



District of Columbia
Office of the State Superintendent of Education

DC Science

The District of Columbia Assessment of
the Next Generation Science Standards

Assessment Design and Blueprints

Grade 8

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The DC Science Assessment

The District of Columbia Assessment of the Next Generation Science Standards

What is the DC Science Assessment?

The DC Science Assessment is the District of Columbia's statewide assessment of the Next Generation Science Standards (NGSS). It is an online assessment that focuses on sense-making and problem solving in science.

As students explore the NGSS learning standards, called Performance Expectations (PEs), they learn to make sense of natural phenomena and solve problems using approaches that scientists use. During the test, students use scientific principles, skills, and behaviors to observe phenomena, generate questions, conduct investigations, create models, predict outcomes, analyze results, and engage in argumentation and communication. The DC Science Assessment presents students with tasks that are built around scientific phenomena as well as engineering design challenges. Tasks are arranged into clusters of items designed to address NGSS's three-dimensional approach to the application of knowledge and practice -- an approach that integrates Disciplinary Core Ideas (DCI), Science and Engineering Practices (SEP), and Crosscutting Concepts (CCC). As students work through these multidimensional clusters of items, they use scientific principles, skills, and behaviors to make sense of scientific phenomena and propose solutions to engineering design problems.

How is DC Science Assessment Administered?

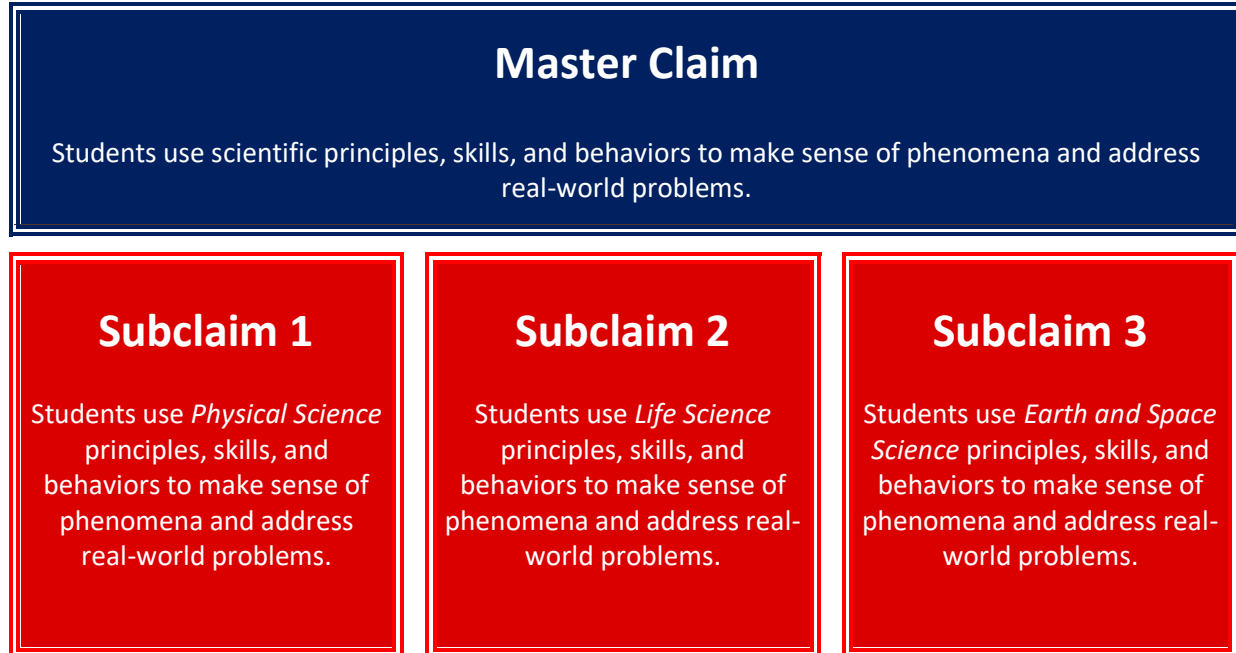
The DC Science Assessment is administered through Pearson TestNav, the same online platform that students use for the Partnership for Assessment of Readiness for College and Careers (PARCC) assessments in English language arts and mathematics. Much like PARCC, DC Science Assessment offers a suite of testing accommodations and features to make the assessment accessible for all students.

