ARIZONA SCIENCE TEST

AzSCI Item Specifications Grade Band 6–8

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Prepared by the Arizona Department of Education

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Introduction

The Arizona Statewide Achievement Assessment for Science (AzSCI) is Arizona's statewide science achievement test. AzSCI assesses the Arizona Science Standards (AzSS) adopted by the Arizona State Board of Education in 2018. AzSCI is a computer-based assessment that allows for the use of a variety of innovative item types where students can apply critical thinking skills to demonstrate a deeper understanding of the three dimensions of the Arizona Science Standards.

During the item-development process, all AzSCI items are written in accordance with the Item Specifications and are reviewed and approved by a committee of Arizona educators to confirm alignment and appropriateness for inclusion in the test. AzSCI item review committee members are generally representative of Arizona's geographic regions and culturally diverse population. Items are reviewed for the following kinds of bias: gender, racial, ethnic, linguistic, religious, geographic, and socioeconomic. Item reviews also include consideration of issues related to individuals with disabilities. Arizona community members also have an opportunity to review items for issues of potential concern to members of the community at large. Reviewers are asked to consider the variety of cultural, regional, philosophical, political, and religious backgrounds throughout Arizona, and then to determine whether the subject matter will be acceptable to Arizona students, families, and other members of Arizona communities.

The AzSCI Item Specifications provide resource documents that define the content and format of the test and test items for item writers and reviewers. Each Item Specifications document indicates the alignment of items with the Arizona Science Standards. It also serves to provide all stakeholders with information about the scope and function of assessment items. This document can also serve to assist educators in understanding how assessment items are developed in alignment with the standards for science. The AzSCI standard-level item specifications provide information about the development of items aligned to the Arizona Science Standards adopted in 2018. AzSCI is designed to reflect the importance of using evidence and reading complex texts outlined in the Arizona Science Standards. Any item specifications absent for standards listed in this document are excluded from the assessable standards. This document does not endorse the exclusion of the instruction of any grade-level content standards.

AzSCI has a test blueprint that was developed by Arizona and is different from any other state or consortium test blueprint. These item specifications for AzSCI are intended to provide information regarding standards, item formats, and response types. The descriptions of blueprints and cognitive complexity in this document are meant to provide an overview of the test. Item specifications are meant for the purposes of assessment, not instruction. They are not intended to be tools for instruction or the basis for curricula. AzSCI has a test blueprint that was developed by Arizona and is different from any other state or consortium test blueprint.

Standards Description

Purpose of the Arizona Science Standards

The Arizona Science Standards present a vision of what it means to be scientifically literate as well as college and career ready. These standards outline what all students need to know, understand, and be able to do by the end of high school and reflect the following shifts for science education:

- Organize standards around thirteen core ideas and develop learning progressions to coherently and logically build scientific literacy from kindergarten through high school.
- Connect core ideas, crosscutting concepts, and science and engineering practices to make sense of the natural world and understand how science and engineering are practiced and experienced.
- Focus on fewer, broader standards that allow for greater depth, more connections, deeper understanding, and more applications of content.

Core Ideas

AzSCI examines students' performance of scientific and engineering practices in the context of core ideas and crosscutting concepts. Although described separately, they generally function in concert. The ten core ideas for Knowing Science center on understanding the causes of phenomena in physical, Earth and space, and life science. The three core ideas for Using Science connect scientific principles, theories, and models; engineering and technological applications; and societal implications to the content knowledge in order to support that understanding.

Core Ideas for Knowing Science		Core Ideas for Using Science
Physical Science P1: All matter in the Universe is made of very small particles. P2: Objects can affect other objects at a distance. P3: Changing the movement of an object requires a net force to be acting on it. P4: The total amount of energy in a closed system is always the same but can be transferred from one energy store to another during an event. **Earth and Space Science** E1: The composition of the Earth and its atmosphere and the natural and human processes occurring within them shape the Earth's surface and its climate. E2: The Earth and our solar system are a very small part of one of many galaxies within the Universe. **Life Science** L1: Organisms are organized on a cellular basis and have a finite life span. L2: Organisms require a supply of energy and materials for which they often depend on, or compete with, other organisms. L3: Genetic information is passed down from one generation of organisms to another. L4: The unity and diversity of organisms, living and extinct, is the result of evolution. *Adapted from ***Working with Big Ideas in Science Education***[2]		U1: Scientists explain phenomena using evidence obtained from observations and or scientific investigations. Evidence may lead to developing models and or theories to make sense of phenomena. As new evidence is discovered, models and theories can be revised. U2: The knowledge produced by science is used in engineering and technologies to solve problems and/or create products. U3: Applications of science often have both positive and negative ethical, social, economic, and/or political implications.

Scientific and Engineering Practices (SEPs)

The science and engineering practices (SEPs) describe a robust process for how scientists investigate and build models and theories of the natural world or how engineers design and build. These practices reflect science and engineering as they are practiced and experienced.

The SEPs are grouped into eight categories, each describing how students should engage in the practices used by scientists and engineers. Students engage in all eight of the SEPs throughout each grade band. As students progress from the lower to the upper grades, the complexity and sophistication of the SEPs increase in order to reflect the progression in students' abilities to use each practice and in their increased understanding of the core ideas.

SEP	Science and Engineering Practice	SEP Reporting Category
INV	Planning and Carrying Out Investigations	Investigating
Q/P	Asking Questions and Defining Problems	Investigating
MCT	Using Mathematical and Computational Thinking	Investigating
DATA	Analyzing and Interpreting Data	Investigating**
MOD	Developing and Using Models	Sensemaking
E/S	Constructing Explanations and Designing Solutions	Sensemaking
ARG	Engaging in Argument from Evidence	Critiquing
INFO	Obtaining, Evaluating, and Communicating Information	Critiquing

**Assessment purpose only.

Crosscutting Concepts (CCCs)

Crosscutting concepts (CCCs) cross boundaries between science disciplines and provide an organizational framework to connect knowledge from various disciplines into a coherent and scientifically based view of the world. They build bridges between science and other disciplines and connect core ideas and practices throughout the fields of science and engineering. Their purpose is to provide a lens to help students deepen their understanding of the core ideas as they make sense of phenomena in the natural and designed worlds. The CCCs are applied across all domains of science and act as a mechanism for linking the different domains. Throughout each grade band, students will engage in all seven CCCs. As with the SEPs, the complexity and sophistication of the CCCs will increase as students increase their understanding of the core ideas while moving from the lower to the upper grades.

CCC	Crosscutting Concept	CCC	Crosscutting Concept
PAT	Patterns	E/M	Energy and Matter
C/E	Cause and Effect	S/F	Structure and Function
SPQ	Scale, Proportion, and Quantity	S/C	Stability and Change
SYS	System and System Models		

Coding and Navigating the Standards

Standard: Grade 7, Core Ideas E1 and U1, standard number 5

CCC: Bold CCCs indicate the CCCs that may be most appropriate for use with the standard.

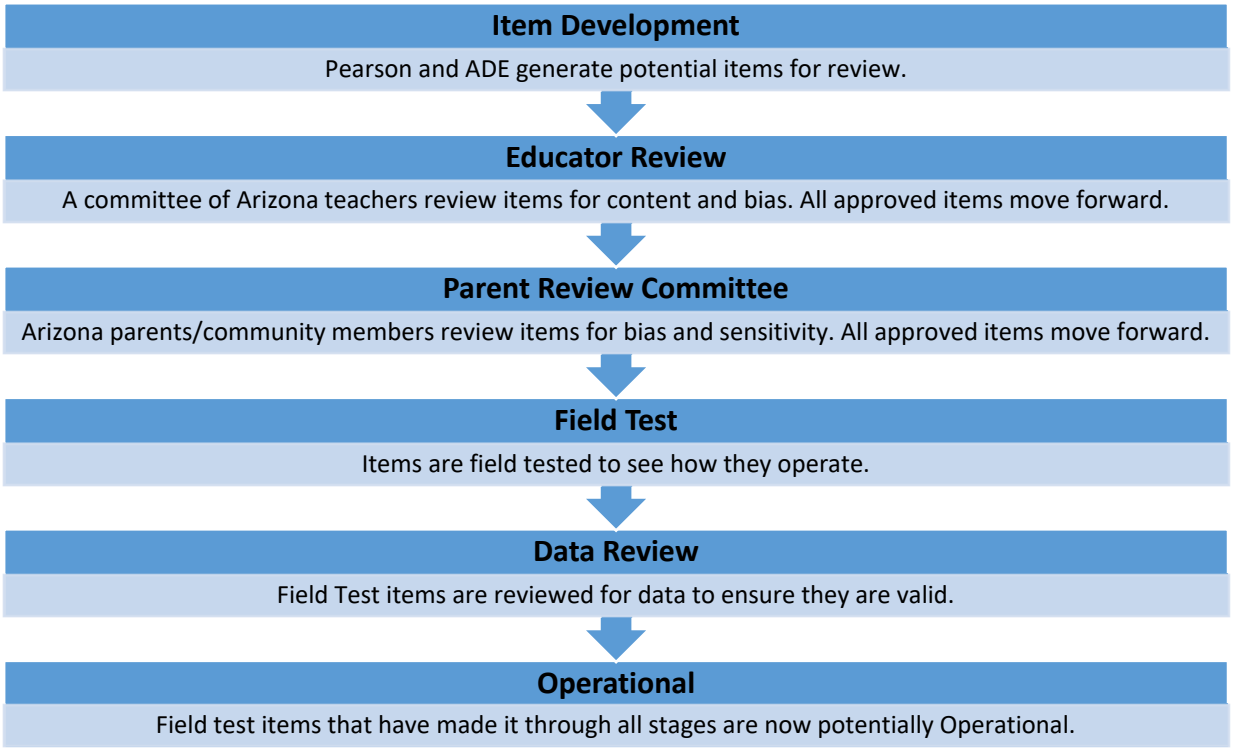
7.E1U1.5	**Crosscutting Concepts:** **Patterns; Cause and Effect**; Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; **Structure and Function**; Stability and Change[4] **Background Information:** **Earth processes** are the result of **energy** flowing and matter cycling within and among the planet's systems. This energy is derived from the sun and Earth's hot interior. The energy that flows and matter that cycles produce **chemical and physical changes** in Earth's materials and living organisms.[4(p.181)] The planet's systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth's history and will determine its future. [4(p.181)] Radioactive decay of material inside the Earth since it was formed is its internal source of energy. Radiation from the Sun provides the energy that enables plants containing chlorophyll to make glucose through the process of photosynthesis.[2(p. 24)] The ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean currents. **Greenhouse gases** in the atmosphere absorb and retain the energy radiated from land and ocean surfaces, thereby regulating Earth's average surface temperature and keeping it habitable.[4(p. 188)] Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation as well as downhill flows on land. The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns.[4(p.185)]
Construct a model that shows the cycling of matter and flow of energy in the atmosphere, hydrosphere, and geosphere.	

SEP: Developing and Using Models

Background Information: A guidance resource embedded into the standards document. This is the first step to deepen content knowledge and to make apparent the research behind the standard. The learning progression is supporting material and not the basis for assessment.

Item Development Process

AzSCI items go through a rigorous review before they are operational. When an item is "operational," it means that it is used to determine a student's score on the assessment. This is a description of the process every item must go through before it is operational on AzSCI.



Sample tests are available online for the science portion of AzSCI. To access the AzSCI Sample Tests, go to: https://home.testnav.com/, select "Arizona," and then select "Mic Check and Sample Tests."

Test Design and Blueprint Tables

AzSCI is a grade-band assessment where each of the Core Ideas is assessed in each grade band: 3–5, 6–8, and high school. The new assessment consists of a combination of independent and cluster items. AzSCI will ask students to do more than answer recall questions about science; they will apply the practices, or behaviors, of scientists and engineers to investigate each real-world phenomenon and design solutions to problems.

The 2018 Arizona Science Standards were developed using a three-dimensional approach to K–12 science education that captures students' interests and provides them with the necessary foundational knowledge for basic proficiency and continuing study in science.

AzSCI Blueprint

AzSCI identifies what it means to be proficient in science; it rests on a view of science as both a body of knowledge and an evidence-based, model- and theory-building enterprise that continually extends, refines, and revises knowledge. AzSCI reflects the three dimensions that are combined to form each standard and item. The construction of the AzSCI assessment is guided by the depth and rigor of the Arizona Science Standards. Items are created to address key components of the standards and assess a range of important skills. The AzSCI Blueprint provides an overview of the distribution of items on the AzSCI according to the standards. The standards for SEPs and CCCs are embedded within all AzSCI items. Further, the AzSCI blueprint outlines the Depth of Knowledge (replaced with the Task Analysis Guide in Science [TAGS]), SEP and CCC coverage, and distribution of items.

