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http://learningcenter.nsta.org
Introducing today’s presenters…

Karen Ostlund
2012-2013 NSTA President

Stephen Pruitt
Vice President for Content, Research, and Development
Achieve, Inc.
NSTA’s Role in NGSS
NGSS Second Public Draft Released yesterday, January 8

Unprecedented to have such widespread involvement of so many states and stakeholders—including classroom teachers—involved in science standards development

NGSS will have a profound influence on curriculum, assessment, and teacher professional development in the years ahead

NSTA encourages all teachers to review the NGSS draft and provide feedback to Achieve by January 29
NSTA role with the NGSS

- One of four partners in a state-led process, including
  - The National Academies of Science (the NRC)
  - Achieve Inc.
  - National Science Teachers Association
  - American Association for the Advancement of Science

- Provided guidance and reviews directly to the National Research Council and Achieve
- Provided names of teachers for writers on the writing teams
NGSS Lead State Partners
NSTA Outreach

- Inform science education community about the NGSS draft
- Encourage science educators to have a voice by engaging in the review process
- Help educators study and learn more about the document
To what extent were you involved in reviewing the May Draft of NGSS?

A. I didn’t see the May Draft.

B. I looked at the May Draft, but I didn’t send in comments.

C. I reviewed the May Draft, and sent in comments.

D. I was a member of a review team for the May Draft.

E. I coordinated a review team for the May Draft.
NSTA Resources on NGSS

www.nsta.org
NSTA Resources on NGSS

www.nsta.org
NSTA Resources on NGSS

www.nsta.org/ngss
For More Information from NSTA

- [www.nsta.org/ngss](www.nsta.org/ngss)
- Email: ngss@nsta.org
Next Generation Science Standards Public Release II
Building on the Past; Preparing for the Future

1990s

1990s-2009

Phase I

Phase II

1/2010 - 7/2011

7/2011 – March 2013
What’s Different About the Next Generation Science Standards?
Conceptual Shifts in the NGSS

1. K-12 Science Education Should Reflect the Interconnected Nature of Science as it is Practiced and Experienced in the Real World.
2. The Next Generation Science Standards are student performance expectations – NOT curriculum.
3. The science concepts build coherently from K-12.
4. The NGSS Focus on Deeper Understanding of Content as well as Application of Content.
5. Science and Engineering are Integrated in the NGSS from K–12.
6. The NGSS and Common Core State Standards (English Language Arts and Mathematics) are Aligned.
Three Dimensions Intertwined

- The NGSS are written as Performance Expectations
- NGSS will require contextual application of the three dimensions by students.
Goal: To distribute and receive feedback from interested stakeholders and continue the transparent development process to enable states to prepare for consideration of NGSS

- The standards opens for review at 3:00 p.m. EST on January 8, 2013.
- The review period will end on January 29, 2013.
- The standards and the survey can be accessed at www.nextgenscience.org
- Final Release – March of 2013
Feedback Data from the May 2012 NGSS Public Draft
• Overall, very positive.
General Strengths of the Drafts

- Pedagogical Vision
- Architecture, including integration of the three dimensions
- Rigor required by the NGSS at all grades
- Web presentation and interactivity
- NGSS are well structured and clear about expectations
  - Clarification statements and assessment boundaries support additional clarity
- Intentional connections to other NGSS and math and ELA CCSS
General Areas for Improvement

- Clarity of Some Language
- Integration of Critical Areas in Some Standards
  - Mathematics, engineering, crosscutting concepts
- Scope of Required Content
- Confusion about the role of standards versus curriculum
- Concern about the consistency of organization of the standards versus *Framework* in terms of coding and arrangement
- Concern about the amount of support that will be needed for implementation of the standards
  - Professional Development, materials, administrator support and understanding, future assessments
Changes Since May

- 95% of the Performance Expectations have been rewritten based on feedback, with more specific and consistent language used
- A review focused on college- and career-readiness resulted in the removal of some content
- Some content shifted grade levels in elementary
- Engineering has been better integrated into the traditional science disciplines
- More math expectations have been added to the performance expectations
- “Nature of science” concepts have been highlighted throughout the document
- The Science and Engineering Practices matrix has been revised to provide more clarity
Appendices have been added to support the NGSS and in response to feedback:

- Appendix A – Conceptual Shifts
- Appendix B – Responses to May Public Feedback
- Appendix C – College and Career Readiness
- Appendix D – All Standards, All Students
- Appendix E – Disciplinary Core Idea Progressions in the NGSS
- Appendix F – Science and Engineering Practices in the NGSS
- Appendix G – Crosscutting Concepts in the NGSS
- Appendix H – Nature of Science
- Appendix I – Engineering Design, Technology, and the Applications of Science in the NGSS
- Appendix J – Model Course Mapping in Middle and High School
- Appendix K – Connections to Common Core State Standards in Mathematics
3. Interdependent Relationships in Ecosystems: Environmental Impacts on Organisms

Students who demonstrate understanding can:

3-LS4-d. Analyze and interpret data about changes in the environment of different areas and describe how the changes may affect the organisms that live in the areas. [Clarification Statement: Environmental changes should include changes to landforms, distribution of water, temperature, or availability of resources. The system is a particular area, its components, and how they interact.] [Assessment Boundary: Data may be provided for students.]

3-LS4-e. Use evidence about organisms in their natural habitats to design an artificial habitat in which the organisms can survive well. [Clarification Statement: Evidence to include needs and characteristics of the organisms. The organism and their habitat make up a system in which the parts depend on each other.]

3-LS4-a. Analyze and interpret data from fossils to describe the types of organisms that lived long ago and the environments in which they lived and compare them with organisms and environments today. [Clarification Statement: Students can observe fossils, images of fossils, and/or other data.]

3-LS2-a. Use multiple sources to generate and communicate information about the size, stability, and specialization of groups animals may form, and how different types of groups may help the members survive in their natural habitats. [Clarification Statement: Systems are groups of animals.] [Assessment Boundary: Knowledge of specific groups of animals is not required.]

Science and Engineering Practices

Analyzing and Interpreting Data
Analyzing data in 3-5 builds on K-2 and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations.

- Display data in tables and graphs, using digital tools when feasible, to reveal patterns that indicate relationships. (3-LS4-d), (3-LS4-a)
- Use data to evaluate claims about cause and effect. (3-LS4-d)

Constructing Explanations and Designing Solutions
Constructing explanations and designing solutions in 3-5 builds on prior experiences in K-2 and progresses to the use of evidence in constructing multiple explanations and designing multiple solutions.

- Use evidence (e.g., measurements, observations, patterns) to construct a scientific explanation or design a solution to a problem. (3-LS4-a)

Obtaining, Evaluating, and Communicating Information
Obtaining, evaluating, and communicating information in 3-5 builds on K-2 and progresses to evaluating the merit and accuracy of ideas and methods.

- Compare and/or combine across complex texts and/or other reliable media to acquire appropriate scientific and/or technical information. (3-LS2-a)

Disciplinary Core Ideas

LS2.1: Ecosystem Dynamics, Functioning, and Resilience
- When the environment changes in ways that affect a place's physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die. (3-LS4-d)

LS2.2: Social Interactions and Group Behavior
- Groups can be collections of equal individuals, hierarchies with dominant members, small families, teams of individuals of common interests, or groups composed of individuals similar in age. Some groups are stable over long periods of time while others are fluid, with members moving in and out. Some groups may specialize in different roles or members may become specialized to each member in a group; all members perform both types of functions. (3-LS2-a), (3-LS4-a)

LS4.1: Evidence of Common Ancestry and Diversity
- Some kinds of plants and animals that once lived on Earth (e.g., dinosaurs) are no longer found anywhere, although others now living (e.g., lizards) resemble them in some ways. (Moved from K-3). (3-LS4-a)

- Fossils provide evidence about the types of organisms (both visible and microscopic) that lived long ago and also about the nature of their environments. Fossils can be compared with one another and to living organisms according to their similarities and differences. (3-LS4-a)

LS4.2: Adaptation
- Changes in an organism's habitat are sometimes beneficial to it.
Other Supplementary Documents for NGSS Public Release II

