Core Content Connectors (CCCs) linked to the
*2024 South Dakota Science Standards – Middle School (Grades 6-8)*

## How to Read the Grade Level Core Content Connectors

The South Dakota Science Core Content Connectors (CCCs) are alternate academic achievement standards (AAAS) for students with the most significant cognitive disabilities. They are intended to promote access to grade level content standards by pinpointing the big ideas and concepts of the *2024 South Dakota Science Standards*. 2The CCCs reflect rigorous science expectations and opportunities for students to learn essential science concepts and procedures given guidance from peers and adults, so that all students can engage in sophisticated science and engineering practices.

As shown in the illustration below, each set of CCCs has a title. The title reveals the organization of the CCCs, which is based on the disciplinary core ideas (DCIs) from the *Framework for K-12 Science Education*. Below the title is the corresponding South Dakota Science Standard. Below the standard are the specific CCCs (listed left to right) to address the science and engineering practices (SEPs), disciplinary core ideas, and crosscutting concepts that, when combined, address the "big idea" of the South Dakota science standard above.

**Science and Engineering Practices**. The blue shaded text on the left includes the CCC for the science and engineering practices used to address the South Dakota science standard listed above. The bold headings are derived from the eight categories detailed in the *Framework for K-12 Science Education*.

**Disciplinary Core Ideas**. The orange shaded text in the middle includes the CCCs to address the South Dakota science standard listed above. The CCCs are arranged by bold headings representing how the core ideas in the *Framework for K-12 Science Education* are divided into a total of 39 sub-ideas representing the 11 core ideas: four in Life Science, four in Physical Science, and three in Earth and Space Science. The CCCs represent what students should understand about that sub-idea at the end of the grade. The CCCs are bulleted to be certain that each statement is distinct.

**Crosscutting Concepts**. The green shaded text on the right includes the CCCs to address the South Dakota science standard listed above. The CCCs are arranged by bold headings which are derived from the seven categories detailed in the *Framework for K-12 Science Education*.

| **Grade. Title** | | |
|---|---|---|
| **South Dakota Science Standard Code**. South Dakota science standard descriptor. | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Planning and Carrying Out Investigations**<br>With guidance and support from peers and adults, investigate … | **PS2.A: Forces and Motion**<br>• Recognize that … | **Cause and Effect**<br>With guidance and support from peers and adults, compare the effect … |

Core Content Connectors (CCCs) linked to the
*2024 South Dakota Science Standards* – Physical Science (Grades 6-8)

**Middle School Physical Science Conceptual Understanding*:**

| **MS-PS1 Matter and Its Interactions** | | |
|---|---|---|
| **MS-PS1-1**. Develop models to describe the atomic composition of simple molecules and extended structures. | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Developing and Using Models**<br>Work with peers to identify the relevant components of the atomic composition of simple molecules and pure substances, and use models to describe molecules of different types of atoms that are attracted to each other to form extended structures (e.g., sugar, nylon). | **PS1.A: Structure and Properties of Matter**<br>• Identify a model that shows an atom's nucleus as made of protons and neutrons, and is surrounded by electrons.<br>• Identify a model that shows individual atoms of the same or different types that repeat to form extended structures (e.g., sodium chloride). | **Scale, Proportion, and Quantity**<br>Work with peers to describe relationships between components of the model (i.e., individual atoms to atoms combined to form molecules, which can be made up of the same type or different types of atoms). |

| **MS-PS1 Matter and Its Interactions** | | |
|---|---|---|
| **MS-PS1-2**. Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred. | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Analyzing and Interpreting Data**<br>Work with peers to organize given data about the characteristic physical and chemical properties (e.g., density, melting point, boiling point, solubility, flammability, odor) of pure substances before and after they interact to determine whether a chemical reaction has occurred. | **PS1.B: Chemical Reactions**<br>• Identify evidence that proves a chemical reaction has taken place (e.g., change in color occurs, gas is created, heat or light is given off or taken in). | **Patterns**<br>Work with peers to use data to identify patterns (i.e., similarities and differences), including the changes in physical and chemical properties of each substance before and after the interaction. |

| **MS-PS1 Matter and Its Interactions** |
|---|

**MS-PS1-3**. Obtain and evaluate information to describe that synthetic materials come from natural resources and impact society.

| Science and Engineering Practices<br>Core Content Connectors | Disciplinary Core Ideas<br>Core Content Connectors | Crosscutting Concepts<br>Core Content Connectors |
|---|---|---|
| **Obtaining, Evaluating, and Communicating Information**<br>Work with peers to gather information (e.g., text, media, visual displays, data) about synthetic materials and the natural resources from which they are derived. | **PS1.A: Structure and Properties of Matter**<br>• Compare and contrast characteristics of natural and synthetic materials (e.g., fibers) from provided information (e.g., text, media, visual displays, data).<br>**PS1.B: Chemical Reactions**<br>• Identify substances that react chemically in characteristic ways.<br>• Identify 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. | **Structure and Function**<br>Work with peers to describe the chemical processes used to create synthetic materials from natural resources and the use of synthetic resources in society (e.g., how the synthetic material satisfies a societal need through the properties of its structure and function). |

