



**Grades 9–12**

**3.5.9-12.O Technology and Engineering:** Design Thinking in Technology and Engineering Education

**Students who demonstrate understanding can** *apply appropriate design thinking processes to diagnose, adjust, and repair systems to ensure precise, safe, and proper functionality.*

**Clarifying Statement:** For many consumer products, federal and state laws require safety information. Tools are used by students for diagnosis, adjustments, and repair. Monitoring the operation, adjusting the parts, and regular maintenance of a system are part of keeping systems in good working order and maintaining safety.

**Assessment Boundary:** N/A

Science and Engineering Practices (SEP)	Disciplinary Core Ideas (DCI)	Technology and Engineering Practices (TEP)
<p><b>Constructing Explanations and Designing Solutions</b></p> <p>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.</p> <ul style="list-style-type: none"> <li>Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.</li> </ul>	<p><b>ETS1.C: Optimizing the Design Solution</b></p> <ul style="list-style-type: none"> <li>Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed.</li> </ul> <p><b>NAEP D.12.18</b></p> <ul style="list-style-type: none"> <li>Analyze a complicated system to identify ways that it might fail in the future. Identify the most likely failure points and recommend safeguards to avoid future failures.</li> </ul>	<p><b>Making and Doing</b></p> <ul style="list-style-type: none"> <li>Demonstrates the ability to regulate and improve making and doing skills.</li> </ul> <p><b>Systems Thinking</b></p> <ul style="list-style-type: none"> <li>Designs and troubleshoots technological systems in ways that consider the multiple components of the system.</li> </ul>

**Pennsylvania Context:** N/A

**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)
<p><b>PA Core Standards: Reading and Writing in Science and Technical Areas</b></p>	<p>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.                      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.</p>
<p><b>PA Core Standards: Reading and Writing in Science and Technical Areas (continued)</b></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>
<p><b>PA Core Standards and Practices: Math</b></p>	<p>MP.1: Make sense of problems and persevere in solving them.</p>
<p><b>Integrated Standards for Science, Environment &amp; Ecology, and Technology &amp; Engineering Standards Grades K–12</b></p>	<p>N/A</p>