- Supplementary Documents and Materials Available at nextgenscience.org
  - Why Standards Matter?
  - How to Read the NGSS
  - How to Complete the NGSS Survey
  - Glossary of Terms
- Additional Aspects of the NGSS Public Release II
  - More flexibility of viewing of the standards has been provided with two official arrangements of the performance expectations: by topics and by DCI
  - Additional flexibility was added to the website views of standards, allowing users to turn off pop up” description boxes
  - The public feedback survey has been completed revised
Before We Get to Your Questions…

- You can turn off notifications of others arriving:
  - Edit -> Preferences -> General -> Visual notifications

- You can minimize OR detach and expand chat panel
  - Left arrow = minimize; right menu = detach

- Continue the discussion in the Community Forums
  - http://learningcenter.nsta.org/discuss
What questions do you have?
Appendices for the NGSS
<table>
<thead>
<tr>
<th>ESS1.A The universe and its stars</th>
<th>K-2</th>
<th>3-5</th>
<th>6-8</th>
<th>9-12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patterns of movement of the sun, moon and stars as seen from Earth can be observed, described and predicted</td>
<td>Stars range greatly in size and distance from Earth and this can explain their relative brightness</td>
<td>The Big Bang describes the origin of the universe; the Earth is part of one galaxy among many</td>
<td>a) Light spectra are used to describe characteristics of stars; b) The sun will burn out over a life span of about 10 billion years; c) Stars and galaxies are abundant in the universe; d) The development of technologies has provided the observable astronomical data that are the empirical evidence of the Big Bang theory</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ESS1.B Earth and the solar system</th>
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</tr>
</thead>
<tbody>
<tr>
<td>The Earth's orbit and rotation, and the orbit of the moon around the Earth cause observed patterns of movement of celestial objects as seen from Earth</td>
<td>The solar system can be modeled to predict tides, eclipses and the apparent motion of planets seen in the sky from Earth. The Earth's tilt cause seasons</td>
<td>a) Kepler's laws describe common features of the motions of orbiting objects; b) Ice ages and other gradual climatic changes are caused by gradual changes in Earth's orbit and changes in Earth's axial tilt</td>
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<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ESS1.C The history of planet Earth</th>
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</thead>
<tbody>
<tr>
<td>Some events on Earth occur in cycles while some are discrete events, any of which can occur over varying time scales</td>
<td>Earth has changed over time; the history of local landscapes can be inferred. Certain features can be used to order events that have occurred in a landscape</td>
<td>Rock strata and the fossil record can be used as evidence to organize the relative occurrence of major historical events in Earth's history</td>
<td>Radioactive-decay lifetimes and isotopic content can be used to fix the scale of geologic time; the rock record resulting from tectonic and other geoscience processes as well as objects from the solar system can provide evidence of Earth's early history and the relative ages of major geologic formations</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ESS2.A Earth materials and systems</th>
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</tr>
</thead>
<tbody>
<tr>
<td>The materials and resources found in association with landforms provide homes for plants and animals</td>
<td>Four major Earth systems interact to affect materials and processes on Earth's surface</td>
<td>Energy flows and matter cycles within and among Earth’s systems, including the sun and Earth’s interior as primary energy sources; Plate tectonics is one result of these processes</td>
<td>Feedback effects exist within and among Earth’s systems;</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ESS2.B Plate tectonics and large-scale system interactions</th>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Wind and water carry natural materials that influence landforms and what can live in a location</td>
<td>Earth’s physical features occur in patterns, as do earthquakes and volcanoes; Maps can be used to locate features and predict location of those events</td>
<td>Plate tectonics is the unifying theory that explains movements of rocks at Earth's surface and geological history; Maps are used to display evidence of plate movement</td>
<td>Radioactive decay and residual heat of formation within Earth’s interior contribute to thermal convection in the mantle</td>
<td></td>
</tr>
</tbody>
</table>
6-8

In the 6-8 grade band, students can classify relationships as causal or correlational and understand that correlation does not necessarily imply causation. Cause and effect relationships may be used to predict phenomena in natural and designed systems. Students understand that some phenomena have more than one cause, and some cause and effect relationships may only be described using probability.

Examples from **Life Science** include using empirical evidence to support an argument for how characteristic animal behaviors affect the probability of successful reproduction (MS-LS1-e). Examples from **Physical Science** includes developing a molecular model that depicts and predicts why either temperature change and/or change of state can occur when adding or removing thermal energy from a pure substance (MS-PS1-c). Examples from **Earth and Space Science** include collecting data and generating evidence to show how changes in weather conditions result from the motions and interactions of air masses (MS-ESS2-i).

