NM Public Education Department

SCIENCE: BIOLOGY

END-OF-COURSE EXAM | GRADE 9–12 | YEAR 18–19

ASSESSMENT BLUEPRINT

Purpose Statement
Biology

The Biology End-of-Course (EOC) exam is intended to measure student proficiency of the New Mexico STEM Ready! Science Standards. This course-level exam is provided to all students who have completed Biology or related courses.
This exam can be given for the following STARS course codes:

1711 - Biology-First Year
1712 - Biology Advanced Studies
1715 - AP Biology

Intended as a final exam for the course, this is a summative assessment covering a range of content, skills, and applications. Scores are reported to the teacher, school, district, and state levels for the purposes of student grades, curriculum review, and NMTeach summative reports.

"The EOCs are exams written by New Mexico Teachers for New Mexico Students."
During the 2018 summer, teachers were brought together in person or online as part of the blueprint and exam revision process. The NM PED extends our gratitude to all those who contributed to this improvement process. Although we were unable to implement every suggestion due to conflicting viewpoints at times, this blueprint reflects the best collaborative effort among dedicated peers.

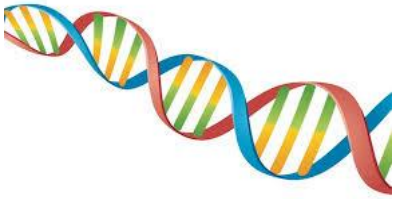
The NM PED would like to especially recognize the following people who led the revision of this blueprint:

- *Katherine Barnett Rivas, La Academia de Esperanza Charter School, Content Lead*
- *Alan Daugherty, Melrose Public Schools*
- *Azza Ezzat, Socorro Consolidated Schools*
- *Janet Bruelhart, Lovington Schools*
- *Kimberly Vigil, Espanola*
- *Melissa Burnett, Artesia*

Explanation of Blueprint Layout & Test Specifications Table

Topics	Clarifications on Test Item Specifications:
The performance expectations (PEs) identified in this portion of the blueprint are aligned to the New Mexico STEM Ready! Science Standards. *The PEs have been deconstructed to highlight the three dimensionality. Consult your NM STEM Ready! Standards for the full PE:* *https://webnew.ped.state.nm.us/bureaus/math-science/nm-stem-ready-science/nm-stem-ready-science-standards/* *and High School Recommended Discipline-Specific Course Map* *https://webnew.ped.state.nm.us/bureaus/math-science/nm-stem-ready-science/nm-stem-ready-science-standards/recommended-secondary-course-maps/* *New Mexico Teachers identified the PEs to be measured on the EOC exam using the following criteria: 1) a great deal of instructional time is spent on the PE as identified in the curriculum and/or; 2) the PE is important to subsequent learning.* *It is important to note that the PEs in the blueprint are only a **subset** of PEs to be measured with the understanding that teachers cover more PEs during the course of instruction than what has been selected to be measured.*	● *This portion of the blueprint identifies the DCI that students will have to demonstrate knowledge of during the exam. These items are not fully aligned to the Science and Engineering Practices (SEPs) and the crosscutting concepts (CCCs).* ● *Although the PE measures other dimensions, the item specifications may place constraints on portions of the DCI in order to provide more transparency as to what specifically will be measured relative to the PE.* ● *Items on this year's NM STEM Ready! transition EOC are content aligned and are items from the existing EOC and/or SBA item banks. PED will be field testing NM STEM Ready! cluster items for EOCs, which are optional for school participation.* **Item Types:** *The item types for this EOC exam are limited to:* *MC = multiple choice with or without stimulus (e.g., picture, graph, chart)* **Sample Question:** *Sample questions have been provided for some PEs to assist teachers to correlate the questions with the performance standards and the test item specification, when applicable. Sample questions could not be provided for all PEs due to the limitations in the existing EOC and SBA item bank.* *.* ● *An * denotes the correct answer* ● *DOK = Depth of Knowledge* ● *Some sample questions may be items released items from prior EOC exams*

