

MS-ESS1-2 Earth's Place in the Universe

California Science Test—Item Content Specifications

# MS-ESS1-2 Earth's Place in the Universe

Students who demonstrate understanding can:

Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.

[Clarification Statement: Emphasis for the model is on gravity as the force that holds together the solar system and Milky Way galaxy and controls orbital motions within them. Examples of models can be physical (such as the analogy of distance along a football field or computer visualizations of elliptical orbits) or conceptual (such as mathematical proportions relative to the size of familiar objects such as students' school or state).] [*Assessment Boundary: Assessment does not include Kepler’s Laws of orbital motion or the apparent retrograde motion of the planets as viewed from Earth.*]

| 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 and use a model to describe phenomena.  | ESS1.A: The Universe and Its Stars 1. Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe.

ESS1.B: Earth and the Solar System 1. The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them.
2. The solar system appears to have formed from a disk of dust and gas, drawn together by gravity.
 | Systems and System Models Models can be used to represent systems and their interactions. Connections to Nature of ScienceScientific Knowledge Assumes an Order and Consistency in Natural Systems Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation.  |

## Assessment Targets

Assessment targets describe the focal knowledge, skills, and abilities for a given three-dimensional Performance Expectation. Please refer to the Introduction (hyperlink to section on explanation of assessment targets) 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

2.2 Ability to use 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

2.2.1 Ability to use models to identify concepts and relationships represented in the models

### Disciplinary Core Idea Assessment Targets

#### ESS1.A.4

* Place Earth in its appropriate relative position within our solar system
* Describe (in degrees of magnitude) the relative spatial scales involved from solar systems to galaxies to broader clusters in the universe
* Consider scale (in mass, distance, and time) as a factor determining which components are relevant when understanding the solar system, galaxy, or universe

#### ESS1.B.3

* Describe gravity as the attractive force that keeps solar systems and galaxies together
* Describe the fundamental relationships between the attractive force of gravity acting upon two objects and their masses (linear) and/or the distance separating them (nonlinear)
* Predict continuing orbital behavior among celestial bodies (without Kepler’s laws) and consider hypotheticals of the introduction or removal of bodies (e.g., what would happen to orbits if the Sun were to disappear?)

#### ESS1.B.5

* Describe the role of gravity in the accretion of gases and dust particles into suns, planets, and other bodies in the solar system

### Crosscutting Concept Assessment Target(s)

CCC4 Use models to represent systems and their interactions

## Examples of Integration of Assessment Targets and Evidence

Note that the list in this section is not exhaustive.

Task provides a model of the solar system which shows the orbital path of the planets around the Sun or moons around a planet:

* Selects and labels components of the model that identify the effect gravity has on the direction of motions of objects within the solar system (2.1.1, ESS1.B.3, and CCC4)

Task provides a randomly ordered list of all the components or sequences of events needed to model the formation of our solar system from a dust cloud (nebula):

* Selects from the list of components and sequences of events to form a correct explanation of the formation of our solar system (2.1.1, ESS1.B.5, and CCC4)

Task provides an incomplete simulated model of the solar system and/or Milky Way galaxy:

* Identifies the locations of several celestial objects, including Earth, within the solar system to complete the model (2.1.1, ESS1.A.4, and CCC4)
* Identifies the approximate location of our solar system within the Milky Way to complete the galaxy model (2.1.1, ESS1.A.4, and CCC4)

Task provides a solar system data table, which includes the diameter, masses, and the planets’ orbital distance to the Sun or the relative orbital distances between planets:

* Identifies a correct relatively sized scaled model of the solar system (2.2.1, ESS1.A.4, and CCC4)

## Possible Phenomena or Contexts

Note that the list in this section is not exhaustive.

* The periodic nature of comets and other small-bodied solar orbiters
* The relationship between Earth, the solar system, and the Milky Way galaxy:
	+ The relative size of Earth compared to the solar system and/or the relative size of the solar system compared to the Milky Way galaxy
	+ The relative motion of Earth, objects in the solar system (including comets and asteroids), and objects in the Milky Way galaxy
	+ The differences in scale when measuring distances between planets, stars, galaxies, and other objects in the universe

## Common Misconceptions

Note that the list in this section is not exhaustive.

* The Milky Way galaxy is at the center of the universe.
* Earth and the solar system are at the center of the Milky Way.
* The relative proximity of Earth to the Sun causes seasons.
* Celestial bodies are discrete bodies without pattern or without hierarchy.
* The solar system always existed in its current form.
* Some, but not all, celestial objects have gravity.

## Additional Assessment Boundaries

None listed at this time.

## Additional References

[MS-ESS1-2 Evidence Statement](https://www.nextgenscience.org/sites/default/files/evidence_statement/black_white/MS-ESS1-2%20Evidence%20Statements%20June%202015%20asterisks.pdf) [https://www.nextgenscience.org/sites/default/files/evidence\_statement/black\_white/MS-ESS1-2 Evidence Statements June 2015 asterisks.pdf](https://www.nextgenscience.org/sites/default/files/evidence_statement/black_white/MS-ESS1-2%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>

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