ARIZONA SCIENCE TEST

AzSCI Item Specifications Grade Band HS

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Prepared by the Arizona Department of Education

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Introduction

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

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

The AzSCI Item Specifications provide resource documents that define the content and format of the test and test items for item writers and reviewers. Each Item Specifications document indicates the alignment of items with the Arizona Science Standards. It also serves to provide all stakeholders with information about the scope and function of assessment items. This document can also serve to assist educators in understanding how assessment items are developed in alignment with the standards for science.

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

Standards Description

Purpose of the Arizona Science Standards

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

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

Core Ideas

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

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

Scientific and Engineering Practices (SEPs)

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

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

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

**Assessment purpose only.

Crosscutting Concepts (CCCs)

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

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

Coding and Navigating the Standards

Standard: Grade 3, Core Ideas L2 and U1, standard number 8

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

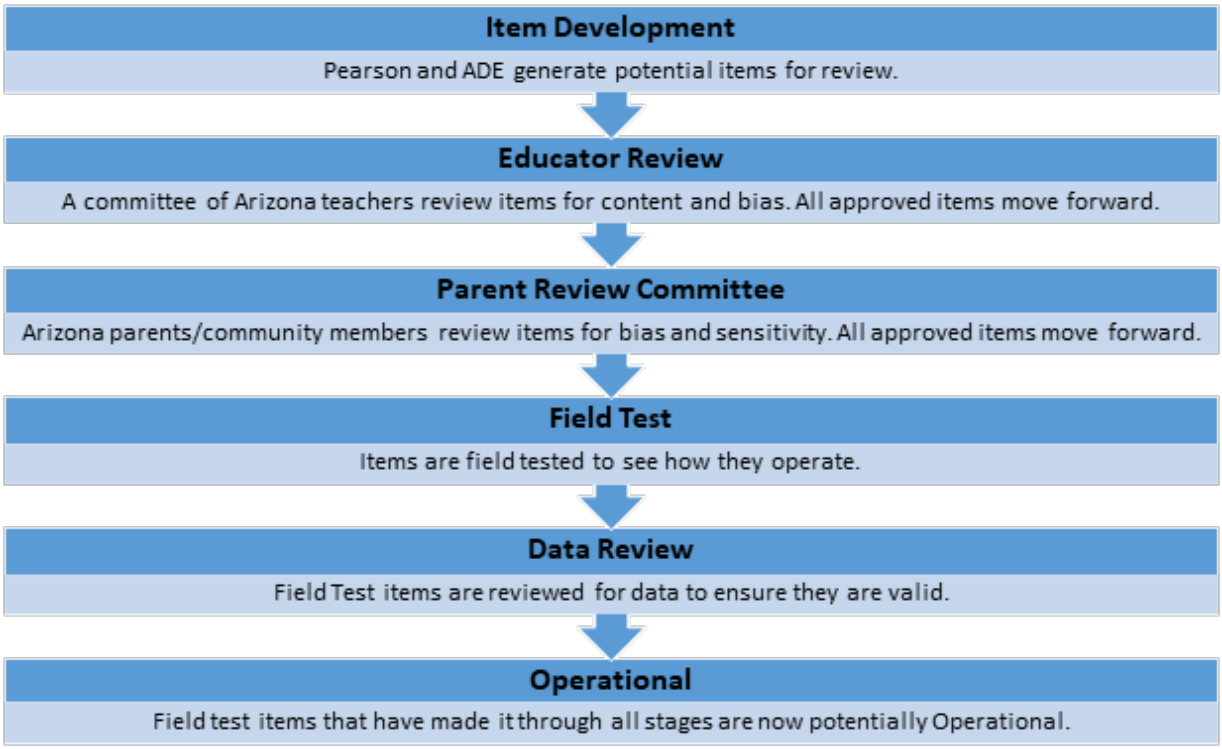
3.L2U1.8	Crosscutting Concepts & Background Information for Educators
Construct an argument from evidence that organisms are interdependent.	**Crosscutting Concepts:** Patterns, Cause and Effect, Scale, Proportion and Quantity; **Systems and System Models**; Energy and Matter; **Structure and Function**; Stability and Change[4] **Background Information:** **Animals** and **plants** alike generally need to take in air and water, animals must take in food, and plants need light and **minerals**; **anaerobic** life, such as **bacteria** in the gut, functions without air. Food provides animals with the materials they need for **body repair** and **growth** and is **digested** to release the **energy** they need to maintain body warmth and for motion. Plants acquire their material for growth chiefly from air and water and process matter they have formed to maintain their **internal conditions** (e.g., at night).[1(p. 148)] Animals need food that they can break down, which comes either directly by eating plants (**herbivores**) or by eating animals (**carnivores**) which have eaten plants or other animals. Animals are ultimately dependent on plants for their survival. The relationships among organisms can be represented as food chains and food webs. Some animals are dependent on plants in other ways as well as for food, for example for shelter and, in the case of human beings, for clothing and fuel. Plants also depend on animals in various ways. For example, many flowering plants depend on insects for pollination and on other animals for dispersing their seeds.[2(p. 27)]

