**SOUTH DAKOTA ALTERNATE ASSESSMENT FOR SCIENCE – Core Content Connectors (CCC) –**

**POLICY ACHIEVEMENT LEVEL DESCRIPTORS**

**Exceeded:** A student who is Exceeded demonstrates a level of understanding that includes the ability to “bring together” the Disciplinary Core Ideas (DCI) and/or Science and Engineering Practices (SEP) and/or Crosscutting Concepts (CCC) associated with a PE.

**Met:** A student who is Met demonstrates an understanding of the Disciplinary Core Ideas (DCI) and/or Science and Engineering Practices (SEP) and/or Crosscutting Concepts (CCC) within the PE at the conceptual level described in the Core Content Connectors.

**Nearly Met:** A student who is Nearly Met demonstrates some understanding of the content of the PE, but that understanding is incomplete and does not yet meet the expectations found in the Core Content Connectors. This student’s understanding is partial but emerging.

**Not Met** A student who is Not Met demonstrates a level of understanding that is at a very preliminary level. This student’s understanding is nonexistent or incomplete, and he or she has diﬃculty meeting the expectations.

**HIGH SCHOOL (Administered in Grade 11)**

SD Alternate Science – CCC High School

|  |  | **Policy Achievement Level Descriptors** |
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|  |  | **Not Met** | **Nearly Met** | **Met** | **Exceeded** |
|  |  | A student who is Not Met demonstrates a level of understanding that is at a very preliminary level. This student’s understanding is nonexistent or incomplete, and he or she has diﬃculty meeting the expectations. | A student who is Nearly Met demonstrates some understanding of the content of the PE, but that understanding is incomplete and does not yet meet the expectations found in the Core Content Connectors. This student’s understanding is partial but emerging. | A student who is Met demonstrates an understanding of the Disciplinary Core Ideas (DCI) and/or Science and Engineering Practices (SEP) and/or Crosscutting Concepts (CCC) within the PE at the conceptual level described in the Core Content Connectors. | A student who is Exceeded demonstrates a level of understanding that includes the ability to “bring together” the Disciplinary Core Ideas (DCI) and/or Science and Engineering Practices (SEP) and/or Crosscutting Concepts (CCC) associated with a PE. |
| **South Dakota Science Standards**  | **DCI Core Content Connectors** | **Range Achievement Level Descriptors** |
| **Code** | **PE** | **Not Met** | **Nearly Met** | **Met** | **Exceeded** |
| **HS-PS1-1** | Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms. | Recognize that elements are organized in the periodic table horizontally by the number of protons equal to the number of electrons (in a neutral atom) in the atom’s nucleus.Recognize that properties vary in a regular pattern across the rows (periods) and down the columns (families or groups) in the periodic table.Recognize the importance of the atom’s outermost electrons in determining the chemical and physical properties of an element.Predict the properties of elements using the periodic table. | Recognize the Periodic Table.Recognize atomic structure. | Identify elements of the Periodic Table.Identify electrons in atomic structure. | Recognize why elements are arranged the way they are in the Periodic Table.Recognize importance of outermost electrons. | Describe the patterns in the elements arranged in the Periodic Table.Describe why outermost electrons are important for chemical and physical properties. |
| **HS-PS1-2** | Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. | Identify an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms.Identify an explanation for the outcome of a simple chemical reaction based on trends in the periodic table. | Recognize when a chemical change takes place. | Recognize a pure substance that would be part of a chemical reaction. | Identify the outcome of a simple chemical reaction (e.g., list of possible products). | Explain the outcome of a simple chemical reaction based on outermost electrons and the Periodic Table. |
| **HS-PS1-3** | Plan and carry out an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles. | Identify bulk properties of substances (i.e., melting point, boiling point, and surface tension).Identify that electrical forces within and between atoms can keep particles close together. | Identify a state of matter. | Identify the properties of matter (e.g., melting point, boiling point, pressure, surface tension). | Use data about different materials to recognize that some bonds are stronger than others. | Use data to determine which substances have stronger bonds (e.g., boiling point of water versus boiling point of olive oil). |
| **HS-PS1-4** | Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends on the changes in total bond energy. | Determine whether energy is released or absorbed in a chemical reaction system using data presented in a table or graph. | Identify a reaction that requires energy to occur (e.g., photosynthesis, baking bread). | Identify a reaction that has either released energy or absorbed energy (e.g., lighting a match, cooking an egg). | Recognize that the rate of a reaction will change if more or less energy is available for use (e.g., ice will melt faster; water will boil faster). | Use a model to determine whether energy is released or absorbed in a chemical reaction system. |
