IUSD
K-12 Science

Curriculum Organizations

Defining Curriculum Organizations

(2015-16 CA Draft Science Framework, Introduction to Grades 6-8)

Curriculum Organizations are creative, innovative ways to package content that is independent of course design and can be applied to any course design chosen, whether they be integrated, discipline specific, or customized. *Curriculum Organizations* provide choice and opportunity for school sites to allow their individuality, autonomy, and school identity to shine.

(http://www.nextgenscience.org/overview-dci)
(http://www.cde.ca.gov/ci/sc/cf/scif1st60daypubreview.asp)

Thematic units can be used school or district wide to organize content independent of course design.

K-2	• Understanding Your World
3-5	• Observing Phenomena and Developing Explanations and Solutions
6-8	• Human Impact on Society and the Natural World
9-12	• History of the Universe • The Science of Health • Local Phenomena • Environmental Issues • The History of Science

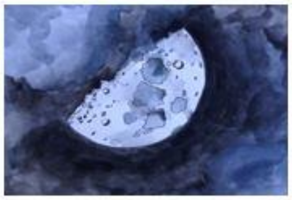
Crosscutting Concepts

(nextgenscience.org/Appendix G)

Crosscutting Concepts can be used to organize content independent of course design. They bridge disciplinary boundaries, helping students deepen their understanding of the disciplinary core ideas and develop a coherent and scientifically based view of the world.

Crosscut Symbols

Patterns



Cause and Effect

Scale

Systems

Energy and Matter

Structure and Function

Stability and Change

Set Performance Expectations in Each Grade Level K-5	
K-2	• Patterns • Systems and System Models • Cause and Effect • Structure and Function • Stability and Change
3-5	• Patterns • Systems and System Models • Cause and Effect • Scale, Proportion and Quantity • Energy and Matter
Set Performance Expectations Depending on Model 6-8	
6-8	• Patterns • Systems and System Models • Cause and Effect • Structure and Function • Stability and Change • Energy and Matter • Scale, Proportion and Quantity
Flexible Performance Expectations 9-12	
9-12	• Patterns • Systems and System Models • Cause and Effect • Structure and Function • Stability and Change • Energy and Matter • Scale, Proportion and Quantity

Crosscutting Concepts

Conceptual Understanding Arrangements

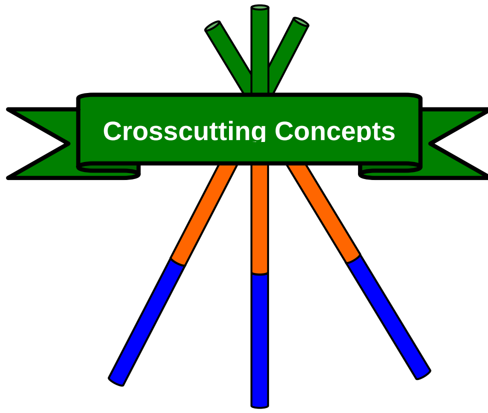
(http://www.cde.ca.gov/ci/sc/cf/scifw1st60daypubreview.asp)

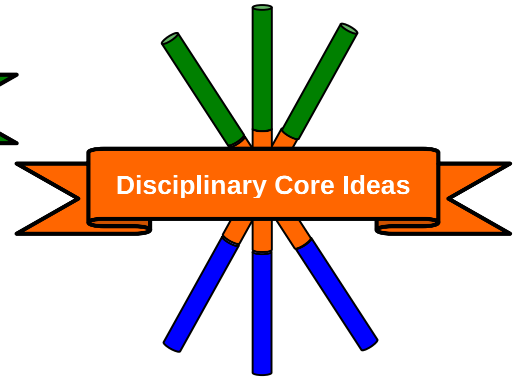
Content can be uniquely bundled for a progression of conceptual understanding in each course.
In California, the design of **high school courses** is a local decision. Disciplinary Core Ideas (DCIs) and Performance Expectations (PEs) for grades 9-12 can be bundled in any order within the grade band (9-12). Districts may choose to use the State Board of Education adopted models, but these models should not be considered limits. High schools should offer opportunities for all students to further their advanced study in areas of interest to them.

Because California is a K-8 instructional material adoption state, it requires Performance Expectations be placed at specific grade levels in **Middle School**. PEs can be bundled or sequenced in any order within a grade level. Below is one example of an instructional organization for 7th grade Integrated Science.

