California Science Test Blueprint

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Prepared by:

Measuring the Power of Learning.™

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Introduction

The California Science Test (CAST), administered pursuant to California *Education Code* (*EC*) Section 60640(b)(2)(B), is part of the California Assessment of Student Performance and Progress (CAASPP) System. The CAST measures the full range of the California Next Generation Science Standards (CA NGSS) and is administered to students in grades five and eight and once in high school (i.e., grade ten, eleven, or twelve).

The CAST blueprint documents how test forms for the CAST will be assembled, including rules for the assessment of the CA NGSS Performance Expectations (PEs) and the integration of the Disciplinary Core Ideas (DCIs), Science and Engineering Practices (SEPs), and Crosscutting Concepts (CCCs). The CA NGSS are referred to as “three dimensional” (3D) because of the interrelationships of the DCIs, SEPs, and CCCs. The CAST is designed to reflect a commitment to the 3D approach in both the writing of test items, each of which is aligned to at least two of the three dimensions, and in the assembly of test forms as detailed in this blueprint.

The test includes three science domains (Physical Sciences, Life Sciences, and Earth and Space Sciences) and one engineering domain (Engineering, Technology, and Application of Science). For scoring and reporting purposes, each of the three science domains will constitute one third of the test (items written to assess PEs associated with Engineering, Technology, and Application of Science will be assigned to one of the three science domains, depending upon the context of their stimulus). California’s Environmental Principles and Concepts will also be used as context for items, as appropriate to the three science domains.

The CAST is an untimed test (meaning that students should be allowed as much time as they need to complete it), and it is expected to take approximately two hours to administer all three segments:

- Segment A contributes to both student and group scores, contains discrete items, and is designed to measure a broad sample of PEs.
- Segment B contributes to both student and group scores, contains performance tasks (PTs), and is designed to provide deep measurement of a targeted sample of a few PEs in item sets.
- Segment C contributes only to group scores and may contain either a block of discrete items or a single PT.

CAST test forms will sample PEs as follows:

- For the segments contributing to individual student scores (Segment A and Segment B), it is not possible to assess all PEs in a single testing year. As a result, PEs assessed in Segment A and Segment B will be rotated from year to year so that all PEs can be assessed in the segments contributing to individual scores over the course of a three-year period.

- For the segment contributing only to group scores (Segment C), matrix sampling (the administration of a number of different versions across the state) will allow for assessment of all PEs annually at a state-wide level.

Although the CAST blueprint is not intended to guide instruction, it is a goal of the CAST to sample PEs broadly each year, as explained, so that instruction in a broad range of PEs across the grade spans will both be true to the intentions of the CA NGSS and will also provide solid preparation for the CAST.

CAST Claims

The CAST has four claims—one overall claim for the entire assessment, and three separate science domain claims. Table 1 shows the claim statements for CAST.

Table 1. CAST Claims

Domains	Description
3D Overall	Students can demonstrate performances associated with the expectations of the California Next Generation Science Standards, through the integration of Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts across the domains of Physical Sciences, Life Sciences, Earth and Space Sciences, and Engineering, Technology, and Application of Science.
3D Physical Sciences	Students can demonstrate performances associated with the expectations in the disciplinary area of Physical Sciences within the California Next Generation Science Standards, through the integration of Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts.
3D Life Sciences	Students can demonstrate performances associated with the expectations in the disciplinary area of Life Sciences within the California Next Generation Science Standards, through the integration of Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts.
3D Earth and Space Sciences	Students can demonstrate performances associated with the expectations in the disciplinary area of Earth and Space Sciences within the California Next Generation Science Standards, through the integration of Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts.