[Performance Expectations using Cause and Effect in 6-8: MS-PS1-c, MS-PS2-c, MS-PS2-e, MS-LS1-e, MS-LS1-f, MS-LS1-g, MS-LS1-h, MS-LS1-i, MS-LS2-a, MS-LS3-a, LS4-b, MS-LS4-e, MS-LS4-f, MS-LS4-j, MS- MS-LS1-l, MS-ESS2-i, MS-ESS2-m,MS-ESS2-p, MS-ESS3-b, MS-ESS3-e, MS-ESS3-f.]
Practice 1 Asking Questions and Defining Problems

Students at any grade level should be able to ask questions of each other about the texts they read, the features of the phenomena they observe, and the conclusions they draw from their models or scientific investigations. For engineering, they should ask questions to define the problem to be solved and to elicit ideas that lead to the constraints and specifications for its solution. (NRC Framework 2012, p. 56)

Scientific questions arise in a variety of ways. They can be driven by curiosity about the world, inspired by the predictions of a model or theory, or they can be stimulated by the need to solve a problem. What distinguishes scientific questions from other types of questions is that they can be answered by appealing to evidence, including evidence that has been gathered by others, or that might be gathered by planning and conducting an investigation.

While science begins with questions, engineering begins with defining a problem to solve. However, engineering may also involve asking questions to define a problem, such as: What is the need or desire that underlies the problem? What are the criteria for a successful solution? Other questions arise when generating ideas, or testing possible solutions, such as: What are the possible trade-offs? What evidence do we need to determine which solution is best?

Whether engaged in science or engineering, the ability to ask good questions and clearly define problems is essential for everyone. The following progression of Practice 1 competencies summarizes what students should be able to do by the end of each grade band.

<table>
<thead>
<tr>
<th>Grades K-2</th>
<th>Grades 3-5</th>
<th>Grades 6-8</th>
<th>Grades 9-12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asking questions and defining problems in</td>
<td>Asking questions and defining problems in</td>
<td>Asking questions and defining problems in</td>
<td>Asking questions and defining problems in</td>
</tr>
<tr>
<td>grades K–2 builds on prior experiences and</td>
<td>grades 3–5 builds from grades K–2 experiences</td>
<td>grades 6–8 builds from grades K–5</td>
<td>grades 9–12 builds from grades K–8 experiences</td>
</tr>
<tr>
<td>progresses to simple descriptive questions that</td>
<td>and progresses to specifying qualitative</td>
<td>and progresses to formulating and refining</td>
<td>and progresses to formulating, refining, and</td>
</tr>
<tr>
<td>can be tested.</td>
<td>relationships.</td>
<td>empirically testable models to explain</td>
<td>evaluating empirically testable questions and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>phenomena or solve problems.</td>
<td>design solutions using models and simulations.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Identify scientific (testable) and non-</td>
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<td></td>
<td></td>
<td>scientific (non-</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>scientific questions and design solutions using models and simulations.</td>
<td></td>
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</tbody>
</table>
# Nature of Science

## Overview

One goal of science education is to help students understand the nature of scientific knowledge. This matrix presents eight major themes and grade level understandings about the nature of science. Four themes extend the scientific and engineering practices and four themes extend the crosscutting concepts. These eight themes are presented in the left column. The matrix describes learning outcomes for the themes at grade bands for K-2, 3-5, middle school, and high school. Appropriate learning outcomes are expressed in selected performance expectations and presented in the foundation boxes throughout the standards.