7th Grade Integrated DCIs

- Matter
- Structure and Process
- Ecosystems
- Earth's Systems
- Earth and Human Activity
- Engineering Design





Sample Grade 7 Integrated storyline showing flow of ideas and distribution of content:

Natural processes and human activities shape Earth's web of life				
	Life Science	**Earth & Space Science**	**Physical Science**	**ETS**
Living and nonliving things are made of atoms				
Unit 1	Organisms are made of molecules made mostly of six different elements.	Earth materials are made mostly of eight different elements. Earth has mineral, energy and water resources.	The interactions and motions of atoms explain properties of matter. Thermal energy affects particle motion, temperature and physical state.	
Matter cycles and energy flows in living systems and Earth systems.				
Unit 2	Organisms grow and get energy by rearranging atoms in food molecules.	Earth's cycles of matter are driven by solar energy. Earth's internal thermal energy and by gravity.	Chemical reactions make new substances, and can release or absorb thermal energy.* Mass is conserved in physical changes and chemical reactions.	Design criteria. Evaluate solutions. Analyze data. Iteratively test and modify.
Natural processes and human activities have shaped Earth's resources and ecosystems				
Unit 3	Matter cycles and energy flows among living and nonliving parts of ecosystems. Resource availability affects organisms and ecosystem populations. Ecosystems have patterns of organism interactions.	Fossils, rocks, continent shapes, and seafloor structures provide evidence of plate motions. Geoscience processes unevenly distribute Earth's mineral, energy and groundwater resources.	Chemical reactions make new substances. Mass is conserved in physical changes and chemical reactions.	
Human activities can help sustain biodiversity and ecosystem services in a changing world				
Unit 4	Biotic and abiotic changes affect ecosystem populations. Design solutions can help maintain biodiversity and ecosystem services.*	Geoscience processes change Earth's surface. Damages from natural hazards can be reduced.	Synthetic material impact society.	Design criteria Evaluate solutions Analyze data

Engineering Design

Engineering Design and Design Thinking can be used to organize content independent of course design.

Definitions: Engineering Design is the process of devising a system, component, or process to meet desired needs. It is a decision-making process (often iterative), in which the basic science and mathematics and engineering sciences are applied to convert resources optimally to meet a stated objective. *(www.me.unlv.edu/Undergraduate/coursenotes/.../ABETdefinition.htm)*

The Design Thinking process first defines the problem and then implements the solutions, always with the needs of the user demographic at the core of concept development. This process focuses on needfinding, understanding, creating, thinking, and doing. At the core of this process is a bias towards action and creation: by creating and testing something, you can continue to learn and improve upon your initial ideas. *(http://dschool.stanford.edu/redesigningtheater/the-design-thinking-process)*

K-2	**Problems Are Situations That People Want to Change** Engineering design in the earliest grades introduces students to "problems" as situations that people want to change. They can use tools and materials to solve simple problems, use different representations to convey solutions, and compare different solutions to a problem and determine which is best. Students in all grade levels are not expected to come up with original solutions, although original solutions are always welcome. Emphasis is on thinking through the needs or goals that need to be met, and which solutions best meet those needs and goals.
3-5	**Formalized Problem Solving with Criteria for Success and Constraints** At the upper elementary grades, engineering design engages students in more formalized problem solving. Students define a problem using criteria for success and constraints or limits of possible solutions. Students research and consider multiple possible solutions to a given problem. Generating and testing solutions also becomes more rigorous as the students learn to optimize solutions by revising them several times to obtain the best possible design.
6-8	**Compare Different Solutions and Arrive at Optimal Design** At the middle school level, students learn to sharpen the focus of problems by precisely specifying criteria and constraints of successful solutions, taking into account not only what needs the problem is intended to meet, but also the larger context within which the problem is defined, including limits to possible solutions. Students can identify elements of different solutions and combine them to create new solutions. Students at this level are expected to use systematic methods to compare different solutions to see which best meet criteria and constraints, and to test and revise solutions a number of times in order to arrive at an optimal design.
9-12	**Social and Global Level** Engineering design at the high school level engages students in complex problems that include issues of social and global significance. Such problems need to be broken down into simpler problems to be tackled one at a time. Students are also expected to quantify criteria and constraints so that it will be possible to use quantitative methods to compare the potential of different solutions. While creativity in solving problems is valued, emphasis is on identifying the best solution to a problem, which often involves researching how others have solved it before. Students are expected to use mathematics and/or computer simulations to test solutions under different conditions, prioritize criteria, consider trade-offs, and assess social and environmental impacts.