SEP: Engaging in Argument from Evidence

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

Item Development Process

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



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

Test Design and Blueprint Tables

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

Each assessment form is composed of 60 items. There are three test units with 20 items in each unit. The approximate time for each test unit is 60 minutes.

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

AzSCI Blueprint

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

AzSCI Assessment Grade Band 9–11 Blueprint

Domain	Percent Range
Science and Engineering Practices and Crosscutting Concepts in Physical Sciences	32%–40%
Science and Engineering Practices and Crosscutting Concepts in Life Sciences	34%–42%
Science and Engineering Practices and Crosscutting Concepts in Earth and Space Sciences	22%–30%

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

AzSCI TAGS

Task	Percent Range
Doing tasks	0%– 5%
Guided tasks	66%– 84%
Scripted tasks	16%–28%

SEP Coverage

Practice	Percent Range
Investigating	16%–26%
Sensemaking	34%–48%
Critiquing	24%–38%

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

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

Cognitive Complexity

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

The Task Analysis Guide in Science (TAGS) was developed for classroom use to evaluate cognitive demand with integration of practices and content (see Tekkumsu-Kisa, Stein, & Schunn, *A Framework for Analyzing Cognitive Demand and Content-Practices Integration: Task Analysis Guide in Science [TAGS]*, 2015). The classroom model is now being adapted for use on assessments (see Center on Standards and Assessment Implementation, *Cognitive Loading in Three-Dimensional NGSS Assessment: Knowledge, Skills, and Know-How)*, 2019.
Arizona modified these models for the AzSCI assessment in order to more accurately recognize that cognitive demand increases as the number of integrated dimensions increases.

AZ Task Analysis Guide in Science

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

These models are intended to enable a user to navigate AzSCI items and focus on how to use the principle of developing AzSCI Item Sets and Item Types.

Item Sets and Item Types

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

Independent Item Set	Cluster Item Set
Aligns to at least one standard	Aligns to at least one standard
Three or more associated items	Five associated items
Items must function independently and do not need to be related.	All five items will be placed on the same form and should work together to show understanding of the phenomena.
Items can target various difficulty levels.	Avoid large differences in difficulty levels of items within a cluster set of five items.
Stimulus has a maximum of two tabs.	Stimulus has a maximum of four tabs.

Item Types

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

For paper-based assessments (including those for students with an IEP or 504 plan that specifies a paper-based accommodation), TEIs will be modified so that they can be key entered and scored electronically.

Item Type	Specifications
Multiple Choice (MC)	Four image, math, or text-based choices with a single correct choice
Multiple Response (MR)	Five to six image, math, or text-based choices with two or three correct choices
Inline Choice	Multiple drop-down menus are used within a range of text to provide several options consisting of words or phrases.
Bar Graph	Vertical bar graph
Point Graph	Points are plotted on a graph.
Hot Spot	Object Selection, Graphic Change. One or more images or portions of an image are selected.
Match	Responses are dragged into text gaps.
Gap Match	Drag and Drop. Responses are dragged into categories.
Graphic Gap Match	Graphic Gap Match interactions are drag and drop that include responses that are images.
Gap Match - Table	Responses are dragged into a table grid.

Item Type	Specifications
Match - Table Grid	Responses are indicated by selecting radio buttons or checkboxes within a table grid.
Two-Part Independent (TPI)	Any combination of item types. Two-part independent (TPI) items will be weighted as two points, one point awarded for each part. TPI items ask the student to demonstrate a deeper understanding of the standard by completing two separate thought processes.
Two-Part Dependent (TPD)	Any combination of item types. Two-part dependent (TPD) items will be weighted as one point (no partial credit). TPD items ask students to demonstrate their understanding of the standard by selecting a claim in Part A and identifying supporting evidence in Part B. Correctly answering Part B is dependent on correctly answering Part A and is part of the same thought process.