AzSCI Assessment Grade Band 6–8 Blueprint

Domain	Percent Range
Science and Engineering Practices and Crosscutting Concepts in Physical Sciences	36%–44%
Science and Engineering Practices and Crosscutting Concepts in Life Sciences	30%–38%
Science and Engineering Practices and Crosscutting Concepts in Earth and Space Sciences	22%–30%

Every standard in each grade band will be assessed over a three-year period.

SEP Coverage

Practice	Percent Range
Investigating	14%–26%
Sensemaking	40%–60%
Critiquing	18%–30%

Investigating Practices	Sensemaking Practices	Critiquing Practices
Asking Questions and Defining Problems	Developing and Using Models	Engaging in Argument from Evidence
Planning and Carrying Out Investigations	Constructing Explanations and Designing Solutions	Obtaining, Evaluating, and Communicating Information
Using Mathematical and Computational Thinking		
Analyzing and Interpreting Data***		

***Assessment Reporting Categories for Science Engineering Practices (SEP) may vary.

Cognitive Complexity

Conventional cognitive complexity models, such as Depth of Knowledge (DOK), evaluate based on individual cognitive actions (memorization, application, evaluation, and analysis). This works well with one-dimensional standards. This does not work as well with multidimensional standards, such as the Arizona Science Standards, because each dimension being assessed could have its own cognitive level. To sufficiently evaluate a student's range of proficiency, Arizona needed a scale that goes beyond a singular focus and takes into account three-dimensionality.

The Task Analysis Guide in Science (TAGS) was developed for classroom use to evaluate cognitive demand with integration of practices and content (see Tekkumsu-Kisa, Stein, & Schunn, *A Framework for Analyzing Cognitive Demand and Content-Practices Integration: Task Analysis Guide in Science [TAGS]*, 2015).

Arizona modified these models for the AzSCI assessment in order to more accurately recognize that cognitive demand increases as the number of integrated dimensions increases.

AZ Task Analysis Guide in Science

TAGS	Az TAGS Example	TAGS Coding	
		Students must use 2 Dimensions	Students must use 3 Dimensions
Doing Science Tasks: Students are required to DO science by using practices to DEVELOP an understanding of a scientific or engineering phenomenon. Students must develop a model, explanation or argument from raw data or information. Students must be able to determine which data or information is appropriate and how to use it.	Doing Science items will typically not direct the students to specific information to use. Students must look through all information/tabs to determine what information is relevant. *Use the information to explain the patterns observed.* OR *Which graph best represents the changes in X?*	D2	D3
Guided Science Tasks: Students use higher-level thinking to work through guided or scaffolded tasks. Students are told what information (model, data etc.) to use or are provided with information and then required to develop the actual answer.	Guided items will typically direct the students to the information to use (Tab 2, Graph 1, etc.), but the method for completing the task is left for the student to develop/ determine with minimal, if any, further instruction. *Based on Graph 1, which statement explains when X event will happen?*	G2	G3
Scripted Science Tasks: Students follow a script (defined actions or procedure) to complete a task.	Scripted items will typically direct the student to the information to use (Tab 1, Table 1, etc.) AND provide a set of well-defined actions or procedures to perform in order to complete a given task. Drag and drop (*Drag the arrows to complete the food chain*), hot spots, etc.	S2	S3

Item Sets and Item Types

An item set is a group of items that share the same stimulus centered on a specific science and/or engineering phenomenon. The AzSCI assessment uses two different types of item sets: independent and clusters. Sets of questions assess student application of knowledge across the domains of science for a comprehensive picture of student readiness for their next grade or course in science.

Independent Item Set	Cluster Item Set
Aligns to at least one standard	Aligns to at least one standard
Three or more associated items	Five associated items
Items must function independently and do not need to be related.	All five items will be placed on the same form and should work together to show understanding of the phenomena.
Stimulus has a maximum of two tabs. (Tabs are labeled as Figures/Tables).	Stimulus has a maximum of four tabs. (Tabs are labeled as Figures/Tables).
Answers to items may be found in figures, tables, and the text surrounding the figures and tables.	Answers to items may be found in figures, tables, and the text surrounding the figures and tables.

Standalone Item
Aligns to one standard
Discrete item that may be any item type
Item functions independently and is not related to other items.
Item is displayed on full screen, without a separate stimulus.
Answers to items may be found in figures, tables, and the text surrounding the figures and tables.

Item Types

AzSCI assessments are composed of item formats that include traditional multiple-choice response items (MC) and technology-enhanced response items (TEI).

For paper-based assessments, TEIs will be modified so that they can be key-entered and scored electronically.

Item Type	Specifications
Multiple Choice (MC)	Four image, math, or text-based choices with a single correct choice
Multiple Response (MR)	Five to six image, math, or text-based choices with two or three correct choices (No partial credit)
Inline Choice	Multiple drop-down menus are used within a range of text to provide several options consisting of words or phrases.
Bar Graph	Vertical bar graph
Point Graph	Points are plotted on a graph.
Hot Spot	Object Selection, Graphic Change. One or more images or portions of an image are selected.
Match	Responses are dragged into text gaps.
Gap Match	Drag and Drop. Responses are dragged into categories.
Graphic Gap Match	Graphic Gap Match interactions are drag and drop that include responses that are images.
Gap Match - Table	Responses are dragged into a table grid.
Match - Table Grid	Responses are indicated by selecting radio buttons or checkboxes within a table grid.
Two-Part Independent (TPI)	Any combination of item types. Two-part independent (TPI) items will be weighted as two points, one point awarded for each part. TPI items ask the student to demonstrate a deeper understanding of the standard by completing two separate thought processes.
Two-Part Dependent (TPD)	Any combination of item types. Two-part dependent (TPD) items will be weighted as one point (no partial credit). TPD items ask students to demonstrate their understanding of the standard by selecting a claim in Part A and identifying supporting evidence in Part B. Correctly answering Part B is dependent on correctly answering Part A and is part of the same thought process.

Universal Tools

The following tools will be available in the online test administration platform to assist each student while taking the AzSCI.

Text to Speech: Text to speech is available to all students who take the AzSCI assessment in the online platform.

Answer Eliminator: Students can use this tool to cross out answers they believe are incorrect.
Notepad: Allows students to take notes on each item screen.

Ruler: Students measure objects on the screen using either a standard or metric ruler.

Highlighter: Students select words on the screen to highlight.

Zoom: If pictures and words on the screen are too small, students can make them larger using buttons on the keyboard.

Protractor: Students measure angles on the screen using the protractor tool.

Calculator:
Grade 5: A four-function calculator is permitted on AzSCI. The Desmos four-function calculator is embedded in the online AzSCI test.
Grades 8 and 11: A scientific calculator is permitted on AzSCI. The scientific calculator should include these functions: standard four functions (addition, subtraction, multiplication, and division), decimal, change sign (+/-), parentheses, square root, and π. They may NOT include: any problem-solving or programming capabilities, place values, or inequalities. Sample acceptable calculator: TI-30X IIS or similar. The Desmos Scientific calculator is embedded in the online AzSCI test.

Exhibits: Exhibits are information sheets available to help students answer some questions. The AzSCI assessment will provide the AzSCI Periodic Table of the Elements (https://www.azed.gov/sites/default/files/2020/10/AzSCI%20Periodic%20Table%20of%20the%20Elements-horizontal.pdf) on both the Grade 8 and Grade 11 assessments. The Grade 11 assessment will also have the AzSCI Formula Reference Guide (https://www.azed.gov/sites/default/files/2021/09/AZSci%20HS%20Reference%20Guide_w_Disclaimer_9.21.2021.pdf) available to assist students on questions that require the use of a specific formula. This document is NOT intended to dictate information that should be taught as part of Arizona Science Standards or curriculum. This reference sheet is intended to cover a list of all potential HS symbols, equations, terminology, and formulas that students may encounter on the AzSCI assessment.

AZ Grades 6-8 Item/Standard Specifications

6.P1U1.1

Standard	**Analyze and interpret data** to show that changes in states of matter are caused by different rates of movement of atoms in solids, liquids, and gases (Kinetic Theory).
SEPs	**Analyzing and Interpreting Data**
CCCs	**Patterns;** Cause and Effect; **Scale, Proportion and Quantity; Systems and System Models; Energy and Matter;** Structure and Function; Stability and Change
Assessment Boundaries	Predictions here are qualitative, not quantitative.
Stimulus Materials	Figures, Diagrams, Graphs, Tables

Task Demand	Common Item Formats
Identify the relationship between temperature, pressure, and particle motion. Use data to show the relationship between changes in states of matter and the kinetic energy of the molecules. Use phase diagrams to identify or predict states of matter when temperature or pressure changes.	• Gap Match • Graphic Gap Match • Inline Choice • Multiple Choice • Multiple Select

Performance Level Descriptors

Minimally Proficient	Partially Proficient
The student strives to • identify the different particle motion in states of matter **SEP** • identify relationships contained in graphical displays of data	The student is able to • differentiate particle motion in different states of matter **SEP** • identify, distinguish, or describe data to construct graphical displays of data • identify, distinguish, or describe data to match graphical displays with data sets
Proficient	**Highly Proficient**
The student is able to • demonstrate changes in state of matter are due to different rates of particle motion **SEP** • analyze and interpret data to identify linear and nonlinear relationships in graphical displays • analyze and interpret data using graphical displays (e.g., maps, charts, graphs, and/or tables) of large data sets to identify temporal and spatial relationships • analyze and interpret data to distinguish between causal and correlational relationships in data • analyze and interpret data to provide evidence for phenomena • analyze and interpret data to seek to improve precision and accuracy of data with better technological tools and methods (e.g., multiple trials) • analyze and interpret data to determine similarities and differences in findings	The student is able to • evaluate result of change in particle motion to state of matter **SEP** • analyze, interpret, and evaluate data to extend quantitative analysis to investigations, distinguishing between correlation and causation • analyze, interpret, and evaluate data to apply concepts of statistics and probability (including mean, median, mode, and variability) to analyze and characterize data, using digital tools when feasible • analyze, interpret, and evaluate data to define an optimal operational range for a proposed object, tool, process, or system that best meets criteria for success

6.P1U1.2

Standard	**Plan and carry out an investigation** to demonstrate that variations in temperature and/or pressure affect changes in state of matter.
SEPs	**Planning and Carrying Out Investigations**
CCCs	**Patterns;** Cause and Effect; **Scale, Proportion and Quantity; Systems and System Models; Energy and Matter;** Structure and Function; Stability and Change
Assessment Boundaries	Predictions here are qualitative, not quantitative.
Stimulus Materials	Figures, Diagrams, Graphs, Tables

Task Demand	Common Item Formats
Identify measurements that can be made during an investigation to demonstrate how variations in temperature and/or pressure affect changes in the state of matter. Explain how changes in an investigation will affect the state of matter. Revise experimental procedures to investigate the relationship between temperature, pressure, and state of matter. Based on observations, predict how variations in temperature and/or pressure affect changes in state of matter.	• Gap Match • Inline Choice • Match Table Grid • Multiple Choice

Performance Level Descriptors

Minimally Proficient	Partially Proficient
The student strives to • identify changes in temperature and/or pressure in matter **SEP** • identify variables • collect data	The student is able to • differentiate states of matter due to changes in temperature and/or pressure **SEP** • carry out pre-planned investigations that use multiple variables and provide evidence to support explanations • carry out pre-planned investigations that involve independent and dependent variables and controls • carry out pre-planned investigations that include various methods for collecting data
Proficient	**Highly Proficient**
The student is able to • demonstrate that variations in temperature and/or pressure affect states of matter **SEP** • develop a plan and carry out investigations that evaluate the accuracy of various methods for collecting data • develop a plan and carry out investigations that produce data to answer scientific questions or test design solutions • develop a plan and carry out investigations that collect data about the performance of a proposed object, tool, process, or system	The student is able to • predict changes in states of matter due to changes in temperature and/or pressure **SEP** • plan, carry out, evaluate, and revise investigations that include how measurements will be recorded and how much data is needed to support a claim • plan, carry out, evaluate, and revise investigations that involve an evaluation and/or revisions to the experimental design

6.P1U1.3

Standard	**Develop and use models** to represent that matter is made up of smaller particles called atoms.
SEPs	**Developing and Using Models**
CCCs	**Patterns;** Cause and Effect; **Scale, Proportion and Quantity; Systems and System Models; Energy and Matter;** Structure and Function; Stability and Change
Assessment Boundaries	Predictions here are qualitative, not quantitative.
Stimulus Materials	Models, Figures, Diagrams

