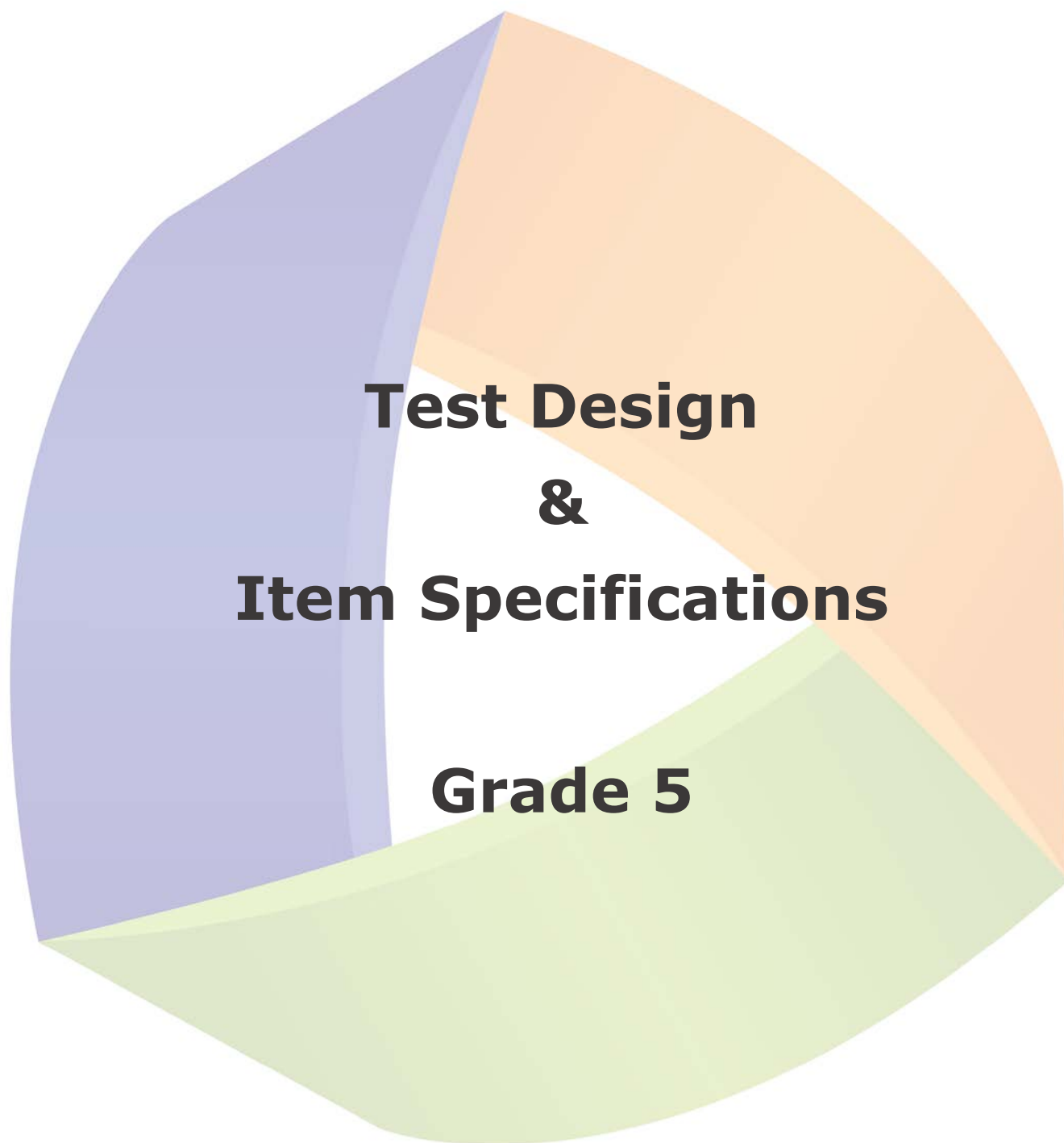


Washington Comprehensive Assessment of Science



Office of Superintendent of Public Instruction

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Purpose Statement

The purpose of the Washington Comprehensive Assessment of Science (WCAS) is to measure the level of science proficiency that Washington students have achieved based on the [Washington State 2013 K–12 Science Learning Standards](#). The standards are the *Next Generation Science Standards* (NGSS), and are organized into four domains: Physical Sciences; Life Sciences; Earth and Space Sciences; and Engineering, Technology, and the Applications of Science. Each domain has three-dimensional performance expectations that integrate science and engineering practices, disciplinary core ideas, and crosscutting concepts. The assessments were first administered in grades 5, 8, and 11 for federal and state accountability purposes in spring 2018.

This item specifications document describes how the item clusters (stimuli and items) and standalone items for the WCAS assessments are developed to assess the NGSS (referred to as “the standards” in the remainder of this document) and includes the second publicly released drafts of the item specifications for the WCAS.

The item specifications are based on the Performance Expectations (PEs) in the standards. The item specification for an individual PE describes how students can demonstrate understanding of the PE on the WCAS. The current draft represents a small sample of PEs; full PE coverage should be achieved by the end of the 2018-19 school year. The item specifications will be updated annually based on input from Washington educators. Future drafts will include a modification log that will be updated at each subsequent publication.

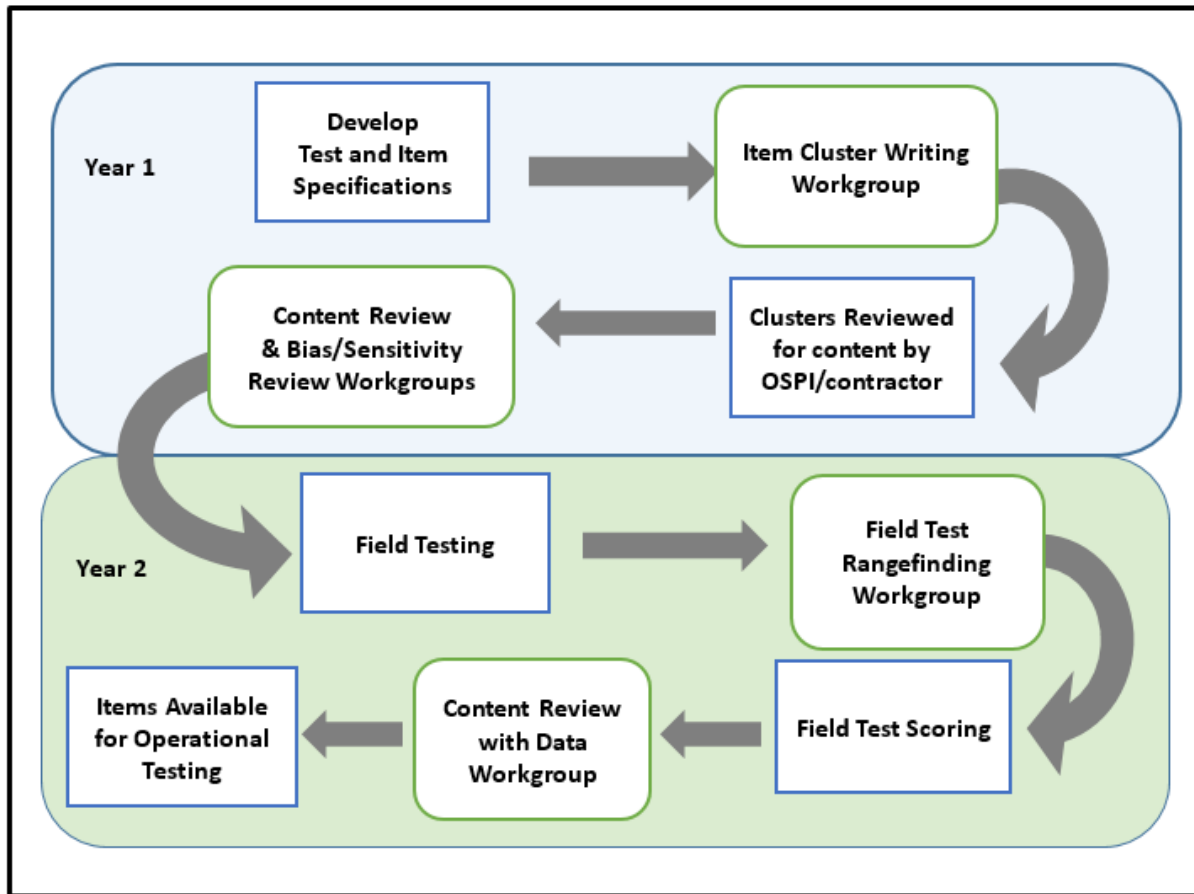
Assessment Development Cycle

The WCAS is written by trained science educators from Washington. Each item cluster and standalone item is planned by the Office of Superintendent of Public Instruction (OSPI) Science Assessment Team in conjunction with an educational assessment contractor and then written, reviewed, and revised by educators during an item cluster writing workshop. From there, the development process involves formal reviews with science educators for all clusters and standalone items and for the scoring criteria in the rubrics of technology-enhanced and short-answer items. The development process assures the assessment contains items that meet the following criteria:

- Include authentic stimuli describing scientific phenomena that students might encounter
- Achieve tight alignment to a specified two- or three-dimensional item specification
- Provide a valid measure of a specified science learning standard
- Include item scoring rubrics that can be applied in a valid manner
- Include technology-enhanced and short-answer items that can be scored in a reliable manner

The Science Assessment Development Cycle flowchart summarizes the two-year process of review and field testing that precedes clusters and standalone items being used on an operational test.

Science Assessment Development Cycle



OSPI solicits critical input from Washington educators by means of four key workgroups each year:

In the **Item Cluster Writing Workgroup**, teams of 2–3 educators write stimuli, items, and rubrics designed to validly measure student understanding of the standards.

In the **Content Review Workgroup**, educators review the products of the item cluster writing workgroup to ensure that every stimulus, item, and rubric is scientifically accurate and gathers appropriate evidence about student understanding and application of the standards. At the same time, a separate committee of community members reviews the items and stimuli for any bias or sensitivity issues.

In the **Field Test Ranging Workgroup**, educators look at a range of student responses to short answer items and decide how to score each response. This educator workgroup refines scoring rubrics and produces the materials that will be used to score the field test items.

In the **Content Review with Data Workgroup**, educators use item performance data, as well as participants' science content knowledge, to decide whether the item should become available for operational testing.

Structure of the Test

The WCAS is composed of item clusters and standalone items aligned to the PEs. [Advisory groups](#) composed of national education experts, science assessment experts, and science educators recommend the item cluster structure for large-scale assessment of the standards because item clusters involve significant interaction of students with stimulus materials leading to a demonstration of the students' application of knowledge and skills. Standalone items increase the PE coverage that can be achieved in a single test administration.

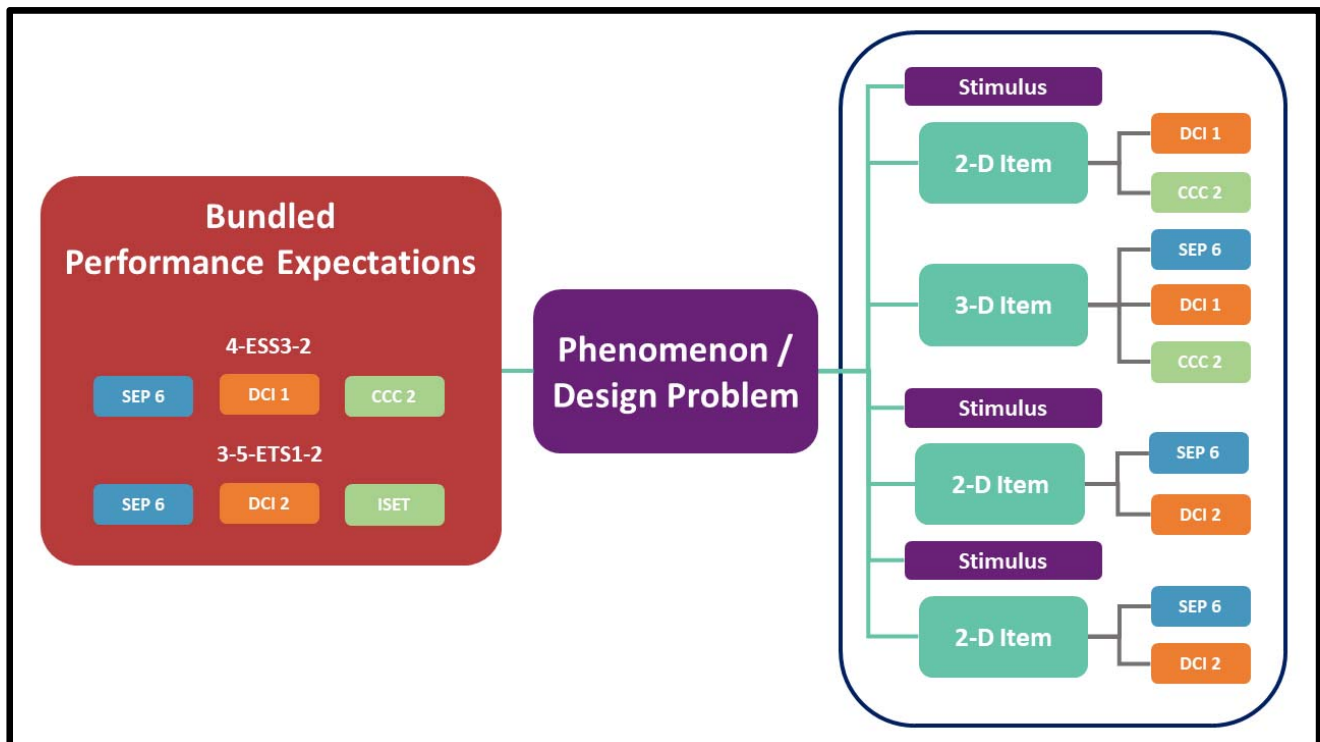
Item Clusters

Item clusters that assess a PE bundle make up the core of the WCAS. A PE bundle is generally two or three related PEs that are used to explain or make sense of a scientific phenomenon or a design problem. A phenomenon gives an item cluster conceptual coherence. The items within an item cluster are interconnected and focused on the given phenomenon. Items are also structured to support a student's progression through the cluster.

