Performance Expectation *and Louisiana Connectors*
8-MS-PS1-1 Develop models to describe the atomic composition of simple molecules and extended structures. *LC-8-MS-PS1-1a Using a model(s), identify that an atom's nucleus as made of protons and neutrons and is surrounded by electrons.* *LC-8-MS-PS1-1b Using a model(s), identify that individual atoms of the same or different types that repeat to form extended structures (e.g., sodium chloride).*

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Developing and using models: Modeling in 6-8 builds on K-5 experiences and progresses to developing, using and revising models to describe, test, and predict more abstract phenomena and design systems. • Develop and/or use a model to predict and/or describe phenomena. *Models can be used to describe phenomena.* *Models can be used to predict phenomena.*	**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) *All matter is composed of tiny particles called atoms.* *Atoms are the basic unit of a chemical element.* *Substances are made from different type of atoms.* *Atoms form molecules ranging from small to very complex structures.* *A molecule is a group of atoms that are joined together and act as a single unit.* *Molecules can contain as many as a billion atoms or a few as two.* *The arrangement, motion, and interaction of these particles determine the three states of matter (solid, liquid, and gas).* Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). (MS.PS1A.e) *Solids have a definite volume and a definite shape.* *Solids may be formed from molecules.* *Solids can be extended structures with repeating subunits.* *Repeating subunits can create crystal structures.* *Salt, sugar, sand, and snow are examples of crystalline solids.*	**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. *Phenomena can be observed at different scales (micro and macro) in a system.* *Phenomena can be studied using models.* *Models can be used to explain time, space, and energy phenomena.*

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.

Performance Expectation *and Louisiana Connectors*
8-MS-PS1-3 Gather and make sense of information to describe that synthetic materials come from natural resources and impact society. ***LC-8-MS-PS1-3a Compare and contrast characteristics of natural and synthetic materials (e.g., fibers) from provided information (e.g., text, media, visual displays, and data).*** ***LC-8-MS-PS1-3b Identify ways in which natural resources undergo a chemical process to form synthetic materials (e.g., medicine, textiles, clothing) which impact society.***

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Obtaining, evaluating, and communicating information: Obtaining, evaluating, and communicating information in 6-8 builds on K-5 experiences and progresses to evaluating the merit and validity of ideas and methods. • 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. ***Gather information from multiple appropriate sources.*** ***Identify and locate information from multiple appropriate sources.*** ***Assess the credibility of each publication.*** ***Assess the accuracy of each publication.*** ***Assess the possible bias of each***	**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) ***Pure substances are made from a single type of atom or molecule.*** ***Elements and compounds are pure substances (e.g., carbon, oxygen, water, sodium chloride, methane).*** ***Pure substances have characteristics (physical and chemical properties) that are used to identify them.*** **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 substances have different properties from those of the reactants. (MS.PS1B.a) ***A natural substance is made up of multiple elements found in nature.*** ***A synthetic substance is made up of multiple substances in a lab by scientists (e.g., pesticides, medicines).*** ***Substances react in characteristic ways (e.g., form gas, form precipitates, change color).*** ***When a chemical reaction occurs, the parts that make up the original substance are regrouped in a new way that makes a new substance with new properties.*** ***If atoms are rearranged, the ending result is a different substance.*** ***Many substances react chemically with other substances to form new substances with different properties.***	**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. ***Structures can be designed to serve different functions.*** ***The design of a structure must be based on the properties of its materials.*** ***The design of a structure must be based on its shape.*** ***The design of a structure must be based on how it is being used.***

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
publication. ***Assess the methods used by each publication.*** ***Describe how the methods used are supported or not supported.***		

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.

Performance Expectation ***and Louisiana Connectors***
8-MS-PS1-6 Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes. ***LC-8-MS-PS1-6a Identify a chemical process that releases or absorbs thermal energy (e.g., dissolving ammonium chloride or calcium chloride) which, given the features of a problem, may provide a solution.*** ***LC-8-MS-PS1-6b Identify a way to test or modify a device that either releases or absorbs thermal energy by chemical processes.***

