

**Hawai'i State Alternate Assessment
in
Science**

HSA-Alt Assessment Development Documents

Grade Band 3–5 Administered at Grade 4

Grade Band 6–8 Administered at Grade 8

High School (Biology)

Revised for Bridge Assessment

October 2018

TABLE OF CONTENTS

CHANGE LOG	2
MOST SIGNIFICANT CHANGES	2
OVERVIEW	5
FIELD TEST DESCRIPTION	5
OPERATIONAL TEST DESCRIPTION.....	5
COMMUNICATION LEVELS.....	5
GENERAL BLUEPRINTS	6
CONTENT STANDARD BLOCKS BY STRAND	7
ITEM FORMATS.....	8
GRADE BAND 3–5 ITEM SPECIFICATIONS	10
THE SCIENTIFIC PROCESS	10
LIFE AND ENVIRONMENTAL SCIENCES	15
PHYSICAL, EARTH, AND SPACE SCIENCES	21
GRADE BAND 6–8 ITEM SPECIFICATIONS	37
THE SCIENTIFIC PROCESS	37
PHYSICAL, EARTH, AND SPACE SCIENCES	44
HIGH SCHOOL (BIOLOGY) ITEM SPECIFICATIONS	71
THE SCIENTIFIC PROCESS	71
LIFE AND ENVIRONMENTAL SCIENCES	82

CHANGE LOG

Hawai'i State Alternate Science Bridge Assessments (HSA-Alt Science Bridge) are intended to provide all students, regardless of the extent to which a school has moved forward with NGSS implementation, with a fair, valid, and reliable test of their science knowledge and skills. In addition, the Bridge Assessments ensure that the performance of students and schools is not negatively impacted by moving forward with implementation of the NGSS.

The Bridge Assessment will measure only the knowledge and skills found in both HCPS III and NGSS. These assessments will:

- have the same reporting categories and family reports as the current assessments.
- be administered at grades 4 and 8 and 11 (Life Science).
- use items from the current HSA-Alt Science item banks so the look and feel will be like the current assessments.
- only include items addressing HCPS III benchmarks which align with content that also appears in NGSS at grades 4, middle school earth and space science, and high school life science, respectively.
- include NGSS field test items. These items will have no impact on student scores.

HSA-Alt Science Bridge Assessments will be used for SY 2018-2019. The assessments beginning in SY 2019-2020 will be completely NGSS-Based and will be administered in grades 5 and 8 and 11 (Life Science).

MOST SIGNIFICANT CHANGES

➤ Engagement Items will not be included on the HSA-Alt Science Bridge Assessments.

The following content is either not included in the NGSS or is addressed at a higher grade level and ***will not be assessed*** on the HSA-Alt Science Bridge Assessments for SY 2018-2019.

Grade 4 Test:

SC.4.3.1—Explain how simple food chains and food webs can be traced back to plants

All Content Specifications

Including:

SC.5.3.1—Describe the cycle of energy among producers, consumers, and decomposers (All Content Specifications) and

SC.5.3.2—Describe the interdependent relationships among producers, consumers, and decomposers in an ecosystem in terms of the cycles of matter (Content Specification 1: Identify the relationships among producers, consumers, and decomposers.)

- SC.4.3.2**—Describe how an organism’s behavior is determined by its environment.
Content Specification 1: Identify the relationships among producers, consumers, and decomposers.
- SC.4.4.1**—Identify the basic differences between plant cells and animal cells
Content Specification 2: Differentiate between a plant and an animal cell when given a model.
- SC.4.5.2**—Describe the roles of various organisms in the same environment
Content Specification 1: Classify organisms in an ecosystem as producers, consumers, or decomposers.
- SC.4.6.1**—Describe how some materials may be combined to form new substances
All Content Specifications
- SC.4.7.1**—Describe that the mass of the Earth exerts a gravitational force on all objects
Content Specification 1: Explain that the Earth’s gravity pulls all objects toward its center.
- SC.3.7.1**—Compare how simple machines do work to make life easier
All Content Specifications
- SC.4.8.3**—Describe the relationship between the sun and the Earth’s daily rotation and annual revolution.
All Content Specifications
Including:
SC.5.8.1—Describe the relationship (size and distance) of the Earth to other components in the solar system (All Content Specifications)
SC.5.8.3—Explain that the planets orbit the sun and that the moon orbits the Earth (All Content Specifications)
- SC.5.8.3**—Explain that the planets orbit the sun and that the moon orbits the Earth
Content Specification 1: Identify the orbits of the Earth and moon, and Content Specification 2: Identify an orbit.

Grade 8 Test:

Life and Environmental Sciences specifications linked only to grade 7 benchmarks have been removed.

- SC.8.6.2**—Explain how seismic waves provide scientists with information about the structure of the Earth’s interior
All Content Specifications
- SC.8.7.1**—Explain that every object has mass and therefore exerts a gravitational force on other objects
All Content Specifications
- SC.8.8.1**—Compare the characteristics of the three main types of rocks
All Content Specifications
- SC.8.8.8**—Describe the composition of objects in the galaxy
All Content Specifications
- SC.8.8.11**—Describe the major components of the universe
Modification to the content limits

Grade 11 (Life Science) Test:

SC.BS.4.1—Describe different cell parts and their functions
All Content Specifications

SC.BS.5.5—Explain chromosomal mutations, their possible causes, and their effects on genetic variation
All Content Specifications

OVERVIEW

FIELD TEST DESCRIPTION

An operational field test for the Hawai'i State Alternate Assessment (HSA-Alt) in Science was conducted during spring 2013. An independent field test was conducted in spring and fall 2015 to strengthen the item pool in preparation for an online computer adaptive HSA-Alt Science test beginning in spring 2016.

Embedded field testing takes place each year. Items will be field tested in each grade for possible placement on the grade level operational forms. The new field test items will be inserted at the end of each content standard block within a grade level form. These field test items will be administered to all students who take the assessment.

OPERATIONAL TEST DESCRIPTION

The HSA-Alt in Science is aligned with the Hawai'i Content and Performance Standards III (HCPS III). The tests are developed for two grade bands, 3–5 and 6–8, with an emphasis on the content of and administration in grades 4 and 8. The tests are also developed for and administered in high school (Biology). The HSA-Alt in Science is an adaptive test, meaning that items are selected by the testing system based on the student's ability as demonstrated on the previously answered items. During every operational administration, each grade level form contains a pre-defined number of items in each content standard block that is assessed. In addition, a required number of items must be administered in each grade level test.

Students will start the test at the difficulty level that is most appropriate for the student, as determined by an online Student Placement Questionnaire (SPQ) which will be automatically shown to the test administrator in the online Test Delivery System. Only students whose SPQ score is low enough will be administered engagement items.

COMMUNICATION LEVELS

The items written for the HSA-Alt in Science are designed not only to assess the Hawai'i Content and Performance Standards III (HCPS III) but also to address three communication levels. These communication levels refer to the communication method that students use. Items written to the pre-symbolic level are intended for nonverbal students who communicate mainly with gestures and eye gaze. Items written to the symbolic level are intended for students who speak or have a vocabulary of signs or use pictures to communicate. Items written to the abstract level are intended for students who speak, read, write, and understand sentences.

GENERAL BLUEPRINTS

Items in each grade level test in the HSA-Alt in Science are grouped by content standard block. Items from a content standard block will be administered consecutively. The number of content standard blocks is different for each grade level test, as is the required number of items to be administered in each grade level standard.

The table below specifies the number of operational items that students in each grade must be administered. During the assessment, it is required that the student be administered the embedded field test items which appear at the end of each content block within a grade level form.

HSA-Alt in Science	
Grade	Required Number of Operational Items
4	36
8	40
High School	40

CONTENT STANDARD BLOCKS BY STRAND

The HSA-Alt in Science is currently aligned to the Hawai'i Content and Performance Standards (HCPS III) for Science or Biological Sciences. The breakdown of the HCPS III strands is as follows: For the grade 4 assessment, The Scientific Process, Life and Environmental Sciences, and Physical, Earth, and Space Sciences will be assessed in separate content standard blocks. For the grade 8 assessment, The Scientific Process, Life and Environmental Sciences, and Physical, Earth, and Space Sciences will be assessed in separate content blocks. For the high school Biology assessment, The Scientific Process, Organisms and the Environment, Structure and Function in Organisms, and Diversity, Genetics, and Evolution will be assessed in separate content standard blocks. All students entering the assessment must encounter items focused on each of the assessed strands per the blueprint.

HSA-Alt in Science Blueprint: Operational Content Standard Blocks by HCPS III Strand			
	Grade 4	Grade 8	High School
Strand	The Scientific Process	The Scientific Process	The Scientific Process
	Life and Environmental Sciences	Life and Environmental Sciences	Organisms and the Environment
	Physical, Earth, and Space Sciences	Physical, Earth, and Space Sciences	Structure and Function in Organisms
			Diversity, Genetics, and Evolution

ITEM FORMATS

There are two types of items in the HSA-Alt in Science: two-option multiple-choice items, and three-option multiple-choice items.

Two-Option Multiple-Choice Items

Two-option multiple-choice items are given a score of 1 point if the student answers the item successfully.

 We're going to talk about birds. Show me, what do all birds have?

feather


fur

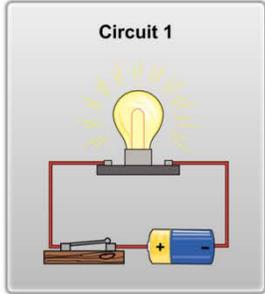

 

Three-Option Multiple-Choice Items

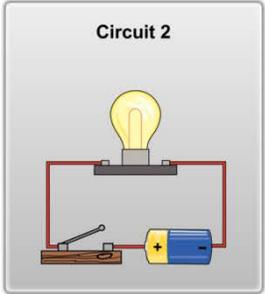
Three-option multiple-choice items are given a score of 1 point if the student answers the item successfully.

 Here are three circuits. Show me, which circuit is closed?

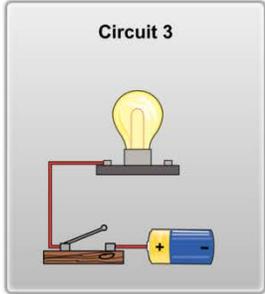
Circuit 1



Circuit 2



Circuit 3



GRADE BAND 3–5 ITEM SPECIFICATIONS

THE SCIENTIFIC PROCESS

Standard 1: SCIENTIFIC INVESTIGATION: Discover, invent, and investigate using the skills necessary to engage in the scientific process		
Topic: Scientific Inquiry	Topic: Scientific Inquiry	Topic: Scientific Inquiry
SC.5.1.1 —Identify the variables in scientific investigations and recognize the importance of controlling variables in scientific experiments	SC.4.1.1 —Describe a testable hypothesis and an experimental procedure	SC.3.1.1 —Pose a question and develop a hypothesis based on observations

Essence: *An experiment has a testable hypothesis and a procedure.*

Content Specification 1: Answer questions about variables in an experiment. (Students are not expected to know the term “variable.”)

Content Specification 2: Follow a plan to test a hypothesis.

Content Specification 3: Relate/match a plan to an outcome.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- The content and context of these items must be drawn from and aligned to the content standards and benchmarks contained within this document or the content standards and benchmarks of lower grade levels that represent the knowledge that is foundational to the standards and benchmarks included in this document.
- Recognition of correct investigative or experimental procedures should be apparent.
- The identification and/or description of variables in a given investigation can be included.
- Explanations of the importance of keeping conditions the same in an experiment can be included.
- Descriptions can be included of how comparisons between the results of experiments may not be fair when some conditions are not kept the same between experiments.
- Steps of the scientific method can be included.
- Although the concepts may be assessed, the terms “control group,” “controlled experiment,” “independent variable,” and “dependent variable” are above content limits.

Sample Item Stems

Content Specification 1:

Show me, to test the hypothesis, how much water should the student give the plant each day?

Content Specification 2:

Show me, what happened in this experiment?

Content Specification 3:

Say: ***We're going to read a science procedure. Let's read the steps of the procedure.***

GRADE BAND 3–5 ITEM SPECIFICATIONS

THE SCIENTIFIC PROCESS

Standard 1: SCIENTIFIC INVESTIGATION: Discover, invent, and investigate using the skills necessary to engage in the scientific process		
Topic: Scientific Inquiry	Topic: Scientific Knowledge	Topic: Scientific Inquiry
SC.5.1.2 —Formulate and defend conclusions based on evidence	SC.4.1.2 —Differentiate between an observation and an inference	SC.3.1.2 —Safely collect and analyze data to answer a question

Essence: *Answers to scientific questions are data-based observations/inferences.*

Content Specification 1: Observe a natural phenomenon or data and make a conclusion.

Content Specification 2: Classify observations and inferences of natural phenomena.

Content Specification 3: Utilize the five senses to make observations and explore the “natural” environment.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- The content and context of these items must be drawn from and aligned to the content standards and benchmarks contained within this document or the content standards and benchmarks of lower grade levels that represent the knowledge that is foundational to the standards and benchmarks included in this document.
- Items should make apparent the differences between making an observation and making an inference.

Sample Item Stems

Content Specification 1:

Show me, based on the experiment, what would make this type of plant grow taller?

Content Specification 2:

Show me, what did the student observe during the experiment?

