MARYLAND STATE DEPARTMENT OF EDUCATION
EQUITY AND EXCELLENCE

Karen B. Salmon, Ph.D.
State Superintendent of Schools

TO: Members of the State Board of Education

FROM: Karen B. Salmon, Ph.D.

DATE: March 26, 2019

SUBJECT: Maryland High School Science Assessment (MISA) as a Graduation Requirement

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PURPOSE:

The purpose of this item is to request permission to delay, for two years, implementation of the High School Maryland Integrated Science Assessment (HS MISA) as a graduation requirement.

HISTORICAL BACKGROUND:

The HS MISA, aligned to the Next Generation Science Standards (NGSS), integrates all three dimensions of the standards including the disciplinary core ideas, science and engineering practices, and crosscutting concepts. The disciplinary core ideas include life science, physical science, Earth and space science content. The primary purpose of MISA is to provide high-quality science assessments to measure how well students understand grade band concepts in science. The assessment is one of several ways to help parents and teachers understand how well children are acquiring science concepts and practices. The High School MISA assesses content and practices contained in multiple high school courses, hence it is not an end of course examination.

In January 2018, the Maryland State Board of Education adopted revisions to COMAR 13A.03.02.09.C granting an exception for all students taking the HS MISA in the 2017-2018 and 2018-2019 school years because the new assessment was being developed to replace the previous High School Assessment in Biology. In addition, during this time, local school systems had been writing and implementing curriculum aligned to NGSS as well as reconfiguring their high school course sequences.

The Maryland High School Graduation Task Force first convened in January 2018 at the request of the State Board and Superintendent of Public Schools. The group was to make recommendations on the Code of Maryland Regulation (COMAR) Chapter 13A.03.02 (Graduation Requirements for Public High Schools in Maryland). In October 2018, the Task Force report was presented to the State Board and specifically recommended students continue to be required to take the HS MISA as a participation-only graduation requirement. The Task Force also suggested a study be conducted on student assessment and course taking data to determine if there is an appropriate way to consider the HS MISA as an end of course exam. Additionally, the Task Force recommended adding the HS MISA to the ESSA plan as an accountability measure.

The HS MISA was field tested in the 2017-2018 school year and is being administered operationally in the 2018-2019 school year. Standard setting for the HS MISA will occur in August 2019 after all the data from that year's administration is compiled. It is expected that the student, school, and school system reports for the first operational year would be sent to school systems on or about November 1, 2019. Students taking the assessment in 2019-2020 would be required to pass in order to graduate.

The local school systems would be provided student, school, and system reports based on the HS MISA results. Schools will receive student scores, and local school systems will receive a school performance level summary. Information about the State, system, and school average results will be included in relevant sections of the reports to help schools and systems understand how student and school performance compares to other students and schools. Additional reports are designed to provide a more in-depth analysis of demographic and program categories with student groups' performance on the assessment and items as they relate to both the alignment to HS MISA Evidence Statements and the NGSS. With this data, school systems will have the evidence to support improvement initiatives prioritizing professional learning, resource decisions, and verifying program alignment with academic standards.

EXECUTIVE SUMMARY:

System, school, and student level data is expected to be released late in the fall 2019, well after instruction has begun for the 2019-2020 school year. Local school systems will not have an opportunity to revise curricula, deliver professional learning, adjust staffing, or secure resources for HS MISA prior to the assessment impacting graduation in the spring 2020. Extending the exemption for the HS MISA as a graduation requirement would allow local school systems time to analyze the initial data from the first operational year of the HS MISA and allow students to participate in a full sequence of courses aligned to the new assessment prior to the HS MISA counting for graduation. The potential exists for many students to be negatively impacted by the convergence of revised programs and the new assessment. In addition, MSDE will be able to conduct a study to determine both the best sequencing of courses as well as the potential for administering HS MISA as an end of course assessment.

ACTION:

Request permission to delay, for two years, the High School Maryland Integrated Science Assessment (HS MISA) as a graduation requirement; COMAR 13A.03.02.09.C *Graduation Requirements for Public High Schools in Maryland* will be addressed during the regulation portion of the meeting.