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Constructing explanations and designing solutions: Constructing explanations and designing solutions in 6-8 builds on K-5 experiences and progresses to include designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. • Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets specific design criteria and constraints. ***Design solutions must meet certain criteria and constraints.*** ***In the design cycle, solutions are modified on the basis of specific design criteria and constraints.*** ***A solution must meet specific design criteria and constraints before it can be implemented.***	**CHEMICAL REACTIONS** Some chemical reactions release energy (exothermic reactions), others store energy (endothermic reactions). (MS.PS1B.c) ***When a substance interacts with other substances, called chemical reactions, it sometimes releases energy and sometimes stores energy.*** ***Some reactions release energy (e.g., burning fuel in the presence of oxygen), and others require energy input (e.g., synthesis of sugars from carbon dioxide and water).*** ***Exothermic reactions release energy.*** ***Endothermic reactions absorb energy.*** **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.ETS1.C.a) ***One design may not perform the best across all tests.*** ***Identify and explain why one model is better than another.*** ***Analyze data from tests to identify how aspects of different design solutions can be modified to create a new design and a better solution.*** ***Analyze data from tests to identify how aspects of different design solutions can be combined to create a new design and a better solution.*** ***Optimization often requires making trade-offs among competing criteria.***	**ENERGY AND MATTER: FLOWS, CYCLES, AND CONSERVATION** The transfer of energy can be tracked as energy flows through a designed or natural system. ***Energy cannot be created or destroyed.*** ***Energy can be transferred.*** ***Energy flows through systems (natural and designed).***

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
	Thus, one criterion is traded off for another that is deemed more important. ***Sometimes, different designs, each of them optimized for different conditions, are needed.***	

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.

Performance Expectation *and Louisiana Connectors*
8-MS-PS3-3 Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer. ***LC-8-MS-PS3-3a Use information (e.g., graph, model) to identify a device (e.g., foam cup, insulated box) that either minimizes or maximizes thermal energy transfer (e.g., keeping liquids hot or cold).***

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Constructing explanations and designing solutions: Constructing explanations and designing solutions in 6-8 builds on K-5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. • Apply scientific ideas, principles, and/or evidence to construct, revise and/or use an explanation for real-world phenomena, examples, or events. ***Apply scientific ideas, principles, and evidence to construct an explanation of phenomena or events.*** ***Apply scientific ideas, principles, and evidence to revise an explanation of phenomena or events.*** ***Apply scientific ideas, principles, and evidence to use an explanation of phenomena or events.***	**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 measurement used to determine how fast particles are moving inside of a substance or how much energy the substance contains.*** ***The temperature of matter is a measurement of the matter's average kinetic energy.*** ***The state, amount of substance, and the type of substance will all affect the total amount of energy it has.*** **CONSERVATION OF ENERGY AND ENERGY TRANSFER** Energy is spontaneously transferred out of hotter regions or objects and into colder ones. (MS.PS3B.c) ***Energy is transferred out of hotter regions into colder ones.*** ***Energy is transferred out of hotter objects into colder ones.*** ***Heat energy transfers from warmer substances to cooler substances until they reach the same temperature.*** **DEFINING AND DELIMITING AN ENGINEERING PROBLEM** 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) ***The engineering design process begins with the identification of a problem to solve and the***	**ENERGY AND MATTER: FLOWS, CYCLES, AND CONSERVATION** The transfer of energy can be tracked as energy flows through a designed or natural system. ***Energy can be transferred.*** ***Energy flows through systems (natural and designed).***

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
	specification of criteria, that the final product or system must meet. ***Define a design problem that can be solved through consideration of potential impacts on people and the environment, and scientific or other issues that are relevant to the problem.*** ***Engineering design is guided by criteria and constraints.*** 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) ***Design solutions must be tested.*** ***Tests are often designed to identify failure points or difficulties.*** ***Testing a solution involves investigating how well it performs under a range of likely conditions.*** ***Solutions are modified on the basis of the test results.*** ***Different solutions can be combined to create a better solution.*** ***Designing solutions to problems is a systematic process.*** ***There are many types of models.*** ***Models can be used to investigate how a design might work.*** ***Models allow the designer to better understand the features of a design problem.***	

Clarification Statement
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.