Who Takes DC Science?

The DC Science Assessment is administered to students in grades 5 and 8 and to students enrolled in high school biology.

Claims Structure

Grades 8 Assessment: NGSS Content Grades 6-8



High Level Blueprint

Grades 8 Assessment Blueprint: NGSS Content Grades 6-8

Reporting Domain (scientific principles, skills, and behaviors for each)	Percentage of PEs per Science Domain in the NGSS	Percentage of PEs per Domain on the DC Science Assessment	Number of Item Clusters*	Total Raw Score Points**
Physical	35%	30% - 40%	9	81
Life	38%	35% - 45%		
Earth and Space	27%	20% -30%		

*Each item cluster is composed of 6 items. Each test form includes item clusters that target content from all three domains and Engineering Design.

**Items have a range of scores from 1 to 3 raw score points.

Assessment Standards

Grade 8 Assessment: Assessed NGSS Performance Expectations from Grades 6-8

The NGSS Performance Expectations are learning goals that describe what students should be able to do by the end of instruction. Each performance expectation describes how students purposely engage in the Science and Engineering Practices, apply the Crosscutting Concepts and use their understanding of core ideas to make sense of the world and address real-world problems. The table shows the NGSS Performance Expectations from grades 6-8 that are assessed in the DC Science Assessment Grade 8 assessment.

Physical Science		Life Science	Earth & Space Science		Engineering, Technology, & Applications of Science
MS-PS1-1	MS-PS3-5	MS-LS1-1	MS-LS4-1	MS-ESS1-1	MS-ETS1-1
MS-PS1-2	MS-PS4-1	MS-LS1-2	MS-LS4-2	MS-ESS1-2	MS-ETS1-2
MS-PS1-3	MS-PS4-2	MS-LS1-3	MS-LS4-3	MS-ESS1-3	MS-ETS1-3
MS-PS1-4	MS-PS4-3	MS-LS1-4	MS-LS4-4	MS-ESS1-4	MS-ETS1-4
MS-PS1-5		MS-LS1-5	MS-LS4-5	MS-ESS2-1	
MS-PS1-6		MS-LS1-6	MS-LS4-6	MS-ESS2-2	
MS-PS2-1		MS-LS1-7		MS-ESS2-3	
MS-PS2-2		MS-LS1-8		MS-ESS2-4	
MS-PS2-3		MS-LS2-1		MS-ESS2-5	
MS-PS2-4		MS-LS2-2		MS-ESS2-6	
MS-PS2-5		MS-LS2-3		MS-ESS3-1	
MS-PS3-1		MS-LS2-4		MS-ESS3-2	
MS-PS3-2		MS-LS2-5		MS-ESS3-3	
MS-PS3-3		MS-LS3-1		MS-ESS3-4	
MS-PS3-4		MS-LS3-2		MS-ESS3-5	

Item Cluster Structure: Item Types and Number of Raw Score Points

This table contains information about the item types included in each item cluster:

Item Type		Number of Items in a Cluster	Number of Raw Score Points for Each Item	Total Number of Raw Score Points
Selected-Response Items	Multiple Choice* Students select one correct answer from among several options.	2	1	2
	Multiple Select* Students select more than one correct answer from among several options.			
	Technology Enhanced* Students taking the computer-based tests respond to items using technology such as drag-and-drop, hot spot, and drop-down menus.	2	1	2
Constructed-Response Items	Constructed Response** Students write a response to a multi-part item.	1	2	2
Total for each Cluster		6		9

*These item types are machine-scored.

**Constructed-response items are hand-scored.

Test Form Structure: Units, Item Clusters, and Number of Raw Score Points

This table shows the point structure of the DC Science Assessment forms:

Unit	Number of Item Clusters*	Number of Items	Number of Raw Score Points	Purpose
1	3	18	81	Individual Reporting
2	3	18		
3	3	18		
4	3	18		

* Three field-test item clusters are randomly placed throughout the form.