Attachments (2):

Attachment I: High School Maryland Integrated Science Assessment as a Graduation Requirement PowerPoint
Attachment II: Summary Sheet of 22 High School Performance Expectations

Attachment I

High School Maryland Integrated Science Assessment (HS MISA) as a Graduation Requirement

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STATE BOARD OF EDUCATION MEETING

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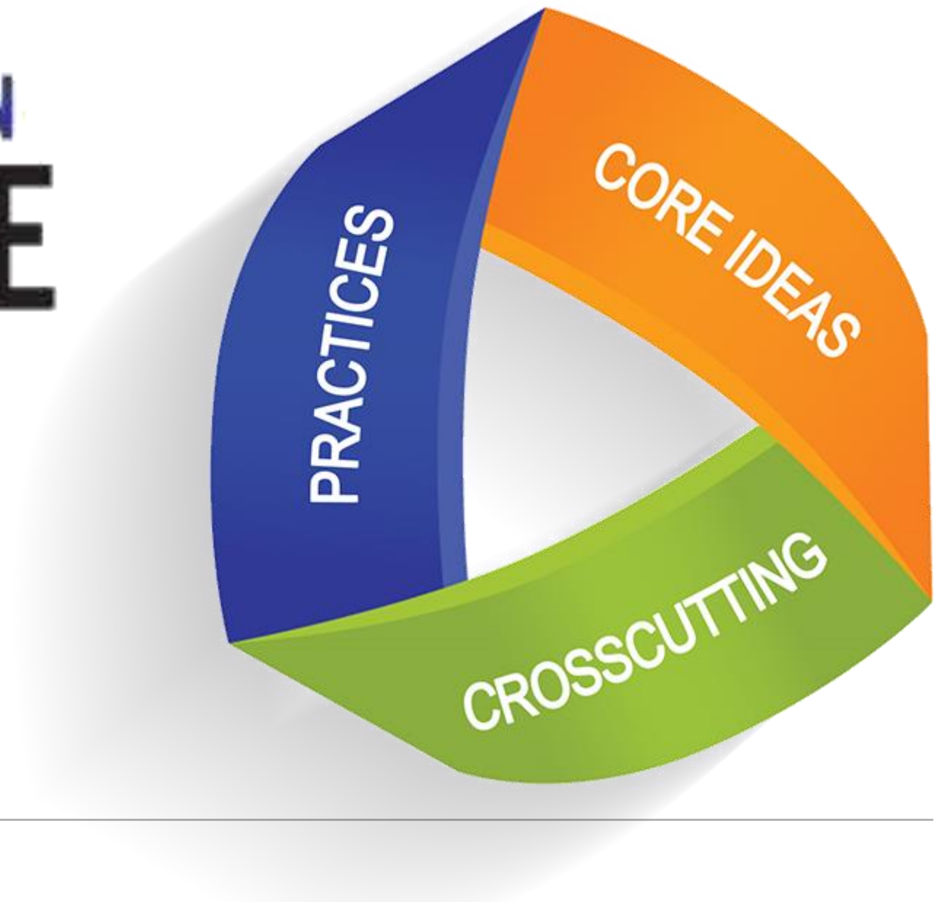
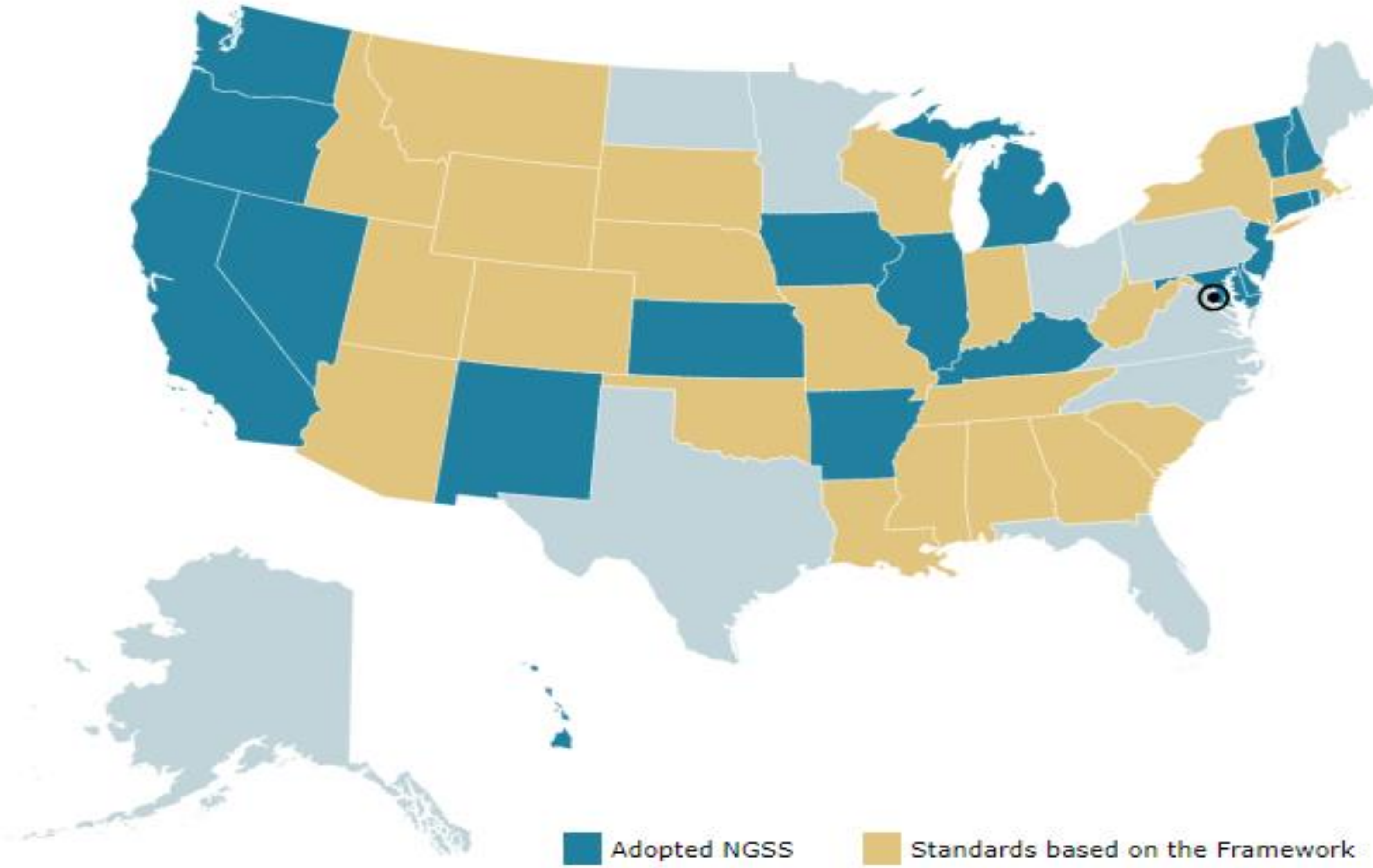
Background

