# Engineering Design—Grade Five

# Alternate Item Content Specifications

**Prepared for the California Department of Education by Educational Testing Service**



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## 3-5-ETS1-1 Engineering Design

| California Science Connector | Focal Knowledge, Skills, and Abilities | Essential Understanding |
| --- | --- | --- |
| Define a simple design problem that can be solved with the development of a new or improved object, tool, or process, and identify the materials and the amount of time needed to develop a successful solution.  | 1. Ability to define a simple design problem that can be solved with the development of a new or improved object, tool, or process.
2. Ability to identify the materials and the amount of time needed to develop the improved object, tool, or process.
 | Recognize that materials, time, or cost, limits solutions to simple design problems.  |

### CA NGSS Performance Expectation

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.**

### Mastery Statements

Students will be able to:

* Match a simple design problem to a new or improved tool or object that can help solve the problem
* Recognize the limitations of a solution based on the materials needed to implement the solution
* Recognize the limitations of a solution based on the time needed to implement the solution
* Recognize the limitations of a solution based on the cost of implementing the solution
* Identify the materials needed to develop an improved object, tool, or process
* Identify the time needed to develop an improved object, tool, or process
* Match a simple design problem to a new or improved process that can help solve the problem
* Identify two reasons that an object, tool, or process will help to solve a simple design problem
* Identify two reasons that specified materials and/or time are needed to solve a simple design problem

### Environmental Principles and Concepts

Principle 5—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 or prescriptive.*

**Possible contexts include the following:**

* Problems involving the cost of implementing an improvement to a simple system, (e.g., using an electric pencil sharpener instead of a manual one)
* Problems involving repairing a broken system quickly in order to mitigate ongoing negative impacts, (e.g., the need to repair an air conditioner quickly when it is very hot outside)
* Problems involving preventing a negative event, such as an egg breaking when dropped from a height, constrained by a limited set of available materials

### Additional Assessment Boundaries

* None listed at this time

### Additional References

California Science Test Item Specification for 3-5-ETS1-1

<https://www.cde.ca.gov/ta/tg/ca/documents/itemspecs-3-5-ets1-1.docx>

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

The *2016 Science Framework for California Public Schools Kindergarten through Grade Twelve* <https://www.cde.ca.gov/ci/sc/cf/cascienceframework2016.asp>

Appendix 1: Progression of the Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts in Kindergarten through Grade Twelve

<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>

## 3-5-ETS1-2 Engineering Design

| California Science Connector | Focal Knowledge, Skills, and Abilities | Essential Understanding |
| --- | --- | --- |
| Compare two possible solutions to the same problem based on how well each is likely to meet the identified criteria (required features) and constraints (limits) for a successful solution. | 1. Ability to compare two possible solutions to the same problem based on how well each is likely to meet the identified criteria for a successful solution.
2. Ability to compare two possible solutions to the same problem based on how well each is likely to meet the identified constraints for a successful solution.
 | Recognize the best solution to a simple problem when given a choice of two possible solutions. |

### CA NGSS Performance Expectation

Students who demonstrate understanding can:

**Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.**

### Mastery Statements

Students will be able to:

* Identify the most appropriate solution for a simple problem
* Recognize how the solution to a simple problem meets identified criteria or constraints
* Recognize how the solution to a simple problem does not meet identified criteria or constraints
* Recognize which of two solutions for a simple problem best meets specified criteria or constraints and recognize why the other does not meet the criteria or constraints

### Environmental Principles and Concepts

Principle 5—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 or prescriptive.*

**Possible contexts include the following:**

* The number of people needed to clean up trash on the school grounds
* Decreasing the risk of failure in a system designed to keep people safe
* Improving the function of a tool or system in the classroom
* Considering the negative impacts of a solution for protecting the environment around the school that might limit access to certain areas periodically to protect nesting birds
* Availability of materials needed to improve a system

### Additional Assessment Boundaries

* None listed at this time

### Additional References

California Science Test Item Specification for 3-5-ETS1-2

<https://www.cde.ca.gov/ta/tg/ca/documents/itemspecs-3-5-ets1-2.docx>

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

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

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## 3-5-ETS1-3 Engineering Design

| California Science Connector | Focal Knowledge, Skills, and Abilities | Essential Understanding |
| --- | --- | --- |
| Carry out tests in which variables are controlled and failure points are considered to determine which solution best solves the problem. | 1. Ability to carry out tests in which variables are controlled and failure points are considered to determine which solution best solves the problem.
 | Match possible solutions to a simple problem and recognize a failure point. |

### CA NGSS Performance Expectation

Students who demonstrate understanding can:

**Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.**

### Mastery Statements

Students will be able to:

* Identify a failure point in a solution to a simple problem
* Recognize which of two solutions to a simple problem has a failure point
* Given data from testing two solutions to a problem, identify the solution that best solves the problem and recognize why the other is not the best solution
* Given data from testing two solutions to a problem, identify the solution that best solves the problem and recognize why it is the best solution

### Possible Phenomena or Contexts

*Note that the list in this section is not exhaustive or prescriptive.*

**Possible contexts include the following:**

* Comparing two coats for effectiveness, (e.g., one with a warm hood and one without a hood)
* Noise to identify appropriate or inappropriate interactions between moving parts (e.g., a squeaky door needs lubrication to reduce friction)
* Ice cream melting and dripping from an ice cream cone
* Observations from a simple scientific demonstration with only two variables, (e.g., using two different materials as insulation to keep ice from melting)
* Simple tools that have a weakness that can cause them to break when used, (e.g., a plastic spoon being used to scoop out frozen ice cream)
* A ladder that is not tall enough to reach what is needed

### Additional Assessment Boundaries

* None listed at this time

### Additional References

California Science Test Item Specification for 3-5-ETS1-3

<https://www.cde.ca.gov/ta/tg/ca/documents/itemspecs-3-5-ets1-3.docx>

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

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