**MS-PS1 Matter and Its Interactions**

**MS-PS1-4**. Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.

| Science and Engineering Practices<br>Core Content Connectors | Disciplinary Core Ideas<br>Core Content Connectors | Crosscutting Concepts<br>Core Content Connectors |
|---|---|---|
| **Developing and Using Models**<br>Work with peers to develop a model to identify particles, including their motion, the system within which the particles are contained, the temperature of the system, and the state of matter of the pure substance (i.e., solid, liquid, gas). | **PS1.A: Structure and Properties of Matter**<br>• Identify that adding or removing thermal energy increases or decreases particle motion until a change of state occurs using drawings or diagrams. | **Cause and Effect**<br>Work with peers to identify the cause and effect relationship of what happens when thermal energy is transferred into a system. |

| **MS-PS1 Matter and Its Interactions** | | |
|---|---|---|
| **MS-PS1-5**. 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. | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Developing and Using Models**<br>Work with peers to develop a model to identify the types and number of molecules that make up the reactants and products. | **PS1.B: Chemical Reactions**<br>• Identify a chemical reaction in which the mass of the reactants is shown to be equal to the mass of the products.<br>• Identify a chemical reaction in which the total number of atoms does not change. | **Energy and Matter**<br>Work with peers to use the model to show that mass is conserved during chemical reactions because the number and types of atoms that are in the reactants equal the number and types of atoms that are in the products. |

| **MS-PS1 Matter and Its Interactions** | | |
|---|---|---|
| **MS-PS1-6**. Design, construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes. Alignment may include 6-8 ETS1-2; ETS1-3; 6-8ETS1-4 | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Constructing Explanations and Designing Solutions**<br>Work with peers to identify how the transfer of thermal energy between the device and other components within the system will solve the given problem. | **PS1.B: Chemical Reactions**<br>• 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.<br>**ETS1.B: Developing Possible Solutions**<br>• Identify a device that either releases or absorbs thermal energy by chemical processes.<br>**ETS1.C: Optimizing the Design Solution**<br>• Identify similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success. | **Energy and Matter**<br>Work with peers to identify the components within the system related to a design solution (i.e., components within the system to or from which energy will be transferred to solve the problem). |

| **MS-PS2 Motion and Stability: Forces and Interactions** | | |
|---|---|---|
| **MS-PS2-1**. Design a solution to a problem involving the motion of two colliding objects that illustrates Newton's Third Law. Alignment may include 6-8 ETS1-1 | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Constructing Explanations and Designing Solutions**<br>Work with peers to describe the force that will be exerted by one of the colliding objects before or after the collision in a problem involving two objects. | **PS2.A: Forces and Motion**<br>• Describe the motion of two colliding objects in terms of the strength of the force relationship of action and reaction forces given a model or scenario.<br>• Develop a solution to a problem involving the motion of two colliding objects.<br>**ETS1.B: Developing Possible Solutions**<br>• Identify a solution involving the motion of two colliding objects that illustrates Newton's Third Law. | **Systems and System Models**<br>Work with peers to develop a model using Newton's Third Law to explain action-reaction force pairs (e.g., air pushing back on a bird's wings with equal force that propels the bird forward; how a bathroom scale indirectly indicates a person's weight; size of the force on the road equals the size of the force on the wheels of a car). |

| **MS-PS2 Motion and Stability: Forces and Interactions** | | |
|---|---|---|
| **MS-PS2-2**. Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object. | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Planning and Carrying Out Investigations**<br>Work with peers to collect data on the motion of an object, the total forces acting on the object, and the mass of the object to support a claim related to the object's motion. | **PS2.A: Forces and Motion**<br>• Recognize, using provided data, that a change in an object's motion is due to the mass of an object and the forces acting on that object. | **Stability and Change**<br>Work with peers to explain that less force is required to change the motion of smaller objects and more force is required to change the motion of larger objects. |

| **MS-PS2 Motion and Stability: Forces and Interactions** | | |
|---|---|---|
| **MS-PS2-3**. Ask questions about data to determine the factors that affect the strength of electric and magnetic forces. | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Asking Questions and Defining Problems**<br>Work with peers to answer questions about how the orientation of magnets affects the direction of the magnetic force (i.e., opposites attract and likes repel). | **PS2.B: Types of Interactions**<br>• Identify that electricity can be used to make magnetism, or magnetism can be used to make electricity.<br>• Examine data of objects (e.g., a model that demonstrates that a piece of metal, when magnetized by electricity, can pick up many times its own weight) to identify cause and effect relationships that affect electromagnetic forces. | **Cause and Effect**<br>Work with peers to illustrate the cause-and-effect relationship that affects magnetic forces due to the distance between objects or the cause and effect relationship that affects electric forces due to the magnitude of the electric charges on the interacting objects. |

| **MS-PS2 Motion and Stability: Forces and Interactions** | | |
|---|---|---|
| **MS-PS2-4**. Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects. | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Engaging in Argument from Evidence**<br>Work with peers, using evidence, to support the claim that gravity applies a greater force on massive objects than on less massive objects despite falling at equal rates. | **PS2.B: Types of Interactions**<br>• Compare the magnitude of gravitational force on interacting objects of different mass (e.g., the Earth and the sun) using a chart displaying the mass of those objects and the strength of interaction. | **Systems and System Models**<br>Work with peers to interpret data (e.g., charts displaying mass, strength of interaction, distances) leading to a relationship between mass and distance on the force of gravity (i.e., more massive objects exert a stronger pull than less massive objects and objects at greater distances exert less pull than closer objects). |

