Unit 1 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 2021

Standards

LA.W.5.1	Write opinion pieces on topics or texts, supporting a point of view with reasons and information.
LA.W.5.6	With some guidance and support from adults and peers, use technology, including the Internet, to produce and publish writing as well as to interact and collaborate with others; demonstrate sufficient command of keyboarding skills to type a minimum of two pages in a single sitting.
LA.W.5.7	Conduct short research projects that use several sources to build knowledge through investigation of different perspectives of a topic.
LA.RI.5.3	Explain the relationships or interactions between two or more individuals, events, ideas, or concepts in a historical, scientific, or technical text based on specific information in the text.
LA.RI.5.4	Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a grade 5 topic or subject area.
LA.RI.5.5	Compare and contrast the overall structure (e.g., chronology, comparison, cause/effect, problem/solution) of events, ideas, concepts, or information in two or more texts.
LA.RI.5.7	Draw on information from multiple print or digital sources, demonstrating the ability to

	locate an answer to a question quickly or to solve a problem efficiently.
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.C.3	Recognize volume as an attribute of solid figures and understand concepts of volume measurement.
MA.5.MD.C.4	Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and non-standard units.
MA.5.MD.C.5	Relate volume to the operations of multiplication and addition and solve real world and mathematical problems involving volume.
MA.5.NF.B.7	Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions.
MA.5.NBT.A.1	Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and 1/10 of what it represents in the place to its left.
CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP2.1	Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.
CRP.K-12.CRP4.1	Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.
CRP.K-12.CRP5	Consider the environmental, social and economic impacts of decisions.
CRP.K-12.CRP5.1	Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organization, and the environment. They are aware of and utilize new technologies, understandings, procedures, materials, and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment and the profitability of the organization.
CRP.K-12.CRP6	Demonstrate creativity and innovation.
CRP.K-12.CRP6.1	Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.
CRP.K-12.CRP7	Employ valid and reliable research strategies.
CRP.K-12.CRP7.1	Career-ready individuals are discerning in accepting and using new information to make decisions, change practices or inform strategies. They use reliable research process to search for new information. They evaluate the validity of sources when considering the use and adoption of external information or practices in their workplace situation.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.

CRP.K-12.CRP8.1	Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.
CRP.K-12.CRP11	Use technology to enhance productivity.
CRP.K-12.CRP11.1	Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring new technology. They are proficient with ubiquitous technology applications. They understand the inherent risks-personal and organizational-of technology applications, and they take actions to prevent or mitigate these risks.
CRP.K-12.CRP12	Work productively in teams while using cultural global competence.
CRP.K-12.CRP12.1	Career-ready individuals positively contribute to every team, whether formal or informal. They apply an awareness of cultural difference to avoid barriers to productive and positive interaction. They find ways to increase the engagement and contribution of all team members. They plan and facilitate effective team meetings.
SCI.5.PS1.A	Structure and Properties of Matter
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SCI.5.PS1.B	Chemical Reactions
SCI.3-5.ETS1.B	Developing Possible Solutions
SCI.3-5-ETS1-3	Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.
SCI.3-5-ETS1	Engineering Design
SCI.5-ESS2-1	Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.
SCI.5-LS2	Ecosystems: Interactions, Energy, and Dynamics
SCI.5-PS1-1	Develop a model to describe that matter is made of particles too small to be seen.
SCI.5-PS1	Matter and its Interactions
SCI.5-PS1-4	Conduct an investigation to determine whether the mixing of two or more substances results in new substances.
SCI.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.
WRK.K-12.P.1	Act as a responsible and contributing community members and employee.
WRK.K-12.P.4	Demonstrate creativity and innovation.
WRK.K-12.P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
TECH.9.4.5.CT.3	Describe how digital tools and technology may be used to solve problems.
TECH.9.4.5.TL.3	Format a document using a word processing application to enhance text, change page formatting, and include appropriate images graphics, or symbols.
TECH.9.4.5.IML	Information and Media Literacy
TECH.9.4.5.IML.2	Create a visual representation to organize information about a problem or issue (e.g., 4.MD.B.4, 8.1.5.DA.3).
	Matter cycles between the air and soil and among plants, animals, and microbes as these

organisms live and die. Organisms obtain gases, and water, from the environment, and release waste matter (gas, liquid, or solid) back into the environment.

Collaborating digitally as a team can often develop a better artifact than an individual working alone.

A system can be described in terms of its components and their interactions.

When two or more different substances are mixed, a new substance with different properties may be formed.

Essential Questions

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.
- 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.
- 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**

Gizmos that support above:

5-PS: Physical Science

5-PS1: Matter and Its Interactions

5-PS1-1: Develop a model to describe that matter is made of particles too small to be seen.

Phase Changes

Phases of Water

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.

Chemical Changes

5-PS1-3: Make observations and measurements to identify materials based on their properties.

Chemical Changes

Circuit Builder

Magnetism

Mineral Identification

Mystery Powder Analysis

Solubility and Temperature

Properties of Matter

5-PS1-4: Conduct an investigation to determine whether the mixing of two or more substances results in new substances.

Chemical Changes

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

Materials

FOSS kit- Unit 1: Mixtures and Solutions

Bill Nye Science Guy/BrainPOP

Science notebook for assessment and journaling

Gizmos (grades 3-5) See learning plan for which Gizmo supports each investigation/concept.

Core Book List

Science Web Apps for the Classroom

Integrated Accommodation and Modifications

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

This link includes content specific accommodations and modifications for all populations:

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.