

# Preparing Students for a Lifetime of Success

Understanding New  
Science Standards  
for Grades 9-12

## How will we prepare students for academic success?

Many states have adopted new standards based on the Next Generation Science Standards (NGSS) because they understand that a robust science education in high school will pave the way for increased opportunities in college and future careers.

The NGSS enable teachers to offer all students interactive science instruction that promotes analysis and interpretation of data, critical thinking, problem solving, and connections across science disciplines—with a high set of expectations for achievement in grades 9-12.

## A quality science education can help expand opportunities for all students.

The science standards complement English/Language Arts and mathematics standards, enabling classroom instruction to reflect a clearer picture of the real world, where solving problems often requires skills and knowledge from multiple disciplines. Further, these standards are designed to benefit and engage all students, whether they currently lack access to a quality science education or already excel in science subjects.



## What is our vision for science education?

The NGSS reflect the latest research and advances in modern science. In order to equip students to think critically, analyze information, and solve complex problems, the standards are arranged such that—from elementary through high school—students have multiple opportunities to build on the knowledge and skills gained during each grade, by revisiting important concepts and expanding their understanding of connections across scientific domains. Parents should understand that while some content might be similar to the past, it may look different from how they were taught.

### As the science standards are implemented in schools and districts, they will enable students to:

- Develop a deeper understanding of science beyond memorizing facts, and
- Experience similar scientific and engineering practices as those used by professionals in the field.

## How will students learn science in the classroom?

Each year, students should be able to demonstrate greater capacity for connecting knowledge across, and between, the physical sciences, life sciences, earth and space sciences, and engineering design.

During grades 9-12, your child will begin to form deeper connections between concepts and skills previously learned in grades 6-8, such as applying statistics to scientific questions, evaluating limitations of models, and creating algorithms to solve problems.

**Upon completion of grades 9-12, your child should have a deeper understanding of:**

- Sub-atomic forces and energy conservation;
- System complexity and the molecular basis of biology;
- How technology measures and predicts chemical reactions and ocean currents and
- How engineering design can help address global issues.

## Physical Sciences

Physical sciences during grades 9-12 may explore topics including sub-atomic chemistry, energy transferred by fields, and electromagnetic radiation. Such lessons will help students develop key problem-solving skills and techniques that prepare them for success in a wide range of college majors or careers, including those in S.T.E.M. (science, technology, engineering, and mathematics) fields.

## Life Sciences

Life sciences during grades 9-12 may explore topics including ecosystem dynamics, molecular photosynthesis, body systems, and DNA. Such lessons will help students develop key problem-solving skills and techniques that prepare them for

success in a wide range of college majors or careers, including those in S.T.E.M. (science, technology, engineering, and mathematics) fields.

## Earth and Space Sciences

Earth and space sciences during grades 9-12 may explore topics including geology, astronomy, and biodiversity. Such lessons will help students develop key problem-solving skills and techniques that prepare them for success in a wide range of college majors or careers, including those in S.T.E.M. (science, technology, engineering, and mathematics) fields.

## Engineering Design

Engineering design during grades 9-12 may explore topics including how to define problems quantitatively and how to identify tradeoffs when developing engineering solutions. Such lessons will help students develop key problem-solving skills and techniques that prepare them for success in a wide range of college majors or careers, including those in S.T.E.M. (science, technology, engineering, and mathematics) fields.

**For additional information about academic expectations for students in Grades 9-12, visit [www.nextgenscience.org/parentguides](http://www.nextgenscience.org/parentguides).**

## How can you support your child's success?

Although this new approach to teaching and learning K-12 science is different than the past, you can still actively support your child's success in the classroom!

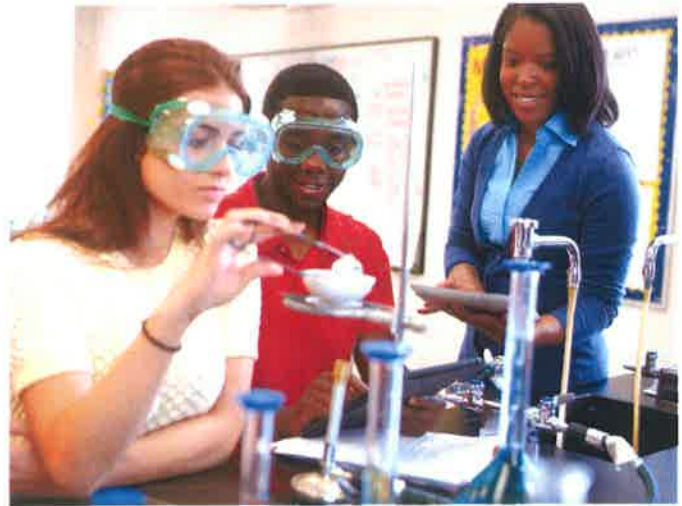
1. Speak to your child's teacher(s) or principal about how these important changes affect your school.
2. Ask your child's teacher thoughtful questions based on the information provided in this brochure.
3. Learn how you can help the teacher(s) reinforce classroom instruction at home.