Blueprint Table – Biology

Topic: From Molecules to Organisms: Structures and Processes	DCI with Test Item Specifications:
HS-LS1-1 **SEP**: Construct an explanation based on evidence for how **DCI**: the structure of DNA determines the structure of proteins, which carry out the essential functions of life through systems of specialized cells. **CCC**: the structure of proteins, which carry out the essential functions **Clarification Statement:** None **Assessment Boundary:** Assessment does not include identification of specific cell or tissue types, whole body systems, specific protein structures and functions, or the biochemistry of protein synthesis.	**LS1.A: Structure and Function** Systems of specialized cells within organisms help them perform the essential functions of life. All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells. **Essential Question:** **How do the structures of organisms enable life's functions?** **Item Types:** *MC = multiple choice with or without stimulus* **Sample Question:** What does the figure below represent?  (A) DNA * (B) RNA (C) amino acid (D) protein

Topic: From Molecules to Organisms: Structures and Processes	DCI with Test Item Specifications:
HS-LS1-2 **SEP**: Develop and use a model to illustrate **DCI**: the hierarchical organization of interacting systems that provide specific functions within multicellular organisms. **CCC**: of interacting systems **Clarification Statement:** Emphasis is on functions at the organism system level such as nutrient uptake, water delivery, and organism movement in response to neural stimuli. An example of an interacting system could be an artery depending on the proper function of elastic tissue and smooth muscle to regulate and deliver the proper amount of blood within the circulatory system. **Assessment Boundary:** Assessment does not include interactions and functions at the molecular or chemical reaction level.	**LS1.A: Structure and Function** Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level. **Essential Question:** **How do the structures of organisms enable life's functions?** **Item Types:** *MC = multiple choice with or without stimulus*

Topic: From Molecules to Organisms: Structures and Processes	DCI with Test Item Specifications:
HS-LS1-3 **SEP**: Plan and conduct an investigation to provide evidence that **DCI**: feedback mechanisms maintain homeostasis. **CCC**: feedback mechanisms maintain homeostasis. **Clarification Statement:** Examples of investigations could include heart rate response to exercise, stomate response to moisture and temperature, and root development in response to water levels. **Assessment Boundary:** Assessment does not include the cellular processes involved in the feedback mechanism.	**LS1.A: Structure and Function** Feedback mechanisms maintain a living system's internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system. **Essential Question:** **How do the structures of organisms enable life's functions?** **Item Types:** *MC = multiple choice with or without stimulus*

Topic: Matter and Energy in Organisms and Ecosystems	DCI with Test Item Specifications:
HS-LS1-5 **SEP**: Use a model to illustrate how **DCI**: photosynthesis transforms light energy into stored chemical energy. **CCC**: to illustrate how **Clarification Statement:** Emphasis is on illustrating inputs and outputs of matter and the transfer and transformation of energy in photosynthesis by plants and other photosynthesizing organisms. Examples of models could include diagrams, chemical equations, and conceptual models. **Assessment Boundary:** Assessment does not include specific biochemical steps.	**LS1.C: Organization for Matter and Energy Flow in Organisms** The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen. **Essential Questions:** **How do organisms obtain and use the matter and energy they need to live and grow?** **Item Types:** *MC = multiple choice with or without stimulus*

Topic: Matter and Energy in Organisms and Ecosystems	DCI with Test Item Specifications:
HS-LS1-7 **SEP**: Use a model to illustrate that **DCI**: cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed, resulting in a net transfer of energy. **CCC**: a net transfer of energy **Clarification Statement:** Emphasis is on the conceptual understanding of the inputs and outputs of the process of cellular respiration. **Assessment Boundary:** Assessment should not include identification of the steps or specific processes involved in cellular respiration.	**LS1.C: Organization for Matter and Energy Flow in Organisms** As matter and energy flow through different organizational levels of living systems, chemical elements are recombined in different ways to form different products. As a result of these chemical reactions, energy is transferred from one system of interacting molecules to another. Cellular respiration is a chemical process in which the bonds of food molecules and oxygen molecules are broken and new compounds are formed that can transport energy to muscles. Cellular respiration also releases the energy needed to maintain body temperature despite ongoing energy transfer to the surrounding environment. **Essential Questions:** **How do organisms obtain and use the matter and energy they need to live and grow?** **Item Types:** *MC = multiple choice with or without stimulus*

