

MS-PS3-2 Energy

California Science Test—Item Content Specifications

# MS-PS3-2 Energy

Students who demonstrate understanding can:

Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.

[Clarification Statement: Emphasis is on relative amounts of potential energy, not on calculations of potential energy. Examples of objects within systems interacting at varying distances could include: the Earth and either a roller coaster cart at varying positions on a hill or objects at varying heights on shelves, changing the direction/orientation of a magnet, and a balloon with static electrical charge being brought closer to a classmate’s hair. Examples of models could include representations, diagrams, pictures, and written descriptions of systems.] [*Assessment Boundary: Assessment is limited to two objects and electric, magnetic, and gravitational interactions.*]

| Science and Engineering Practices | Disciplinary Core Ideas | Crosscutting Concepts |
| --- | --- | --- |
| Developing and Using ModelsModeling in 6–8 builds on K–5 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. | PS3.A: Definitions of Energy1. A system of objects may also contain stored (potential) energy, depending on their relative positions.

PS3.C: Relationship Between Energy and Forces1. When two objects interact, each one exerts a force on the other that can cause energy to be transferred to or from the object.
 | Systems and System ModelsModels can be used to represent systems and their interactions – such as inputs, processes, and outputs – and energy and matter flows within systems. |

## 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

#### PS3.A.7

* Create a model to represent the forces involved in the interaction of two objects in a system
* Create a model in which the potential energy of a system changes as the distance between two objects in the system

#### PS3.C.3

* Describe that when two objects interact at a distance, each object exerts a force on the other that can cause energy to be transferred to or from the objects
* Describe that when energy is transferred to two attracting objects (causing them to move apart), the potential energy of the two-object system increases
* Describe that when energy is transferred to two repelling objects (causing them to move closer), the potential energy of the two-object system increases

### Crosscutting Concept Assessment Target(s)

CCC4 Use models to represent systems and their interactions—such as inputs, processes and outputs—and the flow of energy and matter within the systems

## Examples of Integration of Assessment Targets and Evidence

Note that the list in this section is not exhaustive.

Task provides a qualitative description or incomplete model of interacting objects:

* Identifies and/or describes the components of the model based on the qualitative description to explain the interactions between the objects (2.1.1, PS3.A.7, and CCC4)
* Uses the qualitative description of the interactions between the objects to explain or predict how distance and the amount of potential energy affects those interactions (2.1.1, PS3.A.7, and CCC4)
* Completes the model to illustrate the forces acting between the objects (2.1.1, PS3.A.7, and CCC4)

Task provides a quantitative description based on the relative magnitudes of the potential energy of a system of interacting objects:

* Develops a model or representation of the mechanisms and behaviors, which are often complex and difficult to observe directly, underlying a scientific phenomenon (2.1.3, PS3.C.3, and CCC4)

## Possible Phenomena or Contexts

Note that the list in this section is not exhaustive.

* Model of charged particles and their interactions as the distance between them changes
* Two-magnet system pushed away from or pulled towards each other
* Objects placed at different heights above Earth’s surface

## Common Misconceptions

Note that the list in this section is not exhaustive.

* Potential energy is a conserved quantity.
* Objects in a system have less potential energy when they are separated by a distance.
* The potential energy of objects in a system depends only on the distance between the objects.

## Additional Assessment Boundaries

None listed at this time.

## Additional References

MS-PS3-2 Evidence Statement [https://www.nextgenscience.org/sites/default/files/evidence\_statement/black\_white/MS-PS3-2 Evidence Statements June 2015 asterisks.pdf](https://www.nextgenscience.org/sites/default/files/evidence_statement/black_white/MS-PS3-2%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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