| **MS-PS2 Motion and Stability: Forces and Interactions** | | |
|---|---|---|
| **MS-PS2-5**. Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other when the objects are not in contact. | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Planning and Carrying Out Investigations**<br>Work with peers to investigate to show that a magnetic field exists (e.g., how magnetic forces depend on the magnitude of the magnetic strengths involved and the distances between the interacting objects). | **PS2.B: Types of Interactions**<br>• Evaluate the change in the strength of a force (i.e., electric and magnetic) using data regarding the cause of a force on one object mapped by its effect on a test object. | **Cause and Effect**<br>Work with peers to describe the rationale for why the investigation plan includes changing the strength of the magnetic or electric field and changing the distance between objects. |

| **MS-PS3 Energy** | | |
|---|---|---|
| **MS-PS3-1**. Construct and analyze graphical displays of data to describe the relationships of kinetic energy to the mass and to the speed of an object. | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Analyzing and Interpreting Data**<br>Work with peers to construct graphical displays to describe that kinetic energy increases if either, or both, the mass or the speed of the object increases, or decreases if the either, or both, the mass or the speed of the object decreases. | **PS3.A: Definitions of Energy**<br>• Describe the relationship of kinetic energy to the mass of an object and to the speed of an object by interpreting graphical displays of data. | **Scale, Proportion, and Quantity**<br>Work with peers to identify the linear proportional relationship between kinetic energy and mass (i.e., kinetic energy doubles as the mass of the object doubles) and the non-linear proportional relationship between kinetic energy and speed (i.e., kinetic energy quadruples as the speed of the object doubles). |

| **MS-PS3 Energy** | | |
|---|---|---|
| **MS-PS3-2**. Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system. | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Developing and Using Models**<br>Work with peers to develop a model (e.g., representations, diagrams, pictures) involving two objects interacting at a distance (i.e., the interacting objects, forces, distance between the objects, and potential energy) and describe relationships between components. | **PS3.A: Definitions of Energy**<br>• Describe, using models, how changing distance changes the amount of potential energy stored in the system (e.g., carts at varying positions on a hill). | **Systems and System Models**<br>Work with peers to use the model to show how the amount of potential energy in a system of objects changes when the distance between stationary objects interacting in the system changes (i.e., a force must be applied to move two attracting objects farther apart [or two repelling objects closer together]), transferring energy to the system. |

| **MS-PS3 Energy** | | |
|---|---|---|
| **MS-PS3-3**. Design, construct, and test a device that either minimizes or maximizes thermal energy transfer. Alignment may include 6-8 ETS1-1 and 6-8 ETS1-2 | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Constructing Explanations and Designing Solutions**<br>Work with peers to describe different types of materials used in the design solution and their properties (e.g., thickness, heat conductivity, reflectivity) and how these materials will be used to minimize or maximize thermal energy transfer. | **PS3.A: Definitions of Energy**<br>• 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.<br>**PS3.B: Conservation of Energy and Energy Transfer**<br>• 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).<br>**ETS1.A: Defining and Delimiting an Engineering Problem**<br>• Identify a device that either minimizes or maximizes thermal energy transfer.<br>**ETS1.B: Developing Possible Solutions**<br>• Recognize solutions that either minimizes or maximizes thermal energy transfer. | **Energy and Matter**<br>Work with peers to identify results of the design solution showing that thermal energy is transferred from hotter objects to colder objects. |

| **MS-PS3 Energy** | | |
|---|---|---|
| **MS-PS3-4**. 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. | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Planning and Carrying Out Investigations**<br>Work with peers to describe an investigation to determine the relationships among transfer of thermal energy, the type of matter, the mass of matter involved in thermal energy transfer, and the change in the average kinetic energy. | **PS3.B: Conservation of Energy and Energy Transfer**<br>• Describe the relationship between different masses of the same substance and the change in average kinetic energy when thermal energy is added to or removed from the system using examples and data measurements. | **Scale, Proportion, and Quantity**<br>Work with peers to describe evidence of proportional relationships between changes in temperature of materials and the mass of those materials using results of the investigation. |

| **MS-PS3 Energy** | | |
|---|---|---|
| **MS-PS3-5**. Engage in argument from evidence to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object. | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Engaging in Argument from Evidence**<br>Work with peers to support the claim, using evidence, that when the kinetic energy of an object changes, energy is transferred to or from that object. | **PS3.B: Conservation of Energy and Energy Transfer**<br>• Describe the change in the kinetic energy of an object as energy transferred to or from an object using information from graphical displays of data and models. | **Energy and Matter**<br>Work with peers to describe, using a model or diagram, that when the kinetic energy of an object increases or decreases, the energy (e.g., kinetic, thermal, potential) of other objects within the system increases or decreases, indicating that energy was transferred to or from the object. |

| **MS-PS4 Waves and Their Applications in Technologies for Information Transfer** | | |
|---|---|---|
| **MS-PS4-1**. Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave. | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Using Mathematics and Computational Thinking**<br>Work with peers to identify data related to frequency (e.g., beats per second), amplitude (e.g., height or depth of a water wave from average sea level), and wavelength (e.g., the distance between the tops of a series of water waves). | **PS4.A: Wave Properties**<br>• Identify qualitatively how the amplitude of a wave is related to the energy in a wave using a mathematical or graphical representation. | **Patterns**<br>Work with peers to use simple mathematical wave models to identify patterns (e.g., if twice as many water waves hit the shore each minute, then twice as much energy will be transferred to the shore). |

