

MS-PS1-5 Matter and its Interactions

California Science Test—Item Content Specifications

# MS-PS1-5 Matter and its Interactions

Students who demonstrate understanding can:

**Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.**

[Clarification Statement: Emphasis is on law of conservation of matter and on physical models or drawings, including digital forms, that represent atoms.] [*Assessment Boundary: Assessment does not include the use of atomic masses, balancing symbolic equations, or intermolecular forces.*]

| 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.Connections to Nature of ScienceScience Models, Laws, Mechanisms, and Theories Explain Natural PhenomenaLaws are regularities or mathematical descriptions of natural phenomena. | PS1.B: Chemical Reactions1. 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.
2. The total number of each type of atom is conserved, and thus the mass does not change.
 | Energy and MatterMatter is conserved because atoms are conserved in physical and chemical processes. |

## 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

2.2 Ability to use 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

2.2.2 Ability to use models to generate explanations and predictions about a scientific phenomenon

### Disciplinary Core Idea Assessment Targets

#### PS1.B.4

* Describe that during a chemical reaction the atoms that make up the reactants are rearranged to form new products
* Identify and describe the number and types of atoms in a molecule of a substance based on a chemical formula and/or molecular model
* Describe that each type of atom has a specific mass
* Describe new substances (products, synthetic materials) as rearrangements of the original substances (reactants, natural resources) that form during a chemical reaction of the constituent atoms

#### PS1.B.5

* Describe that the number and types of atoms in the reactants are equal to the number and types of atoms in the products
* Describe that atoms and thus mass are conserved during chemical reactions
* Recognize the components, relationships, and predictive power of a balanced chemical equation

### Crosscutting Concept Assessment Target(s)

CCC5 Identify that matter is conserved because atoms are conserved in physical and chemical processes

## Examples of Integration of Assessment Targets and Evidence

Note that the list in this section is not exhaustive.

Task provides description of a chemical reaction and a list of relevant and irrelevant components:

* Selects the appropriate components to develop the model to illustrate the conservation of atoms or mass (2.1.1, PS1.B.5, and CCC5)

Task provides an incomplete model of a chemical reaction and a list of relevant and irrelevant components:

* Selects the appropriate components to complete the model to illustrate the conservation of atoms or mass (2.1.1, PS1.B.5, and CCC5)

Task provides a model of a chemical reaction that illustrates the conservation of atoms or mass:

* Identifies the explanation that the model is trying to convey (2.2.2, PS1.B.4, PS1.B.5, and CCC5)
* Identifies the predictive meaning of the model (2.2.2, PS1.B.4, PS1.B.5, and CCC5)
* Uses the model to make a correct prediction (2.2.2, PS1.B.5, and CCC5)

## Possible Phenomena or Contexts

Note that the list in this section is not exhaustive.

* Simple, one-directional reactions representing combustion, synthesis, decomposition, and replacement
* Representation of simple, one-directional reactions using particle diagrams
* Models of conservation of mass (i.e., for reactions that use stoichiometric amounts only)
* Potential “everyday” reactions: neutralization of stomach acid with an antacid, decomposition of sodium azide (NaN3) in airbags, neutralization of formic acid from an ant bite using a base (soap), or dissolution of marble or limestone in statues or monuments from acid rain

## Common Misconceptions

Note that the list in this section is not exhaustive.

* Atoms and molecules are the same thing.
* The number of molecules before and after a reaction should be equal.
* Mass is lost or gained in certain reactions out of nowhere.
* Mass of an atom changes during a chemical reaction.
* Chemical reactions cause changes to atoms, not molecules.

## Additional Assessment Boundaries

None listed at this time.

## Additional References

MS-PS1-5 Evidence Statement [https://www.nextgenscience.org/sites/default/files/evidence\_statement/black\_white/MS-PS1-5 Evidence Statements June 2015 asterisks.pdf](https://www.nextgenscience.org/sites/default/files/evidence_statement/black_white/MS-PS1-5%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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