CAST Test Segments Contributing to Individual Scores

Table 2 shows the distribution of points by science domain and by DCI for the two sections of CAST used to generate student scores (Segment A and Segment B). An individual student will receive items with sufficient points in each domain to support the reporting of both an overall score and science domain scores. More detailed tables illustrating the integration of the DCIs, SEPs, and CCCs appear later in this document (see Table 4, Table 5, and Table 6). Note that each assessment draws on PEs from several grades. The grade five assessment draws on PEs from grades three through five (3–5) and also includes the foundational concepts that are addressed in kindergarten through grade 2 (K–2). The grade eight assessment draws on PEs from grades six through eight (6–8), and the high school assessment draws on PEs from the grades nine through twelve (9–12).

For individual test takers, there will be 54–58 score points overall and 12–25 score points for each science domain (depending upon whether PT performance is included in the science domain score).

Table 2. Segments Contributing to Individual Scores—Assessed in Grades 5 and 8, and High School
Testing Time: 1 hour and 40 minutes

Science Domain	Disciplinary Core Idea (DCI)**	Segment A: Discrete Items				Segment B: Performance Tasks (PTs)
		Items by DCI—Grade 5	Items by DCI—Grade 8	Items by DCI—HS	Total Segment A Items (and Points) per Grade Level	
Physical Sciences (PS)	**PS1:** *Matter and Its Interactions*	1–3	1–5	2–7	8–12 (12–18 Points)	2 PTs
	PS2: *Motion and Stability: Forces and Interactions*	1–4	1–4	1–5		
	PS3: *Energy*	1–4	1–4	1–4		
	PS4: *Waves and Their Applications in Technologies for Information Transfer*	1–2	1–2	1–4		
	ETS1: *Engineering Design*	*	*	*		
Life Sciences (LS)s	**LS1:** *From Molecules to Organisms: Structures and Processes*	1–2	1–6	1–6	8–12 (12–18 Points)	
	LS2: *Ecosystems: Interactions, Energy and Dynamics*	1–2	1–4	1–7		
	LS3: *Heredity: Inheritance and Variation of Traits*	1–2	1–2	1–2		
	LS4: *Biological Evolution: Unity and Diversity*	1–4	1–5	1–5		
	ETS1: *Engineering Design*	*	*	*		
Earth and Space Sciences (ESS)	**ESS1:** *Earth's Place in the Universe*	1–2	1–3	1–5	8–12 (12–18 Points)	
	ESS2: *Earth's Systems*	1–5	1–5	1–6		
	ESS3: *Earth and Human Activity*	1–3	1–4	1–5		
	ETS1: *Engineering Design*	*	*	*		
TOTALS					**32–34 Items (42–44 Points)**	**2 PTs, 4–6 Items per PT (12–14 Points Total)**

* Across the three science domains, a student will receive 2 to 4 items assessing Engineering, Technology, and Application of Science. The item(s) may be discrete or part of a PT.

** The CAST Item Specifications provide greater detail on the assessment targets by Performance Expectation.

CAST Test Segment Contributing to Group Scores

Table 3 shows the additional score points by science domain and DCI that will be collected in Segment C and will contribute only to group scores. In Segment C, each student will complete either a block of discrete items that includes both operational and field test items ***or*** one operational PT ***or*** one field test PT.

Note that each assessment draws on PEs from several grades. The grade five assessment draws on PEs from grades three through five (3–5) and also includes the foundational concepts that are addressed in kindergarten through grade 2 (K–2). The grade eight assessment draws on PEs from grades six through eight (6–8), and the high school assessment draws on PEs from grades nine through twelve (9–12).

Table 3. Segment Contributing to Group Scores*—Assessed in Grades 5 and 8, and High School
Testing Time: 20 minutes

