energy and matter</td></tr>
<tr><td colspan="2">.
Matter is conserved because atoms are conserved in physical and chemical processes.</td></tr>
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ENERGY	**7-MS-PS3-4**
LSSS	**NGSS**
Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.	
Clarification Statement	
Emphasis is on observing change in temperature as opposed to calculating total thermal energy transferred. Examples of experiments could include comparing final water temperatures after different masses of ice melted in the same volume of water with the same initial temperature, the temperature change of samples of different materials with the same mass as they cool or heat in the environment, or the same material with different masses when a specific amount of energy is added.	Examples of experiments could include comparing final water temperatures after different masses of ice melted in the same volume of water with the same initial temperature, the temperature change of samples of different materials with the same mass as they cool or heat in the environment, or the same material with different masses when a specific amount of energy is added.
Science and Engineering Practice:	Planning and carrying out investigations
Disciplinary Core Ideas:	Definitions of energy
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)	Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present.
	Conservation of energy and energy transfer
The amount of energy transfer needed to change the temperature of a matter sample by a given amount depends on the nature of the matter, the mass of the sample, and the environment. (MS.PS3B.b) Energy is spontaneously transferred out of hotter regions or objects and into colder ones. (MS.PS3B.c)	The amount of energy transfer needed to change the temperature of a matter sample by a given amount depends on the nature of the matter, the size of the sample, and the environment.
Crosscutting Concepts:	Scale, proportion, and quantity
Proportional relationships (e.g. speed as the ratio of distance traveled to time taken) among different types of quantities provide information about the magnitude of properties and processes..	