Universal Tools

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

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

Answer Eliminator: Students can use this tool to cross out answers they believe are incorrect.

Notepad: Allows students to take notes on each item screen.

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

Highlighter: Students select words on the screen to highlight.

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

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

Calculator:

Grade 5: A four-function calculator is permitted on AzSCI. The Desmos four-function calculator is embedded in the online AzSCI test.

Grades 8 and 11: A scientific calculator is permitted on AzSCI. The scientific calculator should include these functions: standard four functions (addition, subtraction, multiplication, and division), decimal, change sign (+/-), parentheses, square root, and π. They may NOT include: any problem-solving or

programming capabilities, place values, or inequalities. Sample acceptable calculator: TI-30X IIS or similar. The Desmos Scientific calculator is embedded in the online AzSCI test.

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

Development

The AzSCI stimuli and items go through rigorous development and review processes before being used on an assessment. All stimuli and items are approved by Arizona educators and community members as part of the processes.

The development process begins with developing a phenomenon. Once it is determined that the phenomenon is a good fit to assess the intended standards and dimensions, the stimuli and then items are developed using the phenomenon document as the focus and starting point.

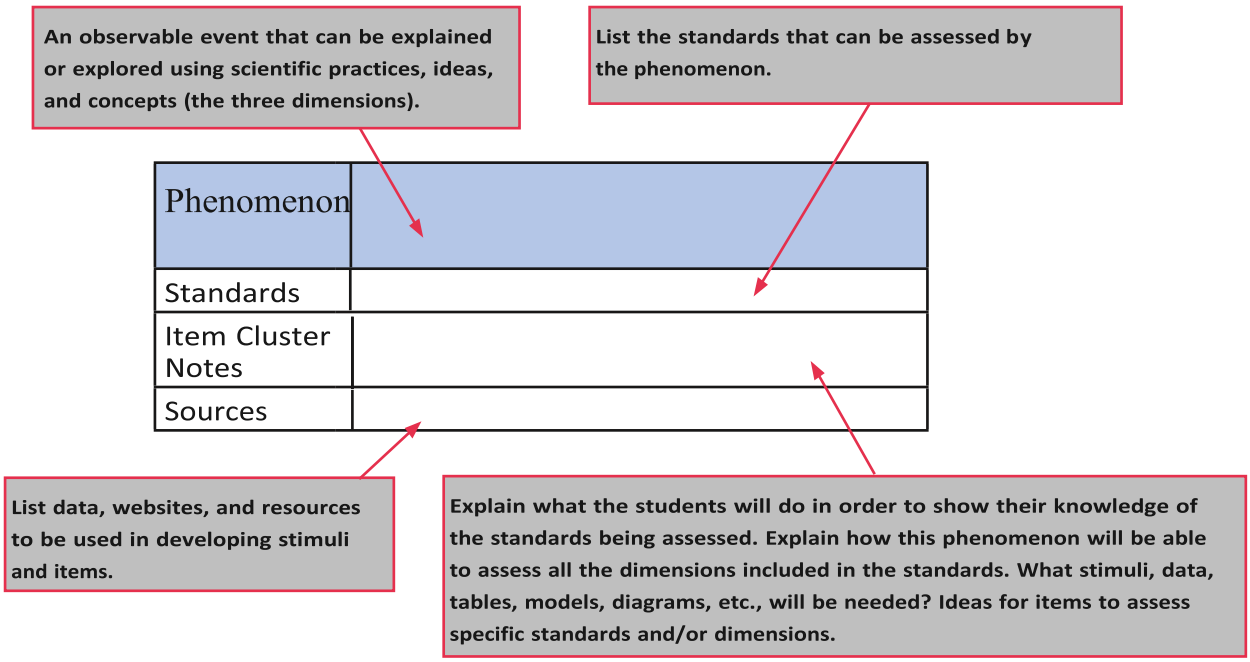
Phenomena Outline

The Arizona Science Standards are not intended to be taught or assessed one at a time or in isolation. Therefore, cluster item sets can be a useful step in organizing phenomena. Item developers group standards together in manageable arrangements to help students and teachers look for the connections between ideas that naturally exist in the sciences.

