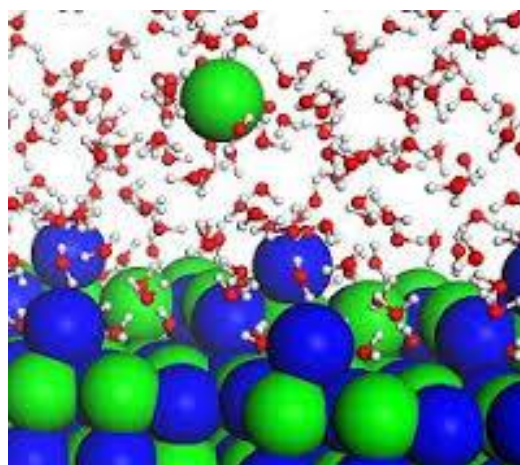




## UNIT 1

## STRUCTURE AND PROPERTIES OF MATTER



## Unit 1: Structure and Properties of Matter

**9 weeks**

In this first unit, students focus on the relationship between changes to matter and its weight. Students will observe, measure, and identify materials based on their properties and begin to conceptualize the understanding that all matter is made of particles too small to be seen. Students will also develop an understanding of the cause and effect relationship between physical changes in matter and conservation of its weight.

Students will observe, measure, and describe a variety of types of matter and physical properties of matter. These properties include color, hardness, reflectivity, electrical conductivity, thermal conductivity, response to magnetic forces, and solubility. They will use evidence from their observations to construct arguments and support claims of explanations of phenomena.

Students will make observations, gather evidence, and develop models in order to understand that matter is made up of particles too small to be seen. Students will plan and carry out investigations, producing data that will be used as evidence to support the idea that matter can still exist and can be detected by means other than seeing.

Students will be engaged in multiple opportunities to investigate the phenomenon of conservation of mass. They will observe and record a variety of changes in matter: physical changes, changes due to heating, cooling, melting, freezing, and/or dissolving. They will analyze their data and use it as evidence to explain changes that do or do not occur, and that regardless of the type of change that matter undergoes, the mass is conserved.

### Unit 1 Performance Expectations

- ❖ **5-PS1-1 Develop a model to describe that matter is made of particles too small to be seen.**  
[Clarification Statement: Examples of evidence supporting a model could include adding air to expand a basketball, compressing air in a syringe, dissolving sugar in water, and evaporating salt water.] [Assessment Boundary: Assessment does not include the atomic-scale mechanism of evaporation and condensation or defining the unseen particles.]
- ❖ **5-PS1-2 Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved.**  
[AR Clarification Statement: Examples could include chemical reactions that form new substances or physical changes including phase changes, dissolving, and mixing.] [AR Assessment Boundary: Assessment does not include distinguishing mass from weight or reactions that involve gases.]
- ❖ **5-PS1-3 Make observations and measurements to identify materials based on their properties.**  
[Clarification Statement: Examples of materials to be identified could include baking soda and other powders, metals, minerals, and liquids. Examples of properties could include color, hardness, reflectivity, electrical conductivity, thermal conductivity, response to magnetic forces, and solubility; density is not intended as an identifiable property.] [Assessment Boundary: Assessment does not include density or distinguishing mass from weight.]
- ❖ **5-PS1-4 Conduct an investigation to determine whether the mixing of two or more substances results in new substances.**  
[AR Clarification Statement: Examples of qualitative evidence could include temperature change, color change, odor change, and the formation of a gas to determine if a new substance has formed.]



**In Unit 1, students will understand...**

- ❖ Matter of any type can be subdivided into particles that are too small to see. The matter still exists and can be detected by other means.
- ❖ Gases are made from matter particles too small to see and are moving freely around in space.
- ❖ Models can be used to explain observations about matter.
- ❖ Matter can change form and the amount (weight) of matter is conserved when it changes.
- ❖ Observations and measurements of a variety of properties can be used to identify materials.
- ❖ New substances may be formed when two or more different substances are mixed.

**Unit 1 Essential Questions:**

- ❖ How does matter change?
- ❖ When matter changes, does its weight change?
- ❖ How can properties be used to identify materials?
- ❖ How do substances combine or change to make new substances?

**Foundational Knowledge:**

Prior to 5<sup>th</sup> grade, students should have knowledge, understanding of, and experiences with the following ideas:

- ❖ Every human-made product is designed by applying some knowledge of the natural world and is built using materials derived from the natural world.
- ❖ Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature.
- ❖ Matter can be described and classified by its observable properties.
- ❖ Different properties are suited to different purposes.
- ❖ Objects can be built up from a small set of pieces; objects may break into smaller pieces and be put together into larger pieces, or change shapes.
- ❖ Objects or samples of a substance can be weighed, and their size can be described and measured.
- ❖ Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible, and sometimes they are not.

*With the implementation of new standards, students may not have had opportunities to engage in these foundational understandings and ideas before 5<sup>th</sup> grade. You may need to provide opportunities for students to experience these ideas as you move forward.*



**Additional Content Connections:**

\*These connections provide opportunities to score to other content standards with focused instruction.