| **HS-PS1-5** | Construct an explanation based on evidence about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs. | Identify the effects of changing the temperature of the reacting particles at the rate at which a simple reaction (i.e., two reactants) occurs using a model (e.g., a table of data) of the number and energy of collisions between particles.Identify the effects of changing the concentration of the reacting particles at the rate at which a simple reaction (i.e., two reactants) occurs using a model (e.g., a table of data) of the number and energy of collisions between particles. | Recognize that a chemical reaction can happen fast or slow. | Recognize that changes in conditions will affect reaction rates. | Identify effects of changing temperature on the reaction rate of a simple reaction. | Identify other factors that can be changed to speed up or slow down a reaction. |
| **HS-PS1-6** | Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium. | Identify a change in one variable (i.e., temperature, concentration, pressure) of a chemical equation that would produce increased amounts of products at equilibrium. | Identify the changes during a chemical reaction. | Identify the conditions present in a chemical reaction. | Explain that changes in the conditions of a reaction result in changes in the amount of product produced. | Predict what would happen to either the reactants or the products of a reaction when a condition is changed. |
| **HS-PS1-7** | Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. | Identify a chemical equation, showing reactants and products of a chemical reaction, which illustrates the claim that matter (i.e., atoms) is neither created nor destroyed during a chemical reaction.Identify a mathematical representation (e.g., table, graph) or pictorial depictions that illustrates the claim that mass is conserved during a chemical reaction. | Recognize that matter can change but cannot be destroyed. | Exposed to a chemical equation. | Identify a balanced chemical equation showing reactants and products. | Explain why an equation must be balanced to show that matter is neither created nor destroyed. |
| **HS-PS1-8** | Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay. | Recognize that nuclear processes (i.e., fusion, fission, and radioactive decays), involve the release or absorption of energy.Contrast changes during the processes of alpha, beta, or gamma radioactive decay using graphs or pictorial depictions of the composition of the nucleus of the atom and the energy released. | Recognize the center of an atom. | Identify models of fission, fusion, and radioactive decay. | Determine what nuclear process releases or absorbs energy. | Complete a model that illustrates fusion, fission, or radioactive decay. |
| **HS-PS2-1** | Analyze data to support the claim that Newton’s Second Law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration. | Predict changes in the motion of a macroscopic object, such as a falling object, an object rolling down a ramp, or a moving object being pulled by a constant force using data (e.g., tables or graphs of position or velocity as a function of time for an object subject to a net unbalanced force). | Identify how an applied force can move an object (e.g., direction, big force, little force). | Compare objects and identify which object would take more force to move. | Recognize the relationship between force and an object’s mass and acceleration. | Use mathematical data to support that the amount of force an object has changes when its mass or acceleration is changed. |
| **HS-PS2-2** | Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system. | Identify an example of the law of momentum conservation (e.g., in a collision, the momentum change of an object is equal to and opposite of the momentum change of the other object) represented using graphical or visual displays (e.g., pictures, pictographs, drawings, written observations, tables, charts). | Identify an object that is in motion. | Recognize that forces affect objects. | Given a picture or model, recognize that a force will change the motion of an object. | Use a mathematical model to predict the amount of change in motion of an object in a given scenario. |
| **HS-PS2-3** | Design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision. | Evaluate a device (e.g., football helmet or a parachute) designed to minimize force by comparing data (i.e., momentum, mass, velocity, force, or time). | Identify a collision. | Identify ways to minimize the force in a collision (e.g., bumper, helmet, air bags in cars). | Use models to predict how impact is minimized when protective components are included. | Use data to describe the best device that will reduce impact in a collision. |
| **HS-PS2-4** | Use mathematical representations of Newton’s Law of Gravitation and Coulomb’s Law to describe and predict the gravitational and electrostatic forces between objects. | Use Newton’s law of universal gravitation as a mathematical model to qualitatively describe or predict the effects of gravitational forces in systems with two objects.Use Coulomb’s law to qualitatively describe or predict the electrostatic forces in systems with two objects. | Recognize that objects can be attracted to each other. | Identify gravity and its effect on objects. | Compare the effects of two forces when applied to a third (e.g., a balloon might stick to a wall with static, but will ultimately fall to the ground). | Identify mathematical data that shows that gravitational force is always constant. |
| **HS-PS2-5** | Plan and carry out an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current. | Compare the relationship between changes in the magnetic field and the amount of electric current created using data. | Recognize an electromagnet. | Identify a magnetic field around an electromagnet. | Identify ways to induce an electric current using a magnet. | Compare ways to increase either the magnetic force around an electromagnet or the amount of electric current produced using a magnet. |
