Stackable Instructionally-embedded Portable Science (SIPS) Assessments Project

Grade 5 Science

Unit 1 Instructional Framework

Matter and Its Interactions

April 2023

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Unit 1 Overview

Storyline Synopsis:

This unit consists of four segments, each engaging students in multiple science and engineering practices as students make sense of the key disciplinary ideas of matter and its properties, physical and chemical changes, and the properties of matter that can be investigated and used to describe substances.

- **Instructional Segment 1:** By engaging in the practices of planning and carrying out investigations, developing and using models, constructing explanations, and obtaining, evaluating, and communicating information, students learn that all matter is made up of particles that are too small to be seen, but that those particles can still be detected. Students then use these understandings to explain the process of "making a cloud in your mouth."
- **Instructional Segment 2:** By engaging in the practices of developing models, analyzing and interpreting data, using mathematical and computational thinking, asking questions, conducting investigations, and constructing explanations, students learn about different properties of substances and that substances can be described using their properties. Students plan and conduct investigations to identify the various types of properties that can be used to identify and describe substances and to investigate a "mystery matter" and determine if it is the same as the substances that were mixed or if it is a new substance.
- **Instructional Segment 3:** By engaging in the practices of developing and using models, planning and carrying out investigations, constructing explanations, analyzing and interpreting data, and obtaining and evaluating information, students observe and measure properties after heating and cooling and when substances are mixed. Students learn about how water in different states is composed of particles too small to be seen and when water changes states, the total weight remains the same. All mixtures in this segment are physical changes; none are chemical changes and thus students do not deal with new substances being formed in this segment. Students also revisit and update their particle model to show a mixture where the particles of the original substances still exist but are now mixed together.
- **Instructional Segment 4:** By engaging in the practices of planning and carrying out investigations, asking questions, constructing explanations, and analyzing and interpreting data, students investigate mixing two substances that result in a new substance. Students learn how to use the properties of substances to determine whether a new substance is formed. Students then investigate whether any matter is added or lost when a new substance is formed, update their particle model to include a mixture that produces a new substance, use data analysis to explain that matter is conserved, and return to the initial anchor phenomenon to explain what went right and what went wrong.

Unit Storyline Framing: *How can we describe and categorize substances?*

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Stage 1 – Desired Results

Overview of Student Learning Outcomes

The Grade 5 Unit 1 Topic Bundle, **"Matter and Its Interactions"** organizes performance expectations with a focus on helping students build an understanding of the structure, properties, and conservation of matter. In addition, students gain an understanding that physical materials can be identified based on their observable and measurable properties and based on those properties, can determine if new substances are formed by mixing two or more substances (i.e., changes in matter). By building familiarity with ideas related to the conservation and particular nature of matter in this unit early in the school year, students are prepared to use this knowledge to explain phenomena and solve design problems when investigating various life and Earth systems in later related units.

Unit 1 Big Ideas:

PS1.A Structure & Properties of Matter	1. Matter can change states (solid, liquid, gas) when heated, cooled, and/or mixed. [prior understanding: PE 2-PS1-1] 2. Matter is made up of particles that are too small to be seen. (5-PS1-1) 3. Certain properties of substances can be used to identify them. (5-PS1-3)
PS1.B Chemical Reactions	4. Mixing two or more substances can lead to the formation of new substances. (5-PS1-4)
PS1.A & PS1.B	5. The total weight of matter does not change, even when it changes form or when new substances are formed. (5-PS1-2)

The SIPS Unit 1 Student Profile describes what students should know and be able to demonstrate prior to and at the culmination of three-dimensional science instruction in Unit 1 to prepare for new and increasingly sophisticated learning opportunities in Unit 2.

Next Generation Science Standards (NGSS) Performance Expectations & Foundation Boxes

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. [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. [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.]

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

Targeted Scientific Practices	Targeted Disciplinary Core Ideas	Targeted Cross-Cutting Concepts
[SEP-2] Developing a Model ● Use models to describe phenomena. **(5-PS1-1)** **[SEP-3] Planning and Carrying Out Investigations** ● Make observations and measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon. **(5-PS1-3)** ● 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)** **[SEP-5] Using Mathematics and Computational Thinking** ● Measure and graph quantities such as weight to address scientific and engineering questions and problems. **(5-PS1-2)**	**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. (**5-PS1-1)** ● The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish. (**5-PS1-2)** ● 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)** **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.) **(5-PS1-2)** ● When two or more different substances are mixed, a new substance with different properties may be formed. **(5-PS1-4)**	**[CCC-2] Cause and Effect** ● Cause and effect relationships are routinely identified and used to explain change. **(5-PS1-4)** **[CCC-3] Scale, Proportion, and Quantity** ● Natural objects exist from the very small to the immensely large. **(5-PS1-1)** ● Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume. **(5-PS1-2) (5-PS1-3)**

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Acquisition Goals
Acquisition Goals are multi-dimensional knowledge-in-use statements that integrate aspects of the NGSS dimensions (SEP & DCI or SEP & DCI & CCC) but are smaller in breadth than a performance expectation. Acquisition Goals describe the essential concepts and key skills a student must acquire to obtain mastery of the unit's objectives and emphasize student understanding as rooted in engagement with the science and engineering practices and not in memorization of science facts. The acquisition goals intentionally include SEP and CCC from outside of the unit's PE bundle.
Students will know and be able to . . .
A1. Describe how properties of matter can be used to compare and contrast materials.
A2. Use mathematical and computational thinking on the properties of substances to identify a substance.
A3. Conduct an investigation to measure and/or qualitatively describe the properties of substances.
A4. Develop or use a model that shows that a substance, regardless of the quantity, is made up of particles too small to be seen.
A5. Construct an explanation to support the claim that substances are made up of particles too small to be seen.
A6. Conduct an investigation to identify a substance by measuring and/or qualitatively describing certain properties of substances.
A7. Obtain, evaluate, and communicate information about how small particles that make up matter can be detected.
A8. Make observations and measurements to produce data about what happens when two (or more) substances are mixed.
A9. Measure and graph weights to produce data that shows that the total weight of substances when heating, cooling, or before or after they are mixed is equal to the total weight of the substance(s) that are formed after they are mixed when a new substance doesn't form.
A10. Construct an explanation to support the claim that when matter changes state, it is still composed of the same particles (that were in the previous state).
A11. Make observations and measurements to produce data that shows the weight of a substance before and after a physical change remains unchanged.
A12. Describe how properties of matter can be used to compare and contrast materials and describe the outcomes of combining substances.
A13. Develop or use a model to determine if substances in different states of matter are made of particles that are too small to be seen.
A14. Conduct an investigation to determine whether the mixing of two or more substances results in new substances. [5-PS1-4]
A15. Conduct an investigation to produce data that shows that the total weight of substances before they are mixed is equal to the total weight of the substance(s) that are formed after they are mixed when a new substance doesn't form.
A16. Make observations and measurements to produce data about which property (or properties) of substances changed after being mixed.

A17. Construct an explanation by comparing properties to determine whether mixing two or more substances results in a new substance.

A18. Analyze and interpret data to identify the pattern that the total weight of substances before they are mixed is equal to the total weight of the substance(s) that are formed after they are mixed.

A19. Collaboratively develop a model based on evidence that shows the relationships among particles when the mixing of two or more substances results in new substances.

A20. Identify/develop testable questions about what happens when two (or more) substances are mixed.

Cross-curricular Integration

Students develop an understanding of matter and its interactions and the structure, properties, and conservation of matter by developing models, making observations, and conducting investigations to demonstrate their understanding. They investigate the properties of matter and determine if new substances are formed when mixing two or more substances. Students use **reading** and **research** skills to acquire **new information and** to **draw on** and **integrate information** from **multiple sources** to **write** or **speak** about the topic and to **construct explanations** with **scientific reasons** and **evidence**. Students use **mathematical practices** such as **reasoning** and **mathematical concepts** related to **measurement, data collection, computation, and graphing** to explain phenomena or create solutions to design problems.

Common Core State Standards for Literacy	Common Core State Standards for Mathematics
Reading Informational **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. **(5-PS1-1)** ***Writing*** **W.5.7** Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic. **(5-PS1-2), (5-PS1-3), (5-PS1-4)** **W.5.8** Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work and provide a list of sources. **(5-PS1-2), (5-PS1-3), (5-PS1-4)** **W.5.9** Draw evidence from literary or informational texts to support analysis, reflection, and research. **(5-PS1-2), (5-PS1-3), (5-PS1-4)**	***Mathematical Practice*** **MP.2** Reason abstractly and quantitatively. **(5-PS1-1), (5-PS1-2), (5-PS1-3)** **MP.4** Model with mathematics**. (5-PS1-1), (5-PS1-2), (5-PS1-3)** **MP.5** Use appropriate tools strategically. **(5-PS1-2), (5-PS1-3)** ***Measurement and Data*** **5.MD.C.3** Recognize volume as an attribute of solid figures and understand concepts of volume measurement. **(5-PS1-1)**

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Enduring Understandings	*Essential Questions*
Students will understand that . . .	
EU1. We can use different types of models to represent particles too small to be seen. **EU2.** Patterns of properties can be used to identify, describe, and compare substances. Patterns of certain properties can be used to describe and explain whether new substances are formed when substances are mixed. **EU3.** Matter can change form through physical and chemical changes, but through any of these changes, the total weight of matter is conserved. **EU4.** Scientific explanations are based on evidence and reasoning. Data collected from an investigation can be analyzed and compared to provide the most relevant evidence for an explanation.	**EQ1.** How can I use models to represent and explain something I cannot see? **EQ2.** How can I identify, describe, and categorize substances? **EQ3.** How can matter change? **EQ4.** How do I use evidence and reasoning effectively to evaluate an explanation? How much evidence is needed to support an argument?

Vocabulary		
● Matter	● Gas	● Volume
● Substance	● Physical change	● Particle
● Chemical change	● Model	● Conservation of mass
● Solid	● Particle arrangement	● Mixture
● Liquid	● Weight	● Solution
● Condensation	● Evaporation	● Filtration
● Filtrate	● Residue	● Precipitation

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Stage 2 – Assessment Evidence

Assessment Overview

For each of the acquisition goals listed in the Stage 1 – Desired Results, evidence statements were developed. These statements provide information on what we would want to see students do to determine the degree to which students have met the acquisition goals. These acquisition goals and evidence statements were then sequenced into instructional segments. Evidence statements and acquisition goals that were deemed critical were identified and assessment opportunities were developed. For this unit, four segments were identified. An overview of each segment is provided below.

Instructional Segment 1 focuses on Big Ideas 1 and 2 and students' abilities to use models and analyze data to explore physical states of substances and the idea that matter is made up of particles too small to be seen. Students are formally assessed on using models to support an argument that matter is made up of particles too small to be seen and their ability to describe properties of substances as they are heated and/or cooled. Students are informally assessed on these same abilities as well as their ability to engage in investigations centered around the particulate nature of matter.

Instructional Segment 2 focuses on Big Ideas 2 and 3 and students' abilities to identify a substance using its properties. Students are both formally and informally assessed on using models to describe the properties and their abilities to identify a substance through investigations.

Instructional Segment 3 focuses on Big Ideas 1 and 5 and students' abilities to describe properties of substances that are mixed without forming a new substance. Students are formally assessed on how they can engage with investigation and modeling to support claims that properties and weights do not change when substances are mixed. Students also use and/or develop a model to support claims that particles in the substances do not change after mixing (when no new substance is formed). Students are informally assessed on these abilities as well as their abilities to use data.

