



Grades 9–12

3.5.9-12.B Technology and Engineering: Applying, Maintaining, Assessing, and Evaluating Technological Products and Systems

Students who demonstrate understanding can *critically assess and evaluate a technology that minimizes resource use and resulting waste to achieve a goal.*

Clarifying Statement: By focusing on a “wicked problem”—one that is complex, has multiple possible solutions, and requires consideration of various perspectives—students can be challenged to go through a process of problem finding/defining, investigation, and design to find technological solutions that are more beneficial for society and the environment. VUCA problems—ones that are volatile, uncertain, complex, and ambiguous—challenge students to actively engage in the engineering design process to find technological solutions that are beneficial to society and minimize negative environmental impact and non-consumable by-products.

Assessment Boundary: N/A

Science and Engineering Practices (SEP)	Disciplinary Core Ideas (DCI)	Technology and Engineering Practices (TEP)
Using Mathematics and Computational Thinking Mathematical and computational thinking in 9–12 builds on K–8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions. <ul style="list-style-type: none"> Use mathematical, computational, and/or algorithmic representations of phenomena or design solutions to describe and/or support claims and/or explanations. 	Developing Possible Solutions <ul style="list-style-type: none"> When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. 	Critical Thinking <ul style="list-style-type: none"> Uses evidence to better understand and solve problems in technology and engineering, including applying computational thinking.

Pennsylvania Context: Examples of Pennsylvania context include but are not limited to Pennsylvania's manufacturing.

Pennsylvania Career Ready Skills: Evaluate consequences from a personal, and civic perspective to inform decision making.

Connections to Other Standards Content and Practices



Standard Source	Possible Connections to Other Standard(s) or Practice(s)
PA Core Standards: Reading and Writing in Science and Technical Areas	<p>CC.1.2.3.G: Use information gained from text features to demonstrate understanding of a text.</p> <p>CC.1.2.4.G: Interpret various presentations of information within a text or digital source and explain how the information contributes to an understanding of text in which it appears.</p> <p>CC.1.2.5.G: Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently.</p> <p>CC.1.4.3.V: Conduct short research projects that build knowledge about a topic.</p> <p>CC.1.4.4.V: Conduct short research projects that build knowledge through investigation of different aspects of a topic.</p> <p>CC.1.4.5.V: Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic.</p> <p>CC.1.4.3.W: Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories.</p>
PA Core Standards: Reading and Writing in Science and Technical Areas (continued)	<p>CC.1.4.4.W: Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources.</p> <p>CC.1.4.5.W: Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources.</p>
PA Core Standards and Practices: Math	MP.3: Construct viable arguments and critique the reasoning of others.
Integrated Standards for Science, Environment & Ecology, and Technology & Engineering Standards Grades K–12	3.3.9-12.R: Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.