In 2013 the State Board of Education adopted the Next Generation Science Standards (NGSS).

NEXT GENERATION SCIENCE STANDARDS



Background



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Comparing Maryland Science Assessments

Biology Core Learning Goals (Standards)	Next Generation Science Standards
↓	↓
Biology Course	Two or Three Science Courses
↓	↓
Biology Assessment	HS MISA

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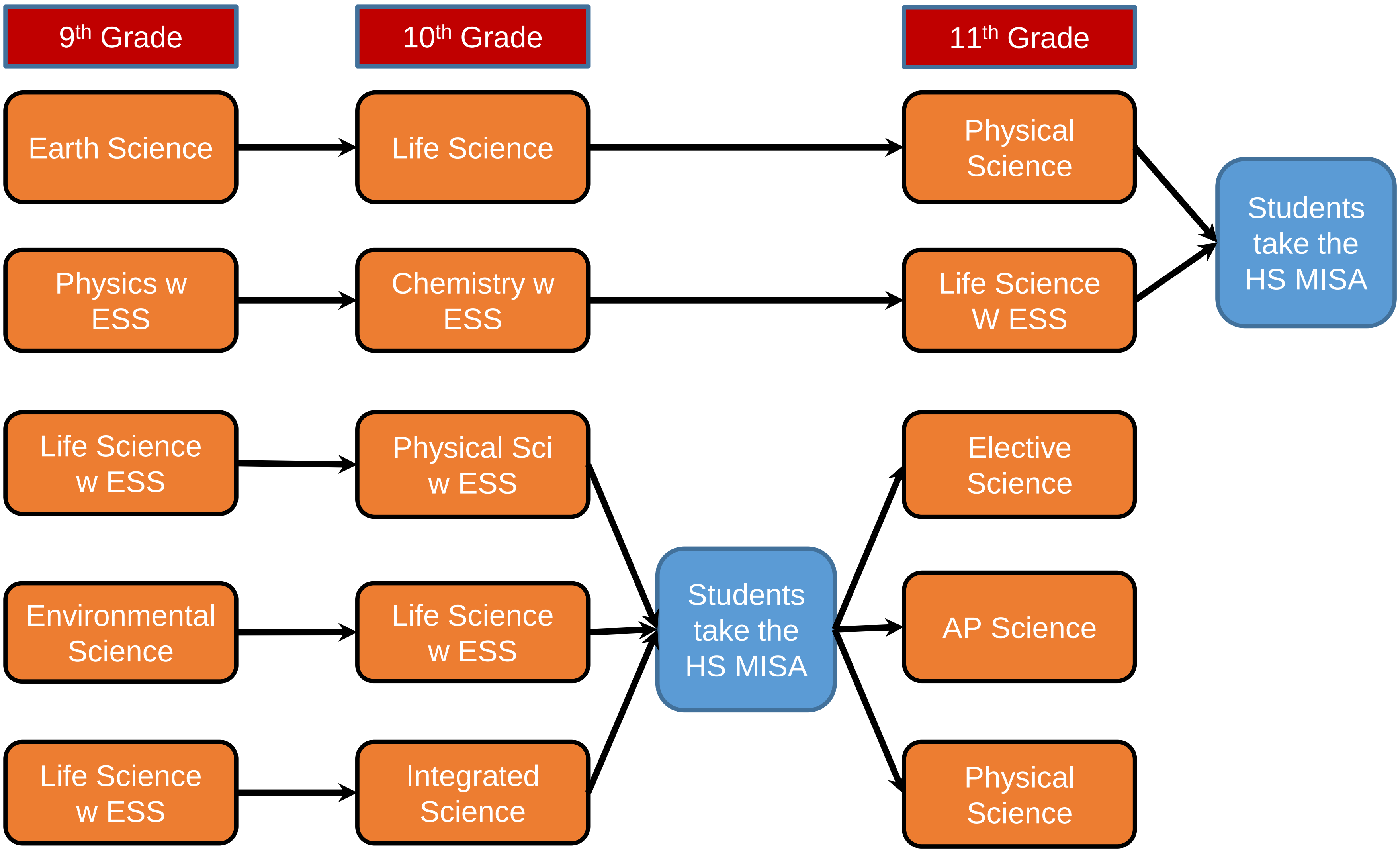
Courses Before Assessing

Number of Science Courses Taken Before Sitting for the HS MISA	Number of Local School Systems
2	10
2.5	4
3	10

Pathways to HS MISA



Science COMAR

- **In 2016 the State Board of Education changed COMAR to state that students taking the HSA Biology in its last year would meet the graduation requirement for science.**

(2) For all students taking the HSA biology assessment in the 2016—2017 school year, taking the HSA biology assessment will meet the graduation assessment requirement for biology.

- **In 2017 the State Board of Education changed COMAR to allow a two year waiver during which students could take, but not necessarily pass the new HS MISA in order to graduate.**

(3) For all students taking the Maryland Integrated Science Assessment in the 2017—2018 and 2018—2019 school years, taking the Maryland Integrated Science Assessment will meet the graduation assessment requirement for science.

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Graduation Task Force Recommendations

- Require all students to participate in the HS MISA until it can be determined by MSDE how to create an "end-of-course" assessment for science.
- After four years of the HS MISA assessment implementation, MSDE conduct a study on student assessment and course-taking data to determine if there is an appropriate way to consider the HS MISA as an end-of- course exam.
- Add the HS MISA as a high school science accountability measure for schools to the state's Every Student Succeeds Act (ESSA) plan.
- The Maryland Graduation Task Force does not support the use of the HS MISA as a graduation requirement

HS MISA Reporting Schedule

January and May 2019
- First operational High School MISA administered

August 2019
- High School MISA standards setting held
- Produces range for proficiency scale scores
- Determines passing score

October 2019
- High School MISA standards presented to the Board for information

November 2019
- High School MISA district, school, and student data released to local school systems for the first time
  ►Districts have one month prior to next assessment to assess impact of curricular and course sequence decisions

January 2020
- Students taking High School MISA MUST pass the assessment in order to graduate
  ►Districts administering assessment without time to make data-informed decisions on efficacy of course sequencing and curriculum

► = concerns

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Recommendation

Extend the current regulation by two years.