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<table>
<tr><th colspan="2">EARTH’S SYSTEMS 7-MS-ESS2-4</th></tr>
<tr><th>LSSS</th><th>NGSS</th></tr>
<tr><td colspan="2">Develop a model to describe the cycling of water through Earth’s systems driven by energy from the sun and the force of gravity.</td></tr>
<tr><th colspan="2">Clarification Statement</th></tr>
<tr><td colspan="2">Emphasis is on the ways water changes its state and location as it moves through the multiple pathways of the hydrologic cycle. Examples of models can be conceptual or physical.</td></tr>
<tr><td colspan="2">Science and Engineering Practice: Developing and using models</td></tr>
<tr><td colspan="2">Disciplinary Core Ideas: The role of water in Earth’s surface processes</td></tr>
<tr><td colspan="2">Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land. (MS.ESS2C.a)
Global movements of water and its changes in form are propelled by sunlight and gravity. (MS.ESS2C.c)</td></tr>
<tr><td colspan="2">Louisiana’s natural resources</td></tr>
<tr><td>Replenishable resources such as groundwater and oxygen are purified by the movement through Earth’s cycles. (MS.EVS1A.c)</td><td>NONE PROVIDED IN NGSS</td></tr>
<tr><td colspan="2">Crosscutting Concepts: Energy and matter</td></tr>
<tr><td colspan="2">Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter.</td></tr>
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<table>
<tr><th colspan="2">EARTH’S SYSTEMS 7-MS-ESS2-5</th></tr>
<tr><th>LSSS</th><th>NGSS</th></tr>
<tr><td colspan="2">Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.</td></tr>
<tr><th colspan="2">Clarification Statement</th></tr>
<tr><td colspan="2">Emphasis is on how air masses flow from regions of high pressure to low pressure, causing weather (defined by temperature, pressure, humidity, precipitation, and wind) at a fixed location to change over time, and how sudden changes in weather can result when different air masses collide. Emphasis is on how weather can be predicted within probabilistic ranges. Examples of data can be provided to students (such as weather maps, diagrams, and visualizations) or obtained through laboratory experiments (such as condensation).</td></tr>
<tr><th colspan="2">Science and Engineering Practice: Planning and carrying out investigations</th></tr>
<tr><th colspan="2">Disciplinary Core Ideas: The role of water in Earth’s surface processes</th></tr>
<tr><td colspan="2">The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. (MS.ESS2C.b)</td></tr>
<tr><th colspan="2">Weather and climate</th></tr>
<tr><td>Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. Because these patterns are so complex, weather can only be predicted probabilistically. (MS.ESS2D.a)</td><td>Because these patterns are so complex, weather can only be predicted probabilistically.</td></tr>
<tr><th colspan="2">Crosscutting Concepts: Cause and effect</th></tr>
<tr><td colspan="2">Cause and effect relationships may be used to predict phenomena in natural or designed systems.</td></tr>
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<tr><th colspan="2">EARTH'S SYSTEMS 7-MS-ESS2-6</th></tr>
<tr><th>LSSS</th><th>NGSS</th></tr>
<tr><td colspan="2">Develop and use a model to describe how unequal heating and rotation of the Earth causes patterns of atmospheric and oceanic circulation that determine regional climates.</td></tr>
<tr><th colspan="2">Clarification Statement</th></tr>
<tr><td>Emphasis is on how patterns vary by latitude, altitude, and geographic land distribution. Emphasis of atmospheric circulation is on the sunlight-driven latitudinal banding, the Coriolis effect, and resulting prevailing winds; emphasis of ocean circulation (e.g. El Niño/La Niña) is on the transfer of heat by the global ocean convection cycle, which is constrained by the Coriolis effect and the outlines of continents. Examples of models can be diagrams, maps and globes, or digital representations.</td><td>Emphasis is on how patterns vary by latitude, altitude, and geographic land distribution. Emphasis of atmospheric circulation is on the sunlight-driven latitudinal banding, the Coriolis effect, and resulting prevailing winds; emphasis of ocean circulation is on the transfer of heat by the global ocean convection cycle, which is constrained by the Coriolis effect and the outlines of continents. Examples of models can be diagrams, maps and globes, or digital representations.</td></tr>
<tr><td colspan="2">Science and Engineering Practice: Developing and using models</td></tr>
<tr><td colspan="2">Disciplinary Core Ideas: The role of water in Earth's surface processes</td></tr>
<tr><td colspan="2">Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents. (MS.ESS2C.d)</td></tr>
<tr><td colspan="2">Weather and climate</td></tr>
<tr><td>Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. Because these patterns are so complex, weather can only be predicted probabilistically. (MS.ESS2D.a)
The ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean currents. (MS.ESS2D.b)</td><td>Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns.
The ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean currents.</td></tr>
<tr><td colspan="2">Crosscutting Concepts: Systems and system models</td></tr>
<tr><td colspan="2">Models can be used to represent systems and their interactions—such as inputs, processes and outputs— and energy, matter, and information flows within systems.</td></tr>
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<table>
<tr><th colspan="2">EARTH AND HUMAN ACTIVITY 7-MS-ESS3-5</th></tr>
<tr><th>LSSS</th><th>NGSS</th></tr>
<tr><td colspan="2">Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.</td></tr>
<tr><th colspan="2">Clarification Statement</th></tr>
<tr><td colspan="2">Examples of factors include human activities (such as fossil fuel combustion, cement production, and agricultural activity) and natural processes (such as changes in incoming solar radiation or volcanic activity). Examples of evidence can include tables, graphs, and maps of global and regional temperatures, atmospheric levels of gases such as carbon dioxide and methane, and the rates of human activities. Emphasis is on the major role that human activities play in causing the rise in global temperatures.)</td></tr>
<tr><th colspan="2">Science and Engineering Practice: Asking questions and defining problems</th></tr>
<tr><th colspan="2">Disciplinary Core Ideas: Global climate change</th></tr>
<tr><td>Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth’s mean surface temperature. Addressing climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely in decisions and activities. (MS.ESS3D.a)</td><td>Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth’s mean surface temperature (global warming). Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely in decisions and activities.</td></tr>
<tr><th colspan="2">Crosscutting Concepts: Stability and change</th></tr>
<tr><td colspan="2">Stability might be disturbed either by sudden events or gradual changes that accumulate over time.</td></tr>
</table>

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FROM MOLECULES TO ORGANISMS: STRUCTURE AND PROCESSES	**7-MS-LS1-3**
LSSS	**NGSS**
Use an argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.	
Clarification Statement	
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. Systems could include circulatory, excretory, digestive, respiratory, muscular, endocrine, or nervous systems.	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.
Science and Engineering Practice:	Engaging in argument from evidence
Disciplinary Core Ideas:	Structure and function
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 in order to maintain homeostasis. (MS.LS1A.c)	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.
	Information processing
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. (MS.LS1D.a)	NONE PROVIDED IN NGSS
Crosscutting Concepts:	Systems and system models
Systems may interact with other systems; they may have subsystems and be a part of larger complex systems.	

