

4-ESS3-2 Earth and Human Activity

California Science Test—Item Content Specifications

# 4-ESS3-2 Earth and Human Activity

Students who demonstrate understanding can:

Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.

[Clarification Statement: Examples of solutions could include designing an earthquake resistant building and improving monitoring of volcanic activity.] [*Assessment Boundary: Assessment is limited to earthquakes, floods, tsunamis, and volcanic eruptions.*]

| Science and Engineering Practices | Disciplinary Core Ideas | Crosscutting Concepts |
| --- | --- | --- |
| Constructing Explanations and Designing SolutionsConstructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution. | ESS3.B: Natural Hazards1. A variety of hazards result from natural processes (e.g., earthquakes, tsunamis, volcanic eruptions). Humans cannot eliminate the hazards but can take steps to reduce their impacts. *(Note: This Disciplinary Core Idea can also be found in 3.WC.)*

ETS1.B: Designing Solutions to Engineering Problems1. Testing a solution involves investigating how well it performs under a range of likely conditions. *(secondary to 4-ESS3-2)*
 | Cause and EffectCause and effect relationships are routinely identified, tested, and used to explain change.Connections to Engineering, Technology, and Applications of ScienceInfluence of Engineering, Technology, and Science on Society and the Natural WorldEngineers improve existing technologies or develop new ones to increase their benefits, to decrease known risks, and to meet societal demands. |

## 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.

6E.1 Ability to solve design problems

6E.2 Ability to evaluate and/or refine solutions to design problems

### 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.

6E.1.2 Ability to generate multiple solutions for a design problem that meet design criteria and constraints

6E.2.1 Ability to compare or critique competing design solutions based on design criteria

6E.2.2 Ability to evaluate and/or refine (optimize) design solutions based on scientific knowledge or evidence

### Disciplinary Core Idea Assessment Targets

#### ESS3.B.3

* Identify natural processes on Earth that can have a negative effect on humans (e.g., earthquakes, volcanoes, floods, landslides)
* Describe the problems caused by these natural processes for humans
* Generate design solutions to reduce the negative effects of these natural processes on humans

#### ETS1.B.5

* Describe the criteria for a design solution to alleviate the negative effects of these natural processes on humans
* Describe the constraints of a design solution, including performance under a range of likely conditions
* Evaluate design solutions based on whether and how well they worked to meet the needs of humans

### Crosscutting Concept Assessment Target(s)

CCC2 Identify and test cause and effect relationships to explain change

## Examples of Integration of Assessment Targets and Evidence

Note that the list in this section is not exhaustive.

Task describes a design problem related to reducing the impacts of a natural process on humans:

* Generates multiple solutions in response to the design problem (6E.1.2, ESS3.B.3, and CCC2)

Task describes a design solution for reducing the impacts of a natural process on humans:

* Identifies constraints of the given design (6E.1.2, ESS3.B.3, and CCC2)

Task describes several design solutions for reducing the impacts of a natural process on humans along with a listing of certain design criteria:

* Selects the most appropriate design based on the list of criteria (6E.2.1, ESS3.B.3, ETS1.B.5, and CCC2)
* Justifies his or her design selection by explaining how it meets the criteria (6E.2.1, ESS3.B.3, ETS1.B.5, and CCC2)
* Ranks the design solutions based on how well they meet the criteria and constraints of the defined problem (6E.2.1, ESS3.B.3, ETS1.B.5, and CCC2)

Task describes a design solution for reducing the impacts of a natural process on humans that was selected over alternative designs:

* Identifies prioritized criteria and/or constraints that resulted in selection of one preferred design (6E.2.1, ESS3.B.3, ETS1.B.5, and CCC2)

Task describes several design solutions for reducing the impacts of a particular natural process on humans along with a listing of certain constraints:

* Selects the most appropriate design solution (6E.2.1, ESS3.B.3, and CCC2)
* Provides justification for the selection based on prioritization of criteria (6E.2.1, ESS3.B.3, ETS1.B.5, and CCC2)
* Evaluates each solution based on science principles and/or evidence (6E.2.2, ESS3.B.3, and CCC2)

## Possible Phenomena or Contexts

Note that the list in this section is not exhaustive.

* Early warning systems for natural hazards
* Reducing the impact of explosive and nonexplosive volcanic eruptions)
* Changes in building codes and designs to reduce the impacts of natural hazards
* Tradeoffs for cost, materials, and time related to the construction of buildings designed to reduce the impact of natural hazards

## Common Misconceptions

Note that the list in this section is not exhaustive.

* Humans cannot take measures to reduce impacts of natural disasters.
* Humans can prevent natural disasters from causing any harm to humans.

## Additional Assessment Boundaries

None listed at this time.

## Additional References

4-ESS3-2 Evidence Statement <https://www.nextgenscience.org/sites/default/files/evidence_statement/black_white/4-ESS3-2%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>

Posted by the California Department of Education, March 2021