Science Domain	DCIs	Discrete Items	Performance Tasks (PT)
Physical Sciences (PS)	**PS1:** *Matter and Its Interactions*	2–3	1 PT
	PS2: *Motion and Stability: Forces and Interactions*		
	PS3: *Energy*		
	PS4: *Waves and Their Applications in Technologies for Information Transfer*		
	ETS1: *Engineering Design*		
Life Sciences (LS)	**LS1:** *From Molecules to Organisms: Structures and Processes*	2–3	
	LS2: *Ecosystems: Interactions, Energy and Dynamics*		
	LS3: *Heredity: Inheritance and Variation of Traits*		
	LS4: *Biological Evolution: Unity and Diversity*		
	ETS1: *Engineering Design*		
Earth and Space Sciences (ESS)	**ESS1:** *Earth's Place in the Universe*	2–3	
	ESS2: *Earth's Systems*		
	ESS3: *Earth and Human Activity*		
	ETS1: *Engineering Design*		
Operational Items per Form (Segment C)		**6–7 Operational Discrete Items**	**1 Operational PT (4–6 Items)** ***OR*** **1 Field Test PT (4–7 Items)**
Field Test Items per Form (Segment C)		**6–7 Field Test Discrete Items**	
TOTAL Operational Items and Points (Segment C)		**4–7 Operational Items (6–8 Total Points)**	

* Group reporting includes items from Segment A, Segment B, and Segment C.

Segment A—Details of PE Distribution for High School Assessment

Segment A is designed to assess a student's mastery of a breadth of PEs of the CA NGSS in high school (9–12). Table 4 displays an "X" for the intersections of SEPs, DCIs, and CCCs articulated in the PEs. These intersections represent opportunities to develop items that can be used to assemble Segment A. While each individual item reflects the intersection of a SEP, DCI, and CCC, the table that follows indicate the proposed distribution of Segment A items by DCI, SEP and CCC.

Table 4. PE Distribution for Segment A of the CAST High School Assessment

		Science Domain and DCI Strands																																						
		Physical Sciences (24 PEs)													Life Sciences (24 PEs)													Earth and Space Sciences (19 PEs)											ETS (4 PEs)	Items per SEP
		PS1			PS2				PS3			PS4			LS1				LS2					LS3		LS4		ESS1				ESS2			ESS3					
	CCC	1	5	7	1	2	4	6	2	4	5	2	4	7	4	5	6	7	2	3	4	5	7	2	3	1	2	1	3	5	7	2	5	7	2	4	7	n/a	n/a	
Science and Engineering Practices	SEP 1													X										X																2–3
	SEP 1E																																						X	
	SEP 2	X	X						X		X				X	X					X								X			X	X	X						2–6
	SEP 3	X				X				X								X																X						2–5
	SEP 4					X																			X	X								X			X			2–5
	SEP 5		X		X		X			X		X								X		X					X		X							X	X		X	2–6
	SEP 6	X									X					X	X					X					X			X	X				X				X	2–6
	SEP 6E			X		X																	X														X			
	SEP 7												X						X				X	X			X	X						X				X		2–6
	SEP 8							X				X														X				X										2–6
	Items per DCI Strand	2–7			1–5				1–4			1–4			1–6				1–7					1–2		1–5		1–5				1–6			1–5				2–4	Total of 32–34 Items
	Items per Domain	8–10													8–10													8–10											2–4	

* For scoring and reporting purposes, items written to assess PEs associated with Engineering, Technology, and Application of Science will be assigned to one of the three science domains, depending upon the context of their stimulus.

Notes on Table 4:

- X indicates that there is at least one PE at the given intersection of the three dimension that can be sampled on a test form for Segment A.
- n/a indicates there is no CCC for at least some of the PEs in the column.
- SEPs 1 and 6 have separate components for science and engineering (SEP 1E and SEP 6E). All other SEPs incorporate the same components for both science and engineering.
    - CA NGSS calls out the distinctive purposes of practices primarily in two specific SEPs: SEP 1 and SEP 6. For SEP 1 in science (SEP1), the practice focuses on identifying questions about phenomena. For SEP 1 in engineering (SEP1-E), the practice focuses on defining a problem to be solved. For SEP 6 in science (SEP6), the goal of the practice is to construct logically coherent explanations of phenomena to incorporate students’ current understanding of science. For SEP 6 in engineering (SEP6-E), the goal is to propose design solutions to balance competing criteria of desired functions.
- Details on the naming conventions and full names of SEPs, DCIs, and CCCs are provided in Appendix B: Full Titles for SEPs, DCIs, and CCCs.