Performance Expectation *and Louisiana Connectors*
8-MS-PS3-5 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. ***LC-8-MS-PS3-5a Using information from graphical displays of data and models, describe the change in the kinetic energy of an object as energy transferred to or from an object.***

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Engaging in argument from evidence: Engaging in argument from evidence in 6-8 builds on K-5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s). • Construct, use, and/or present 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. ***Construct an argument to support or refute an explanation, model, or solution to a problem.*** ***Use an argument to support or refute an explanation, model, or solution to a problem.*** ***Present an argument to support or refute an explanation, model, or solution to a problem.***	**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) ***Mechanical energy comes from the motion (kinetic energy) and position (potential energy) of objects.*** ***Potential energy transforms into kinetic energy (e.g., a book sitting on a counter is at rest, it has potential energy. If a person knocks the book off of the counter, the book has kinetic energy as it falls, because it is in motion and the potential energy has transformed into kinetic energy).*** ***A decrease of one form of energy is accompanied by an increase in one or more other forms of energy and vice versa.*** ***Energy may transfer into or out of a system and it may change forms, but the total energy cannot change.*** ***Within a system, the change in stored energy is always balanced by a change in total kinetic energy.***	**ENERGY AND MATTER** Energy may take different forms (e.g., energy in fields, thermal energy, energy of motion). ***Different forms of energy (e.g., energy in fields, thermal energy, energy of motion) exist.*** ***Energy is transformed from one form of energy to another.***

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.

Performance Expectation ***and Louisiana Connectors***
8-MS-ESS1-4 Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's geologic history. ***LC-8-MS-ESS1-4a Sequence the relative order of events from Earth's history shown by rock strata and patterns of layering (organize was more complex as a task/term than sequence).***

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Constructing explanations and designing solutions: Constructing explanations and designing solutions in 6-8 builds on K-5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. • Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. ***Obtain evidence from valid and reliable sources.*** ***Construct a scientific explanation based on evidence.*** ***Construct a scientific explanation based on the assumption that theories and laws that describe the***	**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) ***Past geological events and environments can be reconstructed by interpreting rock strata.*** ***Earth's history is documented in the chronological order of its layers of rock. However, this ordering is not able to provide absolute dates.*** ***Absolute dating is a method of estimating the age of a rock sample in years via radiometric techniques.*** ***Scientists use relative dating and fossil evidence to correlate sedimentary rock sequences.*** ***Relative dating is a scientific process of evaluation used to determine the relative order of past events, but does not determine the absolute age of an object.*** Scientists use data from radioactive dating techniques to estimate the age of Earth's materials. (MS.ESS1C.b) ***Most elements are stable.*** ***Some elements exist in forms that are unstable.*** ***Over time these elements breakdown or decay by releasing particles and energy.*** ***This process is called radioactive decay.*** ***Scientists use the rate at which these elements decay to calculate a rock's age.*** ***Scientists use radioactive elements as natural clocks for determining ages of certain types of rocks.***	**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. ***Phenomena can be observed at different scales (micro and macro) in a system.*** ***Phenomena can be studied using models.*** ***Models can be used to explain time, space, and energy phenomena.***

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
natural world operate today as they did in the past.		

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.

Performance Expectation *and Louisiana Connectors*
8-MS-ESS2-1 Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process. ***LC-8-MS-ESS2-1a Identify relationships between components in a model showing the cycling of energy flows and matter within and among Earth's systems, including the sun and Earth's interior as primary energy sources.***

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Developing and using models: Modeling in 6-8 builds on K-5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. • Develop and/or use a model to predict and/or describe phenomena. ***Models can be used to describe phenomena.*** ***Models can be used to predict phenomena.***	**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) ***Energy and matter cycle throughout our planet.*** ***The energy which drives these processes is derived from the sun and Earth's hot interior.*** ***Transfers of energy and movements of matter cause physical and chemical changes to occur in Earth's materials and organisms.*** ***The four spheres of the Earth are the atmosphere, the biosphere, the hydrosphere and the lithosphere.*** ***Earth's four spheres interact as part of a dynamic system in which changes over time are the result of external and internal energy sources.***	**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. ***Stability is a condition in which some aspects of a system (natural or designed) are unchanging.*** ***Change can be observed at different scales (large and small/atomic) in a system.***

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.

