

Pennsylvania's New Science, Technology & Engineering, and Environmental Literacy & Sustainability Learning Goals

Parent Guide for Grades 9–12

S

Science

TE

Technology and Engineering

ELS

Environmental Literacy and Sustainability

About the STEELS Standards: Reshaping Education for All Pennsylvania Students

To better prepare Pennsylvania students for college and careers, schools need to ensure that high-quality science, technology, engineering, environmental literacy, and sustainability education is accessible to all students — regardless of ethnicity or zip code.

The Science, Technology & Engineering, and Environmental Literacy & Sustainability (STEELS) Standards set high expectations for what all students should know and be able to do to provide all students access to a challenging education. These learning goals guide the study of the natural and human-made world by fostering children's growing curiosity about the world around them at a young age all the way through high school.

The STEELS Standards were developed based on research about how students learn best by Standards Writing Committees made up of Pennsylvania educators and experts in the field.

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 the planned instruction that supports students to meet those expectations. Please contact your child's teacher or school if you have questions about their curriculum.

How will Pennsylvania's STEELS Standards Prepare your Students for Academic Success?

Rigorous academic standards are a powerful foundation to help students build a thorough understanding of science, technology and engineering, and environmental literacy and sustainability over time.

A strong education in these fields in high school will pave the way for increased students' success in their postsecondary lives. The STEELS Standards enable teachers to offer all students interactive instruction that promotes analysis and interpretation of data, critical thinking, problem

solving, and connections across the STEELS subject areas — with a high set of expectations for achievement in grades 9–12.

The STEELS Standards complement English Language Arts and Mathematics Pennsylvania Core Standards, enabling classroom instruction to reflect a clearer picture of the real world, where solving problems often requires skills and knowledge from multiple subjects.

What is Pennsylvania’s Vision for Science, Technology, Engineering, Environmental Literacy, and Sustainability Education?

The STEELS Standards reflect decades of research and advances in teaching and learning. 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 deepen knowledge and skills by building upon important concepts and expanding their understanding of connections across the STEELS subjects. Parents and guardians should understand that while some content might be similar to what it was in the past, it may look different from how they were taught.

As the STEELS Standards are implemented in schools and districts, they will enable students to:

- Develop a deeper understanding of science, technology, engineering, environmental literacy, and sustainability beyond memorizing facts.
- Experience similar scientific, technology, and engineering practices as those used by professionals in the field.
- Build communication skills as they talk with other students to share, build upon, and revise their own thinking.

How will Students Learn Science, Technology, Engineering, Environmental Literacy, and Sustainability 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, technology and engineering design, and environmental literacy and sustainability.

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. 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 science, technology and engineering, and environmental literacy and sustainability fields.

Students in grades 9–12 will explore questions such as:

Technology and Engineering

Students in grades 9–12 will explore topics including:

- Defining problems quantitatively
- Identifying tradeoffs when developing engineering solutions
- The impact of technology and engineering on social and economic landscapes

Environmental Literacy and Sustainability

Students in grades 9–12 will explore topics including:

- The impact of technologies on agricultural, food, and environmental systems
- Investigating local environmental issues using data

Earth and Space Sciences

Students in grades 9–12 will explore topics including:

- Geology
- Astronomy
- Biodiversity

Physical Sciences

Students in grades 9–12 will explore topics including:

- Sub-atomic chemistry
- Energy transferred by fields
- Electromagnetic radiation

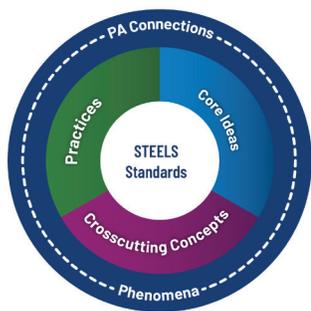
Life Sciences

Students in grades 9–12 will explore topics including:

- Ecosystem dynamics
- Molecular photosynthesis
- Body systems
- DNA

Multiple Dimensions of STEELS Standards Learning

The STEELS Standards emphasize distinct dimensions that help students learn. Each dimension is integrated into the STEELS Standards and — combined — the dimensions build a powerful foundation to help students build a cohesive understanding of these subjects over time.



Science, Technology, and Engineering Practices

A set of skills that scientists, technologists, and engineers use to explain the world or solve problems.

Example Practices: Communication; Planning and Carrying Out Investigations

Disciplinary Core Ideas

Explanatory ideas in each science discipline that scientists, technologists, and engineers use.

Example Disciplinary Core Ideas: Wave Properties; Weather and Climate

Crosscutting Concepts

Concepts that scientists, technologists, and engineers use to deepen their understanding of situations and make connections across subject areas.

Example Crosscutting Concepts: Cause and Effect; Structure and Function

Possible classroom activities look <i>less</i> like:	Possible classroom activities look <i>more</i> like:
<p>Physical Science</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>Physical Science</p> <p>Students use the periodic table as a tool to explain and predict the properties of elements to design a more efficient battery.</p> <p>Students characterize chemical reactions and use that knowledge to explain various local and global biological and geophysical phenomena.</p> <p>Students design, build, and refine devices to optimize solar panels for more efficient energy conversion.</p>
<p>Life Science</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>Life Science</p> <p>Students develop conceptual models of cell growth and differentiation to explain what occurs in a cancer patient's body.</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>Earth and Space Sciences</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>Earth and Space Sciences</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>

Possible classroom activities look <i>less</i> like:	Possible classroom activities look <i>more</i> like:
Students study different types of natural hazards, such as hurricanes and tornadoes.	Students conduct research to gather data on how different types of natural hazards have influenced human activity.
Technology and Engineering	Technology and Engineering
Students learn engineering separately from other STEELS disciplines.	Students consider or apply engineering design principles throughout each STEELS course.
Engineering lessons are offered only to some students.	Technology and engineering lessons are offered to all students and each student is encouraged to connect lessons to their own personal experiences.
Engineering lessons are focused on trial and error “building” projects.	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.
Environmental Literacy and Sustainability	Environmental Literacy and Sustainability
Students read about general environmental issues.	Students plan and conduct investigations utilizing environmental data about local wheat crops suffering due to increased heatwaves.
Students learn about how environmental problems can affect people.	Students analyze and interpret data about the pollution from a local natural gas extraction plant and social equity implications for those who live nearby.
Students listen to a lecture and take notes on different environmental problems.	Students apply research and analytical skills to systematically investigate the contamination of Pennsylvania water sources due to abandoned mine drainage.

How Can You Support Your Child’s Success?

This new approach to teaching and learning is different than what it was in the past and you can actively support your child’s success in the classroom!

1. Speak to your child’s teacher(s) or administrator about how these important changes will affect instruction and assessment.
2. Check with your child’s teacher(s) about the topics they’re learning at school and what activities or related books you can read with your child to reinforce STEELS Standards learning at home.
3. Encourage your child to explore, experiment, and ask questions at home or in your neighborhood.