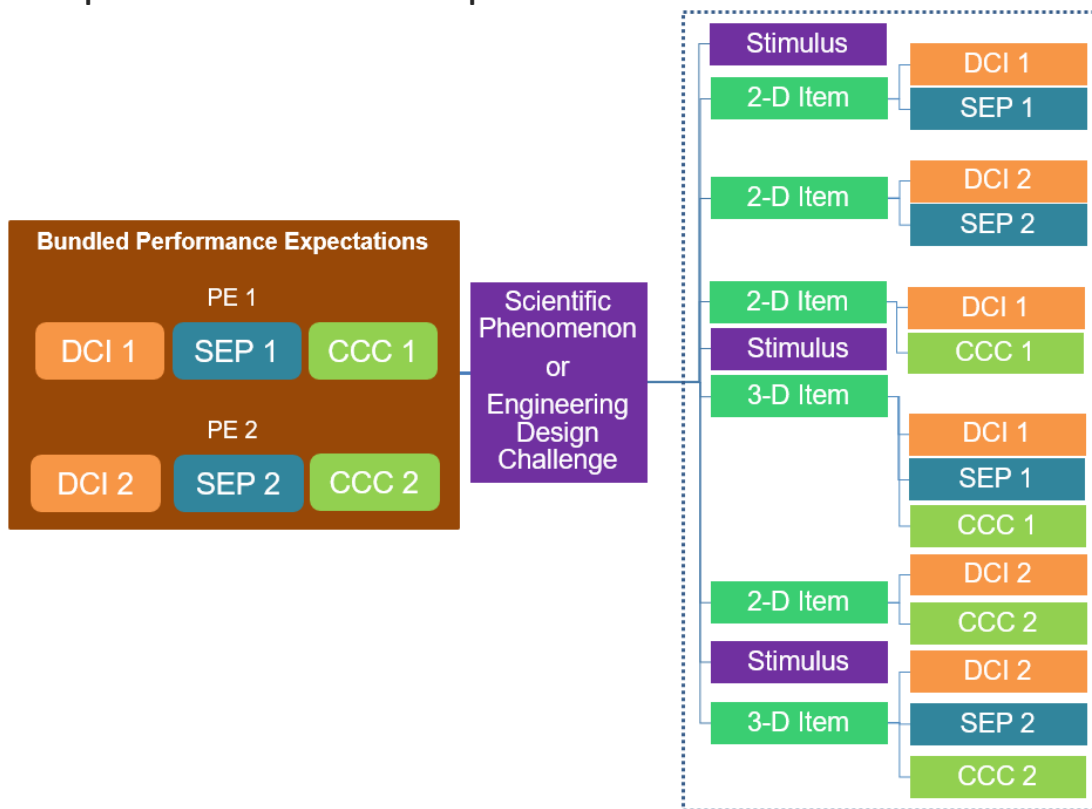
Item Clusters Design

Item clusters are designed to assess a NGSS Performance Expectation (PE) bundles and constitute the building blocks of the DC Science Assessment. A PE bundle is usually made of two or three related PEs that are used to explain or make sense of a scientific phenomenon or to design a solution to a problem presented in the stimulus. The six items in an item cluster are designed around the ideas presented in the stimulus. Although the items are independent from each, they are structured to support a student’s progression through the item cluster.

Students are asked to make sense of phenomena by using the Science and Engineering Practices (SEP), Disciplinary Core Ideas (DCI), and Crosscutting Concepts (CCC) represented in the PE bundle. PEs are often bundled within a single domain, but may include PEs from different domains. PE bundles sometimes share a similar Science and Engineering Practice or Crosscutting Concept or may include multiple Science and Engineering Practices or Crosscutting Concepts. Each item within the cluster aligns to two or three dimensions (2-D, 3-D).

This Sample Item Cluster Map shows how the items in a sample cluster work together to achieve a full representation of dimensionalities in a two-PE bundle.