Topic: Matter and Energy in Organisms and Ecosystems	DCI with Test Item Specifications:
HS-LS2-3 **SEP**: Construct and revise an explanation based on evidence for **DCI**: the cycling of matter and flow of energy in aerobic and anaerobic conditions. **CCC**: the cycling of matter	**LS2.B: Cycles of Matter and Energy Transfer in Ecosystems** Photosynthesis and cellular respiration (including anaerobic processes) provide most of the energy for life processes. **Essential Questions:** **How do matter and energy move through an ecosystem?**
Clarification Statement: Emphasis is on conceptual understanding of the role of aerobic and anaerobic respiration in different environments. **Assessment Boundary:** Assessment does not include the specific chemical processes of either aerobic or anaerobic respiration.	**Item Types:** *MC = multiple choice with or without stimulus*

Topic: Matter and Energy in Organisms and Ecosystems	DCI with Test Item Specifications:
HS-LS2-4 **SEP**: Use mathematical representations to support claims **DCI**: the cycling of matter and flow of energy among organisms in an ecosystem **CCC**: for the cycling of matter and flow of energy **Clarification Statement:** Emphasis is on using a mathematical model of stored energy in biomass to describe the transfer of energy from one trophic level to another and that matter and energy are conserved as matter cycles and energy flows through ecosystems. Emphasis is on atoms and molecules such as carbon, oxygen, hydrogen and nitrogen being conserved as they move through an ecosystem. **Assessment Boundary:** Assessment is limited to proportional reasoning to describe the cycling of matter and flow of energy.	**LS2.B: Cycles of Matter and Energy Transfer in Ecosystems** Plants or algae form the lowest level of the food web. At each link upward in a food web, only a small fraction of the matter consumed at the lower level is transferred upward, to produce growth and release energy in cellular respiration at the higher level. Given this inefficiency, there are generally fewer organisms at higher levels of a food web. Some matter reacts to release energy for life functions, some matter is stored in newly made structures, and much is discarded. The chemical elements that make up the molecules of organisms pass through food webs and into and out of the atmosphere and soil, and they are combined and recombined in different ways. At each link in an ecosystem, matter and energy are conserved. **Essential Questions:** **How do matter and energy move through an ecosystem?** **Item Types:** *MC = multiple choice with or without stimulus* **Sample Question:** Which organisms produce their own food? (A) autotrophs* (B) heterotrophs (C) primary consumers (D) secondary consumers

Topic: Matter and Energy in Organisms and Ecosystems	DCI with Test Item Specifications:
HS-LS2-5 **SEP**: Develop a model to illustrate the role of **DCI**: photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere. **CCC**: to illustrate the role of…among the biosphere, atmosphere, hydrosphere, and geosphere. **Clarification Statement:** Examples of models could include simulations and mathematical models. **Assessment Boundary:** Assessment does not include the specific chemical steps of photosynthesis and respiration.	**LS2.B: Cycles of Matter and Energy Transfer in Ecosystems** Photosynthesis and cellular respiration are important components of the carbon cycle, in which carbon is exchanged among the biosphere, atmosphere, oceans, and geosphere through chemical, physical, geological, and biological processes. **PS3.D: Energy in Chemical Processes** The main way that solar energy is captured and stored on Earth is through the complex chemical process known as photosynthesis. *(secondary)* **Essential Questions:** **How do matter and energy move through an ecosystem?** **Item Types:** *MC = multiple choice with or without stimulus*

Topic: Interdependence in Ecosystems	DCI with Test Item Specifications:
HS-LS2-1 **SEP:** Use mathematical and/or computational representations to support explanations **DCI**: of factors that affect carrying capacity of ecosystems at different scales. **CCC**: at different scales **Clarification Statement:** Emphasis is on quantitative analysis and comparison of the relationships among interdependent factors including boundaries, resources, climate, and competition. Examples of mathematical comparisons could include graphs, charts, histograms, and population changes gathered from simulations or historical data sets. **Assessment Boundary:** Assessment does not include deriving mathematical equations to make comparisons.	**LS2.A: Interdependent Relationships in Ecosystems** Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources and from such challenges such as predation, competition, and disease. Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem. **Essential Questions:** **How do organisms interact with the living and nonliving environments to obtain matter and energy?** **Item Types:** *MC = multiple choice with or without stimulus*