AzSCI stimuli and items are designed by first developing phenomena documents such as the ones shown here. These documents help focus the topic and guide the development of stimuli and items.

Stimuli Development Criteria

- Have a phenomenon statement that incorporates the standards and three dimensions to explain
- Based on real verifiable data
- Creative and interesting to students
- Free of bias and sensitivity concerns
- Concise with only necessary information



Examples of Phenomena Development

An example and template of Phenomena Development is provided to demonstrate some of the many ways Arizona Science Standards can be grouped together to support the development of a cohesive assessment cluster.

This is an example of Phenomena Development for an item set. Actual items can be viewed for practice on the AzSCI Sample Test at https://www.azed.gov/assessment/resources.

High School Independent Item Set

Phenomenon	The biodiversity of insects on nature preserves in western Europe has been steadily declining for over 20 years. (this would focus on HS.L2U3.18 only).
Standards	**HS .L2U3 .18: Obtain, evaluate, and communicate** about the positive and negative ethical, social, economic, and political implications of human activity on the biodiversity of an ecosystem.
Item Cluster Notes	Students will be presented with evidence of declining biodiversity in European insect populations over the past 20 years. Additional information about changes in land use and commensurate losses of plant biodiversity will be used to support L2. Second source demonstrates the linkage between plant and insect diversity. Items may also explore the idea that the establishment of preserves is meant to preserve the ecological linkages without undue competition from crops, etc. To support U3, an item may explore the social and economic impacts of reduced insect biodiversity. For example, students may be asked to consider the economic impacts that would come with continue loss of natural pollinators. To deepen support of U3, an item may present the finding from the third source (i.e. that some protected areas may be

	turning into ecological traps due to outside influences). The implication of this finding is significant – while establishing preserves usually makes sound ecological sense, this finding calls that assumption into question and raises numerous ethical and political questions about how to mitigate further losses of insect biodiversity.
Sources	**Loss of insect biodiversity:** https://www.sciencemag.org/news/2017/05/where-have-all-insects-gone **Linkage of plant biodiversity with insect biodiversity:** https://www.nature.com/articles/s41467-019-09448-8 Study suggesting that large-scale factors like climate change and agricultural development may be so influential that they might turn protected areas into ecological traps: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0185809

High School Cluster Item Set

Phenomenon	Celestial bodies including stars like the sun, and planets like those in the solar system, have characteristics and interactions that are predictable.
Standards	**Essential HS .E2U1 .15 Construct an explanation based on evidence** to illustrate the role of nuclear fusion in the life cycle of a star. **Essential HS .E2U1 .16 Construct an explanation** of how gravitational forces impact the evolution of planetary motion, structure, surfaces, atmospheres, moons, and rings. **Essential HS .E2U1 .17 Construct an explanation** of the origin, expansion, and scale of the universe based on astronomical evidence.
Item Cluster Notes	Students examine diagrams, data, and/or patterns that can be analyzed or used as evidence to support or explain the concepts in the standards in terms of cause-effect; energy and matter; and or stability and change.
Sources	https://snews.bnl.gov/popsci/fusion.html https://iter-qa.ornl.gov/sites/default/files/2018-06/About_Fusion.pdf https://www.osti.gov/includes/opennet/includes/Understanding%20the%20Atom/Controlled%20Nuclear%20Fusion%20V.2.pdf https://earthobservatory.nasa.gov/features/OrbitsHistory/page2.php https://solarsystem.nasa.gov/resources/310/orbits-and-keplers-laws/ https://scienceandtechnology.jpl.nasa.gov/research/research-topics-list/astrophysicsspace-sciences/origin-universe https://science.nasa.gov/science-news/science-at-nasa/1999/ast25may99_1

Phenomena Template

Phenomenon	
Standards	
Item Cluster Notes	
Sources	

Key Terms

- ***Cluster.*** A stimuli and 5 items assessed together on the assessment.
- ***Crosscutting Concept*** *(CCC).* There are seven crosscutting concepts in the Arizona Science Standards.
- ***Grade Band.*** A grade band is a set of grades for elementary grades (K–2 and 3–5), middle school (6–8), or high school (9–12).
- ***Independent Item Set.*** A group of stimuli with associated items designed to be assessed independently from each other.
- ***Phenomenon.*** Something observable that happens in the real world, whether natural or man-made. Student inquiry about phenomena—together with student-driven designing of solutions to problems—should drive instruction.
- ***Science and Engineering Practice*** *(SEP).* There are eight practices described by the Arizona Science Standards.
- ***Standard Core Idea*** *(CI).* The CIs are defined by the Arizona Science Standards, with the associated elements identified as the foundation of each standard.
- ***Task Analysis Guide in Science*** *(TAGS).* TAGS was developed for classroom use to evaluate cognitive demand with integration of practices and content.