Instructional Segment 4 focuses on Big Ideas 4 and 5 and students' abilities to describe properties of substances that are mixed to form a new substance. Students are formally assessed on how they can engage with investigations, and how well they can use data to support claims that (1) a new substance was formed and (2) no matter was created, and no matter was destroyed when the new substance was formed. Students are informally assessed on these abilities as well.

End-of-Unit Stackable, Instructionally-embedded, Portable Science (SIPS) Assessment:

For the end-of-unit SIPS assessment, students engage in three scenario-based assessment tasks. The tasks focus on the PEs: 5-PS1-1, 5-PS1-2, 5-PS1-3, and 5-PS1-4.

Instructionally-Embedded Assessments

For each instructional segment, descriptions of *informal* and *formal* instructionally-embedded assessments are included based on the acquisition goals and evidence statements deemed critical to assess along an instructional plan. Informal assessments defined as "in the moment" assessment opportunities identify student challenges and lack of knowledge or misconceptions and could include class check-ins such as discussion prompts, exit tickets, or graphic organizers. Formal assessments measure how well students perform when engaging with more complex tasks that require integration of the dimensions (SEPs, DCIs, CCCs) in the service of sense-making. They are administered at specific, intentional points in time along an instructional plan before or after a lesson or a series of lessons. Examples include performance tasks, concept maps, research projects, or hands-on tasks.

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Instructionally-embedded Assessments for Use during Instructional Segment 1

Informal Assessment: Classroom Check-ins About Particle Theory of Matter

At various points in time during Segment 1 of instruction, educators can use informal classroom check-ins (e.g., exit tickets and in the moment questions) to gather evidence of students' abilities to gather evidence and obtain information from text and/or related media to support a claim that substances are made of particles too small to be seen.

Assessment Purpose and Use

- Used daily during the course of instruction, for formative purposes to gauge where students are in their learning.
- Identify in which concepts and practices students are gaining proficiency.
- Identify which concepts and practices students are having trouble with.
- Determine next steps and instructional activities for the class and/or individual students.

Administration Time: 5 minutes

Scoring Time: 2-3 minutes

Assessment Type(s)

Informal - Classroom Check-In

Assessment Sub-Type(s)

Exit Tickets

In-the-moment Questions

Discussion prompts

These assessments will assess students' ability to:

- Construct an explanation to accurately support a claim that a given substance in two different quantities is still made up of the same particles that are too small to be seen.
- Evaluate information to correctly determine whether or not it supports a claim that small particles that make up matter can be detected using the instruments.
- Accurately identify and/or describe the information in a model/evidence that supports the idea/claim that the two different amounts of a given substance are made up of the same particles that are too small to be seen.
- Use the information provided in a model to accurately explain that two different amounts of a given substance are made up of the same particles that are too small to be seen.
- Accurately identify and/or describe the information from text and/or related media that supports a claim that small particles that make up matter can be detected using the instruments.
- Develop a model that accurately represents that the particles of a substance in multiple quantities are the same and made up of particles that are too small to be seen.

Stage 1 & Stage 3 Associations:

Stage 3 Connection(s):	NGSS PEs:	CCSS:	EUs/EQs:	AGs:
• What is Air? • Zooming in on Air • Weight of Water • Three States of Water: Ice, Steam, and Liquid. Are They All the Same? • How Did We Make a Cloud in Our Mouth?	5-PS1-1	RI.5.7 W.5.9 MP.5	EU2/EQ2 EU4/EQ4	A3* A4 A5 A7 A9* A10 A11*

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Informal Assessment: Annotated Drawings: Particle Theory of Matter

As students engage in science content, they also engage in scientific practices such as drawing pictures with labels, arrows, and other symbols that represent their learning experiences. Teachers can utilize these informal drawings to check for student understanding and learn about matter and its properties. Students can utilize these drawings and notes to support their development of scientific explanations. Students create representations of demonstrations and experiments that support the claim that matter is made up of particles too small to be seen. For example, drawings show how air is compressible because it is made of particles that are spread apart, while solids and liquids are not compressible because their particles are more densely packed.

Assessment Purpose and Use

- Used periodically by students to document hands-on activities, phenomenon, and other learning experiences in multimodal ways.
- Provides check for understanding of the scientific principles behind phenomena.
- Provide opportunities for students to engage with the practices of the discipline along with the content.
- Measure how well students perform when provided more complex tasks and opportunities to engage in a meaningful way with the content in the curriculum.

Administration Time: 15 minutes

Scoring Time: 5 minutes

Assessment Type(s)

Informal - Classroom Check-In

Assessment Sub-Type(s)

Graphic Organizers

These assessments will assess students' ability to:

- Accurately identify information in a model/evidence that describes appropriate properties of air as having mass, taking up space, and being made of particles too small to be seen and spread apart.
- Accurately identify information in a model/evidence that describes properties of liquids as having mass, taking up space, and being made of particles close together but able to move about.
- Construct an explanation to accurately support a claim that a given substance in different states of matter is made up of the same particles that are too small to be seen.
- Make appropriate observations and/or measurements to produce data that will help determine the properties of solids, liquids, and gases.
- Generate accurate graphs of data on the properties of solids, liquids, and gases.
- Draw appropriate conclusions from data about the properties of solids, liquids, and gases.

Stage 1 & Stage 3 Associations:

Stage 3 Connection(s):	NGSS PEs:	CCSS:	EUs/EQs:	AGs:
● What is Air? ● Zooming in on Air ● Three States of Water: Ice, Steam, and Liquid. Are They All the Same?	5-PS1-1	W.5.7 MP.2 5.MD.C.3	EU1/EQ1 EU4/EQ4	A4 A5 A10 A13

Formal Assessment: Conducting Investigations on the States of Matter

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Students identify evidence and use the information provided in a model to explain that a substance, regardless of the quantity, is made up of particles that are too small to be seen.

Assessment Purpose and Use:

- Determine next steps and instructional activities for the class and/or individual students.
- Check students' understanding throughout and at the culmination of the lessons within the segment.
- Determine if reteaching is required prior to advancing to the next lesson.
- Provide information to support differentiated instruction.
- Assess clarity of instruction.
- Provide opportunities for students to engage with the practices of the discipline along with the content.
- Measure how well students perform when provided more complex tasks and opportunities to engage in a meaningful way with the content in the curriculum.

Administration Time: 15-50 minutes

Scoring Time: 5-15 minutes

Assessment Type

Formal - Short Performance Task

Formal - Extended Performance Task

Assessment Sub-Type(s)

Lab/Experiment

Design Project

Hands-on Task

Scenario/Phenomena-based Assessment Task

These assessments will assess students' ability to:

- Identify and/or describe the evidence that supports a claim that substances, regardless of the quantity, are made up of particles that are too small to be seen.
- Accurately describe changes (and/or what stays the same) in observed properties after a physical change.
- Accurately identify and/or describe the evidence that supports a claim that a given substance in different states of matter is made up of the same particles that are too small to be seen.
- Construct an explanation to accurately support a claim that a given substance in different states of matter is made up of the same particles that are too small to be seen.

Stage 1 & Stage 3 Associations:

Stage 3 Connection(s):	NGSS PEs:	CCSS:	EUs/EQs:	AGs:
● Weight of Water ● Three States of Water: Ice, Steam, and Liquid. Are They All the Same?	5-PS1-1 5-PS1-2	RI.5.7 W.5.9 MP.5	EU1/EQ1 EU3/EQ3 EU4/EQ4	A5 A6* A9* A10 A11 A18*

Formal Assessment: What is Air?

To model the process for writing a scientific explanation, students create an organized series of drawings and notes that help them to support the claim that air is made up of tiny particles too small to see. Students sort their annotated drawings and ideas from their notebooks into a logical order as part of a

graphic organizer and then use additional elements of the graphic organizer to make explicit connections between the drawings and ideas to show how they support the idea that air is made up of particles.

Assessment Purpose and Use

- Documents hands-on activities, phenomenon, and other learning experiences in multimodal ways.
- Provides a check for understanding of the scientific principles behind phenomena.
- Provide opportunities for students to engage with the practices of the discipline along with the content.
- Measure how well students perform when provided more complex tasks and opportunities to engage in a meaningful way with the content in the curriculum.

Administration Time: 60 minutes

Scoring Time: 10 minutes

Assessment Type(s)

Formal - Short Performance Task

Formal - Extended Performance Task

Assessment Sub-Type(s)

Graphic Organizers

These assessments will assess students' ability to:

- Develop a model that accurately represents that the substances are made up of particles that are too small to be seen.
- Accurately identify and/or describe the evidence that supports a claim that substances are made up of particles that are too small to be seen.
- Construct an explanation to accurately support a claim that substances are made up of particles that are too small to be seen.

Stage 1 & Stage 3 Associations:

Stage 3 Connection(s):	NGSS PEs:	CCSS:	EUs/EQs:	AGs:
● What is Air?	5-PS1-1	MP.2	EU1/EQ1	A4
	5-PS1-2	MP.4		A5

Formal Assessment: Three States of Water: Ice, Steam, and Liquid. Are They All the Same?

Students conduct research about water, the water cycle, and the different phase changes that occur. Students gather data as they conduct their research and record their data in notes and a variety of graphic organizers. Students use this learning and learning from other investigations to explain how each state of water is water using annotated drawings and writing.

Assessment Purpose and Use

- Provide an opportunity for students to apply their knowledge to a particular question, or to demonstrate their ability to research a specific topic.
- Allow students to demonstrate how they would apply concepts over an extended period of time.

Administration Time: 100 minutes

Scoring Time: 30 minutes

Assessment Type(s)

Formal - Research Project

Assessment Sub-Type(s)

Concept Map

Research Report

These assessments will assess students' ability to:

- Accurately identify and/or describe the information in a model that supports the idea that substances in different states of matter are made up of particles that are too small to be seen.

- Use the information provided in a model to accurately explain that substances in different states of matter are made up of particles that are too small to be seen.
- Construct an explanation to accurately support a claim that a given substance in different states of matter is made up of the same particles that are too small to be seen.

Stage 1 & Stage 3 Associations:

Stage 3 Connection(s):	NGSS PEs:	CCSS:	EUs/EQs:	AGs:
• Three States of Water: Ice, Steam, and Liquid. Are They All the Same?	5-PS1-1 5-PS1-2	MP.2 MP.4	EU1/EQ1 EU4/EQ4	A4* A9* A10 A11* A13

Formal Assessment: How Did We Make a Cloud in Our Mouth?

Students use models and write an explanation for the phenomenon in How to Make a Cloud in Your Mouth. Students explain the purpose of each of the steps of the phenomenon making explicit connections to learning investigations from Segment 1. Students explain the purpose of the tongue click and the pressurization of the mouth. Students include illustrative drawings to show the evaporation occurring, the heating of the air, and then the condensation.

Assessment Purpose and Use

- Provide opportunities for students to engage with the practices of the discipline along with the content.
- Measure how well students perform when provided more complex tasks and opportunities to engage in a meaningful way with the content in the curriculum.

Administration Time: 50 minutes

Scoring Time: 20-30 minutes

Assessment Type(s)

Formal - Short Performance Task

Assessment Sub-Type(s)

Scenario/Phenomena-based Assessment Task

These assessments will assess students' ability to:

- Develop a model that accurately represents that the substances are made up of particles that are too small to be seen.
- Accurately identify and/or describe the evidence that supports a claim that substances are made up of particles that are too small to be seen.
- Construct an explanation to accurately support a claim that substances are made up of particles that are too small to be seen.
- Accurately identify and/or describe the information in a model that supports the idea that substances in different states of matter are made up of particles that are too small to be seen.
- Use the information provided in a model to accurately explain that substances in different states of matter are made up of particles that are too small to be seen.