Content Specification 3:

Say: ***Let’s look at and touch the plant. What do you see? How does it feel?***

GRADE BAND 3–5 ITEM SPECIFICATIONS

THE SCIENTIFIC PROCESS

Standard 2: NATURE OF SCIENCE: Understand that science, technology, and society are interrelated		
Topic: Unifying Concepts and Themes	Topic: Science, Technology, and Society	Topic: Science, Technology, and Society
SC.5.2.1 —Use models and/or simulations to represent and investigate features of objects, events, and processes in the real world	SC.4.2.1 —Describe how the use of technology has influenced the economy, demography, and environment of Hawai'i	SC.3.2.1 —Describe ways technologies in fields such as agriculture, information, manufacturing, or communication have influenced society

Essence: Technology influences society.

Content Specification 1: Utilize a model to describe the effect of a real-world phenomenon.

Content Specification 2: Identify how a technology affects the economy, demography, and/or environment.

Content Specification 3: Identify different technologies (for example, solar, wind, hydroelectric) that influence the economy, demography, and/or environment.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- The content and context of these items must be drawn from and aligned to the content standards and benchmarks contained within this document or the content standards and benchmarks of lower grade levels that represent the knowledge that is foundational to the standards and benchmarks included in this document.
- Descriptions of how a specific technology (e.g., farming, manufacturing, or communication) has influenced the economy, demography, and environment of Hawai'i and descriptions of plans to improve the conditions in the natural environment can be included.
- Positive and negative aspects of how technology affects the environment and human life can be included.
- The effects of exhausting non-renewable resources can be included.
- Suggestions of appropriate technology include but are not limited to: specific examples of aquaculture, solar energy, wind farms, and hydroelectric power.
- Do not assess wind farms or wind energy as an acceptable form of alternative energy.
- Many teachers in Hawai'i argue that wind farms take away from the beauty of the land and kill endangered species of birds. They have indicated that items that referenced wind farms would bring up sensitivity issues with many students.

Sample Item Stems

Content Specification 1:

Show me, how do solar panels affect the environment?

Content Specification 2:

Show me, what does using solar panels conserve?

Content Specification 3:

Show me, which type of technology uses energy from the sun?

GRADE BAND 3–5 ITEM SPECIFICATIONS

LIFE AND ENVIRONMENTAL SCIENCES

Standard 3: ORGANISMS AND THE NEW ENVIRONMENT: Understand the unity, diversity, and interrelationships of organisms, including their relationship to cycles of matter and energy in the environment		
Topic: Cycles of Matter and Energy	Topic: Cycles of Matter and Energy	
SC.5.3.1—Describe the cycle of energy among producers, consumers, and decomposers	SC.4.3.1—Explain how simple food chains and food webs can be traced back to plants	

Essence: ~~Energy flows through a food chain.~~

~~**Content Specification 1:** Given a set of organisms, diagram a simple food chain or food web.~~

~~**Content Specification 2:** Identify the producers or consumers in a food chain or food web.~~

~~**Content Specification 3:** Identify an organism in a food chain.~~

GRADE BAND 3–5 ITEM SPECIFICATIONS

LIFE AND ENVIRONMENTAL SCIENCES

Standard 3: ORGANISMS AND THE NEW ENVIRONMENT: Understand the unity, diversity, and interrelationships of organisms, including their relationship to cycles of matter and energy in the environment		
Topic: Interdependence	Topic: Interdependence	Topic: Interdependence
SC.5.3.2—Describe the interdependent relationships among producers, consumers, and decomposers in an ecosystem in terms of the cycles of matter	SC.4.3.2— Describe how an organism’s behavior is determined by its environment	SC.3.3.1— Describe how plants depend on animals

Essence: Producers and consumers depend upon each other for their survival (e.g., carbon dioxide/oxygen exchange, pollination, animals eating plants).

~~Content Specification 1:~~ Identify the relationships among producers, consumers, and decomposers.

Content Specification 2: Identify behaviors of organisms that help them survive.

Content Specification 3: Identify how plants need animals.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Examples of appropriate animal behaviors include, but are not limited to, courting, nesting, and feeding patterns.
- Items that require students to explain and/or provide examples of how different organisms’ behaviors are determined by their environments may be included.

Sample Item Stems

~~Content Specification 1:~~

~~Show me, what would happen to the predators if there were fewer prey?~~

Content Specification 2:

Show me, what will a bird do if it sees a predator?

Content Specification 3:

Show me, which organism pollinates plants?

GRADE BAND 3–5 ITEM SPECIFICATIONS

LIFE AND ENVIRONMENTAL SCIENCES

Standard 4: STRUCTURE AND FUNCTION IN ORGANISMS: Understand the structures and functions of living organisms and how organisms can be compared scientifically		
Topic: Cells, Tissues, Organs, and Organ Systems	Topic: Cells, Tissues, Organs, and Organ Systems	Topic: Cells, Tissues, Organs, and Organ Systems
SC.5.4.1 —Describe the structures of the human body and how they work together to sustain life	SC.4.4.1—Identify the basic differences between plant cells and animal cells	SC.3.4.1 —Compare distinct structures of living things that help them to survive

Essence: Structures of organisms work together to sustain life.

Content Specification 1: Identify structures of the human body.

~~**Content Specification 2:** Differentiate between a plant and an animal cell when given a model.~~

Content Specification 3: Identify structures of living things that help them survive.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- ~~Basic differences between plant and animal cells should be limited to the shape of the different cells and the presence/absence of a cell wall and chloroplasts.~~
- ~~Groupings of illustrations of cells based upon structural differences can be included. Students can be asked to justify such groupings.~~
- Do not assess functional differences that result from structural differences.

Sample Item Stems

Content Specification 1:

Show me, which organ pumps blood through the body?

~~Content Specification 2:~~

~~Show me, what type of cell is this?~~

Content Specification 3:

Say: *Here are photographs of birds. They all have wings that they use to fly away from predators.*

GRADE BAND 3–5 ITEM SPECIFICATIONS

LIFE AND ENVIRONMENTAL SCIENCES

Standard 5: DIVERSITY, GENETICS, AND EVOLUTION: Understand genetics and biological evolution and their impact on the unity and diversity of organisms		
Topic: Heredity	Topic: Biological Evolution	
SC.5.5.1 —Recognize that some traits of living things are inherited and others are learned	SC.4.5.1 —Compare fossils and living things	

Essence: *Traits may change over time.*

Content Specification 1: Identify inherited traits of an organism.

Content Specification 2: Compare fossil evidence with living organisms.

Content Specification 3: Identify a fossil.

Acceptable Item Types

- Engagement items
- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Students can be asked to identify similarities and differences between fossils and living organisms.
- Use of fossils as evidence (structural similarity) to explain that extinct organisms may be similar to organisms living today can be included.
- The fact that fossils provide evidence about plants and animals that lived long ago and the nature of the organisms' environment at that time can be included.

Sample Item Stems

Content Specification 1:

Show me, which trait did the offspring inherit from its parent?

Content Specification 2:

Show me, what do the extinct animal and this animal have in common?

Content Specification 3:

Show me, which picture shows a fossil?

GRADE BAND 3–5 ITEM SPECIFICATIONS

LIFE AND ENVIRONMENTAL SCIENCES

Standard 5: DIVERSITY, GENETICS, AND EVOLUTION: Understand genetics and biological evolution and their impact on the unity and diversity of organisms		
	Topic: Unity and Diversity	Topic: Unity and Diversity
	SC.4.5.2—Describe the roles of various organisms in the same environment	SC.3.5.1 —Describe the relationship between structure and function in organisms

Essence: Structures are related to functions in organisms (e.g., meat-eating animals have teeth) and their roles in their environment.

~~Content Specification 1: Classify organisms in an ecosystem as producers, consumers, or decomposers.~~

Content Specification 2: Identify the function of a particular structure of an organism.

Content Specification 3: Observe structures of an organism.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- ~~The terms “decomposers,” “producers,” and “consumers” may be used.~~
- ~~Predator-prey relationships may be included.~~
- Symbiosis is not grade level appropriate.
- Competition is not grade level appropriate.

Sample Item Stems

~~Content Specification 1:~~

~~Show me, why are plants producers?~~

~~Content Specification 2:~~

~~Show me, which organism consumes other organisms?~~

Content Specification 3:

Say: **Let’s look at each part of this plant. Each part plays an important role in the plant’s survival.**

GRADE BAND 3–5 ITEM SPECIFICATIONS

LIFE AND ENVIRONMENTAL SCIENCES

Standard 5: DIVERSITY, GENETICS, AND EVOLUTION: Understand genetics and biological evolution and their impact on the unity and diversity of organisms		
	Topic: Unity and Diversity	
	SC.4.5.3 —Describe how different organisms need specific environmental conditions to survive	

Essence: *Organisms require specific environmental conditions to survive.*

Content Specification 1: Describe the environmental conditions in which an organism survives (e.g., plants need sunlight, pollution harms animal habitats).

Content Specification 2: Identify basic needs of organisms (e.g., plants need water, animals need food, etc.).

Content Specification 3: Identify an organism.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Illustrations and explanations of how specific environmental conditions support the survival of specific organisms may be included.
- Organisms that are endemic to specific areas may be included.
- “Moss” should be used as a substitute for “lichen.”

Sample Item Stems

Content Specification 1:

Show me, where would this animal survive?

Content Specification 2:

Show me, what do plants need to live?

Content Specification 3:

Show me, which picture shows is a living thing?

GRADE BAND 3–5 ITEM SPECIFICATIONS

PHYSICAL, EARTH, AND SPACE SCIENCES

Standard 6: NATURE OF MATTER AND ENERGY: Understand the nature of matter and energy, forms of energy (including waves) and energy transformations, and their significance in understanding the structure of the universe

	Topic: Nature of Matter	
	SC.4.6.1—Describe how some materials may be combined to form new substances	

Essence: *Some materials combine chemically to form new substances.*

~~**Content Specification 1:** Predict what new substance will be created via chemical reaction from mixing specific materials.~~

~~**Content Specification 2:** Given two different materials, create a new substance via chemical reaction (e.g., mix baking soda and vinegar to create a gas).~~

~~**Content Specification 3:** Observe what happens when materials are mixed together.~~

GRADE BAND 3–5 ITEM SPECIFICATIONS

PHYSICAL, EARTH, AND SPACE SCIENCES

Standard 6: NATURE OF MATTER AND ENERGY: Understand the nature of matter and energy, forms of energy (including waves) and energy transformations, and their significance in understanding the structure of the universe		
Topic: Energy and Its Transformation	Topic: Energy and Its Transformation	
SC.5.6.1 —Identify different forms of energy (e.g., thermal, electrical, nuclear, light, sound) and how they can change and transfer energy from one form to another	SC.4.6.2 —Explain what is needed for electricity to flow in a circuit to create light and sound	

Essence: *Energy can transfer from one form to another.*

Content Specification 1: Identify different forms of energy (e.g., electrical, light, sound), and identify the transfer of energy from one form to another (e.g., the transfer of electrical energy to light).

Content Specification 2: Identify what is needed to close a circuit.

Content Specification 3: Observe the transfer of energy (e.g., electrical energy in a battery converted to light in an electrical circuit).

Acceptable Item Types

- Engagement items
- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Items that require students to explain and/or construct open and closed circuits (using batteries, bulbs, buzzers, and wires) may be included.
- Do not assess technology, for example, conductors.

Sample Item Stems

Content Specification 1:

Show me, which type of energy is produced by the light bulb?

Content Specification 2:

Show me, which part of the circuit do we use to connect the light bulb and battery?

Content Specification 3:

Say: ***Here is a circuit. Let's watch what happens to the light bulb when we use a switch to close the circuit.***

GRADE BAND 3–5 ITEM SPECIFICATIONS

PHYSICAL, EARTH, AND SPACE SCIENCES

Standard 6: NATURE OF MATTER AND ENERGY: Understand the nature of matter and energy, forms of energy (including waves) and energy transformations, and their significance in understanding the structure of the universe		
Topic: Energy and Its Transformation		Topic: Energy and Its Transformation
SC.5.6.2 —Describe ways that heat can be transferred from one object to another		SC.3.6.1 —Define energy and explain that the sun produces energy in the form of light and heat

Essence: Energy is the ability to do work and energy can be transferred from one object to another.

Content Specification 1: Describe the effect of the transfer of energy from one object to another (e.g., an ice cube placed in room temperature water).

Content Specification 2: Describe the effect of sun energy (e.g., appearance and temperature of an object placed in sunlight and shade).

Content Specification 3: Identify the source of heat or light.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Do not assess energy transformations.
- Limit types of energy to heat and light.

Sample Item Stems

Content Specification 1:

Show me, what will happen to an ice cube that is placed into hot water?

Content Specification 2:

Show me, how will sunlight affect the melting of an ice cube?

Content Specification 3:

Say: ***Let’s look out the window. The sunlight outdoors provides both light and heat for the environment.***

GRADE BAND 3–5 ITEM SPECIFICATIONS

PHYSICAL, EARTH, AND SPACE SCIENCES

Standard 6: NATURE OF MATTER AND ENERGY: Understand the nature of matter and energy, forms of energy (including waves) and energy transformations, and their significance in understanding the structure of the universe		
		Topic: Waves
		SC.3.6.2 —Explain how things make sound through vibrations

Essence: *Sound is produced from an object that vibrates.*

Content Specification 1: Describe the effect of an object that vibrates (e.g., a plucked guitar string produces sound).

Content Specification 2: Match a vibrating object with the sound produced (e.g., the vibrating string on a guitar produces sound).

Content Specification 3: Identify the source of sound energy.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Sound waves are not grade level appropriate.

Sample Item Stems

Content Specification 1:

Show me, what is produced by a vibrating object?

Content Specification 2:

Show me, which object will make a sound with the highest pitch?