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FROM MOLECULES TO ORGANISMS: STRUCTURE AND PROCESSES	**7-MS-LS1-6**
LSSS	**NGSS**
Construct a scientific explanation based on evidence for the role of photosynthesis and cellular respiration in the cycling of matter and flow of energy into and out of organisms.	
Clarification Statement	
Emphasis is on tracing movement of matter and flow of energy.	
Science and Engineering Practice:	Constructing explanations and designing solutions
Disciplinary Core Ideas:	Organization for matter and energy flow in organisms
Plants, plant-like protists (including algae and phytoplankton), and other microorganisms use the energy from light, to make sugars (food) from carbon dioxide from the atmosphere and water from the environment through the process of photosynthesis, which also releases oxygen. These sugars can be used immediately or stored for growth or later use. (MS.LS1C.a)	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.
	Energy in chemical processes and everyday life
The chemical reaction by which plants produce complex food molecules (sugars) requires an energy input (i.e., from sunlight) to occur. In this reaction, carbon dioxide and water combine to form carbon-based organic molecules and release oxygen. Cellular respiration in plants and animals involve chemical reactions with oxygen that release stored energy. In these processes, complex molecules containing carbon react with oxygen to produce carbon dioxide and other materials. (MS.PS3D.a)	The chemical reaction by which plants produce complex food molecules (sugars) requires an energy input (i.e., from sunlight) to occur. In this reaction, carbon dioxide and water combine to form carbon-based organic molecules and release oxygen. (secondary)
	Louisiana's natural resources
Renewable resources have the ability to self maintain due to the processes of photosynthesis. (MS.EVS1A.a)	NONE PROVIDED IN NGSS
Crosscutting Concepts:	Energy and matter
Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter.	

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FROM MOLECULES TO ORGANISMS: STRUCTURE AND PROCESSES 7-MS-LS1-7

LSSS **NGSS**

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.

Clarification Statement

Emphasis is on describing that molecules are broken apart and put back together and that in this process, energy is released.

Science and Engineering Practice: Developing and using models

Disciplinary Core Ideas: Organization for matter and energy flow in organisms

LSSS	NGSS
Within individual organisms, food (energy) 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 through aerobic and anaerobic respiration. (MS.LS1C.b)	Within individual organisms, food (energy) 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.

Energy in chemical processes and everyday life

Cellular respiration in plants and animals involves chemical reactions with oxygen that release stored energy. In these processes, complex molecules containing carbon react with oxygen to produce carbon dioxide and other materials. (MS.LS1C.c)

Crosscutting Concepts: Energy and matter

Matter is conserved because atoms are conserved in physical and chemical processes.

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<tr><th>FROM MOLECULES TO ORGANISMS: STRUCTURE AND PROCESSES</th><th>7-MS-LS1-8</th></tr>
<tr><th>LSSS</th><th>NGSS</th></tr>
<tr><td>LS1-8 DOES NOT APPEAR IN LOUISIANA STANDARDS</td><td>Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.</td></tr>
<tr><th colspan="2">Clarification Statement</th></tr>
<tr><td>LS1-8 DOES NOT APPEAR IN LOUISIANA STANDARDS</td><td>NONE PROVIDED IN NGSS</td></tr>
<tr><th>Science and Engineering Practice:</th><td>Obtaining, evaluating, and communicating information</td></tr>
<tr><th>Disciplinary Core Ideas:</th><td>Information processing</td></tr>
<tr><td>LS1-8 DOES NOT APPEAR IN LOUISIANA STANDARDS</td><td>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.</td></tr>
<tr><th>Crosscutting Concepts:</th><td>Cause and effect</td></tr>
<tr><td>LS1-8 DOES NOT APPEAR IN LOUISIANA STANDARDS</td><td>Cause and effect relationships may be used to predict phenomena in natural systems.</td></tr>
</table>

FROM MOLECULES TO ORGANISMS: STRUCTURE AND PROCESSES	**7-MS-LS2-4**
LSSS	**NGSS**
Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.	
Clarification Statement	
Emphasis is on recognizing patterns in data, making inferences about changes in populations, and on evaluating empirical evidence supporting arguments about changes to ecosystems.	Emphasis is on recognizing patterns in data, making warranted inferences about changes in populations, and on evaluating empirical evidence supporting arguments about changes to ecosystems.
Science and Engineering Practice:	Engaging in argument from evidence
Disciplinary Core Ideas:	Ecosystem dynamics, functioning, and resilience
Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations. (MS.LS2C.a)	
Crosscutting Concepts:	Stability and change
Small changes in one part of a system might cause large changes in another part.	