Topic: Interdependence in Ecosystems	DCI with Test Item Specifications:
HS-LS2-2 **SEP:** Use mathematical representations to support and revise explanations based on evidence **DCI**: about factors affecting biodiversity and populations in ecosystems of different scales. **CCC**: at different scales **Clarification Statement:** Emphasis is on quantitative analysis and comparison of the relationships among interdependent factors including boundaries, resources, climate, and competition. Examples of mathematical comparisons could include graphs, charts, histograms, and population changes gathered from simulations or historical data sets. **Assessment Boundary:** Assessment does not include deriving mathematical equations to make comparisons.	**LS2.A: Interdependent Relationships in Ecosystems** Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources and from such challenges such as predation, competition, and disease. Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem. **LS2.C: Ecosystem Dynamics, Functioning, and Resilience** A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability. **Essential Questions:** **How do organisms interact with the living and nonliving environments to obtain matter and energy?** **What happens to ecosystems when the environment changes?** **Item Types:** *MC = multiple choice with or without stimulus*

Topic: Interdependence in Ecosystems	DCI with Test Item Specifications:
HS-LS2-6 **SEP:** Evaluate claims, evidence, and reasoning that **DCI**: the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem. **CCC**: the complex interactions in ecosystems maintain relatively consistent… in stable conditions, but changing conditions may result in **Clarification Statement:** Examples of changes in ecosystem conditions could include modest biological or physical changes, such as moderate hunting or a seasonal flood; and extreme changes, such as volcanic eruption or sea level rise. **Assessment Boundary:** None	**LS2.C: Ecosystem Dynamics, Functioning, and Resilience** A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability. **Essential Questions:** **What happens to ecosystems when the environment changes?** **Item Types:** *MC = multiple choice with or without stimulus*

Topic: Interdependence in Ecosystems	DCI with Test Item Specifications:
HS-LS2-7 **SEP**: Design, evaluate, and refine a solution for **DCI**: reducing the impacts of human activities on the environment and biodiversity. **CCC**: impacts of human activities **Clarification Statement:** Examples of human activities can include urbanization, building dams, and dissemination of invasive species **Assessment Boundary:** None	**LS2.C: Ecosystem Dynamics, Functioning, and Resilience** Moreover, anthropogenic changes (induced by human activity) in the environment—including habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change—can disrupt an ecosystem and threaten the survival of some species. **LS4.D: Biodiversity and Humans** Biodiversity is increased by the formation of new species (speciation) and decreased by the loss of species (extinction). *(secondary)* Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value. *(secondary)* **ETS1.B: Developing Possible Solutions** When evaluating solutions it is important to take into account a range of constraints including cost, safety, reliability and aesthetics and to consider social, cultural and environmental impacts. *(secondary)* **Essential Questions:** **What happens to ecosystems when the environment changes?** **What is biodiversity? How do humans affect it, and how does it affect humans?**
	Item Types: *MC = multiple choice with or without stimulus*
	Sample Question: Which human activity would have the most direct impact on the carbon cycle? (A) decreasing the use of water (B) destroying large forested areas * (C) reducing the rate of ecological succession (D) enforcing laws that prevent the use of aerosol cans

Topic: Inheritance and Variation of Traits	DCI with Test Item Specifications:
HS-LS1-4 **SEP:** Use a model to illustrate the role of **DCI**: cellular division (mitosis) and differentiation in producing and maintaining complex organisms. **CCC**: to illustrate the role of **Clarification Statement:** None **Assessment Boundary:** Assessment does not include specific gene control mechanisms or rote memorization of the steps of mitosis.	**LS1.B: Growth and Development of Organisms** In multicellular organisms individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. The organism begins as a single cell (fertilized egg) that divides successively to produce many cells, with each parent cell passing identical genetic material (two variants of each chromosome pair) to both daughter cells. Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism. **Essential Questions:** **How do organisms grow and develop?** **Item Types:** *MC = multiple choice with or without stimulus*

Topic: Inheritance and Variation of Traits	DCI with Test Item Specifications:
HS-LS3-1 **SEP**: Ask questions to clarify relationships about **DCI**: the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring. **CCC**: the role of DNA and chromosomes in coding the instructions for **Clarification Statement:** None **Assessment Boundary:** Assessment does not include the phases of meiosis or the biochemical mechanism of specific steps in the process.	**LS1.A: Structure and Function** All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins. **LS3.A: Inheritance of Traits** Each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA. The instructions for forming species' characteristics are carried in DNA. All cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. Not all DNA codes for a protein; some segments of DNA are involved in regulatory or structural functions, and some have no as-yet known function. **Essential Questions:** **How do the structures of organisms enable life's functions?** **How are characteristics of one generation related to the previous generation?**
	Item Types: *MC = multiple choice with or without stimulus*
	Sample Question: What would be the complementary sequence of nucleotides for an mRNA molecule created from the following DNA sequence: CAT GGG? (A) CTU CCC (B) GTA CCC (C) CUA GGG (D) GUA CCC *