Students must make sense of the phenomenon for an item cluster by using a science and engineering practice (SEP), disciplinary core idea (DCI), and crosscutting concept (CCC) represented in the PE bundle. PE bundles are often within a single domain, but may include PEs from different domains. PE bundles sometimes share a similar practice or crosscutting concept or may include multiple practices or crosscutting concepts. Each item within the cluster will align to two or three dimensions (2-D, 3-D) from one or more of the PEs in the bundle. Achieving as full coverage as possible requires developing items that target a variety of the dimensions represented in the PE bundle. In all cases, item clusters achieve full coverage of the dimensions of each PE within a PE bundle.

The Sample Item Cluster Map shows how the items in a sample cluster work together to achieve full coverage of the dimensions in a two-PE bundle.

Sample Item Cluster Map



Standalone Items

A standalone item is a focused measurement tool that uses a single item to address two or three dimensions of one PE.

Online Test Delivery

The WCAS is delivered online using the same platform as the Smarter Balanced ELA and Mathematics assessments. Students will be familiar with most of the online features of the WCAS; however, there are a few unique features that support efficient and reliable delivery of the clusters and standalone items.

Collapsible Stimuli

The WCAS has some item clusters that include more than one stimulus. Each stimulus is delivered along with the items most closely associated to that stimulus. Once a stimulus is presented, it is available to the student throughout the cluster. To minimize vertical scrolling and the need to move back to previous screens within a cluster, a stimulus is collapsed once the next stimulus is provided. A +/- icon in the heading of a collapsed stimulus section allows the stimulus to be hidden from view or expanded to suit a student's current need.

Locking Items

WCAS clusters include some locking items in which the student cannot change their answer once they have moved on to the next item. A padlock icon next to the item number alerts students that they are answering a locking item. When they start to move on from the item, an "attention" box warns the student that they will not be able to change their answer once they move on. The student can either return to the item or move forward and lock in their answer.

Locking items allow the student to be updated with correct information in subsequent items or stimuli. In addition, locking items help to limit item interaction effects or clueing between items in a cluster.

Students can return and view an item that has been locked. The student will see their answer, but they cannot change their answer.

Animation

In addition to diagrams and graphics, the online platform supports the use of animations in stimuli. The animations provide additional scaffolding for the student.

Screen Display

Item clusters are displayed with a stimulus pane and an item pane on the same screen. The stimulus occupies 40% of the screen, while the item occupies 60% of the screen. However, by clicking expansion arrows, a student can expand either pane to a width of 90% of the screen. Standalone items are displayed on the entire width of the screen.

Item Types

The WCAS include several item types. Collectively, these item types enable measurement of understanding and core competencies in ways that support student engagement. The majority of the item types are represented on the WCAS Training Tests, which are accessed on the [Washington Comprehensive Assessment Program \(WCAP\) Portal](#).

Edit Task Inline Choice (ETC)

- Students select words, numbers, or phrases from drop-down lists to complete a statement.
- The number of drop-down lists in an item will typically be between two and four.
- The length of options in a drop-down list will typically be one to four words.
- A drop-down list can be part of a table.

Grid Interaction (GI)

- Drag and drop
 - Students place arrows, symbols, labels, or other graphical elements into predesignated boxes on a background graphic.
 - The elements are designated as refreshable (able to be used multiple times) or non-refreshable (able to be used only one time).
- Hot Spot
 - Students interact with and construct simple graphs.

Hot Text (HT)

- Students move statements into an ordered sequence.
- The statements are designated as refreshable (able to be used multiple times) or non-refreshable (able to be used only one time).

Multiple Choice (MC)

- Includes a question, or a statement followed by a question.
- The question will present a clear indication of what is required so students will know what to do before looking at the answer choices.
- Students typically select from four options (one correct answer and three distractors).
- The options are syntactically and semantically parallel.
- The options are arranged in numerical or chronological order or according to length.
- Distractors can reflect common errors, misunderstandings, or other misconceptions.
- Distractors will not be partially correct.
- The options “All of the above” and “None of the above” will not be used.

Multiple Select (MS)

- Includes a clear direction or includes a statement followed by a clear direction.
- The clear direction indicates how many options a student should select to complete the item (e.g., “Select **two** pieces of evidence that support the student’s claim”).
- The direction will present a clear indication of what is required so students will know what to do before looking at the answer choices.
- Students select from a maximum of eight options that have at least two correct responses.
- There should be at least three more distractors than correct answers.
- The options are syntactically and semantically parallel.
- The options are arranged in numerical or chronological order or according to length.
- Distractors can reflect common errors, misunderstandings, or other misconceptions.
- Distractors will not be partially correct.
- The options "All of the above" and "None of the above" will not be used.

Short Answer (SA)

- Students write a response based on a specific task statement.
- Directions will give clear indications of the response required of students.
- When appropriate, bullets after phrases like “In your procedure, be sure to include:” or “In your description, be sure to:” will provide extra details to assist students in writing a complete response.
- A response that requires multiple parts may be scaffolded with response boxes to draw attention to the parts.
- Any SA item that requires the students to use information from a stimulus will specifically prompt for the information, such as “Use data from the table to ...” or “Support your answer with information from the chart.”
- Students type text and/or numbers into a response box using the keyboard. SA items are scored by human readers using a scoring rubric.

Simulation (SIM)

- Students use a simulation to control an investigation and/or generate data.
- Simulations can vary in their interaction, design, and scoring.
- The data can be scored directly or used to answer related questions, or both.

Table Input (TI)

- Students complete a table by typing numeric responses into the cells of the table using the keyboard.
- Positive values, negative values, and decimal points are accepted.

Table Match (MI)

- Students check boxes within the cells of a table to make identifications, classifications, or predictions.
- Students are informed when a row or column may be checked once, more than once, or not at all.

Scoring Rubric Development Guidelines

- An item-specific scoring rubric will be developed for each ETC, HT, SIM, TI, MI, and SA during the writing of the item.
- Scoring rubrics will not consider conventions of writing (complete sentences, usage/grammar, spelling, capitalization, punctuation, and paragraphing).
- Scoring rubrics will be edited during field test rangefinding and rubric validation based on student responses.
- Scoring rubrics may be edited during operational rangefinding based on student responses.

Multipart Items

Some items are divided into multiple parts. Typically, this includes two parts (part A and part B). Item parts are mutually reinforcing and strengthen alignment to a PE.

Multipart items can use different types of interactions in each part (e.g., an MC followed by an ETC). One example of this approach would be an item that asks a student to evaluate a claim in part A, and then in part B asks the student to identify how a particular trend in data or piece of evidence supports their evaluation of that claim.

Multipart items can be scored collectively, with each part contributing toward a single point, or separately, with each part earning a single point.

When assessed in an item that does not have multiple parts, the following score points are typically assigned for each item type:

- ETC, HT, MC, MS, SIM, TI, and MI items are worth 1 point.
- GI and SA items are worth 1 or 2 points.

Test Design

Operational Test Form

Each operational test form will contain the same items in a given year. This is known as a “fixed form test,” which is unlike the “adaptive” Smarter Balanced test. Approximately 33% of the points of the test are anchored or linking items with established item calibrations from previous years.

The operational component of the WCAS counts toward a student’s score and is composed of five clusters and six to twelve standalone items.

In addition:

- One PE from each domain (ESS, PS, LS, and ETS) is included in at least one item cluster.
- A minimum of three different SEPs are included across the clusters.
- A minimum of three different CCCs are included across the clusters.
- Standalone items will increase DCI, SEP, and CCC coverage to achieve overall expectations.

Field Test Items

Operational test forms will contain embedded field test items, which will either be a set of items associated with a cluster or a group of standalone items. Several clusters and/or standalone items will be field tested in a given administration. The field test items will not contribute to the student’s score.

Testing Times

The WCAS is intended to be administered online in one to three sessions. The approximate 120-minute administration time includes 30 minutes for giving directions and distributing materials, 75 minutes for the operational form, and 15 minutes for the embedded field test. Contact your district testing coordinator for further information on the specific test schedule for your district or building.

Online Calculator

A calculator is embedded in the online platform for all items in the WCAS. Students should be familiar with the functionality of the calculator prior to using it on the assessment. The [calculator](#) is available online and as an app for practice. In grade 5, students use a basic four-function calculator. In grades 8 and high school, students use a scientific calculator.

Test Blueprint

The total number of points for the WCAS at grade 5 will be 35 points. The point percentages of the WCAS reflect the percentages of the PEs per domain within the standards.

The Engineering, Technology, and Applications of Science (ETS) domain will not be represented by a separate item cluster, but will be bundled in at least one item cluster with one or more PEs from the Physical Sciences (PS), Life Sciences (LS), or Earth and Space Sciences (ESS) domain. ETS points are not specified, and ETS PEs were not included when calculating the percentages in Table 1.

Table 1 specifies the percentage and point ranges of the WCAS in reference to the reporting claims.

Table 1

Reporting Area	Percentage of PEs per Science Domain in the Standards	Percentage Range for the WCAS per Science Domain	Score Point Range for the WCAS per Science Domain
Practices and Crosscutting Concepts in Physical Sciences	40%	35–45%	12–16
Practices and Crosscutting Concepts in Life Sciences	29%	25–35%	8–12
Practices and Crosscutting Concepts in Earth and Space Sciences	31%	25–35%	9–13

Two grade 5 test forms were administered in Spring 2018. The points for a few reporting areas fell slightly outside of the score point range due to the limited size of the item bank. Forms for the 2019 WCAS and beyond will meet all reporting area ranges.

Washington Standards Overview

The WCAS is designed to align to the standards in a way that honors the original intent of the document [A Framework for K–12 Science Education: Practices, Crosscutting Concepts, and Core Ideas](#) (2012) and supports Washington educators in their interpretation of assessment results, instructional design, and classroom practice. This section discusses the structure and usage of PEs as a guiding framework for the development of the WCAS item specifications.

Performance Expectations

The standards are organized into Performance Expectations (PEs). Each PE provides a statement of what students should be able to do by the end of instruction. There are 45 PEs for grades 3–5, 59 PEs for middle school, and 71 PEs for high school. The PEs are further categorized by grade or grade band (K, 1, 2, 3, 4, 5, MS, HS) and by domain: Physical Sciences (PS); Life Sciences (LS); Earth and Space Sciences (ESS); and Engineering, Technology, and Applications of Science (ETS).

Identifying a PE

Each PE is identified by a three-part PE code. The first set of letters or numbers indicates the grade level (or grade band) of the PE (e.g., HS for high school). The middle set of letters and numbers in a PE code refers to an overarching organizing concept that is developed across grades. For example, in MS-ESS1-2, “ESS1” refers to “Earth’s Place in the Universe.”

Finding Related PEs

Searching the [NGSS website](#) for an organizing concept will pull up a complete list of associated PEs at the given grade level. For example, searching the website for MS-ESS1 will pull up a list of associated PEs at the middle school level (MS-ESS1-1 through MS-ESS1-4). Substituting another grade level for “MS” will pull up a complete list of standards related to “Earth’s Place in the Universe” for any other grade level. This strategy is helpful for understanding where a particular PE fits in a learning progression, and it can provide insight into the assessable boundaries of a PE.