<table>
<thead>
<tr>
<th>Categories</th>
<th>K-2</th>
<th>3-5</th>
<th>Middle School</th>
<th>High School</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Scientific Investigations Use a Variety of Methods</strong></td>
<td>- Science investigations begin with a question. - Science uses different ways to study the world.</td>
<td>- Science methods are determined by questions. - Science investigations use a variety of tools and techniques.</td>
<td>- Science investigations use a variety of methods and tools to make measurements and observations. - Science investigations are guided by a set of values to ensure accuracy of measurements, observations, and objectivity of findings.</td>
<td>- Science depends on evaluating proposed explanations. - Scientific values function as criteria in distinguishing between science and non-science.</td>
</tr>
</tbody>
</table>

| **Scientific Knowledge is Based on Empirical Evidence** | - Scientists look for patterns and order when making observations about the world. | - Science findings are based on recognizing patterns. - Science uses tools and technologies to make accurate measurements and observations. | - Science knowledge is based upon logical and conceptual connections between evidence and explanations. - Science disciplines share common rules of obtaining and evaluating empirical evidence. | - Science knowledge is based on empirical evidence. - Science disciplines share common rules of evidence used to evaluate explanations about natural systems. |

| **Scientific Knowledge is Open to Revision in Light of New Evidence** | - Science knowledge can change when new information is found. | - Science explanations can change based on new evidence. | - Scientific explanations are subject to revision and improvement in light of new evidence. - The certainty and durability of science findings varies. - Science findings are frequently revised and/or reinterpreted based on new evidence. | - Scientific explanations can be provisional. - Most scientific knowledge is quite durable, but is, in principle, subject to change based on new evidence and/or reinterpretation of existing evidence. |

| **Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena** | - Science uses drawings, sketches, and models as a way to communicate ideas. | - Science searches for cause and effect relationships to explain natural events. | - Science theories are based on a body of evidence and many tests. - Science explanations describe the mechanisms for natural events. | - Theories are explanations for observable phenomena. - Science theories are based on a body of evidence developed over time. - Laws are regularities or mathematical descriptions of natural phenomena. - A hypothesis is used by scientists as an idea that may contribute important new knowledge for the evaluation of a scientific theory. - The term “theory” as used in science is very different than the common use outside of science. |

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*Next Generation Science Standards*
Engineering in the NGSS

Engineering Performance Expectations

The following chart shows all performance expectations that require engineering design practices, disciplinary core ideas, or the crosscutting concepts of engineering, technology, and society. Engineering performance expectations are designated with an asterisk (*). This chart allows readers to quickly identify the performance expectations in each grade/grade-band. Following the chart are the actual performance expectations in the NGSS architecture.

Engineering in Kindergarten through Fifth Grade

<table>
<thead>
<tr>
<th>Grade / Grade-Level</th>
<th>Science and Engineering Practices</th>
<th>Disciplinary Core Idea</th>
<th>Cross-Cutting Concept</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>K-ESS3-d.</td>
<td></td>
<td>K-ESS3-d.</td>
</tr>
<tr>
<td>1</td>
<td>1-PS4-d.</td>
<td>1-PS4-e.</td>
<td>1-PS4-e.</td>
</tr>
<tr>
<td></td>
<td>1-PS4-e.</td>
<td>1-LS1-b.</td>
<td>1-LS1-b.</td>
</tr>
<tr>
<td></td>
<td>1-LS1-b.</td>
<td></td>
<td>1-LS1-b.</td>
</tr>
<tr>
<td></td>
<td>1-ESS1-b.</td>
<td></td>
<td>1-ESS1-b.</td>
</tr>
</tbody>
</table>
I. Introduction

II. Course Maps
   A. Conceptual Progressions Model (6-8) and (9-12) (Course Map Model 1)
      1. Process and Assumptions: Where did this course map come from?
      2. Refining Course Map 1
4.E Energy

As part of this work, teachers should give students opportunities to use the four operations with whole numbers to solve problems:

4.OA.3. Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding. Science example: The class has 144 rubber bands with which to make rubber-band cars. If each car uses 6 rubber bands, how many cars can be made? If there are 28 students, at most how many rubber bands can each car have (if every car has the same number of rubber bands)?

Alignment notes: Grade 4 students are expected to fluently add and subtract multi-digit whole numbers; multiply a number of up to four digits by a one-digit whole number; multiply two two-digit numbers; and find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors.
The second draft of the NGSS is ready for your review before January 29.

Review the standards and provide feedback.
The second draft of the Next Generation Science Standards will be available for feedback from January 8, 2013 through January 29, 2013. We fully encourage all interested parties to review the draft as individuals or in groups and provide feedback to the Lead States and writers. In this draft, the standards are coded by Disciplinary Core Ideas (DCI) from the NRC’s Framework for K-12 Science Education, and are available in two different arrangements: by DCI and by topic.