Topic: Inheritance and Variation of Traits	DCI with Test Item Specifications:
HS-LS3-2 **SEP:** Make and defend a claim based on evidence that **DCI**: 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. **CCC**: may result from **Clarification Statement:** Emphasis is on using data to support arguments for the way variation occurs. **Assessment Boundary:** Assessment does not include the phases of meiosis or the biochemical mechanism of specific steps in the process.	**LS3.B: Variation of Traits** In sexual reproduction, chromosomes can sometimes swap sections during the process of meiosis (cell division), thereby creating new genetic combinations and thus more genetic variation. Although DNA replication is tightly regulated and remarkably accurate, errors do occur and result in mutations, which are also a source of genetic variation. Environmental factors can also cause mutations in genes, and viable mutations are inherited. Environmental factors also affect expression of traits, and hence affect the probability of occurrences of traits in a population. Thus the variation and distribution of traits observed depends on both genetic and environmental factors. **Essential Questions:** **Why do individuals of the same species vary in how they look, function, and behave?** **Item Types:** *MC = multiple choice with or without stimulus*

Topic: Inheritance and Variation of Traits	DCI with Test Item Specifications:
HS-LS3-3 **SEP:** Apply concepts of statistics and probability to explain **DCI**: the variation and distribution of expressed traits in a population. **CCC**: the variation and distribution **Clarification Statement:** Emphasis is on the use of mathematics to describe the probability of traits as it relates to genetic and environmental factors in the expression of traits. **Assessment Boundary:** Assessment does not include Hardy-Weinberg calculations.	**LS3.B: Variation of Traits** Environmental factors also affect expression of traits, and hence affect the probability of occurrences of traits in a population. Thus the variation and distribution of traits observed depends on both genetic and environmental factors. **Essential Questions:** **Why do individuals of the same species vary in how they look, function, and behave?** **Item Types:** *MC = multiple choice with or without stimulus*

Topic: Natural Selection and Evolution	DCI with Test Item Specifications:
HS-LS4-1 **SEP**: Communicate scientific information that **DCI**: common ancestry and biological evolution are supported by multiple lines of empirical evidence. **CCC**: are supported by multiple lines of empirical evidence. **Clarification Statement:** None **Assessment Boundary:** Emphasis is on a conceptual understanding of the role each line of evidence has relating to common ancestry and biological evolution. Examples of evidence could include similarities in DNA sequences, anatomical structures, and order of appearance of structures in embryological development.	**LS4.A: Evidence of Common Ancestry and Diversity** Genetic information, like the fossil record, provides evidence of evolution. DNA sequences vary among species, but there are many overlaps; in fact, the ongoing branching that produces multiple lines of descent can be inferred by comparing the DNA sequences of different organisms. Such information is also derivable from the similarities and differences in amino acid sequences and from anatomical and embryological evidence. **Essential Question:** **What evidence shows that different species are related?** **Item Types**: *MC = multiple choice with or without stimulus* **Sample Question:** **DOK = 1** What do the earliest cellular life forms appear to have been? (A) fungi (B) prokaryotes * (C) one-celled plants (D) one-celled animals

Topic: Natural Selection and Evolution	DCI with Test Item Specifications:
HS-LS4-2 **SEP:** Construct an explanation based on evidence that **DCI**: 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. **CCC**: primarily results from **Clarification Statement:** Emphasis is on using evidence to explain the influence each of the four factors has on number of organisms, behaviors, morphology, or physiology in terms of ability to compete for limited resources and subsequent survival of individuals and adaptation of species. Examples of evidence could include mathematical models such as simple distribution graphs and proportional reasoning. **Assessment Boundary:** Assessment does not include other mechanisms of evolution, such as genetic drift, gene flow through migration, and co-evolution.	**LS4.B: Natural Selection** Natural selection occurs only if there is both (1) variation in the genetic information between organisms in a population and (2) variation in the expression of that genetic information—that is, trait variation—that leads to differences in performance among individuals. **LS4.C: Adaptation** Evolution is a consequence of the interaction of four factors: (1) the potential for a species to increase in number, (2) the genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for an environment's limited supply of the resources that individuals need in order to survive and reproduce, and (4) the ensuing proliferation of those organisms that are better able to survive and reproduce in that environment. **Essential Questions:** **How does genetic variation among organisms affect survival and reproduction?** **How does the environment influence populations of organisms over multiple generations?** **Item Types:** *MC = multiple choice with or without stimulus*

