

HS-ESS3-2 Earth and Human Activity

 California Science Test—Item Content Specifications

# HS-ESS3-2 Earth and Human Activity

Students who demonstrate understanding can:

Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.

[Clarification Statement: Emphasis is on the conservation, recycling, and reuse of resources (such as minerals and metals) where possible, and on minimizing impacts where it is not. Examples include developing best practices for agricultural soil use, mining (for coal, tar sands, and oil shales), and pumping (for petroleum and natural gas). Science knowledge indicates what can happen in natural systems—not what should happen.]

Continue to the next page for the Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts.

| Science and Engineering Practices | Disciplinary Core Ideas | Crosscutting Concepts |
| --- | --- | --- |
| Engaging in Argument from EvidenceEngaging in argument from evidence in 9–12 builds on K–8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about natural and designed world(s). Arguments may also come from current scientific or historical episodes in science.Evaluate competing design solutions to a real-world problem based on scientific ideas and principles, empirical evidence, and logical arguments regarding relevant factors (e.g., economic, societal, environmental, ethical considerations). | ESS3.A: Natural Resources1. All forms of energy production and other resource extraction have associated economic, social, environmental, and geopolitical costs and risks as well as benefits. New technologies and social regulations can change the balance of these factors.

ETS1.B: Developing Possible Solutions1. When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. *(secondary to HS-ESS3-2)*
 | Connections to Engineering, Technology, and Applications of ScienceInfluence of Science, Engineering, and Technology on Society and the Natural WorldEngineers continuously modify these technological systems by applying scientific knowledge and engineering design practices to increase benefits while decreasing costs and risks.Analysis of costs and benefits is a critical aspect of decisions about technology.Connections to Nature of ScienceScience Addresses Questions About the Natural and Material WorldScience and technology may raise ethical issues for which science, by itself, does not provide answers and solutionsScience knowledge indicates what can happen in natural systems — not what should happen. The latter involves ethics, values, and human decisions about the use of knowledge.Many decisions are not made using science alone, but rely on social and cultural contexts to resolve issues. |

## 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.

7.2 Ability to compare, evaluate, and critique competing arguments

### 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.

7.2.1 Ability to evaluate arguments about a natural phenomenon based on scientific concepts, principles, and big ideas

7.2.2 Ability to respond to a critique from others by revising an argument after analysis of the reasoning and evidence

7.2.3 Ability to evaluate competing perspectives/claims using reasoning and evidence

### Disciplinary Core Idea Assessment Targets

#### ESS3.A.5

* Identify the evidence to determine if/what type of design solution is needed
* Evaluate competing design solutions to minimize the economic, social, environmental, and/or geopolitical costs
* Identify the costs and risks involved in resource management design solutions
* Evaluate competing arguments about the potential benefits and risks of new technologies in resource management design solutions

#### ETS1.B.10

* Identify the constraints for a design solution including cost, safety, reliability, aesthetics, and cultural and environmental effects

### 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 data comparing resource management design solutions:

* Identifies valid evidence relevant to selecting the best solution (7.2.1 and ESS3.A.5)
* Identifies and evaluates evidence of weaknesses and strengths of each solution (7.2.1 and ESS3.A.5)

Task provides a faulty argument about the advantages of a particular resource management design solution and evidence relevant to the solution:

* Revises the faulty argument supported with evidence (7.2.2 and ESS3.A.5)

Task provides multiple arguments about the advantages of resource management design solutions with supporting material:

* Identifies evidence for the weaknesses and strengths of the provided arguments (7.2.3, ESS3.A.5, and ETS1.B.10)
* Describes how the evidence supports a particular argument (7.2.3, ESS3.A.5, and ETS1.B.10)

## California Environmental Principles and Concepts

* EP1: The continuation and health of individual human lives and of human communities and societies depend on the health of the natural systems that provide essential goods and ecosystem services.
* EP2: The long-term functioning and health of terrestrial, freshwater, coastal, and marine ecosystems are influenced by their relationships with human societies.
* EP3: Natural systems proceed through cycles that humans depend upon, benefit from, and can alter.
* EP4: The exchange of matter between natural systems and human societies affects the long-term functioning of both.
* 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.

* Methods of coal mining and the associated costs and benefits
* Methods of petroleum extraction and the associated costs and benefits
* Strategies for soil management that vary with topography and climate
* Evaluating reduce, reuse, and recycle strategies with specific mineral resources
* Evaluating energy sources, both renewable and nonrenewable

## Common Misconceptions

Note that the list in this section is not exhaustive.

* Conservation is always costly.
* Petroleum products are only important in automobiles.
* Technology innovations can always lead to a sustainable system.
* Earth’s resources, such as fuels and water, will never be depleted.
* People must control nature more effectively.
* Natural gas is a renewable resource.

## Additional Assessment Boundaries

None listed at this time.

## Additional References

HS-ESS3-2 Evidence Statement [https://www.nextgenscience.org/sites/default/files/evidence\_statement/black\_white/HS-ESS3-2 Evidence Statements June 2015 asterisks.pdf](https://www.nextgenscience.org/sites/default/files/evidence_statement/black_white/HS-ESS3-2%20Evidence%20Statements%20June%202015%20asterisks.pdf)

California 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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