| **MS-PS4 Waves and Their Applications in Technologies for Information Transfer** | | |
|---|---|---|
| **MS-PS4-2**. Develop and use a model to describe how waves are reflected, absorbed, or transmitted through various materials. | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Developing and Using Models**<br>Work with peers to identify the relevant components of a provided model, including the type of wave (i.e., light or sound), materials through which the waves are reflected, absorbed, or transmitted, and characteristics of the wave after it has interacted with a material (e.g., frequency, amplitude, wavelength). | **PS4.A: Wave Properties**<br>• Describe, using a model, how sound waves are reflected, absorbed, or transmitted through various materials (e.g., water, air, glass).<br>**PS4.B: Electromagnetic Radiation**<br>• Describe, using a model, how light waves are reflected, absorbed, or transmitted through various materials (e.g., water, air, glass). | **Structure and Function**<br>Work with peers to use the model to evaluate given phenomena involving reflection, absorption, or transmission properties of different materials for light or sound waves. |

| **MS-PS4 Waves and Their Applications in Technologies for Information Transfer** | | |
|---|---|---|
| **MS-PS4-3**. Obtain, evaluate, and communicate information to support the evidence-based claim for the reliability of digitized signals ~~are a more reliable way~~ to encode and transmit information compared to analog signals. | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Obtaining, Evaluating, and Communicating Information**<br>Work with peers to evaluate features of digital transmission devices which make them more reliable than devices that use analog transmission of signals (e.g., recorded reliably, storage, transmission over long distances). | **PS4.C: Information Technologies and Instrumentation**<br>• Identify features of waves that make them useful.<br>• Determine if the claim that digitized signals are a more reliable way to encode and transmit information than analog signals is supported by evidence using data or qualitative information (i.e., scientific and technical). | **Structure and Function**<br>Work with peers to describe how the speed of electromagnetic waves has been utilized in communication. |

Core Content Connectors (CCCs) linked to the
*2024 South Dakota Science Standards* – Life Science (Grades 6-8)

**Middle School Life Science Conceptual Understanding*:**

| **MS-LS1 From Molecules to Organisms: Structures and Processes** | | |
|---|---|---|
| **MS-LS1-1**. Plan and carry out an investigation to provide evidence that living things are made of cells; either one cell or many different types and numbers of cells. | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Planning and Carrying Out Investigations**<br>Work with peers to collect evidence of the presence or absence of cells in living and nonliving things to determine that the cell is the fundamental unit of life. | **LS1.A: Structure and Function**<br>• Identify that living things may be made of one cell or many and varied cells. | **Scale, Proportion, and Quantity**<br>Work with peers to discover from the investigation that due to their small-scale size, most cells are unable to be seen with the unaided eye and require magnification devices to be seen. |

| **MS-LS1 From Molecules to Organisms: Structures and Processes** | | |
|---|---|---|
| **MS-LS1-2**. Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function. | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Developing and Using Models**<br>Work with peers to develop a model to identify the structures (e.g., nucleus, chloroplasts, cell wall, mitochondria, cell membrane, the function of a cell as a whole) and functions of components of cells. | **LS1.A: Structure and Function**<br>• Identify the function of a cell as a whole.<br>• Recognize that special structures within cells are responsible for particular functions.<br>• Identify components of a cell.<br>• Identify the functions of the components of a cell. | **Structure and Function**<br>Work with peers to use the model to identify key differences between plant and animal cells based on structure and function (e.g., cell wall vs. cell membrane). |

| **MS-LS1 From Molecules to Organisms: Structures and Processes** | | |
|---|---|---|
| **MS-LS1-3**. Construct an argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells, tissues, and organs. | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Engaging in Argument from Evidence**<br>Work with peers to provide evidence to support the claim that the body is a system of interacting subsystems composed of groups of cells, tissues, and organs. | **LS1.A: Structure and Function**<br>• Recognize that the body is a system of multiple interacting subsystems.<br>• Identify the basic functions of major organ systems (i.e., circulatory, excretory, digestive, respiratory, muscular, or nervous systems).<br>• Identify the levels of organization for structure and function which includes cells, tissues, organs, organ systems, and organisms using models or diagrams. | **Systems and System Models**<br>Work with peers to develop a model which illustrates how every scale (e.g., cells, tissues, organs, organ systems) of body function is composed of systems of interacting components. |

| **MS-LS1 From Molecules to Organisms: Structures and Processes** | | |
|---|---|---|
| **MS-LS1-4**. Construct an evidenced-based argument to support the explanation for a) how characteristic animal behaviors affect the probability of successful reproduction of animals; and b) how specialized structures affect the probability of successful reproduction of plants. | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Engaging in Argument from Evidence**<br>Work with peers to identify evidence (e.g., data and scientific literature) that specialized plant structures affect the probability of successful reproduction of plants. | **LS1.B: Growth and Development of Organisms**<br>• Identify behaviors animals engage in (e.g., vocalization) and specialized plant structures (e.g., bright flower parts) that increase the likelihood of reproduction. | **Cause and Effect**<br>Work with peers to describe the cause-and-effect relationships between animal behaviors (e.g., strategies for acquiring food, building shelters, or evading predators) and how they relate the probability of successful reproduction. |

| **MS-LS1 From Molecules to Organisms: Structures and Processes** | | |
|---|---|---|
| **MS-LS1-5**. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms. | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Constructing Explanations and Designing Solutions**<br>Work with peers to identify evidence (e.g., data and scientific literature) to explain that both environmental and genetic factors influence the growth of organisms. | **LS1.B: Growth and Development of Organisms**<br>• 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.<br>• 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. | **Cause and Effect**<br>Work with peers to describe how both environmental and genetic factors can influence organisms simultaneously and how organism growth is the result of environmental and genetic factors working together (e.g., how plant growth is affected by varying amounts of different soil components). |

