

3-PS2-3 Motion and Stability: Forces and Interactions

California Science Test—Item Content Specifications

# 3-PS2-3 Motion and Stability: Forces and Interactions

Students who demonstrate understanding can:

Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.

[Clarification Statement: Examples of an electric force could include the force on hair from an electrically charged balloon and the electrical forces between a charged rod and pieces of paper; examples of a magnetic force could include the force between two permanent magnets, the force between an electromagnet and steel paperclips, and the force exerted by one magnet versus the force exerted by two magnets. Examples of cause and effect relationships could include how the distance between objects affects strength of the force and how the orientation of magnets affects the direction of the magnetic force.] [*Assessment Boundary: Assessment is limited to forces produced by objects that can be manipulated by students, and electrical interactions are limited to static electricity.*]

| Science and Engineering Practices | Disciplinary Core Ideas | Crosscutting Concepts |
| --- | --- | --- |
| Asking Questions and Defining Problems  Asking questions and defining problems in grades 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships.  Ask questions that can be investigated based on patterns such as cause and effect relationships. | PS2.B: Types of Interactions   1. Electric, and magnetic forces between a pair of objects do not require that the objects be in contact. The sizes of the forces in each situation depend on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other. | Cause and Effect  Cause and effect relationships are routinely identified, tested, and used to explain change. |

## 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.

1.1 Ability to ask and evaluate questions addressing phenomena of the natural world

1.3 Ability to ask and evaluate questions that can be investigated

### 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.

1.1.1 Ability to ask questions that arise from careful observation of phenomena or unexpected results

1.3.1 Ability to ask questions that can be investigated within the scope of the school laboratory, research facilities, or field (e.g., outdoor environment) with available resources

1.3.3 Ability to evaluate a question to determine if it is empirically testable and relevant

### Disciplinary Core Idea Assessment Targets

#### PS2.B.3

* Recognize that interactions involving electromagnetic forces do not require that the interacting objects physically touch
* Identify the strength of the force exerted by two objects interacting through electromagnetic force decreases as the distance between them increases
* Describe forces exerted upon two magnetics in terms of the relative position among magnetic poles
* Differentiate between permanent magnets and objects that can interact in the presence of magnets but not when the magnet is removed
* Identify the act of charging as a means for causing previously neutral objects to interact via electromagnetic forces
* Draw comparisons between interactions among permanent/temporary magnets and among charged objects

### Crosscutting Concept Assessment Target(s)

CCC2 Identify, test, and use 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 provides a picture/description of a scenario of two objects in the natural world that interact via electromagnetic forces:

* Identifies (or generates) a question that best considers the cause-and-effect relationship between observable features of the interacting objects (e.g., their composition, distance, and relative orientation) and of features of the forces (e.g., their strength and direction) (1.1.1, PS2.B.3, and CCC2)
* Identifies a question that best seeks to investigate how the objects are interacting without being in physical contact (1.1.1, PS2.B.3, and CCC2)

Task provides a picture/description of a scenario in which two objects in the natural world interact via electromagnetic forces and the result is unexpected:

* Identifies (or generates) a question that highlights how the expected cause-and effect-relationship was different from the observed interaction between the two objects (1.1.1, PS2.B.3, and CCC2)
* Identifies (or generates) a question regarding the relative orientation/position of the interacting objects that might be the cause of the unexpected result (1.1.1, PS2.B.3, and CCC2)
* Identifies (or generates) a question regarding a new source of information that would help determine if a suggested cause/effect relationship actually occurred (1.1.1, PS2.B.3, and CCC2)

Task provides observations from an experiment in which two objects interact via electromagnetic forces:

* Asks a question about the experiment that effectively compares the observed cause-and-effect relationship to another instance of objects interacting via a different kind of electromagnetic force (1.3.1, PS2.B.3, and CCC2)
* Asks a question regarding unstated features of the materials used (i.e., size, object composition, relative position, relative orientation) that might serve as alternative explanations for the results (1.3.1, PS2.B.3, and CCC2)

Task provides a question regarding objects interacting via electromagnetic forces:

* Evaluates whether the question can be used to predict what will happen to the objects or to the force based on the experimental parameter that will be allowed to vary (1.3.1, PS2.B.3, and CCC2)
* Evaluates the quality of the question in light of a stated set of available resources (e.g., a set of magnets, a compass, and paperclips) that could be used to perform an investigation (1.3.2, PS2.B.3, and CCC2)

## Possible Phenomena or Contexts

Note that the list in this section is not exhaustive.

* Non-metallic, non-magnetic objects interact after one (or both) has become electrically charged (e.g. static electricity, like a balloon on hair).
* Magnets of different strengths exert different magnitudes of force on metallic objects (like paper clips).
* Two magnets exert forces on each other based on their distance from each other, relative magnetic strength, and pole orientation.

## Common Misconceptions

Note that the list in this section is not exhaustive.

* Charged objects never interact with neutral objects.
* All metals are attracted to magnets.
* All silver-colored items are attracted to a magnet.
* Larger magnets are always stronger magnets.

## Additional Assessment Boundaries

None listed at this time.

## Additional References

3-PS2-3 Evidence Statement [https://www.nextgenscience.org/sites/default/files/evidence\_statement/black\_white/3-PS2-3 Evidence Statements June 2015 asterisks.pdf](https://www.nextgenscience.org/sites/default/files/evidence_statement/black_white/3-PS2-3%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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