Task Demand	Common Item Formats
Use a model to demonstrate that matter is made up of smaller particles. Use a model as evidence to support a claim that matter is made up of particles called atoms. Revise a model demonstrating that matter is made of atoms. Develop a model demonstrating that matter is made of atoms.	• Graphic Gap Match • Inline Choice • Match • Match Table Grid • Multiple Choice

Performance Level Descriptors

Minimally Proficient	Partially Proficient
The student strives to • identify atoms as basic units of matter **SEP** • identify models that describe phenomena • identify modifications in models	The student is able to • associate different properties to atomic makeup **SEP** • develop and use models to describe, test, and predict phenomena and design systems • develop and use models to represent evidence • develop and use models to show the relationships among variables
Proficient	**Highly Proficient**
The student is able to • demonstrate matter is made up of particles called atoms **SEP** • develop and use models to describe, test, and predict more abstract phenomena and design systems • develop or modify a model—based on evidence—to match what happens if a variable or component of a system is changed • develop and use models to show relationships among variables, including those that are not observable • develop and use models to predict and/or describe phenomena • develop and use models to generate data to test ideas about phenomena in natural or designed systems	The student is able to • critique models demonstrating that matter is made of atoms **SEP** • develop, revise, and use models to evaluate or revise a model for a proposed object or tool • develop, revise, and use models to evaluate a model of simple systems with uncertain and less predictable factors • develop, revise, and use models to propose design changes to show the relationships among variables, including those that are not observable • develop, revise, and use models to describe unobservable mechanisms • develop, revise, and use models to generate data to test ideas about phenomena in natural or designed systems, including those representing inputs and outputs, and those at unobservable scales

6.P2U1.4

Standard	**Develop and use a model** to predict how forces act on objects at a distance.
SEPs	**Developing and Using Models**
CCCs	**Patterns;** Cause and Effect; **Scale, Proportion and Quantity; Systems and System Models; Energy and Matter;** Structure and Function; Stability and Change
Assessment Boundaries	Not applicable
Stimulus Materials	Models, Figures, Diagrams

Task Demand	Common Item Formats
Use a model to demonstrate how forces act on objects at a distance. Use a model to demonstrate how the relative magnitude and direction of a force acting on an object changes with distance and/or direction. Revise a model to show how changes in distance affect the strength of a force acting on an object. Use a model to predict how forces act on objects at varying distances.	• Graphic Gap Match • Hot Spot • Inline Choice • Multiple Choice • Multiple Select

Performance Level Descriptors

Minimally Proficient	Partially Proficient
The student strives to • identify forces that act at a distance **SEP** • identify models that describe phenomena • identify modifications in models	The student is able to • differentiate how forces at a distance affect objects **SEP** • develop and use models to describe, test, and predict phenomena and design systems • develop and use models to represent evidence • develop and use models to show the relationships among variables
Proficient	**Highly Proficient**
The student is able to • predict how forces acting at a distance affect objects **SEP** • develop and use models to describe, test, and predict more abstract phenomena and design systems • develop or modify a model—based on evidence—to match what happens if a variable or component of a system is changed • develop and use models to show relationships among variables, including those that are not observable • develop and use models to predict and/or describe phenomena • develop and use models to generate data to test ideas about phenomena in natural or designed systems	The student is able to • evaluate predictions of effects of force acting on objects at a distance **SEP** • develop, revise, and use models to evaluate or revise a model for a proposed object or tool • develop, revise, and use models to evaluate a model of simple systems with uncertain and less predictable factors • develop, revise, and use models to propose design changes to show the relationships among variables, including those that are not observable • develop, revise, and use models to describe unobservable mechanisms • develop, revise, and use models to generate data to test ideas about phenomena in natural or designed systems, including those representing inputs and outputs, and those at unobservable scales

6.P4U2.5

Standard	**Analyze** how humans use technology to store (potential) and/or use (kinetic) energy.
SEPs	**Analyzing and Interpreting Data**
CCCs	**Patterns;** Cause and Effect; **Scale, Proportion and Quantity; Systems and System Models; Energy and Matter;** Structure and Function; Stability and Change
Assessment Boundaries	Not applicable
Stimulus Materials	Figures, Diagrams, Graphs, Tables

Task Demand	Common Item Formats
Describe the movement of energy in a system. Distinguish between potential and kinetic energy. Evaluate methods of energy storage and uses of kinetic energy.	• Gap Match • Hot Spot • Inline Choice • Match • Match Table Grid • Multiple Choice • Multiple Select

Performance Level Descriptors

Minimally Proficient	Partially Proficient
The student strives to • categorize methods of energy storage or use of potential and kinetic energy **SEP** • identify relationships contained in graphical displays of data	The student is able to • differentiate storage of potential energy and uses of kinetic energy **SEP** • identify, distinguish, or describe data to construct graphical displays of data • identify, distinguish, or describe data to match graphical displays with data sets
Proficient	**Highly Proficient**
The student is able to • demonstrate how humans use technology to store potential energy and use kinetic energy **SEP** • analyze and interpret data to identify linear and nonlinear relationships in graphical displays • analyze and interpret data using graphical displays (e.g., maps, charts, graphs, and/or tables) of large data sets to identify temporal and spatial relationships • analyze and interpret data to distinguish between causal and correlational relationships in data • analyze and interpret data to provide evidence for phenomena • analyze and interpret data to seek to improve precision and accuracy of data with better technological tools and methods (e.g., multiple trials) • analyze and interpret data to determine similarities and differences in findings	The student is able to • evaluate methods of energy storage and uses of kinetic energy • recommend solutions regarding technology solutions for energy storage or use of kinetic energy **SEP** • analyze, interpret, and evaluate data to extend quantitative analysis to investigations, distinguishing between correlation and causation • analyze, interpret, and evaluate data to apply concepts of statistics and probability (including mean, median, mode, and variability) to analyze and characterize data, using digital tools when feasible • analyze, interpret, and evaluate data to define an optimal operational range for a proposed object, tool, process, or system that best meets criteria for success

6.E1U1.6

Standard	**Investigate and construct an explanation** demonstrating that radiation from the Sun provides energy and is absorbed to warm the Earth's surface and atmosphere.
SEPs	**Planning and Carrying Out Investigations** **Constructing Explanations and Designing Solutions**
CCCs	**Patterns;** Cause and Effect; **Scale, Proportion and Quantity**; **Systems and System Models; Energy and Matter;** Structure and Function; Stability and Change
Assessment Boundaries	Not applicable
Stimulus Materials	Figures, Diagrams, Graphs, Tables

Task Demand	Common Item Formats
Identify architectural or other design changes that would increase or decrease the amount of solar energy absorbed. Use data to support an explanation for the relationship between movement of energy and the change in temperature of the surrounding environment. Explain how radiation from the sun is absorbed by different layers of Earth's surface and atmosphere. Analyze results from an investigation to determine how radiation from the sun provides warmth to Earth's surface and atmosphere.	• Graphic Gap Match • Inline Choice • Match Table Grid • Multiple Choice • Multiple Select

Performance Level Descriptors

Minimally Proficient	Partially Proficient
The student strives to • identify radiation from the sun as the cause of the warming of Earth's surface and atmosphere **SEP** • identify variables • collect data • identify evidence that support scientific ideas, principles, and theories • identify models or representations that support an explanation	The student is able to • distinguish how radiation from the sun is absorbed by different layers of Earth's surface and atmosphere **SEP** • carry out pre-planned investigations that use multiple variables and provide evidence to support explanations • carry out pre-planned investigations that involve independent and dependent variables and controls • carry out pre-planned investigations that include various methods for collecting data • distinguish between explanations and solutions to identify those supported by multiple sources of evidence consistent with scientific ideas • distinguish between explanations and solutions to identify those that include qualitative or quantitative relationships between variables that describe phenomena • distinguish between explanations and solutions to identify those based on valid and reliable evidence

Proficient	Highly Proficient
The student is able to • show that external radiation from the sun is captured in Earth's surface and atmosphere, providing warmth **SEP** • develop a plan and carry out investigations that evaluate the accuracy of various methods for collecting data • develop a plan and carry out investigations that produce data to answer scientific questions or test design solutions • develop a plan and carry out investigations that collect data about the performance of a proposed object, tool, process, or system • construct explanations and design solutions that include qualitative or quantitative relationships between variables that predict phenomena • construct explanations and design solutions that apply scientific reasoning to show why the data or evidence is adequate for the explanation or conclusion	The student is able to • evaluate how Earth's layers and atmosphere capture thermal energy **SEP** • plan, carry out, evaluate, and revise investigations that include how measurements will be recorded and how much data is needed to support a claim • plan, carry out, evaluate, and revise investigations that involve an evaluation and/or revisions to the experimental design • construct and evaluate explanations and solutions that apply scientific ideas or principles in testing a design of an object, tool, process, or system • construct and evaluate explanations and solutions that meet specific design criteria and constraints • construct and evaluate explanations and solutions that optimize performance of a design by prioritizing criteria

6.E2U1.7

Standard	Use ratios and proportions to **analyze and interpret data** related to scale, properties, and relationships among objects in our solar system.
SEPs	**Analyzing and Interpreting Data**
CCCs	**Patterns;** Cause and Effect; **Scale, Proportion and Quantity**; **Systems and System Models; Energy and Matter;** Structure and Function; Stability and Change
Assessment Boundaries	Not applicable
Stimulus Materials	Figures, Diagrams, Graphs, Tables

Task Demand	Common Item Formats
Use data to identify spatial relationships in the solar system. Compare the scale, properties, and relationships among objects in the solar system. Make claims about the relationships of objects in the solar system.	• Gap Match • Inline Choice • Multiple Choice • Multiple Select

Performance Level Descriptors

Minimally Proficient	Partially Proficient
The student strives to • identify the spatial relationship between objects in the solar system **SEP** • identify relationships contained in graphical displays of data	The student is able to • make observations about the scale, properties, or relationships of objects in the solar system **SEP** • identify, distinguish, or describe data to construct graphical displays of data • identify, distinguish, or describe data to match graphical displays with data sets
Proficient	**Highly Proficient**
The student is able to • classify objects in the solar system based on scale, properties, or relationships **SEP** • analyze and interpret data to identify linear and nonlinear relationships in graphical displays • analyze and interpret data using graphical displays (e.g., maps, charts, graphs, and/or tables) of large data sets to identify temporal and spatial relationships • analyze and interpret data to distinguish between causal and correlational relationships in data • analyze and interpret data to provide evidence for phenomena • analyze and interpret data to seek to improve precision and accuracy of data with better technological tools and methods (e.g., multiple trials) • analyze and interpret data to determine similarities and differences in findings	The student is able to • evaluate classification of objects in the solar system based on scale, properties, or relationships to demonstrate phenomena in the solar system **SEP** • analyze, interpret, and evaluate data to extend quantitative analysis to investigations, distinguishing between correlation and causation • analyze, interpret, and evaluate data to apply concepts of statistics and probability (including mean, median, mode, and variability) to analyze and characterize data, using digital tools when feasible • analyze, interpret, and evaluate data to define an optimal operational range for a proposed object, tool, process, or system that best meets criteria for success

6.E2U1.8

Standard	**Develop and use models** to explain how constellations and other night sky patterns appear to move due to Earth's rotation and revolution.
SEPs	**Developing and Using Models**
CCCs	**Patterns;** Cause and Effect; **Scale, Proportion and Quantity; Systems and System Models; Energy and Matter**; Structure and Function; Stability and Change
Assessment Boundaries	Not applicable
Stimulus Materials	Models, Figures, Diagrams

Task Demand	Common Item Formats
Use a model to explain patterns in the night sky. Use a model as evidence to support a claim about the appearance of constellations in the night sky. Use a model to predict the location of night sky patterns due to Earth's revolution. Develop a model to demonstrate how the rotation and revolution of Earth creates patterns in the night sky.	• Graphic Gap match • Hot Spot • Inline Choice • Match Table Grid • Multiple Choice

Performance Level Descriptors

Minimally Proficient	Partially Proficient
The student strives to • differentiate between rotation and revolution **SEP** • identify models that describe phenomena • identify modifications in models	The student is able to • distinguish different positions of night sky patterns due to Earth's position **SEP** • develop and use models to describe, test, and predict phenomena and design systems • develop and use models to represent evidence • develop and use models to show the relationships among variables
Proficient	**Highly Proficient**
The student is able to • demonstrate why night sky patterns have apparent motion **SEP** • develop and use models to describe, test, and predict more abstract phenomena and design systems • develop or modify a model—based on evidence—to match what happens if a variable or component of a system is changed • develop and use models to show relationships among variables, including those that are not observable • develop and use models to predict and/or describe phenomena • develop and use models to generate data to test ideas about phenomena in natural or designed systems	The student is able to • predict location of night sky patterns due to Earth's revolution **SEP** • develop, revise, and use models to evaluate or revise a model for a proposed object or tool • develop, revise, and use models to evaluate a model of simple systems with uncertain and less predictable factors • develop, revise, and use models to propose design changes to show the relationships among variables, including those that are not observable • develop, revise, and use models to describe unobservable mechanisms • develop, revise, and use models to generate data to test ideas about phenomena in natural or designed systems, including those representing inputs and outputs, and those at unobservable scales

