Unit 1: Physical Science Properties and Changes of Matter

Content Area: **Science**
Course(s):
Time Period: **Trimester 1**
Length: **10-12 weeks**
Status: **Published**

Summary

In this unit of study, students will describe that matter is made of particles too small to be seen and will be developing a model to demonstrate what can't be seen with the naked eye. The crosscutting concept of scale, proportion, and quantity is called out as an organizing concept for these disciplinary core ideas. Students develop an understanding of the idea that regardless of the type of change that matter undergoes, the total weight of matter is conserved. Students determine whether the mixing of two or more substances results in new substances.

The crosscutting concepts of patterns;interdependence of science, engineering, and technology; energy and matter; and influence of engineering, technology, and science on society and the natural world are called out as organizing concepts for these disciplinary core ideas. Students demonstrate grade-appropriate proficiency in developing and using models, planning and carrying out investigations, constructing explanations, and designing solutions. Students are also expected to use these practices to demonstrate their understanding of the core ideas.

This unit will be taught utilizing Physical Science: Mixtures and Solutions FOSS program kit.

Revision Date: July 2026

Essential Questions/ Enduring Understandings

Essential Questions:

- When and how does matter change?
- How can properties be used to describe matter?
- To what extent would a model best represent and/or describe matter as made of particles that are too small to be seen?
- What is the result of mixing two or more substances?
- To what extent is a given substance affected by temperature?
- To what extent does the weight of a substance change when the phase of matter is altered?
- To what extent do scientists and engineers contribute to the development and use of models?

Enduring Understandings:

- Everything in the known universe can be put into one of two categories: matter or energy.
- Matter can be described, organized and classified for understanding.
- The amount of matter (weight) is conserved when it changes form, even in transitions when it seems to vanish.
- Scientists and engineers create conceptual and physical models to explain how something works. These models develop the theory and act as a proof for the law.
- Engineers improve existing technologies or develop new ones as people's needs, wants, environment and demands change.

Objectives

Students will know:

- that matter is made of particles too small to be seen.
- that matter is identified by its properties.
- how developing an understanding that matter is conserved when it changes state can serve as the basis for evidence for an explanation of a phenomenon.
- that a mixture is two or more materials intermingled that can be separated and the mass of that mixture is equal to the mass of its constituents.
- how a model can be used to demonstrate and describe natural objects that exist from the very small to the immensely large.
- that models are representations used for communicating and testing.
- that developing a model is an iterative process, which may involve observing, constructing, analyzing, evaluating, and revising.
- how the more concentrated the solution, the more dense the solution is.
- how to compare and contrast a substance with a solution.
- the difference between solvents and solutes.
- how solubility varies from substance to substance.
- that during a reaction, starting substances (reactants) change into new substances (products).
- how working in collaborative groups is important in the scientific and engineering process.

Students will be skilled at:

- Asking questions and defining problems
- Developing and using models
- Planning and carrying out investigations
- Analyzing and interpreting data
- Using mathematics and computational thinking
- Constructing explanations and designing solutions
- Engaging in argument from evidence
- Obtaining, evaluating and communicating information

Learning Plan

The concepts and practices in this unit are foundational for understanding the relationship between changes to matter and its weight. During this unit of study, students will observe, measure, and identify materials based on their properties and begin to get a conceptual understanding of the particle nature of matter (i.e., all matter is made of particles too small to be seen).