**ELA:**

## ❖ Speaking and Listening

- SL.5.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher led) with diverse partners on grade 5 topics and texts, building on others' ideas and expressing their own clearly.
- SL.5.2 Summarize a written text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally.
- SL.5.3 Summarize the points a speaker makes and explain how each claim is supported by reasons and evidence.

**Math:**

## ❖ Measurement and Data

- 5.MD.A.1 Convert among different-sized standard measurement units and use conversions in solving multi-step, real world problems
  - within the metric system
  - within the customary system
- 5.MD.A.3 Recognize volume as an attribute of solid figures and understand concepts of volume measurement.
- 5.MD.A.4 Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units.
- 5.MD.A.5 Relate volume to the operations of multiplication and addition and solve real world and mathematical problems involving volume.

**Unit Vocabulary:**

matter  
particles  
atoms  
mass  
properties  
substance  
temperature  
odor

state of matter  
phase  
phase change  
physical change  
chemical change  
solids  
liquids  
gases

reaction  
materials  
metals  
minerals  
color  
hardness  
reflectivity  
conductor

electrical conductivity  
thermal conductivity  
magnetic force  
solubility  
expanding  
compressing  
dissolving  
evaporating



**Structure and Properties of Matter**

Students who demonstrate understanding can:

**5-PS1-1 Develop a model to describe that matter is made of particles too small to be seen.** [Clarification Statement: Examples of evidence supporting a model could include adding air to expand a basketball, compressing air in a syringe, dissolving sugar in water, and evaporating salt water.] [Assessment Boundary: Assessment does not include the atomic-scale mechanism of evaporation and condensation or defining the unseen particles.]

**5-PS1-2 Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved.** [AR Clarification Statement: Examples could include chemical reactions that form new substances or physical changes including phase changes, dissolving, and mixing.] [AR Assessment Boundary: Assessment does not include distinguishing mass from weight or reactions that involve gases.]

**5-PS1-3 Make observations and measurements to identify materials based on their properties.** [Clarification Statement: Examples of materials to be identified could include baking soda and other powders, metals, minerals, and liquids. Examples of properties could include color, hardness, reflectivity, electrical conductivity, thermal conductivity, response to magnetic forces, and solubility; density is not intended as an identifiable property.] [Assessment Boundary: Assessment does not include density or distinguishing mass from weight.]

**5-PS1-4 Conduct an investigation to determine whether the mixing of two or more substances results in new substances.** [AR Clarification Statement: Examples of qualitative evidence could include temperature change, color change, odor change, and the formation of a gas to determine if a new substance has formed.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p><b>Developing and Using Models</b> Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions.</p> <ul style="list-style-type: none"> <li>Develop a model to describe phenomena. (5-PS1-1)</li> </ul> <p><b>Planning and Carrying Out Investigations</b> Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.</p> <ul style="list-style-type: none"> <li>Conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. (5-PS1-4)</li> <li>Make observations and measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon. (5-PS1-3)</li> </ul> <p><b>Using Mathematics and Computational Thinking</b> Mathematical and computational thinking in 3–5 builds on K–2 experiences and progresses to extending quantitative measurements to a variety of physical properties and using computation and mathematics to analyze data and compare alternative design solutions.</p> <ul style="list-style-type: none"> <li>Measure and graph quantities such as weight to address scientific and engineering questions and problems. (5-PS1-2)</li> </ul>	<p><b>PS1.A: Structure and Properties of Matter</b></p> <ul style="list-style-type: none"> <li>Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. A model showing that gases are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects. (5-PS1-1)</li> <li>The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish. (5-PS1-2)</li> <li>Measurements of a variety of properties can be used to identify materials. (Boundary: At this grade level, mass and weight are not distinguished, and no attempt is made to define the unseen particles or explain the atomic-scale mechanism of evaporation and condensation.) (5-PS1-3)</li> </ul> <p><b>PS1.B: Chemical Reactions</b></p> <ul style="list-style-type: none"> <li>When two or more different substances are mixed, a new substance with different properties may be formed. (5-PS1-4)</li> <li>No matter what reaction or change in properties occurs, the total weight of the substances does not change. (Boundary: Mass and weight are not distinguished at this grade level.) (5-PS1-2)</li> </ul>	<p><b>Cause and Effect</b></p> <ul style="list-style-type: none"> <li>Cause and effect relationships are routinely identified, tested, and used to explain change. (5-PS1-4)</li> </ul> <p><b>Scale, Proportion, and Quantity</b></p> <ul style="list-style-type: none"> <li>Natural objects exist from the very small to the immensely large. (5-PS1-1)</li> <li>Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume. (5-PS1-2, 5-PS1-3)</li> </ul> <p>-----</p> <p>--</p> <p><b>Connections to Nature of Science</b></p> <p><b>Scientific Knowledge Assumes an Order and Consistency in Natural Systems</b></p> <ul style="list-style-type: none"> <li>Science assumes consistent patterns in natural systems. (5-PS1-2)</li> </ul>

