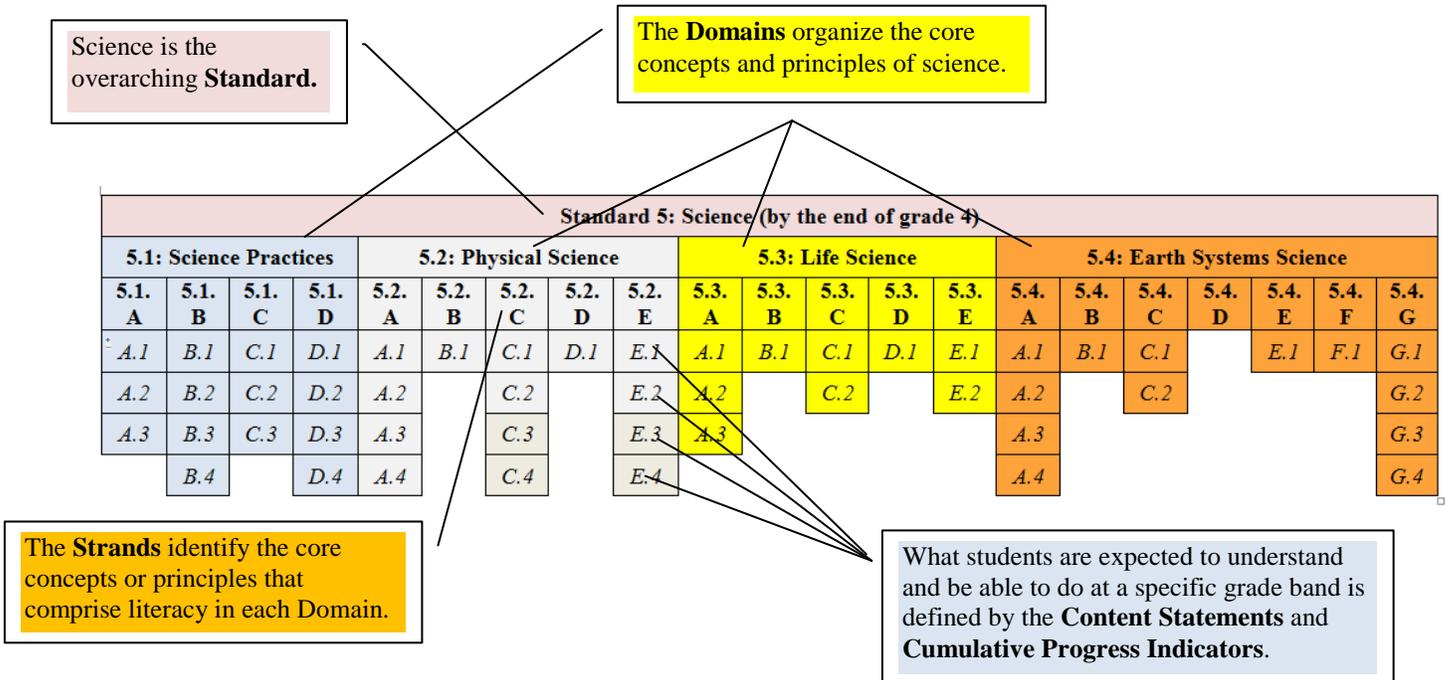


Introduction

The Curriculum Development Graphic Organizers are structured to help districts unburden their curriculum and to focus on the science content and practices that are essential for college and career readiness. The 2009 science standards intentionally focus on fewer concepts, are written to be clearer for the reader, and are intended to allow students to develop deeper conceptual understandings. The graphic organizer encourages educators to look at the big picture and then identify acceptable evidence of understanding before specific units, lessons or instructional materials are selected.

Structure and Function of the 2009 Standards



Updated Definition of Science Proficiency

Knowing science requires individuals to integrate a complex structure of many types of knowledge. These knowledge types include the ideas of science, the relationships between the ideas, the reasons for these relationships, and the ways to use these ideas to complete the following tasks: explain and predict other phenomena, interpret situations, solve problems and participate productively in science practice and discourse.

Updated Definition of Rigor

The meaning of rigor has evolved from a focus on learning all of the facts and specific examples about a concept to an understanding and **application of core principles** of the discipline and **an integration of that knowledge** with the processes that are necessary for **practicing science**.

