

## MS-PS1-1 Matter and its Interactions

Students who demonstrate understanding can:

**MS-PS1-1. Develop models to describe the atomic composition of simple molecules and extended structures.** [Clarification Statement: Emphasis is on developing models of molecules that vary in complexity. Examples of simple molecules could include ammonia and methanol. Examples of extended structures could include sodium chloride or diamonds. Examples of molecular-level models could include drawings, 3D ball and stick structures, or computer representations showing different molecules with different types of atoms.] [Assessment Boundary: Assessment does not include valence electrons and bonding energy, discussing the ionic nature of subunits of complex structures, or a complete description of all individual atoms in a complex molecule or extended structure is not required.]

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

### Science and Engineering Practices

#### Developing and Using Models

Modeling 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 predict and/or describe phenomena.

### Disciplinary Core Ideas

#### PS1.A: Structure and Properties of Matter

- Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms.
- Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals).

### Crosscutting Concepts

#### Scale, Proportion, and Quantity

- Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.

## Observable features of the student performance by the end of the course:

1	Components of the model
a	Students develop models of atomic composition of simple molecules and extended structures that vary in complexity. In the models, students identify the relevant components, including: <ol style="list-style-type: none"> <li>Individual atoms.</li> <li>Molecules.</li> <li>Extended structures with repeating subunits.</li> <li>Substances (e.g., solids, liquids, and gases at the macro level).</li> </ol>
2	Relationships
a	In the model, students describe relationships between components, including: <ol style="list-style-type: none"> <li>Individual atoms, from two to thousands, combine to form molecules, which can be made up of the same type or different types of atom.</li> <li>Some molecules can connect to each other.</li> <li>In some molecules, the same atoms of different elements repeat; in other molecules, the same atom of a single element repeats.</li> </ol>
3	Connections
a	Students use models to describe that: <ol style="list-style-type: none"> <li>Pure substances are made up of a bulk quantity of individual atoms or molecules. Each pure substance is made up of one of the following:               <ol style="list-style-type: none"> <li>Individual atoms of the same type that are connected to form extended structures.</li> <li>Individual atoms of different types that repeat to form extended structures (e.g., sodium chloride).</li> <li>Individual atoms that are not attracted to each other (e.g., helium).</li> <li>Molecules of different types of atoms that are not attracted to each other (e.g., carbon dioxide).</li> <li>Molecules of different types of atoms that are attracted to each other to form extended structures (e.g., sugar, nylon).</li> <li>Molecules of the same type of atom that are not attracted to each other (e.g., oxygen).</li> </ol> </li> <li>Students use the models to describe how the behavior of bulk substances depends on their structures at atomic and molecular levels, which are too small to see.</li> </ol>