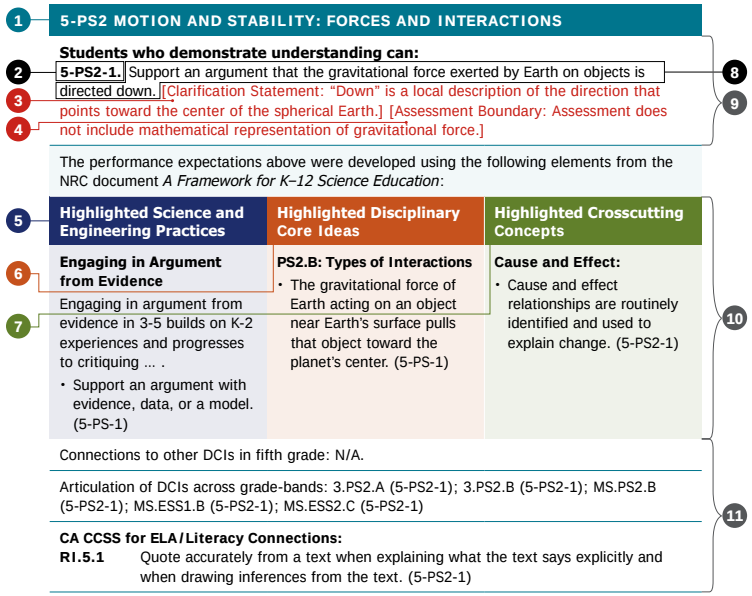
How to Read the California Next Generation Science Standards

While complex at first glance (see figure 1.13), the CA NGSS are referred to by their authors as "architectures" because they have a consistent and intentionally defined structure that highlights three dimensions and provides connections to ensure a coherent curriculum. Each page consists of boxes arranged in four rows (see figure 1.14): (1) a title of the core concept being covered; (2) one or more performance expectations; (3) a foundation box containing the three dimensions of the *National Research Council Framework*; and (4) a connection box. The Performance Expectations (PEs) are the assessable standards; they are statements that describe what students must actually do in order to demonstrate mastery. Each PE is an expression of all three dimensions, and the box below the PEs articulates the aspects of each dimension that are emphasized in each PE. The foundation box has Science and Engineering Practices (SEP) in the blue section to the left, Disciplinary Core Ideas (DCI) in the orange section in the middle, and Crosscutting Concepts (CCC) in the green section on the right. The text in the foundation box comes directly from the *NRC Framework*. The connection box at the bottom denotes how the PEs connect to other DCIs at this grade level, other grade levels, and to other California standards such as the California Common Core State Standards for English Language Arts and Literacy and Mathematics. The sections that follow provide further guidance about the information in each of the boxes.

Figure 1.13. Example of a Standard Page for Grade 5 and Disciplinary Core Idea PS2, Forces and Interactions



1 Title Each grade level has blocks of related performance expectations. The code is unique but the title may be reused as material is revisited at more advanced levels in later grades.

2 Performance Expectation (PE) Code A unique indentifier to reference a specific performance expectation, for example: **5-PS2-4**.

- **5** Grade Level
- **PS** Discipline of science/engineering
- **2** Core idea number within that discipline
- **1** Unique subitem number

3 Clarification Statement Supplies examples or additional clarification to the performance expectation.

4 Assessment Boundary Provides guidance about the scope of the performance expectation at a particular performance expectation at a particular.

5 Scientific and Engineering Practices (SEPs) Activities that scientists and engineers engage in to understand the world and solve problems.

6 Disciplinary Core Ideas (DCIs) Concepts that have broad importance within a discipline and have relevance to people's lives.

7 Crosscutting Concepts (CCCs) Tools for thinking about science and engineering that are common to all disciplines.

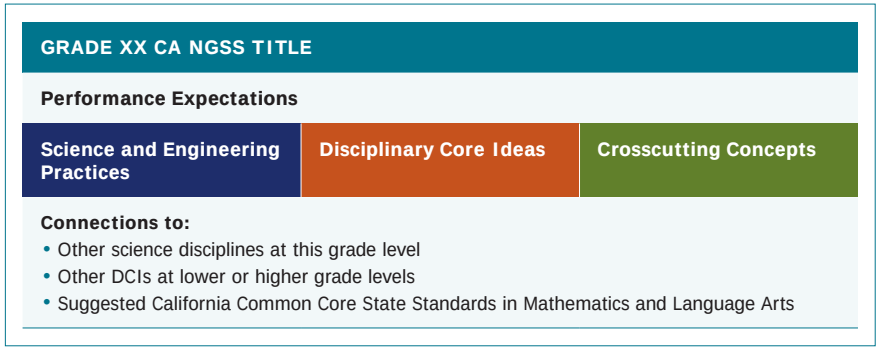
8 Performance Expectation (PE) A statement that combines practices, core ideas, and crosscutting concepts together to describe how students can show what they have learned.

9 What is assessed A collection of performance expectations describing what students should be able to do when they have mastered this standard.

10 Foundation Box A brief description of the practices, core disciplinary ideas, and crosscutting concepts that each performance expectation builds upon.

11 Connection Box Other standards in CA NGSS and other disciplines (including the CA CCSS) that relate to this group of performance expectations.