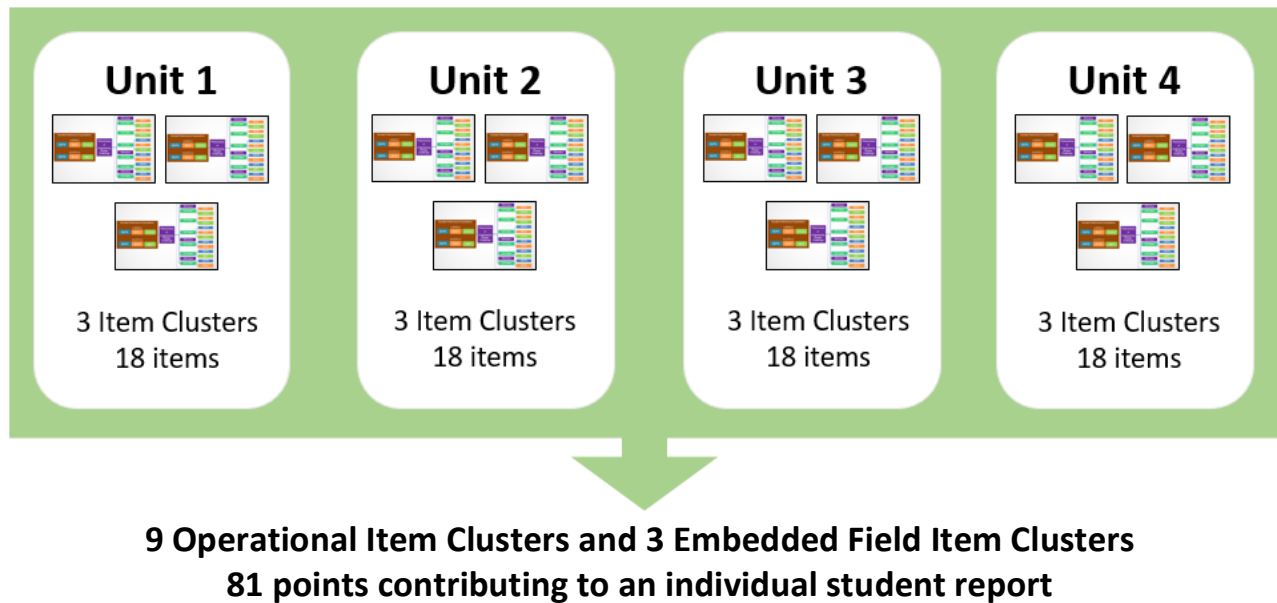
Sample Item Cluster Map



Test Form Design: Operational and Field Test Item Clusters

The DC Science Assessment uses a fixed-form design. Each operational test form contains the same item clusters in a given year.

Operational Test Form



Test Units

The DC Science Assessment is composed of four units. In each unit, students encounter three item clusters. Three of the four units contribute to the individual student score. Each unit can yield up to 27 raw score points.

Field Test Items

Operational test forms contain three embedded field test item clusters. The field test items do not contribute to the student's score. The embedded field-test item clusters are randomly placed in the test.

Testing Times

The DC Science Assessment is intended to be administered online in four sessions. The 180-minute administration time allows 45 minutes for each unit of the test. Contact your district testing coordinator for further information on the specific test schedule for your district or building.

Performance Level Definitions

Performance Level	Description
Exceeds Expectations	A student who <i>Exceeds Expectations</i> demonstrates thorough understanding and sophisticated reasoning when applying Disciplinary Core Ideas, using Science and Engineering Practices, and using Crosscutting Concepts to make sense of phenomena or address solutions in the natural or designed world.
Meets Expectations	A student who <i>Meets Expectations</i> demonstrates a substantial understanding and relevant reasoning when applying Disciplinary Core Ideas, using Science and Engineering Practices, and using Crosscutting Concepts to make sense of phenomena or address solutions in the natural or designed world.
Approaches Expectations	A student who <i>Approaches Expectations</i> demonstrates a basic understanding and draws connections between and among science dimensions when applying Disciplinary Core Ideas, using Science and Engineering Practices, and using Crosscutting Concepts to make sense of phenomena or address solutions in the natural or designed world.
Partially Meets Expectations	A student who <i>Partially Meets Expectations</i> demonstrates a below-basic understanding and is not yet making connections between and among science dimensions when using Disciplinary Core Ideas, using Science and Engineering Practices, and using Crosscutting Concepts to make sense of phenomena or address solutions in the natural or designed world.

