



## Grades 9–12

### 3.5.9-12.X Technology and Engineering: Design Thinking in Technology and Engineering Education

**Students who demonstrate understanding can** *implement the best possible solution to a design using an explicit process.*

**Clarifying Statement:** Students design within provided criteria and constraints and recognize trade-offs associated with optimization.

**Assessment Boundary:** N/A

Science and Engineering Practices (SEP)	Disciplinary Core Ideas (DCI)	Technology and Engineering Practices (TEP)
<b>Constructing Explanations and Designing Solutions</b> Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. <ul style="list-style-type: none"> <li>Apply scientific principles and evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.</li> </ul>	<b>Engineering Design</b> <ul style="list-style-type: none"> <li>Meet a sophisticated design challenge by identifying criteria and constraints, predicting how these will affect the solution, researching and generating ideas, and using trade-offs to balance competing values in selecting the best solution.</li> </ul> <b>Develop and Test Prototypes</b> <ul style="list-style-type: none"> <li>Students develop, test and refine prototypes as part of a cyclical design process.</li> </ul>	<b>Making and Doing</b> <ul style="list-style-type: none"> <li>Demonstrates the ability to regulate and improve making and doing skills.</li> </ul> <b>Optimism</b> <ul style="list-style-type: none"> <li>Shows persistence in addressing technological problems and finding solutions to those problems.</li> </ul>

**Pennsylvania Context:** Examples of Pennsylvania context include but are not limited to the Pennsylvania's food production industries.

**Pennsylvania Career Ready Skills:** Evaluate a situation to identify skills and strategies to prevent and resolve conflicts.

## Connections to Other Standards Content and Practices

Standard Source	Possible Connections to Other Standard(s) or Practice(s)
<b>PA Core Standards: Reading and Writing in Science and Technical Areas</b>	CC.1.2.3.G: Use information gained from text features to demonstrate understanding of a text. 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. 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. CC.1.4.3.V: Conduct short research projects that build knowledge about a topic. CC.1.4.4.V: Conduct short research projects that build knowledge through investigation of different aspects of a topic. CC.1.4.5.V: Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic.



Standard Source	Possible Connections to Other Standard(s) or Practice(s)
PA Core Standards: Reading and Writing in Science and Technical Areas (continued)	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. 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. 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.
PA Core Standards and Practices: Math	MP.5: Use appropriate tools strategically.
Integrated Standards for Science, Environment & Ecology, and Technology & Engineering Standards Grades K–12	N/A