- Provide MSDE time to gather data and conduct research study.
- Allows local school systems to make data informed decisions about science course sequencing and science curriculum.
- Allows local school systems to make data informed decisions about professional development.

PE #	PE		
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.**		
	Clarification Statement: Emphasis is on the astronomical evidence of the redshift of light from galaxies as an indication that the universe is currently expanding, the cosmic microwave background as the remnant radiation from the Big Bang, and the observed composition of ordinary matter of the universe, primarily found in stars and interstellar gases (from the spectra of electromagnetic radiation from stars), which matches that predicted by the Big Bang theory (3/4 hydrogen and 1/4 helium).		
	Scientific and Engineering Practices (SEP)	**Crosscutting Concepts (CCC)**	**Disciplinary Core Ideas (DCI)**
	Constructing Explanations and Designing Solutions	Energy and Matter	ESS1.A: The Universe and Its Stars *PS4.B: Electromagnetic Radiation*
ESS2-2	**Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.**		
	Clarification Statement: Examples should include climate feedbacks, such as how an increase in greenhouse gases causes a rise in global temperatures that melts glacial ice, which reduces the amount of sunlight reflected from Earth's surface, increasing surface temperatures and further reducing the amount of ice. Examples could also be taken from other system interactions, such as how the loss of ground vegetation causes an increase in water runoff and soil erosion; how dammed rivers increase groundwater recharge, decrease sediment transport, and increase coastal erosion; or how the loss of wetlands causes a decrease in local humidity that further reduces the wetland extent.		
	Scientific and Engineering Practices (SEP)	**Crosscutting Concepts (CCC)**	**Disciplinary Core Ideas (DCI)**
	Analyzing and Interpreting Data	Stability and Change	ESS2.A: Earth Materials and Systems ESS2.D: Weather and Climate

ESS2-4	**Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.**			
	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.	
	Scientific and Engineering Practices (SEP)	**Crosscutting Concepts (CCC)**	**Disciplinary Core Ideas (DCI)**	
	Developing and Using Models	Cause and Effect	*ESS1.B: Earth and the Solar System* ESS2.A: Earth Materials and System ESS2.D: Weather and Climate	
ESS2-5	**Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.**			
	Clarification Statement: Emphasis is on mechanical and chemical investigations with water and a variety of solid materials to provide the evidence for connections between the hydrologic cycle and system interactions commonly known as the rock cycle. Examples of mechanical investigations include stream transportation and deposition using a stream table, erosion using variations in soil moisture content, or frost wedging by the expansion of water as it freezes. Examples of chemical investigations include chemical weathering and recrystallization (by testing the solubility of different materials) or melt generation (by examining how water lowers the melting temperature of most solids).			
	Scientific and Engineering Practices (SEP)	**Crosscutting Concepts (CCC)**	**Disciplinary Core Ideas (DCI)**	
	Planning and Carrying Out Investigations	Structure and Function	ESS2.C: The Roles of Water in Earth's Surface Processes	
ESS2-6	**Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.**			
	Clarification Statement: Emphasis is on modeling biogeochemical cycles that include the cycling of carbon through the ocean, atmosphere, soil, and biosphere (including humans), providing the foundation for living organisms.			
	Scientific and Engineering Practices (SEP)	**Crosscutting Concepts (CCC)**	**Disciplinary Core Ideas (DCI)**	
	Developing and Using Models	Energy and Matter	ESS2.D: Weather and Climate	

