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: Designing Solutions (Engineering)

Format	Task Design for Students
1	Present students with a scenario that describes a problem, need, or human desire using text, images, video, and/or data that includes descriptions of the needs or concerns to be addressed, design criteria, and design constraints, *then* Ask students to sketch or describe a design approach that develops a possible solution to the problem, *and* Explain how the relevant scientific ideas are taken into account within their design.
2	Present students with a scenario that describes a problem, need, or human desire using text, images, video, and/or data that includes descriptions of the needs or concerns to be addressed, design criteria, and design constraints, *then* Ask students to sketch, prototype or describe a design that is a possible solution to the problem using relevant materials, *and* Construct a prototype of their design.
3	Present students with a description of a designed system and data from a failure scenario (one that did not completely meet criteria for solutions) associated with the design, then Ask students to analyze the data, Identify the scientific causes of the failure, *and* Ask them them to sketch or describe a design iteration that might be an improvement to the design.
4	Present students with a description of a design in active development and a scenario where the design team has encountered a design tension between two or more criteria perhaps also related to the project constraints, *then* Ask students how they would proceed with the design work to develop a working system that requires consideration of trade-offs and prioritizing one design criterion over another in order to accomplish a working design.
5	Present students with a description of two competing solutions to a well-defined problems given a set of described needs, criteria and constraints, along with evidence related to the performance of each solution, *then* Ask students to evaluate which design better addresses the needs, Evaluate which design meets the criteria and constraints, *and* Justify their conclusion using evidence presented.
6	Present students with a scenario that describes a complex real-world problem. Ask students to design a solution that is based on scientific knowledge, prioritized criteria, and student-generated sources of evidence (e.g., from classroom investigations), *and* Ask them discuss tradeoff considerations for their design approach.