# MSAD 52
# K-12 Science Curriculum

The National Research Council's (NRC) *Framework* describes a vision of what it means to be proficient in science; it presents three dimensions that will be combined to form each standard:

## Dimension 1: Practices

The practices describe behaviors that scientists engage in as they investigate and build models and theories about the natural world and the key set of engineering practices that engineers use as they design and build models and systems. The NRC uses the term practices instead of a term like "skills" to emphasize that engaging in scientific investigation requires not only skill, but also knowledge that is specific to each practice. Part of the NRC's intent is to better explain and extend what is meant by "inquiry" in science and the range of cognitive, social, and physical practices that it requires.

Although engineering design is similar to scientific inquiry, there are significant differences. For example, scientific inquiry involves the formulation of a question that can be answered through investigation, while engineering design involves the formulation of a problem that can be solved through design. Strengthening the engineering aspects of the Next Generation Science Standards will clarify for students the relevance of science, technology, engineering and mathematics (the four STEM fields) to everyday life.

## Dimension 2: Crosscutting Concepts

Crosscutting concepts have application across all domains of science. As such, they are a way of linking the different domains of science. They include: Patterns, similarity, and diversity; Cause and effect; Scale, proportion and quantity; Systems and system models; Energy and matter; Structure and function; Stability and change.

## Dimension 3: Disciplinary Core Ideas

Disciplinary core ideas have the power to focus K–12 science curriculum, instruction and assessments on the most important aspects of science. To be considered core, the ideas should meet at least two of the following criteria and ideally all four:

- Have broad importance across multiple sciences or engineering disciplines or be a key organizing concept of a single discipline;
- Provide a key tool for understanding or investigating more complex ideas and solving problems;
- Relate to the interests and life experiences of students or be connected to societal or personal concerns that require scientific or technological knowledge;
- Be teachable and learnable over multiple grades at increasing levels of depth and sophistication. Disciplinary ideas are grouped in four domains: the physical sciences; the life sciences; the earth and space sciences; and engineering, technology and applications of science.

# Science Standards

To Learn More – Helpful Websites:

www.nextgenscience.org

www.maine.gov/doe/nextscience/index.html

Maine Department of Education

Home → Next Generation Science Standards → NGSS Fact Sheet

# NGSS Fact Sheet

Through a collaborative, state-led process, new K–12 science standards are being developed that will be rich in content and practice and arranged in a coherent manner across disciplines and grades to provide all students an internationally benchmarked science education. The Next Generation Science Standards will be based on the Framework for K–12 Science Education developed by the National Research Council. The NGSS should be completed in early 2013.

## Why Next Generation Science Standards?

- It has been 15 years since state science education standards' guiding documents were developed. Since that time, many advances have occurred in the fields of science and science education, as well as in the innovation-driven economy.
- The U.S. has a leaky K–12 STEM talent pipeline, with too few students entering STEM majors and careers at every level—from those with relevant postsecondary certificates to PhD's. We need new science standards that stimulate and build interest in STEM.
- We can't successfully prepare students for college, careers and citizenship unless we set the right expectations and goals. While standards alone are no silver bullet, they do provide the necessary foundation for local decisions about curriculum, assessments, and instruction.
- Implementing improved K–12 science standards will better prepare high school graduates for the rigors of college and careers. In turn, employers will be able to hire workers with strong science-based skills—including specific content areas but also skills such as critical thinking and inquiry-based problem solving.

## What's Different in the Next Generation Science Standards?

- Every NGSS standard has three dimensions: disciplinary core ideas (content), scientific and engineering practices and cross-cutting concepts. Currently, most state and district standards express these dimensions as separate entities, leading to their separation in both instruction and assessment. The integration of rigorous content and application reflects how science is practiced in the real world.
- Science and Engineering Practices and Crosscutting Concepts are designed so as not be taught in a vacuum; the NGSS encourage integration with multiple core concepts

throughout each year.

- Science concepts will build coherently across K-12. The emphasis of the NGSS is a focused and coherent progression of knowledge from grade band to grade band, allowing for a dynamic process of building knowledge throughout a student's entire K-12 scientific education.
- The NGSS focus on a smaller set of Disciplinary Core Ideas that all students should know by the time they graduate from high school – focus involving deeper understanding and application of content than the often fact-driven standards currently in use in states and districts.
- Science and engineering are integrated into science education by raising engineering design to the same level as scientific inquiry in science classroom instruction at all levels, and by emphasizing the core ideas of engineering and technology.
- The NGSS coordinate with English language arts and Mathematics Common Core State Standards. This allows an opportunity both for science to be a part of a child's comprehensive education as well as ensuring an aligned pace of learning in all content areas. The three sets of standards overlap in meaningful and substantive ways.