Performance Expectation *and Louisiana Connectors*
8-MS-ESS2-2 Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. ***LC-8-MS-ESS2-2a Identify examples of processes to explain that change Earth's surface at varying time and spatial scales that can be large (e.g., plate motions) or small (e.g., landslides).***

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Constructing explanations and designing solutions: Constructing explanations and designing solutions in 6-8 builds on K-5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. • Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. ***Obtain evidence from valid and reliable sources.*** ***Construct a scientific explanation based on evidence from readings, diagrams, charts, and/or tables.*** ***Construct a scientific explanation based on the assumption that the***	**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) ***Earth's systems are dynamic.*** ***Earth's systems interact over a wide range of temporal (fractions of a second to billions of years) and spatial (microscopic to global) scales.*** ***Earth's systems, microscopic to global in size, have cycles that interact with each other.*** ***Most changes occur gradually, but larger and rapid catastrophic events (e.g., volcanic eruptions, earthquakes, hurricanes) also account for changes to Earth's surface.*** ***These processes and their interactions have shaped and will continue to shape the Earth.*** ***Some satellites allow scientists to observe, over time, large-scale changes in the geosphere.*** **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) ***Sedimentary rocks are formed through the processes of weathering, erosion, and deposition.*** ***Erosion shapes rock particles.*** ***Erosion shapes and reshapes the land surface (e.g., coastal erosions land loss).*** ***Over time, microscopic particle movement that takes place during weathering and erosion by the water cycle's continuous movement change the land's surface features (e.g., deposition by the movement of water, ice and wind).***	**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. ***Phenomena can be observed at different scales (micro and macro) in a system.*** ***Phenomena can be studied using models.*** ***Models can be used to explain time, space, and energy phenomena.***

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
natural world operates today as they did in the past.	***Over time, the water cycle's continuous movement create underground formations (e.g., aquifers).***	

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.

Performance Expectation *and Louisiana Connectors*
8-MS-ESS2-3 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. ***LC-8-MS-ESS2-3a Using graphical displays of data, identify how the shapes of the continents (e.g., fit like a jigsaw puzzle) and fossil comparisons (e.g., fit together) along the edges of continents to demonstrate lithospheric plate movement.***

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Analyzing and interpreting data: Analyzing data in 6-8 builds on K-5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. • Analyze and interpret data to provide evidence for phenomena. ***Interpret data to provide evidence for phenomena.*** ***Analyze data to provide evidence for phenomena.***	**THE HISTORY OF PLANET EARTH** Tectonic processes continually generate new ocean sea floor at ridges and destroy old sea floor at trenches. (MS.ESS1C.c) ***Tectonic processes cause the movement of Earth's plates and sea floor spreading.*** ***Large plates of Earth's surface have moved and continue to move due to natural forces in the Earth's interior.*** ***These movements generate new ocean sea floor at mid-ocean ridges.*** ***These movements destroy old ocean floor at trenches (e.g., subduction zones) as plates overlap or pull away from each other.*** ***In sea floor spreading, molten material forms new rock along the mid-ocean ridge.*** ***All subducted plates are oceanic, which keeps the ocean floor in a constant stat e of change; whereas, the continents change much more slowly in geologic tim e.*** **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) ***The theory of plate tectonics explains plate movements and how they cause continental drift.*** ***Scientist believe that at one time the continents were connected and then grad***	**PATTERNS** Patterns in rates of change and other numerical relationships can provide information about natural and human designed systems. ***Patterns in rates of change can provide information about systems (natural and designed).*** ***Patterns in numerical relationships can provide information about systems (natural and designed).***

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
	ually separated by lithospheric plate movement. ***The shapes of the continents (fit like a jigsaw puzzle) demonstrate lithospheric plate movement.*** ***Evidence of the continents being connected include the shapes of the continent s, and fossil and rock similarities from continents no longer connected.*** ***Fossil comparisons along the edges of continents demonstrate lithospheric plate movement.*** ***Data analysis, including maps, the distribution of fossils and rocks, continental shapes, and sea floor spreading provide evidence of past plate motion.***	

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).

Performance Expectation *and Louisiana Connectors*
8-MS-ESS3-1 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. ***LC-8-MS-ESS3-1a Identify explanations of the uneven distributions of Earth's minerals, energy, and groundwater resources due to past and current geoscience processes or by removal of resources.***

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Constructing explanations and designing solutions: Constructing explanations and designing solutions in 6-8 builds on K-5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. • Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. ***Obtain evidence from valid and reliable sources.*** ***Construct a scientific explanation based on evidence.*** ***Construct a scientific explanation based on the assumption that theories and laws that describe the***	**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) ***Humans rely on natural resources from the Earth to meet their ever changing needs.*** ***Many of these resources are not renewable or replaceable over a human lifetime.*** ***Some natural resources, called renewable resources, are naturally replaced in a relatively short time.*** ***Natural resources that are not replaced as they are used are called non-renewable resources.*** ***Natural resources occur all around the world, but are not distributed evenly.*** ***In some locations on Earth, where geological processes have concentrated resources, they may be readily available.*** **LOUISIANA'S NATURAL RESOURCES** Non-renewable resources such as our state's fossil fuels are vast but limited. (MS.EVS1A.b) ***Louisiana has a variety of natural resources that are important for human life.*** ***Non-renewable resources, like the state's fossil fuels we burn for energy, are not replaceable over human lifetimes.***	**CAUSE AND EFFECT** Cause and effect relationships may be used to predict phenomena in natural or designed systems. ***Cause and effect relationships may be used to predict phenomena.***

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
natural world operate today as they did in the past.		

