

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

California Science Test—Item Content Specifications

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

Students who demonstrate understanding can:

Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.

[*Assessment Boundary: Assessment is limited to designing and conducting investigations with provided materials and tools.*]

Continue to the next page for the Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts.

| Science and Engineering Practices | Disciplinary Core Ideas | Crosscutting Concepts |
| --- | --- | --- |
| Planning and Carrying Out InvestigationsPlanning and carrying out investigations to answer questions or test solutions to problems in 9–12 builds on K–8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical and empirical models.Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. | PS2.B: Types of Interactions9. Newton’s law of universal gravitation and Coulomb’s law provide the mathematical models to describe and predict the effects of gravitational and electrostatic forces between distant objects. (HS-PS2-4)10. Forces at a distance are explained by fields (gravitational, electric, and magnetic) permeating space that can transfer energy through space. Magnets or electric currents cause magnetic fields; electric charges or changing magnetic fields cause electric fields.PS3.A: Definitions of Energy8. “Electrical energy” may mean energy stored in a battery or energy transmitted by electric currents. *(secondary to HS-PS2-5)* | Cause and EffectEmpirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. |

## 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.

3.2.2 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

3.3.3 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.9

* Identify the system of objects that are being represented
* Identify and describe the electrostatic force between two objects as the product of their individual charges divided by the separation distance squared
* Predict the change in the electrostatic force between objects when properties of the system are changed

#### PS2.B.10

* Describe that an electric current produces a magnetic field and that a changing magnetic field produces an electric current
* Develop an investigation plan and describe the data that will be collected
* Describe the evidence to be derived from the data collected in an investigation about electric currents and magnetic fields

#### PS3.A.8

* Describe that electrical energy can be either potential energy or kinetic energy

### Crosscutting Concept Assessment Target(s)

CCC2 Identify empirical evidence to differentiate between cause and correlation and make claims about specific causes and effects

## Examples of Integration of Assessment Targets and Evidence

Note that the list in this section is not exhaustive.

Task provides a scenario for measuring the magnetic field near a current-carrying wire:

* Selects or describes experimental procedures appropriate to the target problem under investigation (3.2.2, PS2.B.10, and CCC2)

Task provides an apparatus in a simulation for measuring the current in a wire in a region with a changing magnetic field:

* Uses tools and techniques to collect data useful for investigating a scientific problem (3.3.1, PS2.B.10, and CCC2)
* Uses measuring tools to get accurate and precise measurements required by the scientific investigation (3.3.1, PS2.B.10, and CCC2)

Task provides the results from an investigation relating electric current and magnetic field:

* Determines if the quality of the data meets the objective of the investigation (3.3.3, PS2.B.10, PS2.B.9, and CCC2)
* Determines if the data is sufficient to answer the scientific question under investigation (3.3.3, PS2.B.10, PS3.A.8, and CCC2)

## Possible Phenomena or Contexts

Note that the list in this section is not exhaustive.

* A magnetic field near a current-carrying wire
* A current in a wire near or in a region with a changing magnetic field
* Changing the number of coils on a solenoid (i.e., an electromagnet) to observe the changes in voltage induced by a moving magnet

## Common Misconceptions

Note that the list in this section is not exhaustive.

* Static magnetic fields produce electric currents.

## Additional Assessment Boundaries

None listed at this time.

## Additional References

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