Cut Scores

The DC Science Assessment has a scale of 300-600 with an anchor of 450 as meeting expectations.

Grade/ Subject	Performance Level	Cut Score
Grade 8	Exceeds Expectations	484
	Meets Expectations	450
	Approaches Expectations	409

Performance Level Descriptors (PLDs)

The DC Science Assessment Performance Level Descriptors were developed from the NGSS Performance Expectation to outline specific expectations of student performance. They delineate what a typical student within a performance level would know and be able to demonstrate from a content perspective. The Performance Level Descriptors show a progression of multidimensional performance across performance levels.

Grade 8 Level 2: Approaching Expectations

An eighth-grade student performing at Level 2 demonstrates a basic understanding and draws connections between and among science dimensions when applying grades 6-8 Disciplinary Core Ideas, using middle school Science and Engineering Practices, and using middle school Crosscutting Concepts to make sense of phenomena or address solutions in the natural or designed world.

A student performing at Level 2 can do things like:

Physical Science

- propose the design of an object, a tool, a process, or a system aimed at affecting the average kinetic energy of the particles in a system in a desired way, and the object, tool, process, or system will be evaluated using criteria and constraints including temperature (MS-PS3-3)
- explore the regular and repeating patterns of a wave by analyzing data sets and/or identifying and constructing a graph (MS-PS4-1)
- read and describe appropriate sources related to the design of a structure that encodes and transmits digitized signals that are comprised of a pattern of 1s and 0s (MS-PS4-3)
- use processes for evaluating design solutions with respect to how well they meet the criteria and constraints of a problem and then make an oral or written argument that supports or refutes the advertised performance of a device, process, or system based on empirical evidence concerning whether the technology meets relevant criteria and constraints (MS-ETS1-2)

Life Science

- makes a claim, citing evidence, that tissues and organs are composed of cells and that these cells are specialized for particular body functions. (MS-LS1-3)
- read and understand appropriate sources, assesses the credibility, accuracy, and bias in each, and then communicates that animals change their behavior in response to a sensory input (MS-LS1-8)
- makes an oral or written argument that supports or refutes the advertised performance of a device, process, or system designed to affect biodiversity; a key point of the argument involves the student's understanding of the fact that changes to one part of an ecosystem may cause changes in another part of the ecosystem (MS-LS2-5)
- constructs and uses graphical displays of data and large data sets to compare findings and uses this information to identify criteria and constraints (characteristics) that should be used in the evaluation of a design solution (MS-ETS1-3)

Earth and Space Science

- make a claim, citing evidence, related to the effect of human consumption of resources on Earth (MS-ESS3-4)
- describe that the movement of water affects weather, understand that weather patterns cannot be predicted with exact certainty, and is able to make measurements related to weather (MS-ESS2-5)

Grade 8 Level 3: Meets Expectations

An eighth-grade student performing at Level 2 demonstrates substantial understanding and relevant reasoning when applying grades 6-8 Disciplinary Core Ideas, using middle school Science and Engineering Practices, and using middle school Crosscutting Concepts to make sense of phenomena or address solutions in the natural or designed world.

In addition to the scientific knowledge and practices demonstrated at Level 2, a student performing at Level 3 can do things like:

Physical Science

- use the relationship between temperature and total energy of a system to test a designed object, tool, process, or system intended to affect the flow of energy in a system in a particular way; the test the student uses requires that the student track the energy flow in the system and that the design meets precisely defined design criteria and constraints (MS-PS3-3)
- apply mathematical concepts and/or processes (e.g., interpreting graphs, ratio, rate, percent, basic operations, simple algebra) to determine wavelength, frequency, and amplitude of a wave and/or identify cause and effect relationships in relation to the explanation of a phenomenon (MS-PS4-1)
- synthesize information from at least two credible sources in relation to the explanation of a phenomenon or design problem and use that information in relation to a phenomenon or design problem that relies on the fact that digitized signals, sent as wave pulses, are a more reliable way to encode and transmit information (MS-PS4-3)
- develop systematic processes for evaluating design solutions with respect to how well they meet the criteria and constraints of a problem and then use these processes to evaluate competing design solutions (MS-ETS1-2)