| **MS-LS1 From Molecules to Organisms: Structures and Processes** | | |
|---|---|---|
| **MS-LS1-6**. Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms. | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Constructing Explanations and Designing Solutions**<br>Work with peers to identify evidence to support an explanation that the process of photosynthesis has an important role in energy and matter cycling within plants (i.e., the conversion of carbon dioxide and water into sugars and oxygen; the contribution of sugars to plant growth and internal processes) as well as from plants to other organisms. | **LS1.C: Organization for Matter and Energy Flow in Organisms**<br>• Recognize, using a model of photosynthesis, the movement of matter and flow of energy as plants use the energy from light to make sugars. | **Energy and Matter**<br>Work with peers to summarize the basic process in which energy from sunlight is used to make sugars from carbon dioxide and water (photosynthesis). |

| **MS-LS1 From Molecules to Organisms: Structures and Processes** | | |
|---|---|---|
| **MS-LS1-7**. Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism. | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Developing and Using Models**<br>Work with peers to identify the relevant components (i.e., molecules of food, oxygen, energy, new molecules produced) in a model to describe how food molecules are rearranged as matter moves through an organism. | **LS1.C: Organization for Matter and Energy Flow in Organisms**<br>• Identify the outcome of the process of breaking down food molecules (e.g., sugar) as the release of energy, which can be used to support other processes within the organism. | **Energy and Matter**<br>Work with peers to describe how matter and energy are necessary to build and maintain structures within organisms. |

| **MS-LS2 Ecosystems: Interactions, Energy, and Dynamics** | | |
|---|---|---|
| **MS-LS2-1**. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Analyzing and Interpreting Data**<br>Work with peers to interpret data (e.g., using tables, graphs, and charts) to determine the relationships between resource availability, the size of a population, and the growth and survival of individual organisms. | **LS2.A: Interdependent Relationships in Ecosystems**<br>• Recognize that growth of organisms and population increases are limited by access to resources.<br>• Identify factors (e.g., resources, climate or competition) in an ecosystem that influence growth in populations of organisms. | **Cause and Effect**<br>Work with peers to make predictions based on evidence of relationships between resource availability, organisms, and organism populations (e.g., less food results in fewer organisms). |

| **MS-LS2 Ecosystems: Interactions, Energy, and Dynamics** | | |
|---|---|---|
| **MS-LS2-2**. Construct an explanation that predicts patterns (relationships) of interactions among organisms across multiple ecosystems. | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Constructing Explanations and Designing Solutions**<br>Work with peers to identify evidence that supports the explanation that competitive, predatory, and mutually beneficial interactions among and between organisms occur across multiple and different ecosystems. | **LS2.A: Interdependent Relationships in Ecosystems**<br>• Use models of interactions between organisms in an ecosystem to identify examples of competitive, predatory, or symbiotic relationships. | **Patterns**<br>Work with peers to illustrate that similar patterns of interactions occur between organisms and their environment, regardless of the ecosystem or the species involved and can be used to predict interactions among organisms (e.g., predatory, competitive, or mutually beneficial interactions). |

| **MS-LS2 Ecosystems: Interactions, Energy, and Dynamics** | | |
|---|---|---|
| **MS-LS2-3**. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Developing and Using Models**<br>Work with peers to identify the relevant components in a food web model, including organisms that can be classified as producers, consumers, and/or decomposers and the nonliving parts of an ecosystem (e.g., water, minerals, air). | **LS2.B: Cycle of Matter and Energy Transfer in Ecosystems**<br>• Describe energy transfer between producers and consumers in an ecosystem using a model (e.g., producers provide energy for consumers).<br>• Describe the cycling of matter among living and nonliving parts of a defined system (e.g., the atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem). | **Energy and Matter**<br>Work with peers to identify the cycling of matter and flow of energy through a food web model, including organisms as producers, consumers, and/or decomposers and the nonliving parts of an ecosystem (e.g., water, minerals, air). |

| **MS-LS2 Ecosystems: Interactions, Energy, and Dynamics** | | |
|---|---|---|
| **MS-LS2-4**. Construct an evidence-based argument that articulates how changes to physical or biological components of an ecosystem affect populations. | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Engaging in Argument from Evidence**<br>Work with peers to describe evidence (e.g., data or scientific literature) supporting a claim about relationships between changes in the components of an ecosystem (e.g., rainfall, fires, predator removal, species introduction) with the changes in populations. | **LS2.C: Ecosystem Dynamics, Functioning, and Resilience**<br>• Identify the outcome of changes in physical or biological components of an ecosystem to populations of organisms in that ecosystem. | **Stability and Change**<br>Work with peers to identify specific changes in the physical or biological components of an ecosystem which cause changes that affect the survival of organisms within that ecosystem (e.g., scarcity of food or the elimination of a predator). |

| **MS-LS2 Ecosystems: Interactions, Energy, and Dynamics** | | |
|---|---|---|
| **MS-LS2-5**. Evaluate competing design solutions for maintaining biodiversity and ecosystem preservation practices and services. Alignment may include 6-8 ETS1-2 | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Engaging in Argument from Evidence**<br>Work with peers to evaluate a given design solution for a problem involving biodiversity and/or ecosystem services. | **LS2.C: Ecosystem Dynamics, Functioning, and Resilience**<br>• Recognize the stability of an ecosystem's biodiversity is the foundation of a healthy, functioning ecosystem.<br>**LS4.D: Biodiversity and Humans**<br>• Recognize that 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. | **Stability and Change**<br>Work with peers to identify factors that affect the stability of the biodiversity of the given ecosystem. |

