California Subject Examinations for Teachers®

TEST GUIDE

SCIENCE

General Examination Information

CS-TG-SCIXGI-06

Test Structure for CSET: Science

CSET: Science consists of two separate subtests, each composed of both multiple-choice and constructed-response questions. Each subtest is scored separately.

The structure of the examination is shown in the table below.

CSET: Science*			
Subtest**	**Domains**	**Number of Multiple-Choice Questions**	**Number of Constructed-Response Questions (short [focused] responses)**
I	Scientific Practices, Engineering Design and Applications, and Crosscutting Concepts	33	1
	Physical Sciences	23	1
	Life Sciences	22	1
	Earth and Space Sciences	22	1
	Subtest Total	100	4
II	One of the following concentration areas, each with the designated number of questions:		
	• Life Sciences	50	3
	• Chemistry	50	3
	• Earth and Space Sciences	50	3
	• Physics	50	3

*Candidates verifying subject matter competence by examination for a credential in Foundational-Level General Science are required to take and pass Subtest I only.

**Subtest I covers general science content while Subtest II covers the examinee's area of concentration.

Science (Specialized) Information

Effective spring 2003, the Commission on Teacher Credentialing authorized the addition of four Science (Specialized) areas for Single Subject Teaching Credentials: Biological Sciences (Specialized), Chemistry (Specialized), Physics (Specialized), and Geoscience (Specialized). A Science (Specialized) credential authorization permits the holder to teach in the specific science area listed on the Single Subject Teaching Credential and does not authorize teaching general or integrated science.

To verify subject matter competence for this credential by examination, candidates must pass CSET: Science Subtests II and IV in their specific Science area. The test structure for the examination is shown in the table below.

CSET: Science (Specialized)			
Subtest	**Domains**	**Total Number of Multiple-Choice Questions**	**Number of Constructed-Response Questions (short [focused] responses)**
II	One of the following concentration areas, each with the designated number of questions:		
	• Life Sciences*	50	3
	• Chemistry*	50	3
	• Earth and Space Sciences*	50	3
	• Physics*	50	3
IV	One of the following concentration areas, each with the designated number of questions:		
	Biology/Life Science (Specialized) • Ecology • Genetics and Evolution • Molecular Biology and Biochemistry • Cell and Organismal Biology	40	1
	Chemistry (Specialized) • Heat Transfer and Thermodynamics • Structures and Properties of Matter	40	1
	Earth and Planetary Science (Specialized) • Astronomy • Dynamic Processes of the Earth • Earth Resources	40	1
	Physics (Specialized) • Waves • Forces and Motion • Electricity and Magnetism	40	1

*For a description of these domains, please refer to the corresponding section of the subject matter requirements for General Science.

IMPORTANT NOTE: At its August 14–15, 2014, meeting, the Commission on Teacher Credentialing (CTC) took action to align the science content area authorization structure with the California Next Generation Science Standards (NGSS). As a result of this action, the option to earn a specialized science content area on a Single Subject Teaching Credential will be discontinued as of August 1, 2020, and the last administration of a CSET: Science (Specialized) was July 11, 2015.

The authorizations for specialized science content areas will continue to be issued through August 1, 2020, for individuals who verified subject matter equivalency on or before July 11, 2015.

For more information, see CTC Coded Correspondence #14–09 .

Calculators for CSET: Science

Scientific calculators **will be provided** for examinees taking any CSET: Science subtest. Refer to the California Educator Credentialing Examinations website for a list of the calculator models that may be provided. Directions for the use of the calculator will not be provided at the test administration. You will not be allowed to use your own calculator for CSET: Science subtests.

Annotated List of Resources for CSET: Science

This list identifies some resources that may help candidates prepare to take CSET: Science. While not a substitute for coursework or other types of teacher preparation, these resources may enhance a candidate's knowledge of the content covered on the examination. The references listed are not intended to represent a comprehensive listing of all potential resources. Candidates are not expected to read all of the materials listed below, and passage of the examination will not require familiarity with these specific resources. A brief summary is provided for each reference cited. Resources are organized alphabetically and by content area (General Science, Life Sciences, Chemistry, Earth and Space Sciences, and Physics).

Science/General

American Association for the Advancement of Science (AAAS). (2009). *Benchmarks for Science Literacy: Project 2061*. New York: Oxford University Press. Available online at: http://www.project2061.org/publications/bsl/online/index.php.

> Outlines what all students should know and be able to do in science, mathematics, and technology by the end of grades 2, 5, 8, and 12.

California Department of Education. (approved 2013, revised 2015). *NGSS for California Public Schools, K-12.* Sacramento, CA: California Department of Education. Available online at: http://www.cde.ca.gov/pd/ca/sc/ngssstandards.asp.

> The K-12 science standards, integrated with the Next Generation Science Standards, can be viewed either by grade level Disciplinary Core Idea, or by grade level topic.

California Department of Education. (2016). *Science Framework.* Sacramento, CA: California Department of Education. Available online at: http://www.cde.ca.gov/ci/sc/cf/.

The science framework may be viewed at the grade-specific levels. Each covers the science topics that are expected to be taught at that grade level.

Duncan, Ravit Golan; Krajcik, Joseph; and Rivet, Ann E. (2017). *Disciplinary Core Ideas: Reshaping Teaching and Learning.* Arlington, VA: National Science Teachers Association.

