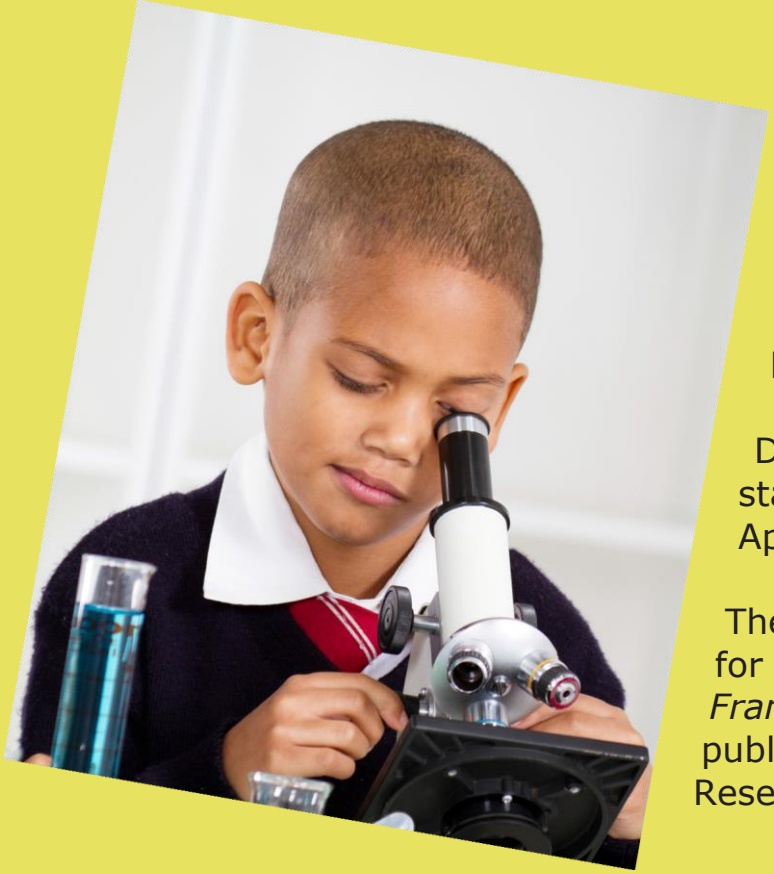
Delaware Next Generation Science Standards

Learning Science by Doing Science



In September of 2013, the Delaware State Board of Education adopted the Next Generation Science Standards (NGSS) making Delaware the seventh state in the nation to adopt the rigorous, internationally benchmarked standards.

Delaware worked with 25 other lead states from September 2011 through April 2013 to develop these standards.

The standards are built upon a vision for science education established by *A Framework for K-12 Science Education* published by the National Academies' National Research Council in 2011.

The Delaware review team included representation from K-12 science educators, post-secondary science professors, post-secondary science education professors, policymakers, and science-related business and industry.

Delaware science education organizations have endorsed these standards, including, but not limited to: the Delaware Association for Teachers of Science, Delaware Science Coalition, DuPont, Delaware Nature Society, Delaware National Education Association, and the Delaware Parent Teacher Association. Teachers, schools, and districts will begin implementing the 2013 Delaware Next Generation Science Standards.

These are rigorous, innovative standards that will require thoughtful implementation. The new Delaware science standards offer an amazing opportunity for teachers, schools, and districts to build on the solid foundation of science education in Delaware and prepare a generation of students to be successful in a world with an ever-increasing emphasis on science and technology.

This booklet will provide an overview of why new science standards have been adopted, a glimpse of *A Framework for K-12 Science Education* and family fun science activities that can be done at home.

When families are involved in their children's education, research shows that children do better in school, are more confident as learners and have higher expectations for themselves.

Why do we need new science standards?

- Our retired Delaware standards were based on national science education standards that were written in the mid 1990s. Since that time, there have been many advances in the fields of science and science education. *A Framework for K-12 Science Education* compiled this research and laid the foundation for the standards.

- Delaware has too few students entering the fields of Science, Technology, Engineering, and Mathematics (STEM) majors and careers at every level—from those with relevant postsecondary certificates to PhDs. Kansas needs new science standards that stimulate and build interest in STEM.

- Students cannot be successfully prepared for college, careers, and citizenship unless the right expectations and goals are identified. While standards alone are not the answer to encouraging and preparing students to choose a career in STEM, they do provide the necessary foundation for local decisions around curriculum, assessments, and instruction.

- These standards are designed to build the knowledge and skills to help students in their lives beyond high school regardless of their chosen career. Our daily lives are full of scientific information -- from a trip to the doctor, to products in the grocery store making scientific-sounding claims -- these standards help prepare students to use the science process to make good decisions.

- 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 is "A Framework for K-12 Science Education"?

A Framework for K-12 Science Education consists of a limited number of elements in three dimensions: (1) scientific and engineering practices, (2) crosscutting concepts, and (3) disciplinary core ideas in science. The framework describes how science elements should be developed across grades K-12. The framework is also designed so that students continually build on and revise their knowledge and abilities throughout their school years. To support learning, all three dimensions need to be integrated into standards, curricula, instruction, and assessment. The Framework for K-12 Science Education includes the following:

DIMENSION 1: SCIENTIFIC AND ENGINEERING PRACTICES

The science and engineering practices focus on what scientists and engineers do in their jobs, but they are also problem skills that can ratchet up anyone's problem-solving skills. For example, all of the disciplines of science share a commitment to data and evidence as the foundation for developing claims about the world. These same skills can help anyone learn about themselves and the world around them.