Stage 1 & Stage 3 Associations:

Stage 3 Connection(s):	NGSS PEs:	CCSS:	EUs/EQs:	AGs:
● What is Air? ● Three States of Water: Ice, Steam, and Liquid. Are They All the Same?	5-PS1-1 5-PS1-2	MP.2 MP.4 W.5.8	EU1/EQ1 EU4/EQ4	A4 A5 A10 A13

Instructionally-embedded Assessments for Use during Instructional Segment 2

Informal Assessment: Matter and Its Properties

As students engage in science content, they also engage in scientific practices such as drawing pictures with labels, arrows, and other symbols that represent their learning experiences. Teachers can utilize these informal drawings to check for student understanding and learn about matter and its properties. Students can utilize these drawings and notes to support their development of scientific explanations. Students, using a graphic organizer, classify each substance as a solid, liquid, or gas, draw the arrangement of its particles, and add onto other properties of that particular substance such as its electrical and magnetic conductivity, mass, volume, thermal conductivity, etc.

Assessment Purpose and Use

- Used periodically by students to document hands-on activities, phenomenon, and other learning experiences in multimodal ways.
- Provides a check for understanding of the scientific principles behind phenomena.
- Provide opportunities for students to engage with the practices of the discipline along with the content.
- Measure how well students perform when provided more complex tasks and opportunities to engage in a meaningful way with the content in the curriculum.

Administration Time: 15 minutes

Scoring Time: 5 minutes

Assessment Type(s)

Informal - Classroom Check-In

Assessment Sub-Type(s)

Graphic Organizers

These assessments will assess students' ability to:

- Accurately identify and/or describe appropriate properties of matter to use when comparing and contrasting materials.
- Accurately identify and/or describe properties of matter after combining substances.
- Accurately compare and contrast properties of matter before and after combining substances.
- Make appropriate observations and/or measurements to produce data that will help determine the properties of a substance.
- Generate accurate graphs of data on the properties of a substance.
- Draw appropriate conclusions from data about the properties of a substance.

Stage 1 & Stage 3 Associations:

Stage 3 Connection(s):	NGSS PEs:	CCSS:	EUs/EQs:	AGs:
● What is Air? (Segment 1) ● What is This? ● What Could it Be?	5-PS1-1 5-PS1-3	MP.5 5.MD.C.3	EU1/EQ1 EU3/EQ3	A1 A3 A6

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Formal Assessment: Investigating the Mystery Matter

Students design a procedure to investigate the physical properties of a variety of substances that may be part of the mystery matter. Students decide what physical properties to be investigated as a class and then plan out their own investigation, decide which tools to use, and how many trials to run. Students then conduct their investigation and record their data.

Assessment Purpose and Use

- Provide opportunities for students to engage with the practices of the discipline along with the content.
- Measure how well students perform when provided more complex tasks and opportunities to engage in a meaningful way with the content in the curriculum.

Administration Time: 100 minutes

Scoring Time: 30 minutes

Assessment Type(s)

Formal - Short Performance Task

Assessment Sub-Type(s)

Lab/Experiment

These assessments will assess students' ability to:

- Make appropriate observations and/or measurements to produce data that will help identify a substance.
- Generate accurate graphs from data about the properties of a substance.
- Identify and/or describe appropriate patterns in data on the properties of a substance.
- Draw appropriate conclusions from data about the identity of a substance.
- Accurately describe the procedure for an investigation to determine the properties of a substance.

Stage 1 & Stage 3 Associations:

Stage 3 Connection(s):	NGSS PEs:	CCSS:	EUs/EQs:	AGs:
● Investigating the Mystery Matter	5-PS1-3	RI.5.7	EU2/EQ2	A2
		W.5.7	EU4/EQ4	A3
		W.5.8		A6
		W.5.9		
		MP.2		

Formal Assessment: What is the Mystery Matter?

Students write a claim for the different parts of the mixture "magnetic slime" and provide evidence and reasoning to support that claim. Students refer back to data gathered during *Investigating the Mystery Matter,* connecting the physical properties observed to the physical properties of magnetic slime.

Assessment Purpose and Use

- Provide opportunities for students to engage with the practices of the discipline along with the content.
- Measure how well students perform when provided more complex tasks and opportunities to engage in a meaningful way with the content in the curriculum.

Administration Time: 60 minutes

Scoring Time:10 minutes

Assessment Type(s)

Formal - Short Performance Task

Assessment Sub-Type(s)

Scenario/Phenomena-based Assessment Task

These assessments will assess students' ability to:

- Make appropriate observations and/or measurements to produce data that will help identify a substance.
- Identify and/or describe appropriate patterns in data on the properties of a substance.
- Draw appropriate conclusions from data about the identity of a substance.

Stage 1 & Stage 3 Associations:

Stage 3 Connection(s):	NGSS PEs:	CCSS:	EUs/EQs:	AGs:
● What is the Mystery Matter?	5-PS1-3	W.5.7 W.5.8 W.5.9 MP.2 RI.5.7	EU2/EQ2 EU4/EQ4	A2 A3* A10*

Instructionally-embedded Assessments for Use during Instructional Segment 3

Informal Assessment: Annotated Drawings of Physical Changes

As students engage in science content, they also engage in scientific practices such as drawing pictures with labels, arrows, and other symbols that represent their learning experiences to compare arrangements of particles in different types of physical changes (for example, miscible vs immiscible solutions). Teachers can utilize these informal drawings to check for student understanding as students progress through the learning experiences. Students can utilize these drawings and notes to support their development of scientific explanations.

Assessment Purpose and Use

- Used periodically by students to document hands-on activities, phenomenon, and other learning experiences in multimodal ways.
- Provides check for understanding of the scientific principles behind phenomena.
- Provide opportunities for students to engage with the practices of the discipline along with the content.
- Measure how well students perform when provided more complex tasks and opportunities to engage in a meaningful way with the content in the curriculum.

Administration Time: 15 minutes

Scoring Time: 5 minutes

Assessment Type(s)

Informal - Classroom Check-In

Assessment Sub-Type(s)

Scenario/Phenomena-based Assessment Task

These assessments will assess students' ability to:

- Develop a model that accurately represents that the particles of a substance in multiple quantities are the same and made up of particles that are too small to be seen.
- Make appropriate observations of a substance before and after a physical change.
- Generate representations of data about properties of substances before and after they are mixed.

Stage 1 & Stage 3 Associations:

Science
Grade: 5 Unit: 1
20 days of instruction

Stage 3 Connection(s):	NGSS PEs:	CCSS:	EUs/EQs:	AGs:
● Colors on the Mooove ● Messin' with Mixtures	MS-PS-1-2	W.5.8 MP.2 MP.4	EU1/Q1 EU2/EQ2 EU3/EQ3	A4 A8 A10* A11*

Formal Assessment: Weight of Water

While conducting several investigations on changes in the state of water, students collect data that supports multiple representations of what occurs. They collect data to record in tables and graphs of mass and volume, make drawings with labels and diagrams at the visual scale and particle scale, write text in paragraphs describing what occurred, and then create a multimodal presentation such as a short social media video that explains what is happening for the phase changes.

Assessment Purpose and Use

- Provide opportunities for students to engage with the practices of the discipline along with the content.
- Measure how well students perform when provided more complex tasks and opportunities to engage in a meaningful way with the content in the curriculum.

Administration Time: 50-100 minutes

Scoring Time: 20 minutes

Assessment Type(s)

Formal - Short Performance Task

Assessment Sub-Type(s)

Scenario/Phenomena-based Assessment Task

Sample Instructionally-embedded Assessment Task: "Weight of Water"

These assessments will assess students' ability to:

- Accurately identify and/or describe how an instrument can be used to determine the properties of substances.
- Accurately describe the procedure for an investigation to determine the properties of a substance.
- Make appropriate observations and/or measurements to produce data that will help determine the properties of a substance.
- Generate accurate graphs of data on the properties of a substance before and after a physical change.
- Measure and graph the weight of water in different phases.
- Describe the changes that occur when a substance changes states.
- Accurately describe changes (and/or what stays the same) in observed properties after a physical change.
- Accurately identify and/or describe the information in a model that supports the idea that substances in different states of matter are made up of particles that are too small to be seen.
- Use the information provided in a model to accurately explain that substances in different states of matter are made up of particles that are too small to be seen.

Science
Grade: 5 Unit: 1
20 days of instruction

Stage 1 & Stage 3 Associations:

Stage 3 Connection(s):	NGSS PEs:	CCSS:	EUs/EQs:	AGs:
● Weight of Water	5-PS1-2	MP.2 MP.5 5.MD.C.3 W.5.7	EU1/EQ1 EU3/EQ3	A1* A3 A9 A10* A11 A13

Formal Assessment: Messin' with Mixtures

Students are presented with examples of mixtures and solutions and challenged to develop ways to separate them back into their individual components utilizing their physical properties. For each situation, students are provided with a list of resources they could use. Examples of challenges could be: finding lost steel parts in dirt/sand, removing toxic compounds from soil, removing oil from an oil spill, or cleaning trash from a river or the ocean. In each situation, students clearly state why it is possible or impossible to separate the mixtures.

Assessment Purpose and Use

- Provide a measure of how well students are able to engage with the concepts taught in the curriculum.
- Questions are generally tied closely to the concepts as they are taught in the curriculum.
- While they can provide formative information, they are generally not designed to provide in-depth information for each of the concepts and instead provide an overview of student performance across a range of concepts.

Administration Time: 30 minutes

Scoring Time: 5 minutes

Assessment Type(s)

Formal - Quiz

Assessment Sub-Type(s)

Other

These assessments will assess students' ability to:

- Accurately compare and contrast properties of matter before and after combining substances.
- Accurately identify and/or describe the evidence that supports a claim about whether or not mixing two substances results in a new substance.

Stage 1 & Stage 3 Associations:

Stage 3 Connection(s):	NGSS PEs:	CCSS:	EUs/EQs:	AGs:
● Messin' with Mixtures	5-PS-1-2	MP.2	EU2/EQ2 EU3/EQ3	A10* A12 A17

Formal Assessment: Why Did it Mooove?

Students return to the segment phenomenon as introduced in *Colors on the Mooove* and finalize their explanation of why the colors break up and spread apart when soap is added to the milk. Students highlight that even though milk is homogenous, it is a solution and it can be separated, which the soap does. Students make connections between the evidence and annotation from observing the

phenomenon and notes from outside resources to their claim about the phenomenon using logic and reasoning.

Assessment Purpose and Use

- Provide opportunities for students to engage with the practices of the discipline along with the content.
- Measure how well students perform when provided more complex tasks and opportunities to engage in a meaningful way with the content in the curriculum.

Administration Time: 30- 50 minutes

Scoring Time: 15 minutes

Assessment Type(s)

Formal - Short Performance Task

Assessment Sub-Type(s)

Scenario/Phenomena-based Assessment Task

These assessments will assess students' ability to:

- Accurately compare and contrast properties of matter before and after combining substances.
- Draw appropriate conclusions from data about which properties of substances change after being mixed.
- Accurately describe which properties of a substance are changed and how they are changed after being mixed.
- Construct an explanation to accurately support a claim that a given substance in different states of matter is made up of the same particles that are too small to be seen.

Stage 1 & Stage 3 Associations:

Stage 3 Connection(s):	NGSS PEs:	CCSS:	EUs/EQs:	AGs:
● Why Did it Mooove?	5-PS1-2	RI.5.7	EU2/EQ2	A10
		W.5.8	EU3/EQ3	A12
		W.5.9	EU4/EQ4	
		MP.2		

Instructionally-embedded Assessments for Use during Instructional Segment 4

Informal Assessment: Annotated Drawings: Formation of New Substances

As students engage in science content, they also engage in scientific practices such as drawing pictures with labels, arrows, and other symbols that represent their learning experiences to explain how a new substance is formed when two or more substances react or are mixed together. Teachers can utilize these informal drawings to check for student understanding as students progress through the learning experiences. Students can utilize these drawings and notes to support their development of scientific explanations.