6.E2U1.9

Standard	**Develop and use models to construct an explanation** of how eclipses, moon phases, and tides occur within the Sun-Earth-Moon system.
SEPs	**Developing and Using Models** **Constructing Explanations and Designing Solutions**
CCCs	**Patterns;** Cause and Effect; **Scale, Proportion and Quantity; Systems and System Models; Energy and Matter**; Structure and Function; Stability and Change
Assessment Boundaries	Not applicable
Stimulus Materials	Models, Figures, Diagrams

Task Demand	Common Item Formats
Use a model to demonstrate how eclipses, moon phases, and tides occur within the Sun-Earth-Moon system. Use a model as evidence to support a claim about eclipses, moon phases, and tides. Use a model to predict the probability of eclipses or tides during a specific phase of the moon. Construct a model to show the spatial relationship within the Sun-Earth-Moon system.	• Gap Match • Hot Spot • Inline Choice • Match Table Grid • Multiple Choice

Performance Level Descriptors

Minimally Proficient	Partially Proficient
The student strives to • identify moon phases, eclipses, and tides **SEP** • identify models that describe phenomena • identify modifications in models • identify evidence that support scientific ideas, principles, and theories • identify models or representations that support an explanation	The student is able to • make observations about specific moon phases, eclipses, and tides **SEP** • develop and use models to describe, test, and predict phenomena and design systems • develop and use models to represent evidence • develop and use models to show the relationships among variables • distinguish between explanations and solutions to identify those supported by multiple sources of evidence consistent with scientific ideas • distinguish between explanations and solutions to identify those that include qualitative or quantitative relationships between variables that describe phenomena • distinguish between explanations and solutions to identify those based on valid and reliable evidence

Proficient	Highly Proficient
The student is able to • demonstrate how moon phases, eclipses, and tides occur **SEP** • develop and use models to describe, test, and predict more abstract phenomena and design systems • develop or modify a model—based on evidence—to match what happens if a variable or component of a system is changed • develop and use models to show relationships among variables, including those that are not observable • develop and use models to predict and/or describe phenomena • develop and use models to generate data to test ideas about phenomena in natural or designed systems • construct explanations and design solutions that include qualitative or quantitative relationships between variables that predict phenomena • construct explanations and design solutions that apply scientific reasoning to show why the data or evidence is adequate for the explanation or conclusion	The student is able to • determine the probability of the occurrence of specific tides or eclipses during a specific phase of the moon **SEP** • develop, revise, and use models to evaluate or revise a model for a proposed object or tool • develop, revise, and use models to evaluate a model of simple systems with uncertain and less predictable factors • develop, revise, and use models to propose design changes to show the relationships among variables, including those that are not observable • develop, revise, and use models to describe unobservable mechanisms • develop, revise, and use models to generate data to test ideas about phenomena in natural or designed systems, including those representing inputs and outputs, and those at unobservable scales • construct and evaluate explanations and solutions that apply scientific ideas or principles in testing a design of an object, tool, process, or system • construct and evaluate explanations and solutions that meet specific design criteria and constraints • construct and evaluate explanations and solutions that optimize performance of a design by prioritizing criteria

6.E2U1.10

Standard	**Use a model** to show how the tilt of Earth's axis causes variations in the length of the day and gives rise to seasons.
SEPs	**Developing and Using Models**
CCCs	**Patterns;** Cause and Effect; **Scale, Proportion and Quantity; Systems and System Models; Energy and Matter**; Structure and Function; Stability and Change
Assessment Boundaries	Not applicable
Stimulus Materials	Models, Figures, Diagrams

Task Demand	Common Item Formats
Use a model to demonstrate the relationship between the tilt of Earth's axis and seasons on Earth. Use a model as evidence to support a claim about the tilt of Earth's axis, length of day, and seasons. Use a model to demonstrate the relationship between Earth's position relative to the sun and Earth' s surface temperatures. Use a model of Earth's orbit to predict the amount of solar energy received at a location on Earth at any given time.	• Gap Match • Graphic Gap Match • Hot Spot • Inline Choice • Multiple Choice • Multiple Select

Performance Level Descriptors

Minimally Proficient	Partially Proficient
The student strives to • correlate the tilt of Earth's axis with the amount of sunlight it receives **SEP** • identify models that describe phenomena • identify modifications in models	The student is able to • distinguish seasons on Earth due to the tilt of Earth's axis **SEP** • develop and use models to describe, test, and predict phenomena and design systems • develop and use models to represent evidence • develop and use models to show the relationships among variables
Proficient	**Highly Proficient**
The student is able to • demonstrate that Earth's tilted axis causes changes in seasons and the amount of daylight **SEP** • develop and use models to describe, test, and predict more abstract phenomena and design systems • develop or modify a model—based on evidence—to match what happens if a variable or component of a system is changed • develop and use models to show relationships among variables, including those that are not observable • develop and use models to predict and/or describe phenomena • develop and use models to generate data to test ideas about phenomena in natural or designed systems	The student is able to • predict possible impacts of a change in Earth's tilted axis, rotation, or revolution **SEP** • develop, revise, and use models to evaluate or revise a model for a proposed object or tool • develop, revise, and use models to evaluate a model of simple systems with uncertain and less predictable factors • develop, revise, and use models to propose design changes to show the relationships among variables, including those that are not observable • develop, revise, and use models to describe unobservable mechanisms • develop, revise, and use models to generate data to test ideas about phenomena in natural or designed systems, including those representing inputs and outputs, and those at unobservable scales

6.L2U3.11

Standard	**Use evidence to construct an argument** regarding the impact of human activities on the environment and how they positively and negatively affect the competition for energy and resources in ecosystems.
SEPs	**Engaging in Argument from Evidence**
CCCs	**Patterns;** Cause and Effect**; Scale, Proportion and Quantity**; **Systems and System Models; Energy and Matter;** Structure and Function; Stability and Change
Assessment Boundaries	Not applicable
Stimulus Materials	Figures, Diagrams, Graphs, Tables

Task Demand	Common Item Formats
Identify human activities that have a positive or negative effect on the environment. Identify evidence to support an argument about human activities and their impact on the environment. Construct an argument about human activities and how they affect the competition for resources in ecosystems. Using evidence, evaluate methods for mitigating the effects of human activities on the environment.	• Inline Choice • Match • Match Table Grid • Multiple Choice • Multiple Select

Performance Level Descriptors

Minimally Proficient	Partially Proficient
The student strives to • identify human activities that impact the environment **SEP** • identify arguments on the same topic	The student is able to • distinguish human activities that impact the environment and affect competition for energy and resources **SEP** • differentiate between two arguments on the same topic
Proficient	**Highly Proficient**
The student is able to • demonstrate how human activities impact the environment and affect competition for energy and resources **SEP** • construct a convincing argument that supports claims • engage in arguments from evidence to compare and critique two arguments and analyze whether they emphasize similar or different evidence	The student is able to • evaluate explanations of how human activities impact the environment and affect competition for energy and resources **SEP** • engage in arguments from evidence to construct, evaluate, or revise a convincing argument that refutes claims • engage in arguments from evidence to provide critiques about explanations, procedures, models, and questions by citing relevant evidence

6.L2U3.12

Standard	**Engage in argument from evidence** to support a claim about the factors that cause species to change and how humans can impact those factors.
SEPs	**Engaging in Argument from Evidence**
CCCs	**Patterns;** Cause and Effect; **Scale, Proportion and Quantity**; **Systems and System Models; Energy and Matter;** Structure and Function; Stability and Change
Assessment Boundaries	Not applicable
Stimulus Materials	Figures, Diagrams, Graphs, Tables

Task Demand	Common Item Formats
Identify human activities that can cause a change in species. Identify evidence to support a claim about human activities and their impact on the environment. Construct an argument from evidence about human activities and their impact on the factors that cause species to change.	• Inline Choice • Match • Match Table Grid • Multiple Choice

Performance Level Descriptors

Minimally Proficient	Partially Proficient
The student strives to • identify factors that cause change in species **SEP** • identify arguments on the same topic	The student is able to • describe factors that can cause a change in species **SEP** • differentiate between two arguments on the same topic
Proficient	**Highly Proficient**
The student is able to • demonstrate how human activities impact the factors that cause species to change **SEP** • construct a convincing argument that supports claims • engage in arguments from evidence to compare and critique two arguments and analyze whether they emphasize similar or different evidence	The student is able to • predict how a change in human activities would impact the factors that cause a change in species **SEP** • engage in arguments from evidence to construct, evaluate, or revise a convincing argument that refutes claims • engage in arguments from evidence to provide critiques about explanations, procedures, models, and questions by citing relevant evidence

6.L2U1.13

Standard	**Develop and use models** to demonstrate the interdependence of organisms and their environment including biotic and abiotic factors.
SEPs	**Developing and Using Models**
CCCs	**Patterns;** Cause and Effect**; Scale, Proportion and Quantity**; **Systems and System Models; Energy and Matter;** Structure and Function; Stability and Change
Assessment Boundaries	Not applicable
Stimulus Materials	Models, Figures, Diagrams

Task Demand	Common Item Formats
Identify biotic and abiotic factors in a model. Use a model to demonstrate the relationship between organisms and their environment. Revise a model to show how a change in biotic or abiotic factors can impact a group of organisms. Use a model to predict how a change in biotic or abiotic factors would affect organisms and their environment.	• Graphic Gap Match • Hot Spot • Inline Choice • Match • Multiple Choice • Multiple Select

Performance Level Descriptors

Minimally Proficient	Partially Proficient
The student strives to • identify biotic and abiotic factors in the environment **SEP** • identify models that describe phenomena • identify modifications in models	The student is able to • demonstrate how organisms depend on the environment, including biotic and abiotic factors **SEP** • develop and use models to describe, test, and predict phenomena and design systems • develop and use models to represent evidence • develop and use models to show the relationships among variables
Proficient	**Highly Proficient**
The student is able to • demonstrate the interdependence of organisms and their environment, including biotic and abiotic factors **SEP** • develop and use models to describe, test, and predict more abstract phenomena and design systems • develop or modify a model—based on evidence—to match what happens if a variable or component of a system is changed • develop and use models to show relationships among variables, including those that are not observable • develop and use models to predict and/or describe phenomena • develop and use models to generate data to test ideas about phenomena in natural or designed systems	The student is able to • predict how a change in a biotic and abiotic factor would affect organisms and their environment **SEP** • develop, revise, and use models to evaluate or revise a model for a proposed object or tool • develop, revise, and use models to evaluate a model of simple systems with uncertain and less predictable factors • develop, revise, and use models to propose design changes to show the relationships among variables, including those that are not observable • develop, revise, and use models to describe unobservable mechanisms • develop, revise, and use models to generate data to test ideas about phenomena in natural or designed systems, including those representing inputs and outputs, and those at unobservable scales

6.L2U1.14

Standard	**Construct a model** that shows the cycling of matter and flow of energy in ecosystems.
SEPs	**Developing and Using Models**
CCCs	**Patterns;** Cause and Effect**; Scale, Proportion and Quantity**; **Systems and System Models; Energy and Matter;** Structure and Function; Stability and Change
Assessment Boundaries	Not applicable
Stimulus Materials	Models, Figures, Diagrams

Task Demand	Common Item Formats
Identify sources of energy in a model. Use a model to explain how energy is transferred in an ecosystem. Develop a model to show the relationships between producers, consumers, and decomposers in an ecosystem. Revise a model about the cycling of matter in an ecosystem to match what happens if a component of the system is changed.	• Gap Match • Graphic Gap Match • Hot Spot • Inline Choice • Match • Multiple Choice