Content Specification 3:

Say: ***Here is a radio. Let's turn on the radio and place our hands over the speaker. Feel the vibrations from the sound coming from the speaker.***

GRADE BAND 3–5 ITEM SPECIFICATIONS

PHYSICAL, EARTH, AND SPACE SCIENCES

Standard 6: NATURE OF MATTER AND ENERGY: Understand the nature of matter and energy, forms of energy (including waves) and energy transformations, and their significance in understanding the structure of the universe		
Topic: Waves		Topic: Waves
SC.5.6.3 —Compare what happens to light when it is reflected, refracted, and absorbed		SC.3.6.3 —Explain how light traveling in a straight line changes when it reaches an object

Essence: *Light can be reflected, refracted, or absorbed by an object.*

Content Specification 1: Identify reflection and refraction.

Content Specification 2: Explain that light is necessary for an object to be seen.

Content Specification 3: Distinguish between light and darkness.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- The cause of refraction is not grade level appropriate.

Sample Item Stems

Content Specification 1:

Show me, which image shows a reflection of the object?

Content Specification 2:

Show me, in what condition would we be able to see the object?

Content Specification 3:

Say: ***Let's turn off (down) the lights. Notice that when we turn off (down) the lights, it is more difficult to see things.***

GRADE BAND 3–5 ITEM SPECIFICATIONS

PHYSICAL, EARTH, AND SPACE SCIENCES

Standard 7: FORCE AND MOTION: Understand the relationship between force, mass, and motion of objects and know the major natural forces: gravitational, electric, and magnetic		
Topic: Forces of the Universe		
SC.5.7.1 —Explain how electrically charged materials can push or pull other charged materials		

Essence: *Electrically charged materials can repel or attract other materials.*

Content Specification 1: Describe the characteristics of an electrically charged object (e.g., a balloon with an electric charge attracts small pieces of paper).

Content Specification 2: Distinguish between the concepts of repel and attract.

Content Specification 3: Observe the characteristics of an electrically charged object.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Students are not expected to know the causes of static electricity or charged materials.

Sample Item Stems

Content Specification 1:

Show me, which object will make sparks?

Content Specification 2:

Show me, how does a repelled object move?

Content Specification 3:

Say: ***This balloon has static electricity. Watch what happens when I bring it close to my hair.***

GRADE BAND 3–5 ITEM SPECIFICATIONS

PHYSICAL, EARTH, AND SPACE SCIENCES

Standard 7: FORCE AND MOTION: Understand the relationship between force, mass, and motion of objects; and know the major natural forces: gravitational, electric, and magnetic		
	Topic: Forces of the Universe	
	SC.4.7.1 —Describe that the mass of the Earth exerts a gravitational force on all objects	

Essence: Gravity causes objects to fall toward the center of mass of the Earth.

~~**Content Specification 1:** Explain that the Earth’s gravity pulls all objects toward its center.~~

Content Specification 2: Identify gravity as the force that makes something fall toward the ground.

Content Specification 3: Recognize that objects fall to the ground when dropped.

Acceptable Item Types

- Engagement items
- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- The relationship between the masses of two objects and the strength of the gravitational force between them is outside of content limits.

Sample Item Stems

Content Specification 1:

Show me, in which direction does gravity pull all objects on Earth?

Content Specification 2:

Show me, which force makes objects fall onto the ground?

Content Specification 3:

Say: ***Let’s observe this ball falling to the ground. It is the force of gravity that pulls the ball to the ground.***

GRADE BAND 3–5 ITEM SPECIFICATIONS

PHYSICAL, EARTH, AND SPACE SCIENCES

Standard 7: FORCE AND MOTION: Understand the relationship between force, mass, and motion of objects and know the major natural forces: gravitational, electric, and magnetic		
		Topic: Forces and Motion
		SC.3.7.1—Compare how simple machines do work to make life easier

Essence: Simple machines change the direction or magnitude of a force.

~~Content Specification 1:~~ Identify that a simple machine provides a mechanical advantage.

~~Content Specification 2:~~ Identify a simple machine (for example, wheelbarrow, ramp, lever, etc.).

~~Content Specification 3:~~ Observe the mechanical advantage gained by the use of a simple machine (e.g., a lever used to lift a heavy object).

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Limit simple machines to wedges, inclined planes, levers, pulleys, screws, and wheel and axle.

Sample Item Stems

Content Specification 1:

Show me, what could we use to lift the load higher?

Content Specification 2:

Show me, what is an example of a lever?

Content Specification 3:

Say: **Look at the seesaw. The seesaw is a lever. The students on either side are able to lift each other off the ground.**

GRADE BAND 3–5 ITEM SPECIFICATIONS

PHYSICAL, EARTH, AND SPACE SCIENCES

Standard 8: EARTH AND SPACE SCIENCE: Understand the Earth and its processes, the solar system, and the universe and its contents		
	Topic: Forces that Shape the Earth	
	SC.4.8.1 —Describe how slow processes sometimes shape and reshape the surface of the Earth	

Essence: *Slow processes sometimes shape/reshape the surface of the Earth.*

Content Specification 1: Explain how slow processes (deposition, erosion, weathering, mountain-building) reshape land over time.

Content Specification 2: Recognize how waves, wind, water, and/or ice reshape the land.

Content Specification 3: Identify the processes that reshape land over time.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Agents of slow processes such as waves, wind, and water can be included.
- Descriptions of evidence of changes on Earth’s surface can be included.
- Differences between weathering and erosion can be included.
- Weathering should be limited to physical weathering.
- Volcanic formation of the Hawaiian Islands may be included.
- Do not assess the freezing and thawing of ice as a weathering agent.

Sample Item Stems

Content Specification 1:

Show me, how does weathering change the shape of a mountain?

Content Specification 2:

Show me, what caused the side of the mountain to become smoother?

Content Specification 3:

Say: ***Here is a picture of a river from 50 years ago. Here is a picture of the river today. See how the river has become wider from the water washing away the sediments along the sides.***

GRADE BAND 3–5 ITEM SPECIFICATIONS

PHYSICAL, EARTH, AND SPACE SCIENCES

Standard 8: EARTH AND SPACE SCIENCE: Understand the Earth and its processes, the solar system, and the universe and its contents		
		Topic: Forces that Shape the Earth
		SC.3.8.2 —Describe how the water cycle is related to weather and climate

Essence: *The water cycle relates to weather and climate.*

Content Specification 1: Identify the relationship between the water cycle and weather.

Content Specification 2: Identify a process of the water cycle (e.g., precipitation, evaporation, condensation).

Content Specification 3: Observe a water cycle process (e.g., precipitation, evaporation, condensation).

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Do not assess the types of clouds.
- Do not assess the effects of weather fronts.

Sample Item Stems

Content Specification 1:

Show me, what causes cloud formations?

Content Specification 2:

Show me, which part of the water cycle can make a pond?

Content Specification 3:

Say: ***Watch how the forecast calls for rain. This happens after the clouds have formed.***

GRADE BAND 3–5 ITEM SPECIFICATIONS

PHYSICAL, EARTH, AND SPACE SCIENCES

Standard 8: EARTH AND SPACE SCIENCE: Understand the Earth and its processes, the solar system, and the universe and its contents		
	Topic: Forces that Shape the Earth	
	SC.4.8.2 —Describe how fast processes (e.g., volcanoes, earthquakes) sometimes shape and reshape the surface of the Earth	

Essence: *Fast processes sometimes shape/reshape the surface of the Earth.*

Content Specification 1: Describe how fast processes shape and reshape the surface of the Earth.

Content Specification 2: Identify how fast processes (e.g., volcanic eruptions, earthquakes, floods) shape and reshape the surface of the Earth.

Content Specification 3: Identify fast processes that shape and reshape the surface of the Earth.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Agents of rapid geologic changes such as earthquakes and landslides can be included.
- Descriptions of evidence of changes on Earth’s surface can be included.
- Identification of volcano types can be included.
- Identification of earthquakes and landslides as examples of agents of rapid geologic change may be included.
- Do not assess volcanoes and floods as agents of rapid geologic change.
- Do not assess use of the word “conduit.”

Sample Item Stems

Content Specification 1:

Show me, how did an earthquake change this landscape?

Content Specification 2:

Show me, what is an effect of a landslide?

Content Specification 3:

Show me, what can quickly change the surface of Earth?

GRADE BAND 3–5 ITEM SPECIFICATIONS

PHYSICAL, EARTH, AND SPACE SCIENCES

Standard 8: EARTH AND SPACE SCIENCE: Understand the Earth and its processes, the solar system, and the universe and its contents		
Topic: Earth in the Solar System		
SC.5.8.1—Describe the relationship (size and distance) of the Earth to other components in the solar system		

***Essence:** The relationship of the Earth to other components of the solar system can be compared and contrasted to gain perspective.*

~~**Content Specification 1:** Describe components of the solar system (e.g., relative sizes of the Earth, moon, and sun, shapes of celestial bodies).~~

~~**Content Specification 2:** Identify components of the solar system.~~

~~**Content Specification 3:** Observe a model of components of the solar system.~~

GRADE BAND 3–5 ITEM SPECIFICATIONS

PHYSICAL, EARTH, AND SPACE SCIENCES

Standard 8: EARTH AND SPACE SCIENCE: Understand the Earth and its processes, the solar system, and the universe and its contents		
Topic: Earth in the Solar System		
SC.5.8.2 —Describe examples of what astronomers have discovered using telescopes		

Essence: *Information about the universe can be obtained using telescopes.*

Content Specification 1: Identify what is observed through a telescope.

Content Specification 2: Identify the telescope as a tool used to observe the night sky.

Content Specification 3: Identify a telescope.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Items may require the student to compare images taken from a telescope.

Sample Item Stems

Content Specification 1:

Show me, what is a telescope used for?

Content Specification 2:

Show me, which tool can be used to view the moon?

Content Specification 3:

Say: ***Here is an image as seen through a telescope. Notice that the moon appears a lot closer than we can see it.***

GRADE BAND 3–5 ITEM SPECIFICATIONS

PHYSICAL, EARTH, AND SPACE SCIENCES

Standard 8: EARTH AND SPACE SCIENCE: Understand the Earth and its processes, the solar system, and the universe and its contents		
Topic: Earth in the Solar System		Topic: The Universe
SC.5.8.3—Explain that the planets orbit the sun and that the moon orbits the Earth		SC.3.8.3 —Safely observe and describe the basic movements of the sun and moon

Essence: The moon orbits the Earth and the Earth orbits the sun.

~~Content Specification 1:~~ Identify the orbits of the Earth and moon.

~~Content Specification 2:~~ Identify an orbit.

Content Specification 3: Identify the path (from east to west) of the sun and moon across the sky.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Do not include the moons of other planets.

Sample Item Stems

~~Content Specification 1:~~

~~Show me, what does the moon orbit?~~

~~Content Specification 2:~~

~~Show me, which part of the diagram shows an orbit?~~

Content Specification 3:

Say: *Here is a model of the solar system. Let's trace the orbit of Earth around the sun.*

GRADE BAND 3–5 ITEM SPECIFICATIONS

PHYSICAL, EARTH, AND SPACE SCIENCES

Standard 8: EARTH AND SPACE SCIENCE: Understand the Earth and its processes, the solar system, and the universe and its contents		
Topic: Earth in the Solar System	Topic: Earth in the Solar System	Topic: The Universe
SC.5.8.4—Demonstrate that day and night are caused by the rotation of the Earth on its axis	SC.4.8.3—Describe the relationship between the sun and the Earth’s daily rotation and annual revolution	SC.3.8.4—Describe that constellations stay the same, though they appear to move across the night sky

Essence: The Earth’s rotation causes day (the Earth exposed to sunlight) and night; the Earth rotates in one day; the Earth revolves around the sun in one year.

~~Content Specification 1:~~ Identify that the daily rotation of the Earth causes day and night.

~~Content Specification 2:~~ Identify that the Earth rotates on its axis and revolves around the sun.

~~Content Specification 3:~~ Observe or participate in a rotating model of the Earth.

GRADE BAND 3–5 ITEM SPECIFICATIONS

PHYSICAL, EARTH, AND SPACE SCIENCES

Standard 8: EARTH AND SPACE SCIENCE: Understand the Earth and its processes, the solar system, and the universe and its contents		
		Topic: Earth Materials
		SC.3.8.1 —Describe different Earth materials (e.g., rocks, minerals, sand, soil) and explain their formation and composition

Essence: The Earth is composed of rocks, minerals, sand, soil, etc.

Content Specification 1: Describe Earth materials (e.g., rocks, minerals, soil, etc.) by size, shape, color, etc.

Content Specification 2: Identify Earth minerals (e.g., rocks, minerals, soil, etc.).

Content Specification 3: Observe Earth materials.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Do not assess types of minerals or rocks.
- Items may require the student to compare physical characteristics of rocks, minerals, and soil.

Sample Item Stems

Content Specification 1:

Show me, which material found in the soil is the largest?

Content Specification 2:

Show me, which material is made from all of these materials?

Content Specification 3:

Say: *Let’s look at some of the materials found in soil. Soil can contain sand, fine dirt, rocks, and even dead leaves.*

GRADE BAND 6–8 ITEM SPECIFICATIONS

THE SCIENTIFIC PROCESS

Standard 1: SCIENTIFIC INVESTIGATION: Discover, invent, and investigate using the skills necessary to engage in the scientific process		
Topic: Scientific Inquiry	Topic: Scientific Inquiry	Topic: Scientific Inquiry
SC.8.1.1 —Determine the link(s) between evidence and the conclusion(s) of an investigation	SC.7.1.1 —Design and safely conduct a scientific investigation to answer a question or test a hypothesis	SC.6.1.1 —Formulate a testable hypothesis that can be answered through a controlled experiment

Essence: *The conclusion of a scientific investigation is connected to the evidence collected.*

Content Specification 1: Link evidence from a scientific investigation to a conclusion.

