

MS-PS2-5 Motion and Stability: Forces and Interactions

California Science Test—Item Content Specifications

# MS-PS2-5 Motion and Stability: Forces and Interactions

Students who demonstrate understanding can:

**Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.**

[Clarification Statement: Examples of this phenomenon could include the interactions of magnets, electrically-charged strips of tape, and electrically-charged pith balls. Examples of investigations could include first-hand experiences or simulations.] [*Assessment Boundary: Assessment is limited to electric and magnetic fields, and is limited to qualitative evidence for the existence of fields.*]

| Science and Engineering Practices | Disciplinary Core Ideas | Crosscutting Concepts |
| --- | --- | --- |
| Planning and Carrying Out Investigations  Planning and carrying out investigations to answer questions or test solutions to problems in 6–8 builds on K–5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or design solutions.  Conduct an investigation and evaluate the experimental design to produce data to serve as the basis for evidence that can meet the goals of the investigation. | PS2.B: Types of Interactions   1. Forces that act at a distance (electric, magnetic, and gravitational) can be explained by fields that extend through space and can be mapped by their effect on a test object (a charged object, or a ball, respectively). | Cause and Effect  Cause and effect relationships may be used to predict phenomena in natural or designed 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.

3.2 Ability to develop, evaluate, and refine a plan for the investigation

3.3 Ability to collect the data for the investigation

### 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.

3.2.1 Ability to decide how to observe and/or measure relevant variables, considering the level of accuracy and precision required and the kinds of instrumentation and techniques best suited to making such measurements

3.2.2 Ability to describe a detailed experimental procedure (e.g., number of trials, identify the control) and experimental setup

3.3.1 Ability to use appropriate tools for accurate and precise measurements

3.3.2 Ability to make observations according to the investigation plan

3.3.3 Ability to evaluate the quality of data to determine if the evidence meets the goals of the investigation

### Disciplinary Core Idea Assessment Targets

#### PS2.B.7

* Identify properties of gravitational, electric, or magnetic fields
* Recognize what type of field is appropriate to analyze for a given physical situation
* Provide evidence that an interaction between two objects occurring over some distance must exist through a field rather than direct contact
* Investigate and/or measure the presence of electric or magnetic forces either through the motion of objects, suspension of objects, or simulation of objects that produce electric or magnetic fields
* Evaluate an experimental design to assess whether data produced by the investigation provides evidence of fields existing between objects that are not in contact with each other

### Crosscutting Concept Assessment Target(s)

CCC2 Use cause and effect relationships to predict phenomena in natural or designed systems

## Examples of Integration of Assessment Targets and Evidence

Note that the list in this section is not exhaustive.

Task provides list of measuring tools and instruments that can help obtain sufficient and precise data:

* Identifies from the list which tool or instrument correctly provides evidence for the existence of electric or magnetic fields (3.2.1, PS2.B.7, and CCC2)

Task provides possible materials that can be used to measure electric and/or magnetic fields:

* Describes an appropriate procedure to measure electric and/or magnetic fields (3.2.2, PS2.B.7, and CCC2)

Task provides a list of useful tools and techniques to collect data for investigating electric or magnetic fields:

* Identifies the appropriateness of each tool and/or technique (3.3.1, PS2.B.7, and CCC2)

Task provides a video or simulated model of point charges creating electric fields and/or magnetic material creating magnetic fields:

* Uses the video or simulated model to observe, record data, and evaluate whether these fields exert forces on other objects without direct contact (3.3.2, PS2.B.7, and CCC2)

Task provides data for either electric fields being generated by point charges or magnetic fields being generated by magnetic material or electric or magnetic forces:

* Evaluates data to determine if there is evidence that fields exert forces on nearby objects without direct contact (3.3.3, PS2.B.7, and CCC2)

## Possible Phenomena or Contexts

Note that the list in this section is not exhaustive.

* Charged object hanging from one end of a string (e.g., a foam ball) with another charged object nearby (e.g., a balloon)
* A plastic rod on a freely rotating platform with charged object nearby
* A hand-held charged plastic rod acting on a charged foam ball
* Iron filings in the vicinity of a bar or horseshoe magnet
* Computer simulations of electric or magnetic fields

## Common Misconceptions

Note that the list in this section is not exhaustive.

* Electric and magnetic fields do not exist because they cannot be seen.
* Electric and magnetic fields exist in one dimension.
* Electric and magnetic fields are the same.
* Magnetism results from how electrons are distributed in a magnet and that the poles of a magnet are charged, with the North Pole as “positive” and the South Pole as “negative.”
* A force exerted by a field results from charged objects moving across field lines to either push or pull on other objects.
* Attraction between nonmetallic objects (e.g., a balloon and foam ball) is due to magnetic forces.

## Additional Assessment Boundaries

None listed at this time.

## Additional References

MS-PS2-5 Evidence Statement [https://www.nextgenscience.org/sites/default/files/evidence\_statement/black\_white/MS-PS2-5 Evidence Statements June 2015 asterisks.pdf](https://www.nextgenscience.org/sites/default/files/evidence_statement/black_white/MS-PS2-5%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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