Performance Level Descriptors

Minimally Proficient	Partially Proficient
The student strives to • identify the matter and energy that cycles in an ecosystem **SEP** • identify models that describe phenomena • identify modifications in models	The student is able to • use a model to distinguish how matter is cycled and energy flows in an ecosystem **SEP** • develop and use models to describe, test, and predict phenomena and design systems • develop and use models to represent evidence • develop and use models to show the relationships among variables
Proficient	**Highly Proficient**
The student is able to • demonstrate the cycling of matter and the flow of energy in an ecosystem **SEP** • develop and use models to describe, test, and predict more abstract phenomena and design systems • develop or modify a model—based on evidence—to match what happens if a variable or component of a system is changed • develop and use models to show relationships among variables, including those that are not observable • develop and use models to predict and/or describe phenomena • develop and use models to generate data to test ideas about phenomena in natural or designed systems	The student is able to • evaluate effects of changes in cycling of matter and flow of energy in ecosystems **SEP** • develop, revise, and use models to evaluate or revise a model for a proposed object or tool • develop, revise, and use models to evaluate a model of simple systems with uncertain and less predictable factors • develop, revise, and use models to propose design changes to show the relationships among variables, including those that are not observable • develop, revise, and use models to describe unobservable mechanisms • develop, revise, and use models to generate data to test ideas about phenomena in natural or designed systems, including those representing inputs and outputs, and those at unobservable scales

7.P2U1.1

Standard	**Collect and analyze data** demonstrating how electromagnetic forces can be attractive or repulsive and can vary in strength.
SEPs	**Analyzing and Interpreting Data**
CCCs	**Patterns; Cause and Effect;** Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; **Structure and Function;** Stability and Change
Assessment Boundaries	Not applicable
Stimulus Materials	Figures, Diagrams, Graphs, Tables

Task Demand	Common Item Formats
Identify the strength of forces acting on an object at different locations. Use data to construct an explanation about magnetic forces and how they can be attractive or repulsive. Graph the strength of the force for objects at different distances.	• Gap Match • Hot Spot • Inline Choice • Match • Match Table Grid • Multiple Choice • Multiple Select

Performance Level Descriptors

Minimally Proficient	Partially Proficient
The student strives to • identify effects of electromagnetic forces **SEP** • identify relationships contained in graphical displays of data	The student is able to • differentiate repulsive from attractive magnetic forces **SEP** • identify, distinguish, or describe data to construct graphical displays of data • identify, distinguish, or describe data to match graphical displays with data sets
Proficient	**Highly Proficient**
The student is able to • demonstrate magnetic forces can repel or attract and can vary in strength **SEP** • analyze and interpret data to identify linear and nonlinear relationships in graphical displays • analyze and interpret data using graphical displays (e.g., maps, charts, graphs, and/or tables) of large data sets to identify temporal and spatial relationships • analyze and interpret data to distinguish between causal and correlational relationships in data • analyze and interpret data to provide evidence for phenomena • analyze and interpret data to seek to improve precision and accuracy of data with better technological tools and methods (e.g., multiple trials) • analyze and interpret data to determine similarities and differences in findings	The student is able to • evaluate the nature of magnetic force and how strength varies at a distance **SEP** • analyze, interpret, and evaluate data to extend quantitative analysis to investigations, distinguishing between correlation and causation • analyze, interpret, and evaluate data to apply concepts of statistics and probability (including mean, median, mode, and variability) to analyze and characterize data, using digital tools when feasible • analyze, interpret, and evaluate data to define an optimal operational range for a proposed object, tool, process, or system that best meets criteria for success

7.P2U1.2

Standard	**Develop and use a model** to predict how forces act on objects at a distance.
SEPs	**Developing and Using Models**
CCCs	**Patterns; Cause and Effect;** Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; **Structure and Function;** Stability and Change
Assessment Boundaries	Not applicable
Stimulus Materials	Models, Figures, Diagrams

Task Demand	Common Item Formats
Identify forces acting on an object. Determine how a change in distance influences the strength of the forces acting on an object. Use a model to demonstrate how the forces acting on an object will change if one variable is changed. Construct a model to predict how forces act on objects at a distance.	• Graphic Gap Match • Hot Spot • Inline Choice • Match • Match Table Grid • Multiple Choice • Multiple Select

Performance Level Descriptors

Minimally Proficient	Partially Proficient
The student strives to • identify forces that act at a distance **SEP** • identify models that describe phenomena • identify modifications in models	The student is able to • differentiate how forces at a distance affect objects **SEP** • develop and use models to describe, test, and predict phenomena and design systems • develop and use models to represent evidence • develop and use models to show the relationships among variables
Proficient	**Highly Proficient**
The student is able to • predict how forces acting at a distance affect objects **SEP** • develop and use models to describe, test, and predict more abstract phenomena and design systems • develop or modify a model—based on evidence—to match what happens if a variable or component of a system is changed • develop and use models to show relationships among variables, including those that are not observable • develop and use models to predict and/or describe phenomena • develop and use models to generate data to test ideas about phenomena in natural or designed systems	The student is able to • evaluate predictions of effects of force acting on objects at a distance **SEP** • develop, revise, and use models to evaluate or revise a model for a proposed object or tool • develop, revise, and use models to evaluate a model of simple systems with uncertain and less predictable factors • develop, revise, and use models to propose design changes to show the relationships among variables, including those that are not observable • develop, revise, and use models to describe unobservable mechanisms • develop, revise, and use models to generate data to test ideas about phenomena in natural or designed systems, including those representing inputs and outputs, and those at unobservable scales

7.P3U1.3

Standard	**Plan and carry out an investigation** that can support an **evidence-based explanation** of how objects on Earth are affected by gravitational force.
SEPs	**Planning and Carrying Out Investigations** **Constructing Explanations and Designing Solutions**
CCCs	**Patterns; Cause and Effect;** Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; **Structure and Function;** Stability and Change
Assessment Boundaries	Not applicable
Stimulus Materials	Figures, Diagrams, Graphs, Tables

Task Demand	Common Item Formats
Identify the source of gravitational force. Compare the relative amounts of force acting on objects of different mass or distance. Explain the results of an investigation of how objects on Earth are affected by gravitational force. Using evidence, predict how a change in mass or distance would affect the gravitational force acting on an object.	• Gap Match • Graphic Gap Match • Hot Spot • Inline Choice • Match • Multiple Choice

Performance Level Descriptors

Minimally Proficient	Partially Proficient
The student strives to • identify the components of gravitational force **SEP** • identify variables • collect data • identify evidence that support scientific ideas, principles, and theories • identify models or representations that support an explanation	The student is able to • identify that there is a relationship between mass, gravity, and distance **SEP** • carry out pre-planned investigations that use multiple variables and provide evidence to support explanations • carry out pre-planned investigations that involve independent and dependent variables and controls • carry out pre-planned investigations that include various methods for collecting data • distinguish between explanations and solutions to identify those supported by multiple sources of evidence consistent with scientific ideas • distinguish between explanations and solutions to identify those that include qualitative or quantitative relationships between variables that describe phenomena • distinguish between explanations and solutions to identify those based on valid and reliable evidence

Proficient	Highly Proficient
The student is able to • demonstrate how objects on Earth are affected by gravitational force **SEP** • develop a plan and carry out investigations that evaluate the accuracy of various methods for collecting data • develop a plan and carry out investigations that produce data to answer scientific questions or test • design solutions • develop a plan and carry out investigations that collect data about the performance of a proposed object, tool, process, or system • construct explanations and design solutions that include qualitative or quantitative relationships between variables that predict phenomena • construct explanations and design solutions that apply scientific reasoning to show why the data or evidence is adequate for the explanation or conclusion	The student is able to • predict how objects on Earth are affected by gravity • evaluate how changes in mass and distance affect gravitational forces on objects **SEP** • plan, carry out, evaluate, and revise investigations that include how measurements will be recorded and how much data is needed to support a claim • plan, carry out, evaluate, and revise investigations that involve an evaluation and/or revisions to the experimental design • construct and evaluate explanations and solutions that apply scientific ideas or principles in testing a design of an object, tool, process, or system • construct and evaluate explanations and solutions that meet specific design criteria and constraints • construct and evaluate explanations and solutions that optimize performance of a design by prioritizing criteria

7.P3U1.4

Standard	**Use** non-algebraic **mathematics and computational thinking** to explain Newton's laws of motion.
SEPs	**Using Mathematics and Computational Thinking**
CCCs	**Patterns;** Cause and Effect; **Scale, Proportion and Quantity; Systems and System Models; Energy and Matter**; Structure and Function**;** Stability and Change
Assessment Boundaries	Not applicable
Stimulus Materials	Figures, Diagrams, Graphs, Tables

Task Demand	Common Item Formats
Identify Newton's laws of motion. Determine the relative strength and direction of a force acting on an object or between two objects. Calculate the overall force acting on a system.	• Gap Match • Graphic Gap Match • Hot Spot • Inline Choice • Multiple Choice • Multiple Select

Performance Level Descriptors

Minimally Proficient	Partially Proficient
The student strives to • identify concepts of Newton's laws of motion **SEP** • identify patterns in data sets	The student is able to • demonstrate concepts of Newton's laws of motion **SEP** • use mathematical and computational thinking to distinguish patterns in data sets that support explanations and arguments
Proficient	**Highly Proficient**
The student is able to • apply concepts of Newton's laws of motion **SEP** • use mathematical and computational thinking in the selection of digital tools (e.g., computers) to analyze very large data sets for patterns and trends • use mathematical and computational thinking to describe and/or support scientific conclusions and design solutions • use mathematical and computational thinking in the use of digital tools and/or mathematical concepts and arguments	The student is able to • evaluate concepts of Newton's laws of motion **SEP** • use mathematical and computational thinking to create or evaluate algorithms (a series of ordered steps) to solve a problem • use mathematical and computational thinking to apply mathematical concepts and/or processes (e.g., ratio, rate, percent, basic operations, simple algebra) to scientific and engineering questions and problems • use mathematical and computational thinking to test and compare proposed solutions to an engineering design problem

7.E1U1.5

Standard	**Construct a model** that shows the cycling of matter and flow of energy in the atmosphere, hydrosphere, and geosphere.
SEPs	**Developing and Using Models**
CCCs	**Patterns; Cause and Effect;** Scale, Proportion and Quantity; Systems and System Models**;** Energy and Matter; **Structure and Function;** Stability and Change
Assessment Boundaries	Not applicable
Stimulus Materials	Models, Figures, Diagrams

Task Demand	Common Item Formats
Identify the components of Earth's atmosphere, hydrosphere, and geosphere that cycle matter in a model. Complete a model to compare the directions of energy flow in Earth's atmosphere, hydrosphere, and geosphere. Use a model to explain how a change in energy flow affects the cycling of matter in Earth's atmosphere, hydrosphere, and geosphere. Use a model to predict the flow of energy and/or matter in Earth's atmosphere, hydrosphere, and geosphere.	• Gap Match • Graphic Gap Match • Inline Choice • Match Table Grid • Multiple Choice • Multiple Select

Performance Level Descriptors

Minimally Proficient	Partially Proficient
The student strives to • identify the components of Earth's atmosphere, hydrosphere, and geosphere that cycle matter **SEP** • identify models that describe phenomena • identify modifications in models	The student is able to • differentiate components of Earth's atmosphere, hydrosphere, and geosphere where energy flows and matter is cycled **SEP** • develop and use models to describe, test, and predict phenomena and design systems • develop and use models to represent evidence • develop and use models to show the relationships among variables

Proficient	Highly Proficient
The student is able to • demonstrate how matter cycles and energy flows within Earth's atmosphere, hydrosphere, and geosphere **SEP** • develop and use models to describe, test, and predict more abstract phenomena and design systems • develop or modify a model—based on evidence—to match what happens if a variable or component of a system is changed • develop and use models to show relationships among variables, including those that are not observable • develop and use models to predict and/or describe phenomena • develop and use models to generate data to test ideas about phenomena in natural or designed systems	The student is able to • evaluate how energy flows and matter is cycled in Earth's atmosphere, hydrosphere, and geosphere **SEP** • develop, revise, and use models to evaluate or revise a model for a proposed object or tool • develop, revise, and use models to evaluate a model of simple systems with uncertain and less predictable factors • develop, revise, and use models to propose design changes to show the relationships among variables, including those that are not observable • develop, revise, and use models to describe unobservable mechanisms • develop, revise, and use models to generate data to test ideas about phenomena in natural or designed systems, including those representing inputs and outputs, and those at unobservable scales

7.E1U1.6

Standard	**Construct a model** to explain how the distribution of fossils and rocks, continental shapes, and seafloor structures provides evidence of the past plate motions.
SEPs	**Developing and Using Models**
CCCs	**Patterns; Cause and Effect;** Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; **Structure and Function;** Stability and Change
Assessment Boundaries	Not applicable
Stimulus Materials	Models, Figures, Diagrams

Task Demand	Common Item Formats
Identify structures that provide evidence of plate tectonics. Select information that could be included to improve a model of plate motion. Use a model to support a claim about past plate motions.	• Gap Match • Graphic Gap Match • Inline Choice • Match Table Grid • Multiple Choice