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).

Performance Expectation ***and Louisiana Connectors***
8-MS-ESS3-2 Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects. ***LC-8-MS-ESS3-2a Use maps, charts, and images of natural hazards to look for patterns in past occurrences of catastrophic events in each of two regions to predict which location may receive a future similar catastrophic event.*** ***LC-8-MS-ESS3-2b Identify technologies that mitigate the effects of natural hazards (e.g., the design of buildings and bridges to resist earthquakes, storm shelters for tornados, levees along rivers to prevent flooding).***

Science and Engineering Practice	**Disciplinary Core Idea**	**Crosscutting Concept**
Analyzing and interpreting data: Analyzing data in 6-8 builds on K-5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. • Analyze and interpret data to provide evidence for phenomena. ***Interpret data to provide evidence for phenomena.*** ***Analyze data to provide evidence for phenomena.***	**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) ***Natural processes can cause sudden or gradual changes to Earth's systems.*** ***Natural hazards such as earthquakes, tsunamis, volcanic eruptions, severe weather, floods, and coastal erosion, adversely affect humans.*** ***Studying patterns of natural hazards allow scientists to assess potential risks so preparations can be made to minimize the hazards.*** ***By mapping the natural events in an area and understanding the geological forces involved, future events can be predicted.*** ***While humans cannot eliminate natural hazards, they can take steps to reduce their impacts.***	**PATTERNS** Graphs, charts, and images can be used to identify patterns in data. ***Graphs can be used to identify patterns.*** ***Charts can be used to identify patterns.*** ***Images can be used to identify patterns.***

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).

Performance Expectation *and Louisiana Connectors*
8-MS-ESS3-3 Apply scientific principles to design a method for monitoring and minimizing human impact on the environment. ***LC-8-MS-ESS3-3 Using data from a design solution for minimizing a human impact on the environment, identify limitations of the solution.***

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Constructing explanations and designing solutions: Constructing explanations and designing solutions in 6-8 builds on K-5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. • Apply scientific ideas or principles to design, construct, and/or test a design of an object, tool, process or system. ***To design an object, tool, process or system, scientists and engineers use scientific ideas and principles.*** ***To construct an object, tool, process or system, scientists and engineers use scientific ideas and principles.*** ***In science and engineering, a design plan includes testing an object, tool, process or system.***	**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) ***People can harm Earth's resources in a variety of ways (e.g., polluting, deforestation, overhunting, wasting water, and electricity, etc.).*** ***The growth in human activities is stretching natural resources to their limit.*** ***This may have a negative impact on Earth unless actions are taken to mitigate this impact.*** ***Some changes to Earth's environment can have a positive impact for living things.*** 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) ***As the human population grows, so does the consumption of natural resources.*** ***As the human population grows, so do the human impacts on the planet.*** ***Some negative effects of human activities are reversible using technology.*** **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)	**CAUSE AND EFFECT** Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation. When describing relationships in science, sometimes one event or effect is the direct result of another event or effect; this is a causal relationship. ***When describing relationships in science, sometimes two events or effects can be described by the strength (e.g., strong or weak) of their relationship; this is a correlational relationship.*** ***When there is a correlation between events or effects, it does***

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
	Design solutions must be tested. *Tests are often designed to identify failure points or difficulties.* *Testing a solution involves investigating how well it performs under a range of likely conditions.* *Solutions are modified on the basis of the test results.* *Different solutions can be combined to create a better solution.* *Designing solutions to problems is a systematic process.* *There are many types of models.* *Models can be used to investigate how a design might work.* *Models allow the designer to better understand the features of a design problem.*	*not automatically mean that one event or effect is the direct result of another event or effect.*

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).