| **HS-PS2-6** | Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials. | Recognize that different materials have different molecular structures and properties which determine different functioning of the material (e.g., flexible, but durable). | Identify an object’s state of matter. | Identify that different states of matter have different properties. | Recognize that different matter have different molecular structures and properties that determine different functions. | Demonstrate how matter have different properties because of differences at the molecular level. |
| **HS-PS3-1** | Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known. | Identify a model showing the change in the energy of one component in a system compared to the change in energy of another component in the system. | Identify an example where the energy of a system changes (e.g., pushing a ball down a ramp, raising a book up, a cup of coffee cooling down). | Recognize how a component has changed when there has been an energy change (e.g., ball moves faster, ramp is steeper, cup cools down quicker in refrigerator). | Use a model that demonstrates changes in energy flows in relation to other components of the model. | Use mathematical data to show that the energy of a system has been conserved despite an observed change in energy. |
| **HS-PS3-2** | Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative position of particles (objects). | Identify that two factors, an object’s mass and height above the ground, affect gravity (i.e., energy stored due to position of an object above Earth) at the macroscopic level. | Identify a source of energy and the type of energy it represents (e.g., sun—light energy, fire—thermal energy). | Recognize that different types of energy can be classified as either kinetic or potential energy. | Use a model that shows how kinetic or potential energy in a system can change (e.g., moving faster, moving higher). | Compare two system models and explain which system has more kinetic or potential energy. |
| **HS-PS3-3** | Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy. | Identify the forms of energy that will be converted by a device that converts one form of energy into another form of energy.Identify steps in a model of a device showing the transformations of energy that occur (e.g., solar cells, solar ovens, generators, turbines).Describe constraints to the design of the device which converts one form of energy into another form of energy (e.g., cost or efficiency of energy conversion). | Identify the effects of energy. | Identify different forms of energy. | Identify a device that can convert energy. | Identify changes in energy from one form to another (e.g., in solar panels and wind turbines). |
| **HS-PS3-4** | Plan and carry out an investigation to provide evidence that the transfer of thermal energy when two components of different temperatures are combined within a closed system results in a more uniform energy distribution among the components in the system (Second Law of Thermodynamics). | Identify the temperatures of two liquids of different temperature before and after combining to show uniform energy distribution. | Compare the relative temperature of two substances (warm versus cool). | Compare the temperature of two substances before and after combining. | Use data to show the temperature of two different substances before and after combining. | Predict what more mass of a substance would do to the transfer of heat to another substance. |
| **HS-PS3-5** | Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to their interaction. | Use a model to identify the cause and effect relationships between forces produced by electric or magnetic fields and the change of energy of the objects in the system | Recognize that like poles repel each other and unlike poles attract each other. | Demonstrate how the orientation of magnets and the distance between them affects the behavior of the magnets. | Model magnetic behavior based on force (e.g., stronger magnets versus weaker magnets; number of paper clips one magnet can hold versus another). | Explain the effect of one magnet on the behavior of another magnet when distance or force is changed in an investigation. |
| **HS-PS4-1** | Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media. | Qualitatively describe cause and effect relationships between changes in wave speed and type of media through which the wave travels using mathematical and graphical representations. | Identify diﬀerent media that waves travel through (e.g., air, water, solid objects). | Identify a property of a wave (e.g., frequency, amplitude, wavelength). | Identify differences in frequency, wavelength, and amplitude by comparing waves traveling through different media. | Use data to explain how a medium impacts a wave’s behavior when the wave travels through that medium (e.g., seismic waves, gelatin, ropes) by using data. |
| **HS-PS4-2** | Evaluate questions about the advantages of using a digital transmission and storage of information. | Use data or qualitative scientific and technical information to evaluate whether features of a digital transmission or storage device are advantages or disadvantages. | Identify different types of digital resources (e.g., emails, text). | Identify how information can be stored reliably in computer memory. | Identify an advantage or disadvantage of a speciﬁc digital information technology. | Compare advantages and disadvantages of various means of digital information. |