| **MS-LS3 Heredity: Inheritance and Variation of Traits** | | |
|---|---|---|
| **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. | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Developing and Using Models**<br>Work with peers to identify the relevant components of a model involving the relationship between mutations and the effects on the organism (e.g., proteins, genes, chromosomes, traits). | **LS3.B: Variation of Traits**<br>• 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. | **Structure and Function**<br>Work with peers to describe that beneficial, neutral, or harmful changes to protein function can cause beneficial, neutral, or harmful changes in the structure and function of organisms. |

| **MS-LS3 Heredity: Inheritance and Variation of Traits** | | |
|---|---|---|
| **MS-LS3-2**. Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation. | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Developing and Using Models**<br>Work with peers to develop models (e.g., Punnett squares, diagrams, simulations) for a given phenomenon involving the differences in genetic variation that arise from sexual and asexual reproduction. | **LS3.A: Inheritance of Traits**<br>• Identify that a variety of inherited traits passed from parents to offspring lead to differences in offspring (e.g., eye color). | **Cause and Effect**<br>Work with peers to describe the cause and effect relationships found in a model (e.g., Punnett squares, diagrams, simulations) to make predictions. |

| **MS-LS4 Biological Evolution: Unity and Diversity** | | |
|---|---|---|
| **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. | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Analyzing and Interpreting Data**<br>Work with peers to analyze and interpret data to determine evidence for the existence, diversity, extinction, and change in life forms throughout the history of Earth. | **LS4.A: Evidence of Common Ancestry and Diversity**<br>• Recognize 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. | **Patterns**<br>Work with peers to identify patterns between sedimentary layers (e.g., presence or absence of large numbers of organisms; types of organisms; complexity of anatomical structures in organisms). |

| **MS-LS4 Biological Evolution: Unity and Diversity** | | |
|---|---|---|
| **MS-LS4-2**. Apply scientific ideas to construct an explanation for similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships. | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Constructing Explanations and Designing Solutions**<br>Work with peers to identify anatomical similarities and differences among organisms to infer evolutionary relationships. | **LS4.A: Evidence of Common Ancestry and Diversity**<br>• Recognize that similarities and differences in external structures can be used to infer evolutionary relationships between living and fossil organisms. | **Patterns**<br>Work with peers to show that organisms that share a pattern of anatomical features are likely to be more closely related (e.g., horses and zebras) than are organisms that do not share a pattern of anatomical features (e.g., birds and insects). |

| **MS-LS4 Biological Evolution: Unity and Diversity** | | |
|---|---|---|
| **MS-LS4-4**. Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment. | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Constructing Explanations and Designing Solutions**<br>Work with peers to gather evidence to support the explanation that the proportion of individual organisms that have genetic variations and traits that are advantageous in a particular environment will increase from generation to generation due to natural selection because the probability that those individuals will survive and reproduce is greater. | **LS4.B: Natural Selection**<br>• Identify a similarity in an external feature (e.g., shape of ears on animals or shape of leaves on plants) between young plants and animals and their parents.<br>• Describe the relationship between genetic variation and the success of organisms in a specific environment (e.g., individual organisms that have genetic variations and traits that are disadvantageous in a particular environment will be less likely to survive, and those traits will decrease from generation to generation due to natural selection). | **Cause and Effect**<br>Work with peers to identify specific traits and the cause and effect relationships between those traits and the probability of survival and reproduction of a given organism in a specific environment. |

| **MS-LS4 Biological Evolution: Unity and Diversity** | | |
|---|---|---|
| **MS-LS4-5**. Obtain, evaluate, and communicate information about how technological advances have changed the way humans influence the inheritance of desired traits in organisms. Alignment may include 6-8 ETS1-1; 6-8 ETS1-4 | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Obtaining, Evaluating, and Communicating Information**<br>Work with peers to gather information about technologies that have changed the way humans influence the inheritance of desired traits in plants and animals through artificial selection. | **LS4.B: Natural Selection**<br>• Identify technologies (e.g., artificial selection for breeding of certain plants and animals) that have changed the way humans influence the inheritance of desired traits in plants and animals.<br>**ETS1.A: Defining and Delimiting an Engineering Problem**<br>• Identify technological advances that have changed the way humans influence the inheritance of desired traits in organisms | **Cause and Effect**<br>Work with peers to identify and describe how a better understanding of cause-and-effect relationships in how and why traits occur in organisms has led to advances in the technology that influence the inheritance of desired traits in organisms. |

| **MS-LS4 Biological Evolution: Unity and Diversity** | | |
|---|---|---|
| **MS-LS4-6**. Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time. | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Using Mathematics and Computational Thinking**<br>Work with peers to identify the relevant components of mathematical and/or computational representations of trends (e.g., averages, histograms, graphs, spreadsheets) in changes to populations over time. | **LS4.C: Adaptation**<br>• 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. | **Cause and Effect**<br>Work with peers to use data (e.g., averages, histograms, graphs, spreadsheets) to identify relationships in changes and trends over time in the distribution of traits within a population or cause and effect relationships between environmental conditions and natural selection in a population. |

