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

Biology

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The DC Science Assessment

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What is the DC Science Assessment?

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 the 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, the DC Science Assessment offers a suite of testing accommodations and features to make the assessment accessible for all students.

Who Takes the DC Science Assessment?

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

Claims Structure

Biology Assessment: High School Life Science NGSS Content

Master Claim

Students use Life Science principles, skills, and behaviors to make sense of phenomena and address real-world problems.

High Level Blueprint

Biology Assessment Blueprint: High School Life Science NGSS Content

NGSS Life Science Topics *(scientific principles, skills, and behaviors for each)*	Percentage of PEs per Topic in the NGSS	Percentage of PEs per Topic on the DC Science Assessment	Number of Item Clusters*	Total Raw Score Points **
From Molecules to Organisms: ***Structures and Processes***	29%	25% - 35%	9	81
Ecosystems: ***Interactions, Energy & Dynamics***	33%	30% - 35%		
Heredity: ***Inheritance and Variation and Traits***	13%	10% - 15%		
Biological Evolution: ***Unity & Diversity***	25%	20% - 30%		

**Each item cluster is composed of six items Each test form includes item clusters that target content from all four Life Science Topics and Engineering Design.*

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

Assessment Standards

Biology Assessment: Assessed Performance Expectations from High School NGSS

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 that are assessed in the DC Science Biology assessment.

Life Science		Engineering, Technology, & Applications of Science
HS-LS1-1	HS-LS2-6	HS-ETS1-1
HS-LS1-2	HS-LS2-7	HS-ETS1-2
HS-LS1-3	HS-LS2-8	HS-ETS1-3
HS-LS1-4	HS-LS3-1	HS-ETS1-4
HS-LS1-5	HS-LS3-2	
HS-LS1-6	HS-LS3-3	
HS-LS1-7	HS-LS4-1	
HS-LS2-1	HS-LS4-2	
HS-LS2-2	HS-LS4-3	
HS-LS2-3	HS-LS4-4	
HS-LS2-4	HS-LS4-5	
HS-LS2-5	HS-LS4-6	

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. Multiple Select* Students select more than one correct answer from among several options.	2	1	2
	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
		1	2	2
Constructed-Response Items	Constructed Response** Students write a response to a multi-part item.	1	3	3
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 tables 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.*

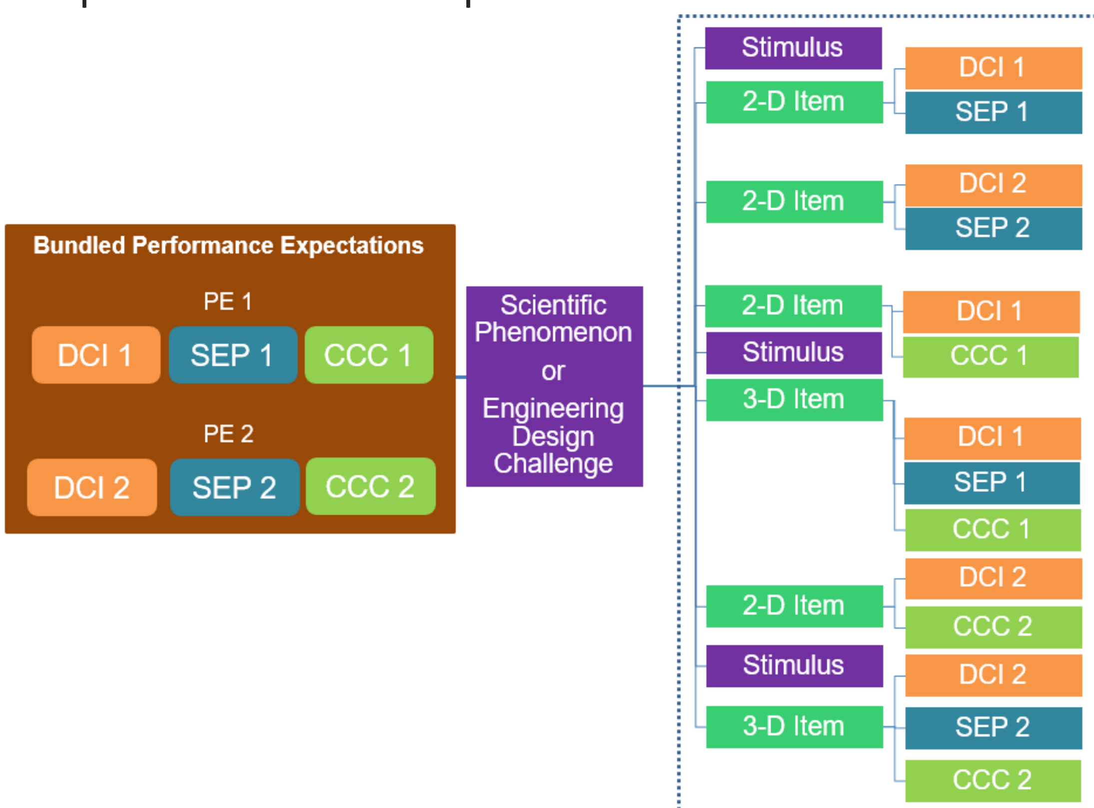
Item Clusters Design

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.