Content Specification 2: Identify the variables in an experiment.

Content Specification 3: Participate in an experiment by testing a hypothesis.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- The content and context of these items must be drawn from and aligned to the content standards and benchmarks contained in this document or the content standards and benchmarks of a lower level that represent the knowledge that is foundational to the standards and benchmarks included in this document.
- Items may require students to draw conclusions based on data from scientific investigations.
- Students may be asked to determine which data or evidence supports the conclusions provided.

Sample Item Stems

Content Specification 1:

Show me, what is our conclusion from this experiment?

Content Specification 2:

Show me, what did the student change in the experiment?

Content Specification 3:

Say: ***Let's follow this procedure to test the effect of gravity on an object.***

GRADE BAND 6–8 ITEM SPECIFICATIONS

THE SCIENTIFIC PROCESS

Standard 1: SCIENTIFIC INVESTIGATION: Discover, invent, and investigate using the skills necessary to engage in the scientific process		
Topic: Scientific Inquiry	Topic: Scientific Inquiry	Topic: Scientific Inquiry
SC.8.1.2 —Communicate the significant components of the experimental design and results of a scientific investigation	SC.7.1.2 —Explain the importance of replicable trials	SC.6.1.2 —Use appropriate tools, equipment, and techniques safely to collect, display, and analyze data

Essence: *The results of a scientific investigation are dependent upon its experimental design.*

Content Specification 1: Identify the significant components of the experimental design.

Content Specification 2: Identify repeated trials.

Content Specification 3: Identify the tools used to collect data in a scientific investigation.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- The content and context of these items must be drawn from and aligned to the content standards and benchmarks contained in this document or the content standards and benchmarks of a lower level that represent the knowledge that is foundational to the standards and benchmarks included in this document.
- Examples of acceptable components to assess include, but are not limited to, how to correctly display and analyze data, how to revise a hypothesis to make it testable, identifying independent and dependent variables and control groups, methods of data collection, understanding the significant components of a procedure, and how to improve an experimental design.
- Items should focus on revising the investigation at hand; items should not go on to developing a new investigation.

Sample Item Stems

Content Specification 1:

Show me, what did the student keep the same throughout her experiment?

Content Specification 2:

Show me, how many times did the student repeat the experiment?

Content Specification 3:

Say: ***A student's hypothesis stated that water drains through rocks faster than sand. Let's look at the setup the student made to test this hypothesis.***

GRADE BAND 6–8 ITEM SPECIFICATIONS

THE SCIENTIFIC PROCESS

Standard 1: SCIENTIFIC INVESTIGATION: Discover, invent, and investigate using the skills necessary to engage in the scientific process		
	Topic: Scientific Knowledge	
	SC.7.1.3 —Explain the need to revise conclusions and explanations based on new scientific evidence	

Essence: *New scientific evidence may require that a scientific investigation be revised.*

Content Specification 1: Identify the need to revise a conclusion.

Content Specification 2: Identify inconsistent information.

Content Specification 3: Identify outcomes of an investigation.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- The content and context of these items must be drawn from and aligned to the content standards and benchmarks contained in this document or the content standards and benchmarks of a lower level that represent the knowledge that is foundational to the standards and benchmarks included in this document.

Sample Item Stems

Content Specification 1:

Show me, what did the student do wrong during her experiment?

Content Specification 2:

Show me, which variable should the student have kept the same?

Content Specification 3:

Say: ***Let's read the results of this investigation.***

GRADE BAND 6–8 ITEM SPECIFICATIONS

THE SCIENTIFIC PROCESS

Standard 2: NATURE OF SCIENCE: Understand that science, technology, and society are interrelated		
Topic: Science, Technology, and Society	Topic: Science, Technology, and Society	Topic: Science, Technology, and Society
SC.8.2.1 —Describe significant relationships among society, science, and technology and how one impacts the other	SC.7.2.1 —Explain the use of reliable print and electronic sources to provide scientific information and evidence	SC.6.2.1 —Explain how technology has an impact on society and science

Essence: Significant relationships exist between science, technology, and society.

Content Specification 1: Identify scientific/technological advances that have impacted society.

Content Specification 2: Identify sources of scientific information.

Content Specification 3: Identify a technological advance.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Ways in which society has benefited or been negatively impacted from improvements in technology may be assessed.
- Advances in alternative energy may be assessed.

Sample Item Stems

Content Specification 1:

Show me, how did the invention of batteries help people?

Content Specification 2:

Show me, which source should a student use to learn about cells?

Content Specification 3:

Show me, which technology improved communication?

GRADE BAND 6–8 ITEM SPECIFICATIONS

THE SCIENTIFIC PROCESS

Standard 2: NATURE OF SCIENCE: Understand that science, technology, and society are interrelated		
Topic: Unifying Concepts and Themes		Topic: Unifying Concepts and Themes
SC.8.2.2 —Describe how scale and mathematical models can be used to support and explain scientific data		SC.6.2.2 —Explain how the needs of society have influenced the development and use of technologies

Essence: Scale or mathematical models may be used to present scientific data.

Content Specification 1: Identify how scale or mathematical models can be used to support or explain scientific data.

Content Specification 2: Identify a scale or mathematical model.

Content Specification 3: Observe the use of a scale or mathematical model.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- The content and context of these items must be drawn from and aligned to the content standards and benchmarks contained in this document or the content standards and benchmarks of a lower level that represent the knowledge that is foundational to the standards and benchmarks included in this document.
- Examples of appropriate information to assess include, but are not limited to, the use of data to support a statement and how models can be used to demonstrate a science phenomenon.
- Graphs depicting a linear relationship are an acceptable form of data representation.

Sample Item Stems

Content Specification 1:

According to the graph, show me, how did the height of the plant change during the experiment?

Content Specification 2:

Show me, which type of graph should we use to show how a population of birds in an ecosystem has changed over the years?

Content Specification 3:

Show me, which is a line graph?

GRADE BAND 6–8 ITEM SPECIFICATIONS

LIFE AND ENVIRONMENTAL SCIENCES

Standard 5: DIVERSITY, GENETICS, AND EVOLUTION: Understand genetics and biological evolution and their impact on the unity and diversity of organisms		
Topic: Biological Evolution	Topic: Biological Evolution	
SC.8.5.1 —Describe how changes in the physical environment affect the survival of organisms	SC.7.5.5 —Explain how fossils provide evidence that life and environmental conditions have changed over time	

Essence: Changes in the environment can affect the survival of organisms.

Content Specification 1: Identify changes in the physical environment that may affect the survival of organisms.

Content Specification 2: Identify a fossil record indicating change over time.

Content Specification 3: Identify changes that can occur in the environment.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Items may require students to understand that adaptations are inherited characteristics and behaviors that help an organism survive in its habitat.
- Items may require students to understand that changes in the environment can cause a population to evolve through natural selection.
- Items may require students to understand that variations within a population are necessary for evolution to occur.
- Items may require students to understand that organisms interact with the biotic and abiotic factors in their ecosystem and these interactions affect an organism’s ability to survive and reproduce.
- Items may require students to understand that the size of a population is affected by factors such as the availability of food, space, competition, and predation.
- Items may require students to understand that human intervention can cause changes to ecosystems.
- Students are not expected to understand how populations of bacteria can be manipulated in a lab setting.

Sample Item Stems

Content Specification 1:

Show me, what do animals do when there is a forest fire?

Content Specification 2:

Show me, according to the types of fossils found in this area, what was this environment once like?

Content Specification 3:

Here is an ecosystem. Show me, which diagram shows the ecosystem when there is less water?

GRADE BAND 6–8 ITEM SPECIFICATIONS

PHYSICAL, EARTH, AND SPACE SCIENCES

Standard 6: NATURE OF MATTER AND ENERGY: Understand the nature of matter and energy, forms of energy (including waves) and energy transformations, and their significance in understanding the structure of the universe

Topic: Waves

SC.8.6.1—Explain the relationship between the color of light and wavelength within the electromagnetic spectrum

Essence: *Different wavelengths of visible light emit different colors.*

Content Specification 1: Identify why objects appear to be a certain color (for example, an apple is red because it reflects the red wavelength of light.)

Content Specification 2: Identify the color of light reflected by common objects (e.g., an apple is red, grass is green).

Content Specification 3: Observe that light is composed of colors (for example, with a prism or mist rainbow).

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Students are not required to understand how a wave’s energy changes across the electromagnetic spectrum.

Sample Item Stems

Content Specification 1:

Show me, why does the apple appear to have a red color?

Content Specification 2:

Show me, which color is reflected by the square on this piece of paper?

Content Specification 3:

Say: ***We’re going to observe a rainbow. I can use a prism to show that light is made of all the colors of the rainbow.***

GRADE BAND 6–8 ITEM SPECIFICATIONS

PHYSICAL, EARTH, AND SPACE SCIENCES

Standard 6: NATURE OF MATTER AND ENERGY: Understand the nature of matter and energy, forms of energy (including waves) and energy transformations, and their significance in understanding the structure of the universe		
Topic: Waves		Topic: Waves
SC.8.6.2—Explain how seismic waves provide scientists with information about the structure of the Earth’s interior		SC.6.6.10—Explain how vibrations in materials set up wavelike disturbances that spread away from the source

Essence: *Seismic waves provide information about the Earth’s interior.*

~~**Content Specification 1:** Identify that earthquakes travel in waves.~~

~~**Content Specification 2:** Identify the epicenter of an earthquake.~~

~~**Content Specification 3:** Observe a demonstration of an earthquake.~~

GRADE BAND 6–8 ITEM SPECIFICATIONS

PHYSICAL, EARTH, AND SPACE SCIENCES

Standard 6: NATURE OF MATTER AND ENERGY: Understand the nature of matter and energy, forms of energy (including waves) and energy transformations, and their significance in understanding the structure of the universe		
Topic: Waves		
SC.8.6.3 —Identify the characteristics and properties of mechanical and electromagnetic waves		

Essence: *Mechanical and electromagnetic waves have similar characteristics.*

Content Specification 1: Identify similar characteristics between two waves (e.g., similar heights, similar wavelengths).

Content Specification 2: Identify a property of a wave (e.g., frequency, amplitude, wavelength).

Content Specification 3: Identify a mechanical wave (e.g., in rope, water waves).

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Items may require students to understand the differences between mechanical and electromagnetic waves and to give examples of each kind of wave.
- Items may require students to understand that all waves transfer energy.
- Items may require students to understand the definitions of amplitude, wavelength, and frequency of a wave.
- Items may require students to understand that the speed of a wave depends on the properties of the medium through which the wave travels.
- Items may require students to understand and illustrate how light waves can be refracted at surface boundaries, reflected from and to surfaces, dispersed, and absorbed by objects. Only common materials such as air, water, and glass can be used to demonstrate refraction.
- Pitch may not be assessed.

Sample Item Stems

Content Specification 1:

Show me, which waves have similar wavelengths on the diagram?

Content Specification 2:

Show me, which property can be observed in all waves?

Content Specification 3:

Show me, which object makes a wave that we can see?

GRADE BAND 6–8 ITEM SPECIFICATIONS

PHYSICAL, EARTH, AND SPACE SCIENCES

Standard 6: NATURE OF MATTER AND ENERGY: Understand the nature of matter and energy, forms of energy (including waves) and energy transformations, and their significance in understanding the structure of the universe		
		Topic: Energy and Its Transformation
		SC.6.6.1 —Compare how heat energy can be transferred through conduction, convection, and radiation

Essence: Heat energy can be transferred.

Content Specification 1: Identify how heat is transferred in a given scenario.

Content Specification 2: Identify warmer objects as having more heat energy.

Content Specification 3: Observe the transfer of heat energy.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Students are not expected to know the transfer of energy among particles in conduction.
- Students may be expected to know the movement of warmer and cooler liquid or gas during convection.

Sample Item Stems

Content Specification 1:

Show me, which diagram shows conduction?

Content Specification 2:

Show me, which object has more heat energy?

Content Specification 3:

Say: *Let’s carefully hold this mug. It feels warm because the heat is being transferred from the mug to our hands.*

GRADE BAND 6–8 ITEM SPECIFICATIONS

PHYSICAL, EARTH, AND SPACE SCIENCES

Standard 6: NATURE OF MATTER AND ENERGY: Understand the nature of matter and energy, forms of energy (including waves) and energy transformations, and their significance in understanding the structure of the universe		
		Topic: Energy and Its Transformation
		SC.6.6.2 —Describe the different types of energy transformations

Essence: Energy can be transformed from one type to another (e.g., heat energy into mechanical energy, light energy into chemical energy, electrical energy into magnetic energy).

Content Specification 1: Identify different types of energy transformations (e.g., heat energy into mechanical energy, light energy into chemical energy, electrical energy into magnetic energy).

Content Specification 2: Identify that energy can be transformed.

Content Specification 3: Observe the transformation of energy from one type to another.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Items that include the conservation of energy align to SC.6.6.3.

Sample Item Stems

Content Specification 1:

Show me, which type of energy transformation occurs in this circuit?

Content Specification 2:

Show me, how is the potential energy of the falling ball changing?

