



Stackable Instructionally- embedded Portable Science (SIPS) Assessments Project

Grade 5 Science

Unit 1 Instructionally-embedded Assessment Task Specification Tool:

“Weight of Water”

Structure and Properties of Matter

June 2023

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Grade 5	Unit 1	Instructional Segment 3	Task Title: Weight of Water
Unit 2 Title: Gravity and Motion of Objects in the Solar System			
Anchor Phenomenon		Problematization/Investigative Strategy for the Unit	
<p>An anchoring phenomenon should be relevant to the student population. For this unit, we will use a scenario involving baking soda bread, but a different phenomenon could be used instead. For example, you may want to select a different yeastless 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 will revisit their explanation of the anchoring phenomenon to explain what occurred and why it occurred.</p>		<p>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.</p>	
Segment 3 Overview			
<p>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 their particle model and update it to show a mixture where the particles of the original substances still exist but are now mixed together.</p> <p>Assessments for this segment focus on students' ability 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.</p>			

Lesson Title(s)	Lesson Description(s)
Weight of Water	<p>In the lesson, "Weight of Water," 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 should discuss in their groups why the total weight stays the same, what that means, and record their thinking in their notebooks.</p> <p>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 should record and discuss their observations and document their thinking in their notebooks.</p> <p>Students then explore ice and water. Students should 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.</p> <p>Students should create annotated drawings and record their thinking in their notebooks about how changing states impacted the mass and the volume, and how mixing two substances impacted the mass and volume.</p> <p><u>What Students Figure Out</u></p> <p>a. The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish. (DCI: Structure and Properties of Matter).</p> <p>b. Standard units can be used to measure and describe physical quantities such as weight, time, temperature, and volume and include in a graphical representation to illustrate the conservation of matter (CCC: Scale, Proportion, and Quantity; SEP: Using Mathematics and Computational Thinking).</p>
Formal Assessment Title	Assessment Description
Weight of Water	<p>While conducting several investigations on changes in the state of water, students collect data that supports multiple representations of what occurs. They will 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.</p>
NGSS PE(s) Code(s) & Description(s)	

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.]

AG(s) Code(s) & Description(s)

A1. Describe how properties of matter can be used to compare and contrast materials.*

A3. Conduct an investigation to measure and/or qualitatively describe the properties of substances.

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.

Evidence Statement(s)

- 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.
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Phenomenon or Phenomenon-rooted Design Problem

- Substances can change physically, such as in their shape or number of pieces, while staying in the same state or not, and the amount (weight) of matter is conserved. Also, substances can change states/phases, such as between solid, liquid, and gas, and the amount (weight) of matter is conserved. The small particles of the substances and their changes can be shown in model diagrams. The weights can be shown in various types of graphs. The models and graphs can be used in the explanations to support claims about substances.
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General Scenario Description

- Students in a science class are observing changes in water when it is frozen, melted, or boiled. Students will explore how the amount of matter (mass/weight) is conserved during physical changes.

Chain of Sensemaking

- Students determine the tools to be used to measure and describe physical quantities, such as mass/weight and volume.
- Students describe the procedure and what quantities to measure to investigate the conservation of matter during a change in state from liquid to solid.
- Students describe the physical change when a liquid becomes a solid.
- Students use data to show that the total amount of matter (water) was conserved during a change in state from liquid to solid.
- Students use data to show that the total amount of matter is conserved when mixing two different substances.
- Students graph data to explain how observations and measurements are useful for identifying the change to the properties of one substance when mixed with another.
- Students recognize that materials can be identified based on their observable and measurable properties.

Work Products

- Data table
- Graph
- Selected-response
- Constructed-response

Application of Universal Design for Learning-based Guidelines to Promote Accessibility (<https://udlguidelines.cast.org/>)

Multiple Means of Engagement	Multiple Means of Representation	Multiple Means of Action & Expression
<ul style="list-style-type: none"><input checked="" type="checkbox"/> Context or content<input checked="" type="checkbox"/> Age appropriate<input checked="" type="checkbox"/> Appropriate for different groups<input checked="" type="checkbox"/> Makes sense of complex ideas in creative ways<input checked="" type="checkbox"/> Vary the degree of challenge or complexity within prompts	<ul style="list-style-type: none"><input checked="" type="checkbox"/> Provide visual diagrams and charts<input type="checkbox"/> Make explicit links between information provided in texts and any accompanying representation of that information in illustrations, equations, charts, or diagrams<input checked="" type="checkbox"/> Activate relevant prior knowledge<input type="checkbox"/> Bridge concepts with relevant and simple analogies and limited use of metaphors<input checked="" type="checkbox"/> Highlight or emphasize key elements in text, graphics, diagrams, formulas<input checked="" type="checkbox"/> Use outlines, graphic organizers, unit organizer routines, concept organizer	<ul style="list-style-type: none"><input checked="" type="checkbox"/> Solve problems using a variety of strategies<input type="checkbox"/> Sentence starters<input type="checkbox"/> Embed prompts to “show and explain your work”

routines, and concept mastery routines to emphasize key ideas and relationships

- ☒ Give explicit prompts for each step in a sequential process

Targeted PE(s) Code(s) and Alternate Conception(s)

- **NGSS PE: 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.
 - **Common Alternate Conceptions**
 - Solids are always heavier than liquids.
 - Gases are weightless.
 - An increase or decrease in weight during a physical or chemical change indicates that matter is not conserved.
- **NGSS PE: 5-PS1-3** Make observations and measurements to identify materials based on their properties.
 - **Common Alternate Conceptions**
 - All shiny/reflective objects are made of metals.
 - All metal objects are attracted to magnets.
 - Charged objects never interact with neutral objects.
 - Larger magnets always are stronger magnets.

Unit 1 Vocabulary

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|-------------|------------------------|
| ● Matter | ● Model |
| ● Substance | ● Volume |
| ● Solid | ● Conservation of mass |
| ● Liquid | ● Weight |
| ● Gas | ● Properties |
| ● Melt | ● Solution |
| ● Freeze | ● Physical change |
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