Science Practices (5.1)

Contemporary views of learning prize understanding and application or knowledge in use. Learners who understand concepts and principles can use and apply them in novel and diverse contexts, drawing connections among multiple representations of a given concept. They appreciate the foundations of knowledge and consider the evidence for claims. Accomplished learners know when to ask a question, how to challenge claims, where to go to learn more, and they are aware of their own ideas and how these change over time (2007, NRC). This contemporary view requires students to use science practices to make sense of the concepts and to use the practices to demonstrate understanding of the concepts. The practices and content are inextricably linked and must be integrated for effective instruction.

The Science Practices emphasize the importance of students independently creating scientific arguments and explanations for observations made during investigations. Science curriculum thereby becomes a sense-making enterprise for students in which they are systematically provided with ongoing opportunities to:

- ✓ Interact directly with the natural and designed world using tools, data-collection techniques, models, and theories of science.
- ✓ Actively participate in scientific investigations and use cognitive and manipulative skills associated with the formulation of scientific explanations.
- ✓ Use evidence, apply logic, and construct arguments for their proposed explanations.

Beyond The Scientific Method

The process of theory development and testing is iterative, uses both deductive and inductive logic, and incorporates many tools besides direct experiment. Modeling (both mechanical models and computer simulations) and scenario building (including thought experiments) play an important role in the development of scientific knowledge. The ability to examine one's own knowledge and conceptual frameworks, to evaluate them in relation to new information or competing alternative frameworks and to alter them by a deliberate and conscious effort is key scientific practices (2007, NRC).

The process by which scientific understandings are developed and the form that those understandings take differ from one domain of science to another, but all sciences share certain common features at the core of their problem-solving and inquiry approaches. Chief among these is that data and evidence hold a primary position in deciding any issue. Thus, when well-established data, from experiment or observation, conflict with a theory or hypothesis, then that idea must be modified or abandoned and other explanations must be sought that can incorporate or take account of the new evidence. This also means that models, theories, and hypotheses are valued to the extent that they make testable (or in principle testable) precise predictions for as yet unmeasured or unobserved effects; provide a coherent conceptual framework that is consistent with a body of facts that is currently known; and offer suggestions of new paths for further study. (2007, NRC)

A process of argumentation and analysis that relates data and theory is another essential feature of science. This includes evaluation of data quality, modeling, and development of new testable questions from the theory, as well as modifying theories as data dictate the need. Finally, scientists need to be able to examine, review, and evaluate their own knowledge. Holding some parts of a conceptual framework as more or less established and being aware of the ways in which that knowledge may be incomplete are critical scientific practices. (2007, NRC)

Components of the Graphic Organizers

<p>Standard: The Standard outlines the core understanding for each content domain. Each standard statement explains why the strands and cumulative progress indicators are important.</p>		
<p>Strand: The strand defines a core concept or principle in physical, life, or earth systems science. Each strand runs throughout students' K-12 academic experience. Each of the strands supports the core understanding of the standard.</p>		
<p>Essential Questions</p>	<p>Enduring Understandings</p>	<p>Labs, Investigation, and Student Experiences</p>
<p>These questions have no 'right' or 'easy' answer, and are meant to inspire investigation and raise more questions.</p>	<p>These understandings are insights that a student gains through learning experiences, and are transferable to new situations.</p>	<ul style="list-style-type: none"> • Plan instructional strategies and learning experiences that will develop students' abilities to demonstrate the Desired Results. • These need to be specific and clear so that others may understand them. • Fundamental principles of instructional design assist students in achieving their intended learning goals through lab-science experiences that: <ul style="list-style-type: none"> ✓ Are designed with clear learning outcomes in mind; ✓ Are sequenced thoughtfully into the flow of classroom science instruction; ✓ Integrate learning of science content with learning about science practices; <p>C:\Users\mheinz.CURRICULUM\Desktop\Curriculum Resources\Curriculum Dev. Templates\Introduction to Science Curriculum Development Templates.doc and</p> <ul style="list-style-type: none"> ✓ Incorporate ongoing student reflection and discussion (National Research Council, 2007).
<p>Content Statements</p>	<p>Cumulative Progress Indicators (CPI)</p>	
<p>These statements describe the concept/content that a student needs to understand about the strand at a specific grade band.</p>	<p>These statements describe how students can demonstrate their understanding of the concept/content. The CPIs are a deliberate connection between a content statement and a science practice.</p>	
<p>Desired Results (Assessment)</p>		
<p>How do you know that the students understand the concepts deeply enough to apply them to new or novel situations?</p> <p>Assessment needs to include both explicit integration of a Science Practice and age appropriate Content.</p>		