| **HS-PS4-3** | Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other. | Identify a model or description of electromagnetic radiation (e.g., a radio, microwave, light) as a wave model.Identify a model or description of electromagnetic radiation (e.g., radiant energy carried by sunlight) as a particle model. | Identify a model of electromagnetic radiation as a wave. | Identify how electromagnetic radiation travels as particles from the sun. | Describe radiant energy. | Explain the photoelectric effect. |
| **HS-PS4-4** | Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter. | Recognize the relationship between the damage to living tissue from electromagnetic radiation and the energy of the radiation. | Identify the source of different waves (e.g., light from the sun, sound from a speaker). | Identify that waves can come in varying wavelengths and amplitudes. | Compare two waves and their wavelengths to determine which wave has more thermal energy. | Recognize that as the size of the wavelength increases, the less easily it is absorbed by matter and the less thermal energy it releases. |
| **HS-PS4-5** | Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy. | Identify examples of large amounts of information that can be stored and transmitted as a result of being digitized (e.g., a picture stored as the values of an array of pixels). | Identify common devices that use light or sound waves to transmit information. | Identify how common technological devices are used for different purposes. | Use evidence to show how some devices use light and sound waves to transmit and capture information. | Compare and evaluate how two different machines use electromagnetic waves and sound waves differently. |
| **HS-LS1-1** | Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells. | Relate DNA molecules to the way cells store and use information to guide their functions.Relate groups of specialized cells (e.g., heart cells, nerve cells, muscle cells, epithelial cells, fat cells, blood cells) within organisms to the performance of essential functions of life. | Identify that living things are made up of cells. | Recognize that DNA is found in the nucleus of the cell. | Identify that the DNA in a cell’s nucleus is the genetic code that determines a cell’s function. | Identify that body tissues are systems of specialized cells with similar functions (e.g., skin cells, muscle cells, brain cells) that use speciﬁc DNA structures. |
| **HS-LS1-2** | Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms. | Identify a model of the levels of organization for structure and function in organisms which includes cells, tissues, organs, and organ systems. | Recognize one of the levels of biological organization. | Use a model to identify different levels of biological organization in an organism. | Identify the structure and function of different organs. | Explain similarities and differences in structure and functions between organisms. |
| **HS-LS1-3** | Plan and carry out an investigation to provide evidence that feedback mechanisms maintain homeostasis. | Identify how different organisms react (e.g., heart rate, body temperature) to changes in their external environment. | Identify stimuli that lead to reactions in a living system (e.g., temperature, amount of light present, sounds, smells). | Identify ways the body reacts to stimuli to maintain homeostasis (e.g., sweating when hot, increasing heart rate and breathing during exercise, pupils reacting to light). | Use data (graphical or in a table) to identify changes in body systems during exercise or other activities. (Graphs should show the body’s response and a return to homeostasis). | Identify the correct sequence of steps necessary in an investigation to show how an organism reacts to stimuli (e.g., eye reacting to light, heart or lungs reacting to exercise). |
| **HS-LS1-4** | Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms. | Identify how growth occurs when cells multiply (i.e., mitosis) using a model. | Identify that cells divide. | Identify a model of the cellular division process. | Use a model to illustrate how cellular division contributes to the growth and development of the organism. | Explain how cellular division contributes to the growth and development of the organism. |
| **HS-LS1-5** | Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy. | Recognize that photosynthesis results in the conversion of light energy to stored chemical energy. | Identify that plants make their own food with energy from the sun. | Recognize the purpose of photosynthesis. | Identify what a plant uses (e.g., sunlight, water) and what a plant produces (e.g., food, oxygen) during photosynthesis (e.g., ﬁll in the missing part of the model). | Use a model (using words or pictures) to explain the overall process of photosynthesis. |
| **HS-LS1-6** | Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules. | Identify a model which demonstrates how organisms take in matter (allowing growth and maintenance) and rearrange the atoms in chemical reactions to form different products. | Identify the simple molecule that organisms need for survival. | Recognize that plants and animals rely on sugar molecules to create other molecules necessary for survival. | Identify a model of the process of creating other molecules from sugar molecules. | Explain how the elements that make up sugar molecules can be used to form other molecules (e.g., amino acids, DNA, proteins). |
| **HS-LS1-7** | Use a model of the major inputs and outputs of cellular respiration (aerobic and anaerobic) to exemplify the chemical process in which the bonds of food molecules are broken, the bonds of new compounds are formed, and a net transfer of energy results. | Identify respiration as the transfer of stored energy to the cell to sustain life’s processes (i.e., energy to muscles or energy for maintaining body temperature). | Identify the reasons why consumers need food and air. | Identify the molecules that are involved in cellular respiration. | Use a model of cellular respiration to illustrate the input and output of the process. | Given a scenario, describe how food and oxygen molecules are used in the process of cellular respiration. |