Life Science

- use arguments supported by evidence to support or refute an explanation or a model for a phenomenon related to the fact that body systems are made of organs that work together and that the body is a system of interacting subsystems (MS-LS1-3)
- synthesize information from at least two credible sources to communicate that the response of sensory receptors to various inputs results in the transmission of signals that travel along nerve cells to the brain, where signals are processed; understand that this results in immediate behaviors or memories; and describe how the information is supported or not supported by evidence (MS-LS1-8)
- evaluate competing design solutions regarding a problem related to biodiversity based on jointly developed and agreed-upon design criteria, using systematic processes. The student uses an understanding of the fact that small changes in one part of the ecosystem may cause large changes in another part of the ecosystem, together with an understanding of changes in biodiversity and its influence on human resources (MS-LS2-5)

- use systematic processes that measure important characteristics to provide evidence for phenomena, to determine similarities and differences in findings, and/or to evaluate design solutions in order to determine similarities and differences between various design solutions; use these results to identify the characteristics of the design that performed the best in each test and to make recommendations about which characteristics to incorporate in a new design (MS-ETS1-3)

Earth and Space Science

- construct arguments based on empirical evidence and scientific reasoning to support or refute an explanation that, unless the activities and technologies involved are engineered otherwise, an increase in human populations and per capita consumption of natural resources may result in negative environmental impacts (MS-ESS3-4)
- use the relationship between cause and effect to show that the complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. The student uses this information to determine which data are needed as the basis for evidence to answer scientific questions or test design solutions under a range of conditions (MS-ESS2-5)

Grade 8 Level 4: Exceeds Expectations

An eighth-grade student performing at Level 2 demonstrates thorough understanding and sophisticated reasoning when applying grades 6-8 Disciplinary Core Ideas, using middle school Science and Engineering Practices, and using middle school Crosscutting Concepts to make sense of phenomena or address solutions in the natural or designed world.

In addition to the scientific knowledge and practices demonstrated at Level 3, a student performing at Level 4 can do things like:

Physical Science

- use the relationship between temperature and the total energy of a system to design an object, tool, process, or system aimed at affecting the flow of energy in a particular way; the proposed design should involve a prediction of the flow of energy in the system over time and/or optimize the performance of a design by prioritizing criteria, making tradeoffs, testing, revising, and re-testing (MS-PS3-3)
- interpret graphs and charts to determine the energy in a single wave and/or place waves in order of relative energy in order to test or support the explanation of a phenomenon (MS-PS4-1)
- synthesize qualitative and/or quantitative information from text and graphics to clarify claims related to why digitized signals are more reliable than analog signals and then uses the synthesized information to encode and decode information contained in simple digitized signals and/or to evaluate/modify the design of structures to improve their functions (MS-PS4-3)
- evaluate and/or revise systematic processes for evaluating design solutions with respect to how well they meet the criteria and constraints of a problem and then revise a design solution so that it is more favorably evaluated using those processes (MS-ETS1-2)

Life Science

- evaluate and/or revise an argument and/or compare and critique two arguments using evidence to support or refute the explanation or the model of a phenomenon. In doing so, the student predicts the

ways in which problems or difficulties with one body system may affect other body systems. (MS-LS1-3)

- synthesize qualitative and/or quantitative information from text and graphics to clarify claims using three or more credible sources and use the information to predict the way in which the response to a stimulus (the cause) changes an animal's behavior (the effect) (MS-LS1-8)
- revise a design solution regarding a problem related to biodiversity. In the process of revision of the design solution, the student can predict the ways in which changes to an ecosystem will affect biodiversity and human resources, describing how small changes in one part of the ecosystem can result in large changes in another part. (MS-LS2-5)
- develops systematic processes using statistics and probability to analyze and compare data in the evaluation of a design solution. The student evaluates the design solutions with respect to how well they meet the criteria and constraints of a problem and incorporates characteristics that performed the best into the redesign process (MS-ETS1-3)