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<table>
<tr><th>HEREDITY: INHERITANCE AND VARIATION OF TRAITS</th><th>7-MS-LS2-5</th></tr>
<tr><th>LSSS</th><th>NGSS</th></tr>
<tr><td>Undertake a design project that assists in maintaining diversity and ecosystem services.</td><td>Evaluate competing design solutions for maintaining biodiversity and ecosystem services.</td></tr>
<tr><td colspan="2">Clarification Statement</td></tr>
<tr><td colspan="2">Examples of ecosystem services could include water purification, nutrient recycling, habitat conservation or soil erosion mitigation. Examples of design solution constraints could include scientific, economic, or social considerations.</td></tr>
<tr><td colspan="2">Science and Engineering Practice: Constructing explanations and designing solutions</td></tr>
<tr><td colspan="2">Disciplinary Core Ideas: Ecosystem dynamics, functioning, and resilience</td></tr>
<tr><td colspan="2">Biodiversity describes the variety of species found in Earth’s terrestrial and aquatic ecosystems. The completeness or integrity of an ecosystem’s biodiversity is often used as a measure of its health. (MS.LS2C.b)</td></tr>
<tr><td colspan="2">Biodiversity and humans</td></tr>
<tr><td>Changes in biodiversity can influence humans’ resources, such as food, energy, and medicines, as well as ecosystem services on which humans rely. (MS.LS4D.a)</td><td>Changes in biodiversity can influence humans’ resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on—for example, water purification and recycling. (secondary)</td></tr>
<tr><td colspan="2">Engineering design: developing possible solutions</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>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: Stability and change</td></tr>
<tr><td colspan="2">Small changes in one part of a system might cause large changes in another part.</td></tr>
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<table>
<tr><th colspan="2">HEREDITY: INHERITANCE AND VARIATION OF TRAITS 7-MS-LS3-2</th></tr>
<tr><th>LSSS</th><th>NGSS</th></tr>
<tr><td colspan="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.</td></tr>
<tr><th colspan="2">Clarification Statement</th></tr>
<tr><td colspan="2">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.</td></tr>
<tr><td colspan="2">Science and Engineering Practice: Developing and using models</td></tr>
<tr><td colspan="2">Disciplinary Core Ideas: Growth and development of organisms</td></tr>
<tr><td>Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring. (MS.LS1B.a)
Cells divide through the processes of mitosis and meiosis. (LS.MS.1B.b)</td><td>Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring.</td></tr>
<tr><td colspan="2">Inheritance of traits</td></tr>
<tr><td colspan="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.LS3A.d)</td></tr>
<tr><td colspan="2">Variation of traits</td></tr>
<tr><td colspan="2">In sexually reproducing organisms, each parent contributes to 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.LS3B.a)</td></tr>
<tr><td colspan="2">Crosscutting Concepts: Cause and effect</td></tr>
<tr><td colspan="2">Cause and effect relationships may be used to predict phenomena in natural or designed systems.</td></tr>
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<tr><th>HEREDITY: INHERITANCE AND VARIATION OF TRAITS</th><th>7-MS-LS4-4</th></tr>
<tr><th>LSSS</th><th>NGSS</th></tr>
<tr><td colspan="2">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.</td></tr>
<tr><th colspan="2">Clarification Statement</th></tr>
<tr><td>Emphasis is on using simple probability statements and proportional reasoning to construct explanations about why some traits are suppressed and other traits become more prevalent for those individuals better at finding food, shelter, or avoiding predators.</td><td>Emphasis is on using simple probability statements and proportional reasoning to construct explanations.</td></tr>
<tr><td>Science and Engineering Practice:</td><td>Constructing explanations and designing solutions</td></tr>
<tr><td>Disciplinary Core Ideas:</td><td>Natural selection</td></tr>
<tr><td colspan="2">Natural selection leads to the predominance of certain traits in a population and the suppression of others. (MS.LS4B.a)</td></tr>
<tr><td>Crosscutting Concepts:</td><td>Cause and effect</td></tr>
<tr><td colspan="2">Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability.</td></tr>
</table>

*Underlined sections denote ***additional information*** that appears in the Louisiana Student Standards for Science.*

<table>
<tr><th colspan="2">BIOLOGICAL EVOLUTION: UNITY AND DIVERSITY 7-MS-LS4-5</th></tr>
<tr><th>LSSS</th><th>NGSS</th></tr>
<tr><td colspan="2">Gather, read, and synthesize information about technologies that have changed the way humans influence the inheritance of desired traits in organisms.</td></tr>
<tr><th colspan="2">Clarification Statement</th></tr>
<tr><td colspan="2">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.</td></tr>
<tr><td>Science and Engineering Practice:</td><td>Obtaining, communicating, and evaluating information</td></tr>
<tr><td>Disciplinary Core Ideas:</td><td>Natural selection</td></tr>
<tr><td>Genetic engineering techniques can manipulate the DNA within various organisms. Technology has changed the way humans influence the inheritance of desired traits in organisms. (e.g., selective breeding, gene modification, gene therapy, or other methods) (MS.LS4B.b)</td><td>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 onto offspring.</td></tr>
<tr><td>Crosscutting Concepts:</td><td>Cause and effect</td></tr>
<tr><td colspan="2">Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability.</td></tr>
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*Underlined sections denote **wording differences** that appear in the Louisiana Student Standards for Science.