Segment A—Details of PE Distribution for Grade 8 Assessment

Segment A is designed to assess a student's mastery of a breadth of PEs of the CA NGSS in grades six through eight (6–8). Table 5 displays an "X" for the intersections of SEPs, DCIs, and CCCs articulated in the PEs. These intersections represent opportunities to develop items that can be used to assemble Segment A. While each individual item reflects the intersection of a SEP, DCI, and CCC, the table that follows indicate the proposed distribution of Segment A items by DCI, SEP, and CCC.

Table 5. PE Distribution for Segment A of the CAST Grade 8 Assessment

		Science Domain and DCI Strands																																						
		Physical Sciences (19 PEs)													Life Sciences (21 PEs)													Earth and Space Sciences (15 PEs)												ETS (4 PEs)	Items per SEP
		PS1					PS2			PS3			PS4		LS1					LS2				LS3		LS4		ESS1			ESS2						ESS3				
	CCC	1	2	3	5	6	2	4	7	3	4	5	1	6	2	3	4	5	6	1	2	5	7	2	6	1	2	1	3	4	1	2	3	4	5	7	1	2	7	n/a	
Science and Engineering Practices	SEP 1						X																																X	X	1–3
	SEP 1E																																								
	SEP 2		X	X	X						X			X				X	X			X		X	X			X		X				X	X	X				X	1–16
	SEP 3						X		X	X						X																X									1–5
	SEP 4	X								X											X					X			X		X						X			X	1–9
	SEP 5												X														X														1–2
	SEP 6														X			X		X						X	X		X				X					X			1–12
	SEP 6E				X			X				X																										X			
	SEP 7							X				X			X		X						X															X		X	1–8
	SEP 8					X								X	X												X														1–4
	Items per DCI Strand	1–5					1–4			1–4			1–2		1–6					1–4				1–2		1–5		1–3			1–5						1–4			2–4	Total of 32–34 Items
	Items per Domain	8–10													8–10													8–10												2–4	

* For scoring and reporting purposes, items written to assess PEs associated with Engineering, Technology, and Application of Science will be assigned to one of the three science domains, depending upon the context of their stimulus.

Notes on Table 5:

- X indicates that there is at least one PE at the given intersection of the three dimension that can be sampled on a test form for Segment A.

- n/a indicates there is no CCC for at least some of the PEs in the column.

- SEPs 1 and 6 have separate components for science and engineering (SEP 1E and SEP 6E). All other SEPs incorporate the same components for both science and engineering.

    - CA NGSS calls out the distinctive purposes of practices primarily in two specific SEPs: SEP 1 and SEP 6. For SEP 1 in science (SEP1), the practice focuses on identifying questions about phenomena. For SEP 1 in engineering (SEP1-E), the practice focuses on defining a problem to be solved. For SEP 6 in science (SEP6), the goal of the practice is to construct logically coherent explanations of phenomena to incorporate students’ current understanding of science. For SEP 6 in engineering (SEP6-E), the goal is to propose design solutions to balance competing criteria of desired functions.

- Details on the naming conventions and full names of SEPs, DCIs, and CCCs are provided in Appendix B: Full Titles for SEPs, DCIs, and CCCs.

Segment A—Details of PE Distribution for Grade 5 Assessment

Segment A is designed to assess a student's mastery of a breadth of PEs of the CA NGSS in grades three through five (3–5) and also includes the foundational concepts that are introduced in kindergarten–grade 2 (K–2). Table 6 displays an "X" for the intersections of SEPs, DCIs, and CCCs articulated in the PEs. These intersections represent opportunities to develop items that can be used to assemble Segment A. While each individual item reflects the intersection of a SEP, DCI, and CCC, the tables that follow indicate the proposed distribution of Segment A items by DCI, SEP, and CCC.

