

## Science and Engineering Practices Progression for Students and Families: Grades 9-12

Each of the practices is described through questions for teachers, families and students. “Can I” questions can be posed during a lesson as a tool to help students learn how to engage in the practices. “Did I” questions can be used to help students reflect on their use of the practices after a lesson or unit.

9-12	PRACTICE 1: Asking Questions and Defining Problems	PRACTICE 2: Developing and Using Models	PRACTICE 3: Planning and Carrying Out Investigations	PRACTICE 4: Analyzing and Interpreting Data
Science and Engineering Practices CAN I? DID I?	<p><b>Can I... ? Did I...?</b></p> <ul style="list-style-type: none"> <li>a) Ask questions based on observations, models, or theory, to clarify or gather more information?</li> <li>b) Ask questions to determine how variables interact?</li> <li>c) Ask questions to improve or clarify a model, explanation, or problem?</li> <li>d) Evaluate if a question is testable or relevant?</li> <li>e) Make reasonable hypotheses based on a model or scientific theory?</li> <li>f) Ask or examine questions that challenge the logic or assumptions of an argument, analysis of a data set, or a design?</li> <li>a) Determine/define a real-world problem that is solved by improving a series of steps or system of interacting parts and criteria and constraints?</li> </ul>	<p><b>Can I... ? Did I...?</b></p> <ul style="list-style-type: none"> <li>a) Revise a model based on its advantages and limitations?</li> <li>b) Develop, revise, or use a model based on evidence?</li> <li>c) Develop, revise, or use a model to make predictions between systems or with in a system?</li> <li>d) Develop a model to test a proposed process or system?</li> </ul>	<p><b>Can I... ? Did I...?</b></p> <ul style="list-style-type: none"> <li>a) Plan and conduct an investigation or test a design to produce data that can be used as evidence?</li> <li>b) Think carefully about what data is needed, how much is enough, and how accurate and precise it needs to be to help make the best conclusions?</li> <li>c) Consider other variables, their effects on the data, and control variables as needed?</li> <li>d) Plan and conduct investigations safely, ethically, and with consideration of the environmental impact?</li> <li>e) Select appropriate tools to collect, record, analyze, and evaluate data?</li> <li>f) Describe how the variables in the investigation interact?</li> <li>g) Manipulate variables and collect data about a model, process, or system and use that data to refine it?</li> </ul>	<p><b>Can I... ? Did I...?</b></p> <ul style="list-style-type: none"> <li>a) Analyze data to make valid and reliable claims or determine the best design solutions?</li> <li>b) Use statistics and probability to make inferences from the data that address scientific and engineering questions and problems?</li> <li>c) Take into account the way I gathered and analyzed my data, while drawing my conclusions?</li> <li>d) Compare and contrast different data sets to look for consistency?</li> <li>e) Determine the effect new data has on existing explanations or models?</li> <li>f) Use data to improve ideas based on the criteria for success for a proposed system or process?</li> </ul>

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9-12	PRACTICE 5: Using Mathematical and Computational Thinking	PRACTICE 6: Constructing Explanations and Designing Solutions	PRACTICE 7: Engaging in Argument from Evidence	PRACTICE 8: Obtaining, Evaluating, and Communicating Information
Science and Engineering Practices CAN I? DID I?	<p><b>Can I... ? Did I...?</b></p> <ol style="list-style-type: none"> <li>Create or revise a computational model or simulation to better represent something?</li> <li>Use math or computer modeling to describe or support claims or explanations?</li> <li>Apply algebra and functions to represent and solve science and engineering problems?</li> <li>Use simple limit cases to see if a model “makes sense” by comparing the outcomes with what is known in the real world?</li> <li>Apply ratios, rates, percentages, and unit conversions to solve complex measurement problems?</li> </ol>	<p><b>Can I... ? Did I...?</b></p> <ol style="list-style-type: none"> <li>Make a qualitative and/or quantitative claim regarding the relationship between variables?</li> <li>Construct and revise an explanation that includes valid and reliable evidence and sources (including students’ own investigations, models, theories, simulations, peer review)?</li> <li>Explain phenomena and solve design problems using scientific ideas, principles, and/or evidence and taking into account unexpected effects?</li> <li>Use scientific reasoning, theory and/or models to link evidence to the claims and to evaluate the extent to which the data supports the explanation?</li> <li>Design, evaluate, and/or refine a solution to a complex, real-life problem using:               <ul style="list-style-type: none"> <li>scientific knowledge?</li> <li>student-generated sources of evidence?</li> <li>prioritized criteria?</li> <li>tradeoff considerations?</li> </ul> </li> </ol>	<p><b>Can I... ? Did I...?</b></p> <ol style="list-style-type: none"> <li>Make and defend a scientific or engineering claim based on evidence that reflects scientific knowledge and student-generated evidence?</li> <li>Determine the quality of an argument by evaluating the claim, evidence, and reasoning that is used to make it?</li> <li>Respectfully provide and/or receive critiques of arguments by examining the evidence and reasoning?</li> <li>Seek additional information and consider diverse perspectives to better understand challenging ideas, conclusions and contradictions?</li> <li>Evaluate the quality of competing arguments based on current explanations, new evidence, and ethical issues?</li> <li>Evaluate competing design solutions to real-world problems using constraints and criteria (e.g. economic, societal, environmental, ethical)?</li> </ol>	<p><b>Can I... ? Did I...?</b></p> <ol style="list-style-type: none"> <li>Critically read, identify central ideas, and paraphrase it in simpler, but accurate terms?</li> <li>Compare, integrate, and evaluate sources of information found in media and in writing?</li> <li>Gather, read, and assess information from a variety of sources?</li> <li>Evaluate the quality of sources, content of the sources, and synthesize information across sources?</li> <li>Communicate science and engineering information orally, graphically, textually, and mathematically?</li> </ol>