Topic: Natural Selection and Evolution	DCI with Test Item Specifications:
HS-LS4-3 **SEP:** Apply concepts of statistics and probability to support explanations that **DCI**: organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait. **CCC**: tend to **Clarification Statement:** Emphasis is on analyzing shifts in numerical distribution of traits and using these shifts as evidence to support explanations. **Assessment Boundary:** Assessment is limited to basic statistical and graphical analysis. Assessment does not include allele frequency calculations.	**LS4.B: Natural Selection** Natural selection occurs only if there is both (1) variation in the genetic information between organisms in a population and (2) variation in the expression of that genetic information—that is, trait variation—that leads to differences in performance among individuals. The traits that positively affect survival are more likely to be reproduced, and thus are more common in the population. **LS4.C: Adaptation** Natural selection leads to adaptation, that is, to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment. That is, the differential survival and reproduction of organisms in a population that have an advantageous heritable trait leads to an increase in the proportion of individuals in future generations that have the trait and to a decrease in the proportion of individuals that do not. Adaptation also means that the distribution of traits in a population can change when conditions change. **Essential Questions:** **How does genetic variation among organisms affect survival and reproduction?** **How does the environment influence populations of organisms over multiple generations?**
	Item Types: *MC = multiple choice with or without stimulus*

Topic: Natural Selection and Evolution	DCI with Test Item Specifications:
HS-LS4-4 **SEP:** Construct an explanation based on evidence for how **DCI**: natural selection leads to adaptation of populations. **CCC**: leads to **Clarification Statement:** Emphasis is on using data to provide evidence for how specific biotic and abiotic differences in ecosystems (such as ranges of seasonal temperature, long-term climate change, acidity, light, geographic barriers, or evolution of other organisms) contribute to a change in gene frequency over time, leading to adaptation of populations. **Assessment Boundary:** None	**LS4.C: Adaptation** Natural selection leads to adaptation, that is, to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment. That is, the differential survival and reproduction of organisms in a population that have an advantageous heritable trait leads to an increase in the proportion of individuals in future generations that have the trait and to a decrease in the proportion of individuals that do not. **Essential Questions:** **How does the environment influence populations of organisms over multiple generations?** **Item Types:** *MC = multiple choice with or without stimulus*

Topic: Earth's Systems	DCI with Test Item Specifications:
HS-ESS2-4 **SEP**: Use a model to describe how **DCI**: variations in the flow of energy into and out of Earth's systems result in changes in climate. **CCC**: result in **Clarification Statement:** Examples of the causes of climate change differ by timescale, over 1-10 years: large volcanic eruption, ocean circulation; 10-100s of years: changes in human activity, ocean circulation, solar output; 10-100s of thousands of years: changes to Earth's orbit and the orientation of its axis; and 10-100s of millions of years: long-term changes in atmospheric composition. **Assessment Boundary:** Assessment of the results of changes in climate is limited to changes in surface temperatures, precipitation patterns, glacial ice volumes, sea levels, and biosphere distribution.	**ESS1.B: Earth and the Solar System** Cyclical changes in the shape of Earth's orbit around the sun, together with changes in the tilt of the planet's axis of rotation, both occurring over hundreds of thousands of years, have altered the intensity and distribution of sunlight falling on the earth. These phenomena cause a cycle of ice ages and other gradual climate changes. **ESS2.A: Earth Materials and Systems** The geological record shows that changes to global and regional climate can be caused by interactions among changes in the sun's energy output or Earth's orbit, tectonic events, ocean circulation, volcanic activity, glaciers, vegetation, and human activities. These changes can occur on a variety of time scales from sudden (e.g., volcanic ash clouds) to intermediate (ice ages) to very long-term tectonic cycles. **ESS2.D: Weather and Climate** The foundation for Earth's global climate systems is the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy's re-radiation into space. **Essential Questions:** **What are the predictable patterns caused by Earth's movement in the solar system?** **How do Earth's major systems interact?** **What regulates weather and climate?**
	Item Types: *MC = multiple choice with or without stimulus*
	Sample Question: What is one effect of the fact that there is more solar radiation hitting Earth at the equator than at the poles? (A) increased surface temperatures at the equator * (B) El Niño precipitation patterns (C) increased surface temperatures at the poles (D) decreased sea levels at the equator