Table 6. PE Distribution for Segment A of the CAST Grade 5 Assessment

		Science Domain and DCI Strands																											
		Physical Sciences (17 PEs)								Life Sciences (12 PEs)										Earth and Space Sciences (13 PEs)								ETS (3 PEs)	Items per SEP
		PS1		PS2			PS3	PS4		LS1			LS2		LS3		LS4			ESS1		ESS2				ESS3			
	CCC	2	3	1	2	n/a	5	1	2	1	4	5	2	4	1	2	2	3	4	1	3	1	2	3	4	2	4	n/a	
Science and Engineering Practices	SEP 1				X		X																					X	1–4
	SEP 1E					X																							
	SEP 2		X				X	X	X	X	X			X											X				1–7
	SEP 3	X	X	X	X		X																X					X	1–7
	SEP 4														X			X		X		X							2–4
	SEP 5		X																					X					1–2
	SEP 6						X									X		X		X								X	2–8
	SEP 6E						X	X																		X			
	SEP 7				X						X	X	X				X		X		X					X			1–8
	SEP 8																					X				X	X		1–3
	Items per DCI Strand	1–3		1–4			1–4	1–2		1–2			1–2		1–2		1–4			1–2		1–5				1–3		2–4	Total of 32–34 Items
	Items per Domain	8–10								8–10										8–10								2–4	

* For scoring and reporting purposes, items written to assess PEs associated with Engineering, Technology, and Application of Science will be assigned to one of the three science domains, depending upon the context of their stimulus.

Notes on Table 6:

- X indicates that there is at least one PE at the given intersection of the three dimension that can be sampled on a test form for segment A.

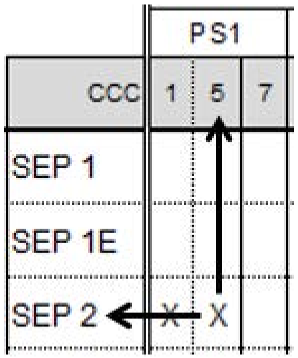
- n/a indicates there is no CCC for at least some of the PEs in the column.

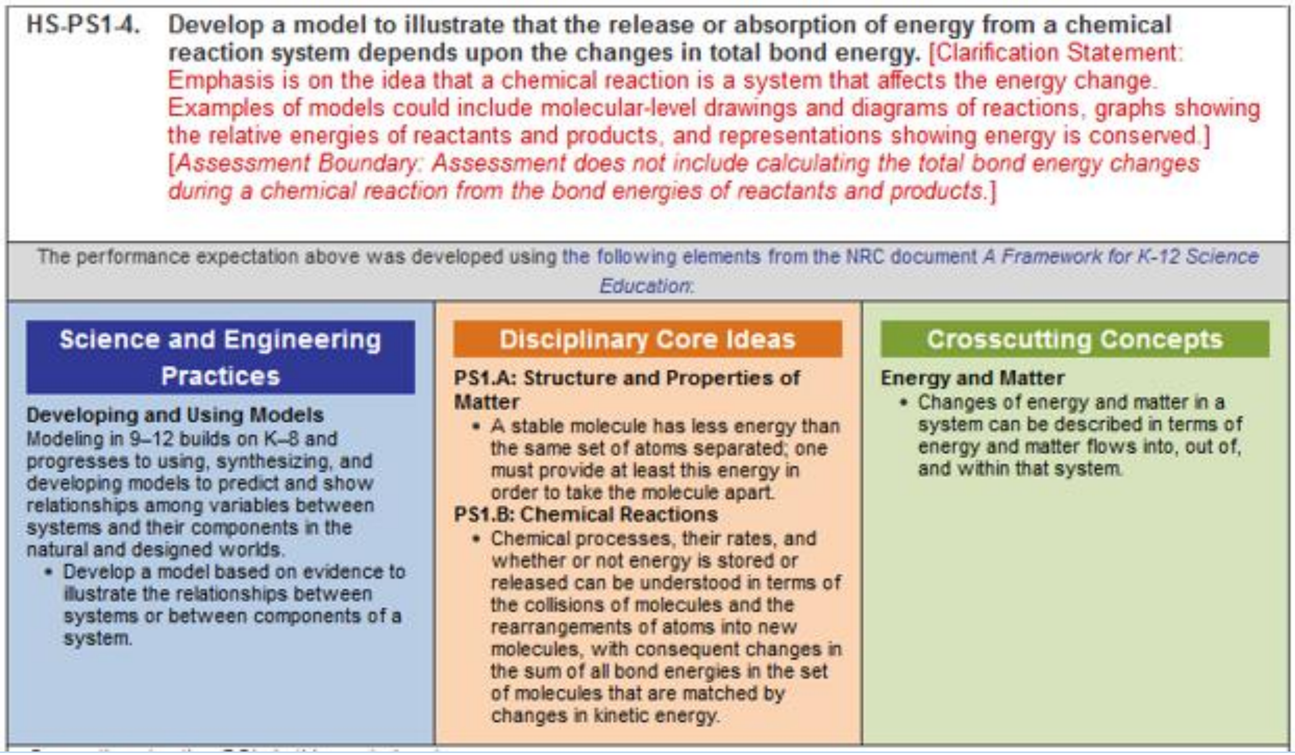
- SEPs 1 and 6 have separate components for science and engineering (SEP 1E and SEP 6E). All other SEPs incorporate the same components for both science and engineering.