Performance Level Descriptors

Minimally Proficient	Partially Proficient
The student strives to • identify structures to provide evidence of plate motions **SEP** • identify models that describe phenomena • identify modifications in models	The student is able to • select evidence that can be used to show past plate motions **SEP** • develop and use models to describe, test, and predict phenomena and design systems • develop and use models to represent evidence • develop and use models to show the relationships among variables
Proficient	**Highly Proficient**
The student is able to • demonstrate how past plate motions can be determined with available evidence **SEP** • develop and use models to describe, test, and predict more abstract phenomena and design systems • develop or modify a model—based on evidence—to match what happens if a variable or component of a system is changed • develop and use models to show relationships among variables, including those that are not observable • develop and use models to predict and/or describe phenomena • develop and use models to generate data to test ideas about phenomena in natural or designed systems	The student is able to • evaluate evidence used to determine past motion of plates **SEP** • develop, revise, and use models to evaluate or revise a model for a proposed object or tool • develop, revise, and use models to evaluate a model of simple systems with uncertain and less predictable factors • develop, revise, and use models to propose design changes to show the relationships among variables, including those that are not observable • develop, revise, and use models to describe unobservable mechanisms • develop, revise, and use models to generate data to test ideas about phenomena in natural or designed systems, including those representing inputs and outputs, and those at unobservable scales

7.E1U2.7

Standard	**Analyze and interpret data to construct an explanation** for how advances in technology has improved weather prediction.
SEPs	**Analyzing and Interpreting Data** **Constructing Explanations and Designing Solutions**
CCCs	**Patterns; Cause and Effect;** Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; **Structure and Function;** Stability and Change
Assessment Boundaries	Not applicable
Stimulus Materials	Figures, Diagrams, Graphs, Tables

Task Demand	Common Item Formats
Identify the technology used to create weather forecasts. Explain the advantages and disadvantages of different types of technology in weather prediction. Use data gathered from advanced weather technologies to create a prediction about a future weather event. Suggest improvements for a current weather forecasting tool that would improve its accuracy during specific weather conditions.	• Graphic Gap Match • Hot Spot • Inline Choice • Match • Match Table Grid • Multiple Choice

Performance Level Descriptors

Minimally Proficient	Partially Proficient
The student strives to • identify different types of technology used in weather prediction **SEP** • identify relationships contained in graphical displays of data • identify evidence that support scientific ideas, principles, and theories • identify models or representations that support an explanation	The student is able to • examine types of technology used in weather prediction **SEP** • identify, distinguish, or describe data to construct graphical displays of data • identify, distinguish, or describe data to match graphical displays with data sets • distinguish between explanations and solutions to identify those supported by multiple sources of evidence consistent with scientific ideas • distinguish between explanations and solutions to identify those that include qualitative or quantitative relationships between variables that describe phenomena • distinguish between explanations and solutions to identify those based on valid and reliable evidence

Proficient	Highly Proficient
The student is able to • demonstrate how advances in technology have improved weather prediction **SEP** • analyze and interpret data to identify linear and nonlinear relationships in graphical displays • analyze and interpret data using graphical displays (e.g., maps, charts, graphs, and/or tables) of large data sets to identify temporal and spatial relationships • analyze and interpret data to distinguish between causal and correlational relationships in data • analyze and interpret data to provide evidence for phenomena • analyze and interpret data to seek to improve precision and accuracy of data with better technological tools and methods (e.g., multiple trials) • analyze and interpret data to determine similarities and differences in findings • construct explanations and design solutions that include qualitative or quantitative relationships between variables that predict phenomena • construct explanations and design solutions that apply scientific reasoning to show why the data or evidence is adequate for the explanation or conclusion	The student is able to • design a solution to improve technology in weather prediction **SEP** • analyze, interpret, and evaluate data to extend quantitative analysis to investigations, distinguishing between correlation and causation • analyze, interpret, and evaluate data to apply concepts of statistics and probability (including mean, median, mode, and variability) to analyze and characterize data, using digital tools when feasible • analyze, interpret, and evaluate data to define an optimal operational range for a proposed object, tool, process, or system that best meets criteria for success • construct and evaluate explanations and solutions that apply scientific ideas or principles in testing a design of an object, tool, process, or system • construct and evaluate explanations and solutions that meet specific design criteria and constraints • construct and evaluate explanations and solutions that optimize performance of a design by prioritizing criteria

7.L1U1.8

Standard	**Obtain, evaluate, and communicate information** to provide evidence that all living things are made of cells, cells come from existing cells, and cells are the basic structural and functional unit of all living things.
SEPs	**Obtaining, Evaluating, and Communicating Information**
CCCs	**Patterns; Cause and Effect;** Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; **Structure and Function;** Stability and Change
Assessment Boundaries	Not applicable
Stimulus Materials	Figures, Diagrams, Graphs, Tables

Task Demand	Common Item Formats
Identify information to support the argument that all living things are made of cells. Using evidence from an investigation, construct a claim about cell theory. Evaluate evidence and determine whether it aligns with or contradicts cell theory.	• Graphic Gap Match • Inline Choice • Match Table Grid • Multiple Choice

Performance Level Descriptors

Minimally Proficient	Partially Proficient
The student strives to • identify cells as the basis of all living things **SEP** • identify the accuracy of ideas and methods	The student is able to • distinguish components of cell theory **SEP** • distinguish between the reliability of ideas and methods based on the credibility of sources
Proficient	**Highly Proficient**
The student is able to • synthesize evidence to support the explanation of cell theory **SEP** • obtain, evaluate, and communicate information to critically review scientific information to determine the central idea • obtain, evaluate, and communicate information to describe patterns in and/or evidence about the natural and/or designed worlds • obtain, evaluate, and communicate information to evaluate data, hypotheses, and/or conclusions in scientific and technical texts in light of competing information or accounts • obtain, evaluate, and communicate information to communicate scientific and/or technical information	The student is able to • evaluate evidence of cell theory **SEP** obtain, evaluate, and communicate information to synthesize information from multiple appropriate sources and assess the credibility, accuracy, possible bias, and the methods used to explain whether the sources are supported by the evidence

7.L1U1.9

Standard	**Construct an explanation** to demonstrate the relationship between major cell structures and cell functions (plant and animal).
SEPs	**Constructing Explanations and Designing Solutions**
CCCs	**Patterns; Cause and Effect;** Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; **Structure and Function;** Stability and Change
Assessment Boundaries	At this grade level, only a few major cell structures should be introduced.
Stimulus Materials	Figures, Diagrams, Graphs, Tables

Task Demand	Common Item Formats
Identify different plant and animal cells. Explain the differences between plant and animal cells. Explain the differences between major cell structures within an organism. Identify the primary function of different cells within an organism. Demonstrate homeostasis within plant or animal cells.	• Gap Match • Graphic Gap Match • Inline Choice • Match • Match Table Grid • Multiple Choice • Multiple Select

Performance Level Descriptors

Minimally Proficient	Partially Proficient
The student strives to • identify plant and animal cells **SEP** • identify evidence that support scientific ideas, principles, and theories • identify models or representations that support an explanation	The student is able to • differentiate between components of plant and animal cells and their functions **SEP** • distinguish between explanations and solutions to identify those supported by multiple sources of evidence consistent with scientific ideas • distinguish between explanations and solutions to identify those that include qualitative or quantitative relationships between variables that describe phenomena • distinguish between explanations and solutions to identify those based on valid and reliable evidence
Proficient	**Highly Proficient**
The student is able to • demonstrate the relationship between structure and function in cells of plants and animals **SEP** • construct explanations and design solutions that include qualitative or quantitative relationships between variables that predict phenomena • construct explanations and design solutions that apply scientific reasoning to show why the data or evidence is adequate for the explanation or conclusion	The student is able to • predict how a change in structure affects functions of plant or animal cells to reestablish internal stability (based on changes in external factors) **SEP** • construct and evaluate explanations and solutions that apply scientific ideas or principles in testing a design of an object, tool, process, or system • construct and evaluate explanations and solutions that meet specific design criteria and constraints • construct and evaluate explanations and solutions that optimize performance of a design by prioritizing criteria

7.L1U1.10

Standard	**Develop and use a model** to explain how cells, tissues, and organ systems maintain life (animals).
SEPs	**Developing and Using Models**
CCCs	**Patterns; Cause and Effect;** Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; **Structure and Function;** Stability and Change
Assessment Boundaries	Not applicable
Stimulus Materials	Models, Figures, Diagrams

Task Demand	Common Item Formats
Identify cells, tissues, and organs within a model. Explain the function of different major cells. Use a model to explain how cells work together to maintain homeostasis. Use a model to predict the cellular response to alterations in external factors.	• Gap Match • Graphic Gap Match • Inline Choice • Match • Multiple Choice • Multiple Select

Performance Level Descriptors

Minimally Proficient	Partially Proficient
The student strives to • identify animal cells, tissues, and organs **SEP** • identify models that describe phenomena • identify modifications in models	The student is able to • differentiate between animal cells, tissues, and organs and their functions **SEP** • develop and use models to describe, test, and predict phenomena and design systems • develop and use models to represent evidence • develop and use models to show the relationships among variables
Proficient	**Highly Proficient**
The student is able to • demonstrate how animal cells, tissues, and organ systems are organized and interact to maintain life **SEP** • develop and use models to describe, test, and predict more abstract phenomena and design systems • develop or modify a model—based on evidence—to match what happens if a variable or component of a system is changed • develop and use models to show relationships among variables, including those that are not observable • develop and use models to predict and/or describe phenomena • develop and use models to generate data to test ideas about phenomena in natural or designed systems	The student is able to • predict how animal cells, tissues, and organs will maintain life **SEP** • develop, revise, and use models to evaluate or revise a model for a proposed object or tool • develop, revise, and use models to evaluate a model of simple systems with uncertain and less predictable factors • develop, revise, and use models to propose design changes to show the relationships among variables, including those that are not observable • develop, revise, and use models to describe unobservable mechanisms • develop, revise, and use models to generate data to test ideas about phenomena in natural or designed systems, including those representing inputs and outputs, and those at unobservable scales

7.L1U1.11

Standard	**Construct an explanation** for how organisms maintain internal stability and evaluate the effect of the external factors on organisms' internal stability.
SEPs	**Constructing Explanations and Designing Solutions**
CCCs	**Patterns; Cause and Effect;** Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; **Structure and Function;** Stability and Change
Assessment Boundaries	Not applicable
Stimulus Materials	Figures, Diagrams, Graphs, Tables

Task Demand	Common Item Formats
Explain a situation that would prevent an organism from maintaining homeostasis. Demonstrate how the body maintains stability in internal conditions when faced with changes in the external environment. Predict how an organism will respond to alterations in the external environment as it strives to preserve homeostasis.	• Gap Match • Inline Choice • Multiple Choice • Multiple Select

Performance Level Descriptors

Minimally Proficient	Partially Proficient
The student strives to • identify external factors affecting an organism's internal stability **SEP** • identify evidence that support scientific ideas, principles, and theories • identify models or representations that support an explanation	The student is able to • differentiate an organism that is in a state of internal stability from an organism that is not **SEP** • distinguish between explanations and solutions to identify those supported by multiple sources of evidence consistent with scientific ideas • distinguish between explanations and solutions to identify those that include qualitative or quantitative relationships between variables that describe phenomena • distinguish between explanations and solutions to identify those based on valid and reliable evidence
Proficient	**Highly Proficient**
The student is able to • demonstrate how equilibrium is maintained and evaluate the effect of external factors on internal stability **SEP** • construct explanations and design solutions that include qualitative or quantitative relationships between variables that predict phenomena • construct explanations and design solutions that apply scientific reasoning to show why the data or evidence is adequate for the explanation or conclusion	The student is able to • predict how an external factor will affect the ability of an organism to maintain homeostasis **SEP** • construct and evaluate explanations and solutions that apply scientific ideas or principles in testing a design of an object, tool, process, or system • construct and evaluate explanations and solutions that meet specific design criteria and constraints • construct and evaluate explanations and solutions that optimize performance of a design by prioritizing criteria

7.L2U1.12

Standard	**Construct an explanation** for how some plant cells convert light energy into food energy.
SEPs	**Constructing Explanations and Designing Solutions**
CCCs	**Patterns; Cause and Effect;** Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; **Structure and Function;** Stability and Change
Assessment Boundaries	Not applicable
Stimulus Materials	Figures, Diagrams, Graphs, Tables

Task Demand	Common Item Formats
Identify the parts of a plant that can convert light energy to food energy. Identify the chemicals used by plants during photosynthesis and those made by the plants. Explain how plant cells conduct photosynthesis. Predict the influence of changes in environmental conditions on the rate of photosynthesis.	• Inline Choice • Match • Match Table Grid • Multiple Choice