Part 1

- In the first portion of the unit, students will focus on measuring and describing a variety of physical properties, including color, hardness, reflectivity, electrical conductivity, thermal conductivity, response to magnetic forces and solubility. These observations and measurements are used to produce data that serves as the basis for evidence that can be used to identify materials.
- Students observe, measure, and describe a variety of types of matter, such as baking soda and other powders; metals; minerals; and liquids. Standard units should be used to measure the properties of weight, time, temperature, and volume; however, at this grade level, mass and weight are not distinguished. In addition, students are not expected to understand density as a physical property, and no attempt should be made to define unseen particles or explain the atomic-scale mechanism of evaporation and condensation.
- Students make observations, gather evidence, and develop models in order to understand that matter is made up of particles too small to be seen. Matter of any type can be subdivided into small particles.
- Students will produce data to be used as evidence to support the idea that even though matter is made of particles too small to be seen, matter can still exist and can be detected by means other than seeing. This evidence will be used to support students' thinking as they develop models that depict matter. For example, a model that represents solids at the particle level would show particles tightly packed, while a model that represents gases would show particles moving freely around in space. Observing such phenomena as adding air to expand a basketball, compressing air in a syringe, dissolving sugar in water, or evaporating salt water could help students to understand matter at the particle level and to build models that represent this phenomenon.
- Although engineering design is not explicitly called out in this unit, students could incorporate engineering design in a number of ways as they explore the particle nature of matter.
- Students can design ways/tools to measure a given physical property, such as hardness, reflectivity, electrical or thermal conductivity, or response to magnetic forces. The engineering design process can be used to analyze students' models using criteria. Then students can improve their designs based on analysis.
- Developing and using models to understand that models are representations that assist with communicating and testing of ideas/theories.

Part 2

- In the next section of this unit, students will use mathematical and computational thinking to understand the cause and effect relationship between physical physical changes in matter and conservation of weight. Students need multiple opportunities to observe and document changes in matter due to physical changes. Multiple opportunities are needed in order to analyze data to explain changes that do or do not occur in the physical properties of matter.
- Students begin by planning and conducting investigations to determine whether or not a new substance is made when two or more substances are mixed. As they work with a variety of substances, they should: Measure, observe, and document physical properties (e.g. color, mass, volume, size, shape, hardness, reflectivity, conductivity, and responses to magnetic forces) of 2-3 substances.
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- Mix the original substances
- Measure, observe, and document the physical properties of the substance produced when the original substances are mixed.
- Compare data from the original substances to data from the substance produced, and determine what changes, if any, have occurred.
- Use observations and data as evidence to explain whether or not a new substance was produced, and to explain any changes that occurred when the original substances were mixed.
- It is strongly suggested that teachers demonstrate the experiment and mixing of multiple substances before students begin working independently. Students may not have experience in mixing substances and therefore believe that when combined, the mass or weight of the new substance doesn't change.
- With each set of substances that students investigate, it is important that they use balances to measure the mass of the original substances and the mass of the substance made when the original substances are mixed.
- This data should be documented so that students can analyze the data.
- Students should then compare data from experiment(s) and they should recognize that when two or more substances are mixed, the mass of the resulting substance equals the sum of the masses of the original substances. In other words, the total mass is conserved.
- Conservation of mass is a critical concept that is developed over time; therefore, students need multiple opportunities to investigate this phenomenon. Students should measure: the mass of each substance, document the data they collect in a table or chart, use the data as evidence that regardless of the changes that occur when mixing substances, the total weight of matter is conserved.
- In addition to observing changes that occur when substances are mixed, students should also have opportunities to investigate other types of physical changes. For example, students can observe changes in matter due to heating, cooling, melting, freezing, and/or dissolving.
- As before, students should measure, observe, and document the physical properties of the substance before and after a physical change, and use the data as evidence to explain any changes that occur. The data should also provide evidence that regardless of the type of change that matter undergoes, the mass is conserved.

Foss Investigations that support the above:

Investigation 1 Part 1: Making and Separating Mixtures

Investigation 1 Part 2: Separating a Salt Solution

Investigation 1 Part 3: Separating a Dry Mixture

Investigation 1 Part 4: Outdoor Solutions (Optional)

Investigation 2 Part 1: Black Boxes (modeling and developing a model)

Investigation 2 Part 2: Drought Stopper

Investigation 2 Part 3: Models for Change in Properties

*Note: Primary focus should be on particle models of solids liquids and gasses including movement and spaces of particles. And the changes in melting, freezing, and boiling.

Investigation 3 Part 1: Soft-Drink Recipes (Optional)

Investigation 3 Part 2: Salt Concentration

Investigation 3 Part 3: Mystery Solutions

Investigation 3 Part 4: Liquid Layers

*Note: Concentration is very hard to tackle and there's nothing in NGSS elementary about this. However, if you choose to do this investigation, you should relate it back to particle models of matter.

Investigation 4 and 5 - Are quite complex.