PE Structure

Each PE starts with the PE statement, which is a brief synopsis of the performance the PE is meant to address. Each PE statement incorporates the three dimensions of the NGSS framework: one or more Science and Engineering Practices (SEPs), one or more Disciplinary Core Ideas (DCIs), and one or more Crosscutting Concepts (CCCs). The PE statement can provide some insight as to how students are expected to utilize the SEPs, DCIs, and CCCs together to achieve the PE.

Clarification Statements and Assessment Boundaries

The PE statement may be followed by a clarification statement and/or an assessment boundary. When present, the clarification statement supplies examples or additional clarification to the PE. The assessment boundaries are meant to specify limits for large-scale assessment of a PE. They are **not** meant to limit what can or should be taught or how it is taught. The main function of an assessment boundary statement is to provide guidance to assessment developers.

Dimensions—SEPs, DCIs, and CCCs

Science and Engineering Practices

The standards include a total of eight SEPs that develop across grade levels and grade bands:

1. Asking Questions and Defining Problems
2. Developing and Using Models
3. Planning and Carrying Out Investigations
4. Analyzing and Interpreting Data
5. Using Mathematical and Computational Thinking
6. Constructing Explanations and Designing Solutions
7. Engaging in Argument from Evidence
8. Obtaining, Evaluating, and Communicating Information

For the standards and the WCAS Item Specifications, the SEP statement is presented in the leftmost column inside a blue box. Each SEP statement contains a particular skill or practice from a particular grade level, as determined by the PE. Bulleted text under the grade-level description of the SEP presents a subskill associated with the specific PE. Additional details on the subskills and their progressions across grade bands can be found in [NGSS Appendix F](#).

Disciplinary Core Ideas

Science knowledge is represented as a collection of disciplinary core ideas, which have been explicitly developed in grade-level progressions. For the standards and the WCAS Item Specifications, the DCI statement is presented in the middle column inside an orange box. The number of DCIs is intentionally limited, so as to allow deeper exploration and eventual proficiency of key concepts as students broaden and deepen their understanding of science. The sum total of all DCIs is not meant to be an exhaustive list of all topics that should be taught in a science classroom. Rather, DCIs provide for links among classroom lesson or activity topics at a high level.

To build the links, DCIs are broken up into several groups within three primary domains: Life Sciences (LS), Physical Sciences (PS), and Earth and Space Sciences (ESS). The Engineering, Technology, and Applications of Science (ETS; also sometimes called Engineering Design) DCIs are treated somewhat differently from the other DCIs in that they appear in separate ETS PEs.

For the standards and the WCAS Item Specifications, the DCI statement is presented in the central column, inside an orange box. Each DCI statement contains key ideas appropriate to a particular grade level, as determined by the PE. Bulleted text under the grade-level description of the DCI presents ideas and understandings associated with the specific DCI. Additional details on these ideas and understandings and their progressions across grade bands can be found in [NGSS Appendix E](#).

Crosscutting Concepts

The standards contain seven CCCs that progress throughout each grade level and grade band. The seven CCCs are:

1. Patterns
2. Cause and Effect
3. Scale, Proportion, and Quantity
4. Systems and System Models
5. Energy and Matter
6. Structure and Function
7. Stability and Change

For the standards and the WCAS Item Specifications, the CCC statement is presented in the rightmost column, inside a green box. Bulleted text under the grade-level description of the CCC presents sub-concepts associated with the specific PE. Additional details on these sub-concepts and their progressions across grade bands can be found in [NGSS Appendix G](#).

Evidence Statements

OSPI uses the NGSS [evidence statements](#) to guide development of two- and three-dimensional items. The evidence statements were designed to support a granular analysis of proficiency with specific PEs, via an explicit articulation of how students can use SEPs to demonstrate their understanding of DCIs through the lens of the CCCs. They do this by clarifying several important details related to the three dimensions:

- How the three dimensions can be assessed together, rather than in independent units
- The underlying knowledge required to develop each DCI
- The detailed approaches to application of the SEP
- How CCCs might be used to deepen content understanding and practice-driven learning

Evidence statements are written primarily from the focus of the SEP dimension. Therefore, developing two-dimensional items aligned to a DCI and a CCC sometimes requires moving entirely outside the scope of the evidence statement. With that said, it is also acceptable to write items to a particular part of an evidence statement (e.g., leaving the SEP portion of the evidence statement out of the item design and writing only to the CCC and DCI elements). Aligning an item to a combination of evidence statements is also permissible, and is often done when items leverage the complexity of real-world scientific phenomena.

NGSS Progressions Appendices

When working to establish learning progressions or continuity and growth of skills across grade levels, educators will find value in the NGSS progressions appendices (see the “Resources” section). Organized by dimension ([SEP](#), [DCI](#), and [CCC](#)), the appendices present detailed learning progressions and comparisons of various skills and competencies across grade levels.

The WCAS Item Specifications use the NGSS progressions appendices in unpacking PE dimension statements to reveal and incorporate elements from a given learning progression. For example, consider a grade 4 PE that lists Planning and Carrying Out Investigations as its SEP dimension and has bulleted text that focuses on making observations. According to the NGSS learning progressions, making observations may be expanded within grade 4 to also include elements of planning, prediction, or evaluations of a fair test. Therefore, from an assessment perspective, items written using these linked subskills still align to the SEP.

WCAS Item Specifications

The science assessment team at OSPI has been working with assessment research and development partners to create assessment item specifications that support multidimensional item development, and assist teachers in their interpretation of WCAS assessment data. The following two pages present a sample of one such item specification.

The WCAS Item Specifications are a guiding framework that is built to evolve and change; OSPI will revise them as needed, in collaboration with teachers and other stakeholders. While the item specifications are not intended to dictate curricula in any way, examples of science topics or contexts within the scope of the PE may occasionally be provided in the details and clarifications section. Such examples will be noted in parenthetical remarks after a particular clarification, and denoted with the convention “e.g.”

The first page of a WCAS item specification consolidates key information under the same PE code used by the corresponding standard in the NGSS. It also directs users to pertinent pages in the [K–12 Framework](#) and the NGSS progressions appendices for each dimension ([SEP](#), [DCI](#), or [CCC](#)). The first page also presents any clarification statements or assessment boundaries associated with the PE. Items in the grade 5 WCAS use language targeted to the previous grade or lower readability with the exception of the expected science terms. A list of expected SEP, DCI, and CCC vocabulary is included at the end of this document.

The second page of each item specification presents four alignment codes for the PE. These codes identify the various combinations of PE dimensions that can be measured using a multidimensional item. Additionally, each item specification includes a list of details and clarifications that help unpack the elements used to determine item alignment.

For example, when using the WCAS Item Specifications, an item with an alignment code of 4-LS1-1.2 indicates that the item aligns to both the SEP and DCI dimensions of the PE 4-LS1-1. The item specification suggests that this type of item will involve making observations of specific types of evidence related to the DCI. The Details and Clarifications section lists types of observations that are permissible under this PE, as well as the forms of evidence that are within the bounds of the PE.

Performance Expectation	4-LS1-1 Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.		
Dimensions	Science & Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
	Engaging in Argument from Evidence Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s). <ul style="list-style-type: none"> Construct an argument with evidence, data, and/or a model. 	LS1.A: Structure and Function <ul style="list-style-type: none"> Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. 	Systems and System Models <ul style="list-style-type: none"> A system can be described in terms of its components and their interactions.
These item specifications were developed using the following reference materials:			
K–12 Framework	pp. 71–74	pp. 143–145	pp. 91–94
NGSS Appendices	Appendix F pp. 13–14	Appendix E p. 4	Appendix G pp. 7–8
Clarification Statement	Examples of structures could include thorns, stems, roots, colored petals, heart, stomach, lung, brain, and skin.		
Assessment Boundary	Assessment is limited to macroscopic structures within plant and animal systems.		

Items may ask students to:

Code	Alignment	Item Specification
4-LS1-1.1	SEP-DCI-CCC	Construct an argument using system models to describe plants and/or animals in terms of their structures and how the structures interact to serve various survival, growth, behavioral, and/or reproductive functions .
4-LS1-1.2	SEP-DCI	Construct an argument to show that plant and/or animal structures serve various survival, growth, behavioral, and/or reproductive functions .
4-LS1-1.3	DCI-CCC	Use system models to show how plant and/or animal structures serve various survival, growth, behavioral, or reproductive functions .
4-LS1-1.4	SEP-CCC	Construct an argument that connects system components and interactions in a system model.
Details and Clarifications		
<ul style="list-style-type: none"> • Construct an argument is expanded to include: <ul style="list-style-type: none"> ○ using evidence to support an argument and/or a claim ○ developing an argument based on evidence, data, or a simple model ○ distinguishing between observations and inferences in an explanation or argument ○ comparing and/or refining arguments and/or claims based on evidence ○ providing feedback on an explanation, an argument, and/or a claim • Structures and functions may include, but are NOT limited to structures that work together to support: <ul style="list-style-type: none"> ○ plants <ul style="list-style-type: none"> • obtaining water/sunlight/air • growing toward sunlight and/or water • defending against herbivores • attracting pollinators ○ animals <ul style="list-style-type: none"> • pumping blood/breathing/moving/digesting food • obtaining food • defending against predators • attracting mates • System models may include, but are NOT limited to: <ul style="list-style-type: none"> ○ an entire organism (plant or animal) ○ a subsystem within a plant or animal ○ the interactions of structures working together within a plant or animal system or subsystem 		

As stated earlier in this document, the item specifications that follow represent a small sample of PEs; full PE coverage should be achieved by the end of the 2018-19 school year. The item specifications will be updated annually based on input from Washington educators. Future drafts will include a modification log that will be updated at each subsequent publication.

Resources

Resource	Description
<u>K–12 Framework</u>	Provides information about the foundational principles that were used to develop the NGSS.
<u>SAIC Assessment Framework</u>	Provides options and rationales for development of high-quality, NGSS-aligned summative assessment items.
<u>SAIC Prototype Item Cluster</u>	Demonstrates a three-dimensional NGSS-aligned item cluster using a variety of stimuli and innovative item types.
<u>Developing Assessments for the Next Generation Science Standards</u>	Provides guidance on an approach to science assessment that supports the vision of the NGSS.
<u>NGSS Appendix E</u>	Includes tables showing the DCI progressions by grade level.
<u>NGSS Appendix F</u>	Includes tables showing the SEP progressions by grade level.
<u>NGSS Appendix G</u>	Includes tables showing the CCC progressions by grade level.
<u>NGSS Evidence Statements</u>	Provides additional detail on what students should know and be able to do based on performance expectations.

References

Council of Chief State School Officers (CCSSO). (2015). *Science Assessment Item Collaborative (SAIC) Assessment Framework*. Washington, DC: Council of Chief State School Officers.

National Research Council (NRC). (2012). *A Framework for K–12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*. Washington, DC: National Academies Press.

National Research Council. (2014). *Developing Assessments for the Next Generation Science Standards*. Washington, DC: The National Academies.

Next Generation Science Standards (NGSS) Lead States. (2013). *Next Generation Science Standards: For States, By States*. Washington, DC: The National Academies Press.

Physical Sciences

Core Ideas:

- PS1 Matter and Its Interactions
- PS2 Motion and Stability: Forces and Interactions
- PS3 Energy
- PS4 Waves and Their Applications in Technologies for Information Transfer

The item specifications that follow represent a **sample** of PEs. The sample will continue to expand until this document contains all the PEs. The sample of PEs represents only a part of what could be assessed on the WCAS. The inclusion of a PE in this document does not indicate that PE will be assessed by an item on the WCAS, nor does the absence of a PE from this document indicate that the PE will not be assessed on the WCAS.

Future item specifications drafts will include modification logs that will be updated at each subsequent publication.

Performance Expectation	5-PS1-1 Develop a model to describe that matter is made of particles too small to be seen.		
Dimensions	Science & Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
	Developing and Using Models Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions. <ul style="list-style-type: none"> Use models to describe phenomena. 	PS1.A: Structure and Properties of Matter <ul style="list-style-type: none"> Matter of any type can be subdivided into particles that are too small to see, but even then, the matter still exists and can be detected by other means. A model showing that gases are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects. 	Scale, Proportion, and Quantity <ul style="list-style-type: none"> Natural objects exist from the very small to the immensely large.
These item specifications were developed using the following reference materials:			
K–12 Framework	pp. 56–59	pp. 106–108	pp. 89–91
NGSS Appendices	Appendix F p. 6	Appendix E p. 7	Appendix G pp. 6–7
Clarification Statement	Examples of evidence supporting a model could include adding air to expand a basketball, compressing air in a syringe, dissolving sugar in water, and evaporating salt water.		
Assessment Boundary	Assessment does not include the atomic-scale mechanism of evaporation and condensation or defining the unseen particles.		

