### 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)**

**Constructing Explanations and Designing Solutions**

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.

- Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.

**Disciplinary Core Ideas (DCI)**

**NAEP D.12.8**

- 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.

**ISTE 4C**

- Students develop, test and refine prototypes as part of a cyclical design process.

**Technology and Engineering Practices (TEP)**

**Making and Doing**

- Demonstrates the ability to regulate and improve making and doing skills.

**Optimism**

- Shows persistence in addressing technological problems and finding solutions to those problems.

### 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

<table>
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<tr>
<th>Standard Source</th>
<th>Possible Connections to Other Standard(s) or Practice(s)</th>
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| **PA Core Standards: Reading and Writing in Science and Technical Areas** | 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. |
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| **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                                                                                                                       |