Integrating Science Practices Into Assessment Tasks

The Next Generation Science Standards call for the development of "three-dimensional science proficiency," that is, students' integrated understanding of disciplinary core ideas, science and engineering practices, and crosscutting concepts. Assess three-dimensional science proficiency requires *multicomponent tasks* (National Research Council, 2014). These are a set of prompts linked by a common scenario, phenomenon, or engineering design challenge.

Developing three-dimensional science assessments is challenging. Most current assessments focus on testing students' knowledge of science facts. Few focus on having students apply their understanding of disciplinary core ideas in the context of engaging in a science or engineering practice. Fewer still make connections to crosscutting concepts.

The "task format" templates included in this document are tools to help teachers and district leaders design three-dimensional assessment tasks. They are based on the language of *A Framework for K-12 Science Education* and the NGSS Evidence Statements, focusing on all eight science practices and two engineering practices. These task formats represent different ways that assessment tasks can be written to engage students in science practice. They do not specify precisely which disciplinary core ideas are to be integrated into tasks, which would be determined by the team designing the assessments.

The different formats get at different aspects of a given science and engineering practice. Some formats are likely to be more demanding cognitively for students than others. The idea of presenting multiple formats is to give task developers a sense of the range of tasks that can be written. A good "test" of a student's grasp of a particular practice, in the context of a disciplinary core idea and crosscutting concept, would be comprised of multiple tasks and draw on multiple formats.

How to Read a Template Task

Scenario presented to students

Format	Task Requirements for Students
1	Present students with a textual description of an investigation of an observable phenomenon, *then* Ask students to formulate a scientific question relevant to Investigating that phenomenon.

Task(s) for students to complete

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Potential Task Formats: Using Mathematics and Computational Thinking (Science)

Format	Task Requirements for Students
1	Present students with a scenario that describes a phenomenon using text, images, and/or video and data in the form of measured quantities, *then* Ask students to describe patterns in the data using counting and numbers, Ask students to construct a display of the data using simple graphs, *and* Ask students to identify and describe the patterns and relationships from the representation and written description.
2	Present students with a scenario that includes a dataset from an investigation, the question the investigation is intended to answer, *then* Ask students to identify mathematical properties of the dataset (e.g., range, average) that should be analyzed to answer the question.
3	Present students with a scenario that describes a phenomenon using text, images, and/or video and data in the form of measured quantities, *then* Ask students to develop an equation or algorithm that corresponds to the description, *and* Explain how the equation or algorithm represents the textual description.
4	Present students with a scenario that describes a phenomenon using text, images, and /or video and data, measured quantities of data, and a mathematical equation, *then* Ask students to make a prediction about the state of the phenomenon in the future given the data, *and* Ask students to write an explanation for the prediction, using the mathematical model as supporting evidence.
5	Present students with a computational model of a phenomenon, *then* Ask students to describe the patterns and relationships from the computational model by applying concepts and process (e.g., ratio, rate, percent, unit conversions), *and* Write an explanation of the phenomenon using the results of the computational model as supportive evidence.
6	Present students with a simulation of a scientific process, *then* Ask students to describe the patterns and relationships from the simulation, *and* Write an explanation of the rules of the simulation using scientific theory as supporting evidence.
7	Present students with a simulation of a phenomenon, *then* Ask students to compare the simulation results with real-world data analyzed using mathematics, *and* Write an argument for whether or not the simulation makes sense using the comparison as supporting evidence.
8	Present students with a two simulations of the same phenomenon, *then* Ask students to decide which of the two simulations is the most plausible, Compare to real-world data with outputs of each simulation, *and* Write an argument for which simulation is most plausible using the comparison as supporting evidence.