Survey by DCI Arrangement / PDF version

Survey by Topics Arrangement / PDF version

Click here for a PDF of the DCI Arrangement of the standards, click here for a PDF of the Topical Arrangement of the standards, or use the search buttons above to explore interactive versions of the standards.

The NGSS will be completed in March of 2013. Since the May draft release, the Lead States and the writers evaluated the tens of thousands of comments collected during the May 2012 review period and worked on revising the standards. The goal of this public release is to share revisions based on the first public review and the college and career
Search Standards by DCI

You can also search for topical arrangements of standards.

Download a PDF of all performance expectations grouped by DCI, or select criteria below to search for individual DCI groupings. You can Ctrl+click (cmd+click on Macs) to select or de-select multiple criteria. Note that adding criteria from both categories narrows your results.

Grades
K-2
K
1
2
3-5
3
4
5
Middle School (6-8)

Disciplinary Core Idea
Earth and Space Sciences
- ESS1A: The Universe and its Stars
- ESS1B: Earth and the Solar System
- ESS1C: The History of Planet Earth
- ESS2A: Earth Materials and Systems
- ESS2B: Plate Tectonics and Large-Scale Systems
- ESS2C: The Role of Water in Earth’s Surface Processes
- ESS2D: Weather and Climate
- ESS2E: Biogeology
Performance Expectations by DCI
Click on a topic to view associated performance expectations.

<table>
<thead>
<tr>
<th>Elementary</th>
<th>K-5 Storylines: K</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>K.PS1 Matter and its Interactions</td>
<td>2.LS2 Ecosystems: Interactions, Energy and Dynamics</td>
<td>4.PS3 Energy</td>
<td></td>
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</tr>
<tr>
<td>K.PS3 Energy</td>
<td>2.LS4 Biological Evolution: Unity and Diversity</td>
<td>4.PS4 Waves and Their Applications in Technologies for Information Transfer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>K.LS1 From molecules to organisms: Structures and processes</td>
<td>2.ESS2 Earth's Systems</td>
<td>4.LS1 From Molecules to Organisms: Structures and Processes</td>
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<td></td>
</tr>
<tr>
<td>K.ESS2 Earth's Systems</td>
<td>3.PS2 Motion and Stability: Forces and Interactions</td>
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<td></td>
</tr>
<tr>
<td>K.ESS3 Earth and Human Activity</td>
<td>3.LS1 From Molecules to Organisms: Structures and Processes</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>1.PS4 Waves and Their Applications in Technologies for Information Transfer</td>
<td>3.LS2 Ecosystems: Interactions, Energy and Dynamics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.LS1 From Molecules to Organisms: Structure and Processes</td>
<td>3.LS3 Heredity: Inheritance and Variation of Traits</td>
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<td>1.ESS1 Earth's Place in the Universe</td>
<td>3.ESS2 Earth's Systems</td>
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<td>2.PS1 Matter and Its Interactions</td>
<td>3.ESS3 Earth and Human Activity</td>
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<td>2.PS2 Motion and Stability: Forces and Interactions</td>
<td>4.ESS1 Earth's Place in the Universe</td>
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<td>2.PS3 Energy</td>
<td>4.ESS2 Earth's Systems</td>
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PS: Physical Sciences

<table>
<thead>
<tr>
<th>Middle School</th>
<th>High School</th>
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<tbody>
<tr>
<td>MS.PS1 Matter and Its Interactions</td>
<td>HS.PS1 Matter and Its Interactions</td>
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<tr>
<td>MS.PS2 Motion and Stability: Forces and Interactions</td>
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<td>HS.PS3 Energy</td>
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<tr>
<td>MS.PS4 Waves and Their Applications in Technologies for Information Transfer</td>
<td>HS.PS4 Waves and Their Applications in Technologies for Information Transfer</td>
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</table>
You can also search for standards by the DCI arrangement.

**Download a PDF** of all performance expectations grouped by topic, or scroll down to view the full table of standards or select criteria below to search for individual topic groupings. You can Ctrl+click (cmd+click on Macs) to select or de-select multiple criteria. *Note that adding criteria from both categories narrows your results.*

This arrangement of the Next Generation Science Standards (NGSS) is similar to earlier iterations of the standards. At the beginning of the 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 has continued through the process.