AZ High School Item/Standard Specifications

Standard	**Essential HS.P1U1.1** **Develop and use models** to explain the relationship of the structure of atoms to patterns and properties observed within the Periodic Table and describe how these models are revised with new evidence.
SEPs	**Develop and use models**
CCCs	Patterns; Cause and Effect; Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; Stability and Change; Structure and Function
Assessment Boundaries	Not applicable
Stimulus Materials	Models, Figures, Diagrams
Item Types	MC, Hot Spot, Text Entry

Standard	**Essential HS.P1U1.2** **Develop and use models** for the transfer or sharing of electrons to predict the formation of ions, molecules, and compounds in both natural and synthetic processes.
SEPs	**Develop and use models**
CCCs	Patterns; Cause and Effect; Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; Stability and Change; Structure and Function
Assessment Boundaries	Not applicable
Stimulus Materials	Models, Figures, Diagrams
Item Types	Inline Choice, MC, Gap Match, Text Entry

Standard	**Essential HS.P1U1.3** **Ask questions, plan, and carry out investigations** to explore the cause and effect relationship between reaction rate factors.
SEPs	**Ask questions and define problems, Plan and carry out investigations**
CCCs	Patterns; Cause and Effect; Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; Stability and Change; Structure and Function
Assessment Boundaries	Not applicable
Stimulus Materials	Figures, Diagrams, Graphs, Tables
Item Types	MC, Inline Choice, Hot Spot, Multiple Select

Standard	**Essential HS.P1U3.4** **Obtain, evaluate, and communicate information** about how the use of chemistry related technologies have had positive and negative ethical, social, economic, and/or political implications.
SEPs	**Obtaining, Evaluating, and Communicating Information**
CCCs	Patterns; Cause and Effect; Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; Stability and Change; Structure and Function
Assessment Boundaries	Not applicable
Stimulus Materials	Figures, Diagrams, Graphs, Tables
Item Types	MC

Standard	**Essential HS.P2U1.5** **Construct an explanation** for a field's strength and influence on an object (electric, gravitational, magnetic).
SEPs	**Constructing Explanations and Designing Solutions**
CCCs	Patterns; Cause and Effect; Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; Stability and Change; Structure and Function
Assessment Boundaries	Not applicable
Stimulus Materials	Figures, Diagrams, Graphs, Tables
Item Types	MC, Graphic Gap Match, Inline Choice, Multiple Select, Point Graph, Hot Spot

Standard	**Essential HS.P3U1.6** **Collect, analyze and interpret data** regarding the change in motion of an object or system in one dimension, to construct an explanation using Newton's Laws.
SEPs	**Analyze and Interpret Data**
CCCs	Patterns; Cause and Effect; Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; Stability and Change; Structure and Function
Assessment Boundaries	Not applicable
Stimulus Materials	Figures, Diagrams, Graphs, Tables
Item Types	MC, Inline Choice, Match, Point Graph, Multiple Select, Graphic Gap Match

Standard	**Essential HS.P3U2.7** **Use mathematics and computational thinking** to explain how Newton's laws are used in engineering and technologies to create products to serve human ends.
SEPs	**Using Mathematics and Computational Thinking**
CCCs	Patterns; Cause and Effect; Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; Stability and Change; Structure and Function
Assessment Boundaries	Not applicable
Stimulus Materials	Figures, Diagrams, Graphs, Tables
Item Types	MC, Inline Choice

Standard	**Essential HS.P4U1.8** **Engage in argument from evidence** that the net change of energy in a system is always equal to the total energy exchanged between the system and the surroundings.
SEPs	**Engaging in Argument from Evidence**
CCCs	Patterns; Cause and Effect; Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; Stability and Change; Structure and Function
Assessment Boundaries	Not applicable
Stimulus Materials	Figures, Diagrams, Graphs, Tables
Item Types	MC, Bar Graph, Inline Choice, Gap Match