Assessment Purpose and Use

- Used periodically by students to document hands-on activities, phenomenon, and other learning experiences in multimodal ways.
- Provides check for understanding of the scientific principles behind phenomena.
- Provide opportunities for students to engage with the practices of the discipline along with the content.

Administration Time: 60 minutes

Scoring Time: 10 minutes

Assessment Type(s)

Informal - Classroom Check-In

Assessment Sub-Type(s)

Discussion prompts

Other

- Measure how well students perform when provided more complex tasks and opportunities to engage in a meaningful way with the content in the curriculum.

These assessments will assess students' ability to:

- Accurately identify and/or describe the information in a model that supports the idea that a given substance in two different quantities is made up of the same particles that are too small to be seen.
- Use the information provided in a model to accurately explain that a given substance in two different quantities is made up of the same particles that are too small to be seen.

Stage 1 & Stage 3 Associations:

Stage 3 Connection(s):	NGSS PEs:	CCSS:	EUs/EQs:	AGs:
• Where Did it Go? • What Happened? • Modeling New Substance Formation	5-PS1-4	W.5.8 MP.2	EU2/EQ2 EU3/EQ3	A19

Formal Assessment: How Did the Balloon Fill?

The teacher demonstrates to students a chemical reaction in which a balloon is filled with carbon dioxide by a reaction of baking soda and an acid such as vinegar. Students gather observational and numeric data during the demonstration and then conduct additional research to understand the process of a chemical reaction that leads to the formation of products such as carbon dioxide. Students use their data and evidence from their research to write an explanation of the phenomenon and make connections back to the anchoring phenomenon.

Assessment Purpose and Use

- Provide opportunities for students to engage with the practices of the discipline along with the content.
- Measure how well students perform when provided more complex tasks and opportunities to engage in a meaningful way with the content in the curriculum.

Administration Time: 50 minutes

Scoring Time: 30 minutes

Assessment Type(s)

Formal - Short Performance Task

Assessment Sub-Type(s)

Scenario/Phenomena-based Assessment Task

Sample Instructionally-embedded Assessment Task: "How Did the Balloon Fill?"

These assessments will assess students' ability to:

- Accurately identify and/or describe the evidence that supports a claim about whether or not mixing two substances results in a new substance.
- Construct an appropriate explanation to support a claim about whether or not mixing two substances results in a new substance.

Stage 1 & Stage 3 Associations:

Science
Grade: 5 Unit: 1
20 days of instruction

Stage 3 Connection(s):	NGSS PEs:	CCSS:	EUs/EQs:	AGs:
● Where Did it Go? ● What Happened?	5-PS-1-4	RI.5.7 W.5.8 W.5.9	EU2/EQ2 EU3/EQ3 EU4/EQ4	A14* A17

Formal Assessment: Physical Change or Chemical Change?

Students are presented with several different scenarios which are examples of physical changes or chemical changes. Students are presented with data about physical properties, weights, and representations of what occurred when the substances were mixed. Students are tasked with determining the type of change that occurred and citing evidence from what was provided to support that answer.

Assessment Purpose and Use

- Provide a measure of how well students are able to engage with the concepts taught in the curriculum.
- Questions are generally tied closely to the concepts as they are taught in the curriculum.
- While they can provide formative information, they are generally not designed to provide in-depth information for each of the concepts and instead provide an overview of student performance across a range of concepts.

Administration Time: 20 minutes

Scoring Time: 10-15 minutes

Assessment Type(s)

Formal - Quiz

Assessment Sub-Type(s)

Scenario/Phenomena-based Assessment Task

These assessments will assess students' ability to:

- Accurately compare and contrast properties of matter before and after combining substances.
- Accurately identify and/or describe the evidence that supports a claim about whether or not mixing two substances results in a new substance.

Stage 1 & Stage 3 Associations:

Stage 3 Connection(s):	NGSS PEs:	CCSS:	EUs/EQs:	AGs:
● Messin' with Mixtures (Segment 3) ● Why Did it Mooove? (Segment 3) ● Where Did it Go? ● What Happened? ● Modeling New Substance Formation	5-PS1-2 5-PS1-4	MP2 W.5.8	EU2/EQ2 EU3/EQ3 EU4/EQ4	A12 A14* A18 A19*

Formal Assessment: What Happened in The Anchoring Phenomenon

After completing the various learning experiences in the unit, students return to the anchoring phenomenon to create a multimodal scientific explanation based on a claim they have that explains what occurred in the anchoring phenomenon. For example, students develop a claim to answer the question, what went wrong when baking the bread? Students then use evidence gathered over the course of the unit to explain what occurred for the particular phenomenon, connecting the evidence to their claim using logic and reasoning.

Science
Grade: 5 Unit: 1
20 days of instruction

Assessment Purpose and Use

- Provide a measure of how well students are able to engage with the concepts taught in the curriculum.
- Questions are generally tied closely to the concepts as they are taught in the curriculum.
- While they can provide formative information, they are generally not designed to provide in-depth information for each of the concepts and instead provide an overview of student performance across a range of concepts.

Administration Time: 50 – 100 min

Scoring Time: 30 min

Assessment Type(s)

Formal - Extended Performance Task

Assessment Sub-Type(s)

Scenario/Phenomena-based Assessment Task

These assessments will assess students' ability to:

- Accurately identify and/or describe the evidence that supports a claim that a given substance in two different quantities is still made up of the same particles that are too small to be seen.
- Construct an appropriate explanation and identify the evidence to support a claim about whether or not mixing two substances results in a new substance.
- Accurately identify and/or describe properties of matter after combining substances.
- Accurately compare and contrast properties of matter before and after combining substances.

Stage 1 & Stage 3 Associations:

Stage 3 Connection(s):	NGSS PEs:	CCSS:	EUs/EQs:	AGs:
• What Went Right? • What Went Wrong?	5-PS1-1 5-PS-1-4	MP.2 W.5.8	EU2/EQ2 EU3/EQ3 EU4/EQ4	A1* A10 A12 A17

Guidance for Equitable Assessments for Diverse Learners

How do we optimize accessibility for diverse learners and why is this important? Designing Equitable Assessments for Diverse Learners provides steps to planning and developing equitable assessments that incorporate the principles of Universal Design for Learning (UDL) and the elements of Universally Designed Assessments (UDA). Both UDL and UDA are designed to promote access to instruction and/or assessment to the widest range of students. This includes, but is not limited to, students with varying abilities, cultures, primary languages, background knowledge, and interests. For more information about equitable assessment design and use, and why it is important, view *Chapter 4: Fairness and Accessibility* of the Strengthening Claims-based Interpretations and Uses of Local and Large-scale Science Assessment Scores (SCILLSS) Digital Workbook on Educational Assessment Design and Evaluation: Creating and Evaluating Effective Educational Assessments.

Assessment Resources

Stage 2 Instructionally-embedded Classroom Assessment Resources:

Segment 2

- Performance Assessment Resource Bank Performance Tasks Gr5

[https://www.performanceassessmentresourcebank.org/bin/performance-tasks]

- Wonder of Science Assessment Drafts Gr5
  [https://thewonderofscience.com/draft-assessment]
- KY Through Course Task Example Gr5 Matter Models Evap of Water
  [https://education.ky.gov/curriculum/conpro/science/Documents/Matter_Models_TCT.pdf]
- Wisconsin Assessment Ex 5th Grade Matter Task
  [https://dpi.wi.gov/science/assessment/examples]
- Stanford Assessment Ex's Instructionally Embedded Tasks
  [https://scienceeducation.stanford.edu/snap/assessments/instructionally-embedded-assessments]
- Stanford Assessment Ex's Short Performance Assessments
  [https://scienceeducation.stanford.edu/snap/assessments/short-performance-assessments]
- Exemplars Sample Performance Tasks Gr3-5
  [https://exemplars.com/sample-performance-tasks/ngss-science-samples]
- TGR Foundation Design Challenge Tasks
  [https://tgrfoundation.org/designchallenges/]
- TeachEngineering STEM K12 EditorsPicksProjects
  [https://www.teachengineering.org/editorspicks

Segment 3

- Ambitious Science Teaching Guide-Face-to-Face-Tools.pdf
  [http://ambitiousscienceteaching.org/wp-content/uploads/2014/08/Guide-Face-to-Face-Tools.pdf]
- Ambitious Science Teaching Tools Face to Face Website
  [https://ambitiousscienceteaching.org/tools-face-to-face/]
- Uncovering Student Ideas Through Formative Assessment (Page Keely)
  [https://www.uncoveringstudentideas.org/]
- Science 3D Rubrics for Arapaho CO
  [https://arapahoe.adams12.org/sites/arapahoe.d7sb.adams12.org/files/attachments/Science GRC.pdf]
- GTS Rubric for Explanations
  [https://docs.google.com/document/d/1MuZSdFCgGaObNxyPTQnfNoN4twptJA6hvKMjZ2pyzoc/edit]
- Science Practices Continuums by Science Practices Leadership
  [C:\Users\ErinBuchanan\AppData\Local\Box\Box Edit\Documents\n4YLwIXNf0qJpqDmcAhmig==\temp]
- CCSSO Using Crosscutting Concepts to Prompt Student Responses
  [https://ccsso.org/sites/default/files/2018-06/Using Crosscutting Concepts To Prompt Student Responses Science.pdf]
- Integrating Science Practices in Assessment StemTeachTool30

[http://stemteachingtools.org/assets/landscapes/STEM-Teaching-Tool-30-Task-Formats-for-3D-Assessment-Design-v2_a11y.pdf]

- Integrating Crosscutting Concepts in Assessment StemTeachingTool41
  [http://stemteachingtools.org/assets/landscapes/STEM-Teaching-Tool-41-CrossCuttingConceptsRPC.pdf]
- Informal Formative Assessment Cycle StemTeachingTool16
  [http://stemteachingtools.org/brief/16]
- Classroom Talk Formative Assessment StemTeachingTool
  [http://stemteachingtools.org/sp/talk-resource-tool-classroom-talk-as-a-formative-assessment-opportunity]
- Teachers Guide Classroom Conversation StemTeachingTool48
  [http://stemteachingtools.org/brief/48]
- Arguing From Evidence for Sensemaking StemTeachingTool72
  [http://stemteachingtools.org/brief/72]
- Thinking Science by Bristol UK
  [https://www.stem.org.uk/system/files/elibrary-resources/2018/11/THINKING SCIENCE.pdf]
- Exit Tickets by NSTA
  [https://www.nsta.org/exit-tickets]
- Six Types Socratic Questions by Umich
  [http://www.umich.edu/~elements/probsolv/strategy/cthinking.htm]
- KnowAtom Blogs 3D Assessments
  [https://www.knowatom.com/blog/topic/next-generation-assessments]

Segment 4

- Thinking Science: Questions to Provoke Thinking and Discussion
  [https://www.stem.org.uk/system/files/elibrary-resources/2018/11/THINKING%20SCIENCE.pdf]
- Exit Tickets by NSTA
  [https://www.nsta.org/exit-tickets]
- Constructivism In the Classroom: Concept Mapping for NGSS
  [https://www.knowatom.com/blog/constructivism-in-the-classroom-concept-mapping-for-ngss-standards-mastery]

Science
Grade: 5 Unit: 1
20 days of instruction

Stage 3 – Learning Plan

Learning Plan Rationale

The learning plan is based on an articulation of learning goals (i.e., NGSS PEs, CCSS, EUs/EQs, and acquisition goals (defined in Stage 1) distributed over four instructional segments. These learning goals are used in Stage 2 to identify and describe the assessments that will be used to assess (to collect evidence of) students' learning throughout the course of the unit and instruction. The lessons in Instructional Segments 1 through 4 are designed to ensure students have opportunities to acquire and apply the learning goals in Stage 1. The instructional segments in both Stage 2 and Stage 3 are similar in terms of the learning goals they represent. Assessments listed in Stage 2 for a segment might use (assess) fewer learning goals than are present in the respective Stage 3 but will not use additional learning goals (unless they were taught in a prior segment).

