

MS-ESS2-4 Earth's Systems

California Science Test—Item Content Specifications

# MS-ESS2-4 Earth's Systems

Students who demonstrate understanding can:

Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.

[Clarification Statement: Emphasis is on the ways water changes its state as it moves through the multiple pathways of the hydrologic cycle. Examples of models can be conceptual or physical.] [*Assessment Boundary: A quantitative understanding of the latent heats of vaporization and fusion is not assessed.*]

| Science and Engineering Practices | Disciplinary Core Ideas | Crosscutting Concepts |
| --- | --- | --- |
| Developing and Using Models  Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.  Develop a model to describe unobservable mechanisms. | ESS2.C: The Roles of Water in Earth's Surface Processes   1. Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land. 2. Global movements of water and its changes in form are propelled by sunlight and gravity. | Energy and Matter  Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter. |

## 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.

2.1 Ability to develop models

### 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.

2.1.1 Ability to determine components of a scientific event, system, or design solution

2.1.2 Ability to determine the relationships among multiple components of a scientific event, system, or design solution

2.1.3 Ability to determine scope, scale, and grain-size of models, as appropriate for their intended use

2.1.4 Ability to represent mechanisms, relationships, and connections to illustrate, explain, or predict a scientific event

### Disciplinary Core Idea Assessment Targets

#### ESS2.C.3

* Identify the components of the water cycle including water, energy, gravity, the atmosphere, landforms, and organisms
* Identify the processes of the water cycle such as transpiration, evaporation, condensation, crystallization, precipitation, and runoff
* Describe the relationships between the components of the water cycle (e.g., the transfer of energy from the Sun drives the evaporation of water)

#### ESS2.C.4

* Describe that the transfer of energy between water and the environment during phase changes drives the cycling of water
* Describe that gravity acting on water in different phases and locations drives the cycling of water
* Develop and use models of the water cycle that include both energy from light and the force of gravity driving water cycling between the oceans, the atmosphere, and land

### Crosscutting Concept Assessment Target(s)

CCC5 Identify that within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter

## Examples of Integration of Assessment Targets and Evidence

Note that the list in this section is not exhaustive.

Task provides a phenomenon involving the water cycle and a list of relevant and irrelevant components and processes to model the phenomenon:

* Selects the relevant components and/or labels the components (2.1.1, ESS2.C.3, and CCC5)
* Selects the processes operating between components and/or labels those processes (2.1.1, ESS2.C.3, and CCC5)

Task provides an incomplete model representing a relevant weather event such as a map showing sea surface temperatures that lead to hurricane formation:

* Completes the model to illustrate or predict the event (2.1.1, ESS2.C.4, and CCC5)

Task provides a diagram of the water cycle with all components the same size:

* Selects the relative scale and size of the components appropriate to their relative importance (e.g., oceans have more influence on the cycle than lakes) (2.1.2, ESS2.C.3, and CCC5)

Task provides representations such as text descriptions, labels, or arrows to model phase changes and other processes in the water cycle:

* Selects the representations that best illustrates the phase change or process (2.1.3, ESS2.C.4, and CCC5)

## California Environmental Principles and Concepts

* EP3: Natural systems proceed through cycles that humans depend upon, benefit from, and can alter.

## Possible Phenomena or Contexts

Note that the list in this section is not exhaustive.

* The movement of water from the atmosphere to plants and from plants to the atmosphere
* The movement of water through aquifers or over landmasses
* Energy transfers to and from the environment during phase changes such as evaporation and condensation.
* The roles of solar energy and gravity on the movement of water, leading to cloud formation, precipitation, and other weather processes
* The relationship between energy in the atmosphere and oceans and the volume of glacial ice on Earth’s surface

## Common Misconceptions

Note that the list in this section is not exhaustive.

* All processes in the water cycle are linear.
* Living things are not part of the water cycle.

## Additional Assessment Boundaries

None listed at this time.

## Additional References

MS-ESS2-4 Evidence Statement [https://www.nextgenscience.org/sites/default/files/evidence\_statement/black\_white/MS-ESS2-4 Evidence Statements June 2015 asterisks.pdf](https://www.nextgenscience.org/sites/default/files/evidence_statement/black_white/MS-ESS2-4%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 California Environmental Principles and Concepts <https://www.cde.ca.gov/ci/sc/cf/documents/scifwappendix2.pdf>

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