Content Specification 3:

Say: **Let's turn on the flashlight. The flashlight uses a battery to transform chemical energy into electrical energy. The electrical energy is then transformed into light and heat energy.**

GRADE BAND 6–8 ITEM SPECIFICATIONS

PHYSICAL, EARTH, AND SPACE SCIENCES

Standard 6: NATURE OF MATTER AND ENERGY: Understand the nature of matter and energy, forms of energy (including waves) and energy transformations, and their significance in understanding the structure of the universe		
		Topic: Energy and Its Transformation
		SC.6.6.3 —Explain how energy can change forms and is conserved

Essence: *Energy conservation can be explained by comparing the input and output of energy of a specific device or process (e.g., throwing a ball against a wall).*

Content Specification 1: Describe how energy is conserved.

Content Specification 2: Identify that energy is conserved.

Content Specification 3: Observe the input and output of energy (e.g., throwing a ball against a wall).

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- The relationship of potential and kinetic energy may be included.

Sample Item Stems

Content Specification 1:

Show me, if the ball is thrown straight up into the air, and the kinetic energy of the ball is decreasing, how is the potential energy effected?

Content Specification 2:

Show me, what happened to some of the energy when the ball hit the ground?

Content Specification 3:

Say: ***If we drop this ball, the ball will not bounce back as high. That is because some of the energy is lost when the ball hits the ground.***

GRADE BAND 6–8 ITEM SPECIFICATIONS

PHYSICAL, EARTH, AND SPACE SCIENCES

Standard 6: NATURE OF MATTER AND ENERGY: Understand the nature of matter and energy, forms of energy (including waves) and energy transformations, and their significance in understanding the structure of the universe		
		Topic: Energy and Its Transformation
		SC.6.6.4 —Describe and give examples of different types of energy waves

Essence: Energy travels in waves (e.g., radio waves, sound waves, light waves).

Content Specification 1: Identify ways in which energy travels (e.g., radio waves, sound waves, light waves).

Content Specification 2: Recognize a model/representation of an energy wave.

Content Specification 3: Observe the effect of an energy wave.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Students are not expected to compare the properties of different types of waves.

Sample Item Stems

Content Specification 1:

Show me, according to this diagram, which wave is the longest?

Content Specification 2:

Show me, which diagram shows a wave with the highest energy?

Content Specification 3:

Say: *Here is a diagram of the electromagnetic spectrum. It shows the wavelengths of radio waves, visible light, and x-rays.*

GRADE BAND 6–8 ITEM SPECIFICATIONS

PHYSICAL, EARTH, AND SPACE SCIENCES

Standard 6: NATURE OF MATTER AND ENERGY: Understand the nature of matter and energy, forms of energy (including waves) and energy transformations, and their significance in understanding the structure of the universe		
		Topic: Nature of Matter
		SC.6.6.5 —Explain how matter can change physical or chemical forms, but the total amount of matter remains constant

Essence: *Matter remains constant before and after physical and chemical changes (e.g., breaking and weathering of rocks, lighting a match).*

Content Specification 1: Recognize that the amount of matter in a given system is constant.

Content Specification 2: Identify the change(s) of a substance that has undergone a physical/chemical change.

Content Specification 3: Observe a physical/chemical change in matter.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Students may be expected to know that the total mass remains the same before and after a chemical or physical change.

Sample Item Stems

Content Specification 1:

Show me, if a 50-gram ice cube melts, what will be the mass of the water?

Content Specification 2:

Show me, which is a phase change?

Content Specification 3:

Say: ***Here is an ice cube. It melts into water. This phase change is a physical change.***

GRADE BAND 6–8 ITEM SPECIFICATIONS

PHYSICAL, EARTH, AND SPACE SCIENCES

Standard 6: NATURE OF MATTER AND ENERGY: Understand the nature of matter and energy, forms of energy (including waves) and energy transformations, and their significance in understanding the structure of the universe		
		Topic: Nature of Matter
		SC.6.6.6 —Describe and compare the physical and chemical properties of different substances

Essence: *Different substances (e.g., salts, sugars, elements, acids, bases) have different physical and chemical properties (e.g., mass, melting point, boiling point, magnetism, conductivity, rusting, reactivity).*

Content Specification 1: Identify physical/chemical properties of a substance.

Content Specification 2: Differentiate substances that have different physical/chemical properties.

Content Specification 3: Observe physical/chemical properties of a substance.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Students may be expected to know how the nature of matter changes during physical and chemical changes.

Sample Item Stems

Content Specification 1:

Show me, what is the density of the material this cube is made of?

Content Specification 2:

Show me, which material has higher density?

Content Specification 3:

Say: ***Here is a cube made from an unknown material. We can find out its density if we measure its mass and volume.***

GRADE BAND 6–8 ITEM SPECIFICATIONS

PHYSICAL, EARTH, AND SPACE SCIENCES

Standard 6: NATURE OF MATTER AND ENERGY: Understand the nature of matter and energy, forms of energy (including waves) and energy transformations, and their significance in understanding the structure of the universe		
		Topic: Nature of Matter
		SC.6.6.7 —Describe the organization of the periodic table

Essence: *The periodic table is used to identify patterns of elements (e.g., metals, nonmetals, inert gases).*

Content Specification 1: Identify basic ways matter is organized in the periodic table (e.g., metals, nonmetals, inert gases).

Content Specification 2: Identify an element as a pure substance.

Content Specification 3: Identify the periodic table.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Do not assess bonding of elements or the meaning of atomic numbers or weights.

Sample Item Stems

Content Specification 1:

Show me, which element is a metal?

Content Specification 2:

Show me, which element is a pure substance?

Content Specification 3:

Say: ***Here is a periodic table. It gives us information about elements. Let's find carbon on the periodic table.***

GRADE BAND 6–8 ITEM SPECIFICATIONS

PHYSICAL, EARTH, AND SPACE SCIENCES

Standard 6: NATURE OF MATTER AND ENERGY: Understand the nature of matter and energy, forms of energy (including waves) and energy transformations, and their significance in understanding the structure of the universe		
		Topic: Nature of Matter
		SC.6.6.8 —Recognize changes that indicate that a chemical reaction has taken place

Essence: *A release of heat, light, and/or gas is an indication that a chemical reaction has taken place.*

Content Specification 1: Identify indications (e.g., release of heat, light, gas) that a chemical reaction has taken place.

Content Specification 2: Identify that a new substance has formed as a result of a chemical reaction.

Content Specification 3: Observe a chemical reaction.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Students are not expected to read chemical equations.

Sample Item Stems

Content Specification 1:

Show me, how do we know that mixing vinegar and baking soda causes a chemical reaction?

Content Specification 2:

Show me, what is produced from mixing baking soda and vinegar?

Content Specification 3:

Say: ***Here are baking soda and vinegar. I am going to mix them. Watch for signs of a chemical reaction.***

GRADE BAND 6–8 ITEM SPECIFICATIONS

PHYSICAL, EARTH, AND SPACE SCIENCES

Standard 6: NATURE OF MATTER AND ENERGY: Understand the nature of matter and energy, forms of energy (including waves) and energy transformations, and their significance in understanding the structure of the universe		
		Topic: Nature of Matter
		SC.6.6.9 —Describe matter using the atomic model

Essence: *Matter is made up of atoms that contain protons and neutrons in the nucleus and orbiting electrons.*

Content Specification 1: Identify that all matter is made of smaller units called atoms.

Content Specification 2: Identify a model/representation of an atom.

Content Specification 3: Observe a model/representation of an atom.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Do not assess the symbols, relative charges, or relative masses of the subatomic particles.

Sample Item Stems

Content Specification 1:

Show me, what is all matter made of?

Content Specification 2:

Show me, which model shows an atom?

Content Specification 3:

Say: ***Here is a model of an atom. Let's count the electrons, neutrons, and protons.***

GRADE BAND 6–8 ITEM SPECIFICATIONS
PHYSICAL, EARTH, AND SPACE SCIENCES

Standard 7: FORCE AND MOTION: Understand the relationship between force, mass, and motion of objects and know the major natural forces: gravitational, electric, and magnetic		
Topic: Forces of the Universe		
SC.8.7.1—Explain that every object has mass and therefore exerts a gravitational force on other objects		

Essence: Gravitational force exists between any two objects.

~~Content Specification 1:~~ Compare the mass of two different objects.

~~Content Specification 2:~~ Use a scale to measure the mass of an object.

~~Content Specification 3:~~ Identify gravity as the force that pulls objects toward each other.

GRADE BAND 6–8 ITEM SPECIFICATIONS

PHYSICAL, EARTH, AND SPACE SCIENCES

Standard 7: FORCE AND MOTION: Understand the relationship between force, mass, and motion of objects and know the major natural forces: gravitational, electric, and magnetic		
		Topic: Forces of the Universe
		SC.6.7.2 —Explain that electric currents can produce magnetic effects and that magnets can use electric currents

Essence: *Magnets can produce electric currents and electric currents produce a magnetic field.*

Content Specification 1: Recognize electric currents and magnetic effects.

Content Specification 2: Identify a magnetic field.

Content Specification 3: Observe a magnetic effect.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Items may include content related to electromagnets.
- Do not assess the right-hand rule.

Sample Item Stems

Content Specification 1:

Show me, which magnets will repel each other?

Content Specification 2:

Show me, which material is attracted to a magnet?

Content Specification 3:

Say: ***Here is a magnet. Let's test some materials to see whether they are magnetic.***

GRADE BAND 6–8 ITEM SPECIFICATIONS

PHYSICAL, EARTH, AND SPACE SCIENCES

Standard 7: FORCE AND MOTION: Understand the relationship between force, mass, and motion of objects and know the major natural forces: gravitational, electric, and magnetic		
		Topic: Force and Motion
		SC.6.7.1 —Describe examples of how forces affect an object’s motion

Essence: *Newton’s Laws of Motion describe how forces affect an object’s motion (e.g., constant speed in a straight line unless a force is acting upon it).*

Content Specification 1: Identify the force(s) that affects an object’s motion.

Content Specification 2: Identify examples of forces.

Content Specification 3: Observe how a force can affect an object’s motion.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Students may be expected to interpret a force diagram or displacement-vs.-time graph.

Sample Item Stems

Content Specification 1:

Show me, what causes the boxes to stop sliding down the ramp?

Content Specification 2:

Show me, which force pushes up on the box?

Content Specification 3:

Say: ***Here is a force diagram. It shows the direction and magnitude of forces acting on a box.***

GRADE BAND 6–8 ITEM SPECIFICATIONS

PHYSICAL, EARTH, AND SPACE SCIENCES

Standard 8: EARTH AND SPACE SCIENCE: Understand the Earth and its processes, the solar system, and the universe and its contents

Topic: Earth Materials

~~SC.8.8.1—Compare the characteristics of the three main types of rocks~~

Essence: *The three main types of rocks are igneous, metamorphic, and sedimentary.*

~~**Content Specification 1:** Distinguish the three main types of rocks.~~

~~**Content Specification 2:** Identify similarities/differences of two different types of rocks (e.g., sedimentary rock has layers; igneous rock does not).~~

GRADE BAND 6–8 ITEM SPECIFICATIONS

PHYSICAL, EARTH, AND SPACE SCIENCES

Standard 8: EARTH AND SPACE SCIENCE: Understand the Earth and its processes, the solar system, and the universe and its contents		
Topic: Earth Materials		
SC.8.8.2 —Illustrate the rock cycle and explain how igneous, metamorphic, and sedimentary rocks are formed		

Essence: The formation of igneous, metamorphic, and sedimentary rocks is cyclical.

Content Specification 1: Match the type of rock to how it was formed.

Content Specification 2: Identify a type of rock.

Content Specification 3: Identify differences in rocks (e.g., in size, texture).

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Items may require students to diagram the rock cycle and identify the major factors (e.g., time, pressure, temperature) in the formation of igneous, metamorphic, and sedimentary rocks.

Sample Item Stems

Content Specification 1:

Show me, which type of rock came from a volcano?

Content Specification 2:

Show me, what type of rock is this?

Content Specification 3:

Here is a picture of a rock, and here is a picture of the same rock after it changed. Show me, what is different about the rock now?

GRADE BAND 6–8 ITEM SPECIFICATIONS

PHYSICAL, EARTH, AND SPACE SCIENCES

Standard 8: EARTH AND SPACE SCIENCE: Understand the Earth and its processes, the solar system, and the universe and its contents		
Topic: Earth in the Solar System		
SC.8.8.3 —Describe how the Earth’s motions and tilt on its axis affect the seasons and weather patterns		

Essence: Earth’s tilt causes seasons.

Content Specification 1: Identify the seasons in a diagram of Earth’s revolution.

Content Specification 2: Identify that the Earth tilts on its axis.

Content Specification 3: Identify the four seasons.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Items may require students to compare how Earth’s motions and tilt on its axis affect the seasons and weather patterns in different regions of the world.

Sample Item Stems

Content Specification 1:

Show me, if it is summer in the Northern Hemisphere, where is Earth on the diagram of its orbit?

Content Specification 2:

Show me, which diagram shows Earth’s position in its orbit?

Content Specification 3:

Show me, what season is it?

GRADE BAND 6–8 ITEM SPECIFICATIONS

PHYSICAL, EARTH, AND SPACE SCIENCES

Standard 8: EARTH AND SPACE SCIENCE: Understand the Earth and its processes, the solar system, and the universe and its contents		
Topic: Forces that Shape the Earth		
SC.8.8.4 —Explain how the sun is the major source of energy influencing climate and weather on the Earth		

Essence: The sun is the major source of energy that influences weather on the Earth.

Content Specification 1: Recognize how the sun contributes to weather.

Content Specification 2: Recognize that the sun contributes to the water cycle through evaporation.

Content Specification 3: Identify a part in the water cycle (condensation/clouds, precipitation/rain).