Engaging in the full range of scientific practices helps students understand how scientific knowledge develops and gives them an appreciation of the wide range of approaches that are used to investigate, model, and explain the world. It gives them a true feel of what a career in a science-related field might be like.

1. Asking questions (for science) and defining problems (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

DIMENSION 2: CROSSCUTTING CONCEPTS

The seven crosscutting concepts encompass big ideas in science and engineering that cut across disciplines and connect knowledge from the various disciplines into a coherent and scientific view of the world. For example, the concept of "cause and effect: mechanism and explanation" includes the key understandings that events have causes; that a major activity of science is investigating and explaining these relationships; and that such mechanisms can be tested and used to make predictions.

1. Patterns
2. Cause and effect: mechanism and explanation
3. Scale, proportion, and quantity
4. Systems and system models
5. Energy and matter: flows, cycles, and conservation
6. Structure and function
7. Stability and change

DIMENSION 3: DISCIPLINARY CORE IDEAS

The Disciplinary Core Ideas described in the *Framework* include core ideas for the physical sciences, life sciences, earth and space sciences, and engineering. The focus is on a limited number of core ideas in science and engineering. It is designed to allow sufficient time for teachers and students to explore each idea in depth and thus with understanding of each concept using instruction that blends together this science content with the science and engineering practices and the crosscutting concepts.

Physical Sciences
PS 1: Matter and its interactions
PS 2: Motion and stability: forces and interactions
PS 3: Energy
PS 4: Waves and their applications in technologies for information transfer

Life Sciences
LS 1: From molecules to organisms: structures and processes
LS 2: Ecosystems: interactions, energy, and dynamics
LS 3: Heredity: inheritance and variation of traits
LS 4: Biological Evolution: unity and diversity

Earth and Space Sciences
ESS 1: Earth's place in the universe
ESS 2: Earth's systems
ESS 3: Earth and human activity

Engineering, Technology, and the Applications of Science
ETS 1: Engineering design
ETS 2: Links among engineering, technology, science, and society

Everyone is a Scientist. Science is all around us.

- It is using what we do, see, hear, smell, taste, and feel to answer questions about the world around us.
- It helps us discover how things work and why we do things certain ways.
- It is an exploration of the unknown.
- It is a way of thinking that leads us to new discoveries.
- It is filling in gaps in our knowledge base.
- It is changing old ideas and modifying concepts. Science is dynamic.
- It is discovering that we don't have all the answers.
- It is about thinking outside of the box of what we already know and discovering new ideas.

Fun Family Science Activities

All children have different interests and will be drawn to different types of science activities. Listed are activities designed for you to do with your child at home or in the community. These activities can show your child that science plays a part in many everyday activities and that it is used in many places and environments.

Many activities can be adapted according to the age of your child. As your child gets older, don't discontinue doing this type of interactive learning together; make it more challenging! Don't assume that children need spectacular demonstrations to learn science. They enjoy things on their level best. Consider your interests and personality as well as where you live and what's available to you when choosing activities.

- Observe the moon each night and draw its shape to see how it changes over the course of a month.
- Cook together. Cooking is a great example of science in action. Identify solids, liquids and gases. Watch what happens when heat is added to a mixture or when vinegar is added to milk.
- Go for a walk and talk about things you observe in nature. Observe similarities and differences in various animals or plants, habitats for different animals, running water after it rains, and more.
- Make a bubble solution with dishwashing detergent and water. Use a variety of items such as clothes hangers made into circular shapes or sifters to blow bubbles. Discuss the science in this fun. There is actually gas trapped inside the soapy liquid, until the shell pops.
- Explore with water. Fill a large bucket or sink with water and experiment with various items to see if they sink or float. Have your child make predictions before dropping in items.
- Collect items from outside such as leaves, rocks, flower petals, and dead bugs. Talk about these items. How could you categorize them? (size, shape, hardness, smoothness, color, etc.)

- Plant flower or vegetable seeds in a small pot indoors. Discuss what is necessary for plants to grow (sunlight and water). Have your child observe the changes in the plant as it grows and keep notes in a journal.
- Recycle waste products from your household. As a family, discuss what types of things can be recycled and organize your method to do so.
- Watch the weather forecast on the news or a weather channel and discuss weather patterns happening across the country.

The activities listed are just to get you started. The sky's the limit when it comes to having fun with your child while developing and reinforcing science skills. Being "scientific" involves being curious, observing, asking how things happen and learning how to find the answers. Curiosity is natural to children, but they need help understanding how to make sense of what they see and to relate their observations to their existing ideas and understandings. This is why being involved is so important in children's science education!

Where can I find more information about the Next Generation Science Standards?

Delaware PTA
1-302-838-8770
www.delawarepta.org

Next Generations Science Standards
www.nextgenscience.org

Delaware PTA
everychild. onevoice.