Unit Entrance

Anchor Phenomenon

An anchoring phenomenon should be relevant to the student population. For this unit, we use a scenario involving baking soda bread, but a different phenomenon could be used instead. For example, you may want to select a different yeast-less bread that is relevant to the local population. It is essential that it uses a chemical leavening agent, such as baking soda, to support making the chemical connections later in the unit (frybread, cornbread, banana bread for example). As students progress through the unit, they revisit their explanation of the anchoring phenomenon to explain what occurred and why it occurred.

Unit Framing

Framing for SIPS Instructional Framework

Using baking bread (or another relevant phenomenon) as an example, the class examines the impacts of physical and chemical changes, explores the properties of different substances, and gathers additional information to explain the anchoring phenomenon using evidence and reasoning.

Example Driving Questions

Potential/example driving questions that students might generate, based on their observations of this anchor phenomenon include:

- How did the air bubbles and gaps form in the bread?
- What were the ingredients that were mixed?
- Why did the bread grow when it was baked?
- What was the mistake and what went wrong?

Potential Investigative Phenomena (Scaffolded by having a Common Point of Exploration)

Throughout this unit, students are seeking to explain a relevant phenomenon that involves molecules, changes of state, and physical and chemical changes. Students experience other smaller phenomena that relate to these concepts and then apply their learning around those smaller-scale phenomena to the larger anchoring phenomenon.

- Why does cutting onions make you cry?

Science
Grade: 5 Unit: 1
20 days of instruction

- How can we make our own salad dressing that will last over time?

Instructional Segment 1

Learning Investigations and Sample Lessons

Stage 1 Associations

NGSS PEs:

5-PS1-1
5-PS1-3

CCSS:

MP.2
MP.4
MP.5
RI.5.7
W.5.7
W.5.8
W.5.9

EUs/EQs:

EU1/EQ1
EU2/EQ2
EU3/EQ3
EU4/EQ4

AGs:

A4
A5
A6*
A7
A8
A10
A13

Estimated Classroom Time: 300 minutes

What Went Wrong?

- 5Es: Engage
- Estimated Time: 50 minutes
- AGs: A8

Students are presented with the following scenario, and if possible, provided with samples for students to examine. The teacher explains how "Last night I was baking in preparation for a big dinner. I needed to bake two loaves of bread. Here is the recipe I needed to follow." The teacher provides students with a recipe for soda bread, such as from All Recipes, and gives them time to look it over. The teacher provides only the recipe today, and later in the unit students look for additional information. The teacher says, "For the first loaf of bread I followed the recipe, but something went wrong with the second recipe, and I'm not sure what." The teacher shows students the two loaves of bread, one made with buttermilk, and one made with a switched ingredient that decreases the rise of the bread. To do this, the teacher switches whole milk for buttermilk. Switching out the milk changes the liquid from an acid (buttermilk) to a base (whole milk) removing the chemical reaction of the baking soda and the acidic buttermilk. The baking powder will still create some rise, but it should not be as much as it would otherwise be.

The teacher provides students with the opportunity to examine the two bread loaves and record observations. Students can write a prediction and explanation of their prediction in their science notebooks. The teacher encourages students to draw diagrams and add labels to their explanations.

To increase the relevancy and to support students in understanding the complex processes that are involved, the teacher encourages students to bake their own soda bread or some other yeast-less bread, and then write down what they notice as they are making the bread. If this is not an option, students could watch a video on baking soda bread to see changes from ingredients to the dough to bread, such as How To Make Traditional Irish Soda Bread.

What is Air?

- 5Es: Engage, Explore
- Estimated Time: 100 minutes
- AGs: A4, A5, A6*, A7, A8
- Model Lesson

For Segment 1, students witness a phenomenon, then conduct research and investigations to explain how this "cloud" was able to form. They connect this

back to the anchoring phenomenon as they seek to explain the processes involved in baking soda bread (anchoring activity).

The teacher begins by demonstrating to students how to make a cloud in their mouths. If the teacher is unable to conduct the demonstration in class, students could watch How to Make a Cloud in Your Mouth, stopping at 1:13. It is important to stop at 1:13 because the video goes on to explain the phenomenon. After viewing the opening demonstration and trying it themselves, students generate questions about the phenomenon that they can answer and will help them explain each of the steps of making the cloud.

Next, students engage in a series of explorations related to air. These activities provide students with the chance to gather observations and data that show how air is made of matter and has weight, takes up space, and has certain properties. The teacher reminds students as they explore to connect the activities back to making a cloud in their mouths. First, students investigate air to determine if the air is in matter (investigation 13), then identify the properties of air (investigations 14 and 16). If using these resources, the teacher skips activities utilizing the particle magnifier at this time.

Resources:

- Air, a Gas: Investigation 13

  [https://inquiryproject.terc.edu/curriculum/curriculum5/4_air/inv_13/index.html]
- Air, a Gas: Investigation 14

  [https://inquiryproject.terc.edu/curriculum/curriculum5/4_air/inv_14/index.html]
- Air, a Gas: Investigation 16

  [https://inquiryproject.terc.edu/curriculum/curriculum5/4_air/inv_16/index.html]

During the activities, students are introduced to the idea of creating annotated drawings of the different explorations, adding labels, arrows, and text to explain how they know that air is matter, why water is able to be compressed, and why it expands or contracts when heated or cooled. Students learn this skill in context with the learning as they utilize annotated drawings throughout the unit and future units as part of developing scientific explanations.

Sample Lesson: "What Is Air?"

Zooming in on Air

- 5Es: Explore & Explain
- Estimated Time: 50 minutes
- AGs: A4, A5, A7

In this lesson, the teacher adds on to the data that they collect in the lesson *What is Air?*, using a simulation and other outside resources to refine these drawings before working to connect them back to the segment and anchoring phenomenon.

The teacher starts the lesson by having students review and discuss their annotated drawings in small groups. Students give each other feedback and then generate a list of questions that they still have or that they have come up with because of the explorations.

Students explore a simulation where they can see particles of air moving around. As a class, they discuss the simulation and what it means that matter is made up of tiny particles which are too small to see. The class looks at different states of matter as part of the examination and considers how the molecules look in solids, liquids, and gases (investigation 15 and second half of 16).

Resources:

- Air, a Gas Investigation 15
  [https://inquiryproject.terc.edu/curriculum/curriculum5/4_air/inv_15/index.html]
- Air, a Gas: Investigation 16
  [https://inquiryproject.terc.edu/curriculum/curriculum5/4_air/inv_16/index.html]
- PheT Simulation: States of Matter: Basics
  [https://phet.colorado.edu/en/simulations/states-of-matter-basics]

Students revisit and revise their annotated drawings. Students share their annotated drawings with their group members and make further revisions. Students consider what questions they still have.

Next, students return to the anchoring phenomenon in their notebooks to connect their learning about air and molecules to the phenomenon. The teacher may need to support students through in the moment questions and guidance in helping them connect the heating/cooling of gases with the pressure in the mouth and to consider the gases.

Three States of Water: Ice, Steam, and Liquid. Are They All the Same?

- 5Es: Explain, Elaborate
- Estimated Time: 50 minutes
- AGs: A4, A5, A7, A10, A13,

The teacher begins the class by encouraging students to engage in a whole class discussion about what they have learned over the last several lessons related to matter and states of matter. The teacher asks them to consider how this all connects back to understanding how we can make a cloud form in our mouths. The teacher asks them to consider, “If we want to explain what happened with this phenomenon, what else do we need to figure out?” The teacher generates a list of questions the class still has and wants to try and figure out.

Depending on the student population, the class may want to conduct open research or more guided research. Guided research could utilize curated resources such as videos, core text passages, supplemental reading passages, additional simulations, or other additional resources. A list of additional resources is provided at the end of the instructional framework. Students utilize

these resources to find information to help the class answer the questions they still have, and students share their findings in a community organizer as well as document their thinking in their notebooks.

To build on this learning and make connections to real-world systems, students explore and observe examples of real-world phenomena related to the states of water in the water cycle and discuss the phase changes of water during the water cycle, introducing relevant vocabulary such as evaporation, condensation, precipitation, etc. Then, students engage in a state of matter characteristic card sort. Each card displays a word or phrase related to a solid, liquid, or gas. Students discuss with their groups and arrange them on a sorting mat. The lesson continues with a visual card sort (images of solids, liquids, and gases). Students discuss characteristics from the previous activity to sort them into categories. Combining the two activities, students use a Frayer Model (graphic organizer) to define solid, liquid, and gas. Students discuss the particle nature of matter, create a visual model of the arrangement of particles in a solid, liquid, and gas, and construct a written explanation to support the claim that when matter changes state, it is still composed of the same particles.

Sample Lesson – *Three States of Water: Ice, Steam, and Liquid. Are They All the Same?*

How Did We Make a Cloud in Our Mouth?

- Explain, Evaluate
- Estimated Time: 50 minutes
- AGs: A4, A5, A7, A10, A13

In this lesson, students work as a class to create an explanatory model/explanation that uses their annotated drawings, observations, numeric data, and reasoning to start developing an explanation of what led to the cloud being formed in their mouth. For this topic, work as a whole class to model the process of analyzing the data from all sources and then use that to develop an explanation with the evidence and reasoning to explain the physical processes that allow us to form a cloud in our mouth. The teacher has students evaluate the class explanation and model for students how to give constructive feedback.

After finishing the explanation, the teacher revisits How to Make a Cloud in Your Mouth from *What is Air?,* showing students the full video. The teacher asks students to evaluate the video's explanation, what information they left out, and what information they included that we did not. Finally, the teacher asks students to consider what and how all of this learning connects back to the bread or another anchoring phenomenon. What have we learned that can help us explain what went wrong with the second loaf of bread? Or how does this help us explain another anchoring phenomenon?

Science
Grade: 5 Unit: 1
20 days of instruction

Instructional Segment 2

Learning Investigations and Sample Lessons

Stage 1 Associations

NGSS PEs:

5-PS1-1
5-PS1-3

CCSS:

MP.2
MP.5
5.MD.C3
W.5.7
W.5.8
W.5.9

EUs/EQs:

EU1/EQ1
EU2/EQ2
EU3/EQ3
EU4/EQ4

AGs:

A1
A2
A3
A6
A8
A10*
A12
A15*
A16
A18
A20

Estimated Classroom Time: 175 minutes

What is This?

- 5Es: Engage, Explore
- Estimated Time: 50 minutes
- AGs: A1, A2, A3*, A6, A12

Students start by experimenting and testing a mystery matter, magnetic slime, without knowing what it is or what it is made from. They record notes in their notebooks on what they see and what the different properties of magnetic slime are.

Next, students engage in a class discussion of the different types of properties that can be used to describe substances, including both characteristic properties (e.g., solubility, flammability, odor, heat conductivity, magnetism) and non-characteristic properties (e.g., weight, volume). Students plan an investigation to describe the properties of given substances by accurately describing which variables are investigated, which variables are controlled, the number of trials considered, the tools used, and the types of observations that will be made. The teacher may need to support students in creating a list by providing examples. Examples should include the ingredients from the bread recipe (or other anchoring activity) as well as the ingredients for magnetic slime. Note: looking at materials/substances may include mixtures.