Performance Expectation *and Louisiana Connectors*
8-MS-LS1-4 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. ***LC-8-MS-LS1-4a Identify behaviors animals engage in (e.g., vocalization) that increase the likelihood of reproduction.*** ***LC-8-MS-LS1-4b Identify specialized plant structures (e.g., bright flower parts) that increase the likelihood of reproduction.***

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Engaging in argument from evidence: Engaging in argument from evidence in 6-8 builds on K-5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s). • Construct, use, and/or present 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. ***Use empirical evidence to construct an argument.*** ***Use empirical evidence to support an argument.*** ***Use scientific reasoning to construct an argument.*** ***Use scientific reasoning to support an argument.*** ***Use an argument to support a***	**GROWTH AND DEVELOPMENT OF ORGANISMS** Animals engage in characteristic behaviors that increase the odds of reproduction. (MS.LS1B.c) ***Animals typically have behaviors that increase their likelihood to survive and reproduce.*** ***A stimulus is a signal that causes an organism to react in some way.*** ***A response is an organism's reaction to the stimulus.*** ***An animals response may include external actions, internal changes (e.g., increased heartrate), or both.*** ***There are similarities and differences in how organisms respond to stimuli.*** Plants (flowering and non-flowering) reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction. (MS.LS1B.d) ***Plants reproduce in a variety of ways.*** ***Some plants rely on animals to survive and reproduce, such as brightly colored flowers to attract pollinators.*** Group behavior has evolved because membership can increase the chances of survival for individuals and their genetic relatives. (MS.LS2D.a) ***There is usually some advantage to living in a group.*** ***Animals form groups which increase their likelihood to survive and reproduce.*** ***In herds, some may watch for danger while others feed.*** ***Animals in groups communicate information (e.g., food sources, danger, defending themselves) to each other.***	**CAUSE AND EFFECT** Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. ***Phenomena may have more than one cause.*** ***Some cause and effect relationships in systems can only be described using probability.*** ***Some cause and effect relationships are complex and can only be predicted using probabilities.***

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
model for a phenomena. ***Use an argument to refute a model for a phenomena.*** ***Use an argument to support a solution to a problem.*** ***Use an argument to refute a solution to a problem.***	***Some animal groups migrate to an area that provides abundant food, or a favorable place for reproduction, or both.***	

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.

Performance Expectation ***and Louisiana Connectors***
8-MS-LS1-5 Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms. ***LC-8-MS-LS1-5a Identify a scientific explanation for how environmental factors (e.g., availability of light, space, water, size of habitat) affect the growth of animals and plants.*** ***LC-8-MS-LS1-5b Identify a scientific explanation for how genetic factors (e.g., specific breeds of plants and animals and their typical sizes) affect the growth of animals and plants.***

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Constructing explanations and designing solutions: Constructing explanations (science) and designing solutions (engineering) in 6-8 builds on K-5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. • Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. ***Construct a scientific explanation based on evidence.*** ***Construct a scientific explanation based on the assumption that theories and laws that describe the***	**GROWTH AND DEVELOPMENT OF ORGANISMS** Genetic factors as well as local conditions affect the growth of the adult plant. (MS.LS1B.e) ***Environmental factors (e.g., availability of light, space, water, size of habitat) affect the growth of plants.*** ***Genetic factors (e.g., specific breeds of plants) affect the growth of plants.*** ***Genetic factors as well as local conditions affect the size of the adult plant.***	**CAUSE AND EFFECT** Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. ***Phenomena may have more than one cause.*** ***Some cause and effect relationships in systems can only be described using probability.*** ***Some cause and effect relationships are complex and can only be predicted using probabilities.***

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
natural world operate today as they did in the past.		

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.

Performance Expectation *and Louisiana Connectors*
8-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. ***LC-8-MS-LS3-1a Use a model to explain how genetic variations in specific traits may occur as organisms pass on their genetic material from one generation to the next, along with small changes.***

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Developing and using models: Modeling in 6-8 builds on K-5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. • Develop and/or use a model to predict and/or describe phenomena. ***Models can be used to describe phenomena.*** ***Models can be used to predict phenomena.***	**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) ***In sexual reproduction after the egg is fertilized, each of the new cells in the developing organism receives an exact copy of the genetic information contained in the nucleus of a fertilized egg.*** ***Chromosomes are found in the nucleus of the cell and contain genes that are made of DNA.*** ***Inherited traits of individuals are controlled by genes.*** ***Each cell contains two variants of each chromosome, one inherited from each parent.*** ***An allele is defined as one of a pair of genes that appear at a particular location on a particular chromosome.*** ***Each gene 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. (MS.LS3A.b) ***Mutations occur randomly.*** ***Mutations can introduce variations in traits.*** ***Mutations can affect structures and resulting functions of the organism's trait characteristics.*** **VARIATION OF TRAITS** In addition to variations that arise from sexual reproduction, genetic information can be	**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. ***Complex structures can be visualized.*** ***Microscopic structures can be visualized.*** ***Complex structures can be modeled.*** ***Microscopic structures***