Items may ask students to:

Code	Alignment	Item Specification
5-PS1-1.1	SEP-DCI-CCC	Develop and/or use a model to provide evidence that matter can be subdivided into particles that are at a scale that is too small to be seen.
5-PS1-1.2	SEP-DCI	Develop and/or use a model to describe evidence of matter that can be subdivided into particles that are too small to be seen.
5-PS1-1.3	DCI-CCC	Use the concept of scale to connect matter large enough to be seen and matter subdivided into particles too small to be seen.
5-PS1-1.4	SEP-CCC	Develop and/or use a model to describe the scale of matter.
Details and Clarifications		
<ul style="list-style-type: none"> • Develop and/or use a model is expanded to include: <ul style="list-style-type: none"> ○ revising a complete or partial model ○ comparing complete or partial models ○ using a model to describe a scientific principle ○ using a model to describe a process ○ using a model to make predictions • Models that describe evidence of matter made up of particles too small to be seen may include, but are NOT limited to: <ul style="list-style-type: none"> ○ diagram, simulation, and/or description of solid material dissolving into a liquid ○ diagram, simulation, and/or description of how adding particles of gas can cause an increase in the volume of an elastic container ○ diagram, simulation, and/or description showing bulk matter is made up of much smaller particles • Scale may include, but is NOT limited to: <ul style="list-style-type: none"> ○ observation that macroscopic scale matter can be very large ○ observation that microscopic scale matter or parts of larger matter can be too small to be seen 		

Performance Expectation	3-PS2-1 Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.		
Dimensions	Science & Engineering Practice	Disciplinary Core Ideas	Crosscutting Concept
	Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions. <ul style="list-style-type: none"> Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. Connections to Nature of Science Scientific Investigations Use a Variety of Methods <ul style="list-style-type: none"> Science investigations use a variety of methods, tools, and techniques. 	PS2.A: Forces and Motion <ul style="list-style-type: none"> Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object’s speed or direction of motion. (Boundary: Qualitative and conceptual, but not quantitative addition of forces are used at this level.) PS2.B: Types of Interactions <ul style="list-style-type: none"> Objects in contact exert forces on each other. 	Cause and Effect <ul style="list-style-type: none"> Cause and effect relationships are routinely identified.
These item specifications were developed using the following reference materials:			
K-12 Framework	pp. 59–61	pp. 114–118	pp. 87–89
NGSS Appendices	Appendix F pp. 7–8 Appendix H p. 5	Appendix E p. 7	Appendix G pp. 5–6
Clarification Statement	Examples could include an unbalanced force on one side of a ball can make it start moving; and, balanced forces pushing on a box from both sides will not produce any motion at all.		
Assessment Boundary	Assessment is limited to one variable at a time: number, size, or direction of forces. Assessment does not include quantitative force size, only qualitative and relative. Assessment is limited to gravity being addressed as a force that pulls objects down.		

Items may ask students to:

Code	Alignment	Item Specification
3-PS2-1.1	SEP-DCI-CCC	Plan and/or conduct an investigation to produce evidence of cause and effect relationships between the forces acting on an object and the motion of an object.
3-PS2-1.2	SEP-DCI	Plan and/or conduct an investigation to produce evidence that objects in contact exert forces on each other and/or that forces that do not sum to zero cause a change in the motion of an object.
3-PS2-1.3	DCI-CCC	Use cause and effect relationships to connect that objects in contact exert forces on each other and/or that forces that do not sum to zero cause a change in the motion of an object.
3-PS2-1.4	SEP-CCC	Plan and/or conduct an investigation to produce evidence of cause and effect relationships between objects.
Details and Clarifications		
<ul style="list-style-type: none"> • Plan and/or conduct an investigation is expanded to include: <ul style="list-style-type: none"> ○ identifying relevant variables and/or data to be gathered in an investigation ○ describing appropriate methods and/or tools to collect data ○ collecting data that can be used to support an explanation, make comparisons, and/or make predictions • Evidence of a change in motion may include, but is NOT limited to: <ul style="list-style-type: none"> ○ change in an object's speed (e.g., slowing down, speeding up) ○ change in an object's direction (e.g., up, down, left, right) • Forces may include, but are NOT limited to: <ul style="list-style-type: none"> ○ a push ○ a pull ○ gravity • Cause and effect relationships between force and motion may include, but are NOT limited to: <ul style="list-style-type: none"> ○ the force of gravity pulls an object towards Earth's center ○ balanced forces acting on an object will result in an object's motion staying constant ○ unbalanced forces acting on an object will result in an object's motion changing ○ applying different strengths and/or directions of force on an object at rest will result in motion ○ applying different strengths and/or directions of force on an object in motion will result in a change in motion ○ when objects exert forces on each other (e.g., collide), their motions change 		

Performance Expectation	3-PS2-3 Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.		
Dimensions	Science & Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
	Asking Questions and Defining Problems Asking questions and defining problems in grades 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships. <ul style="list-style-type: none"> • Ask questions that can be investigated based on patterns such as cause and effect relationships. 	PS2.B: Types of Interactions <ul style="list-style-type: none"> • Electric and magnetic forces between a pair of objects do not require that the objects be in contact. The sizes of the forces in each situation depend on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other 	Cause and Effect <ul style="list-style-type: none"> • Cause and effect relationships are routinely identified, tested, and used to explain change.
These item specifications were developed using the following reference materials:			
K-12 Framework	pp. 54–56	pp. 116–118	pp. 87–89
NGSS Appendices	Appendix F pp. 4–5	Appendix E p. 7	Appendix G pp. 5–6
Clarification Statement	Examples of an electric force could include the force on hair from an electrically charged balloon and the electrical forces between a charged rod and pieces of paper; examples of a magnetic force could include the force between two permanent magnets, the force between an electromagnet and steel paperclips, and the force exerted by one magnet versus the force exerted by two magnets. Examples of cause and effect relationships could include how the distance between objects affects strength of the force and how the orientation of magnets affects the direction of the magnetic force.		
Assessment Boundary	Assessment is limited to forces produced by objects that can be manipulated by students, and electrical interactions are limited to static electricity.		

Items may ask students to:

Code	Alignment	Item Specification
3-PS2-3.1	SEP-DCI-CCC	Ask questions that can be investigated using cause and effect relationships to determine that electric and/or magnetic forces between two objects do not require the objects to be in contact.
3-PS2-3.2	SEP-DCI	Ask questions that can be investigated to determine that electric and/or magnetic forces between two objects do not require the objects to be in contact.
3-PS2-3.3	DCI-CCC	Use cause and effect relationships to determine that electric and/or magnetic forces can act between two objects that are not in contact.
3-PS2-3.4	SEP-CCC	Ask questions that can be investigated to determine cause and effect relationships between two objects.

Details and Clarifications

- **Ask questions** is expanded to include:
 - asking questions about what would happen if a variable is changed
 - asking and/or identifying questions that can be answered through observation and/or investigation
 - predicting the outcome of questions that can be answered through observation and/or investigation
 - asking questions about observations, data, claims, and/or proposed designs
 - describing criteria for a successful solution
 - describing constraints that could limit the success of a solution
- **Electric forces** may include:
 - forces between objects with opposite charges
 - forces between objects that have similar charges
- **Magnetic forces** may include:
 - forces between objects with opposite poles
 - forces between objects with similar poles
- **Cause and effect** relationships may include, but are NOT limited to:
 - objects with opposite charges and/or poles attract each other
 - objects with similar charges and/or poles repel each other
 - an electromagnet attracts magnetic objects
 - the strength of the force between two objects increases as the distance between the objects decreases
 - the magnetic force between two objects changes as the orientation of the objects in relation to each other changes

Performance Expectation	4-PS3-2 Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.		
Dimensions	Science & Engineering Practice	Disciplinary Core Ideas	Crosscutting Concept
	Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions. <ul style="list-style-type: none"> • Make observations to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. 	PS3.A: Definitions of Energy <ul style="list-style-type: none"> • Energy can be moved from place to place by moving objects, or through sound, light, or electric currents. PS3.B: Conservation of Energy and Energy Transfer <ul style="list-style-type: none"> • Energy is present whenever there are moving objects, sound, light, or heat. When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is produced. • Light also transfers energy from place to place. • Energy can also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat, or light. The currents may have been produced to begin with by transforming the energy of motion into electrical energy. 	Energy and Matter <ul style="list-style-type: none"> • Energy can be transferred in various ways and between objects.
These item specifications were developed using the following reference materials:			
K–12 Framework	pp. 59–61	pp. 120–124 pp. 124–126	pp. 94–96
NGSS Appendices	Appendix F pp. 7–8	Appendix E p. 7	Appendix G pp. 8–9
Clarification Statement	A clarification statement is not provided for this PE.		
Assessment Boundary	Assessment does not include quantitative measurements of energy.		

Items may ask students to:

Code	Alignment	Item Specification
4-PS3-2.1	SEP-DCI-CCC	Make observations to serve as evidence that energy can be transferred from place to place by sound, light, heat, electric currents, and/or colliding objects.
4-PS3-2.2	SEP-DCI	Due to a strong overlap between the DCI and the CCC, items are not coded 4-PS3-2.2.
4-PS3-2.3	DCI-CCC	Use the concept of energy transfer to connect energy flow by sound, light, heat, electric currents, and/or colliding objects.
4-PS3-2.4	SEP-CCC	Make observations to serve as evidence that energy can be transferred in various ways and/or between objects.

Details and Clarifications

- **Make observations** is expanded to include:
 - identifying relevant variables and/or data to be gathered in an investigation
 - describing appropriate methods and/or tools to collect data
 - collecting data that can be used to support an explanation, make comparisons, and/or make predictions
- **Types of evidence** of energy transfer may include, but are NOT limited to:
 - presence of sound by hearing or using a sound meter or other recording device
 - presence of light by seeing or using a light meter, photography, or other method of recording light
 - presence of heat by feeling or measuring temperature change
 - presence of electric current by observing the sound, light, heat, and/or kinetic energy output from devices in a circuit
 - motion of objects before and after a collision
- **Energy transfers** may include, but are NOT limited to:
 - the transfer of sound energy from a vibrating object to the surrounding air
 - the transfer of light energy from a source of light to an object that absorbs light
 - the transfer of electric energy to produce motion, sound, heat, or light
 - the transfer of heat energy from a source of heat to the surrounding air or to an object
 - the transfer of kinetic energy between colliding objects
- Note: The concept of energy conservation is beginning to develop in this PE by observing that noticeable forms of energy have transferred from other places. Energy conservation is not explicitly assessed in this PE.

Performance Expectation	4-PS4-1 Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.		
Dimensions	Science & Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
	Developing and Using Models Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions. • Develop a model using an analogy, example, or abstract representation to describe a scientific principle. Connections to Nature of Science Scientific Knowledge is Based on Empirical Evidence • Science findings are based on recognizing patterns.	PS4.A: Wave Properties • Waves, which are regular patterns of motion, can be made in water by disturbing the surface. When waves move across the surface of deep water, the water goes up and down in place; there is no net motion in the direction of the wave except when the water meets a beach. (Note: This grade band endpoint was moved from K–2.) • Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks).	Patterns • Similarities and differences in patterns can be used to sort, classify, and analyze simple rates of change for natural phenomena.
These item specifications were developed using the following reference materials:			
K-12 Framework	pp. 56–59	pp. 131–133	pp. 85–87
NGSS Appendices	Appendix F p. 6 Appendix H p. 5	Appendix E p. 8	Appendix G pp. 3–5
Clarification Statement	Examples of models could include diagrams, analogies, and physical models using wire to illustrate wavelength and amplitude of waves.		
Assessment Boundary	Assessment does not include interference effects, electromagnetic waves, non-periodic waves, or quantitative models of amplitude and wavelength.		