Earth and Space Science

- evaluate and/or revise oral and/or written arguments based on empirical evidence and scientific reasoning to support or refute an explanation to predict the effect of changes of human populations and per capita consumption of resources in an area, given changes to activities and technologies (MS-ESS3-4)
- apply scientific reasoning, ideas, or principles to show why the data or evidence are adequate for an explanation or conclusion, and/or construct, revise, or use an explanation for real-world phenomena, examples, or events. The student can evaluate the quality of the data that are collected. (MS-ESS2-5)

NGSS Performance Expectations and Three-Dimensional Performance

The DC Science Assessment is composed of sets of items that are related to a stimulus (phenomenon or engineering design challenge) and are aligned to two or more of the NGSS performance expectations (PE) and use them to elicit evidence of student achievement with respect to the NGSS standards.

PEs provide descriptions of what students should be able to do by the end of instruction for a given grade level or grade band, and are designed “to gather evidence of students’ ability to apply the Science and Engineering Practices (SEP) and their understanding of the Crosscutting Concepts (CCC) in the contexts of specific applications in multiple Disciplinary Core Ideas.” (National Research Council, 2012, p. 218).

NGSS performance expectations, appendices, evidence statements, and supporting documents are used to guide the development of the DC Science Assessment and add to the framework of reporting results for students, teachers, and others.

The following tables show the learning targets of this assessment including Science and Engineering Practices (SEP), Crosscutting Concepts (CCC), and Disciplinary Core Ideas (DCI). Additionally, the NGSS Tasks Analysis Guide that is used to determine the cognitive demand of the DC Science Assessment tasks, is also provided.

Science and Engineering Practices (SEP)

The practices are what students do to make sense of phenomena. They are both a set of skills and a set of knowledge to be internalized. The SEPs reflect the major practices that scientists and engineers use to investigate the world and design and build systems.

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

For more information on the Science and Engineering Practices, see Appendix F of the NGSS (nextgenscience.org/sites/default/files/resource/files/Appendix%20F%20%20Science%20and%20Engineering%20Practices%20in%20the%20NGSS%20-%20FINAL%20060513.pdf).

Disciplinary Core Ideas (DCI)

The fundamental ideas that are necessary for understanding a given science discipline. The core ideas all have broad importance within or across science or engineering disciplines, provide a key tool for understanding or investigating complex ideas and solving problems, relate to societal or personal concerns, and can be taught over multiple grade levels at progressive levels of depth and complexity.

Disciplinary Core Ideas	
Physical Sciences	
PS1	Matter and its interactions
PS2	Motion and stability: Forces and interactions
PS3	Energy
PS4	Waves and their applications in technologies for information transfer
Life Sciences	
LS1	From molecules to organisms: Structures and processes
LS2	Ecosystems: Interactions and variation of traits
LS3	Heredity: Inheritance and variation of traits
LS4	Biological evolution: Unity and diversity
Earth and Space Sciences	
ESS1	Earth's place in the universe
ESS2	Earth's systems
ESS3	Earth and human activity Engineering, Technology, and Applications of Science
Engineering, Technology, and Applications of Science	
ETS1	Engineering design
ETS2	Links among engineering, technology, science, and society

For more information on the Disciplinary Core Ideas, see the Framework (<https://www.nap.edu/catalog/13165/a-framework-for-k-12-science-education-practices-crosscutting-concepts>) or Appendix E of the NGSS (nextgenscience.org/sites/default/files/resource/files/AppendixE-ProgressionswithinNGSS-061617.pdf).

Crosscutting Concepts (CCC)

These are concepts that hold true across the natural and engineered world. Students can use them to make connections across seemingly disparate disciplines or situations, connect new learning to prior experiences, and more deeply engage with material across the other dimensions. The NGSS requires that students explicitly use their understanding of the CCCs to make sense of phenomena or solve problems.

Crosscutting Concepts	
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 more information on the Crosscutting Concepts, see Appendix G of the NGSS (nextgenscience.org/sites/default/files/resource/files/Appendix%20G%20-%20Crosscutting%20Concepts%20FINAL%20edited%204.10.13.pdf).