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Items may require students to describe how the sun’s heating of Earth drives weather systems, ocean currents, and the water cycle.
- Items may require students to analyze and explain the importance of the sun’s role in influencing the climate and weather on Earth.
- Items that assess the cycling of water under this benchmark must be distinct from water cycle items aligned to SC.BS.3.1. Benchmark SC.8.8.4 concerns how the sun heating Earth drives the water cycle and how the water cycle can affect Earth’s weather and climate. In contrast, items aligned to SC.BS.3.1 concern Earth’s finite pool of available water and the cycling of water molecules.

Sample Item Stems

Content Specification 1:

Show me, which step of the water cycle causes rain?

Content Specification 2:

Show me, in which step of the water cycle would the sun dry up a puddle?

Content Specification 3:

Show me, what is a source of energy that causes evaporation?

GRADE BAND 6–8 ITEM SPECIFICATIONS

PHYSICAL, EARTH, AND SPACE SCIENCES

Standard 8: EARTH AND SPACE SCIENCE: Understand the Earth and its processes, the solar system, and the universe and its contents		
Topic: Forces that Shape the Earth		
SC.8.8.5 —Explain the concepts of continental drift and plate tectonics		

Essence: *Plates on the Earth’s crust move, causing continental drift.*

Content Specification 1: Explain that continents move because plates move.

Content Specification 2: Recognize that the continents are on plates.

Content Specification 3: Identify the Earth’s interior (e.g., crust, mantle, core).

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Items may require students to describe continental drift and how Earth’s crust is divided into plates that move on convection currents of magma in the mantle.
- Items may require students to defend predictions for future continental drift based on knowledge of plate tectonics.

Sample Item Stems

Content Specification 1:

Show me, why do the continents move?

Content Specification 2:

Show me, which continent is located on this tectonic plate?

Content Specification 3:

Show me, in which part of Earth are continents found?

GRADE BAND 6–8 ITEM SPECIFICATIONS

PHYSICAL, EARTH, AND SPACE SCIENCES

Standard 8: EARTH AND SPACE SCIENCE: Understand the Earth and its processes, the solar system, and the universe and its contents		
Topic: Forces that Shape the Earth		
SC.8.8.6 —Explain the relationship between density and convection currents in the ocean and atmosphere		

Essence: *Warm fluids rise; cold fluids sink.*

Content Specification 1: Recognize that warm water rises and cold or dense water sinks.

Content Specification 2: Observe that temperature affects the movement of water.

Content Specification 3: Distinguish between hot and cold water.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Items may require students to explain the relationship between density and convection currents and how they affect global wind patterns and major ocean currents.

Sample Item Stems

Content Specification 1:

Show me, where will the cold water go if we pour it into the cup of warm water?

Content Specification 2:

Show me, how does warm and cold water move in a tank?

Content Specification 3:

Say: ***Here are cups of warm and cold water. Let’s feel the difference between warm and cold water.***

GRADE BAND 6–8 ITEM SPECIFICATIONS

PHYSICAL, EARTH, AND SPACE SCIENCES

Standard 8: EARTH AND SPACE SCIENCE: Understand the Earth and its processes, the solar system, and the universe and its contents		
Topic: Forces that Shape the Earth		
SC.8.8.7 —Describe the physical characteristics of oceans		

Essence: *Oceans have physical characteristics such as depth, density, salinity, currents, and temperature.*

Content Specification 1: Describe physical characteristics of an ocean.

Content Specification 2: Identify physical characteristics of an ocean.

Content Specification 3: Identify an ocean.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Items may require students to describe and illustrate the physical characteristics (e.g., size, depth, geologic history, ocean floor, and currents) of the oceans.
- Items may require students to explain how the physical characteristics of the ocean have changed over geologic time.

Sample Item Stems

Content Specification 1:

Show me, which part of the ocean diagram shows more salty (dense) water?

Content Specification 2:

Show me, what do all oceans have in common?

Content Specification 3:

Show me, which is an example of an ocean?

GRADE BAND 6–8 ITEM SPECIFICATIONS

PHYSICAL, EARTH, AND SPACE SCIENCES

Standard 8: EARTH AND SPACE SCIENCE: Understand the Earth and its processes, the solar system, and the universe and its contents

Topic: The Universe

~~SC.8.8.8—Describe the composition of objects in the galaxy~~

Essence: The galaxy is composed of stars, star systems, planets, etc.

~~Content Specification 1:~~ Compare physical properties of other objects in the solar system to the Earth.

~~Content Specification 2:~~ Identify physical properties of the Earth.

~~Content Specification 3:~~ Identify objects in a solar system.

GRADE BAND 6–8 ITEM SPECIFICATIONS

PHYSICAL, EARTH, AND SPACE SCIENCES

Standard 8: EARTH AND SPACE SCIENCE: Understand the Earth and its processes, the solar system, and the universe and its contents		
Topic: The Universe		
SC.8.8.9 —Explain the predictable motions of the Earth and moon		

Essence: *The moon revolves around the Earth and the Earth revolves around the sun.*

Content Specification 1: Identify movement of patterns of the Earth and moon around the sun.

Content Specification 2: Recognize that the Earth and the moon move/revolve, but the sun does not (in our solar system).

Content Specification 3: Identify the Earth, sun, and moon.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Items may require students to explain the phenomena caused by the predictable motions of Earth and the moon (e.g., day, night, season, year, eclipses, phases of moon, tides).
- Items may require students to analyze the predictable motions of Earth and the moon and their impacts on Earth.

Sample Item Stems

Content Specification 1:

Show me, which path shows the moon's orbit in this diagram?

Content Specification 2:

Show me, what object moves around Earth?

Content Specification 3:

Show me, which planet is Earth on this diagram?

GRADE BAND 6–8 ITEM SPECIFICATIONS

PHYSICAL, EARTH, AND SPACE SCIENCES

Standard 8: EARTH AND SPACE SCIENCE: Understand the Earth and its processes, the solar system, and the universe and its contents		
Topic: The Universe		
SC.8.8.10 —Compare the characteristics and movement patterns of the planets in our solar system		

Essence: Planets revolve around the sun.

Content Specification 1: Compare the characteristics and movements of two planets in the solar system.

Content Specification 2: Identify the characteristics and movements of one planet.

Content Specification 3: Identify the planets.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Items may require students to compare the movement of the planets in our solar system.
- Items may require students to compare different characteristics (e.g., planets differ in size, orbit, number of moons, composition, surface features, and movement patterns) of planets.

Sample Item Stems

Content Specification 1:

Show me, how do planets move around the sun?

Content Specification 2:

Show me, which planet is gaseous?

Content Specification 3:

Show me, which planet is closest to the sun?

GRADE BAND 6–8 ITEM SPECIFICATIONS

PHYSICAL, EARTH, AND SPACE SCIENCES

Standard 8: EARTH AND SPACE SCIENCE: Understand the Earth and its processes, the solar system, and the universe and its contents		
Topic: The Universe		
SC.8.8.11 —Describe the major components of the universe		

Essence: *The universe consists of galaxies, stars, planets, moons, asteroids, comets, etc.*

Content Specification 1: Identify that the universe is composed of multiple galaxies.

Content Specification 2: Identify that a galaxy is composed of stars and other systems.

Content Specification 3: Identify a component in a solar system.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Items may require students to explain the major components in the universe, their movements, ~~and their characteristics.~~
- Components of the universe include, but are not limited to, stars, ~~black holes,~~ and galaxies.
- ~~Items may require students to describe that the universe consists of billions of galaxies that are classified by shape and contain most of the visible mass of the universe.~~
- ~~Items that address the life cycle of stars, including the life and death of stars, may be included.~~
- Hertzsprung-Russell diagrams may be not assessed.

Sample Item Stems

Content Specification 1:

Show me, what is a major part of the universe?

Content Specification 2:

Show me, what are galaxies made of?

Content Specification 3:

Show me, which star is in our solar system?

GRADE BAND 6–8 ITEM SPECIFICATIONS

PHYSICAL, EARTH, AND SPACE SCIENCES

Standard 8: EARTH AND SPACE SCIENCE: Understand the Earth and its processes, the solar system, and the universe and its contents		
Topic: The Universe		
SC.8.8.12 —Describe the role of gravitational force in the motions of planetary systems		

Essence: Gravity holds objects in orbit.

Content Specification 1: Describe how gravity holds an object in orbit.

Content Specification 2: Identify gravity as a force that pulls.

Content Specification 3: Identify an orbit.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Items may require students to describe how gravitational force keeps Earth, other planets, and their moons in their orbits.
- Items may require students to analyze the role of gravity in determining the shape of the motions of planetary systems.

Sample Item Stems

Content Specification 1:

Show me, which force keeps Earth in its orbit?

Content Specification 2:

Show me, which force pulls objects to Earth?

Content Specification 3:

Show me, which path shows an orbit in this diagram?

HIGH SCHOOL (BIOLOGY) ITEM SPECIFICATIONS

THE SCIENTIFIC PROCESS

Standard 1: SCIENTIFIC INVESTIGATION: Discover, invent, and investigate using the skills necessary to engage in the scientific process

Topic: Scientific Inquiry

SC.BS.1.1—Describe how a testable hypothesis may need to be revised to guide a scientific investigation

Essence: *An experiment may be extended to advance a scientific investigation.*

Content Specification 1: Develop a new hypothesis to extend a scientific investigation.

Content Specification 2: Determine whether a scientific investigation’s results support the original hypothesis.

Content Specification 3: Participate in an investigation.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- The content and context of these items must be drawn from and aligned to the content standards and benchmarks contained in this document or the content standards and benchmarks of lower grade levels that represent the knowledge that is foundational to the standards and benchmarks included in this document.
- Items that require students to describe testable hypotheses and explain how they might be revised based on data from physical science or biological science investigations and primary sources (e.g., results, class data, or information from reputable sources) may be included.

Sample Item Stems

Content Specification 1:

We concluded in our last experiment that too much water can hurt a plant. Show me, what hypothesis should we develop to find out how much water the plant should have?

Content Specification 2:

Show me, do the results support the hypothesis?

Content Specification 3:

Based on the hypothesis, show me, which variable should stay the same throughout the investigation?

HIGH SCHOOL (BIOLOGY) ITEM SPECIFICATIONS

THE SCIENTIFIC PROCESS

Standard 1: SCIENTIFIC INVESTIGATION: Discover, invent, and investigate using the skills necessary to engage in the scientific process

Topic: Scientific Inquiry

SC.BS.1.2—Design and safely implement an experiment, including the appropriate use of tools and techniques to organize, analyze, and validate data

***Essence:** Appropriate tools and techniques are used to safely implement an experiment.*

Content Specification 1: Conduct an experiment with the appropriate tools and organize the data.

Content Specification 2: Identify appropriate tools in order to conduct an experiment.

Content Specification 3: Participate in an experiment with the appropriate tools.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- The content and context of these items must be drawn from and aligned to the content standards and benchmarks contained in this document or the content standards and benchmarks of lower grade levels that represent the knowledge that is foundational to the standards and benchmarks included in this document.

Sample Item Stems

Content Specification 1:

Show me, which tool should we use to measure the volume of the substance?

Content Specification 2:

Show me, what is the mass of this object?

Content Specification 3:

Show me, what tool is needed to measure temperature?

HIGH SCHOOL (BIOLOGY) ITEM SPECIFICATIONS

THE SCIENTIFIC PROCESS

Standard 1: SCIENTIFIC INVESTIGATION: Discover, invent, and investigate using the skills necessary to engage in the scientific process

Topic: Scientific Inquiry

SC.BS.1.3—Defend and support conclusions, explanations, and arguments based on logic, scientific knowledge, and evidence from data

Essence: A conclusion is supported using evidence.

Content Specification 1: Construct an explanation to defend the results of the scientific investigation.

Content Specification 2: Provide evidence to support a scientific investigation.

Content Specification 3: Answer a question after participating in a scientific investigation.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- The content and context of these items must be drawn from and aligned to the content standards and benchmarks contained in this document or the content standards and benchmarks of lower grade levels that represent the knowledge that is foundational to the standards and benchmarks included in this document.
- Students may be asked to evaluate the data analysis portion of a lab report and draw logical conclusions and formulate explanations and arguments based on the results of the investigation.

Sample Item Stems

Content Specification 1:

Show me, why can we conclude that sunlight helps plants grow?

Content Specification 2:

Show me, which graph shows that sunlight helps plants grow?

Content Specification 3:

Show me, how did the sunlight affect the plants?

HIGH SCHOOL (BIOLOGY) ITEM SPECIFICATIONS

THE SCIENTIFIC PROCESS

Standard 1: SCIENTIFIC INVESTIGATION: Discover, invent, and investigate using the skills necessary to engage in the scientific process

Topic: Scientific Inquiry

SC.BS.1.4 —Determine the connection(s) among hypotheses, scientific evidence, and conclusions
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Essence: *Hypotheses, scientific evidence, and conclusions are connected.*

Content Specification 1: Identify the connections between the hypothesis, evidence, and conclusion in a scientific investigation.

Content Specification 2: After completing a valid experiment, determine whether the results support the hypothesis.

Content Specification 3: Participate in an experiment and identify the purpose.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- The content and context of these items must be drawn from and aligned to the content standards and benchmarks contained in this document or the content standards and benchmarks of lower grade levels that represent the knowledge that is foundational to the standards and benchmarks included in this document.
- Students may be asked to analyze provided data and describe whether the experimental data supports or refutes a provided hypothesis.

Sample Item Stems

Content Specification 1:

Show me, which part of our results show that the hypothesis is not supported?

Content Specification 2:

Show me, do the results support the hypothesis?

Content Specification 3:

Show me, in this experiment, what do we want to learn?