Performance Level Descriptors

Minimally Proficient	Partially Proficient
The student strives to • identify which plant cells can convert light energy to food energy **SEP** • identify evidence that support scientific ideas, principles, and theories • identify models or representations that support an explanation	The student is able to • identify the products and reactants in the process of converting light energy to food energy (photosynthesis) in some plant cells **SEP** • distinguish between explanations and solutions to identify those supported by multiple sources of evidence consistent with scientific ideas • distinguish between explanations and solutions to identify those that include qualitative or quantitative relationships between variables that describe phenomena • distinguish between explanations and solutions to identify those based on valid and reliable evidence
Proficient	**Highly Proficient**
The student is able to • demonstrate how some plant cells convert light energy into food energy (photosynthesis) **SEP** • construct explanations and design solutions that include qualitative or quantitative relationships between variables that predict phenomena • construct explanations and design solutions that apply scientific reasoning to show why the data or evidence is adequate for the explanation or conclusion	The student is able to • demonstrate how the process to convert light energy into food energy (photosynthesis) can be impacted by a change in biotic or abiotic factors **SEP** • construct and evaluate explanations and solutions that apply scientific ideas or principles in testing a design of an object, tool, process, or system • construct and evaluate explanations and solutions that meet specific design criteria and constraints • construct and evaluate explanations and solutions that optimize performance of a design by prioritizing criteria

8.P1U1.1

Standard	**Develop and use a model** to demonstrate that atoms and molecules can be combined or rearranged in chemical reactions to form new compounds with the total number of each type of atom conserved.
SEPs	**Developing and Using Models**
CCCs	Patterns; **Cause and Effect;** Scale, Proportion and Quantity; Systems and System Models; **Energy and Matter;** Structure and Function; **Stability and Change**
Assessment Boundaries	Not applicable
Stimulus Materials	Models, Figures, Diagrams

Task Demand	Common Item Formats
Use a model to identify the number of atoms contained in one molecule of a substance. Select pieces of evidence that can be used to determine whether a chemical reaction has occurred in a model. Demonstrate the rearrangement, yet conservation, of atoms in chemical reactions.	• Gap Match • Graphic Gap Match • Hot Spot • Inline Choice • Match Table Grid • Multiple Choice

Performance Level Descriptors

Minimally Proficient	Partially Proficient
The student strives to • determine whether a chemical reaction has occurred based on the rearrangement of particles **SEP** • identify models that describe phenomena • identify modifications in models	The student is able to • show rearrangement of particles in chemical reactions **SEP** • develop and use models to describe, test, and predict phenomena and design systems • develop and use models to represent evidence • develop and use models to show the relationships among variables
Proficient	**Highly Proficient**
The student is able to • demonstrate that matter is conserved in chemical reactions **SEP** • develop and use models to describe, test, and predict more abstract phenomena and design systems • develop or modify a model—based on evidence—to match what happens if a variable or component of a system is changed • develop and use models to show relationships among variables, including those that are not observable • develop and use models to predict and/or describe phenomena • develop and use models to generate data to test ideas about phenomena in natural or designed systems	The student is able to • predict the outcome of the rearrangement of particles in chemical reactions with regard to conservation of matter **SEP** • develop, revise, and use models to evaluate or revise a model for a proposed object or tool • develop, revise, and use models to evaluate a model of simple systems with uncertain and less predictable factors • develop, revise, and use models to propose design changes to show the relationships among variables, including those that are not observable • develop, revise, and use models to describe unobservable mechanisms • develop, revise, and use models to generate data to test ideas about phenomena in natural or designed systems, including those representing inputs and outputs, and those at unobservable scales

8.P1U1.2

Standard	**Obtain and evaluate information** regarding how scientists identify substances based on unique physical and chemical properties.
SEPs	**Obtaining, Evaluating, and Communicating Information**
CCCs	Patterns; **Cause and Effect;** Scale, Proportion and Quantity; Systems and System Models; **Energy and Matter;** Structure and Function; **Stability and Change**
Assessment Boundaries	Not applicable
Stimulus Materials	Figures, Diagrams, Graphs, Tables

Task Demand	Common Item Formats
Identify the distinct physical and chemical properties exhibited by substances. Identify methods for identifying substances based on their physical properties. Use information about the different properties of a substance to anticipate its response to alterations in external conditions.	• Graphic Gap Match • Inline Choice • Match • Match Table Grid • Multiple Choice • Multiple Select

Performance Level Descriptors

Minimally Proficient	Partially Proficient
The student strives to • identify unique physical and chemical properties of substances **SEP** • identify the accuracy of ideas and methods	The student is able to • differentiate chemical from physical properties of substances **SEP** • distinguish between the reliability of ideas and methods based on the credibility of sources
Proficient	**Highly Proficient**
The student is able to • identify unique physical and chemical properties of substances **SEP** • obtain, evaluate, and communicate information to critically review scientific information to determine the central idea • obtain, evaluate, and communicate information to describe patterns in and/or evidence about the natural and/or designed worlds • obtain, evaluate, and communicate information to evaluate data, hypotheses, and/or conclusions in scientific and technical texts in light of competing information or accounts • obtain, evaluate, and communicate information to communicate scientific and/or technical information	The student is able to • predict types of properties used to distinguish different substances **SEP** • obtain, evaluate, and communicate information to synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias and methods used to explain whether the sources are supported by the evidence

8.P4U1.3

Standard	**Construct an explanation** on how energy can be transferred from one energy store to another.
SEPs	**Constructing Explanations and Designing Solutions**
CCCs	Patterns; **Cause and Effect;** Scale, Proportion and Quantity; Systems and System Models; **Energy and Matter;** Structure and Function; **Stability and Change**
Assessment Boundaries	Not applicable
Stimulus Materials	Figures, Diagrams, Graphs, Tables

Task Demand	Common Item Formats
Identify situations where energy is transferred. Identify the type of energy that is transferred in a scenario. Explain the path of energy transfer in a scenario. Predict the outcome of an experiment involving energy transfer.	• Gap Match • Graphic Gap Match • Hot Spot • Inline Choice • Match Table Grid • Multiple Choice • Multiple Select

Performance Level Descriptors

Minimally Proficient	Partially Proficient
The student strives to • identify energy transfers **SEP** • identify evidence that support scientific ideas, principles, and theories • identify models or representations that support an explanation	The student is able to • distinguish types of energy transfers **SEP** • distinguish between explanations and solutions to identify those supported by multiple sources of evidence consistent with scientific ideas • distinguish between explanations and solutions to identify those that include qualitative or quantitative relationships between variables that describe phenomena • distinguish between explanations and solutions to identify those based on valid and reliable evidence
Proficient	**Highly Proficient**
The student is able to • demonstrate how energy is transferred **SEP** • construct explanations and design solutions that include qualitative or quantitative relationships between variables that predict phenomena • construct explanations and design solutions that apply scientific reasoning to show why the data or evidence is adequate for the explanation or conclusion	The student is able to • evaluate or revise explanations of energy transfer methods **SEP** • construct and evaluate explanations and solutions that apply scientific ideas or principles in testing a design of an object, tool, process, or system • construct and evaluate explanations and solutions that meet specific design criteria and constraints • construct and evaluate explanations and solutions that optimize performance of a design by prioritizing criteria

8.P4U1.4

Standard	**Develop and use mathematical models to explain** wave characteristics and interactions.
SEPs	**Developing and Using Models** **Using Mathematics and Computational Thinking**
CCCs	Patterns; **Cause and Effect;** Scale, Proportion and Quantity; Systems and System Models; **Energy and Matter;** Structure and Function; **Stability and Change**
Assessment Boundaries	Not applicable
Stimulus Materials	Models, Figures, Diagrams

Task Demand	Common Item Formats
Identify the type of wave depicted in a model. Identify the different properties of a wave. Construct a model that illustrates the different wave characteristics and interactions. Revise a model to illustrate the impact of wave characteristics when the amount of energy in the system is changed.	• Gap Match • Graphic Gap Match • Inline Choice • Match • Match Table Grid • Multiple Choice • Multiple Select

Performance Level Descriptors

Minimally Proficient	Partially Proficient
The student strives to • identify when waves occur **SEP** • identify models that describe phenomena • identify modifications in models • identify patterns in data sets	The student is able to • identify wave characteristics and interactions **SEP** • develop and use models to describe, test, and predict phenomena and design systems • develop and use models to represent evidence • develop and use models to show the relationships among variables • use mathematical and computational thinking to distinguish patterns in data sets that support explanations and arguments

Proficient	Highly Proficient
The student is able to • describe wave characteristics and interactions **SEP** • develop and use models to describe, test, and predict more abstract phenomena and design systems • develop or modify a model—based on evidence—to match what happens if a variable or component of a system is changed • develop and use models to show relationships among variables, including those that are not observable • develop and use models to predict and/or describe phenomena • develop and use models to generate data to test ideas about phenomena in natural or designed systems • use mathematical and computational thinking in the selection of digital tools (e.g., computers) to analyze very large data sets for patterns and trends • use mathematical and computational thinking to describe and/or support scientific conclusions and design solutions • use mathematical and computational thinking in the use of digital tools and/or mathematical concepts and arguments	The student is able to • use, revise, or evaluate explanations of wave characteristics or interactions • predict the impact of wave characteristics when the amount of energy in the system is changed **SEP** • develop, revise, and use models to evaluate or revise a model for a proposed object or tool • develop, revise, and use models to evaluate a model of simple systems with uncertain and less predictable factors • develop, revise, and use models to propose design changes to show the relationships among variables, including those that are not observable • develop, revise, and use models to describe unobservable mechanisms • develop, revise, and use models to generate data to test ideas about phenomena in natural or designed systems, including those representing inputs and outputs, and those at unobservable scales • use mathematical and computational thinking to create or evaluate algorithms (a series of ordered steps) to solve a problem • use mathematical and computational thinking to apply mathematical concepts and/or processes (e.g., ratio, rate, percent, basic operations, simple algebra) to scientific and engineering questions and problems • use mathematical and computational thinking to test and compare

	proposed solutions to an engineering design problem

8.P4U2.5

Standard	**Develop a solution** to increase efficiency when transferring energy from one source to another.
SEPs	**Constructing Explanations and Designing Solutions**
CCCs	Patterns; **Cause and Effect;** Scale, Proportion and Quantity; Systems and System Models; **Energy and Matter;** Structure and Function; **Stability and Change**
Assessment Boundaries	Not applicable
Stimulus Materials	Figures, Diagrams, Graphs, Tables

Task Demand	Common Item Formats
Identify the form of energy transfer in a scenario. Explain the efficiency of a material at preventing or facilitating energy transfer. Design a solution that will improve the efficiency of a system involving energy transfer. Determine whether specific changes to a system will improve the efficiency of energy transfer.	• Graphic Gap Match • Hot Spot • Inline Choice • Match • Match Table Grid • Multiple Choice • Multiple Select

Performance Level Descriptors

Minimally Proficient	Partially Proficient
The student strives to • identify efficiency in energy transfers **SEP** • identify evidence that support scientific ideas, principles, and theories • identify models or representations that support an explanation	The student is able to • differentiate between the levels of efficiency in energy transfer **SEP** • distinguish between explanations and solutions to identify those supported by multiple sources of evidence consistent with scientific ideas • distinguish between explanations and solutions to identify those that include qualitative or quantitative relationships between variables that describe phenomena • distinguish between explanations and solutions to identify those based on valid and reliable evidence
Proficient	**Highly Proficient**
The student is able to • describe a solution that leads to increases in efficiency of energy transfer **SEP** • construct explanations and design solutions that include qualitative or quantitative relationships between variables that predict phenomena • construct explanations and design solutions that apply scientific reasoning to show why the data or evidence is adequate for the explanation or conclusion	The student is able to • evaluate solutions leading to increases in efficiency of energy transfer **SEP** • construct and evaluate explanations and solutions that apply scientific ideas or principles in testing a design of an object, tool, process, or system • construct and evaluate explanations and solutions that meet specific design criteria and constraints • construct and evaluate explanations and solutions that optimize performance of a design by prioritizing criteria

8.E1U1.6

Standard	**Analyze and interpret data** about the Earth's geological column to **communicate** relative ages of rock layers and fossils.
SEPs	**Analyzing and Interpreting Data** **Obtaining, Evaluating, and Communicating Information**
CCCs	Patterns; **Cause and Effect;** Scale, Proportion and Quantity; Systems and System Models; **Energy and Matter;** Structure and Function; **Stability and Change**
Assessment Boundaries	Not applicable
Stimulus Materials	Figures, Diagrams, Graphs, Tables