However, in response to the previous public feedback and direction of the Lead State Partners, the **coding structure of individual performance expectations has changed** to be based on the same DCI arrangement as the Framework. The topic names have been retained in order to allow easy comparisons and, where possible, the order of the performance expectations has been retained as well.

Since many states prefer the topical arrangement, and because the writers want to be transparent about changes made from draft to draft, this topic view is once again offered to those who prefer to review the NGSS in this form. Due to the fact that the NGSS progress toward end-of-high school core ideas, the standards may be rearranged in any order.

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**Grades**

<table>
<thead>
<tr>
<th>Grades</th>
<th>Discipline</th>
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<tbody>
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<tr>
<td>K</td>
<td>Engineering, Technology, and Applications of Science</td>
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<tr>
<td>1</td>
<td>Life Sciences</td>
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<td>2</td>
<td>Physical Sciences</td>
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<td>Middle School (6-8)</td>
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</table>
# Performance Expectations by Topic
Click on a topic to view associated performance expectations.

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<th>Elementary</th>
<th>K-5 Storylines:  K</th>
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<tbody>
<tr>
<td><strong>K. Structure and Properties of Matter</strong></td>
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<td><strong>K. Relationships in Ecosystems</strong></td>
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<td><strong>K. Weather and Climate</strong></td>
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<td>1. Waves: Light and Sound</td>
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<tr>
<td>1. Space Systems: Patterns and Cycles</td>
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<td>4. Earth's Surface Systems</td>
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<td>5. Structure and Properties of Matter</td>
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<td>5. Matter and Energy in Organisms and Ecosystems</td>
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<td>5. Space Systems: Stars and the Solar System</td>
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## PS: Physical Sciences

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<td><strong>HS. Structure and Properties of Matter</strong></td>
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<tr>
<td><strong>MS. Chemical Reactions</strong></td>
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<tr>
<td><strong>MS. Waves and Electromagnetic Radiation</strong></td>
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## LS: Life Sciences

<table>
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<tbody>
<tr>
<td><strong>MS. Structure, Function, and Information Processing</strong></td>
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</tr>
<tr>
<td><strong>MS. Growth, Development, and Reproduction of Organisms</strong></td>
<td><strong>HS. Inheritance and Variation of Traits</strong></td>
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<tr>
<td><strong>MS. Matter and Energy in Organisms and Ecosystems</strong></td>
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<td><strong>HS. Natural Selection and Evolution</strong></td>
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</tbody>
</table>
K.PS1 Matter and Its Interactions

Students who demonstrate understanding can:

**K.PS1-a.** Design and conduct an investigation of different kinds of materials to describe their observable properties and classify the materials based on the patterns observed. [Clarification Statement: Observations are qualitative only and could include relative length, weight, color, texture, and hardness. Patterns include the similar properties that different materials share.]

**K.PS1-b.** Design and conduct investigations to test the idea that some materials can be a solid or liquid depending on temperature. [Assessment Boundary: Only a qualitative description of temperature should be used such as hot, cool, and warm]

**K.PS1-c.** Ask questions, based on observations, to classify different objects by their use and to identify whether they occur naturally or are human-made.* [Clarification Statement: Patterns include the similar characteristics of objects that determine whether they occur naturally or are human-made]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

**Science and Engineering Practices**

- **Asking Questions and Defining Problems**
  - Asking questions and defining problems in grades K–2 builds on prior experiences and progresses to simple descriptive questions that can be tested
  - Ask questions based on observations of the natural and/or designed world. (K.PS1-c)

- **Planning and Carrying Out Investigations**
  - Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions
  - With guidance, design and conduct investigations in collaboration with peers. (K.PS1-a),(K.PS1-b)
  - Make direct or indirect observations and/or measurements to collect data which can be used to make comparisons. (K.PS1-a) (K.PS1-b)

- **Connections to the Nature of Science**
  - Science Knowledge is based on empirical evidence
  - Scientists look for patterns and order when making observations about the world. (K.PS1-a),(K.PS1-b),(K.PS1-c)