    - CA NGSS calls out the distinctive purposes of practices primarily in two specific SEPs: SEP 1 and SEP 6. For SEP 1 in science (SEP1), the practice focuses on identifying questions about phenomena. For SEP 1 in engineering (SEP1-E), the practice focuses on defining a problem to be solved. For SEP 6 in science (SEP6), the goal of the practice is to construct logically coherent explanations of phenomena to incorporate students' current understanding of science. For SEP 6 in engineering (SEP6-E), the goal is to propose design solutions to balance competing criteria of desired functions.

- Details on the naming conventions and full names of SEPs, DCIs, and CCCs are provided in Appendix B: Full Titles for SEPs, DCIs, and CCCs.

Appendix A: Guidance on Interpreting Table 4, Table 5, and Table 6

Excerpt	Description
	In the excerpt shown (from Table 4), the "X" corresponds to a PE that has DCI(s) in the PS1 strand and is coded to SEP 2 (Developing and Using Models), and CCC 5 (Energy and Matter). The corresponding PE is excerpted from the CA NGSS Evidence Statements document here:



HS-PS1-4. **Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.** [Clarification Statement: Emphasis is on the idea that a chemical reaction is a system that affects the energy change. Examples of models could include molecular-level drawings and diagrams of reactions, graphs showing the relative energies of reactants and products, and representations showing energy is conserved.] *[Assessment Boundary: Assessment does not include calculating the total bond energy changes during a chemical reaction from the bond energies of reactants and products.]*

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices

Developing and Using Models
Modeling in 9–12 builds on K–8 and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds.
- Develop a model based on evidence to illustrate the relationships between systems or between components of a system.

Disciplinary Core Ideas

PS1.A: Structure and Properties of Matter
- A stable molecule has less energy than the same set of atoms separated; one must provide at least this energy in order to take the molecule apart.

PS1.B: Chemical Reactions
- Chemical processes, their rates, and whether or not energy is stored or released can be understood in terms of the collisions of molecules and the rearrangements of atoms into new molecules, with consequent changes in the sum of all bond energies in the set of molecules that are matched by changes in kinetic energy.

Crosscutting Concepts

Energy and Matter
- Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system.

Appendix B: Full Titles for SEPs, DCIs, and CCCs

Science and Engineering Practices (SEPs)

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

Disciplinary Core Ideas (DCIs)

PS1—Matter and Its Interactions
PS2—Motion and Stability: Forces and Interactions
PS3—Energy
PS4—Waves and Their Applications in Technologies for Information Transfer
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
ESS1—Earth’s Place in the Universe
ESS2—Earth’s Systems
ESS3—Earth and Human Activity
ETS1—Engineering, Technology, and Application of Science

Crosscutting Concepts (CCCs)

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