Items may ask students to:

Code	Alignment	Item Specification
4-PS4-1.1	SEP-DCI-CCC	Develop and/or use a model of waves to describe similarities and/or differences in patterns of amplitude and/or wavelength, and/or that waves can cause objects to move.
4-PS4-1.2	SEP-DCI	Develop and/or use a model of waves to show patterns in amplitude and/or wavelength, and that waves can cause objects to move.
4-PS4-1.3	DCI-CCC	Connect similarities and/or differences in patterns of amplitude and/or wavelength to waves causing objects to move.
4-PS4-1.4	SEP-CCC	Develop and/or use a model to describe the similarities and/or differences in patterns.
Details and Clarifications		
<ul style="list-style-type: none"> • Develop and/or use a model is expanded to include: <ul style="list-style-type: none"> ○ revising a complete or partial model ○ comparing complete or partial models ○ using a model to describe a scientific principle ○ using a model to describe a process ○ using a model to make predictions • Models may include, but are NOT limited to: <ul style="list-style-type: none"> ○ diagrams ○ tables ○ descriptions • Similarities and/or differences in patterns may include, but are NOT limited to: <ul style="list-style-type: none"> ○ similarities and/or differences in amplitude among waves ○ similarities and/or differences in wavelength among waves ○ similarities and/or differences in speed among waves ○ similarities and/or differences in the forces used to produce various water waves ○ similarities and/or differences in the motion of floating objects in water as various waves travel 		

Life Sciences

Disciplinary Core Ideas:

- LS1 From Molecules to Organisms: Structures and Processes
- LS2 Ecosystems: Interactions, Energy, and Dynamics
- LS3 Heredity: Inheritance and Variation of Traits
- LS4 Biological Evolution: Unity and Diversity

The item specifications that follow represent a **sample** of PEs. The sample will continue to expand until this document contains all the PEs. The sample of PEs represents only a part of what could be assessed on the WCAS. The inclusion of a PE in this document does not indicate that PE will be assessed by an item on the WCAS, nor does the absence of a PE from this document indicate that the PE will not be assessed on the WCAS.

Future item specifications drafts will include modification logs that will be updated at each subsequent publication.

Performance Expectation	3-LS1-1 Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.		
Dimensions	Science & Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
	Developing and Using Models Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions. • Develop models to describe phenomena. Connections to Nature of Science Scientific Knowledge is Based on Empirical Evidence • Science findings are based on recognizing patterns.	LS1.B: Growth and Development of Organisms • Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles.	Patterns • Patterns of change can be used to make predictions.
These item specifications were developed using the following reference materials:			
K-12 Framework	pp. 56–59	pp. 145–147	pp. 85–87
NGSS Appendices	Appendix F p. 6	Appendix E p. 4	Appendix G pp. 3–5
Clarification Statement	Changes organisms go through during their life form a pattern.		
Assessment Boundary	Assessment of plant life cycles is limited to those of flowering plants. Assessment does not include details of human reproduction.		

Items may ask students to:

Code	Alignment	Item Specification
3-LS1-1.1	SEP-DCI-CCC	Develop and/or use a model to show patterns in the life cycle stages of plants and/or animals, and/or use patterns of change in life cycle stages to make predictions.
3-LS1-1.2	SEP-DCI	Develop and/or use a model to describe plant and/or animal life cycle stages .
3-LS1-1.3	DCI-CCC	Use patterns to connect similarities and/or differences among plant and/or animal life cycle stages , and/or make predictions about plant and/or animal life cycle stages .
3-LS1-1.4	SEP-CCC	Develop and/or use a model to describe how patterns can be used to describe relationships and/or make predictions.
Details and Clarifications		
<ul style="list-style-type: none"> • Develop a model is expanded to include: <ul style="list-style-type: none"> ○ revising a complete or partial model ○ comparing complete or partial models ○ using a model to describe a scientific principle ○ using a model to describe a process ○ using a model to make predictions • Models may include, but are NOT limited to: <ul style="list-style-type: none"> ○ a diagram and/or description of an organism's life cycle that includes birth, growth, reproduction, and death ○ a diagram and/or description that compares life cycles of different types of organisms • Life cycle stages for all organisms include birth, growth, reproduction, and death. • Patterns in plant and animal life cycles may include, but are NOT limited to: <ul style="list-style-type: none"> ○ similarities and differences among life cycle stages for plants and/or animals ○ predictable characteristics at each life cycle stage for plants and/or animals ○ unique and/or diverse characteristics in each life cycle stage when considered across categories (plant, animal) or within a specific group of organisms ○ changes in one life cycle stage cause changes in other stages (e.g., if growth is disrupted, reproduction becomes less likely) ○ reproduction is essential to continued survival of an organism 		

Performance Expectation	4-LS1-1 Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.		
Dimensions	Science & Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
	Engaging in Argument from Evidence Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s). <ul style="list-style-type: none"> Construct an argument with evidence, data, and/or a model. 	LS1.A: Structure and Function <ul style="list-style-type: none"> Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. 	Systems and System Models <ul style="list-style-type: none"> A system can be described in terms of its components and their interactions.
These item specifications were developed using the following reference materials:			
K–12 Framework	pp. 71–74	pp. 143–145	pp. 91–94
NGSS Appendices	Appendix F pp. 13–14	Appendix E p. 4	Appendix G pp. 7–8
Clarification Statement	Examples of structures could include thorns, stems, roots, colored petals, heart, stomach, lung, brain, and skin.		
Assessment Boundary	Assessment is limited to macroscopic structures within plant and animal systems.		

Items may ask students to:

Code	Alignment	Item Specification
4-LS1-1.1	SEP-DCI-CCC	Construct an argument using system models to describe plants and/or animals in terms of their structures and how the structures interact to serve various survival, growth, behavioral, and/or reproductive functions .
4-LS1-1.2	SEP-DCI	Construct an argument to show that plant and/or animal structures serve various survival, growth, behavioral, and/or reproductive functions .
4-LS1-1.3	DCI-CCC	Use system models to show how plant and/or animal structures serve various survival, growth, behavioral, or reproductive functions .
4-LS1-1.4	SEP-CCC	Construct an argument that connects system components and interactions in a system model.

Details and Clarifications

- **Construct** an **argument** is expanded to include:
 - using evidence to support an argument and/or a claim
 - developing an argument based on evidence, data, or a simple model
 - distinguishing between observations and inferences in an explanation or argument
 - comparing and/or refining arguments and/or claims based on evidence
 - providing feedback on an explanation, an argument, and/or a claim
- **Structures** and **functions** may include, but are NOT limited to, structures that work together to support:
 - plants
 - obtaining water/sunlight/air
 - growing toward sunlight and/or water
 - defending against herbivores
 - attracting pollinators
 - animals
 - pumping blood/breathing/moving/digesting food
 - obtaining food
 - defending against predators
 - attracting mates
- **System models** may include, but are NOT limited to:
 - an entire organism (plant or animal)
 - a subsystem within a plant or animal
 - the interactions of structures working together within a plant or animal system or subsystem

Performance Expectation	5-LS1-1 Support an argument that plants get the materials they need for growth chiefly from air and water.		
Dimensions	Science & Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
	Engaging in Argument from Evidence Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s). <ul style="list-style-type: none"> Support an argument with evidence, data, or a model. 	LS1.C: Organization for Matter and Energy Flow in Organisms <ul style="list-style-type: none"> Plants acquire their material for growth chiefly from air and water. 	Energy and Matter <ul style="list-style-type: none"> Matter is transported into, out of, and within systems.
These item specifications were developed using the following reference materials:			
K-12 Framework	pp. 71–74	pp. 147–148	pp. 94–96
NGSS Appendices	Appendix F pp. 13–14	Appendix E p. 4	Appendix G pp. 8–9
Clarification Statement	Emphasis is on the idea that plant matter comes mostly from air and water, not from the soil.		
Assessment Boundary	An assessment boundary is not provided for this PE.		

Items may ask students to:

Code	Alignment	Item Specification
5-LS1-1.1	SEP-DCI-CCC	Support an argument that plants get the materials they need for growth chiefly by transporting air and/or water into, out of, and/or within systems.
5-LS1-1.2	SEP-DCI	Support an argument that plants get the materials they need for growth chiefly from air and water.
5-LS1-1.3	DCI-CCC	Connect the transport of air and water into, out of, and/or within systems to the materials plants need for growth .
5-LS1-1.4	SEP-CCC	Support an argument about matter being transported into, out of, and/or within a system.
Details and Clarifications		
<ul style="list-style-type: none"> • Support an argument is expanded to include: <ul style="list-style-type: none"> ○ using evidence to support an argument and/or a claim ○ developing an argument and/or a claim based on evidence, data, or a simple model ○ distinguishing between observations and inferences in an explanation or argument ○ comparing and/or refining arguments and/or claims based on evidence ○ providing feedback on an explanation, an argument, and/or a claim • Types of evidence may include, but are NOT limited to: <ul style="list-style-type: none"> ○ observed plant growth over time when air and/or water are provided ○ observations of changes in the mass of soil and/or water, compared to the mass of a growing plant over time ○ observations of plants that grow without soil • Materials that are transported into, out of, and within a system for growth may include: <ul style="list-style-type: none"> ○ air ○ water 		

Performance Expectation	3-LS2-1 Construct an argument that some animals form groups that help members survive.		
Dimensions	Science & Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
	Engaging in Argument from Evidence Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s). <ul style="list-style-type: none"> Construct an argument with evidence, data, and/or a model. 	LS2.D: Social Interactions and Group Behavior <ul style="list-style-type: none"> Being part of a group helps animals obtain food, defend themselves, and cope with changes. Groups may serve different functions and vary dramatically in size (Note: Moved from K–2). 	Cause and Effect <ul style="list-style-type: none"> Cause and effect relationships are routinely identified and used to explain change.
These item specifications were developed using the following reference materials:			
K-12 Framework	pp. 71–74	pp. 156–157	pp. 87–89
NGSS Appendices	Appendix F pp. 13–14	Appendix E p. 5	Appendix G pp. 5–6
Clarification Statement	A clarification statement is not provided for this PE.		
Assessment Boundary	An assessment boundary is not provided for this PE.		

Items may ask students to:

Code	Alignment	Item Specification
3-LS2-1.1	SEP-DCI-CCC	Construct an argument using cause and effect relationships to describe how forming a group helps animals survive.
3-LS2-1.2	SEP-DCI	Construct an argument that forming a group helps animals survive.
3-LS2-1.3	DCI-CCC	Use cause and effect relationships to connect forming a group and animal survival.
3-LS2-1.4	SEP-CCC	Construct an argument that cause and effect relationships are used to describe relationships.

Details and Clarifications

- **Construct** an **argument** is expanded to include:
 - using evidence to support an argument and/or a claim
 - developing an argument based on evidence, data, or a simple model
 - distinguishing between observations and inferences in an explanation or argument
 - comparing and/or refining arguments and/or claims based on evidence
 - providing feedback on an explanation, an argument, and/or a claim
- A **group** of animals may include, but is NOT limited to:
 - a group of equal individuals (e.g., copepods)
 - a group with dominant members (e.g., elephant herd)
 - small families (e.g., mountain lion mother and cubs)
 - a group of single or mixed gender (e.g., antelope herd)
 - a group composed of individuals similar in age (e.g., duckling crèche)
 - a group that is stable over long periods of time
 - a group with members moving in and out (e.g., dolphin pod)
 - a group that assigns specialized tasks to each member (e.g., bee colony, ant colony)
 - a group in which all members perform the same function or a similar range of functions (e.g., schooling anchovies)
- **Cause and effect** relationships that describe how being in a **group** helps animals may include, but are NOT limited to:
 - being in a group can cause individuals in the group to obtain more food than solitary individuals do
 - being in a group can cause individuals in the group to survive predation more frequently than solitary individuals do
 - being in a group can cause individuals in the group to survive environmental or ecological changes (e.g., seasons, climate, habitat disruption, species introduction) more frequently than solitary individuals do

Performance Expectation	3-LS4-3 Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.		
Dimensions	Science & Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
	Engaging in Argument from Evidence Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s). <ul style="list-style-type: none"> Construct an argument with evidence. 	LS4.C: Adaptation <ul style="list-style-type: none"> For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all. 	Cause and Effect <ul style="list-style-type: none"> Cause and effect relationships are routinely identified and used to explain change.
These item specifications were developed using the following reference materials:			
K–12 Framework	pp. 71–74	pp. 164–166	pp. 87–89
NGSS Appendices	Appendix F pp. 13–14	Appendix E p. 6	Appendix G pp. 5–6
Clarification Statement	Examples of evidence could include needs and characteristics of the organisms and habitats involved. The organisms and their habitat make up a system in which the parts depend on each other.		
Assessment Boundary	An assessment boundary is not provided for this PE.		

Items may ask students to:

Code	Alignment	Item Specification
3-LS4-3.1	SEP-DCI-CCC	Construct an argument , using evidence, that establishes a cause and effect relationship between organism characteristics and survival in a particular habitat.
3-LS4-3.2	SEP-DCI	Construct an argument , using evidence, that organisms in a particular habitat can have different characteristics and can have differential levels of survival .
3-LS4-3.3	DCI-CCC	Use cause and effect relationships to relate organism characteristics to survival in a particular habitat.
3-LS4-3.4	SEP-CCC	Construct an argument , using evidence , that explains change through a cause and effect relationship.