**Disciplinary Core Ideas**

- **PS1.A: Structure and Properties of Matter**
  - Different kinds of matter exist (e.g., wood, metal, water) and many of them can be either solid or liquid depending on temperature. (K.PS1-a),(K.PS1-b)
  - Matter can be described and classified by its observable properties (e.g., visual, aural, textual), by its use, and by whether it occurs naturally or is manufactured. (K.PS1-a),(K.PS1-c)

**Crosscutting Concepts**

- **Patterns**
  - Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence. (K.PS1-a) (K.PS1-c)

- **Cause and Effect**
  - Events have causes that generate observable patterns. (K.PS1-b)
  - Simple tests can be designed to gather evidence to support or refute student ideas about causes. (K.PS1-b)

- **Connections to Engineering, Technology, and Applications of Science**
  - Influence of Engineering, Technology, and Science on Society and the Natural World
    - People depend on various technologies in their lives; human life would be very different without technology. (K.PS1-c)
    - Every human-made product is designed by applying some knowledge of the natural world and is built by using materials derived from the natural world, even when the materials are not themselves natural—for example, spoons made from refined metals. (K.PS1-c)
Students who demonstrate understanding can:

**K-PS1-a.** Design and conduct an investigation of different kinds of materials to describe their observable properties and classify the materials based on the patterns observed. [Clarification Statement: Observations are qualitative only and could include relative length, weight, color, texture, and hardness. Patterns include the similar properties that different materials share.]

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Contact Information

Stephen Pruitt, Ph.D.
Vice President, Content, Research and Development

spruitt@achieve.org

www.nextgenscience.org
Before We Get to Your Questions…

• You can turn off notifications of others arriving:
  ➢ Edit -> Preferences -> General -> Visual notifications

• You can minimize OR detach and expand chat panel
  ➢ Left arrow = minimize; right menu = detach

• Continue the discussion in the Community Forums
  ➢ http://learningcenter.nsta.org/discuss
What questions do you have?
NSTA Resources
About NGSS
NSTA Resources on NGSS

www.nsta.org
NSTA Resources on NGSS

www.nsta.org/ngss
Below are group forums that you may join. Post to existing topics or start your own! All NSTA resources, personally uploaded resources, and collections may be shared and commented upon within these discussions.

### Pedagogy and Research Forums

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<td>by Susan German, Wed Sep 12, 2012 10:25 PM Science Lessons for Inclusion Students</td>
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<td>New Teachers</td>
<td>by Mary Elgie, Thu Sep 13, 2012 6:20 PM New Teacher Question</td>
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<td><strong>Next Generation Science Standards</strong></td>
<td>by Wendy Ruchti, Today, 10:33 AM CCSS and NGSS</td>
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<td>Professional Development</td>
<td>by Adah Stock, Wed Sep 12, 2012 4:33 PM WestEd New Series &quot;Making Sense of Science&quot;</td>
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NSTA Print Resources

NSTA Reader’s Guide to the Framework

NSTA Journal Articles about the Framework and the Standards
NSTA National Conference

San Antonio, Texas
April 11-14
Upcoming NSTA Web Seminars about NGSS

- **Engineering Practices in the NGSS**
  Mariel Milano, Orange County Public Schools & NGSS Writer
  6:30-8:00, on Tuesday, January 15th

- **Using the NGSS Practices in the Elementary Grades**
  Heidi Schweingruber, National Research Council
  and Deborah Smith, Pennsylvania State University
  6:30-8:00, on Tuesday, January 29th

- **Connections between the Practices in NGSS, Common Core Math, and Common Core ELA**
  Sarah Michaels, Clark University and author of *Ready, Set, Science*
  6:30-8:00, on Tuesday, February 12th
Feb. 19: Patterns
March 5: Cause and effect: Mechanism and explanation
March 19: Scale, proportion, and quantity
April 2: Systems and system models
April 16: Energy and matter: Flows, cycles, and conservation
April 30: Structure and function
May 14: Stability and change

All sessions will take place from 6:30-8:00 on Tuesdays

Also, archives of last fall’s web seminars about the Scientific and Engineering Practices are available
The End
Thanks to today’s presenters...

Karen Ostlund
2012-2013 NSTA President

Stephen Pruitt
Vice President for Content, Research, and Development
Achieve, Inc.
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