Classroom activities in High School will look less like this:	And more like this:
<p><b>Physical Sciences</b> </p> <p>Students learn the periodic table by rote memorization.</p> <p>Students learn that substances combine or react to make new substances.</p> <p>Students calculate energy transfer.</p>	<p><b>Physical Sciences</b> </p> <p>Students use the periodic table as a tool to explain and predict the properties of elements.</p> <p>Students characterize chemical reactions and use that knowledge to explain various biological and geophysical phenomena.</p> <p>Students design, build, and refine devices to optimize the conversion of energy.</p>
<p><b>Life Sciences</b> </p> <p>Students learn the stages of mitosis.</p> <p>Students learn about trophic levels in ecosystems.</p> <p>Students create Punnett squares to learn about Mendelian genetics.</p>	<p><b>Life Sciences</b> </p> <p>Students create scientific arguments for how mitosis can produce complex organisms with different kinds of body parts.</p> <p>Students construct explanations for the role of energy in the cycling of matter in organisms and ecosystems.</p> <p>Students use statistics and probability concepts in written essays explaining how traits are expressed in a population.</p>
<p><b>Earth &amp; Space Sciences</b> </p> <p>Students learn about the composition of asteroids and meteors.</p> <p>Students learn about different Earth systems, including water systems and weather systems.</p> <p>Students study different types of natural hazards, such as hurricanes and tornadoes.</p>	<p><b>Earth &amp; Space Sciences</b> </p> <p>Students use evidence from meteorites and other planetary surfaces to form hypotheses about the early history of Earth.</p> <p>Students analyze geoscience data to determine the feedback effects between Earth systems.</p> <p>Students conduct research to gather data on how different types of natural hazards have influenced human activity.</p>
<p><b>Engineering Design</b> </p> <p>Students learn engineering separately from other science disciplines.</p> <p>Engineering lessons are only offered to some students.</p> <p>Engineering lessons are focused on trial and error "building" projects.</p>	<p><b>Engineering Design</b> </p> <p>Students consider or apply engineering design principles throughout each science course.</p> <p>Engineering lessons are offered to all students and each student is encouraged to connect lessons to their own personal experiences.</p> <p>Students use their understanding of engineering design concepts to explore major global issues; first breaking them down into smaller problems, then researching and discussing possible solutions that can be tackled with engineering methods.</p>

## About NGSS: Reshaping Science Education for All Students

To better prepare American students for college and careers, schools need to ensure that quality science education is accessible to all students—regardless of ethnicity or zip code.

In an effort to bolster America's competitive edge in an increasingly global economy, 26 states led the development of the Next Generation Science Standards (NGSS) by working with teachers, higher education, business, and practicing scientists. This collaborative process produced a set of high quality, college- and career-ready K-12 academic standards that set meaningful expectations for student performance and achievement in science. The NGSS are rich in both content and practice and arranged in a coherent manner across all disciplines and grades.

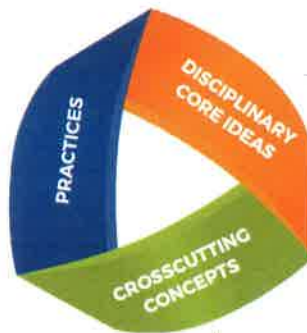


**Fact:** “Standards” are not “curriculum”. “Standards” provide clarity about *what students should know and be able to do by the end of each grade level*. “Curriculum” refers to *how students meet those expectations*. Please contact your child’s teacher or school if you have questions about their curriculum.

## Three Dimensions of Science Learning

The NGSS emphasizes three distinct, yet equally important dimensions that help students learn science. Each dimension is integrated into the NGSS and—combined—the three dimensions build a powerful foundation to help students build a cohesive understanding of science over time.

Standard behaviors that scientists and engineers use to explain the world or solve problems



Fundamental scientific knowledge

Frameworks for scientific thinking across disciplines

**Support your child’s success in the classroom!**