NGSS Tasks Analysis Guide

This framework is used to demine the cognitive demand of NGSS tasks that focus on sense-making and problem solving.

Cognitive Demand Levels	Task Description	Number of NGSS Dimensions Used in Completing the Task	Definitions
5*	Task involves Doing Science	3	Doing Science: Students use scientific principles, skills, and behaviors to independently make sense of relevant phenomena and/or address real-world problems building rich and elaborated content knowledge.
4	Task involves Integrated Understanding	3	Integrated Understanding: Students are engaged in higher-level thinking with less reliance on scaffolds. Students are required to integrate their understanding of practice with their understanding of content to make sense of phenomena and/or solve engineering problems. The task may ask students to conduct investigations, create models, make predictions, generate interpretations, and propose solutions.
3	Task involves Guided Understanding	2 or 3	Guided Understanding: Students are engaged in higher-level thinking using scaffolds. These may include USING a model, using data, and using information to develop an explanation, using science content to construct an argument or to formulate a solution to a problem. The tasks provide scaffolds by telling or providing the students something and asking for the rest of it.
2	Task involves Scripted Understanding	2	Scripted Understanding: Students are provided, well-defined set of actions or procedures that they need to take, usually in a given order, to complete a given task. A student can follow those actions and reach the desired answer without really knowing how or why the script leads to that answer.
1*	Task involves Memorization and Recall	1	Memorization and Recall: Students are asked to reproduce definitions, formulas, explanations of practices, and principles about particular content they have previously seen.

Based on: Tekkumru-Kisa, Miray & Stein, Mary & Schunn, Christian. (2015). A framework for analyzing cognitive demand and content-practices integration: Task analysis guide in science: TASK ANALYSIS GUIDE IN SCIENCE. *Journal of Research in Science Teaching*. 52. 10.1002/tea.21208.

* This type of task is not used in NGSS large scale assessments

Testing Accommodations, Accessibility Features, and Administrative Considerations

This table shows the accommodations that are available for the DC Science Assessment. For more information about each accommodation and its eligibility criteria, including instructions for IEP teams in selecting appropriate accommodations, please access resources on the OSSE Testing Accommodations website: <https://osse.dc.gov/service/testing-accommodations>.

Accessibility Features Available to All Students

Presentation
<ul style="list-style-type: none"> ▪ Answer masking ▪ Student reads assessment aloud to self ▪ Color contrast ▪ Audio amplification and audio speed control ▪ Magnifier ▪ General masking ▪ Answer eliminator ▪ Bookmark tool ▪ Highlight tool ▪ Line reader tool ▪ Redirect student to test

Administrative Considerations

Setting	Timing and Scheduling	Presentation
<ul style="list-style-type: none"> ▪ Separate /alternate location ▪ Small group testing ▪ Specialized equipment or furniture ▪ Specified area or setting ▪ Headphones or noise buffer 	<ul style="list-style-type: none"> ▪ Time of day ▪ Each unit may be administered on a separate day ▪ Frequent breaks 	<ul style="list-style-type: none"> ▪ Directions clarified by test administrator ▪ Human reader or human signer ▪ Redirect student to test

Accommodations for Students with Disabilities (IEP or 504) and English Language Learners (ELs) with EL Plans

Setting	Timing and Scheduling	Presentation	Response	English Language Learners
<ul style="list-style-type: none"> Unique accommodation request 	<ul style="list-style-type: none"> Extended time Unique accommodation request 	<ul style="list-style-type: none"> Directions not available in ASL: Use human signer for test directions Screen reader available as text-to-speech Paper-based edition Large print edition Hard-copy Braille edition with tactile graphics Directions read-aloud and repeated as needed by test administrator Unique accommodation request 	<ul style="list-style-type: none"> Use of calculator on non-calculator sections Answers recorded in test book: Must be transcribed into online form Braille writer or note-taker device not available: Use human scribe Word prediction external device Unique accommodation request 	<ul style="list-style-type: none"> Spanish online Spanish paper edition Extended time General administration directions clarified in student's native language (by test administrator) General administration directions read aloud and repeated as needed in student's native language (by test administrator) Human reader in Spanish