**Middle School Earth and Space Science Conceptual Understanding*:**

| **MS-ESS1 Earth's Place in the Universe** | | |
|---|---|---|
| **MS-ESS1-1**. Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons. | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Developing and Using Models**<br>Work with peers to develop a model (e.g., physical, conceptual, graphical) of the Earth-moon-sun system to identify Earth, the sun, and the moon and use the model to describe moon phases, eclipses, and seasons. | **ESS1.A: The Universe and Its Stars**<br>• Use an Earth-sun-moon model to show that the Earth-moon system orbits the sun once an Earth year and the orbit of the moon around Earth corresponds to a month.<br>**ESS1.B: Earth and the Solar System**<br>• Use an Earth-sun-moon model to explain eclipses of the sun and the moon.<br>• Use an Earth-sun-moon model to explain how variations in the amount of the sun's energy hitting Earth's surface results in seasons. | **Patterns**<br>Work with peers to use patterns observed from a model to describe the relationships between components (i.e., relationships between Earth and the moon; relationships between the Earth-moon system and the sun). |

| **MS-ESS1 Earth's Place in the Universe** | | |
|---|---|---|
| **MS-ESS1-2**. Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system. | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Developing and Using Models**<br>Work with peers to develop a model of the solar system to identify gravity, the sun, planets, moons, and asteroids and describe how the gravitational force of the sun causes the planets and other bodies to orbit around it, holding the solar system together. | **ESS1.A: The Universe and Its Stars**<br>• Use a model to identify the solar system as one of many systems orbiting the center of the larger system of the Milky Way galaxy, which is one of many galaxy systems in the universe.<br>**ESS1.B: Earth and the Solar System**<br>• Use a model to describe the relationships and interactions between components of the solar system as a collection of many varied objects held together by gravity. | **Systems and System Models**<br>Work with peers to use a model to describe that objects too far away from the sun do not orbit it because the sun's gravitational force on those objects is too weak to pull them into orbit. |

| **MS-ESS1 Earth's Place in the Universe** | | |
|---|---|---|
| **MS-ESS1-3**. Analyze and interpret data to determine scale properties of objects in the solar system. | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Analyzing and Interpreting Data**<br>Work with peers to use data (e.g., statistical information, drawing, photographs) to identify characteristics of different categories of solar system objects (e.g., planets, meteors, asteroids, comets) based on their features. | **ESS1.B: Earth and the Solar System**<br>• Determine similarities and differences among solar system objects using data (e.g., statistical information, drawings and photographs, and models). | **Scale, Proportion, and Quantity**<br>Work with peers to interpret data on solar system objects (e.g., transforming tabular data into pictures, diagrams, graphs, or physical models) to illustrate changes in scale. |

| **MS-ESS1 Earth's Place in the Universe** | | |
|---|---|---|
| **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 4.6-bilion-year-old history. | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Constructing Explanations and Designing Solutions**<br>• Work with peers to 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. | **ESS1.C: The History of Planet Earth**<br>• Interpret geologic time scale from rock strata to provide a way to organize Earth's history.<br>• Recognize that analyses of rock strata and the fossil record provides only relative dates, not an absolute scale. | **Scale and Proportion**<br>• Work with peers to interpret evidence within rock strata to determine the relative age of Earth. |

| **MS-ESS2 Earth's Systems** | | |
|---|---|---|
| **MS-ESS2-1**. Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process. | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Developing and Using Models**<br>Work with peers to model the natural cycling of rocks (e.g., the formation of new sediment though erosion and weathering). | **ESS2.A: Earth Materials and Systems**<br>• 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. | **Stability and Change**<br>Work with peers, using a model, to describe how energy from the Earth's interior and the sun drive Earth processes that together cause matter cycling through different forms of Earth materials (e.g., formation of new rock through heat and compaction of the sediment). |

| **MS-ESS2 Earth's Systems** | | |
|---|---|---|
| **MS-ESS2-2**. Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Constructing Explanations and Designing Solutions**<br>Work with peers to construct a scientific explanation, based on valid and reliable evidence, showing that the surface of Earth changes constantly, and that some of these changes happen slowly (e.g., plate motions or the uplift of large mountain ranges) while other changes happen quickly and result from catastrophic events (e.g., major storms and volcanoes). | **ESS2.A: Earth Materials and Systems**<br>• Identify examples of processes that change Earth's surface at varying time and spatial scales that can be large (e.g., plate motions) or small (e.g., landslides). | **Scale, Proportion, and Quantity**<br>Work with peers to describe changes that occur on very large or small spatial and/or temporal (i.e., time) scales (e.g., stream tables to illustrate erosion and deposition, maps and models to show the motion of tectonic plates). |

| **MS-ESS2 Earth's Systems** | | |
|---|---|---|
| **MS-ESS2-3**. Analyze and interpret data on the age of the Earth, distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions. | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Analyzing and Interpreting Data**<br>Work with peers to use data related to similarities of rock and fossil types on different continents, the shapes of continents, and the locations of ocean structures to provide evidence for past plate motion. | **ESS2.B: Plate Tectonics and Large-Scale System Interactions**<br>• 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. | **Patterns**<br>Work with peers to illustrate how the shapes of continents, which roughly fit together (like pieces in a jigsaw puzzle) suggest that those land masses were once joined and have since separated. |

