California Science

NGSS Science and Engineering Practices grade 6, 7, 8

Asking Questions and Defining Problems
Asking questions and defining problems in 6–8 builds on K–5 experiences and progresses to specifying relationships between variables, and clarifying arguments and models SEP-1

1-i Ask questions * that arise from careful observation of phenomena, models, or unexpected results, to clarify and/or seek additional information. * to identify and/or clarify evidence and/or the premise(s) of an argument. * to determine relationships between independent and dependent variables and relationships in models.. * to clarify and/or refine a model, an explanation, or an engineering problem. SEP-1-I

1-ii Ask questions that require sufficient and appropriate empirical evidence to answer. * Ask questions that can be investigated within the scope of the classroom, outdoor environment, and museums and other public facilities with available resources and, when appropriate, frame a hypothesis based on observations and scientific principles. SEP-1-II

1-iii Ask questions that challenge the premise(s) of an argument or the interpretation of a data set. SEP-1-III

1-iv Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions. SEP-1-IV

Developing and Using Models
Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. SEP-2

2-i Evaluate limitations of a model for a proposed object or tool. SEP-2-I

2-ii Develop or modify a model—based on evidence – to match what happens if a variable or component of a system is changed. SEP-2-II

2-iii Use and/or develop a model of simple systems with uncertain and less predictable factors. SEP-2-III

2-iv Develop and/or revise a model to show the relationships among variables, including those that are not observable but predict observable phenomena. SEP-2-IV

2-v Develop and/or use a model to predict and/or describe phenomena. SEP-2-V

2-vi Develop a model to describe unobservable mechanisms. SEP-2-VI

	2-vii Develop and/or use a model to generate data to test ideas about phenomena in natural or designed systems, including those representing inputs and outputs, and those at unobservable scales. SEP-2-VII
Planning and Carrying Out Investigations Planning and carrying out investigations in 6-8 builds on K-5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or solutions. SEP-3	**3-i** Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim. SEP-3-I
	3-ii Conduct an investigation and/or evaluate and/or revise the experimental design to produce data to serve as the basis for evidence that meet the goals of the investigation. SEP-3-II
	3-iii Evaluate the accuracy of various methods for collecting data. SEP-3-III
	3-iv Collect data to produce data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions SEP-3-IV
	3-v Collect data about the performance of a proposed object, tool, process, or system under a range of conditions. SEP-3-V
Analyzing and Interpreting Data Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. SEP-4	**4-i** Construct, analyze, and/or interpret graphical displays of data and/or large data sets to identify linear and nonlinear relationships. SEP-4-I
	4-ii Use graphical displays (e.g., maps, charts, graphs, and/or tables) of large data sets to identify temporal and spatial relationships. SEP-4-II
	4-iii Distinguish between causal and correlational relationships in data. SEP-4-III
	4-iv Analyze and interpret data to provide evidence for phenomena. SEP-4-IV
	4-v Apply concepts of statistics and probability (including mean, median, mode, and variability) to analyze and characterize data, using digital tools when feasible. SEP-4-V
	4-vi Consider limitations of data analysis (e.g., measurement error), and/or seek to improve precision and accuracy of data with better technological tools and methods (e.g., multiple trials). SEP-4-VI
	4-vii Analyze and interpret data to determine similarities and differences in findings. SEP-4-VII
	4-viii Analyze data to define an optimal operational range for a proposed object, tool, process or system that best meets criteria for success. SEP-4-VIII
Using Mathematics and Computational Thinking Mathematical and	**5-i** Use digital tools (e.g., computers) to analyze very large data sets for patterns and trends. SEP-5-I

computational thinking in 6–8 builds on K–5 experiences and progresses to identifying patterns in large data sets and using mathematical concepts to support explanations and arguments. SEP-5	**5-ii** Use mathematical representations to describe and/or support scientific conclusions and design solutions SEP-5-II
	5-iii Create algorithms (a series of ordered steps) to solve a problem. SEP-5-III
	5-iv Apply mathematical concepts and/or processes (such as ratio, rate, percent, basic operations, and simple algebra) to scientific and engineering questions and problems. SEP-5-IV
	5-v Use digital tools and/or mathematical concepts and arguments to test and compare proposed solutions to an engineering design problem. SEP-5-V
Constructing Explanations and Designing Solutions 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. SEP-6	**6-i** Construct an explanation that includes qualitative or quantitative relationships between variables that predict(s) and/or describe(s) phenomena. SEP-6-I
	6-ii Construct an explanation using models or representations. SEP-6-II
	6-iii 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. SEP-6-III
	6-iv Apply scientific ideas, principles, and/or evidence to construct, revise and/or use an explanation for realworld phenomena, examples, or events. SEP-6-IV
	6-v Apply scientific reasoning to show why the data or evidence is adequate for the explanation or conclusion. SEP-6-V
	6-vi Apply scientific ideas or principles to design, construct, and/or test a design of an object, tool, process or system. SEP-6-VI
	6-vii Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets specific design criteria and constraints. SEP-6-VII
	6-viii Optimize performance of a design by prioritizing criteria, making tradeoffs, testing, revising, and retesting SEP-6-VIII
Engaging in Argument from Evidence Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or	**7-i** Compare and critique two arguments on the same topic and analyze whether they emphasize similar or different evidence and/or interpretations of facts. SEP-7-I
	7-ii Respectfully provide and receive critiques about one's explanations, procedures, models and questions by citing relevant evidence and posing and responding to questions that elicit pertinent elaboration and detail. SEP-7-II
	7-iii Construct, use, and/or present an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. SEP-7-III

solutions about the natural and designed world(s). SEP-7	**7-iv** Make an oral or written argument that supports or refutes the advertised performance of a device, process, or system, based on empirical evidence concerning whether or not the technology meets relevant criteria and constraints. SEP-7-IV
	7-v Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. SEP-7-V
Obtaining, Evaluating, and Communicating Information Obtaining, evaluating, and communicating information in 6–8 builds on K–5 experiences and progresses to evaluating the merit and validity of ideas and methods. SEP-8	**8-i** Critically read scientific texts adapted for classroom use to determine the central ideas and/or obtain scientific and/or technical information to describe patterns in and/or evidence about the natural and designed world(s). SEP-8-I
	8-ii Integrate qualitative and/or quantitative scientific and/or technical information in written text with that contained in media and visual displays to clarify claims and findings. SEP-8-II
	8-iii Gather, read, synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence. SEP-8-III
	8-iv Evaluate data, hypotheses, and/or conclusions in scientific and technical texts in light of competing information or accounts. SEP-8-IV
	8-v Communicate scientific and/or technical information (e.g. about a proposed object, tool, process, system) in writing and/or through oral presentations SEP-8-V