

**California Department of Education**  
**California Next Generation Science Standards**  
**April 2014**  
**Preferred Integrated Learning Progression Course Overview**

On September 4, 2013, the State Board of Education (SBE) adopted the *Next Generation Science Standards for California Public Schools, Kindergarten through Grade Twelve* (CA NGSS) as required by California *Education Code* 60605.85. The CA NGSS is based upon the nationally developed Next Generation Science Standards (NGSS).

The nationally developed NGSS presented middle grade standards in a grade span of sixth through eighth grade. However, California is a kindergarten through eighth grade instructional materials adoption state and requires that standards be placed at specific grade levels – sixth, seventh, and eighth. Therefore, the Superintendent of Public Instruction (SSPI) recommended the adoption of the placement of these original NGSS standards at each grade level as described in the document below. On November 6, 2013, the SBE adopted the Integrated Learning Progression as the preferred model. This Integrated Learning Progression Course arrangement of standards was developed by the Science Expert Panel (SEP), a group made up of kindergarten through grade twelve teachers, scientists, educators, business, industry representatives and informal science educators. Feedback was provided by the SEP, from the public via three open forums, and a webinar.

The SEP used the following criteria to arrange the performance expectations (standards) for grades six, seven, and eight:

1. Performance expectations (PEs) were placed at each grade level so that they support content articulation across grade levels (from fifth through eighth grade) and provide the opportunity for content integration within each grade level.
2. Performance expectations were aligned with the Common Core State Standards in English Language Arts and Mathematics so that science learning would not be dependent upon math skills not yet acquired.
3. The final arrangement of performance expectations reflected a balance both in content complexity and number at each grade level with human impact and engineering performance expectations appropriately integrated.

In addition to these criteria, the SEP worked to ensure that the performance expectations could be bundled together in various ways to facilitate curriculum development. SEP members Helen Quinn, Kathy DiRanna, Dean Gilbert, Laura Henriques, Maria Simani, and Phil Lafontaine of the California Department of Education contributed to this rationale of the proposed learning progressions for middle school grades six, seven, and eight.

The chart below illustrates the vision for middle school: opportunities for articulation between grades (six, seven, eight) within the disciplines, as well as opportunities for content integration across disciplines at each grade.

Articulation ↑	8					
	7					
	6	→ Integration				
		Life	Earth/Space	Physical	Human Impact	Engineering Design

Keep this chart in mind as you explore the arrangement of the CA NGSS. The order in which the performance expectation in each discipline is listed does not imply the order of teaching or the instructional sequence. Bundling the performance expectations provides a content view to which one can more easily apply cross-cutting concepts as the topics are integrated. While many cross-cutting concepts could be used to organize the performance expectations for each grade, the SEP identified topics for bundling as presented in the CA NGSS.

### **ARRANGEMENT FOR ARTICULATION**

The chart below illustrates the topic arrangement of the performance expectations to link the learning progression from elementary through middle school in each discipline.

Grade	Cross cutting concepts	Life	Earth and Space	Physical	Human Impact	Engineering
<b>Eighth</b>	Stability and change; scale, proportion and quantity	Natural Selection	History of the Earth  Space systems	Waves and Electro-magnetic radiation  Energy  Forces and Interactions	Human Impact	ETS
<b>Seventh</b>	Energy and Matter: flows, cycles, and conservation; cause and effect	Ecosystems	Natural resources	Structure and property of matter	Human Impact	ETS
<b>Sixth</b>	Patterns; structure and function; systems and system models	Cells and Organisms	Weather and climate	Energy	Human Impact	ETS
<b>Fifth</b>	Energy and Matter: flows, cycles and conservation; Scale, proportion and quantity	Matter cycles through living and non living things	Earth in space, interactions of earth systems	Properties and structure of matter	Human Impact	ETS

**Life Science (six–eight):** The learning progression builds from the individual organism in sixth grade, to its place in an ecosystem in seventh grade, to the development of these systems over time in eighth grade. In sixth grade, the focus is on the structure of cells and organisms including: body systems, growth and development, and the basis of sexual and asexual reproduction. More detailed DNA-level of understanding is deferred to eighth grade, after students have developed sufficient understanding of chemical processes and atomic level structure for these concepts to be meaningfully developed. The performance expectations at seventh grade develop the idea of the interdependence of organisms to each other and abiotic factors as well as the cycling of matter and flow of energy that maintains ecosystems. These concepts are supported by the energy and matter concepts from sixth and seventh grade. In eighth grade, the critical ideas of variability and natural selection are introduced, and, together with the ideas of deep time and the fossil record, form the basis for the relationship between the history of the earth and life on it. These topics require understanding of time scale and population distributions of traits that need eighth grade level mathematical sophistication.

**Earth and Space Science (six–eight):** The learning progression builds from the interaction of earth’s systems in fifth grade to a deeper exploration of the hydrosphere and atmosphere in sixth grade. These two systems play very large roles in weather conditions and in regional and global climate. In seventh grade, the focus turns to the

geosphere as students learn about changes to the earth's surface, plate movement and the formation of earth materials. In eighth grade, the earth takes its place in the solar system and the universe as students get a much broader sense of time and space, including the more cosmic perspectives of the solar system, Milky Way galaxy, and a universe teeming with other galaxies.

**Human Impact (six–eight):** Embedded in the Earth and Space Science Performance Expectations are those PEs for human impact. In sixth grade, the PE asks students to apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. This links nicely with the concepts of weather and climate. In seventh grade, the PE highlights natural hazards providing opportunities to investigate earthquakes and connect with plate tectonics. In eighth grade, the PE challenges students to think deeply about the consequences of human population growth and resource consumption.

**Physical Science (six–eight):** The learning progression builds on the knowledge of the particulate structure of matter from fifth grade as student develop an understanding of energy in terms of the motions of particles of matter in sixth grade. Students investigate thermal energy and the transfer of energy. They are also introduced to a conceptual understanding of potential and kinetic energy with the full mathematical understanding of the concepts delayed until eighth grade. In seventh grade, the structure and property of matter and chemical reactions are studied. These build on and deepen ideas from kindergarten through grade five (K-5), connect to the chemical nature of the earth and life science concepts in seventh grade, and begin to develop atomic and molecular level ideas about matter that are the base for eighth grade and high school science. Eighth grade provides opportunities to continue the study of forces and interactions built in K-5, applied in the context of structure and function in sixth grade, and structure and properties of matter in seventh grade, and finally to the context of space science in eighth grade. In eighth grade, mathematical expressions and relationships for forces and interactions and kinetic and potential energy are introduced and students begin to build an understanding of them that includes these more quantitative aspects. Waves and electromagnetic interactions are also not introduced until eighth grade because of the mathematical representations required to describe and quantify their properties.

**Engineering (six–eight):** There are four engineering PEs. They are arranged for each grade to maximize opportunities for students to engage in the engineering practices. These standards can be combined with any of the science disciplines to provide rich learning experiences for students.