- The biggest thing students need to understand here is that regardless of type of change (physical or chemical, melting, boiling, chemical reaction, etc) the mass of the system stays the same.
- The following are not addressed enough in FOSS:
- Spend more time identifying different materials based on their properties.
- Need to do more of heating and cooling of substances to show that matter is conserved during physical changes

Optional Engineering Design Challenge (Lesson plan provided in "Materials" section

Assessment

Formative: teacher observation, student responses during lessons, exit tickets, science notebook questions/observations

Summative: investigation response sheets, science notebooks, quizzes, Survey/Posttest Questions

Benchmark: iChecks , Student Notebook

Alternative: oral presentation with visual model such as a Google slideshow to demonstrate understanding of concepts, drawing models, FOSS extensions, Google Applied Digital Skills Classroom lessons, Gizmo Lesson Assessment

Standards

P.1	Act as a responsible and contributing community members and employee.
5-PS1-1	Develop a model to describe that matter is made of particles too small to be seen.
P.3	Consider the environmental, social and economic impacts of decisions.
P.4	Demonstrate creativity and innovation.
P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
	Developing and Using Models
P.6	Model integrity, ethical leadership and effective management.
PS1.A	Structure and Properties of Matter
P.8	Use technology to enhance productivity increase collaboration and communicate effectively.
P.9	Work productively in teams while using cultural/global competence.
	Scale, Proportion, and Quantity
	Natural objects exist from the very small to the immensely large.
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.
	Examples of reactions or changes could include phase changes, dissolving, and mixing that form new substances.
	Using Mathematics and Computational Thinking
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.
PS1.B	Chemical Reactions
	No matter what reaction or change in properties occurs, the total weight of the substances does not change.
5-PS1-3	Make observations and measurements to identify materials based on their properties.
	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.
	Planning and Carrying Out Investigations
PS1.A	Structure and Properties of Matter
	Measurements of a variety of properties can be used to identify materials.
RI.CR.5.1	Quote accurately from an informational text when explaining what the text says explicitly and make relevant connections when drawing inferences from the text.
5-PS1-4	Conduct an investigation to determine whether the mixing of two or more substances results in new substances.
RL.MF.5.6	Analyze how visual and multimedia elements contribute to the meaning, tone, or beauty of a text (e.g., graphic novel, multimedia presentation of fiction, folktale, myth, poem).
RI.MF.5.6	Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, timelines, animations, or interactive elements on web pages) and explain how the information contributes to an understanding of the text in which it appears.
MA.5.MD.A	Convert like measurement units within a given measurement system.
MA.5.MD.A.1	Convert among different-sized standard measurement units within a given measurement

	system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real world problems.
MA.5.MD.B	Represent and interpret data.
MA.5.MD.B.2	Make a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8). Use operations on fractions for this grade to solve problems involving information presented in line plots.
MA.5.MD.C	Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition.
SL.PE.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.PE.5.1.B	Follow agreed-upon rules for discussions and carry out assigned roles.
SL.PE.5.1.C	Pose and respond to specific questions by making comments that contribute to the discussion and elaborate on the remarks of others.
SL.PI.5.4	Report on a topic or text or present an opinion, sequencing ideas logically and using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.
SL.UM.5.5	Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes.
ESS3.C	Human Impacts on Earth Systems
	Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments.

Materials

FOSS kit- Unit 1: Mixtures and Solutions

BrainPOP

Science notebook for assessment and journaling

Mystery Science

Core Book List

Science Web Apps for the Classroom

Optional Engineering Design Challenge - Water Treatment Plant

Integrated Accommodations and Modifications, Special Education students, English Language Learners, At-Risk students, Gifted and Talented students, Career Education, and those with 504's

https://docs.google.com/spreadsheets/d/1Pp6EJOCsFz5o4-opzsXpQDQoa6aClW-

bkRGPDRHXVrk/edit?usp=sharing

These additional strategies are helpful when learning Science content and skills:

- Reading texts aloud for students for difficult concepts by utilizing Foss Interactive Science Resource Book, Audio version, or FOSS APP
- Providing opportunities for text-to-speech for written responses.
- Use visual presentations of all materials to include graphic organizers for writing.
- Mark texts with a highlighter.