This book explores by subject and K–12 grade bands the core ideas in the physical sciences, life sciences, earth and space sciences, and engineering, technology and applications of science.

The National Academies of Sciences, Engineering and Medicine. (2012). *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*. Washington, D.C.: The National Academies Press. Available online at: https://www.nap.edu/read/13165/chapter/1.

The *Framework* outlines expectations for K-12 students in science and engineering and identifies three dimensions around which to develop science education: crosscutting concepts; scientific and engineering practices; and disciplinary core ideas in the physical sciences, life sciences, earth and space sciences, and engineering, technology, and applications of science core ideas.

Schwarz, Christina V.; Passmore, Cynthia; and Reiser, Brian J. (2017). *Helping Students Make Sense of the World Using Next Generation Science and Engineering Practices.* Arlington, VA: National Science Teachers Association.

This book explores each of the NGSS scientific and engineering practices in detail. For each of the NGSS practices, an introduction is given, followed by classroom examples and interactive activities at multiple grade levels that incorporate that practice. Key features of the practice, clarification of the parameters of a good version of the practice, and how to support the practice in the classroom are also reviewed.

Life Sciences

Biological Sciences Curriculum Study. (2016). *BSCS Biology: A Human Approach* (5th Edition). Dubuque, IA. Kendall Hunt.

A general introductory high school biology text, integrating science and engineering practices of the Next Generation Science Standards (NGSS).

Solomon, Eldra, *et al*. (2014). *Biology* (10th edition). Independence, KY: Brooks Cole.

A college-level biology text also used in AP Biology classes, this text covers introductory and advanced concepts in biology. Graphics enhance the reader's understanding of complex topics such as protein synthesis, cellular respiration, and physiological systems.

Urry, Lisa A., *et al*. (2017). *Campbell Biology* (11th edition). New York, NY: Pearson.

A college text frequently used in AP Biology classrooms, this text is a comprehensive look at introductory college-level biology from molecules to ecosystems. Covers human anatomy and physiology, energetics, and cell biology in depth.

Chemistry

Brown, Theodore L.; LeMay, Jr., H. Eugene; and Bursten, Bruce Edward. (2009). *Chemistry: The Central Science* (11th edition). Upper Saddle River, NJ: Pearson Prentice Hall.

A standard in general chemistry, this text provides a broad introduction to all areas of chemistry.

Petrucci, Ralph H.; Herring, F. Geoffrey; and Madura, Jeffry D.; Bissonnette, Carey. (2017). *General Chemistry: Principles and Modern Applications* (1st edition). Don Mills, Ontario; Pearson Canada Inc.

This introductory text explores a wide range of topics while covering practical applications, social significance, and historical roots of subjects.

Zumdahl, Steven S., and Zumdahl, Susan. (2013). *Chemistry* (9th edition). Independence, KY: Brooks Cole.

This introductory text covers a wide range of topics in general chemistry.

Earth and Space Sciences

Ahrens, C. Donald. (2008). *Meteorology Today: An Introduction to Weather, Climate, and the Environment* (9th edition). Independence, KY: Cengage Learning.

This widely-used college textbook covers the topics of Earth's atmosphere, clouds, precipitation, local and global systems, weather forecasting, hurricanes, tornados, global climate, and human interactions.

Plummer, Charles C.; McGeary, David; and Carlson, Diane H. (2012). *Physical Geology* (14th edition). New York, NY: McGraw-Hill Education.

This book provides an in-depth look into a wide variety of subjects, including atoms, minerals, rock cycle, dating methods, hydrology, weathering, geologic structures, earthquakes, volcanoes, topography, plate tectonics, and geologic resources.

Skinner, Brian J., and Porter, Stephen C. (2014). *The Dynamic Earth: An Introduction into Physical Geology* (6th edition). Burlington, MA: Jones & Bartlett Learning.

A college level text that examines geologic and hydrologic systems, the tectonic system, and Earth's resources.

Tarbuck, Edward J., and Lutgens, Frederick, K. (2015). *Earth Science* (14th edition). New York, NY: Pearson.

This text provides an excellent survey of the major content areas in earth science, including geology, oceanography, meteorology, and astronomy.

Physics

Feynman, Richard. (1970). *The Feynman Lectures on Physics (Volume I, II, and III).* Pasadena, CA: CalTech Publishing. Available online at: www.feynmanlectures.caltech.edu/.

A classic introduction to the study of physics. Feynman provides excellent explanations of concepts ranging from the basic principles of Newtonian physics to theories such as Einstein's general relativity, superconductivity, and quantum mechanics. Originally published in print, all of the lectures are available by topic for free online.

Halliday, David; Resnick, Robert; and Walker, Jearl. (2013). *Fundamentals of Physics* (10th edition). New York, NY: John Wiley & Sons.

An introductory college-level text including in-depth looks at forces and motion, waves, kinetic theory, electromagnetism and atoms. Online features include videos and animations.

Hewitt, Paul. (2014). *Conceptual Physics* (12th edition). New York, NY: Pearson.

An introductory-level physics text with little emphasis on mathematics, this book provides easy-to-understand explanations of basic physics concepts. Many examples of applications to daily life are included.

Knight, Randall D. (2007). *Physics for Scientists and Engineers with Modern Physics: A Strategic Approach*. (2nd edition). San Francisco, CA: Benjamin Cummings.

A calculus-based physics book that includes sections on Newtonian forces, thermodynamics, waves and optics, electricity and magnetism, and relativity and quantum physics.