Task Demand	Common Item Formats
Identify the relative age of different rock layers. Identify fossil evidence that supports a claim about the relative age of a rock layer. Use data to create a chronological sequence illustrating the formation of a rock structure. Evaluate geological methods, including stratigraphy, fossil analysis, and principles such as superposition, to determine the relative age of rocks.	• Gap Match • Graphic Gap Match • Inline Choice • Multiple Choice • Multiple Select

Performance Level Descriptors

Minimally Proficient	Partially Proficient
The student strives to • identify methods to determine relative age of rock layers **SEP** • identify relationships contained in graphical displays of data • identify the accuracy of ideas and methods	The student is able to • examine how rock layers and fossils can be useful in determining relative age **SEP** • identify, distinguish, or describe data to construct graphical displays of data • identify, distinguish, or describe data to match graphical displays with data sets

	• distinguish between the reliability of ideas and methods based on the credibility of sources

Proficient	Highly Proficient
The student is able to • demonstrate how data from Earth's geological column can be used to communicate the relative ages of rock layers and fossils **SEP** • analyze and interpret data to identify linear and nonlinear relationships in graphical displays • analyze and interpret data using graphical displays (e.g., maps, charts, graphs, and/or tables) of large data sets to identify temporal and spatial relationships • analyze and interpret data to distinguish between causal and correlational relationships in data • analyze and interpret data to provide evidence for phenomena • analyze and interpret data to seek to improve precision and accuracy of data with better technological tools and methods (e.g., multiple trials) • analyze and interpret data to determine similarities and differences in findings • obtain, evaluate, and communicate information to critically review scientific information to determine the central idea • obtain, evaluate, and communicate information to describe patterns in and/or evidence about the natural and/or designed worlds • obtain, evaluate, and communicate information to evaluate data, hypotheses, and/or conclusions in scientific and technical texts in light of competing information or accounts	The student is able to • evaluate methods of determining relative age **SEP** • analyze, interpret, and evaluate data to extend quantitative analysis to investigations, distinguishing between correlation and causation • analyze, interpret, and evaluate data to apply concepts of statistics and probability (including mean, median, mode, and variability) to analyze and characterize data, using digital tools when feasible • analyze, interpret, and evaluate data to define an optimal operational range for a proposed object, tool, process, or system that best meets criteria for success • obtain, evaluate, and communicate information to synthesize information from multiple appropriate sources and assess the credibility, accuracy, possible bias, and the methods used to explain whether the sources are supported by the evidence

• obtain, evaluate, and communicate information to communicate scientific and/or technical information	

8.E1U3.7

Standard	**Obtain, evaluate, and communicate** information about data and historical patterns to predict natural hazards and other geological events.
SEPs	**Obtaining, Evaluating, and Communicating Information**
CCCs	Patterns; **Cause and Effect;** Scale, Proportion and Quantity; Systems and System Models; **Energy and Matter;** Structure and Function; **Stability and Change**
Assessment Boundaries	Not applicable
Stimulus Materials	Figures, Diagrams, Graphs, Tables

Task Demand	Common Item Formats
Identify technologies that assist in weather forecasting. Identify patterns in historical data regarding natural hazards or geological events. Integrate data with historical patterns to enhance predictions of natural hazards and geological events for improved preparedness and mitigation. Utilize data and historical patterns to assess and predict the probability of natural hazards and geological events.	• Gap Match • Graphic Gap Match • Hot Spot • Inline Choice • Match • Match Table Grid • Multiple Choice

Performance Level Descriptors

Minimally Proficient	Partially Proficient
The student strives to • identify how data is collected for natural hazards and geologic events **SEP** • identify the accuracy of ideas and methods	The student is able to • recognize that there are patterns in data that can be used to predict future natural hazards and geologic events **SEP** • distinguish between the reliability of ideas and methods based on the credibility of sources
Proficient	**Highly Proficient**
The student is able to • synthesize information about data and historical patterns to predict natural hazards and other geological events **SEP** • obtain, evaluate, and communicate information to critically review scientific information to determine the central idea • obtain, evaluate, and communicate information to describe patterns in and/or evidence about the natural and/or designed worlds • obtain, evaluate, and communicate information to evaluate data, hypotheses, and/or conclusions in scientific and technical texts in light of competing information or accounts • obtain, evaluate, and communicate information to communicate scientific and/or technical information	The student is able to • predict the likelihood of natural hazards and other geological events based on data and historical patterns **SEP** • obtain, evaluate, and communicate information to synthesize information from multiple appropriate sources and assess the credibility, accuracy, possible bias, and the methods used to explain whether the sources are supported by the evidence

8.E1U3.8

Standard	**Construct and support an argument** about how human consumption of limited resources impacts the biosphere.
SEPs	**Engaging in Argument From Evidence**
CCCs	Patterns; **Cause and Effect;** Scale, Proportion and Quantity; Systems and System Models; **Energy and Matter;** Structure and Function; **Stability and Change**
Assessment Boundaries	Not applicable
Stimulus Materials	Figures, Diagrams, Graphs, Tables

Task Demand	Common Item Formats
Identify limited resources that humans use that disrupt the biosphere. Identify positive and negative impacts of human consumption of limited and unlimited resources. Construct a statement to support a claim that human activities affect the biosphere. Predict the effects of human consumption of limited resources on the biosphere.	• Hot Spot • Inline Choice • Match • Match Table Grid • Multiple Choice • Multiple Select

Performance Level Descriptors

Minimally Proficient	Partially Proficient
The student strives to • identify types of human consumption that impact the biosphere **SEP** • identify arguments on the same topic	The student is able to • differentiate between the consumption of limited and unlimited resources **SEP** • differentiate between two arguments on the same topic
Proficient	**Highly Proficient**
The student is able to • demonstrate how human consumption of limited resources affects the biosphere **SEP** • construct a convincing argument that supports claims • engage in arguments from evidence to compare and critique two arguments and analyze whether they emphasize similar or different evidence	The student is able to • predict effects on the biosphere due to human consumption of limited resources **SEP** • engage in arguments from evidence to construct, evaluate, or revise a convincing argument that refutes claims • engage in arguments from evidence to provide critiques about explanations, procedures, models, and questions by citing relevant evidence

8.L3U1.9

Standard	**Construct an explanation** of how genetic variations occur in offspring through the inheritance of traits or through mutations.
SEPs	**Constructing Explanations and Designing Solutions**
CCCs	Patterns; **Cause and Effect;** Scale, Proportion and Quantity; Systems and System Models; **Energy and Matter;** Structure and Function; **Stability and Change**
Assessment Boundaries	The stress here is on the impact of gene transmission in reproduction, not the mechanism.
Stimulus Materials	Figures, Diagrams, Graphs, Tables

Task Demand	Common Item Formats
Identify inherited traits. Distinguish between beneficial and harmful mutations. Explain how offspring can develop traits that differ from those of their parents. Predict the genetic variations in offspring arising from either inheritance or mutation.	• Hot Spot • Inline Choice • Match Table Grid • Multiple Choice • Multiple Select

Performance Level Descriptors

Minimally Proficient	Partially Proficient
The student strives to • identify traits that can vary from parent to offspring **SEP** • identify evidence that support scientific ideas, principles, and theories • identify models or representations that support an explanation	The student is able to • distinguish genetic variations that occur through inheritance versus from mutation **SEP** • distinguish between explanations and solutions to identify those supported by multiple sources of evidence consistent with scientific ideas • distinguish between explanations and solutions to identify those that include qualitative or quantitative relationships between variables that describe phenomena • distinguish between explanations and solutions to identify those based on valid and reliable evidence
Proficient	**Highly Proficient**
The student is able to • demonstrate how genetic variations occur in offspring through inheritance or through mutation **SEP** • construct explanations and design solutions that include qualitative or quantitative relationships between variables that predict phenomena • construct explanations and design solutions that apply scientific reasoning to show why the data or evidence is adequate for the explanation or conclusion	The student is able to • predict genetic variations that may result from inheritance or mutation **SEP** • construct and evaluate explanations and solutions that apply scientific ideas or principles in testing a design of an object, tool, process, or system • construct and evaluate explanations and solutions that meet specific design criteria and constraints • construct and evaluate explanations and solutions that optimize performance of a design by prioritizing criteria

8.L4U1.11

Standard	**Develop and use a model** to explain how natural selection may lead to increases and decreases of specific traits in populations over time.
SEPs	**Developing and Using Models**
CCCs	Patterns; **Cause and Effect;** Scale, Proportion and Quantity; Systems and System Models; **Energy and Matter;** Structure and Function; **Stability and Change**
Assessment Boundaries	Not applicable
Stimulus Materials	Models, Figures, Diagrams

Task Demand	Common Item Formats
Identify beneficial traits in a population. Predict the impact on a population of organisms resulting from changes in traits. Construct a model demonstrating how smaller populations of an organism can affect trait variability. Evaluate a model that predicts how natural selection will affect trait frequency over time.	• Gap Match • Graphic Gap Match • Hot Spot • Inline Choice • Match Table Grid • Multiple Choice • Multiple Select

Performance Level Descriptors

Minimally Proficient	Partially Proficient
The student strives to • identify the frequency of traits that exist in a population **SEP** • identify models that describe phenomena • identify modifications in models	The student is able to • distinguish traits that increase or decrease in a population over time due to natural selection **SEP** • develop and use models to describe, test, and predict phenomena and design systems • develop and use models to represent evidence • develop and use models to show the relationships among variables
Proficient	**Highly Proficient**
The student is able to • demonstrate how natural selection can alter the frequency of traits in a population over time **SEP** • develop and use models to describe, test, and predict more abstract phenomena and design systems • develop or modify a model—based on evidence—to match what happens if a variable or component of a system is changed • develop and use models to show relationships among variables, including those that are not observable • develop and use models to predict and/or describe phenomena • develop and use models to generate data to test ideas about phenomena in natural or designed systems	The student is able to • evaluate explanations of how natural selection affects trait frequency over time **SEP** • develop, revise, and use models to evaluate or revise a model for a proposed object or tool • develop, revise, and use models to evaluate a model of simple systems with uncertain and less predictable factors • develop, revise, and use models to propose design changes to show the relationships among variables, including those that are not observable • develop, revise, and use models to describe unobservable mechanisms • develop, revise, and use models to generate data to test ideas about phenomena in natural or designed systems, including those representing inputs and outputs, and those at unobservable scales

8.L4U1.12

Standard	**Gather and communicate evidence** on how the process of natural selection provides an explanation of how new species can evolve.
SEPs	**Obtaining, Evaluating, and Communicating Information** **Engaging in Argument From Evidence**
CCCs	Patterns; **Cause and Effect;** Scale, Proportion and Quantity; Systems and System Models; **Energy and Matter;** Structure and Function; **Stability and Change**
Assessment Boundaries	Not applicable
Stimulus Materials	Figures, Diagrams, Graphs, Tables

Task Demand	Common Item Formats
Identify external factors that account for the evolutionary adaptations of an organism. Describe how external pressures can lead to the emergence of a new species within an organism. Examine ideas about how natural selection supports the creation of new species.	• Gap Match • Inline Choice • Match • Match Table Grid • Multiple Choice • Multiple Select

Performance Level Descriptors

Minimally Proficient	Partially Proficient
The student strives to • identify external pressures that can affect the process of natural selection **SEP** • identify the accuracy of ideas and methods • identify arguments on the same topic	The student is able to • describe how external pressures affect the process of natural selection **SEP** • distinguish between the reliability of ideas and methods based on the credibility of sources • differentiate between two arguments on the same topic
Proficient	**Highly Proficient**
The student is able to • show how natural selection provides an explanation of how new species can evolve **SEP** • obtain, evaluate, and communicate information to critically review scientific information to determine the central idea • obtain, evaluate, and communicate information to describe patterns in and/or evidence about the natural and/or designed worlds • obtain, evaluate, and communicate information to evaluate data, hypotheses, and/or conclusions in scientific and technical texts in light of competing information or accounts • obtain, evaluate, and communicate information to communicate scientific and/or technical information • construct a convincing argument that supports claims • engage in arguments from evidence to compare and critique two	The student is able to • evaluate explanations of how natural selection promotes the emergence of new species **SEP** • obtain, evaluate, and communicate information to synthesize information from multiple appropriate sources and assess the credibility, accuracy, possible bias, and the methods used to explain whether the sources are supported by the evidence • engage in arguments from evidence to construct, evaluate, or revise a convincing argument that refutes claims • engage in arguments from evidence to provide critiques about explanations, procedures, models, and questions by citing relevant evidence

arguments and analyze whether they emphasize similar or different evidence	

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