

MS-PS1-2 Matter and its Interactions

California Science Test—Item Content Specifications

# MS-PS1-2 Matter and its Interactions

Students who demonstrate understanding can:

Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.

[Clarification Statement: Examples of reactions could include burning sugar or steel wool, fat reacting with sodium hydroxide, and mixing zinc with hydrogen chloride.] [*Assessment boundary: Assessment is limited to analysis of the following properties: density, melting point, boiling point, solubility, flammability, and odor.*]

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 |
| --- | --- | --- |
| Analyzing and Interpreting Data  Analyzing data in 6–8 builds on K–5 and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.  Analyze and interpret data to determine similarities and differences in findings.  Connections to Nature of Science  Scientific Knowledge is Based on Empirical Evidence  Science knowledge is based upon logical and conceptual connections between evidence and explanations. | PS1.A: Structure and Properties of Matter   1. Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it.   PS1.B: Chemical Reactions   1. Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. | Patterns  Macroscopic patterns are related to the nature of microscopic and atomic-level structure. |

## 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.

4.2 Ability to analyze data to identify relationships

### 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.

4.2.1 Ability to use empirical data to describe patterns and relationships

### Disciplinary Core Idea Assessment Targets

#### PS1.A.8

* Identify characteristic physical properties of pure substances (e.g., color, smell, boiling point, melting point, and density)
* Identify characteristic chemical properties of pure substances (e.g., flammability)

#### PS1.B.4

* Describe that during a chemical reaction the atoms that make up the original substances (reactants) are rearranged to form new substances (products)
* Describe that the properties of the reactants are different than the properties of the products
* Determine whether a chemical reaction has occurred based on the properties of the reactants and the products

### Crosscutting Concept Assessment Target(s)

CCC1 Identify macroscopic patterns that are related to the nature of microscopic and atomic-level structure

## Examples of Integration of Assessment Targets and Evidence

Note that the list in this section is not exhaustive.

Task provides information about a pure substance:

* Identifies characteristic chemical properties of the substance (4.2.1, PS1.A.8, and CCC1)

Task provides a scenario involving a chemical reaction or set of reactions:

* Interprets the observations and data and describes how the observations and data indicate that a chemical change has occurred (4.2.1, PS1.B.4, and CCC1)
* Describes how the properties of the reactants and products are different (4.2.1, PS1.B.4, and CCC1)

Task provides a set of reactants and a set of products:

* Determines whether a chemical reaction occurred based on observations and/or empirical data of physical and chemical properties (4.2.1, PS1.B.4, and CCC1)

## Possible Phenomena or Contexts

Note that the list in this section is not exhaustive.

* Combustion reactions
  + Natural gas (mostly methane [CH4]) in furnaces or boilers, butane (C4H10) in lighters, gasoline (mostly octane [C8H18]) in a combustion engine, etc.
* Replacement (displacement) reactions that produce a gas, precipitate, or color change
  + Baking soda and acid reaction
  + Vinegar dissolving calcium carbonate deposits
* Decomposition and synthesis reactions
  + Decomposition of H2O2 (foaming on skin cuts); experiments adding H2O2 to freshly cut potato pieces
  + Sodium metal (Na) and chlorine gas (Cl2) combining to form sodium chloride (NaCl)

## Common Misconceptions

Note that the list in this section is not exhaustive.

* All physical changes are reversible; all chemical changes are irreversible.
* Changes of state are chemical changes.
* Chemical changes always occur when substances are mixed or dissolved.
* An increase or decrease in the temperature of a chemical system always indicates a chemical change.
* The physical properties of reactants in a chemical process are similar to the physical properties of the products.

## Additional Assessment Boundaries

None listed at this time.

## Additional References

MS-PS1-2 Evidence Statement [https://www.nextgenscience.org/sites/default/files/evidence\_statement/black\_white/MS-PS1-2 Evidence Statements June 2015 asterisks.pdf](https://www.nextgenscience.org/sites/default/files/evidence_statement/black_white/MS-PS1-2%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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