| **HS-LS2-1** | Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales. | Recognize that the carrying capacities of ecosystems are related to the availability of living and nonliving resources and challenges (e.g., predation, competition, disease).Use a graphical representation to identify carrying capacities in ecosystems as limits to the numbers of organisms or populations they can support. | Identify an ecosystem. | Recognize how animals depend on other organisms to survive. | Use data to explain the patterns and/or trends between population size and the availability of resources. | Use a graphical representation to describe how the population of an organism changes over time if an environmental factor changes. |
| **HS-LS2-2** | Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. | Use mathematical representations (trends, averages, or graphs) to identify dependencies of an animal population on other organisms for food and their environment for shelter. | Identify the needs of a common plant or animal. | Recognize the interdependence of two or more organisms in an ecosystem. | Identify how modest changes affect stability in ecosystems. | Predict changes in an ecosystem if there are modest versus extreme changes. |
| **HS-LS2-3** | Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions. | Recognize a model of the flow of matter or energy in aerobic respiration.Recognize a model of the flow of matter or energy in anaerobic respiration. | Identify that matter cycles and energy flows through an ecosystem. | Identify anaerobic or aerobic conditions in an ecosystem. | Recognize the difference between aerobic and anaerobic conditions. | Use a graphical representation to describe how one form of respiration is more efficient than the other in releasing energy. |
| **HS-LS2-4** | Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem. | Use a graphical representation to identify the changes in the amount of matter as it travels through a food web.Use a graphical representation to identify the changes in the amount of energy as it travels through a food web. | Identify that matter and energy flow through food chains. | Identify the types of matter and energy that flow through a food web. | Diagram the movement of matter and energy through a food web (ecosystem). | Given an example of a food web, explain why there are more producers than consumers in an ecosystem. |
| **HS-LS2-5** | Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere. | Use a model of photosynthesis to identify that carbon is exchanged between living and nonliving systems.Use a model of cellular respiration to identify that carbon is exchanged between living and nonliving systems. | Identify what a plant needs to make its own food. | Recognize the purpose/importance of photosynthesis and respiration to plants.  | Identify that the outputs of photosynthesis are the inputs of respiration, and the outputs of respiration are the inputs of photosynthesis.  | Describe the link between photosynthesis and cellular respiration in the carbon cycle.  |
| **HS-LS2-6** | Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms under stable conditions; however, moderate to extreme fluctuations in conditions may result in new ecosystems. | Use evidence to identify how modest biological or physical changes versus extreme changes affect stability and change (e.g., number and types of organisms) in ecosystems. | Differentiate between biotic and abiotic factors of an ecosystem. | Identify how an abiotic factor affects and changes a population (e.g., sunlight, water, soil). | Classify natural and human-initiated changes in the physical environment that could affect a population. | Describe how a change can affect the physical and biological environment and, in turn, affect the populations in an ecosystem. |
| **HS-LS2-7** | Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity. | Describe how people can help protect the Earth's environment and biodiversity (e.g., preserving ecosystems) and how a human activity would threaten Earth's environment and biodiversity (e.g., pollution, damaging habitats, over hunting). | Identify human activities that can be harmful to Earth. | Identify human activities that can be harmful to Earth and match the human activity with its effect on Earth. | Identify human activities that can have a negative effect on Earth and then identify a solution that reduces its impact on the environment. | Describe a solution to reduce the impact of human activities on the environment. |
| **HS-LS2-8** | Evaluate the evidence for the role of group behavior on individual and species’ chances to survive and reproduce. | Evaluate evidence supporting the outcome of group behavior (e.g., life expectancy, species’ chances to survive and reproduce). | Identify potential threats to a population of animals. | Identify a group behavior that helps an animal species survive. | Given a group behavior, describe how that behavior helps individuals and species to survive and reproduce. | Use data (pictorial, graphical, or tabular) to illustrate the positive impact of group behavior on an animal’s species. |