Figure 1.14. Schematic View of the Layout of Standards in the CA NGSS.



Performance Expectations

The Performance Expectations (PEs) are the assessable statements of what students should be able to accomplish in order to demonstrate understanding of a subject area's core content. These expectations describe ways in which scientifically literate students can express understanding about the world around them and apply that understanding to solve problems in that world. The PEs provide a foundation for advanced science courses such as Advanced Placement, International Baccalaureate, and college-level classes. PEs are not a set of instructional practices, a curriculum, or actual assessment tasks. Rather, they are general descriptions of what students should be able to perform at the end of instruction. There are many possible ways to assess mastery of a given PE.

Each PE has a unique code with three parts so that it can be referenced concisely. In the PE "5-PS2-1," the "5" indicates the grade level (a one-character abbreviation is used for kindergarten through grade five; "MS" indicates grades six, seven, and eight; and "HS" covers grades nine through twelve). The "PS2" indicates Physical Science core idea number 2 from the list in the *NRC Framework,* and the "1" refers to the first performance expectation in the series. The wording of PE 5-PS2-1 reveals a three-dimensional combination of a practice ("support an argument"), conceptual ideas ("gravitational force"), and crosscutting concept ("effect") that students will need to learn and practice during instruction.

A *Clarification Statement* presented in red font often follows the PE to provide the intended interpretation of certain parts of the PE or examples of phenomena. In the PE in figure 1.13, the clarification statement helps teachers understand what is meant by "down." Also shown in red font is the *Assessment Boundary,* which clarifies the scope and detail appropriate to the grade level.

Foundation Boxes

Science and Engineering Practices (SEPs). The blue box on the left side of the row of foundation boxes includes only the primary SEPs required for the performance task outlined by the PEs above it. Since PEs often represent the culmination of a long sequence of instruction, students will use other SEPs besides the ones listed in the box. The text in the box that describes the SEPs comes directly from the *NRC Framework.*

Disciplinary Core Ideas (DCIs). The orange box includes DCIs from the *NRC Framework.* The box includes only the DCIs most relevant to the student's understanding of the PE at this grade level, and students will draw on their understanding of other DCIs to accomplish the PE. Because the DCIs are part of a coherent K–12 progression, students will likely draw on prior knowledge of the same DCI from a previous grade level. As such, each PE highlights understanding at an increased depth for each grade level.

Crosscutting Concepts (CCCs). The green box provides the major CCCs that are helpful to apply in exploring this disciplinary core idea. This column includes material from the chapter on crosscutting concepts in the *NRC Framework,* as well as elements of the Engineering, Technology, and Applications of Science core idea and of the nature of science concepts that are important to develop or use in the context of this core idea.

Both the SEP column and the CCC column may also contain supplemental learning goals identified as the "Engineering, Technology, and Application of Science" (found only in the green CCC column) and the "Nature of Science" connections (found both in the SEP and the CCC columns). These additional learning goals are described in the NGSS Appendix H (Nature of Science) and Appendix J (Science, Technology, Society, and the Environment) posted at https://www.nextgenscience.org/resources/ngss-appendices.

Connection Boxes

The connection boxes listed below the foundation boxes are intended to support teachers and curriculum designers in developing a coherent, well-integrated curriculum both in science and in other subject areas. The three boxes are (1) *Connections to other DCIs in this grade-band*—to bundle related PEs during curriculum design; (2) *Articulation of DCIs across grade levels*—to find what students have done on the topic in prior grade levels and recognize what is needed at this grade level to provide a firm foundation for later grades; and (3) *Connections to the California Common Core State Standards.* Tables in the grade-level chapters of this document add further connections to the CA ELD standards and the Environmental Principles & Concepts.

Guidance to Support CA NGSS Implementation

On November 3, 2016, the SBE adopted the *Science Framework for California Public Schools: Kindergarten Through Grade Twelve* (*CA Science Framework*). This key document serves as a professional learning tool to support the implementation of the CA NGSS. California's latest science framework is the backbone of professional development taking place across the state.

The *CA Science Framework* provides examples of implementation of standards in the classroom through the use of:

- snapshots and vignettes in all grade-level chapters that demonstrate three dimensional learning;
- links to resources and Web sites for additional support;
- integration of the Environmental Principles & Concepts.

The *CA Science Framework* also provides grade-span chapters, which were created to support teachers as they implement the standards in their classrooms. There are seven grade-level chapters: TK, K–2, 3–5, two separate chapters covering grades 6–8, and two separate chapters covering grades 9–12. Each chapter begins with an introduction of the grade span that highlights the three dimensions and how they will progress over the grade levels.

Each grade level contains a short overview with additional grade-specific details in each instructional segment. These are examples of how the performance expectations are bundled into instructional segments with the cross-cutting concepts as the main thread that runs from one instructional segment to the next. There are Instructional Segment tables that provide an overview of relevant performance expectations and topics that will be covered and then developed more under each instructional segment.

The *CA Science Framework* also provides guidance in the areas of assessment, access and equity, instructional strategies, and support for administrators and publishers. Likewise, the framework offers additional tools to support the implementation of the CA NGSS.

The *CA Science Framework* is posted on the CDE Web site at http://www.cde.ca.gov/ci/sc/cf/.

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