

**Science & Engineering Practices**  
**Constructing Explanations and Designing Solutions**

The end-products of science are explanations and the end-products of engineering are solutions. The goal of science is the construction of theories that provide explanatory accounts of the world. A theory becomes accepted when it has multiple lines of empirical evidence and greater explanatory power of phenomena than previous theories. The goal of engineering design is to find a systematic solution to problems that is based on scientific knowledge and models of the material world. Each proposed solution results from a process of balancing competing criteria of desired functions, technical feasibility, cost, safety, aesthetics, and compliance with legal requirements. The optimal choice depends on how well the proposed solutions meet criteria and constraints.



K–2 Condensed Practices	3–5 Condensed Practices	6–8 Condensed Practices	9–12 Condensed Practices
Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions.	Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.	Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.	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>Use information from observations (firsthand and from media) to construct an evidence-based account for natural phenomena.</li> </ul>	<ul style="list-style-type: none"> <li>Construct an explanation of observed relationships (e.g., the distribution of plants in the backyard).</li> </ul>	<ul style="list-style-type: none"> <li>Construct an explanation that includes qualitative or quantitative relationships between variables that predict(s) and/or describe(s) phenomena.</li> <li>Construct an explanation using models or representations.</li> </ul>	<ul style="list-style-type: none"> <li>Make a quantitative and/or qualitative claim regarding the relationship between dependent and independent variables.</li> </ul>
	<ul style="list-style-type: none"> <li>Use evidence (e.g., measurements, observations, patterns) to construct or support an explanation or design a solution to a problem.</li> </ul>	<ul style="list-style-type: none"> <li>Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students’ own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.</li> <li>Apply scientific ideas, principles, and/or evidence to construct, revise and/or use an explanation for real-world phenomena, examples, or events.</li> </ul>	<ul style="list-style-type: none"> <li>Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students’ own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.</li> <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>
	<ul style="list-style-type: none"> <li>Identify the evidence that supports particular points in an explanation.</li> </ul>	<ul style="list-style-type: none"> <li>Apply scientific reasoning to show why the data or evidence is adequate for the explanation or conclusion.</li> </ul>	<ul style="list-style-type: none"> <li>Apply scientific reasoning, theory, and/or models to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion.</li> </ul>
<ul style="list-style-type: none"> <li>Use tools and/or materials to design and/or build a device that solves a specific problem or a solution to a specific problem.</li> <li>Generate and/or compare multiple solutions to a problem.</li> </ul>	<ul style="list-style-type: none"> <li>Apply scientific ideas to solve design problems.</li> <li>Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution.</li> </ul>	<ul style="list-style-type: none"> <li>Apply scientific ideas or principles to design, construct, and/or test a design of an object, tool, process or system.</li> <li>Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets specific design criteria and constraints.</li> <li>Optimize performance of a design by prioritizing criteria, making tradeoffs, testing, revising, and re-testing.</li> </ul>	<ul style="list-style-type: none"> <li>Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.</li> </ul>