

MS-ETS1-4 Engineering Design

California Science Test—Item Content Specifications

# MS-ETS1-4 Engineering Design

Students who demonstrate understanding can:

Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

| Science and Engineering Practices | Disciplinary Core Ideas | Crosscutting Concepts |
| --- | --- | --- |
| 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.  Develop a model to generate data to test ideas about designed systems, including those representing inputs and outputs. | ETS1.B: Developing Possible Solutions   1. A solution needs to be tested, and then modified on the basis of the test results, in order to improve it.   9. Models of all kinds are important for testing solutions.  ETS1.C: Optimizing the Design Solution  4. The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. | Not applicable |

## Assessment Targets

Assessment targets describe the focal knowledge, skills, and abilities for a given three-dimensional Performance Expectation. Please refer to the Introduction for a complete description of assessment targets.

### Science and Engineering Subpractice(s)

Please refer to appendix A for a complete list of Science and Engineering Practices (SEP) subpractices. Note that the list in this section is not exhaustive.

2.1 Ability to develop models

### Science and Engineering Subpractice Assessment Targets

Please refer to appendix A for a complete list of SEP subpractice assessment targets. Note that the list in this section is not exhaustive.

2.1.1 Ability to determine components of a scientific event, system, or design solution

2.1.2 Ability to determine the relationships among multiple components of a scientific event, system, or design solution

2.1.3 Ability to determine scope, scale, and grain-size of models, as appropriate for their intended use

2.1.4 Ability to represent mechanisms, relationships, and connections to illustrate, explain, or predict a scientific event

### Disciplinary Core Idea Assessment Targets

#### ETS1.B.6

* Identify the components relevant to testing ideas about the problem being solved including criteria and constraints
* Test a proposed solution
* Modify a solution based on test results

#### ETS1.B.9

* Develop a model and identify the components relevant to testing ideas about the designed system

#### ETS1.C.4

* Use a model to generate data to represent the functioning of a proposed solution
* Consider iterations of a proposed solution as components of the model are modified
* Describe how data generated by the model can be used to optimize the solution through iterative modification and testing

### Crosscutting Concept Assessment Target(s)

Not applicable

## Examples of Integration of Assessment Targets and Evidence

Note that the list in this section is not exhaustive.

Task provides a description of a proposed object, tool, or process:

* Selects or adds components, labels those components, and represents or describes relationships and behaviors between the components to illustrate, explain, or predict a scientific phenomenon or event (2.1.1 and ETS1.B.6)

Task provides a general model that can be applied to a large range of scales:

* Determines the appropriate scale for the model based on the problem to be solved (2.1.2 and ETS1.C.4)

Task provides an incomplete model designed to test a proposed object, tool, or process:

* Proposes correct completions to the model to illustrate, explain, or predict a scientific event, system, or design solution (2.1.3 and ETS1.B.9)

## Possible Phenomena or Contexts

Note that the list in this section is not exhaustive.

* Generate or review data from testing methods to minimize negative environmental impacts such as pollution mitigation (e.g., oil, water, or light), water conservation, air quality maintenance, oil spill cleanup, endangered species protection, and habitat loss prevention
* Generate or review data from testing design solutions to address bioengineering challenges
* Design or modify a design based on data (e.g., improving rocket design, bird feeder design, or rainwater collection methods)

## Common Misconceptions

None listed at this time.

## Additional Assessment Boundaries

None listed at this time.

## Additional References

MS-ETS1-4 Evidence Statement [https://www.nextgenscience.org/sites/default/files/evidence\_statement/black\_white/MS-ETS1-4 Evidence Statements June 2015 asterisks.pdf](https://www.nextgenscience.org/sites/default/files/evidence_statement/black_white/MS-ETS1-4%20Evidence%20Statements%20June%202015%20asterisks.pdf)

The *2016 Science Framework for California Public Schools Kindergarten through Grade 12*

Appendix 1: Progression of the Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts in Kindergarten through Grade 12 <https://www.cde.ca.gov/ci/sc/cf/documents/scifwappendix1.pdf>

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