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
	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. (MS.LS3B.b) ***Alternative versions of genes (different alleles) account for variations in inherited characteristics.*** ***Traits that have changed can be passed from parent to offspring.*** ***Mutations can be inherited.*** ***Mutations can be harmful, neutral, or an advantage for an organism.***	***can be modeled.*** ***The function of a structure depends on its shape.*** ***The function of a structure depends on its composition.*** ***The function of a structure depends on relationships among its parts.*** ***Designed structures/systems can be analyzed to determine how they function.***

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.

Performance Expectation ***and Louisiana Connectors***
8-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. ***LC-8-MS-LS4-1a Use data to identify that fossils of different animals that lived at different times are placed in chronological order (i.e., fossil record) and located in different sedimentary layers.***

Science and Engineering Practice	**Disciplinary Core Idea**	**Crosscutting Concept**
Analyzing and interpreting data: Analyzing data in 6-8 builds on K-5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. • Analyze and interpret data to determine similarities and differences in findings. ***Use data to determine similarities in findings.*** ***Use data to determine differences in findings.***	**EVIDENCE OF COMMON ANCESTRY AND DIVERSITY** Genetic information provides evidence of evolution. DNA sequences vary among species, but there are many overlaps; in fact, the ongoing branching that produces multiple lines of descent can be inferred by comparing the DNA sequences of different organisms. Such information is also derivable from the similarities and differences in amino acid sequences and from observable anatomical and embryological evidence. (HS.LS4A.a) ***All living organisms on earth show tremendous differences of form and function.*** ***Scientists can compare DNA sequences to determine how species are related.*** ***Scientists can compare protein (i.e., amino acid) sequences to determine how species are related.*** ***Genetic information varies among species, but there are many overlaps.*** ***Similarities in DNA sequences, anatomical structure, and embryonic development can serve as evidence of evolution.*** ***Genetic information, similar structures, embryological development, and fossil evidence support hypotheses of common ancestry.***	**PATTERNS** Graphs, charts, and images can be used to identify patterns in data. ***Graphs can be used to identify patterns.*** ***Charts can be used to identify patterns.*** ***Images can be used to identify patterns.***

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.

Performance Expectation ***and Louisiana Connectors***
8-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 evolutionary relationships. ***LC-8-MS-LS4-2a Recognize that similarities and differences in external structures can be used to infer evolutionary relationships between living and fossil organisms.*** ***LC-8-MS-LS4-2b Identify an explanation of the evolutionary relationships between modern and fossil organisms.***

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Constructing explanations and designing solutions: Constructing explanations (science) and designing solutions (engineering) in 6-8 builds on K-5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. • Apply scientific ideas, principles, and/or evidence to construct, revise and/or use an explanation for real-world phenomena, examples, or events. ***Apply scientific ideas to construct an explanation of phenomena or events.*** ***Apply scientific principles to construct an explanation of phenomena or events.*** ***Apply scientific evidence to construct an explanation of phenomena or events.***	**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) ***By comparing modern-day organisms to organisms of the past, scientist can infer how closely related they are in an evolutionary sense (e.g., comparing pictures of an ape, caveman, and human).*** ***The Earth's present day species evolved from earlier, distinctly different species.*** ***Similarities and differences in anatomical structures between living organisms and extinct organisms can serve as evidence of evolution.*** ***Similarities and differences in anatomical structures between living organisms (e.g., skulls of modern crocodiles, skeletons of birds, features of modern whales and elephants) and extinct organisms (e.g., skulls of fossilized crocodiles and fossilized dinosaurs) can show lines of evolutionary descent.*** ***More recently deposited rock layers are more likely to contain fossils resembling existing species.*** Comparison of the embryological development of different species also reveals similarities that show relationships not evident in the fully-formed anatomy. (MS.LS4A.c) ***Similarities in embryonic development can serve as evidence of the relatedness of different species.*** ***Similarities in early development stages are evidence that species are related and shared a common ancestor.***	**PATTERNS** Patterns can be used to identify cause and effect relationships. ***Scientists use patterns to identify cause and effect relationships.*** ***Identify causes and effects of different phenomena.***

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Apply scientific ideas to revise an explanation of phenomena or events. *Apply scientific principles to revise an explanation of phenomena or events.* *Apply scientific evidence to revise an explanation of phenomena or events.* *Apply scientific ideas to use an explanation of phenomena or events.* *Apply scientific principles to use an explanation of phenomena or events.* *Apply scientific evidence to use an explanation of phenomena or events.*		

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.