| **MS-ESS2 Earth's Systems** | | |
|---|---|---|
| **MS-ESS2-4**. Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity. | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Developing and Using Models**<br>Work with peers to develop and use a model (conceptual or physical) to describe how both energy from sunlight and the force of gravity drives water cycling between oceans, the atmosphere, and land. | **ESS2.C: The Roles of Water in Earth's Surface Processes**<br>• Identify components in a model of water cycling among land, ocean, and atmosphere, and recognize how it is propelled by sunlight and gravity. | **Energy and Matter**<br>Work with peers to explain how heat energy drives the water cycle. |

| **MS-ESS2 Earth's Systems** | | |
|---|---|---|
| **MS-ESS2-5**. Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions. | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Planning and Carrying Out Investigations**<br>Work with peers to plan an investigation and describe the data to be collected for a study of the relationships between air mass movement and changes in weather. | **ESS2.C: The Roles of Water in Earth's Surface Processes**<br>• Identify how water influences weather and weather patterns through atmospheric, land, and oceanic circulation. | **Cause and Effect**<br>Work with peers to illustrate the relationship between the uneven heating of Earth's components (i.e., water, land, air) and its influence on weather and climate. |

| **MS-ESS2 Earth's Systems** | | |
|---|---|---|
| **MS-ESS2-6**. Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates. | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Developing and Using Models**<br>Work with peers to develop a model and identify relevant components of the system (i.e., Earth, atmosphere, ocean, continents, global distribution of ice, distribution of living things, and energy). | **ESS2.D: Weather and Climate**<br>• Recognize that as the sun's energy warms the air over the land (expands and rises), the air over the ocean (cooler air) rushes in to take its place and is called wind (sea breeze).<br>• Recognize that weather and climate vary with latitude, altitude, and regional geography. | **Systems and System Models**<br>Work with peers to use the model to identify relationships (i.e., differences in the distribution of solar energy and temperature changes; motion of ocean waters and air masses; factors affecting the motion of wind and currents; thermal energy transfer) between components of Earth systems. |

| **MS-ESS3 Earth and Human Activity** | | |
|---|---|---|
| **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. | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Constructing Explanations and Designing Solutions**<br>Work with peers to identify the type and distribution of an example of each type of Earth resource (i.e., mineral, energy, and groundwater) and the ways in which the extraction of each type of resource by humans changes how much and where more of that resource can be found. | **ESS3.A: Natural Resources**<br>• 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. | **Cause and Effect**<br>Work with peers to identify that since resources are formed as a result of past and current geologic processes, the conditions that formed the resources are specific to certain areas on Earth, thus identifying why those resources are found only in those specific places. |

| **MS-ESS3 Earth and Human Activity** | | |
|---|---|---|
| **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. | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Analyzing and Interpreting Data**<br>Work with peers to organize a given data set that represents a type of natural hazard event and features associated with that type of event to determine similarities and differences. | **ESS3.B: Natural Hazards**<br>• 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.<br>• 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). | **Patterns**<br>Work with peers to identify patterns in a data set to make a forecast for the potential of a natural hazard event to affect an area in the future. |

| **MS-ESS3 Earth and Human Activity** | | |
|---|---|---|
| **MS-ESS3-3**. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. Alignment may include 6-9 ETS1-1 | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Constructing Explanations and Designing Solutions**<br>Work with peers to identify a human environmental impact and assess solutions that are feasible that could reduce that impact. | **ESS3.C: Human Impacts on Earth Systems**<br>• Use data from an existing design solution for minimizing a human impact on the environment to identify limitations of the use of technologies employed by the solution.<br>**ETS2.B: Influence of Engineering, Technology, and Science on Society and the Natural World**<br>• Use a model to determine how different human activity that draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment. | **Cause and Effect**<br>Work with peers to identify relationships between a human activity and the negative environmental impact based on scientific evidence. |

| **MS-ESS3 Earth and Human Activity** | | |
|---|---|---|
| **MS-ESS3-4**. Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems. | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Engaging in Argument from Evidence**<br>Work with peers to provide evidence to support the claim that increases in the size of the human population and per-capita consumption of natural resources affects Earth's systems. | **ESS3.C: Human Impacts on Earth Systems**<br>• Identify changes that humans have made to Earth's natural systems using a variety of resources. | **Cause and Effect**<br>Work with peers to evaluate the evidence, for its sufficiency, for supporting the claim that increases in the size of the human population affect Earth's systems (e.g., Because human population growth affects natural resource consumption and natural resource consumption influences Earth's systems, changes in human populations have a cause-and-effect role in changing Earth's systems). |

| **MS-ESS3 Earth and Human Activity** | | |
|---|---|---|
| **MS-ESS3-5**. Ask questions to clarify evidence of the factors that may have caused a change in global temperatures over the past century. | | |
| **Science and Engineering Practices**<br>**Core Content Connectors** | **Disciplinary Core Ideas**<br>**Core Content Connectors** | **Crosscutting Concepts**<br>**Core Content Connectors** |
| **Asking Questions and Defining Problems**<br>Work with peers to identify patterns in data that connect natural processes and human activities to changes in global temperatures over the past century. | **ESS3.D: Global Climate Change**<br>• Identify evidence of the effects of human activities on changes in global temperatures over the past century using a variety of resources (e.g., tables, graphs, and maps of global and regional temperatures; atmospheric levels of gases, such as carbon dioxide and methane; and rates of human activities). | **Stability and Change**<br>Work with peers to identify the major role that human activities play in causing the rise in global temperatures (e.g., changes in the concentration of carbon dioxide and other greenhouse gases in the atmosphere over the past century). |