

3-5-ETS1-1 Engineering Design

California Science Test—Item Content Specifications

# 3-5-ETS1-1 Engineering Design

Students who demonstrate understanding can:

Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

| Science and Engineering Practices | Disciplinary Core Ideas | Crosscutting Concepts |
| --- | --- | --- |
| Asking Questions and Defining Problems  Asking questions and defining problems in 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships.  Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost. | ETS1.A: Defining and Delimiting Engineering Problems   1. Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. | Influence of Science, Engineering, and Technology on Society and the Natural World  People’s needs and wants change over time, as do their demands for new and improved technologies. |

## 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.

1E.2 Ability to define a design problem

### 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.

1E.2.2 Ability to define a design problem to develop an object, process, or system that takes into consideration criteria and constraints based on scientific concepts

### Disciplinary Core Idea Assessment Targets

#### ETS1.A.4

* Describe an engineering problem in terms of some criteria for success
* Describe how material resource availability can be a relevant constraint on potential solutions to an engineering problem
* Describe how costs (both human and capital) can be relevant constraints on potential solutions to an engineering problem
* Describe how time (and timeliness) can be a relevant constraint on potential solutions to an engineering problem
* Compare multiple potential design solutions on the basis of both meeting the criteria for success and keeping within the relevant constraints (e.g., on materials, costs, and time)

### 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 both scientific and contextual information regarding a human want or need that can be met by designing an engineering solution as well as regarding relevant constraints on potential solutions:

* Generates or selects a correct problem definition statement for the provided scenario that includes both the criteria for success and the applicable constraints (1E.2.2 and ETS1.A.4)

Task provides both scientific and contextual information regarding a human want or need. It also includes a problem definition statement that only includes criteria for success:

* Selects relevant constraints on potential solutions (1E.2.2 and ETS1.A.4)
* Generates or selects an alternative problem definition statement that is inclusive of relevant constraints (1E.2.2 and ETS1.A.4)

Task provides both scientific and contextual information regarding a human want or need as well as regarding potential engineering solutions that may help to meet them:

* Selects the correct problem definition from a list that best helps to choose between multiple potential engineering solutions (1E.2.2 and ETS1.A.4)

## California Environmental Principles and Concepts

* EP5: Decisions affecting resources and natural systems are based on a wide range of considerations and decision-making processes.

## Possible Phenomena or Contexts

Note that the list in this section is not exhaustive.

* Problems involving the efficiency of an ongoing process (in units per time), but which also need to decrease the per-unit cost
* Problems involving repairing a broken system quickly in order to mitigate ongoing negative impacts
* Problems involving the prevention of a negative impact to a system, such as an egg breaking when dropped from a height, constrained by a limited set of materials
* Problems involving identifying criteria or distinguishing between criteria and constraints to meet the goals of a design solution (e.g., determining criteria for a successful garden)

## Common Misconceptions

Note that the list in this section is not exhaustive.

* Engineering solutions should only consider achieving success, not relevant costs.
* Human wants and needs do not fundamentally change.

## Additional Assessment Boundaries

None listed at this time.

## Additional References

3-5-ETS1-1 Evidence Statement [https://www.nextgenscience.org/sites/default/files/evidence\_statement/black\_white/3-5-ETS1-1 Evidence Statements June 2015 asterisks-4.pdf](https://www.nextgenscience.org/sites/default/files/evidence_statement/black_white/3-5-ETS1-1%20Evidence%20Statements%20June%202015%20asterisks-4.pdf)

Environmental Principles and Concepts <http://californiaeei.org/abouteei/epc/>

California Education and the Environment Initiative <http://californiaeei.org/>

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>

Appendix 2: Connections to Environmental Principles and Concepts <https://www.cde.ca.gov/ci/sc/cf/documents/scifwappendix2.pdf>

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