| **HS-LS3-1** | Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring. | Recognize that DNA molecules in all cells contain the instructions for traits passed from parents to offspring. | Identify different types of traits (biological phenotypes). | Identify traits passed from parents to offspring. | Recognize that DNA in all cells contains the instructions for traits passed from parents to offspring. | Explain how traits can vary in a population because of changes in DNA. |
| **HS-LS3-2** | Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors. | Identify a model showing evidence that parents and offspring may have different traits.Recognize that meiosis is a process which distributes genetic material among the new cells (i.e., gametes) produced, which results in genetic variation.Recognize that when DNA makes a copy of itself, sometimes errors occur that may lead to genetic variations.Identify examples of mutations in DNA caused by environmental factors. | Identify that traits are determined by genetic information (DNA) that is kept in the chromosome. | Identify a reason why two siblings can have different characteristics even though they have the same parents. | Identify the causes of genetic variation. | Given a scenario, explain why reproduction may or may not result in oﬀspring with different traits. |
| **HS-LS3-3** | Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population. | Calculate the probability (e.g., two out of four) of a particular trait in an offspring based on a completed Punnett square.Identify examples, using data, of environmental factors which affect the expression of traits, and so then affect the probability of occurrences of traits in a population. | Match a trait that a parent and offspring have in common.  | Identify that a Punnett square can be used to determine traits that can be passed on to offspring. | Use a Punnett square to explore the probability of a particular trait appearing in offspring. | Use a Punnett square to determine the probability of two traits passed on to offspring. |
| **HS-LS4-1** | Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. | Identify patterns (e.g., DNA sequences, fossil records) as evidence to a claim of common ancestry. | Identify similarities of physical characteristics in different organisms. | Identify patterns of physical characteristics in different organisms. | Compare changes in fossil records to identify evidence of a common ancestor. | Identify multiple examples of evidence of a common ancestor. |
| **HS-LS4-2** | Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment. | Recognize that as a species grows in number, competition for limited resources also increases.Recognize that different individuals have specific traits that give advantages (e.g., survive and reproduce at higher rates) over other individuals in the species.Identify how evolution may be a result of genetic variation through mutations and sexual reproduction in a species that is passed on to their offspring. | Identify evolution as a process that results in species developing beneficial characteristics. | Identify new characteristics caused by evolution that increase the chances of survival. | Determine which factor(s) (e.g., an inherited genetic variation, limited resources, organisms that were more fit to survive in an environment) resulted in a speciﬁc adaptation within a species. | Given a scenario (e.g., limited resources), describe an adaptation that a speciﬁc species may develop and pass on to future generations. |
| **HS-LS4-3** | Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait. | Use patterns in data to identify how heritable variations in a trait may lead to an increasing proportion of individuals within a population with that trait (i.e., an advantageous characteristic). | Identify that some organisms survive better in certain environments. | Identify an advantageous inheritable trait. | Given a scenario of similar organisms with diﬀerent traits, explain why an organism will likely survive based on the given environment (e.g., birds with different-shaped beaks trying to eat insects). | Use data (pictorial, graphical, or tabular) to explain why there is an increased probability of individual organisms exhibiting an advantageous trait over time. |
| **HS-LS4-4** | Construct an explanation based on evidence for how natural selection leads to adaptation of populations. | Use data to provide evidence for how specific biotic or abiotic differences in ecosystems (e.g., ranges of seasonal temperature, acidity, light, geographic barriers) support the claim that organisms with an advantageous heritable trait are better able to survive over time. | Identify a trait. | Identify a trait that would give an organism a better chance of survival in a specific environment. | Explain why organisms with beneficial traits are more likely to survive and reproduce. | Describe how over time, populations become better adapted to a specific environment. |
| **HS-LS4-5** | Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species. | Recognize that species become extinct because they can no longer survive and reproduce given changes in the environment.Recognize the relationship between naturally occurring or human-induced changes in the environment (e.g., drought, flood, deforestation, fishing, application of fertilizers) and the expression of traits in a species (e.g., peppered moth studies). | Identify the survival needs of the organisms present in a specific environment. | Identify a gradual change in a specific environment (e.g., deforestation, fishing, fertilizer application, drought, or ﬂood). | Explain how a gradual change in the environment can cause changes in organisms. | Use data to predict what will happen to specific species over time based on an environmental change. |