Details and Clarifications

- **Construct** an **argument** is expanded to include:
 - using evidence to support an argument and/or claim
 - developing an argument and/or claim based on evidence, data, or a simple model
 - distinguishing between observations and inferences in an explanation or argument
 - comparing and/or refining arguments and/or claims based on evidence
 - providing feedback on an explanation, an argument, and/or a claim
- Organism **characteristics** may include, but are NOT limited to:
 - physical characteristics
 - behavior
 - resource needs
- Measures of **survival** in the particular habitat include, but are NOT limited to:
 - average lifespan
 - overall health
 - ability to successfully reproduce
 - the size of a population
- **Cause and effect** relationships may include, but are NOT limited to:
 - relating changes in the availability of resources to changes in survival
 - relating changes in the number organisms with a specific characteristic to changes in survival
 - relating changes in survival to changes in habitat

Performance Expectation	3-LS4-4 Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.		
Dimensions	Science & Engineering Practice	Disciplinary Core Ideas	Crosscutting Concept
	Engaging in Argument from Evidence Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s). <ul style="list-style-type: none"> • Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem. 	LS2.C: Ecosystem Dynamics, Functioning, and Resilience <ul style="list-style-type: none"> • When the environment changes in ways that affect a place’s physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die. LS4.D: Biodiversity and Humans <ul style="list-style-type: none"> • Populations live in a variety of habitats, and change in those habitats affects the organisms living there. 	Systems and System Models <ul style="list-style-type: none"> • A system can be described in terms of its components and their interactions. Connections to Engineering, Technology, and Applications of Science Interdependence of Engineering, Technology, and Science on Society and the Natural World <ul style="list-style-type: none"> • Knowledge of relevant scientific concepts and research findings is important in engineering.
These item specifications were developed using the following reference materials:			
K-12 Framework	pp. 71–74	pp. 154–156 pp. 166–167	pp. 91–94 pp. 210–212
NGSS Appendices	Appendix F pp. 13–14	Appendix E p. 5 Appendix E p. 6	Appendix G pp. 7–8 Appendix J pp. 2–3
Clarification Statement	Examples of environmental changes could include changes in land characteristics, water distribution, temperature, food, and other organisms.		
Assessment Boundary	Assessment is limited to a single environmental change. Assessment does not include the greenhouse effect or climate change.		

Items may ask students to:

Code	Alignment	Item Specification
3-LS4-4.1	SEP-DCI-CCC	Make a claim about the merit of a solution to a problem caused when the environment in a given system changes , which may result in changes to the types of plants and/or animals in that system .
3-LS4-4.2	SEP-DCI	Make a claim about the merit of a solution to a problem caused when an environmental change causes changes to types of plants and/or animals.
3-LS4-4.3	DCI-CCC	Connect changes to the types of plants and/or animals in a system to changes in the environment of the system .
3-LS4-4.4	SEP-CCC	Make a claim about the merit of a solution to a problem caused by interactions among the components of a system.

Details and Clarifications

- **Make a claim** is expanded to include:
 - using evidence to support a claim
 - developing an argument and/or a claim based on evidence, data, or a simple model
 - distinguishing between observations and inferences in an explanation or argument
 - comparing and/or refining arguments and/or claims based on evidence
 - providing feedback on an explanation, an argument, and/or a claim
- The **merit** of a **solution** may include, but is NOT limited to:
 - how well a solution meets given criteria
 - constraints on the success of a given solution
 - how well a solution reduces the impact of the problem
- A **change** in the environment of a given **system** may include, but is NOT limited to:
 - a change in the size, shape, and/or distribution of local landscape features
 - a change in the quality of the air, water, and/or soil
 - a change in the availability of air, water, food, and/or shelter
 - a change in temperature
 - a change caused by human activity (e.g., mining, pollution, habitat destruction)
- A **change** in the plants and/or animals of a given **system** may include, but is NOT limited to:
 - a decrease in the population of a particular plant or animal species within the system
 - migration of organisms into or out of a given system
 - migration of invasive species into a given system

Earth and Space Sciences

Disciplinary Core Ideas:

- ESS1 Earth's Place in the Universe
- ESS2 Earth's Systems
- ESS3 Earth and Human Activity

The item specifications that follow represent a **sample** of PEs. The sample will continue to expand until this document contains all the PEs. The sample of PEs represents only a part of what could be assessed on the WCAS. The inclusion of a PE in this document does not indicate that PE will be assessed by an item on the WCAS, nor does the absence of a PE from this document indicate that the PE will not be assessed on the WCAS.

Future item specifications drafts will include modification logs that will be updated at each subsequent publication.

Performance Expectation	4-ESS1-1 Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.		
Dimensions	Science & Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
	Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems. • Identify the evidence that supports particular points in an explanation.	ESS1.C: The History of Planet Earth • Local, regional, and global patterns of rock formations reveal changes over time due to earth forces, such as earthquakes. The presence and location of certain fossil types indicate the order in which rock layers were formed.	Patterns • Patterns can be used as evidence to support an explanation. Connections to Nature of Science Scientific Knowledge Assumes an Order and Consistency in Natural Systems • Science assumes consistent patterns in natural systems.
These item specifications were developed using the following reference materials:			
K–12 Framework	pp. 67–71	pp. 177–179	pp. 85–87
NGSS Appendices	Appendix F pp. 11–12	Appendix E p. 2	Appendix G pp. 3–5 Appendix H pp. 1–10
Clarification Statement	Examples of evidence from patterns could include rock layers with marine shell fossils above rock layers with plant fossils and no shells, indicating a change from land to water over time; and, a canyon with different rock layers in the walls and a river in the bottom, indicating that over time a river cut through the rock.		
Assessment Boundary	Assessment does not include specific knowledge of the mechanism of rock formation or memorization of specific rock formations and layers. Assessment is limited to relative time.		

Items may ask students to:

Code	Alignment	Item Specification
4-ESS1-1.1	SEP-DCI-CCC	Identify evidence from patterns in rock formations and/or fossils in rock layers that supports an explanation of change over time due to earth forces .
4-ESS1-1.2	SEP-DCI	Identify evidence that supports an explanation of change over time due to earth forces .
4-ESS1-1.3	DCI-CCC	Use patterns in rock formations and/or patterns in the fossils in rock layers to support an explanation of change over time due to earth forces .
4-ESS1-1.4	SEP-CCC	Identify evidence , in the form of patterns, that supports an explanation.

Details and Clarifications

- **Identify** evidence is expanded to include:
 - using measurements, observations, or patterns to support an explanation
 - using measurements, observations, or patterns to generate and/or compare solutions to a problem
 - using evidence to design a solution to a problem
 - comparing solutions to a problem as to how well they meet criteria for success
 - comparing solutions in terms of constraints that limit the success of the solution
- **Types of evidence** may include, but are NOT limited to:
 - vertical ordering of rock layers
 - presence or absence of rock layers
 - presence or absence of fossils in rock layers
 - types of fossils in rock layers
- **Changes over time** due to **earth forces** may include, but are NOT limited to:
 - changes in a landscape and/or fossils due to changing climate
 - changes in rock layers or a landscape due to weathering, erosion, and/or deposition
 - changes in rock layers or a landscape due to tectonic forces and/or earthquakes
- **Patterns** used as evidence may include, but are NOT limited to:
 - sequence of fossils in rock layers
 - sequence of rock types in rock layers
 - presence, absence, or thickness of rock formations
 - presence, absence, or abundance of fossil types across rock layers

Performance Expectation	5-ESS1-2 Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.		
Dimensions	Science & Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
	Analyzing and Interpreting Data Analyzing data in 3–5 builds on K–2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used. <ul style="list-style-type: none"> • Represent data in graphical displays (bar graphs, pictographs and/or pie charts) to reveal patterns that indicate relationships. 	ESS1.B: Earth and the Solar System <ul style="list-style-type: none"> • The orbits of Earth around the sun and of the moon around Earth, together with the rotation of Earth about an axis between its North and South poles, cause observable patterns. These include day and night; daily changes in the length and direction of shadows; and different positions of the sun, moon, and stars at different times of the day, month, and year. 	Patterns <ul style="list-style-type: none"> • Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena.
These item specifications were developed using the following reference materials:			
K-12 Framework	pp. 61–63	pp. 175–176	pp. 85–87
NGSS Appendices	Appendix F p. 9	Appendix E p. 2	Appendix G pp. 3–5
Clarification Statement	Examples of patterns could include the position and motion of Earth with respect to the sun and selected stars that are visible only in particular months.		
Assessment Boundary	Assessment does not include causes of seasons.		

Items may ask students to:

Code	Alignment	Item Specification
5-ESS1-2.1	SEP-DCI-CCC	Represent data to show patterns of daily changes in length and/or direction of shadows, day and night, and/or the seasonal appearance of some stars in the night sky caused by Earth's rotation on its axis and/or orbital relationships among Earth, the sun, and/or the moon.
5-ESS1-2.2	SEP-DCI	Due to strong overlap between the SEP and the CCC, items are not coded 5-ESS1-2.2.
5-ESS1-2.3	DCI-CCC	Use patterns to connect the daily changes in length and direction of shadows, day and night, and/or the seasonal appearance of some stars in the night sky caused by Earth's rotation on its axis and/or orbital relationships among Earth, the sun, and/or the moon.
5-ESS1-2.4	SEP-CCC	Represent data to show similarities and differences in patterns.
Details and Clarifications		
<ul style="list-style-type: none"> • Represent data is expanded to include: <ul style="list-style-type: none"> ○ recording observations ○ organizing data in tables or graphical displays (e.g., chart, graph) ○ summarizing data to identify relationships between data sets ○ comparing and/or contrasting data collected by different groups • Data may include, but are NOT limited to, graphical displays of: <ul style="list-style-type: none"> ○ hours of daylight ○ length and/or direction of shadows ○ presence/absence of stars and/or constellations ○ phases of the moon • Rotational and orbital relationships may include, but are NOT limited to: <ul style="list-style-type: none"> ○ Earth completes a single rotation on its axis once a day. ○ Earth completes a single orbit around the sun once a year. ○ Earth's moon completes a single orbit around Earth about once a month. • Patterns in day and night may include, but are NOT limited to: <ul style="list-style-type: none"> ○ seasonal patterns in the duration of daylight ○ daily patterns of day and night ○ daily patterns of change in the length and direction of shadows ○ patterns of sunrise and sunset ○ patterns of appearance for stars and/or constellations 		

Performance Expectation	3-ESS2-1 Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.		
Dimensions	Science & Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
	Analyzing and Interpreting Data Analyzing data in 3–5 builds on K–2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used. <ul style="list-style-type: none"> • Represent data in tables and various graphical displays (bar graphs and pictographs) to reveal patterns that indicate relationships. 	ESS2.D: Weather and Climate <ul style="list-style-type: none"> • Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next. 	Patterns <ul style="list-style-type: none"> • Patterns of change can be used to make predictions.
These item specifications were developed using the following reference materials:			
K-12 Framework	pp. 61–63	pp. 186–189	pp. 85–87
NGSS Appendices	Appendix F p. 9	Appendix E p. 3	Appendix G pp. 3–5
Clarification Statement	Examples of data could include average temperature, precipitation, and wind direction.		
Assessment Boundary	Assessment of graphical displays is limited to pictographs and bar graphs. Assessment does not include climate change.		

Items may ask students to:

Code	Alignment	Item Specification
3-ESS2-1.1	SEP-DCI-CCC	Represent data to show patterns of change in weather conditions across different seasons and/or locations that can be used to make predictions .
3-ESS2-1.2	SEP-DCI	Due to a strong overlap between the DCI and the CCC, items are not coded 3-ESS2-1.2.
3-ESS2-1.3	DCI-CCC	Use patterns of change in weather conditions across different seasons and/or locations to make predictions .
3-ESS2-1.4	SEP-CCC	Represent data to show patterns of change that can be used to make predictions.