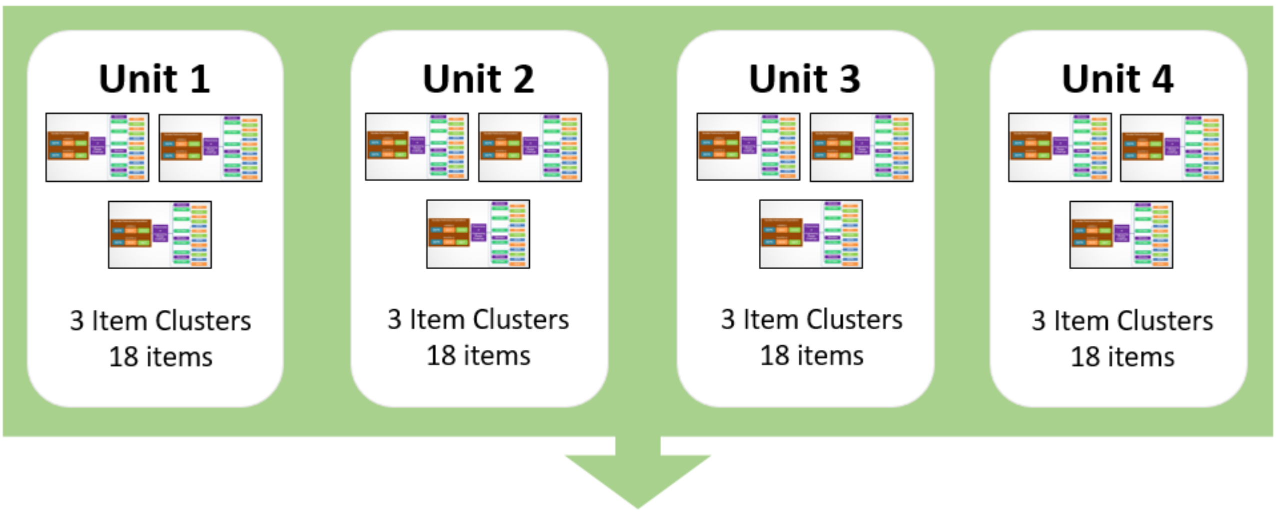
Sample Item Cluster Map



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



9 Operational Item Clusters and 3 Embedded Field Item Clusters
81 points contributing to an individual student report

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 *Exceeds Expectations* 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 *Meets Expectations* 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 Approaches Expectations 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 Partially Meets Expectations 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
Biology	Exceeds Expectations	476
	Meets Expectations	450
	Approaches Expectations	412

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.

Biology Level 2: Approaching Expectations

A biology student demonstrates a basic understanding and draws connections between and among science dimensions when applying high school life science Disciplinary Core Ideas, using high school Science and Engineering Practices, and using high 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:

- make a hypothesis and identify tools needed to collect, record, analyze, and evaluate data to support a claim related to the ways that feedback is important for stabilization of a living system (HS-LS1-3)
- explain that energy cannot be created or destroyed and clearly describe how cellular respiration is important to the cell; identify models that correctly illustrate the relationships between systems or components of systems (HS-LS1-7)
- use orders of magnitude and apply algebraic techniques and functions to represent models (a graph is one example) that show that the complex interactions in ecosystems keep the numbers and types of organisms relatively constant over long periods of time (HS-LS2-2)
- apply scientific ideas, principles, and/or evidence, together with knowledge of the basic process of photosynthesis and the fact that changes in matter in a system can be described in terms of the flow of matter into that system, to provide an explanation of a phenomenon (HS-LS2-3)
- describe the fact that cells have chromosomes made of DNA that code for traits and all cells in an organism have the same genetic content; use this information to ask questions that are important in the explanation of a phenomenon; the questions arise from examining models or a theory to clarify relationships (HS-LS3-1)
- use claims, evidence, and reasoning to support currently accepted explanations or solutions; determine the merits of arguments related to the effect of genetic and environmental factors on the distribution of traits (HS-LS3-2)
- read scientific literature critically to determine the central ideas or conclusions and/or to obtain scientific and/or technical information related to the patterns in genetic information as evidence of evolution (HS-LS4-1)
- apply basic math processes to the explanation of patterns in a phenomenon related to variation of genetic information in a population (HS-LS4-3)

- applies scientific ideas, principles, and/or evidence to solve a design problem, identifying appropriate constraints in the process, and demonstrates understanding of the ways in which the solution impacts society and the environment (HS-ETS1-3)

Biology Level 3: Meets Expectations

A biology student performing at Level 3 demonstrates a substantial understanding and relevant reasoning when applying high school life science Disciplinary Core Ideas, using high school Science and Engineering Practices, and using high 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:

- describe the design of an experimental investigation and make directional hypotheses to support a claim that predicts the ways in which feedback can stabilize or destabilize a system; describe the type, amount, and accuracy of data needed to quantify the change and rates of change over very short or very long periods of time (HS-LS1-3)
- understand that chemical elements are recombined in different ways to form different products, and use models based on evidence to generate data and illustrate and/or predict the relationships between systems or between components of systems through which matter and energy move from one place to another (HS-LS1-7)
- use mathematical representations at one scale to relate to a model at another scale that show extreme fluctuations in conditions or the size of any population can challenge the functioning of ecosystems in terms of resources and habitat availability (HS-LS2-2)
- make a quantitative and/or qualitative claim regarding dependent and independent variables and use valid evidence, together with knowledge of the basic process of cellular respiration and changes in matter and energy in a system, to construct or revise an explanation related to a phenomenon (HS-LS2-3)
- use empirical evidence and models or theories—together with knowledge of chromosomes, gene expression, and/or regulation—to ask questions and/or develop hypotheses to determine relationships, including quantitative relationships between independent and dependent variables, and/or to evaluate a question related to a phenomenon to determine if it is testable and relevant (HS-LS3-1)
- evaluate and compare claims related to an explanation of a phenomenon that involves the process of meiosis, the sources of genetic variation, and/or the influence of environmental factors on expression of traits; claim is based on empirical evidence and allows for differentiation of cause and correlation (HS-LS3-2)
- compare, integrate, and/or evaluate information related to the use of patterns in DNA sequences of different organisms in order to analyze lines of descent; use changes in patterns of DNA sequences as evidence for causality in explanations of phenomena (HS-LS4-1)
- apply concepts of statistics and probability to scientific questions related to patterns observed at each of the scales at which a system is studied; the patterns relate to an explanation of a

phenomenon that involves variation in the expression of genetic information, traits that affect survival, and changes in the proportion of individuals with or without the trait over time (HS-LS4-3)
- evaluates a design solution analyzing costs and benefits, taking into account 2 or more constraints, including cost, safety, reliability, and aesthetics, and considering social, cultural, and environmental impacts (HS-ETS1-3)

Biology Level 4: Exceeds Expectations

A biology student performing at Level 4 demonstrates thorough understanding and sophisticated reasoning when applying high school life science Disciplinary Core Ideas, using high school Science and Engineering Practices, and using high 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:

- analyze data intended to support a claim in relation to the effects of a change in external conditions on a living system; evaluate the limitations on the precision of the data (e.g., number of trials, cost, risk, time), identifies confounding variables or effects, and propose refinements to the investigation design to fully support the claim. (HS-LS1-3)
- predict the flow of matter and energy through the various organizational levels of living systems. As the products of photosynthesis are used as reactants in cellular respiration and as matter is cycled, there is a net transfer of energy. The student uses evidence to evaluate the merits, limitations, and reliability of two different models of the relationships between systems or between components of a system through which energy and matter flow in order to select or revise a model that best fits the evidence or design criteria (HS-LS1-7)
- test, evaluate, and/or revise mathematical and/or computational representations of models at two different scales, describe the relationship between the two models, and use these comparisons to predict whether a given disturbance to an ecosystem will challenge the functioning of the ecosystem in terms of resources and habitat availability (HS-LS2-2)
- apply scientific reasoning, theory, and/or models and use the relationship between photosynthesis and cellular respiration, together with the knowledge that changes in matter and energy in a system result from changes in matter and energy that flows into or out of that system, in relation to an explanation of a phenomenon (HS-LS2-3)
- describe empirical evidence and models or theories that, when taken together with knowledge of chromosomes, gene expression, or regulation, would allow the student to ask, evaluate, compare, and/or revise questions or hypotheses related to a phenomenon (HS-LS3-1)
- evaluate, revise, and/or compare competing explanations based on claims related to an explanation of a phenomenon that requires the student to predict the effects of swapping of chromosomes during meiosis, errors that occur during DNA replication, and/or changes in environmental factors; describe empirical evidence and reasoning that could be used for differentiation of cause and correlation (HS-LS3-2)

- evaluate the validity and reliability of and/or synthesize multiple claims, methods, and/or design in relation to similarities and differences in amino acid sequences, along with anatomical and embryological evidence, in order to make predictions of causality and infer evolutionary relationships (HS-LS4-1)
- consider the limitations of data analysis and compare and contrast various types of data sets to examine consistency of measurements and observations related to the effects of changing environmental conditions on the relative proportion of genetic information, genetic expression, the link between a trait and reproductive success, and/or organism and population survival (HS-LS4-3)
- refines a design solution analyzing costs and benefits, taking into account 3 or more constraints including cost, safety, reliability, and aesthetics, considering social, cultural, and environmental impacts, and predicting the ways in which the design solution impacts society and the environment (HS-ETS1-3)

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 areas." (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 NGSSS 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 individualized education program (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
▪ 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
▪ Separate /alternate location ▪ Small group testing ▪ Specialized equipment or furniture ▪ Specified area or setting ▪ Headphones or noise buffer	▪ Time of day ▪ Each unit may be administered on a separate day ▪ Frequent breaks	▪ 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
▪ Unique accommodation request	▪ Extended time ▪ Unique accommodation request	▪ 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	▪ 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	▪ 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