What Could it Be?

- 5Es: Explore
- Estimated Time: 50 minutes
- AGs: A1, A2, A3, A6, A12*

Students carry out their planned investigation. Multiple stations are set up to investigate the properties of the chosen substances. For each station, students make observations and take measurements on different types of properties (e.g., magnetism, volume, weight, color, odor, solubility in water, etc.). Students record data in tables to organize the different properties of the different materials. After gathering the data, students work in small groups to construct an explanation about how properties of matter can be used to compare and contrast materials by considering essential question 2: "How can I identify, describe, and categorize substances?"

Investigating the Mystery Matter

- 5Es: Explore, Explain
- Estimated Time: 50 minutes
- AGs: A8, A12, A15*, A16, A18, A20

Students use properties of substances to determine if substances are the same or different before and after mixing. Students first make a hypothesis about

whether or not the substances before and after mixing are the same or different substances. They begin conducting the investigation. The teacher provides students with several options to consider mixing, including materials that are used in making magnetic slime and the anchoring phenomenon. In the investigation, students identify and/or describe properties of matter before and after combining substances. Students do this identification by making observations and measurements for the properties of substances before and after mixing. They compare and contrast the data on the properties of matter before and after combining substances. Students support or refute their initial hypothesis with the evidence they have gathered from the investigation to determine whether the mystery matter is the same or different from the substances that were mixed.

Sample Lesson – *Mixing It Up*

What is the Mystery Matter?

- 5Es: Evaluate, Elaborate
- Estimated Time: 25 minutes
- AGs: A2, A6, A12, A16

Having collected evidence about different types of matter and what occurs when they are mixed together, students revisit the mystery matter to explain what they think it is made of and provide evidence for that. Students make connections between the physical properties of the mystery matter and the physical properties that they have observed.

After everyone has shared their thinking, the teacher can share with students the recipe for magnetic slime and ask students to identify what physical characteristics of the slime connect with which ingredients.

Finally, students revisit the anchoring phenomenon and consider what physical properties are different between the two loaves and how bread may or may not be a mixture (or another anchoring phenomenon). Students revise their explanation to include new information added during Segment 2 and give each other feedback.

Instructional Segment 3

Learning Investigations and Sample Lessons

Stage 1 Associations

NGSS PEs:

5-PS1-1
5-PS1-2
5-PS1-3

CCSS:

MP.2

Estimated Classroom Time: 225 minutes

Colors on the Mooove

- 5Es: Engage
- Estimated Time: 50 minutes
- AGs: A8, A20*

To introduce students to the idea of mixtures and solutions, the teacher presents them with a sample of milk. The teacher asks them what it is and how they know that. To connect it back to concepts in the lesson *What is This?***,** the

MP.4
W.5.8
W.5.9
RI.5.7

EUs/EQs:

EU1/EQ1
EU2/EQ2
EU3/EQ3

AGs:

A4
A5
A7
A8
A9
A10
A11
A12
A13
A14*
A15
A16*
A17
A18
A20*

teacher encourages students to give physical characteristics of milk and to explain what they think milk is in terms of movement of particles within it.

The teacher has students conduct the exploration with milk as outlined in Colors on the Mooove and asks them to consider what is occurring. The teacher asks students to make a prediction on what they think is happening and why, then have them record their thinking in the notebooks.

The teacher has students write a prediction on what they think is happening. In Segment 3, students explore the concept of mixtures and then connect that back to milk by explaining how milk is a mixture that can be separated.

Weight of Water

- 5Es: Explore
- Estimated Time: 50 minutes
- AGs: A4, A5, A7, A8, A9, A10, A11, A13, A15, A18

Students focus more specifically on the weight of a substance to determine that when substances are physically mixed, heated, or cooled, the total weight does not change. First, students record observations of the physical properties of salt, measure water and salt separately, then mix them until the salt dissolves (Investigation 5). Students discuss in their groups why the total weight stays the same, what that means, and record their thinking in their notebooks.

Next, students explore situations where water changes state to find that even when changing (heated/cooled) the weight stays the same. Students examine a closed system where heated water is allowed to evaporate but not disperse into the air, such as in Investigation 7. Students record and discuss their observations and document their thinking in their notebooks.

Students explore ice and water. Students record the properties of ice that they observe and record the properties of water. Students measure liquid water and place it in a closed container to freeze. (Be sure to have students leave space for the water to expand.) After freezing the water, students measure the weight and volume of the frozen water system and compare that to the weight and volume before freezing.

Students create annotated drawings and record their thinking in their notebooks about how changing states and mixing the two substances impacted the mass and volume.

Resources:

- What changes and what stays the same when salt dissolves in water? Investigation 5

  [https://inquiryproject.terc.edu/curriculum/curriculum5/1_water/inv_05/index.html]
- What happened to the water?

  [https://inquiryproject.terc.edu/curriculum/curriculum5/2_vapor/inv_07/index.html]
- What happens to weight and volume when water freezes?

[https://inquiryproject.terc.edu/curriculum/curriculum5/3_ice/inv_11/index.html]

Messin' with Mixtures

- 5Es: Explore, Explain
- Estimated Time: 100 minutes
- AGs: A8, A9, A11, A14*, A15, A16*, A18

In this activity, students investigate a heterogenous mixture and how to separate that mixture. To do this, students separate trail mix into its components as outlined in Mixtures vs. Solutions and Messin' with Mixtures. Note: students may have nut allergies; to avoid using nuts; another nut-free food mixture such as breakfast cereal with different elements in it could be substituted. The teacher introduces to students the concepts of mixtures and solutions and then presents them with the challenge of testing the "soil" sample outside of a construction site in order to determine how best to clean up the soil. As students work through the activity, they document the physical characteristics of the different materials as well as make measurements of the weight of the different elements individually and as a whole.

After the investigation, the class discusses how this is an example of a mixture and how it is a reversible physical change. Then, students brainstorm ideas on how this mixture could become a solution. What would need to happen? And would we be able to separate it back apart if it was a solution? Students consider ideas for separating solutions as well.

Next, students try to separate a solution. Using Separating Mixtures or Separate Solutions as a guide, the teacher provides students with the materials for solutions involving soil (instead of sand) and salt as well as a variety of resources to filter, evaporate, or otherwise separate the solution. Additional ideas on how to separate a mixture can be found here. As students explore these activities, they create annotated drawings and record them in their notebooks to use later to help explain the *Colors on the Mooove* phenomenon. Again, the teacher ensures that students gather data on the physical characteristics and measurements of the weight of the individual elements and the solutions.

After students have explored both mixtures and solutions, the whole class comes together to discuss what they have noticed about these two concepts, how they are similar, and how they are different. The teacher encourages students to consider the physical characteristics of the individual elements and the mixture/solution and if there are any changes. Using questioning strategies, the teacher provides support to students to help them find that both can be separated back out, though it may be harder for solutions than mixtures.

Students connect the idea of mixtures and solutions back to *Colors on the Mooove* using their annotated drawings and observational evidence. Using questioning strategies, the teacher may need to help students in finding that milk may be a solution.

Why Did it Mooove?

- 5Es: Explain & Elaborate
- Estimated Time: 25 minutes
- AGs: A8, A9, A11, A12 A14*, A15, A16*, A18, A20*

Students connect their investigations to the *Colors on the Mooove* activity. Using their annotated drawings, observations, and notes from the curated resources, students revisit the phenomenon with the goal of developing an explanation to answer the question of why the colors move apart when the soap acts on them. Working in small groups, students develop an explanation and then share it with peers for feedback. Students revise their understanding based on the suggestions from peers and then share their explanations with the class.

After the class shares their explanations, the class reads the "What's Happening in There?" section of Colors on the Mooove or watches the associated YouTube video which explains the phenomenon. Students evaluate the ACS explanation as a class and then discuss how their explanation could be better before returning to their own explanation and making final revisions.

After finalizing their explanations, students return to the unit anchoring phenomenon. Students work together in their small groups to find connections between their learning about mixtures and solutions to connect it back to the process of baking bread and figuring out the mistake for the second loaf.

Instructional Segment 4

Learning Investigations and Sample Lessons

Stage 1 Associations

NGSS PEs:

5-PS1-1
5-PS1-2
5-PS1-3
5-PS1-4

CCSS:

MP.2
MP.5
RI.5.7
W.5.8
W.5.9

Estimated Classroom Time: 300 Minutes

Where Did it Go?

- 5Es: Engage & Explore
- Estimated Time: 50 minutes
- AGs: A1, A8, A12, A14, A16, A17*, A18, A19*, A20

To introduce the idea of mixing and chemical changes, the teacher mixes baking soda (base) and vinegar/lemon juice (acid). The class measures the mass of the acid, base, and container before the reaction. As the class discusses the physical characteristics of these items, students may want to refer to *What is This?* for their list of physical characteristics of these two reactants. The teacher allows students to observe the reaction and record their observations. After the reaction is concluded, the teacher measures the weight of the container and the products still in the container. Then, students gather data on the physical

EUs/EQs:

EU1/EQ1
EU2/EQ2
EU3/EQ3
EU4/EQ4

AGs:

A1
A5*
A8
A10*
A12
A14
A16
A17
A18
A19
A20

properties. The class generates questions they have about this mixture and what they have seen. If students do not notice it, the teacher uses questioning to point out the change in total weight.

Using this change in weight as a talking point encourages students to consider why there was a change, ideally with students recognizing that during the reaction there were bubbles so some of it may have turned into a gas. The teacher repeats the experiment in a closed container; using a balloon is one way to do this. PBS.org Example. Again, the teacher gathers data on the weight of the closed system, which will be the same as, or near, the weight of the system to start.

Looking at the weight and the physical properties, students find that this mixture is not like the others. To support that thinking, the teacher encourages students to consider how they would separate the mixture back. If students suggest boiling off the water to obtain vinegar, they find that the result is to create "hot ice". For more information about hot ice see ThoughtCo.

The class generates a series of questions about this reaction that students work to better understand over the remainder of the segment.

Sample Lesson: "Where Did It Go?"

What Happened?

- 5Es: Explore, Explain
- Estimated Time: 100 minutes
- AGs: A1, A12, A17, A19*

Students obtain information from curated resources that help explain how to determine if a new substance was formed using properties of the substance(s) before and after. The teacher can provide this list of resources with specific questions or encourage students to engage in a more open exploration using the class-generated questions as a guide of what to look for. The teacher can refer to the core text and instructional resources at the end of the unit for potential resources as well as their core curriculum.

Students are asked to synthesize what they learned in the information along with what they observed during the *Where Did it Go?* investigation to explain how they know whether a new substance was formed (i.e., a chemical reaction occurred).

Modeling New Substance Formation

- 5Es: Explain
- Estimated Time: 50 minutes
- AGs: A17, A19

The teacher and students collaboratively model particles of the substances before and after mixing. The model will still be at the particle level (not molecular/atomic; use the same modeling conventions used in models in

Segments 1 and 2). The model will show that the new substance is composed of new particles, which are different from the particles in the original substance. Through discussion, the class makes prediction(s) about whether any matter was lost when these new particles were produced (i.e., post-reaction). Students discuss how they could use weight to determine if any matter was lost. They plan an investigation to gather the data to determine if weight changed (i.e., matter was lost or created).

What Went Right?

- 5Es: Explain, Elaborate
- Estimated Time: 50 minutes
- AGs: A5*, A10*, A12, A17

Students revisit the anchoring phenomenon with the information they have learned over the unit. Students break down the recipe to identify the physical properties of each of the ingredients and then go through the steps of the recipe to identify what occurs in each step. As they go through the recipe they connect the learning experiences from the unit to the steps, highlighting examples of mixtures, solutions, physical and chemical changes, changes of state, and the interaction of particles. Students use this learning and the analysis of the recipe to explain what went right in the first loaf of bread.