Details and Clarifications

- **Represent data** is expanded to include:
 - recording observations
 - organizing data in a table and/or graphical display (e.g., chart, graph)
 - summarizing data to identify relationships between data sets
 - comparing and/or contrasting data collected by different groups
- **Data** may include, but are NOT limited to:
 - average temperature
 - amount and/or type of precipitation
 - wind direction and/or speed
- **Patterns** of **change** in **weather conditions** may include, but are NOT limited to:
 - average precipitation, temperature, and/or wind direction experienced in a location for several seasons and/or during the same season over several years
 - weather data recorded in different locations during the same season
- Weather **predictions** based on a **pattern** may include, but are NOT limited to:
 - the most likely temperature (e.g., high, low) during a future season and/or in a particular location
 - the most likely type and/or amount of precipitation in a future season and/or in a particular location

Performance Expectation	4-ESS2-1 Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.		
Dimensions	Science & Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
	Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions. <ul style="list-style-type: none"> • Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon. 	ESS2.A: Earth Materials and Systems <ul style="list-style-type: none"> • Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around. ESS2.E: Biogeology <ul style="list-style-type: none"> • Living things affect the physical characteristics of their regions. 	Cause and Effect <ul style="list-style-type: none"> • Cause and effect relationships are routinely identified, tested, and used to explain change.
These item specifications were developed using the following reference materials:			
K-12 Framework	pp. 59–61	pp. 179–182 pp. 189–190	pp. 87–89
NGSS Appendices	Appendix F pp. 7–8	Appendix E p. 2 Appendix E p. 3	Appendix G pp. 5–6
Clarification Statement	Examples of variables to test could include angle of slope in the downhill movement of water, amount of vegetation, speed of wind, relative rate of deposition, cycles of freezing and thawing of water, cycles of heating and cooling, and volume of water flow.		
Assessment Boundary	Assessment is limited to a single form of weathering or erosion.		

Items may ask students to:

Code	Alignment	Item Specification
4-ESS2-1.1	SEP-DCI-CCC	Make observations and/or measurements to provide evidence of the effects of weathering and/or the rate of erosion by water, ice, wind, or vegetation on the physical characteristics of Earth materials .
4-ESS2-1.2	SEP-DCI	Make observations and/or measurements to provide evidence of weathering and/or erosion by water, ice, wind, or vegetation and/or changes in the physical characteristics of Earth materials .
4-ESS2-1.3	DCI-CCC	Use cause and effect relationships to connect weathering and/or the rate of erosion by water, ice, wind, or vegetation to changes in the physical characteristics of Earth materials .
4-ESS2-1.4	SEP-CCC	Make observations and/or measurements to provide evidence of cause and effect relationships used to explain change.
Details and Clarifications		
<ul style="list-style-type: none"> • Make observations and/or measurements is expanded to include: <ul style="list-style-type: none"> ○ identifying relevant variables and/or data to be gathered in an investigation ○ describing appropriate methods and/or tools to collect data ○ collecting data that can be used to support an explanation, make comparisons, and/or make predictions • Observations and/or measurements that provide evidence may include, but are NOT limited to: <ul style="list-style-type: none"> ○ relative slope of an angle for the downhill movement of water ○ relative frequency of freezing and thawing of water ○ relative amount of soil and/or sediment carried by water ○ relative water and/or wind speed ○ type and/or amount of vegetation ○ relative changes in the shape of Earth materials • Cause and effect relationships that explain changes to physical characteristics may include, but are NOT limited to: <ul style="list-style-type: none"> ○ animal behavior (e.g., eating plants, building nests/dams) alters the physical environment ○ movement of wind, water, and/or ice breaks down rocks and/or changes the shape of landforms ○ movement of wind and/or water erodes rocks and/or removes vegetation • Earth materials include, but are NOT limited to: <ul style="list-style-type: none"> ○ rocks ○ soil ○ water 		

Performance Expectation	5-ESS2-1 Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.		
Dimensions	Science & Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
	Developing and Using Models Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions. <ul style="list-style-type: none"> • Develop a model using an example to describe a scientific principle. 	ESS2.A: Earth Materials and Systems <ul style="list-style-type: none"> • Earth’s major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth’s surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather. 	Systems and System Models <ul style="list-style-type: none"> • A system can be described in terms of its components and their interactions.
These item specifications were developed using the following reference materials:			
K-12 Framework	pp. 56–59	pp. 179–182	pp. 91–94
NGSS Appendices	Appendix F p. 6	Appendix E p. 2	Appendix G pp. 7–8
Clarification Statement	Examples could include the influence of the ocean on ecosystems, landform shape, and climate; the influence of the atmosphere on landforms and ecosystems through weather and climate; and the influence of mountain ranges on winds and clouds in the atmosphere. The geosphere, hydrosphere, atmosphere, and biosphere are each a system.		
Assessment Boundary	Assessment is limited to the interactions of two systems at a time.		

Items may ask students to:

Code	Alignment	Item Specification
5-ESS2-1.1	SEP-DCI-CCC	Develop and/or use a model to describe interactions within and/or between Earth's systems : the geosphere, the biosphere, the hydrosphere, and/or the atmosphere.
5-ESS2-1.2	SEP-DCI	Due to a strong overlap between the DCI and the CCC, items are not coded 5-ESS2-1.2.
5-ESS2-1.3	DCI-CCC	Connect interactions within and/or between Earth's systems : geosphere, biosphere, hydrosphere, and/or atmosphere.
5-ESS2-1.4	SEP-CCC	Develop and/or use a model to describe interactions within and/or between the components of a system.

Details and Clarifications

- **Develop** and/or **use** a **model** is expanded to include:
 - revising a complete or partial model
 - comparing complete or partial models
 - using a model to describe a scientific principle
 - using a model to describe a process
 - using a model to make predictions
- **Models** may include, but are NOT limited to:
 - diagrams
 - simulations
 - descriptions of interactions
- Components of **Earth's systems** may include, but are NOT limited to:
 - geosphere: rock, soil, sediments
 - biosphere: living things
 - hydrosphere: water, ice
 - atmosphere: air, wind
- Examples of **interactions** between two of **Earth's systems** may include, but are NOT limited to:
 - wind shaping the land
 - organisms producing soil
 - landforms influencing weather conditions
 - the ocean affecting climate
 - water moving rocks, soil, and/or sediment

Performance Expectation	5-ESS2-2 Describe and graph the amounts of salt water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.		
Dimensions	Science & Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
	Using Mathematics and Computational Thinking Mathematical and computational thinking in 3–5 builds on K–2 experiences and progresses to extending quantitative measurements to a variety of physical properties and using computation and mathematics to analyze data and compare alternative design solutions. <ul style="list-style-type: none"> Describe and graph quantities such as area and volume to address scientific questions. 	ESS2.C: The Roles of Water in Earth’s Surface Processes <ul style="list-style-type: none"> Nearly all of Earth’s available water is in the ocean. Most fresh water is in glaciers or underground; only a tiny fraction is in streams, lakes, wetlands, and the atmosphere. 	Scale, Proportion, and Quantity <ul style="list-style-type: none"> Standard units are used to measure and describe physical quantities such as weight and volume.
These item specifications were developed using the following reference materials:			
K–12 Framework	pp. 64–67	pp. 184–186	pp. 89–91
NGSS Appendices	Appendix F p. 10	Appendix E p. 3	Appendix G pp. 6–7
Clarification Statement	A clarification statement is not provided for this PE.		
Assessment Boundary	Assessment is limited to oceans, lakes, rivers, glaciers, groundwater, and polar ice caps, and does not include the atmosphere.		

Items may ask students to:

Code	Alignment	Item Specification
5-ESS2-2.1	SEP-DCI-CCC	Use standard units to describe and/or graph quantities that show that Earth's available water is distributed in various reservoirs .
5-ESS2-2.2	SEP-DCI	Describe and/or graph quantities that show that Earth's available water is distributed in various reservoirs .
5-ESS2-2.3	DCI-CCC	Use standard units to describe the quantities of available water distributed in various reservoirs .
5-ESS2-2.4	SEP-CCC	Describe and/or graph quantities using standard units.
Details and Clarifications		
<ul style="list-style-type: none"> • Describe and/or graph quantities is expanded to include: <ul style="list-style-type: none"> ◦ using mathematics to represent variables and their relationships ◦ measuring, comparing, and/or organizing quantitative attributes (e.g., area, volume, mass) to reveal patterns that suggest relationships ◦ graphing quantities to address scientific questions and/or problems • Reservoirs containing Earth's available water include: <ul style="list-style-type: none"> ◦ glaciers ◦ groundwater ◦ lakes ◦ oceans ◦ polar ice caps ◦ rivers • A description of Earth's available water may include, but is NOT limited to: <ul style="list-style-type: none"> ◦ comparison of the relative amounts of fresh water and/or salt water available on Earth ◦ quantitative statements of the differences in amount and/or type of water in two or more reservoirs • A graph of Earth's available water may include, but is NOT limited to: <ul style="list-style-type: none"> ◦ a graph showing amounts of fresh water and/or salt water in two or more reservoirs ◦ a graph showing relative amounts of fresh water and/or salt water in two or more reservoirs • Standard units may include, but are NOT limited to: <ul style="list-style-type: none"> ◦ cubic meters ◦ kilograms ◦ liters 		

Performance Expectation	4-ESS3-1 Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.		
Dimensions	Science & Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
	Obtaining, Evaluating, and Communicating Information Obtaining, evaluating, and communicating information in 3–5 builds on K–2 experiences and progresses to evaluate the merit and accuracy of ideas and methods. <ul style="list-style-type: none"> Obtain and combine information from books and other reliable media to explain phenomena. 	ESS3.A: Natural Resources <ul style="list-style-type: none"> Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not. 	Cause and Effect <ul style="list-style-type: none"> Cause and effect relationships are routinely identified and used to explain change. Connections to Engineering, Technology, and Applications of Science Interdependence of Science, Engineering, and Technology <ul style="list-style-type: none"> Knowledge of relevant scientific concepts and research findings is important in engineering. Influence of Engineering, Technology, and Science on Society and the Natural World <ul style="list-style-type: none"> Over time, people’s needs and wants change, as do their demands for new and improved technologies.
These item specifications were developed using the following reference materials:			
K-12 Framework	pp. 74–77	pp. 191–192	pp. 87–89 pp. 210–212 pp. 212–214
NGSS Appendices	Appendix F p. 15	Appendix E p. 3	Appendix G pp. 5–6 Appendix J pp. 1–3
Clarification Statement	Examples of renewable energy resources could include wind energy, water behind dams, and sunlight; non-renewable energy resources are fossil fuels and fissile materials. Examples of environmental effects could include loss of habitat due to dams, loss of habitat due to surface mining, and air pollution from burning of fossil fuels.		
Assessment Boundary	An assessment boundary is not provided for this PE.		

Items may ask students to:

Code	Alignment	Item Specification
4-ESS3-1.1	SEP-DCI-CCC	Obtain and combine information to describe how human use of energy and/or fuels derived from renewable and/or non-renewable resources can cause changes to the environment.
4-ESS3-1.2	SEP-DCI	Due to a strong overlap between the DCI and the CCC, items are not coded 4-ESS3-1.2.
4-ESS3-1.3	DCI-CCC	Use cause and effect relationships to connect the human use of energy and/or fuels derived from renewable and/or non-renewable resources to changes to the environment.
4-ESS3-1.4	SEP-CCC	Obtain and combine information to identify cause and effect relationships.

Details and Clarifications

- **Obtain and combine information** is expanded to include:
 - summarizing information to describe a scientific concept and/or support a scientific claim
 - comparing information to describe a scientific concept and/or support a scientific claim
- **Information** formats may include, but are NOT limited to:
 - text
 - diagrams
 - graphs
 - tables
 - models
 - animations
- **Renewable resources** may include, but are NOT limited to:
 - wind
 - water behind dams
 - sunlight
 - waves
- **Non-renewable resources** may include, but are NOT limited to:
 - fossil fuels
 - nuclear energy
- **Cause and effect** relationships may include, but are NOT limited to:
 - use of a natural resource decreases the availability of that resource
 - use of nonrenewable fuel resources decreases available habitats

Performance Expectation	5-ESS3-1 Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.		
Dimensions	Science & Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
	Obtaining, Evaluating, and Communicating Information Obtaining, evaluating, and communicating information in 3–5 builds on K–2 experiences and progresses to evaluating the merit and accuracy of ideas and methods. <ul style="list-style-type: none"> Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem. 	ESS3.C: Human Impacts on Earth Systems <ul style="list-style-type: none"> Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments. 	Systems and System Models <ul style="list-style-type: none"> A system can be described in terms of its components and their interactions. Connections to Nature of Science Science Addresses Questions About the Natural and Material World <ul style="list-style-type: none"> Science findings are limited to questions that can be answered with empirical evidence.
These item specifications were developed using the following reference materials:			
K-12 Framework	pp. 74–77	pp. 194–196	pp. 91–94
NGSS Appendices	Appendix F p. 15	Appendix E p. 3	Appendix G pp. 7–8 Appendix H p. 6
Clarification Statement	A clarification statement is not provided for this PE.		
Assessment Boundary	An assessment boundary is not provided for this PE.		

