FIFTH GRADE: MATTER

Standards Bundle

Standards are listed within the bundle. Bundles are created with potential instructional use in mind, based upon potential for related phenomena that can be used throughout a unit.

5-PS1-1 Develop a model to describe that matter is made of particles too small to be seen. (SEP: 2; DCI: PS1.A; CCC: Scale/Prop.) [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. (SEP: 5; DCI: PS1.A, PS1.B; CCC: Scale/Prop.) [Clarification Statement: Examples of reactions or changes could include phase changes, dissolving, and mixing that form new substances.] *[Assessment Boundary: Assessment does not include distinguishing mass and weight.]*

5-PS1-3 Make observations and measurements to identify materials based on their properties. (SEP: 3; DCI: PS1.A; CCC: Scale/Prop.) [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 and weight.]*

5-PS1-4 Conduct an investigation to determine whether the mixing of two or more substances results in new substances. (SEP: 3; DCI: PS1.B; CCC: Cause/Effect)

Content Overview

This section provides a generic overview of the content or disciplinary core ideas as an entry point to the standards.

Matter is everything around us and is made up of particles that are too small to be seen. Students can use models to gain an understanding of these tiny particles even though they cannot see the actual particles that make up matter. Matter has unique properties that can be observed and measured. Students can use these properties to identify and determine identities of substances. Matter can change in physical and chemical ways, however total weight is conserved. Each type of material or substance has unique properties which can be used to predict what kind of changes could occur when the material or substance interacts with other materials or substances.

Phenomena

Phenomena can be used at varying levels of instruction. One could be used to anchor an entire unit, while another might be more supplemental for anchoring

just a unit. Please remember that phenomena should allow students to engage in the SEP and use the CCC/DCI to understand and explain the phenomenon.

- Identify materials based on their properties, for example a spice rack in a grocery store, an image of a forest ecosystem, or an array of baking and cooking supplies (baking soda, powder sugar, vinegar, oil, cream, milk).
- Condensation droplets forming on a object such as dew on grass or on a glass.
- Scientists looking for dark matter and neutrinos at Sanford Lab in Lead, SD.
- Physical properties of water (can change).
- Chemical and physical reactions.
- When adding 50 mL of isopropyl alcohol and 50 mL of water together, the total volume is less than 100mL, but the mass of the two substances combined is the same as the mass of the two individuals substances.

Storyline

This section aims to decode not only the DCI connections, but also the SEP and CCC in a detailed account of how they possibly fit together in a progression for student learning, including both rationale and context for the bundle.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models ● Use models to describe phenomena. **Using Mathematics and Computational Thinking** ● Measure and graph quantities such as weight to address scientific and engineering questions and problems. **Planning and Carrying Out Investigations**	**PS1.A: Structure and Properties of Matter** ● 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. **PS1.A: Structure and Properties of Matter** ● The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish.	**Scale, Proportion, and Quantity** ● Natural objects exist from the very small to the immensely large. ● Standard units are used to measure and describe physical quantities such as weight, time, temperature,

● Make observations and measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon. ● 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.	**PS1.B: Chemical Reactions** ● 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.) **PS1.A: Structure and Properties of Matter** ● 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.) **PS1.B: Chemical Reactions** ● When two or more different substances are mixed, a new substance with different properties may be formed.	and volume. **Cause and Effec**t ● Cause and effect relationships are routinely identified and used to explain change.

In this bundle of performance expectations students have an opportunity to understand that everything is made up of matter and that matter is made of particles that are too small to be seen. Students focus on the crosscutting concept of cause and effect in addition to scale, proportion and quantity in relation to properties of materials and interactions among substances.

Students should be given opportunities to gather and analyze data to determine that matter exists at a scale that is too small to be seen. Students can develop and communicate their understanding of this abstract concept by observing instances where they know matter is taking up space even if they can't see the things that make up matter. Keep in mind, at this age students can begin to examine the world around them and think about everything as a system or an organized group of related objects or components that form a whole.

Students at this level should have some experiences with measuring length and can expand on measurement to include weight and where appropriate, volume. Students should be able to construct a model, such as diagrams, pictures, or simulations to communicate their understanding of this concept. A student-developed model will vary in quality based on how deep an understanding they have of the system they are modeling, their skill level, and their prior knowledge. Students can use their understanding of particles of matter to consider what happens to the number of particles when matter changes in form (from liquid to solid, solid to liquid, liquid to gas) or when substances are mixed.

Students can conduct investigations and collect measurable data about the weight of a substance before and after it changes forms or reacts with another substance.

All matter has observable properties that can be measured, tested, identified, and used to identify materials. Students can carry out investigations to collect both measurable numeric data (quantitative) such as weight and temperature and non-measurable numeric data (qualitative) such as color, smell, hardness, reflectivity, electrical and thermal conductivity, response to magnetic fields, and solubility to group and identify materials and substances.

Matter can undergo both physical and chemical changes. Physical changes occur when a substance's physical properties change, but not its chemical properties. It is simply changing in states and therefore some of its physical properties are changing. When certain substances are mixed with other substances a change can occur that results in a new substance. This is called a chemical change. There are other ways that chemical change can occur, like when a substance is burned. However at this age, students are not expected to know physical and chemical change. They are only asked to explore the mixing of two substances to determine if a new substance is formed. This lays the groundwork for students to explore the differences between physical and chemical changes in later grades.

Formative Assessment

Formative assessment is crucial because all learners benefit from timely and focused feedback from others. It promotes self-reflection, self-explanation, and social learning. It can also make learning more relevant. Each of the questions below might be used throughout the formative assessment process. Specific prompts may focus on individual practices, core ideas, or crosscutting concepts, but, together, the components need to support inferences about students' three-dimensional science learning as described in a given bundle, standard or lesson-level performance expectation.

SEP Developing and Using Models

- Develop a model to show how condensation occurs.
- How can we use a football as model to demonstrate that there are particles in matter that we can not see?

SEP Mathematics and Computational Thinking

- Measure and/or calculate the weight of a specific amount of a substance (i.e. 100 ml) in its liquid and frozen state.

SEP Planning and Carrying Out an Investigation

- Describe, and ask questions, about the changes in properties observed during and/or after heating, cooling, or mixing substances.

CCC Scale, Proportion, and Quantity

- How can we speed up condensation?
- What metric measurement will we use when we measure liquids? Volume?

CCC Cause and Effect

- How does temperature affect condensation?.

Performance Outcomes

These are statements of how students use knowledge and are similar to the standards in how they blend DCI, SEP, and CCC, but at a smaller grain-size. These are potential outcomes for instruction as it plays out in lessons and activities in the classroom. It is important to also think of these as smaller outcomes that build toward the larger goal of mastering the standards.

- **Measure and observe** different substances **to identify** them *based on their properties*.
- **Develop a model** to represent particles of matter *too small to be seen*.
- **Measure quantities** of different substances and create a **graph** of the measurements before and after *heating, cooling, or mixing*.
- **Provide evidence** that the total weight of matter is *conserved***.**