## Key Milestones in the Development of the Next Generation Science Standards

- Fall 2011 – Lead states and writers identified
- Winter 2011 – Confidential Lead State draft
- Winter 2011 – Writing team reacts to review
- Winter 2012 – College and Career Readiness Advisory Meeting
- Winter 2012 – Lead State and critical stakeholders draft
- Spring 2012 – Writing team reacts to review
- May 11–June 1 2012 – First public draft comment period
- Summer 2012 – College and Career Ready Review
- Summer 2012 – Writing team reacts to reviews
- Fall 2012 – Confidential State and critical stakeholder draft
- Fall 2012 – Writing team reacts to review
- Fall 2012 – Finalize the College and Career Ready Definition
- Fall 2012 – Revise draft based on new College and Career Ready Definition
- January 2013 – Second public draft comment period
- Winter 2013 – Writing team reacts to review
- March 2013 – Next Generation Science Standards released for adoption

## Site Information

# NGSS: The Next Generation Science Standards
# Sample Template

Grade Level: 8 School: TMS

**Unit Title:** Structure and Properties of Matter

**Students who demonstrate understanding can:**

- Develop models to describe the atomic composition of simple molecules and extended structures.
- Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.
- Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.

**Harcourt Text References/Handouts:**

- Textbook: Chemical Building Blocks - Ch. 1: Sect. 1, 2, 3; Ch. 2: Sect. 1 & 2

**Needed Supplementation:**

**Possible Activities:**

**Assessments:**

Formative Assessments:

Element, molecule and compound modeling
Chemical and Physical Changes (demonstration)
Sodium Acetate Demonstration (saturated solution)
Chromatography Lab (solubility)

Summative Assessments:

Structures and Properties of Matter Common Assessment

# NGSS: The Next Generation Science Standards
# Sample Template

Grade 9-12 School: LAHS

## Unit Title: Cell Division and Cancer

| Essential Questions | Essential Content | Essential Skills | Assessments / Activities |
|---|---|---|---|
| • How do organisms create new cells for growth and replace dead and damaged cells?<br>• What happens when an organism loses the ability to control the rate of the cell cycle? | • Cell cycle<br>  • Interphase, mitosis, Cytokinesis<br>  • DNA, chromosomes, chromatin<br>• Cancer<br>  • Checkpoints, tumor suppressor genes,<br>  • Proto-oncogene | • Sequence events: Identify the stages of the cell cycle<br>• Analyze data, make inferences<br>  • Review a case study and data to determine the likelihood of a patient developing cancer | • View onion root tips<br>• View online animations<br>• Make mitosis stop animation movies<br>• NIH videos<br>• Cancer Case Study<br><br>**Common Formative Assessment:**<br>3-multiple choice questions<br>Admit Slips<br><br>**Common Summative Assessment:**<br>Mitosis Vocab Quiz: Quizlet 3/15 |
| • How are gametes made?<br>• What are some potential problems that arise when chromosomes fail to separate appropriately? | • Meiosis<br>  • Gametes formation and potential uneven distribution issues - Karyotypes<br>• Source of genetic variation<br>  • Cross-over, independent assortment, random fertilization (overview in academic, detail in advanced) | • Make careful observations of karyotypes<br>• Make careful observations of flower parts and relate the parts of the flower to their role in plant meiosis and reproduction | • Create flip books<br>• Plant dissection lab<br>• Grocery store botany: Peanut and apple, orange dissection<br><br>**Common Formative Assessment:**<br>Admit slip: Compare and contrast mitosis and meiosis<br><br>**Common Summative Assessment:** |

# Topic Arrangements of the Next Generation Science Standards

At the beginning of the NGSS development process, in order to eliminate potential redundancy, seek an appropriate grain size, and seek natural connections among the Disciplinary Core Ideas (DCIs) identified within the *Framework for K-12 Science Education*, the writers arranged the DCIs into topics around which to develop the standards. This structure provided the original basis of the standards, and is preferred by many states. However, **the coding structure of individual performance expectations reflects the DCI arrangement** in the *Framework*.

Due to the fact that the NGSS progress toward end-of-high school core ideas, the standards may be rearranged in any order within a grade level.

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