| **HS-LS4-6** | Use a simulation to research and analyze possible solutions for the adverse impacts of human activity on biodiversity. | Identify long or short term goals of a solution meant to minimize adverse impacts of a human activity on biodiversity. | Identify a human activity that negatively impacts another species. | Identify other species that have been signiﬁcantly impacted by human activity (e.g., endangered or extinct species). | Use data (pictorial, graphical, or tabular) to determine the effectiveness of a strategy to protect a species. | Use data (pictorial, graphical, or tabular) to determine alternative ways for humans to continue an activity without negatively affecting another species. |
| **HS-LS4-7** | 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. | Identify patterns (i.e., pictorial displays, representations, data) as evidence of relationships among species. | Identify patterns of anatomical similarities between members of the same species. | Identify patterns of anatomical similarities between members of the same genus. | Identify patterns of similar embryological development between different organisms that appear unrelated. | Explain that the more different organisms appear from each other, the longer it has been since they appeared from a common ancestor. |
| **HS-ESS1-1** | Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun’s core to release energy that eventually reaches Earth in the form of radiation. | Describe components of a model illustrating that the sun shines because of nuclear fusion reactions which release light and heat energy which make life on Earth possible. | Identify that the sun releases energy. | Recognize that energy from the sun reaches Earth. | Use a model to show that the energy released from the sun's core warms Earth and provides the surface of Earth with light. | Explain how energy released from the sun's core warms Earth and provides the surface of Earth with light. |
| **HS-ESS1-2** | Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe. | Identify that the universe is expanding and must have been smaller in the past based on astronomical evidence (i.e., light spectra, motion of distant galaxies, and composition of matter in the universe). | Identify that Earth is part of a galaxy.  | List a tool or method scientists use to provide evidence that the universe is expanding. | Use evidence to explain that the motion of distant galaxies is one way we know that the universe is expanding from its origin. | Explain pictorial or graphical data representing the expansion of the universe from its origin based on the motion of distant galaxies. |
| **HS-ESS1-3** | Communicate scientific ideas about the way stars, over their life cycle, produce elements. | Recognize that solar activity creates elements through nuclear fusion. | Differentiate stars from other celestial bodies (e.g., planets, moons, comets). | Identify the elements produced over the life cycle of a star. | Use a model to explain that stars produce elements (including hydrogen, helium, and iron) during their life cycles. | Use a model to explain that the elements stars produce during their life cycles get larger and heavier. |
| **HS-ESS1-4** | Use mathematical or computational representations to predict the motion of orbiting objects in the solar system. | Recognize that objects in the solar system orbit the sun and have an orderly motion (e.g., elliptical paths around the sun).Relate Earth’s orbital characteristics to other bodies in the solar system. | Identify that planets have motion. | Recognize that Earth and other planets and objects orbit the sun. | Demonstrate the orderly motion of objects orbiting the sun. | Relate Earth's orbital characteristics to other bodies in the solar system. |
| **HS-ESS1-5** | Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks. | Explain the relationship between the motion of continental plates and how materials of different ages are arranged on Earth’s surface. | Recognize Earth's crust is divided into tectonic plates. | Identify ways that tectonic plates move. | Explain that the youngest rocks are formed as tectonic plates move apart. | Use evidence to show the ages of crustal rocks near and far from a divergent boundary (e.g., rocks closest to the boundary are youngest). |
| **HS-ESS1-6** | Apply scientific reasoning and evidence from ancient earth materials, meteorites, and other planetary surfaces to construct an account of Earth’s formation and early history. | Identify ancient Earth materials, lunar rocks, asteroids, and meteorites as sources of evidence scientists use to understand Earth’s early history. | Recognize that Earth is part of a solar system with planetary bodies. | Identify the similarities and differences between Earth and other orbiting bodies. (e.g., shape, size, orbit, moons) | Identify different pieces of information that could support Earth’s early history (e.g., asteroid craters on Earth and Mars, plate subduction). | Compare pieces of data that would support an explanation of Earth’s early history and formation. |
| **HS-ESS2-1** | Analyze geoscience data to make the claim that one change to Earth’s surface can create feedback that causes changes to other Earth systems. | Identify relationships, using a model, of how the Earth's surface is a complex and dynamic set of interconnected systems (i.e., geosphere, hydrosphere, atmosphere, and biosphere). | Identify Earth’s systems. | Identify Earth's cycles. | Use a model to show Earth's complex set of interconnected systems. | Explain changes on Earth's surface caused by the interconnection of Earth's cycles. |