ESS2-7	**Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth.**			
	Clarification Statement: Emphasis is on the dynamic causes, effects, and feedbacks between the biosphere and Earth's other systems, whereby geoscience factors control the evolution of life, which in turn continuously alters Earth's surface. Examples include how photosynthetic life altered the atmosphere through the production of oxygen, which in turn increased weathering rates and allowed for the evolution of animal life; how microbial life on land increased the formation of soil, which in turn allowed for the evolution of land plants; or how the evolution of corals created reefs that altered patterns of erosion and deposition along coastlines and provided habitats for the evolution of new life forms.		Assessment Boundary: Assessment does not include a comprehensive understanding of the mechanisms of how the biosphere interacts with all of Earth's other systems.	
	Scientific and Engineering Practices (SEP)	**Crosscutting Concepts (CCC)**	**Disciplinary Core Ideas (DCI)**	
	Engaging in Argument from Evidence	Stability and Change	ESS2.D: Weather and Climate ESS2.E: Biogeology	
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.**			
	Clarification Statement: Examples of evidence, for both data and climate model outputs, are for climate changes (such as precipitation and temperature) and their associated impacts (such as on sea level, glacial ice volumes, or atmosphere and ocean composition).		Assessment Boundary: Assessment is limited to one example of a climate change and its associated impacts.	
	Scientific and Engineering Practices (SEP)	**Crosscutting Concepts (CCC)**	**Disciplinary Core Ideas (DCI)**	
	Analyzing and Interpreting Data	Stability and Change	ESS3.D: Global Climate Change	

ESS3-6	**Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.**		
	Clarification Statement: Examples of Earth systems to be considered are the hydrosphere, atmosphere, cryosphere, geosphere, and/or biosphere. An example of the far-reaching impacts from a human activity is how an increase in atmospheric carbon dioxide results in an increase in photosynthetic biomass on land and an increase in ocean acidification, with resulting impacts on sea organism health and marine populations.	Assessment Boundary: Assessment does not include running computational representations but is limited to using the published results of scientific computational models.	
	Scientific and Engineering Practices (SEP)	**Crosscutting Concepts (CCC)**	**Disciplinary Core Ideas (DCI)**
	Using Mathematics and Computational Thinking	Systems and System Models	ESS2.D: Weather and Climate ESS3.D: Global Climate Change
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.**		
	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.		
	Scientific and Engineering Practices (SEP)	**Crosscutting Concepts (CCC)**	**Disciplinary Core Ideas (DCI)**
	Constructing Explanations and Designing Solutions	Structure and Function	LS1.A: Structure and Function
LS2-2	**Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.**		
	Clarification Statement: Examples of mathematical representations include finding the average, determining trends, and using graphical comparisons of multiple sets of data.	Assessment Boundary: Assessment is limited to provided data.	
	Scientific and Engineering Practices (SEP)	**Crosscutting Concepts (CCC)**	**Disciplinary Core Ideas (DCI)**
	Using Mathematics and Computational Thinking	Scale, Proportion, and Quantity	LS2.A: Interdependent Relationships in Ecosystems LS2.C: Ecosystem Dynamics, Functioning, and Resilience

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.**		
	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.	
	Scientific and Engineering Practices (SEP)	**Crosscutting Concepts (CCC)**	**Disciplinary Core Ideas (DCI)**
	Developing and Using Models	Systems and System Models	LS2.B: Cycles of Matter and Energy Transfer in Ecosystems *PS3.D: Energy in Chemical Processes*
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.**		
	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.	
	Scientific and Engineering Practices (SEP)	**Crosscutting Concepts (CCC)**	**Disciplinary Core Ideas (DCI)**
	Engaging in Argument from Evidence	Cause and Effect	LS3.B: Variation of Traits
LS4-1	**Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.**		
	Clarification Statement: 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.		
	Scientific and Engineering Practices (SEP)	**Crosscutting Concepts (CCC)**	**Disciplinary Core Ideas (DCI)**
	Obtaining, Evaluating, and Communicating Information	Patterns	LS4.A: Evidence of Common Ancestry and Diversity

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.**		
	Clarification Statement: Emphasis is on using evidence to explain the influence each of the four factors has on the 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.	
	Scientific and Engineering Practices (SEP)	**Crosscutting Concepts (CCC)**	**Disciplinary Core Ideas (DCI)**
	Constructing Explanations and Designing Solutions	Cause and Effect	LS4.B: Natural Selection LS4.C: Adaptation
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.**		
	Clarification Statement: Emphasis is on determining cause and effect relationships for how changes to the environment such as deforestation, fishing, application of fertilizers, drought, flood, and the rate of change of the environment affect distribution or disappearance of traits in species.		
	Scientific and Engineering Practices (SEP)	**Crosscutting Concepts (CCC)**	**Disciplinary Core Ideas (DCI)**
	Engaging in Argument from Evidence	Cause and Effect	LS4.C: Adaptation
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.**		
	Clarification Statement: Examples of chemical reactions could include the reaction of sodium and chlorine, of carbon and oxygen, or of carbon and hydrogen.	Assessment Boundary: Assessment is limited to chemical reactions involving main group elements and combustion reactions.	
	Scientific and Engineering Practices (SEP)	**Crosscutting Concepts (CCC)**	**Disciplinary Core Ideas (DCI)**
	Constructing Explanations and Designing Solutions	Patterns	PS1.A: Structure and Properties of Matter PS1.B: Chemical Reactions

