# Introduction to the California Science Test Item Specifications

**Prepared for the California Department of Education by Educational Testing Service**



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## About the California Science Test Item Specifications

The information in this document provides guidance to stakeholders on the California Science Test (CAST) item specifications. The CAST item specifications provide details on each assessed dimension of a California Next Generation Science Standards (CA NGSS) Performance Expectation (PE). The CA NGSS dimensions are Science and Engineering Practices (SEPs), Disciplinary Core Ideas (DCIs), and Crosscutting Concepts (CCCs). The PE statements are designed to show that a student demonstrates understanding by engaging in the SEP and making connections to the CCC to explore the DCI. For more information on PEs and their dimensions, refer to the CDE [NGSS for California Public Schools, K–12 web page](https://www.cde.ca.gov/pd/ca/sc/ngssstandards.asp).

There are 175 item specifications, one for each assessed PE (i.e., 45 for grade five, 59 for grade eight, and 71 for high school). Originally, the specification documents were created as tools for item writers to ensure that new, multidimensional items are aligned with the CA NGSS PEs. Over time, it became clear that the item specifications could be an important tool for educators along with the 2016 Science Framework for California Public Schools (Science Framework). With these specifications, educators will gain a better understanding of the three-dimensional nature of the assessment; however, they are *not* intended to guide instruction. Educators can use the item specifications and the *Science Framework* as resources for developing items for interim, benchmark, and summative assessments for the classroom.

The format of the item specifications begins with the PE and includes the clarification statement, applicable assessment boundaries, and the three dimensions (SEPs, DCIs, and CCCs). The specifications then break down each of the dimensions into assessment targets. These three assessment targets are integrated into possible tasks. A task is an item, set of items, or an instructional activity for students. The item specifications also provide relevant environmental principles and concepts, examples of phenomena and misconceptions, and additional assessment boundaries and references. Each section of the item specifications is discussed in detail.

## Sections of the Item Specifications

### California Next Generation Science Standards Performance Expectations

The CA NGSS consist of PEs that have three integrated dimensions: the SEPs, CCCs, and DCIs. Each PE describes what students should know and be able to do in science. Clarification statements provide greater detail about examples within the DCI that can be emphasized; assessment boundaries determine the level of detail that is appropriate for an assessment.

Educational Testing Service added a coding structure to the bulleted DCI statements in a PE for easier tracking of each science concept (i.e., DCI topic) captured in the DCIs. This coding structure is used in the item specifications to further explain the DCIs. Refer to figure 1 and accompanying text for an example of the coding structure.

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| **Disciplinary Core Ideas** |
| **PS1.A: Structure and Properties of Matter** |
| 8. Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. |
| **PS1.B: Chemical Reactions** |
| 4. Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants |

Figure 1. Sample DCI Statement

In this excerpt from MS-PS1-2, the DCI PS1.B: Chemical Reactions appears in three previous PEs (i.e., 2-PS1-4, 5-PS1-2, and 5-PS1-4). The fourth occurance of the Chemical Reactions appears in MS-PS1-2; therefore, a “4” has been placed before the science concept associated with the DCI PS1.B.

### Assessment Targets

Assessment targets are the knowledge, skills, and abilities of students that are the focus of an assessment. Assessment targets in the item specifications reduce the “universe” of understanding in each dimension to smaller assessable pieces for statewide assessments that can be integrated into an item or set of items.

#### Science and Engineering Subpractices

Educational Testing Service used published educational research and existing CA NGSS documents to analyze each SEP and generate essential components called “subpractices.” The subpractices describe a variety of ways to express the same SEP in an item. An item specifications document for a specific PE lists only those subpractices that are most relevant to how the PE incorporates the SEP. Therefore, not all item specifications documents will list all subpractices (refer to [appendix A](http://www.cde.ca.gov/ta/tg/ca/documents/cast_itemspecsappendixa.docx) for a complete list of SEP subpractices).

#### Science and Engineering Subpractice Assessment Targets

Educational Testing Service further analyzed each subpractice to generate subpractice assessment targets. They selected certain subpractice assessment targets that best fit the intention of the PE to be listed on the item specifications. Not all subpractice assessment targets are listed with every instance of their corresponding subpractice.

#### Disciplinary Core Idea Assessment Targets

Educational Testing Service analyzed each DCI in each PE to generate DCI assessment targets. They selected certain DCI assessment targets that best fit the intention of the PE to be listed on the item specifications. Not all DCI assessment targets are listed with every instance of their corresponding DCI.

#### Crosscutting Concept Assessment Target(s)

In a way similar to the analyses of the SEPs and DCIs, Educational Testing Service analyzed each CCC to generate CCC assessment targets. They selected certain CCC assessment targets that best fit the intention of the PE to be listed on the item specifications. Not all CCC assessment targets are listed with every instance of their corresponding CCC.

### Examples of Integration of Assessment Targets and Evidence

The CAST items are aligned with at least two dimensions (i.e., SEP, DCI, or CCC). The item specifications capture these dimensions as assessment targets. Integration of the dimensions is described by the task descriptions in the examples of integration of assessment targets and evidence.

The examples of integration are designed such that a student’s participation in a task provides evidence of proficiency with the PE. For example, on the CAST, task participation is the student’s interaction with and response to an item. A student’s correct response to an item likely indicates a level of proficiency with the PE because the items are built using specific SEP, DCI, and CCC assessment targets appropriate for the PE.

### Environmental Principles and Concepts

California’s Environmental Principles and Concepts (EP&Cs) examine the interactions and interdependence of human societies and natural systems. EP&Cs are used as context for assessment items, where appropriate, but students are not directly assessed on environmental literacy beyond what is called for in certain PEs. The EP&Cs, unique to California, are not considered a dimension for any of the PEs in the CA NGSS.

The EP&Cs have a strong association with specific PEs in the CA NGSS and provide basis for phenomena (or context) for assessing those PEs. Only the appropriate environmental principles will be listed for PEs, where appropriate; that is, not all PEs will have an EP&C listed on the item specifications. Refer to [appendix 2](https://www.cde.ca.gov/ci/sc/cf/documents/scifwappendix2.pdf) of the *2016 Science Framework for California Public Schools* for more information on the connections between the EP&Cs and PEs.

### Possible Phenomena or Contexts

Broad categories or specific examples that are appropriate for the PE are provided. This section is generated from cycles of development of the CAST items and from interactions with California teachers during professional development activities. The list of possible phenomena or contexts is not exhaustive, nor does the list imply that those phenomena or contexts are more likely to appear on the CAST.

### Common Misconceptions

Common misconceptions may be listed, if appropriate. Common misconceptions are generated from cycles of development of the CAST items and from interactions with California teachers during professional development activities. The list of common misconceptions is not exhaustive.

### Additional Assessment Boundaries

In some cases, additional assessment boundaries above and beyond the PE may be provided. These additional boundaries are for statewide assessment development purposes only and are *not* intended to limit instruction of the PE.

### Additional References

All item specifications documents list general references. Some item specifications have additional references more specific to the PE or suitable phenomena.