Standard	**Essential HS.P4U3.9** **Engage in argument from evidence** regarding the ethical, social, economic, and/or political benefits and liabilities of energy usage and transfer.
SEPs	**Engaging in Argument from Evidence**
CCCs	Patterns; Cause and Effect; Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; Stability and Change; Structure and Function
Assessment Boundaries	Not applicable
Stimulus Materials	Figures, Diagrams, Graphs, Tables
Item Types	MC

Standard	**Essential HS.P4U1.10** **Construct an explanation** about the relationships among the frequency, wavelength, and speed of waves traveling in various media, and their applications to modern technology.
SEPs	**Construct explanations and design solutions**
CCCs	Patterns; Cause and Effect; Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; Stability and Change; Structure and Function
Assessment Boundaries	Not applicable
Stimulus Materials	Figures, Diagrams, Graphs, Tables
Item Types	MC, Graphic Gap Match, Inline Choice, Multiple Select, Point Graph, Hot Spot

Standard	**Essential HS.E1U1.11** **Analyze and interpret data** to determine how energy from the Sun affects weather patterns and climate.
SEPs	**Analyze and interpret data**
CCCs	Patterns; Cause and Effect; Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; Stability and Change; Structure and Function
Assessment Boundaries	Not applicable
Stimulus Materials	Figures, Diagrams, Graphs, Tables
Item Types	MC, Match, Hot Spot, Match - Table Grid, Multiple Select

Standard	**Essential HS.E1U1.12** **Develop and use models** of the Earth that explains the role of energy and matter in Earth's constantly changing internal and external systems (geosphere, hydrosphere, atmosphere, biosphere).
SEPs	**Develop and use models**
CCCs	Patterns; Cause and Effect; Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; Stability and Change; Structure and Function
Assessment Boundaries	Not applicable
Stimulus Materials	Models, Figures, Diagrams
Item Types	MC, Bar Graph, Match - Table Grid, Hot Spot, Inline Choice, Multiple Select

Standard	**Essential HS.E1U1.13**
	Evaluate explanations and theories about the role of energy and matter in geologic changes over time.
SEPs	**Constructing Explanations and Designing Solutions**
CCCs	Cause and Effect; Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; Stability and Change
Assessment Boundaries	Not applicable
Stimulus Materials	Figures, Diagrams, Graphs, Tables
Item Types	MC

Standard	**Essential HS.E1U3.14**
	Engage in argument from evidence about the availability of natural resources, occurrence of natural hazards, changes in climate, and human activity and how they influence each other.
SEPs	**Engaging in Argument from Evidence**
CCCs	Patterns; Cause and Effect; Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; Stability and Change; Structure and Function
Assessment Boundaries	Not applicable
Stimulus Materials	Figures, Diagrams, Graphs, Tables
Item Types	MC, Match - Table Grid

Standard	**Essential HS.E2U1.15** **Construct an explanation based on evidence** to illustrate the role of nuclear fusion in the life cycle of a star.
SEPs	**Constructing Explanations and Designing Solutions**
CCCs	Patterns; Cause and Effect; Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; Stability and Change; Structure and Function
Assessment Boundaries	Not applicable
Stimulus Materials	Figures, Diagrams, Graphs, Tables
Item Types	MC, Multiple Select

Standard	**Essential HS.E2U1.16** **Construct an explanation** of how gravitational forces impact the evolution of planetary motion, structure, surfaces, atmospheres, moons, and rings.
SEPs	**Constructing Explanations and Designing Solutions**
CCCs	Patterns; Cause and Effect; Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; Stability and Change; Structure and Function
Assessment Boundaries	Not applicable
Stimulus Materials	Figures, Diagrams, Graphs, Tables
Item Types	MC, Inline Choice, Hot Spot, Match - Table Grid

Standard	**Essential HS.E2U1.17** **Construct an explanation** of the origin, expansion, and scale of the universe based on astronomical evidence.
SEPs	**Constructing Explanations and Designing Solutions**
CCCs	Patterns; Cause and Effect; Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; Stability and Change; Structure and Function
Assessment Boundaries	Not applicable
Stimulus Materials	Figures, Diagrams, Graphs, Tables
Item Types	MC, Inline Choice, Hot Spot