What Went Wrong?

- 5Es: Elaborate & Evaluate
- Estimated Time: 50 minutes
- AGs: A5*, A10*, A12, A17

To summarize the unit, students create presentations to explain what went wrong when making the second loaf of bread. They use evidence from the unit and anchoring phenomenon to provide logical reasoning and explain what the mistake was and why it had an impact. Students are encouraged to consider what could have been done instead to ensure that the second loaf came out as close to the first loaf as possible.

Accessibility and Differentiation for Diverse Learners

"Universal Design for Learning (UDL) is a framework to improve and optimize teaching and learning for all people based on scientific insights into how humans learn" (CAST, 2022). Taking time to reflect on prior instruction when planning for accessible, differentiated, and culturally responsive instruction for diverse learners and culturally diverse classrooms serves to identify ways to improve future instructional practices. The UDL Guidelines provide a framework for this reflection. The guidelines include three principles, Multiple Means of Engagement, Multiple Means of Representation, and Multiple Means of Action & Expression as ways to focus on variety and flexibility in instructional practices. By examining instruction and instructional materials through the lens of each of these principles, we can identify and thus reduce or remove barriers to diverse learners.

Providing Multiple Means of Engagement (e.g., allowing choices, authentic scenarios, varying demands, and clear goals), broadens the opportunities for gaining and sustaining students' interest

and cognitive engagement in learning the content. Providing Multiple Means of Representation (e.g., variety of presentation modes, clarifying vocabulary, activating background knowledge) allows students to receive and comprehend the content. Providing Multiple Means of Action & Expression (e.g., a variety of methods to respond to instruction, and a variety of ways to interact with the instructional materials) helps students to use their strengths and abilities to access the instructional materials and express what they understand. Accommodations typically reserved for students receiving special education, students who have a 504 plan, and English Learners can be made available to all students using the UDL principles, thus allowing all students to benefit from the accommodations.

The SIPS Grade 5 Unit 1 Instructional Framework Differentiation Strategies and Resources support educators' intentional planning of accessible, differentiated, and culturally responsive instruction for all students aligned to the specific performance expectations in focus for this unit.

Core Text Connections

Digital Resources:

- Encyclopedia Brittanica: Matter
  [https://www.britannica.com/science/matter]
- Live Science: States of Matter, Definition and Phase Changes
  [https://www.livescience.com/46506-states-of-matter.html]
- NASA Climate Kids: 10 Interesting Things About Air
  [https://climatekids.nasa.gov/10-things-air/]
- WorldAtlas: What Are The Properties of Matter?
  [https://www.worldatlas.com/articles/what-are-the-properties-of-matter.html]
- American Chemistry Society: Matter is Made of Tiny Particles
  [https://www.acs.org/content/dam/acsorg/education/k-8/inquiry-in-action/fifth-grade/g5-l1.1-reading.pdf]
- Let's Talk Science: Introduction to the Particle Theory of Matter
  [https://letstalkscience.ca/educational-resources/backgrounders/introduction-particle-theory-matter]
- Chem4Kids: States of Matter
  [http://www.chem4kids.com/files/matter_states.html]
- Twinkl: Mixtures
  [https://www.twinkl.com/teaching-wiki/mixture]
- TeachEngineering: Mixtures and Solutions
  [https://www.teachengineering.org/populartopics/mixturesandsolutions]

Videos:

- Periwinkle YouTube: Properties of Matter
  [https://youtu.be/NUskg2qWLPQ]
- Crash Course Kids YouTube: Matter Compilation
  [https://youtu.be/wyRy8kowyM8]

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- USA Test Prep YouTube: Physical Properties
  [https://youtu.be/nb1uv0LAD6Y]
- GenerationGenius YouTube: Properties of Matter
  [https://youtu.be/t8a2Ys8a6r4]
- AumSum YouTube: Physical and Chemical Changes
  [https://www.youtube.com/watch?v=BgM3e8YZxuc]
- Crash Course Kids: Part(icles) of Your World
  [https://youtu.be/npv74D2MO6Q]
- TeachEngineering: Mixtures and Solutions
  [https://youtu.be/38vphCR-U8g]

Print Texts For Children

- Walliman, D. (2016). Professor Astrocat's atomic adventure.
  [https://www.amazon.com/Professor-Astro-Cats-Atomic-Adventure/dp/1909263605]
- Kelsey, E. (2012). You are stardust.
  [https://www.amazon.com/You-Are-Stardust-Elin-Kelsey/dp/1926973356]
- Berne, J. (2016). On a beam of light: A story of Albert Einstein.
  [https://www.amazon.com/Beam-Light-Story-Albert-Einstein/dp/0545657059]
- Wells, R. (1995). What's smaller than a pygmy shrew?.
  [https://www.amazon.com/Whats-Smaller-Pygmy-Knowledge-Science/dp/0807588385]
- Mason, A. (2006). Change it! Solids, liquids, gases and you.
  [https://www.amazon.com/Change-Liquids-Primary-Physical-Science/dp/1553378385]
- Stille, D. (2004). Matter: See it, touch it, taste it, smell it.
  [https://www.amazon.com/Matter-Touch-Taste-Amazing-Science/dp/1404803440]
- Slade, S. (2014). Splat! Wile E. Coyote experiments with states of matter.
  [https://www.amazon.com/Splat-Coyote-Experiments-Physical-Science/dp/1476552150]
- Bang, M. (2017). Rivers of sunlight: How the sun moves water around the earth.
  [https://www.amazon.com/Rivers-Sunlight-Moves-Water-Around/dp/0545805414]
- Braun, E. (2012). Joe-Joe the wizard brews up solids, liquids and gases.
  [https://www.amazon.com/Joe-Joe-Wizard-Solids-Liquids-Science/dp/1404872388]
- Green, D. (2008). Physics: Why matter matters.
  [https://www.amazon.com/Physics-Matter-Matters-Dan-Green/dp/0753462141]
- Yorifuji, B. (2012). Wonderful life with the elements: The periodic table personified.
  [https://www.amazon.com/Wonderful-Life-Elements-Periodic-Personified/dp/1593274238]
- Munroe, R. (2015). Thing explainer: Complicated stuff in simple words.
  [https://www.amazon.com/Thing-Explainer-Complicated-Stuff-Simple/dp/0544668251]

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Instructional Resources
Stage 3 Instructional Resources: ***Modeling*** ● teaching gr 5 structure and props of matter through modeling (3).pdf - Google Drive [https://drive.google.com/file/d/1ewg6mvBCWrEg2-vf94wm8roNq5eYJcX4/view] 5-PS1-1 ● 5th Grade Structures and Properties of Matter.pdf (kyschools.us) [https://www.mccracken.kyschools.us/Downloads/5th Grade Structures and Properties of Matter.pdf] ● Matter Is Made of Tiny Particles - American Chemical Society (acs.org) [https://www.acs.org/content/acs/en/education/resources/k-8/inquiryinaction/fifth-grade/chapter-1-investigating-matter-at-the-particle-level/matter-is-made-of-tiny-particles.html] ● Lesson Now You See It, Now You Don't... Dissolving Matter (betterlesson.com) [https://teaching.betterlesson.com/lesson/636182/now-you-see-it-now-you-don-t-dissolving-matter] ● Concord Activities [https://authoring.concord.org/activities/10854/b29a5f5f-367b-4a3f-b37a-c1442d41d36c] ● Dissolving M&Ms - American Chemical Society (acs.org) [https://www.acs.org/content/acs/en/education/resources/k-8/inquiryinaction/fifth-grade/chapter-1-investigating-matter-at-the-particle-level/dissolving-an-m-and-m.html] ● Dissolving and Back Again - American Chemical Society (acs.org) [https://www.acs.org/content/acs/en/education/resources/k-8/inquiryinaction/fifth-grade/chapter-1-investigating-matter-at-the-particle-level/lesson-1-3--dissolving-and-back-again.html] ● The Water Cycle - American Chemical Society (acs.org) [https://www.acs.org/content/acs/en/education/resources/k-8/inquiryinaction/fifth-grade/chapter-1-investigating-matter-at-the-particle-level/lesson-1-4--the-water-cycle.html] 5-PS1-2 ● Conservation of Mass - American Chemical Society (acs.org) [https://www.acs.org/content/acs/en/education/resources/k-8/inquiryinaction/fifth-grade/chapter-4/conservation-of-mass.html] 5-PS1-3 ● What's the Matter in Mr. Whisker's Room? (nsta.org) [https://ngss.nsta.org/Resource.aspx?ResourceID=363] ● Mystery Powders (uen.org) [https://www.uen.org/lessonplan/view/2176] ● Using Dissolving to Identify Substances - American Chemical Society (acs.org)

[https://www.acs.org/content/acs/en/education/resources/k-8/inquiryinaction/fifth-grade/substances-have-characteristic-properties/lesson-2-1--using-dissolving-to-identify-substances.html]

- Identifying an Unknown Liquid - American Chemical Society (acs.org)
  [https://www.acs.org/content/acs/en/education/resources/k-8/inquiryinaction/fifth-grade/substances-have-characteristic-properties/lesson2-2--identifying-an-unknown-liquid.html]
- Mixing Liquids to Identify an Unknown Liquid - American Chemical Society (acs.org)
  [https://www.acs.org/content/acs/en/education/resources/k-8/inquiryinaction/fifth-grade/substances-have-characteristic-properties/lesson-2-3--mixing-liquids-to-identify-an-unknown-liquid.html]
- Density and Sinking and Floating - American Chemical Society (acs.org)
  [https://www.acs.org/content/acs/en/education/resources/k-8/inquiryinaction/fifth-grade/substances-have-characteristic-properties/lesson-2-4--density-and-sinking-and-floating.html]
- The Density of Liquids - American Chemical Society (acs.org)
  [https://www.acs.org/content/acs/en/education/resources/k-8/inquiryinaction/fifth-grade/substances-have-characteristic-properties/density-of-liquids.html]

5-PS1-4

- Chemical Cafe (nsta.org)
  [https://ngss.nsta.org/Resource.aspx?ResourceID=385]
- Lesson 3.5 - Different Substances React Differently - American Chemical Society (acs.org)
  [https://www.acs.org/content/acs/en/education/resources/k-8/inquiryinaction/fifth-grade/chapter-3/different-substances-react-differently.html]
- How can you separate a soil mixture (AGI.org)
  [https://www.americangeosciences.org/education/k5geosource/activities/investigations/soils/soil-as-a-mixture]
- Separating Mixtures
  [https://www.education.com/science-fair/article/separating-mixtures/]
- Equation for the Reaction Between Baking Soda and Vinegar
  [https://www.thoughtco.com/equation-for-the-reaction-of-baking-soda-and-vinegar-604043]
- Messin' With Mixtures (Teach Engineering)
  [https://www.teachengineering.org/activities/view/cub_mix_lesson3_activity1]
- Properties of Mixtures vs. Solutions: Mix It Up!
  [https://www.teachengineering.org/lessons/view/cub_mix_lesson3]
- Colors on the Moooove
  [https://www.acs.org/education/whatischemistry/adventures-in-chemistry/experiments/colors-move.html]

Webinars

- Teaching Next Generation Science Standards in Elementary School—Fifth Grade - YouTube
  [https://www.youtube.com/watch?v=-i49gAtvoC8]

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- Teaching Next Generation Science Standards in K-5: Constructing Explanations from Evidence - YouTube
  [https://www.youtube.com/watch?v=GBxSIroyBd4]
- Using the Next Generation Science Standards Practices in the Elementary Grades - YouTube
  [https://www.youtube.com/watch?v=SuEVCbkzOlM]
- Next Generation Science Standards Core Ideas: Matter and Its Interactions - YouTube
  [https://www.youtube.com/watch?v=Tl4rsV9WA_I]