HIGH SCHOOL (BIOLOGY) ITEM SPECIFICATIONS

THE SCIENTIFIC PROCESS

Standard 1: SCIENTIFIC INVESTIGATION: Discover, invent, and investigate using the skills necessary to engage in the scientific process

Topic: Scientific Inquiry

SC.BS.1.5 —Communicate the components of a scientific investigation, using appropriate techniques
--

Essence: A scientific investigation has components that are well established.

Content Specification 1: Present a logical argument to support conclusions from a scientific investigation.

Content Specification 2: Summarize and connect facts related to a scientific investigation.

Content Specification 3: Communicate information/facts related to a scientific investigation.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- The content and context of these items must be drawn from and aligned to the content standards and benchmarks contained in this document or the content standards and benchmarks of lower grade levels that represent the knowledge that is foundational to the standards and benchmarks included in this document.
- Items may require students to describe how the question, testable hypothesis, experimental design, analysis of data, and conclusions may be appropriately presented.

Sample Item Stems

Content Specification 1:

Show me, why did the ice melt the fastest on the aluminum?

Content Specification 2:

A student is investigating how quickly ice melts on different surfaces. Show me, what is the difference between the surfaces in the investigation?

Content Specification 3:

Let's look at the data table from this experiment. Show me, how long did it take for the ice cube to melt on the plastic surface?

HIGH SCHOOL (BIOLOGY) ITEM SPECIFICATIONS

THE SCIENTIFIC PROCESS

Standard 1: SCIENTIFIC INVESTIGATION: Discover, invent, and investigate using the skills necessary to engage in the scientific process

Topic: Scientific Inquiry

SC.BS.1.6 —Engage in and explain the importance of peer review in science
--

Essence: *Scientific investigations are peer reviewed in science.*

Content Specification 1: Critique a scientific investigation.

Content Specification 2: Compare and contrast different scientific investigations.

Content Specification 3: Review a scientific investigation.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- The content and context of these items must be drawn from and aligned to the content standards and benchmarks contained in this document or the content standards and benchmarks of lower grade levels that represent the knowledge that is foundational to the standards and benchmarks included in this document.
- Include questions that reduce the reading load, e.g., “What should be done to evaluate...?”

Sample Item Stems

Content Specification 1:

Student 2 recorded changes that he saw in the height of his plant. Student 1 recorded the height of her plant in inches. Show me, which method of measurement is more accurate?

Content Specification 2:

Both of these experiments use plants. Show me, what is the difference between Student 1’s and Student 2’s measurements?

Content Specification 3:

Say: ***Here is a lab report that another student wrote. Let’s read it together.***

HIGH SCHOOL (BIOLOGY) ITEM SPECIFICATIONS

THE SCIENTIFIC PROCESS

Standard 1: SCIENTIFIC INVESTIGATION: Discover, invent, and investigate using the skills necessary to engage in the scientific process

Topic: Scientific Knowledge

SC.BS.1.7 —Revise, as needed, conclusions and explanations based on new evidence

Essence: Conclusions can be revised if new evidence is discovered.

Content Specification 1: Use new evidence to revise a conclusion.

Content Specification 2: Formulate a logical conclusion based on results of a scientific investigation.

Content Specification 3: Choose a conclusion based on the results of a scientific investigation.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- The content and context of these items must be drawn from and aligned to the content standards and benchmarks contained in this document or the content standards and benchmarks of lower grade levels that represent the knowledge that is foundational to the standards and benchmarks included in this document.
- Items that require the student to reflect on new evidence from other valid sources and revise conclusions and explanations, as needed, may be included.
- Items that require students to make recommendations for improving investigations can be included.

Sample Item Stems

Content Specification 1:

Students collected additional data in this table. Show me, how should the conclusion be revised?

Content Specification 2:

Show me, what conclusion can we make based on these results?

Content Specification 3:

Show me, which conclusion matches these results?

HIGH SCHOOL (BIOLOGY) ITEM SPECIFICATIONS

THE SCIENTIFIC PROCESS

Standard 1: SCIENTIFIC INVESTIGATION: Discover, invent, and investigate using the skills necessary to engage in the scientific process

Topic: Scientific Knowledge

SC.BS.1.8 —Describe the importance of ethics and integrity in scientific investigation

Essence: Ethics and integrity are paramount in science.

Content Specification 1: Explain why it is important to be ethical in a scientific investigation.

Content Specification 2: Identify ethical and unethical behavior in a scientific investigation.

Content Specification 3: Identify ethical and unethical behavior in a science class.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- The content and context of these items must be drawn from and aligned to the content standards and benchmarks contained in this document or the content standards and benchmarks of lower grade levels that represent the knowledge that is foundational to the standards and benchmarks included in this document.
- Items that require students to identify and describe physical and biological science examples of ethical and unethical experimentation, citation, and conclusions (e.g., items that require students to provide guidelines concerning the appropriate treatment of living things and the environment, credit sources, and reduce bias) may be included.
- Ethical and unethical behavior may extend to right and wrong.

Sample Item Stems

Content Specification 1:

Both students' hypotheses were shown to be incorrect. Student 1 changed her data to match her hypothesis. Student 2 submitted his data and concluded that his hypothesis was not supported. Show me, which student used correct ethics?

Content Specification 2:

If there is a mistake in your data, show me, should you copy a classmate's data?

Content Specification 3:

Student 1 completed an assignment. Student 2 did not know how to do the assignment. Show me, is it acceptable for Student 2 to copy Student 1's work?

HIGH SCHOOL (BIOLOGY) ITEM SPECIFICATIONS

THE SCIENTIFIC PROCESS

Standard 1: SCIENTIFIC INVESTIGATION: Discover, invent, and investigate using the skills necessary to engage in the scientific process

Topic: Scientific Knowledge

SC.BS.1.9—Explain how scientific explanations must meet a set of established criteria to be considered valid

Essence: Scientific explanations have criteria for validity.

Content Specification 1: Describe an aspect that influences validity in a scientific investigation.

Content Specification 2: Identify the criteria of a valid scientific investigation.

Content Specification 3: Match steps in the scientific process with examples.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- The content and context of these items must be drawn from and aligned to the content standards and benchmarks contained in this document or the content standards and benchmarks of lower grade levels that represent the knowledge that is foundational to the standards and benchmarks included in this document.
- Items that requires students to describe how a published study meets the criteria of scientific explanation (e.g., it must be consistent with experimental and observational evidence about nature, make accurate predictions about systems being studied, be logical, abide by the rules of evidence, be open to questions and modifications, be based on historical and current scientific knowledge, and make a commitment to making the knowledge public) in order to draw conclusions about the study's validity may be included.
- Items that require students to analyze a scientific explanation and determine whether it meets a set of established criteria can be included.

Sample Item Stems

Content Specification 1:

A student conducted a scientific investigation and wrote a report that included the hypothesis, procedure, and conclusion. Show me, how could the student improve the reporting of his investigation?

Content Specification 2:

Show me, in order for a scientific investigation to be considered valid, what is an aspect that must be met?

Content Specification 3:

Show me, what is the last step of the scientific process?

HIGH SCHOOL (BIOLOGY) ITEM SPECIFICATIONS

THE SCIENTIFIC PROCESS

Standard 2: NATURE OF SCIENCE: Understand that science, technology, and society are interrelated
Topic: Science, Technology, and Society
SC.BS.2.1 —Explain how scientific advancements and emerging technology have influenced society

Essence: *Scientific advancements and technology have influenced society.*

Content Specification 1: Describe how different types of scientific technology have led to scientific advancements.

Content Specification 2: Identify the purpose of a type of scientific technology.

Content Specification 3: Identify different types of scientific technology (e.g., microscope, magnifying glass, x-ray).

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Items that require students to describe a current scientific advancement or emerging technology, list its key features and uses, and its possible impact on society may be included.

Sample Item Stems

Content Specification 1:

Show me, how have microscopes made a difference in what we know about living things?

Content Specification 2:

Show me, what do microscopes allow us to observe?

Content Specification 3:

Show me, which tool should we use to look at very tiny things?

HIGH SCHOOL (BIOLOGY) ITEM SPECIFICATIONS

THE SCIENTIFIC PROCESS

Standard 2: NATURE OF SCIENCE: Understand that science, technology, and society are interrelated
Topic: Science, Technology, and Society
SC.BS.2.2 —Compare the risks and benefits of potential solutions to technological issues

Essence: Solutions to technological issues may have both risks and benefits.

Content Specification 1: Compare risks and benefits of technological issues.

Content Specification 2: Identify risks and benefits of technological issues.

Content Specification 3: Recognize technological issues in daily life.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Items that require students to compare risks and benefits (e.g., in terms of the impact on populations, resources, health, disease, and the environment) of alternative solutions to a specific current technological issue (e.g., biotechnology, alternative energy sources) can be included.

Sample Item Stems

Content Specification 1:

Show me, what is a benefit and a risk of using windmills?

Content Specification 2:

Windmills require a certain amount of air movement to create electricity. Show me, is this a risk or a benefit?

Content Specification 3:

Say: ***We're going to read an article about various forms of clean energy.***

HIGH SCHOOL (BIOLOGY) ITEM SPECIFICATIONS

LIFE AND ENVIRONMENTAL SCIENCES

Standard 3: ORGANISMS AND THE ENVIRONMENT: Understand the unity, diversity, and interrelationships of organisms, including their relationship to cycles of matter and energy in the environment

Topic: Cycles of Matter and Energy

SC.BS.3.1—Describe biogeochemical cycles within ecosystems

Essence: *Biogeochemical cycles exist in ecosystems.*

Content Specification 1: Identify the components of a biogeochemical cycle.

Content Specification 2: Associate a naturally occurring process with a biogeochemical cycle (e.g., associate rain with the water cycles).

Content Specification 3: Recognize a component of the biogeochemical cycle (e.g., water cycle, carbon cycle, nitrogen cycle).

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Items that require students to use diagrams to describe the cycling of biogeochemical compounds (e.g., water, carbon, nitrogen, oxygen, potassium) through living and nonliving systems and explain the importance of these cycles in supporting such systems may be included.
- Items that require students to compare biogeochemical cycles within ecosystems can be included.
- Items that assess the cycling of water under this benchmark must be distinct from water cycle items aligned to SC.8.8.4. Benchmark SC.BS.3.1 concerns Earth’s finite pool of available water and the cycling of water molecules. In contrast, items aligned to SC.8.8.4 concern how the sun heating Earth drives the water cycle.

Sample Item Stems

Content Specification 1:

Show me, what are the processes of the water cycle?

Content Specification 2:

Show me, which process is part of the water cycle?

Content Specification 3:

Say: ***Let’s trace the path of water through the water cycle.***

HIGH SCHOOL (BIOLOGY) ITEM SPECIFICATIONS

LIFE AND ENVIRONMENTAL SCIENCES

Standard 3: ORGANISMS AND THE ENVIRONMENT: Understand the unity, diversity, and interrelationships of organisms, including their relationship to cycles of matter and energy in the environment

Topic: Cycles of Matter and Energy

SC.BS.3.2—Explain the chemical reactions that occur in photosynthesis and cellular respiration that result in cycling of energy

Essence: Photosynthesis and cellular respiration result in cycling of matter and energy.

Content Specification 1: Describe the process that plants use to make food.

Content Specification 2: Identify the inputs that go into the plant (e.g., sunlight, water) and the output from the plant (e.g., food, oxygen) during photosynthesis and respiration.

Content Specification 3: Recognize the purpose of photosynthesis and respiration.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Items that require students to compare the chemical reactions that occur in photosynthesis and cellular respiration and explain the interrelationships (inputs and outputs) that occur between the two processes can be included.

Sample Item Stems

Content Specification 1:

Show me, what is a source of energy that plants use to make their own food?

Content Specification 2:

Show me, what do plants need to make their own food?

Content Specification 3:

Show me, do plants or animals make their own food?

HIGH SCHOOL (BIOLOGY) ITEM SPECIFICATIONS

LIFE AND ENVIRONMENTAL SCIENCES

Standard 3: ORGANISMS AND THE ENVIRONMENT: Understand the unity, diversity, and interrelationships of organisms, including their relationship to cycles of matter and energy in the environment

Topic: Cycles of Matter and Energy

SC.BS.3.3—Explain how matter and energy flow through living systems and the physical environment

Essence: Matter and energy flow through the physical environment.

Content Specification 1: Diagram the movement of matter and energy through a physical environment.

Content Specification 2: Identify how matter and energy move through a physical environment.

Content Specification 3: Recognize the direction of the flow of matter and energy in a physical environment.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Items that require students to diagram and explain the cycling of matter and flow of energy through living systems and the physical environment can be included.
- Items that require students to compare different energy pathways can be included.
- Items may include food chains, food webs, trophic levels, and biomass.
- Do not assess the definition of “biomass.” If “biomass” is used in a stem, it must be defined.

Sample Item Stems

Content Specification 1:

Show me, what is the path of energy from the sun to the lion in this food web?

Content Specification 2:

Show me, which organism is the primary consumer?

Content Specification 3:

Show me, in this food chain, which organism eats this organism?

HIGH SCHOOL (BIOLOGY) ITEM SPECIFICATIONS

LIFE AND ENVIRONMENTAL SCIENCES

Standard 3: ORGANISMS AND THE ENVIRONMENT: Understand the unity, diversity, and interrelationships of organisms, including their relationship to cycles of matter and energy in the environment

Topic: Interdependence

SC.BS.3.4—Explain dynamic equilibrium in organisms, populations, and ecosystems; explain the effect of equilibrium shifts

Essence: Dynamic equilibrium exists in organisms, populations, and ecosystems.