Standard	**Essential HS.L2U3.18** **Obtain, evaluate, and communicate** about the positive and negative ethical, social, economic, and political implications of human activity on the biodiversity of an ecosystem.
SEPs	**Obtaining, Evaluating, and Communicating Information**
CCCs	Patterns; Cause and Effect; Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; Stability and Change; Structure and Function
Assessment Boundaries	Not applicable
Stimulus Materials	Figures, Diagrams, Graphs, Tables
Item Types	MC, Inline Choice, Multiple Select, Hot Spot, Match, Match - Table Grid

Standard	**Essential HS.L2U1.19** **Develop and use models** that show how changes in the transfer of matter and energy within an ecosystem and interactions between species may affect organisms and their environment.
SEPs	**Develop and Use Models**
CCCs	Patterns; Cause and Effect; Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; Stability and Change; Structure and Function
Assessment Boundaries	Not applicable
Stimulus Materials	Models, Figures, Diagrams
Item Types	MC, Match - Table Grid

Standard	**Essential HS.L1U1.20** **Ask questions and/or make predictions** based on observations and evidence to demonstrate how cellular organization, structure, and function allow organisms to maintain homeostasis.
SEPs	**Asking Questions and Defining Problems**
CCCs	Patterns; Cause and Effect; Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; Stability and Change; Structure and Function
Assessment Boundaries	Not applicable
Stimulus Materials	Figures, Diagrams, Graphs, Tables
Item Types	MC

Standard	**Essential HS.L2U1.21**
	Obtain, evaluate, and communicate data showing the relationship of photosynthesis and cellular respiration; flow of energy and cycling of matter.
SEPs	**Obtaining, Evaluating, and Communicating Information**
CCCs	Patterns; Cause and Effect; Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; Stability and Change; Structure and Function
Assessment Boundaries	Not applicable
Stimulus Materials	Figures, Diagrams, Graphs, Tables
Item Types	MC

Standard	**Essential HS.L1U1 .22**
	Construct an explanation for how cellular division (mitosis) is the process by which organisms grow and maintain complex, interconnected systems.
SEPs	**Constructing Explanations and Designing Solutions**
CCCs	Patterns; Cause and Effect; Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; Stability and Change; Structure and Function
Assessment Boundaries	Not applicable
Stimulus Materials	Figures, Diagrams, Graphs, Tables
Item Types	MC

Standard	**Essential HS.L3U1.24** **Construct an explanation** of how the process of sexual reproduction contributes to genetic variation.
SEPs	**Constructing Explanations and Designing Solutions**
CCCs	Patterns; Cause and Effect; Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; Stability and Change; Structure and Function
Assessment Boundaries	Not applicable
Stimulus Materials	Figures, Diagrams, Graphs, Tables
Item Types	MC

Standard	**Essential HS.L3U1.25** **Obtain, evaluate, and communicate information** about the causes and implications of DNA mutation.
SEPs	**Obtaining, Evaluating, and Communicating Information**
CCCs	Patterns; Cause and Effect; Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; Stability and Change; Structure and Function
Assessment Boundaries	Not applicable
Stimulus Materials	Figures, Diagrams, Graphs, Tables
Item Types	MC

Standard	**Essential HS.L3U3.26** **Engage in argument from evidence** regarding the ethical, social, economic, and/or political implications of a current genetic technology.
SEPs	**Engaging in Argument from Evidence**
CCCs	Patterns; Cause and Effect; Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; Stability and Change; Structure and Function
Assessment Boundaries	Not applicable
Stimulus Materials	Figures, Diagrams, Graphs, Tables
Item Types	MC

Standard	**Essential HS.L4U1.27** **Obtain, evaluate, and communicate** evidence that describes how changes in frequency of inherited traits in a population can lead to biological diversity.
SEPs	**Obtaining, Evaluating, and Communicating Information**
CCCs	Patterns; Cause and Effect; Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; Stability and Change; Structure and Function
Assessment Boundaries	Not applicable
Stimulus Materials	Figures, Diagrams, Graphs, Tables
Item Types	MC

Standard	**Essential HS.L4U1.28** **Gather, evaluate, and communicate** multiple lines of empirical evidence to explain the mechanisms of biological evolution.
SEPs	**Obtaining, Evaluating, and Communicating Information**
CCCs	Patterns; Cause and Effect; Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; Stability and Change; Structure and Function
Assessment Boundaries	Not applicable
Stimulus Materials	Figures, Diagrams, Graphs, Tables
Item Types	MC

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