| **HS-ESS2-2** | Develop a model based on evidence of Earth’s interior to describe the cycling of matter by thermal convection. | Use a model of Earth to identify that the motion of the mantle and its plates occurs primarily through thermal convection, which is primarily driven by radioactive decay within Earth’s interior. | Identify plate tectonics. | Identify sources of tectonic motion. | Use a model to show thermal convection from the mantle to the crust. | Explain how thermal convection from deep in Earth causes the surface of Earth to move or change. |
| **HS-ESS2-3** | Use a model to describe how variations in the flow of energy into and out of Earth’s systems result in changes in climate. | Use a model to identify different causes of climate change and results of those changes with respect to the Earth’s surface temperatures, precipitation patterns, or sea levels over a wide range of temporal and spatial scales.Identify different causes of climate change and results of those changes with respect to the Earth’s surface temperatures, precipitation patterns, or sea levels over a wide range of temporal and spatial scales using a model. | Identify the differences between geographical climates. | Identify climate changes that have occurred. | Use a model to identify the different reasons that a climate can change. | Change a model to show how a climate would change if something in the environment changes. |
| **HS-ESS2-4** | Plan and carry out an investigation of the properties of water and its effects on earth materials and surface processes. | Identify a connection between the properties of water and its effects on Earth materials. | Identify properties of water. | Connect properties of water to effects on earth materials. | Examine water properties and its effects on Earth's systems. | Demonstrate how humans can affect the water cycle that results in benefits as well as hazards. |
| **HS-ESS3-1** | Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity. | Explain the relationship between human activity (e.g., population size, where humans live, types of crops grown) and changes in the amounts of natural resources using evidence.Explain the relationship between human activity (e.g., population size, where humans live, types of crops grown) and changes in the occurrence of natural hazards using evidence. | Identify natural resources. | Recognize that a pattern exists between the availability of natural resources and human activity. | Describe how the availability of natural resources and/or the occurrence of natural hazards influence human activity. | Predict human activity based on the availability of natural resources and the occurrence of natural hazards. |
| **HS-ESS3-2** | Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios. | Identify the solution that demonstrates the most preferred cost-benefit ratios for developing, managing, and utilizing energy and mineral resources (i.e., conservation, recycling, and reuse of resources). | Identify a source of a natural resource (e.g., decaying plants and animals are the source of natural gas and oil; the sun is the source of solar power). | Identify a human impact on the environment when utilizing a resource (e.g., mining for ore has an impact on environment, fishing may catch apex predators). | Identify a solution that would help manage resources that will reduce the human impact on the environment. | Compare two solutions around managing resources and identify the best one that would reduce human impact when given constraints. |
| **HS-ESS3-3** | Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity. | Use numerical data to determine the effects of a conservation strategy to manage natural resources and to sustain human society and plant and animal life. | Identify human activities that affect Earth’s resources. | Identify ways in which humans use living and natural resources. | Identify steps that can be taken to sustain human populations and living resources. | Use data to illustrate how the management of natural resources promotes the sustainability of human populations and biodiversity.  |
| **HS-ESS3-4** | Evaluate or refine a technological solution that reduces impacts of human activities on natural systems. | Connect a technological solution (e.g., wet scrubber; baghouse) to its outcome (e.g., clean air) and to which human activity impact (e.g., air pollution) it is reducing. | Identify examples of technology. | Identify technologies that can reduce the effect of human activities on natural systems. | Predict how given technologies (e.g., recycling plants, devices to reduce emissions) will reduce the effect of human activities on natural systems based on a scenario. | Explain how technology (e.g., solar energy, wind turbines) can reduce the effect of human activities on natural systems. |
| **HS-ESS3-5** | Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems. | Use geoscience data to determine the relationship between a change in climate (e.g., precipitation, temperature) and its impact in a region. | Recognize patterns of change on Earth's systems. | Identify trends in climate data. | Predict environmental change based on current climate data. | Analyze data to explain the future rates of change in Earth's systems based on current trends. |
| **HS-ESS3-6** | Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity. | Use representations to describe the relationships among Earth systems and how those relationships are being modified due to human activity (e.g., increase in atmospheric carbon dioxide, increase in ocean acidification, effects on organisms in the ocean (coral reef), carbon cycle of the ocean, possible effects on marine populations). | Identify human activities that affect Earth systems. | Relate human activity to changes in amounts of natural resources. | Relate human activity and changes in the occurrence of natural hazards. | Describe how human activity is modifying Earth systems. |