Performance Expectation *and Louisiana Connectors*
8-MS-LS4-3 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. ***LC-8-MS-LS4-3a Identify patterns (i.e., pictorial displays, representations, data) in the embryological development as evidence of relationships among species.***

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Analyzing and interpreting data: Analyzing data in 6-8 builds on K-5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. • Construct, analyze, and/or interpret graphical displays of data and/or large data sets to identify linear and nonlinear relationships. ***Use graphical display of data to define the meaning of linear relationships.*** ***Use graphical display of data to define the meaning of nonlinear relationships.*** ***Use graphical displays of data to identify linear relationships.*** ***Use graphical displays of data to identify nonlinear relationships.*** ***Use large data sets to identify***	**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) ***By comparing modern-day organisms, scientists can infer how closely related they are in an evolutionary sense.*** ***The Earth's present day species evolved from earlier, distinctly different species.*** ***Similarities and differences in anatomical structures between living organisms and extinct organisms can serve as evidence of evolution.*** ***Similarities and differences in anatomical structures between living organisms and extinct organisms can show lines of evolutionary descent.*** ***More recently deposited rock layers are more likely to contain fossils resembling existing species.*** Comparison of the embryological development of different species also reveals similarities that show relationships not evident in the fully-formed anatomy. (MS.LS4A.c) ***Similarities in embryonic development can serve as evidence of the relatedness of different species.*** ***Similarities in early development stages are evidence that species are related and shared a common ancestor.***	**PATTERNS** Graphs, charts, and images can be used to identify patterns in data. ***Graphs can be used to identify patterns.*** ***Charts can be used to identify patterns.*** ***Images can be used to identify patterns.***

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
linear relationships. ***Use large data sets to identify nonlinear relationships.***		

Clarification Statement
Emphasis is on inferring general patterns of relatedness among embryos of different organisms by comparing the macroscopic appearance of diagrams or pictures.

Performance Expectation *and Louisiana Connectors*
8-MS-LS4-6 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. ***LC-8-MS-LS4-6a Analyze numerical data sets that represent a proportional relationship between some change in the environment and corresponding changes in genetic variation (i.e., traits) over time.***

Science and Engineering Practice	**Disciplinary Core Idea**	**Crosscutting Concept**
Using mathematics and computational thinking: Mathematical and computational thinking in 6-8 builds on K-5 experiences and progresses to identifying patterns in large data sets and using mathematical concepts to support explanations and arguments. • Use mathematical representations to describe and/or support scientific conclusions and design solutions. ***Use mathematical representations to describe scientific conclusions.*** ***Use mathematical representations to support scientific conclusions.*** ***Use mathematical representations to describe design solutions.*** ***Use mathematical representations to support design solutions.***	**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) ***Some organisms in a population exhibit traits and behaviors that will favor their chance to survive and reproduce.*** ***Adaptations are the favorable traits and behaviors, which allow an organism to survive in its environment.*** ***Adaptation by natural selection leads to more organisms in a population with traits that favor the chance to survive and reproduce.*** ***Inherited traits that aid survival and reproduction are much more likely to become common in a population, than traits that don't aid survival.*** ***Species acquire many of their unique characteristics through biological adaptations, which involve the selection of naturally occurring variations in populations.*** ***These organisms reproduce, develop, have predictable life cycles, and pass on heritable traits to their offspring.***	**CAUSE AND EFFECT** Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. ***Phenomena may have more than one cause.*** ***Some cause and effect relationships in systems can only be described using probability.*** ***Some cause and effect relationships are complex and can only be predicted using probabilities.***

Clarification Statement
Emphasis is on using mathematical models, probability statements, and proportional reasoning to support explanations of trends in changes to populations over time. Students should be able to explain trends in data for the number of individuals with specific traits changing over time.