Content Specification 1: Describe how factors affect dynamic equilibrium in an ecosystem.

Content Specification 2: Identify factors that could affect dynamic equilibrium (e.g., birth rate/death rate, immigration/emigration, invasive species).

Content Specification 3: Identify parts of an ecosystem.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Items that require students to describe dynamic equilibrium in an organism, populations, and ecosystem, including how a fluctuating state of approximate equilibrium is maintained (e.g., homeostatic mechanisms; growth of a population held in check by environmental factors such as depletion of food or nesting sites, predators, or parasites) and explain what happens if the equilibrium shifts (e.g., due to climate changes, immigration, emigration, birth and death rates) can be included.
- Items that require students to compare the effects of different equilibrium shifts may be included.

Sample Item Stems

Content Specification 1:

Show me, what happens to a population of organisms if the birth rate is higher than the death rate?

Content Specification 2:

Show me, which factor could cause animals to leave an ecosystem?

Content Specification 3:

Show me, which organism lives in this ecosystem?

HIGH SCHOOL (BIOLOGY) ITEM SPECIFICATIONS

LIFE AND ENVIRONMENTAL SCIENCES

Standard 4: STRUCTURE AND FUNCTION IN ORGANISMS: Understand the structures and functions of living organisms and how organisms can be compared scientifically

Topic: Cells, Tissues, Organs, and Organ Systems

~~SC.BS.4.1—Describe different cell parts and their functions~~

Essence: Cell parts have specific functions.

~~Content Specification 1:~~ Identify and describe various types of cell parts and their functions.

~~Content Specification 2:~~ Identify and label cell parts.

~~Content Specification 3:~~ Recognize different types of cells and cell parts.

HIGH SCHOOL (BIOLOGY) ITEM SPECIFICATIONS

LIFE AND ENVIRONMENTAL SCIENCES

Standard 4: STRUCTURE AND FUNCTION IN ORGANISMS: Understand the structures and functions of living organisms and how organisms can be compared scientifically
--

Topic: Cells, Tissues, Organs, and Organ Systems

SC.BS.4.2 —Explain how cells are specialized into different tissues and organs

Essence: *Cells are specialized into tissues and organs.*

Content Specification 1: Match a specialized cell to its organ system, organs, or tissue.

Content Specification 2: Identify that cells are specialized for certain organ systems, organs, or tissues.

Content Specification 3: Match organs to their organ systems.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Items may require students to describe how cell structures and functions are specific to tissues and organs (e.g., blood cells carry oxygen, muscle cells contract, liver cells detoxify poisons).
- Plant tissues and animal tissues should be included.

Sample Item Stems

Content Specification 1:

Show me, in which system does a skin cell belong?

Content Specification 2:

Show me, why do muscles need specialized cells that stretch?

Content Specification 3:

Say: ***Let's look at a model of the human body. This shows our circulatory system, and here is where the heart is located*** (indicate the heart in the model).

HIGH SCHOOL (BIOLOGY) ITEM SPECIFICATIONS

LIFE AND ENVIRONMENTAL SCIENCES

Standard 4: STRUCTURE AND FUNCTION IN ORGANISMS: Understand the structures and functions of living organisms and how organisms can be compared scientifically
--

Topic: Cells, Tissues, Organs, and Organ Systems

SC.BS.4.3 —Differentiate between the processes of mitosis and meiosis
--

Essence: *Mitosis and meiosis are different processes for cell division.*

Content Specification 1: Use a model to demonstrate the division and regrouping of chromosomes.

Content Specification 2: Sequence the steps of cell division.

Content Specification 3: Recognize that cells reproduce by dividing.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Items may require students to compare the difference between mitosis and meiosis and their roles in reproduction.

Sample Item Stems

Content Specification 1:

Show me, which model shows cells that have been divided and have the same number of chromosomes as the parent cells?

Content Specification 2:

Show me, which model shows cells after they have divided?

Content Specification 3:

Say: ***Let's look at a model of cells dividing. Cells reproduce by dividing and creating new cells.***

HIGH SCHOOL (BIOLOGY) ITEM SPECIFICATIONS

LIFE AND ENVIRONMENTAL SCIENCES

Standard 4: STRUCTURE AND FUNCTION IN ORGANISMS: Understand the structures and functions of living organisms and how organisms can be compared scientifically
--

Topic: Cells, Tissues, Organs, and Organ Systems

SC.BS.4.4 —Describe how homeostatic balance occurs in cells and organisms
--

Essence: *Cells and organisms seek homeostasis.*

Content Specification 1: Identify a process in which a body seeks homeostasis.

Content Specification 2: Identify ways the body reacts to stimuli.

Content Specification 3: Recognize reactions to stimuli.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Items that require students to explain how specific systems respond to or compensate for a change in physiological or environmental conditions (e.g., cells, tissues, organs, organ systems; osmosis and diffusion) can be included.
- Items that require students to explain how one homeostatic process affects another in maintaining balance in cells and organisms can be included.

Sample Item Stems

Content Specification 1:

Show me, what is one way our bodies try to remain at the same temperature when the weather is hot?

Content Specification 2:

Show me, what is the body's reaction to feeling cold?

Content Specification 3:

Say: ***Let's look at a way in which our bodies change when the temperature rises. When we get too hot, our bodies produce sweat.***

HIGH SCHOOL (BIOLOGY) ITEM SPECIFICATIONS

LIFE AND ENVIRONMENTAL SCIENCES

Standard 4: STRUCTURE AND FUNCTION IN ORGANISMS: Understand the structures and functions of living organisms and how organisms can be compared scientifically

Topic: Cells, Tissues, Organs, and Organ Systems

SC.BS.4.5—Describe the components and functions of a variety of macromolecules active in biological systems

Essence: *Carbohydrates, fats, nucleic acids, and proteins have specific components and functions.*

Content Specification 1: Describe the functions of different macromolecules and their building blocks (e.g., amino acids are the building blocks of proteins).

Content Specification 2: Recognize that macromolecules are made up of smaller subunits.

Content Specification 3: Recognize different examples of macromolecules (e.g., fats, proteins, carbohydrates, nucleic acids).

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Items that require students to identify the building blocks of and explain the functions of a variety of macromolecules active in biological systems can be included.
- Examples of appropriate macromolecules include, but are not limited to, carbohydrates, nucleic acids, lipids, and proteins.

Sample Item Stems

Content Specification 1:

Show me, what are proteins made from?

Content Specification 2:

Show me, is DNA made from even smaller units?

Content Specification 3:

Say: ***Let's look at a model of a macromolecule. A protein is a macromolecule that is made up of subunits called amino acids.***

HIGH SCHOOL (BIOLOGY) ITEM SPECIFICATIONS

LIFE AND ENVIRONMENTAL SCIENCES

Standard 4: STRUCTURE AND FUNCTION IN ORGANISMS: Understand the structures and functions of living organisms and how organisms can be compared scientifically

Topic: Classification

SC.BS.4.6—Explain the organization of life on the Earth using the modern classification system

Essence: *Organisms are classified using the modern classification system.*

Content Specification 1: Sort organisms into kingdoms by characteristic.

Content Specification 2: Order the hierarchy of the modern classification system.

Content Specification 3: Identify the plant, animal, and fungus kingdoms.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Items that require students to classify a variety of organisms using the modern classification system and explain the evidence that supports the system's organization (e.g., structural similarities, the fossil record, and genetic relationships among organisms).
- Items that require students to decide how to classify organisms that do not easily fit into the modern classification system may be included.

Sample Item Stems

Content Specification 1:

Show me, in which kingdom are fish classified?

Content Specification 2:

Show me, which group contains more organisms than an order?

Content Specification 3:

Show me, what is an example of a kingdom?

HIGH SCHOOL (BIOLOGY) ITEM SPECIFICATIONS

LIFE AND ENVIRONMENTAL SCIENCES

Standard 5: DIVERSITY, GENETICS, AND EVOLUTION: Understand genetics and biological evolution and their impact on the unity and diversity of organisms

Topic: Biological Evolution

SC.BS.5.1—Explain the theory of evolution and describe evidence that supports this theory

Essence: *The theory of evolution explains the change across successive generations in a biological population.*

Content Specification 1: Describe causes of evolution.

Content Specification 2: Describe progressions of different evolutionary cycles.

Content Specification 3: Identify examples of evolution.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Items that require students to explain that Earth’s present day life forms have evolved from earlier, distinctly different species and describe molecular and anatomical evidences that support the theory of evolution can be included.
- Examples of sources of evidence that support the theory of evolution include, but are not limited to, DNA, protein sequence analysis, comparative embryology, and fossil records.

Sample Item Stems

Content Specification 1:

Show me, what might have caused this change in the finches’ beaks over time?

Content Specification 2:

Show me, which change occurred during the evolution of the whale?

Content Specification 3:

Show me, which organism is an ancestor of this organism?

HIGH SCHOOL (BIOLOGY) ITEM SPECIFICATIONS

LIFE AND ENVIRONMENTAL SCIENCES

Standard 5: DIVERSITY, GENETICS, AND EVOLUTION: Understand genetics and biological evolution and their impact on the unity and diversity of organisms
--

Topic: Biological Evolution

SC.BS.5.2 —Explain the theory of natural selection

Essence: *The theory of natural selection explains how biological traits become either more or less common in a population over time.*

Content Specification 1: Discuss reasons why a species may or may not survive in an environment.

Content Specification 2: Identify traits an organism needs to survive in a particular habitat.

Content Specification 3: Match an organism to a habitat.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Items that require students to provide examples of how natural selection accounts for the diversity and unity of past and present life forms can be included.
- Items that require students to use the theory of natural selection to analyze the differences between related organisms can be included.
- Some examples of organisms that may be used as examples of products of natural selection include, but are not limited to, Darwin’s finches, snails, the Nene, lobelia, silverswords, and honeycreepers. (Examples should not be limited to Hawaiian organisms.)

Sample Item Stems

Content Specification 1:

Show me, which rabbit is more likely to survive in a snowy habitat?

Content Specification 2:

Show me, what does the animal need to survive in the habitat?

Content Specification 3:

Show me, which animal survives in an aquatic habitat?

HIGH SCHOOL (BIOLOGY) ITEM SPECIFICATIONS

LIFE AND ENVIRONMENTAL SCIENCES

Standard 5: DIVERSITY, GENETICS, AND EVOLUTION: Understand genetics and biological evolution and their impact on the unity and diversity of organisms

Topic: Unity and Diversity

SC.BS.5.3—Explain the structural properties of DNA and the role of DNA in heredity and protein synthesis

Essence: DNA contains genetic information that is passed from parent (cell or organism) to offspring.

Content Specification 1: Discuss the idea that genes are passed from one generation to the next through DNA.

Content Specification 2: Identify the function of DNA.

Content Specification 3: Identify DNA.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Items that require students to diagram and explain the role of DNA in heredity and proteins synthesis (e.g., DNA replication, translation, transcription, mRNA, and codons) can be included.

Sample Item Stems

Content Specification 1:

Show me, what structure contains genetic information that is passed from parents to their offspring?

Content Specification 2:

Show me, which molecule is the code for our traits?

Content Specification 3:

Say: *Here is a model of DNA. Its shape is called a “double helix,” and it is a code that is translated into proteins.*

HIGH SCHOOL (BIOLOGY) ITEM SPECIFICATIONS

LIFE AND ENVIRONMENTAL SCIENCES

Standard 5: DIVERSITY, GENETICS, AND EVOLUTION: Understand genetics and biological evolution and their impact on the unity and diversity of organisms

Topic: Unity and Diversity

SC.BS.5.4—Explain how Mendel’s laws of heredity can be used to determine the traits of possible offspring

Essence: Mendel’s laws of heredity explain how characteristics are passed from parent organisms to their offspring.

Content Specification 1: Using a simple Punnett square, discuss the concepts of dominant and recessive traits.

Content Specification 2: Using a model, create a Punnett square using a simple trait (e.g., dominant and recessive traits).

Content Specification 3: Recognize that probability is related to the use of a Punnett square.

Acceptable Item Types

- Two-option multiple-choice items
- Three-option multiple-choice items

Content Limits

- Items that require students to describe the various gene combinations of two parents to determine the genotype and phenotype of possible offspring using Mendel’s laws may be included.
- Pedigrees and Punnett squares may be included.
- Students can be asked to use Punnett squares (with no more than two traits) to predict probabilities of phenotypes and genotypes. Answers should be kept as ratios (e.g., 3:4) so items do not rely on a student’s math skills.
- Test crosses can be included in items, but students should not be expected to recall the definition of a test cross.

Sample Item Stems

Content Specification 1:

Show me, will most of the offspring have the dominant or recessive trait?

Content Specification 2:

Let’s complete this Punnett square. Show me, what should be placed in this box?

Content Specification 3:

Say: ***Let’s look at this Punnett square and work together to find the probability of seeing purple flowers in the next generation.***

HIGH SCHOOL (BIOLOGY) ITEM SPECIFICATIONS**LIFE AND ENVIRONMENTAL SCIENCES**

Standard 5: DIVERSITY, GENETICS, AND EVOLUTION: Understand genetics and biological evolution and their impact on the unity and diversity of organisms
--

Topic: Unity and Diversity

SC.BS.5.5—Explain chromosomal mutations, their possible causes, and their effects on genetic variation
--

Essence: Chromosomal mutations result in genetic variation.

~~**Content Specification 1:** Describe the causes and effects of mutated cells.~~

~~**Content Specification 2:** Distinguish between harmful and beneficial mutations.~~

~~**Content Specification 3:** Recognize observable genetic variation.~~