Topic: Earth and Human Activity	DCI with Test Item Specifications:
HS-ESS3-1 **SEP**: Construct an explanation based on evidence for how **DCI**: the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity. **CCC**: have influenced human activity. **Clarification Statement:** Examples of key natural resources include access to fresh water (such as rivers, lakes, and groundwater), regions of fertile soils such as river deltas, and high concentrations of minerals and fossil fuels. Examples of natural hazards can be from interior processes (such as volcanic eruptions and earthquakes), surface processes (such as tsunamis, mass wasting and soil erosion), and severe weather (such as hurricanes, floods, and droughts). Examples of the results of changes in climate that can affect populations or drive mass migrations include changes to sea level, regional patterns of temperature and precipitation, and the types of crops and livestock that can be raised. **Assessment Boundary:** None	**ESS3.A: Natural Resources** Resource availability has guided the development of human society. **ESS3.B: Natural Hazards** Natural hazards and other geologic events have shaped the course of human history; [they] have significantly altered the sizes of human populations and have driven human migrations. **Essential Questions:** **How do humans depend on Earth's resources?** **How do natural hazards affect individuals and societies?** **Item Types:** *MC = multiple choice with or without stimulus* **Sample Question:** Which of the following could increase the conservation of water in New Mexico? (A) improve the systems of agricultural irrigation (B) reduce the amount of land covered by grass and lawns (C) reduce residential water use (D) all of the above *

Topic: Earth and Human Activity	DCI with Test Item Specifications:
HS-ESS3-4 **SEP**: Evaluate or refine a technological solution **DCI**: that reduces impacts of human activities on natural systems. **CCC**: that reduces impacts **Clarification Statement:** Examples of data on the impacts of human activities could include the quantities and types of pollutants released, changes to biomass and species diversity, or areal changes in land surface use (such as for urban development, agriculture and livestock, or surface mining). Examples for limiting future impacts could range from local efforts (such as reducing, reusing, and recycling resources) to large-scale geoengineering design solutions (such as altering global temperatures by making large changes to the atmosphere or ocean). **Assessment Boundary:** None	**ESS3.C: Human Impacts on Earth Systems** Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation. **ETS1.B: Developing Possible Solutions** When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. *(secondary)* **Essential Questions:** **How do humans change the planet?** **What is the process for developing potential design solutions?** **Item Types:** *MC = multiple choice with or without stimulus*

Biology Science – EoC Reporting Category Alignment Framework					
Reporting Category	**Performance Expectation**	**DOK (Count by DOK)**			**Grand Total**
		1	**2**	**3**	
Engineering Design (repeat)	HS-ETS1-1				
	HS-ETS1-2				
	HS-ETS1-3				
	HS-ETS1-4				
From Molecules to Organisms: Structures and Processes	HS-LS1-1		2		**2**
	HS-LS1-2	1			**1**
	HS-LS1-3		1		**1**
Matter and Energy in Organisms and Ecosystems	HS-LS1-5			1	**1**
	HS-LS1-6				
	HS-LS1-7		1		**1**
	HS-LS2-3	1			**1**
	HS-LS2-4			1	**1**
	HS-LS2-5	1			**1**
Interdependence in Ecosystem	HS-LS2-1	1			**1**
	HS-LS2-2	1			**1**
	HS-LS2-6			1	**1**
	HS-LS2-7		2		**2**
	HS-LS2-7 NM				
	HS-LS2-8				
	HS-LS4-6				
Inheritance and Variation of Traits	HS-LS1-4			1	**1**
	HS-LS3-1	1		1	**2**
	HS-LS3-2	4	2		**6**

	HS-LS3-3		1		**1**
Natural Selection and Evolution	HS-LS4-1	3	1		**4**
	HS-LS4-2		3		**3**
	HS-LS4-3		1		**1**
	HS-LS4-4	1	2		**3**
	HS-LS4-5				
Earth's Systems	HS-ESS2-4		1		**1**
	HS-ESS2-7				
Earth and Human Activity	HS-ESS3-1		2		**2**
	HS-ESS3-3				
	HS-ESS3-4	1			**1**
	Grand Total	**15**	**20**	**5**	**40**