Generic Resources

- 29477, MacDonald, Standards for Mathematical Practices- Engaging English Learners in Mathematical Meaning-Making--Resources .pdf
  [C:\Users\KathleenNewm_hyz0f4g\OneDrive - edCount\Downloads\29477, MacDonald, Standards for Mathematical Practices- Engaging English Learners in Mathematical Meaning-Making--Resources .pdf]
- Formative Assessment Probes: Embedding Formative Assessment Into the 5E Instructional Model | National Science Teaching Association (nsta.org)
  [https://my.nsta.org/resource/?id=10.2505/4/sc17_055_04_28]
- 201204_Framework-ReiserBerlandKenyon.pdf (nsta.org)
  [https://static.nsta.org/ngss/resources/201204_Framework-ReiserBerlandKenyon.pdf]
- 201112_Framework-Bybee.pdf (nsta.org)
  [https://static.nsta.org/ngss/resources/201112_Framework-Bybee.pdf]

Videos

- Grade 5 Classroom Case 1 | Video Case | The Inquiry Project (terc.edu)
  [https://inquiryproject.terc.edu/prof_dev/resources/video_cases/video_case.cfm%3Fcase_type=cc&case_grade=5&case_num=1&case_return=library.html]
- Grade 5 Classroom Case 2 | Video Case | The Inquiry Project (terc.edu)
  [https://inquiryproject.terc.edu/prof_dev/resources/video_cases/video_case.cfm%3Fcase_type=cc&case_grade=5&case_num=2&case_return=library.html]
- Grade 5 Classroom Case 3 | Video Case | The Inquiry Project (terc.edu)
  [https://inquiryproject.terc.edu/prof_dev/resources/video_cases/video_case.cfm%3Fcase_type=cc&case_grade=5&case_num=3&case_return=library.html]
- Grade 5 Classroom Case 4 | Video Case | The Inquiry Project (terc.edu)
  [https://inquiryproject.terc.edu/prof_dev/resources/video_cases/video_case.cfm%3Fcase_type=cc&case_grade=5&case_num=4&case_return=library.html]

Student Investigations

Pre-Activity Teacher Prep:

- The Child's Ideas for Water, a Liquid | Grade 5 Curriculum | The Inquiry Project (terc.edu)
  [https://inquiryproject.terc.edu/curriculum/curriculum5/child_and_scientist/carol5_1.cfm.html]
- Scientist's Essay for Water, a Liquid | Grade 5 Curriculum | The Inquiry Project (terc.edu)
  [https://inquiryproject.terc.edu/curriculum/curriculum5/child_and_scientist/roger5_1.cfm.html]

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Video:

- Grade 5 Scientist Case 1 | Video Case | The Inquiry Project (terc.edu)
  [https://inquiryproject.terc.edu/prof_dev/resources/video_cases/video_case.cfm%3Fcase_type=sc&case_grade=5&case_num=1&case_return=ip_5_1.html]

Student Activities:

- Water 1 | Grade 5 Curriculum | The Inquiry Project (terc.edu)
  [https://inquiryproject.terc.edu/curriculum/curriculum5/1_water/inv_01/index.html]
- Water 2 | Grade 5 Curriculum | The Inquiry Project (terc.edu)
  [https://inquiryproject.terc.edu/curriculum/curriculum5/1_water/inv_02/index.html]
- Water 3 | Grade 5 Curriculum | The Inquiry Project (terc.edu)
  [https://inquiryproject.terc.edu/curriculum/curriculum5/1_water/inv_03/index.html]
- Water 4 | Grade 5 Curriculum | The Inquiry Project (terc.edu)
  [https://inquiryproject.terc.edu/curriculum/curriculum5/1_water/inv_04/index.html]
- Water 5 | Grade 5 Curriculum | The Inquiry Project (terc.edu)
  [https://inquiryproject.terc.edu/curriculum/curriculum5/1_water/inv_05/index.html]
- The Child's Ideas for Water to Vapor | Grade 5 Curriculum | The Inquiry Project (terc.edu)
  [https://inquiryproject.terc.edu/curriculum/curriculum5/child_and_scientist/carol5_2.cfm.html]
- Scientist's Essay for Water to Vapor | Grade 5 Curriculum | The Inquiry Project (terc.edu)
  [https://inquiryproject.terc.edu/curriculum/curriculum5/child_and_scientist/roger5_2.cfm.html]

Video and Resources:

- Grade 5 Scientist Case 2 | Video Case | The Inquiry Project (terc.edu)
  [https://inquiryproject.terc.edu/prof_dev/resources/video_cases/video_case.cfm%3Fcase_type=sc&case_grade=5&case_num=2&case_return=ip_5_2.html]
- Vapor 6 | Grade 5 Curriculum | The Inquiry Project (terc.edu)
  [https://inquiryproject.terc.edu/curriculum/curriculum5/2_vapor/inv_06/index.html]
- Vapor 7 | Grade 5 Curriculum | The Inquiry Project (terc.edu)
  [https://inquiryproject.terc.edu/curriculum/curriculum5/2_vapor/inv_07/index.html]
- Vapor 8 | Grade 5 Curriculum | The Inquiry Project (terc.edu)
  [https://inquiryproject.terc.edu/curriculum/curriculum5/2_vapor/inv_08/index.html]
- Vapor 9 | Grade 5 Curriculum | The Inquiry Project (terc.edu)
  [https://inquiryproject.terc.edu/curriculum/curriculum5/2_vapor/inv_09/index.html]
- The Child's Ideas for Water to Ice | Grade 5 Curriculum | The Inquiry Project (terc.edu)
  [https://inquiryproject.terc.edu/curriculum/curriculum5/child_and_scientist/carol5_3.cfm.html]
- Scientist's Essay for Water to Ice | Grade 5 Curriculum | The Inquiry Project (terc.edu)
  [https://inquiryproject.terc.edu/curriculum/curriculum5/child_and_scientist/roger5_3.cfm.html]

Video and Resources:

- Grade 5 Scientist Case 3 | Video Case | The Inquiry Project (terc.edu)

[https://inquiryproject.terc.edu/prof_dev/resources/video_cases/video_case.cfm%3Fcase_type=sc&case_grade=5&case_num=3&case_return=ip_5_3.html]

- Ice 10 | Grade 5 Curriculum | The Inquiry Project (terc.edu)
  [https://inquiryproject.terc.edu/curriculum/curriculum5/3_ice/inv_10/index.html]
- Ice 11 | Grade 5 Curriculum | The Inquiry Project (terc.edu)
  [https://inquiryproject.terc.edu/curriculum/curriculum5/3_ice/inv_11/index.html]
- Ice 12 | Grade 5 Curriculum | The Inquiry Project (terc.edu)
  [https://inquiryproject.terc.edu/curriculum/curriculum5/3_ice/inv_12/index.html]
- The Child's Ideas for Air, a Gas | Grade 5 Curriculum | The Inquiry Project (terc.edu)
  [https://inquiryproject.terc.edu/curriculum/curriculum5/child_and_scientist/carol5_4.cfm.html]
- Scientist's Essay for Air, a Gas | Grade 5 Curriculum | The Inquiry Project (terc.edu)
  [https://inquiryproject.terc.edu/curriculum/curriculum5/child_and_scientist/roger5_4.cfm.html]

Video and Resources:

- Grade 5 Scientist Case 4 | Video Case | The Inquiry Project (terc.edu)
  [https://inquiryproject.terc.edu/prof_dev/resources/video_cases/video_case.cfm%3Fcase_type=sc&case_grade=5&case_num=4&case_return=ip_5_4.html]
- Air 13 | Grade 5 Curriculum | The Inquiry Project (terc.edu)
  [https://inquiryproject.terc.edu/curriculum/curriculum5/4_air/inv_13/index.html]
- Air 14 | Grade 5 Curriculum | The Inquiry Project (terc.edu)
  [https://inquiryproject.terc.edu/curriculum/curriculum5/4_air/inv_14/index.html]
- Air 15 | Grade 5 Curriculum | The Inquiry Project (terc.edu)
  [https://inquiryproject.terc.edu/curriculum/curriculum5/4_air/inv_15/index.html]
- Air 16 | Grade 5 Curriculum | The Inquiry Project (terc.edu)
  [https://inquiryproject.terc.edu/curriculum/curriculum5/4_air/inv_16/index.html]
- Scale 17 | Grade 5 Curriculum | The Inquiry Project (terc.edu)
  [https://inquiryproject.terc.edu/curriculum/curriculum5/5_scale/inv_17/index.html]
- Scale 18 | Grade 5 Curriculum | The Inquiry Project (terc.edu)
  [https://inquiryproject.terc.edu/curriculum/curriculum5/5_scale/inv_18/index.html]

Student Worksheets

- Evaporation Concept Cartoon | Grade 5 Curriculum | The Inquiry Project (terc.edu)
  [https://inquiryproject.terc.edu/curriculum/curriculum5/concept_cartoon/evaporation/index.html]
- Condensation Concept Cartoon | Grade 5 Curriculum | The Inquiry Project (terc.edu)
  [https://inquiryproject.terc.edu/curriculum/curriculum5/concept_cartoon/condensation/index.html]
- Air Has Weight Concept Cartoon | Grade 5 Curriculum | The Inquiry Project (terc.edu)
  [https://inquiryproject.terc.edu/curriculum/curriculum5/concept_cartoon/air_has_weight/index.html]

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Additional Student Activities

- slime-activity.pdf (acs.org)
  [https://www.acs.org/content/dam/acsorg/education/whatischemistry/adventuresinchemistry/experiments/timeforslime/slime-activity.pdf]
- Science Activity: Baking Soda & Vinegar Bubble Bomb! | Exploratorium
  [https://www.exploratorium.edu/science_explorer/bubblebomb.html]
- flame-experiment.pdf (acs.org)
  [https://www.acs.org/content/dam/acsorg/education/whatischemistry/adventuresinchemistry/experiments/flameout/flame-experiment.pdf]
- Microsoft Word - 9 Elephant Toothpaste (regent.edu)
  [https://www.regent.edu/acad/schedu/pdfs/mcms/elephant_toothpaste.pdf]

Additional Full Lessons (Multiple NGSS alignment)

- What's the Difference between Baking Soda and Baking Powder? - American Chemical Society (acs.org) **[5-PS1-1, 5-PS1-3, 5-PS1-4]**
  [https://www.acs.org/content/acs/en/education/resources/k-8/inquiryinaction/fifth-grade/chapter-3/baking-soda-vs-baking-powder.html]
- Exploring Baking Powder - American Chemical Society (acs.org) **[5-PS1-3, 5-PS1-4]**
  [https://www.acs.org/content/acs/en/education/resources/k-8/inquiryinaction/fifth-grade/chapter-3/exploring-baking-powder.html]
- Forming a Precipitate - American Chemical Society (acs.org) **[5-PS1-3, 5-PS1-4]**
  [https://www.acs.org/content/acs/en/education/resources/k-8/inquiryinaction/fifth-grade/chapter-3/forming-a-precipitate.html]
- Chemical Reactions & Color Change - American Chemical Society (acs.org) **[5-PS1-3, 5-PS1-4]**
  [https://www.acs.org/content/acs/en/education/resources/k-8/inquiryinaction/fifth-grade/chapter-3/chemical-reactions-and-color-change.html]
- Engineering a Floatation Device - American Chemical Society (acs.org)
  [https://www.acs.org/content/acs/en/education/resources/k-8/inquiryinaction/fifth-grade/chapter-5/enginerring-flotation-device.html]