Items may ask students to:

Code	Alignment	Item Specification
5-ESS3-1.1	SEP-DCI-CCC	Obtain and combine information about the components of and/or interactions between Earth's resources and environments and the ways individual communities use science ideas to protect them from the effects of human activities .
5-ESS3-1.2	SEP-DCI	Obtain and combine information about the effects of human activities on Earth's resources and/or environments .
5-ESS3-1.3	DCI-CCC	Connect the components of and/or interactions between Earth's resources and environments and the ways individual communities use science ideas to protect them from the effects of human activities .
5-ESS3-1.4	SEP-CCC	Obtain and combine information about the components of and/or interactions within a system.
Details and Clarifications		
<ul style="list-style-type: none"> • Obtain and combine information is expanded to include: <ul style="list-style-type: none"> ○ summarizing information to describe a scientific concept and/or support a scientific claim ○ comparing information to describe a scientific concept and/or support a scientific claim • Information formats may include, but are NOT limited to: <ul style="list-style-type: none"> ○ text ○ diagrams ○ graphs ○ tables ○ models ○ animations • Ways to protect Earth's resources and environments may include, but are NOT limited to: <ul style="list-style-type: none"> ○ reusing and recycling materials to reduce trash ○ developing and choosing alternative sources of energy and/or fuels ○ developing technologies that preserve ecosystems ○ protecting areas to prevent future habitat loss • Effects of human activities on Earth's resources and environments may include, but are NOT limited to: <ul style="list-style-type: none"> ○ modifying bodies of water affects the quality, availability, and/or distribution of Earth's water ○ use of forest land for development disrupts ecosystems ○ some industries decrease air quality 		

Performance Expectation	4-ESS3-2 Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.		
Dimensions	Science & Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
	Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems. <ul style="list-style-type: none"> • Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution. 	ESS3.B: Natural Hazards <ul style="list-style-type: none"> • A variety of hazards result from natural processes (e.g., earthquakes, tsunamis, volcanic eruptions). Humans cannot eliminate the hazards but can take steps to reduce their impacts. (Note: This Disciplinary Core Idea can also be found in 3.WC.) ETS1.B: Designing Solutions to Engineering Problems <ul style="list-style-type: none"> • Testing a solution involves investigating how well it performs under a range of likely conditions. (secondary) 	Cause and Effect <ul style="list-style-type: none"> • Cause and effect relationships are routinely identified, tested, and used to explain change. Connections to Engineering, Technology, and Applications of Science Influence of Engineering, Technology, and Science on Society and the Natural World <ul style="list-style-type: none"> • Engineers improve existing technologies or develop new ones to increase their benefits, to decrease known risks, and to meet societal demands.
These item specifications were developed using the following reference materials:			
K-12 Framework	pp. 67–71	pp. 192–194 pp. 206–208	pp. 87–89
NGSS Appendices	Appendix F pp. 11–12	Appendix E p. 3 Appendix I pp. 1–7	Appendix G pp. 5–6 Appendix J pp. 2–3
Clarification Statement	Examples of solutions could include designing an earthquake resistant building and improving monitoring of volcanic activity.		
Assessment Boundary	Assessment is limited to earthquakes, floods, tsunamis, and volcanic eruptions.		

Items may ask students to:

Code	Alignment	Item Specification
4-ESS3-2.1	SEP-DCI-CCC	Generate and/or compare solutions , using cause and effect relationships, to reduce the impacts of natural hazards on humans.
4-ESS3-2.2	SEP-DCI	Due to a strong overlap between the DCI and the CCC, items are not coded 4-ESS3-2.2.
4-ESS3-2.3	DCI-CCC	Use cause and effect relationships to connect human solutions to the reduction of impacts from natural hazards .
4-ESS3-2.4	SEP-CCC	Generate and/or compare multiple solutions to a problem, using cause and effect relationships.
Details and Clarifications		
<ul style="list-style-type: none"> • Generate and/or compare solutions is expanded to include: <ul style="list-style-type: none"> ◦ using measurements, observations, or patterns to support an explanation ◦ using measurements, observations, or patterns to generate and/or compare solutions to a problem ◦ using evidence to design a solution to a problem ◦ comparing solutions to a problem as to how well they meet criteria for success ◦ comparing solutions in terms of constraints that limit the success of the solution • Solutions may include, but are NOT limited to: <ul style="list-style-type: none"> ◦ reducing the impact of a hazard through engineering of materials, structures, or landscapes ◦ restricting humans from living in hazard-prone areas ◦ monitoring and/or early warning systems • Impacts of natural hazards may include, but are NOT limited to: <ul style="list-style-type: none"> ◦ damage to or destruction of property ◦ ecological changes (e.g., loss of habitat) ◦ disruption of human activities • Natural hazards resulting from natural processes include: <ul style="list-style-type: none"> ◦ earthquakes ◦ floods ◦ tsunamis ◦ volcanic eruptions • Cause and effect relationships include, but are NOT limited to: <ul style="list-style-type: none"> ◦ an early warning system gives humans more time to evacuate an area ◦ sandbags reduce water damage from a flood ◦ tsunami evacuation routes allow people to move quickly to safe locations 		

Engineering, Technology, and Applications of Science

Disciplinary Core Ideas:

- ETS1 Engineering Design

The item specifications that follow represent a **sample** of PEs. The sample will continue to expand until this document contains all the PEs. The sample of PEs represents only a part of what could be assessed on the WCAS. The inclusion of a PE in this document does not indicate that PE will be assessed by an item on the WCAS, nor does the absence of a PE from this document indicate that the PE will not be assessed on the WCAS.

Future item specifications drafts will include modification logs that will be updated at each subsequent publication.

Performance Expectation	3-5-ETS1-1 Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.		
Dimensions	Science & Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
	Asking Questions and Defining Problems Asking questions and defining problems in 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships. <ul style="list-style-type: none"> Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost. 	ETS1.A: Defining and Delimiting Engineering Problems <ul style="list-style-type: none"> Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. 	Influence of Science, Engineering, and Technology on Society and the Natural World <ul style="list-style-type: none"> People’s needs and wants change over time, as do their demands for new and improved technologies.
These item specifications were developed using the following reference materials:			
K-12 Framework	pp. 54–56	pp. 204–206	pp. 212–214
NGSS Appendices	Appendix F pp. 4–5	Appendix I pp. 1–7	Appendix J pp. 2–3
Clarification Statement	A clarification statement is not provided for this PE.		
Assessment Boundary	An assessment boundary is not provided for this PE		

Items may ask students to:

Code	Alignment	Item Specification
3-5-ETS1-1.1	SEP-DCI-CCC	Define a simple design problem reflecting a need and/or a want that includes specified criteria for a successful solution and/or constraints on materials, time, and/or cost that could limit the success of a solution.
3-5-ETS1-1.2	SEP-DCI	Define a simple design problem that includes specified criteria for a successful solution and/or constraints on materials, time, and/or cost that could limit the success of a solution.
3-5-ETS1-1.3	DCI-CCC	Connect criteria for a successful solution and/or constraints on materials, time, and/or cost that could limit the success of a solution to a design problem that reflect a need and/or a want.
3-5-ETS1-1.4	SEP-CCC	Define a simple design problem that reflects a need and/or a want.
Details and Clarifications		
<ul style="list-style-type: none"> • Define a problem is expanded to include: <ul style="list-style-type: none"> ○ asking questions about what would happen if a variable is changed ○ asking and/or identifying questions that can be answered through observation and/or investigation ○ predicting the outcome of questions that can be answered through observation and/or investigation ○ asking questions about observations, data, claims, and/or proposed designs ○ describing criteria for a successful solution ○ describing constraints that could limit the success of a solution • Criteria for a successful solution may include, but are NOT limited to: <ul style="list-style-type: none"> ○ relatively high degree of safety ○ relatively high effectiveness in solving specific aspects of the given problem ○ relatively low cost ○ readily available materials ○ relatively short time needed to implement • Constraints that could limit the success of a solution may include, but are NOT limited to: <ul style="list-style-type: none"> ○ relative lack of safety ○ relative deficiency in solving specific aspects of the given problem ○ relatively high cost ○ materials that are difficult to acquire ○ relatively long period of time to implement 		

Performance Expectation	3-5-ETS1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.		
Dimensions	Science & Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
	Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems. <ul style="list-style-type: none"> • Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem. 	ETS1.B: Developing Possible Solutions <ul style="list-style-type: none"> • Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. • At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. 	Influence of Science, Engineering, and Technology on Society and the Natural World <ul style="list-style-type: none"> • Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands.
These item specifications were developed using the following reference materials:			
K-12 Framework	pp. 67–71	pp. 206–208	pp. 212–214
NGSS Appendices	Appendix F pp. 11–12	Appendix I pp. 1–7	Appendix J pp. 2–3
Clarification Statement	A clarification statement is not provided for this PE.		
Assessment Boundary	An assessment boundary is not provided for this PE.		

Items may ask students to:

Code	Alignment	Item Specification
3-5 ETS1-2.1	SEP-DCI-CCC	Compare solutions to a problem using given research and/or test results to develop improvements that increase benefits , decrease risks , and/or meet societal demands while addressing known criteria and constraints .
3-5 ETS1-2.2	SEP-DCI	Compare solutions to a problem based on how well each solution meets criteria for a successful solution and/or how the constraints of each solution could limit success.
3-5 ETS1-2.3	DCI-CCC	Use given research and/or test results for solutions to a problem to develop improvements that increase benefits , decrease risks , and/or meet societal demands while addressing known criteria and constraints .
3-5 ETS1-2.4	SEP-CCC	Compare solutions to a problem based on improvements that increase benefits, decrease risks, and/or meet societal demands while addressing known criteria and constraints.
Details and Clarifications		
<ul style="list-style-type: none"> • Compare solutions is expanded to include: <ul style="list-style-type: none"> ○ using measurements, observations, or patterns to support an explanation ○ using measurements, observations, or patterns to generate and/or compare solutions to a problem ○ using evidence to design a solution to a problem ○ comparing solutions to a problem as to how well they meet criteria for success ○ comparing solutions in terms of constraints that limit the success of the solution • Criteria for a successful solution may include, but are NOT limited to: <ul style="list-style-type: none"> ○ relatively high degree of safety ○ relatively high effectiveness in solving specific aspects of the given problem ○ relatively low cost ○ readily available materials ○ relatively short time needed to implement • Constraints that could limit the success of a solution may include, but are NOT limited to: <ul style="list-style-type: none"> ○ relative lack of safety ○ relative deficiency in solving specific aspects of the given problem ○ relatively high cost ○ materials that are difficult to acquire ○ relatively long period of time to implement • Research and test results may include, but are NOT limited to: <ul style="list-style-type: none"> ○ Internet research ○ market research ○ experimental results ○ field observations • Improvements of a solution to increase benefits, decrease risks, and/or meet societal demands may include, but are NOT limited to: <ul style="list-style-type: none"> ○ decreasing costs required to implement a solution ○ increasing the safety, resilience, and/or reliability of a solution ○ increasing the efficiency of a solution 		

SEP, DCI, and CCC Vocabulary Used in Assessment Items at Grade 5 **(Partial List)**

The following list is based on the item specifications included in the December 2018 draft of the Test Design and Item Specifications document. The list will be updated in the next draft of the document which is expected to be published late spring 2019.

Items use language targeted to the previous grade level or lower readability with the exception of the required SEP, DCI, and CCC terms in the following list.

a	disease	heat energy
advantage	distance	hydrosphere
amplitude		
angle	e	i
atmosphere	earthquake	impact
attract	ecosystem	increase
axis	effect	inherited
	electric current	input
b	electric force	interaction
balanced force	electricity	investigation
behavior	electromagnet	
biosphere	energy	l
	energy transfer	landform
c	engineer	life cycle
camouflage	environment	light energy
cause	erosion	limitation
characteristic	evaporate	liquid
charge	evidence	
claim	exert	m
classify	extinct	magnet
climate		magnetic
collide	f	magnetic force
collision	factor	marine
compare	food web	mass
conclusion	force	material
conserve	fossil	matter
constraint	fossil fuel	measure
criteria	function	mineral
		model
d	g	motion energy
device	gas	
data	geosphere	n
decomposer	glacier	nonrenewable
decrease	graph	
defend	gravity	o
demonstration	groundwater	object
describe		observation
design	h	offspring
diagram	habitat	orbit
disadvantage	hazard	organism
		output

p

particle
pattern
physical property
polar ice cap
pole (of a magnet)
pollution
population
precipitation
predator
predict
prediction
process
property

q

quantity

r

recycle
reduce
relationship
renewable
repel
reproduction
research
resource
result
rock formation
rock layer
rotate
runoff

s

scientist
sediment
similarity
simulation
solar energy
solid
solution (to a problem)
sound energy
species
speed

stability
state (of matter)
structure
substance
subsystem
support
surface
survive
system

t

technology
temperature
trait
tsunami

u

unbalanced force

v

variable
volcanic eruption
volume

w

wave
wavelength
weathering
wetland
wind energy

