# Engineering Design—Grade Eight

# Alternate Item Content Specifications

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



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MS-ETS1-1 Engineering Design

| California Science Connector | Focal Knowledge, Skills, and Abilities | Essential Understanding |
| --- | --- | --- |
| Define a design problem that can be solved through consideration of criteria and constraints, potential impacts on people and the environment, and scientific or other issues that are relevant to the problem. | 1. Ability to define a design problem that can be solved through consideration of criteria and constraints relevant to the problem. 2. Ability to define a design problem that can be solved through consideration of potential impacts on people and the environment that are relevant to the problem. 3. Ability to define a design problem that can be solved through consideration of scientific or other issues that are relevant to the problem. | Recognize that a solution to a simple design problem can impact people and the environment. |

### CA NGSS Performance Expectation

Students who demonstrate understanding can:

**Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.**

### Mastery Statements

Students will be able to:

* Identify one result of a solution to a simple design problem that will impact people or the environment
* Identify one solution to a design problem that would have specific impacts on humans or the environment
* Identify one solution to a design problem that incorporates specified scientific issues

### Possible Phenomena or Contexts

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

**Possible contexts include the following:**

* Forms of pollution
* Loss of wildlife habitat
* Enhancing mobility for people with disabilities
* Enhancing access to clean water
* Solar and wind energy

### Additional Assessment Boundaries

* None listed at this time

### Additional References

California Science Test Item Specification for MS-ETS1-1

<https://www.cde.ca.gov/ta/tg/ca/documents/itemspecs-ms-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>

MS-ETS1-2 Engineering Design

| California Science Connector | Focal Knowledge, Skills, and Abilities | Essential Understanding |
| --- | --- | --- |
| Use a systematic process to evaluate how well two different design solutions meet the criteria and constraints of the problem. | 1. Ability to use a systematic process to evaluate how well two different design solutions meet the criteria and constraints of the problem. | Recognize how a solution through a systematic process would solve the problem. |

### CA NGSS Performance Expectation

Students who demonstrate understanding can:

**Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.**

### Mastery Statements

Students will be able to:

* Recognize how a solution solves a simple problem
* Recognize a criterion that both of two solutions meet
* Recognize a constraint or limit, that affects both of two solutions
* Match two solutions to criteria that they meet or constraints that affect them

### Possible Phenomena or Contexts

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

**Possible contexts include the following:**

* Pollution caused by wasting resources such as paper or using disposable products
* Destroying natural areas for commercial development
* Enhancing mobility for people with disabilities
* Enhancing access to clean water
* Using solar or wind energy to help power a school

### Additional Assessment Boundaries

* None listed at this time

### Additional References

California Science Test Item Specification for MS-ETS1-2

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

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

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MS-ETS1-3 Engineering Design

| California Science Connector | Focal Knowledge, Skills, and Abilities | Essential Understanding |
| --- | --- | --- |
| Analyze data from tests to identify how aspects of two different design solutions can be modified or combined to create a better solution. | 1. Ability to analyze data from tests to identify how aspects of different design solutions can be modified to create a better solution. 2. Ability to analyze data from tests to identify how aspects of two different design solutions can be combined to create a better solution. | Identify evidence of similarities or differences in features of solutions. |

### CA NGSS Performance Expectation

Students who demonstrate understanding can:

**Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.**

### Mastery Statements

Students will be able to:

* Identify a similarity in the features of two solutions
* Identify a difference in the features of two solutions
* Use data to identify one modification of a solution that will improve the solution
* Identify two solutions that can be combined to create one improved solution
* Use data to identify one aspect of each of two solutions that will improve the solutions when they are combined to create one improved solution
* Use data to identify two solutions that can be combined to form one improved solution and identify how the new solution is improved

### 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:**

* Forms of pollution
* Loss of wildlife habitat
* Enhancing mobility for people with disabilities
* Enhancing access to clean water
* Solar and wind energy

### Additional Assessment Boundaries

* None listed at this time

### Additional References

California Science Test Item Specification for MS-ETS1-3

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

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

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MS-ETS1-4 Engineering Design

| California Science Connector | Focal Knowledge, Skills, and Abilities | Essential Understanding |
| --- | --- | --- |
| Evaluate the data from various testing methods to modify a proposed object, tool, or process to optimize the design solution. | 1. Ability to evaluate the data from various testing methods to modify a proposed object, tool, or process to optimize the design solution. | Identify a strength or weakness of a particular design solution using data. |

### CA NGSS Performance Expectation

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.**

### Mastery Statements

Students will be able to:

* Use simple data to identify a strength of a design solution
* Use simple data to identify a weakness of a design solution
* Use data to identify a modification of an object, tool, or process that will make it function better as part of a design solution
* Use data to identify a modification of an object, tool, or process that will make it function better as part of a design solution and identify why the modification will improve the function (increased production, less pollution, fewer resources needed, etc.)

### Possible Phenomena or Contexts

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

**Possible contexts include the following:**

* Forms of pollution
* Loss of wildlife habitat
* Enhancing mobility for people with disabilities
* Enhancing access to clean water
* Solar and wind energy

### Additional Assessment Boundaries

* None listed at this time

### Additional References

California Science Test Item Specification for MS-ETS1-4

<https://www.cde.ca.gov/ta/tg/ca/documents/itemspecs-ms-ets1-4.docx>

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

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