PS1-5	**Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.**			
	Clarification Statement: Emphasis is on student reasoning that focuses on the number and energy of collisions between molecules.		Assessment Boundary: Assessment is limited to simple reactions in which there are only two reactants; evidence from temperature, concentration, and rate data; and qualitative relationships between rate and temperature.	
	Scientific and Engineering Practices (SEP)	**Crosscutting Concepts (CCC)**		**Disciplinary Core Ideas (DCI)**
	Constructing Explanations and Designing Solutions	Patterns		PS1.B: Chemical Reactions
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.**			
	Clarification Statement: Examples of data could include tables or graphs of position or velocity as a function of time for objects subject to a net unbalanced force, such as a falling object, an object rolling down a ramp, or a moving object being pulled by a constant force.		Assessment Boundary: Assessment is limited to one-dimensional motion and to macroscopic objects moving at non-relativistic speeds.	
	Scientific and Engineering Practices (SEP)	**Crosscutting Concepts (CCC)**		**Disciplinary Core Ideas (DCI)**
	Analyzing and Interpreting Data	Cause and Effect		PS2.A: Forces and Motion
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.**			
	Clarification Statement: Emphasis is on explaining the meaning of mathematical expressions used in the model.		Assessment Boundary: Assessment is limited to basic algebraic expressions or computations; to systems of two or three components; and to thermal energy, kinetic energy, and/or the energies in gravitational, magnetic, or electric fields.	
	Scientific and Engineering Practices (SEP)	**Crosscutting Concepts (CCC)**		**Disciplinary Core Ideas (DCI)**
	Using Mathematics and Computational Thinking	Systems and System Models		PS3.A: Definitions of Energy PS3.B: Conservation of Energy and Energy Transfer

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 positions of particles (objects).**			
	Clarification Statement: Examples of phenomena at the macroscopic scale could include the conversion of kinetic energy to thermal energy, the energy stored due to position of an object above the earth, and the energy stored between two electrically-charged plates. Examples of models could include diagrams, drawings, descriptions, and computer simulations.			
	Scientific and Engineering Practices (SEP)	**Crosscutting Concepts (CCC)**	**Disciplinary Core Ideas (DCI)**	
	Developing and Using Models	Energy and Matter	PS3.A: Definitions of Energy	
PS3-3	**Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.***			
	Clarification Statement: Emphasis is on both qualitative and quantitative evaluations of devices. Examples of devices could include Rube Goldberg devices, wind turbines, solar cells, solar ovens, and generators. Examples of constraints could include use of renewable energy forms and efficiency.	Assessment Boundary: Assessment for quantitative evaluations is limited to total output for a given input. Assessment is limited to devices constructed with materials provided to students.		
	Scientific and Engineering Practices (SEP)	**Crosscutting Concepts (CCC)**	**Disciplinary Core Ideas (DCI)**	
	Constructing Explanations and Designing Solutions	Energy and Matter	PS3.A: Definitions of Energy PS3.D: Energy in Chemical Processes ETS1.A: Defining and Delimiting an Engineering Problem	
PS4-1	**Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.**			
	Clarification Statement: Examples of data could include electromagnetic radiation traveling in a vacuum and glass, sound waves traveling through air and water, and seismic waves traveling through the Earth.	Assessment Boundary: Assessment is limited to algebraic relationships and describing those relationships qualitatively.		
	Scientific and Engineering Practices (SEP)	**Crosscutting Concepts (CCC)**	**Disciplinary Core Ideas (DCI)**	
	Using Mathematics and Computational Thinking	Cause and Effect	PS4.A: Wave Properties	

* The performance expectations marked with an asterisk integrate traditional science content with engineering through a Practice or Disciplinary Core Idea.