Stackable Instructionally-embedded Portable Science (SIPS) Assessments Project

Grade 5 Science

Unit 1 Task 2 Specification Tool & Verification of Alignment

Matter and Its Interactions

September 2023

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SIPS Grade 5 Unit 1 Task 2 Specification & Verification of Alignment

Grade: 5	Unit: 1	Task Number: 2	Task Title: What Just Happened?

NGSS Performance Expectations

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.*]

Phenomena or Phenomena-rooted Design Problem

- Materials that seem to appear when they condense or precipitate (e.g., condensation on a cold glass of water).

Scenario/Context/Situation/Boundaries

- The scenario is based on the phenomenon of condensation as observed by a 5th-grade science class in which students are planning an investigation in order to identify unknown material using observations and data.

Variable Features to Shift Complexity or Focus

- Complexity of scientific concept(s) to be modeled.
- Domain-specific vocabulary and definitions.
- Format of "real-world" phenomenon under investigation: image, data, text, combination.
- Properties presented (e.g., color, hardness, reflectivity, conductivity (i.e., electrical or thermal), magnetic, solubility).
- Standard units (e.g., grams, liters).
- Range of standard units.
- States of matter represented and/or included.
- Number of states of matter presented.

- Comparisons of states of matter.
- Materials to be identified.

General Description of Task/Chain of Sensemaking

- Students use an example of condensation to develop models to describe particle arrangements of matter (i.e., gas and liquid). **[Prompt 1, Part A: 5-PS1-1, KSA1]**
- Students use the developed models to describe a process (i.e., condensation) that involves particles too small to be seen. **[Prompt 1, Part B: 5-PS1-1 & 5-PS1-2, KSA1]**
- Students use properties and measurements in a data table as evidence to explain the identification of a material. **[Prompt 2: 5-PS1-3, KSA2]**
- Students use properties and measurements in a data table and identify which measurements and observations are necessary to explain the identification of a material. **[Prompt 3: 5-PS1-3, KSA1]**

Targeted PE-related KSAs

5-PS1-1, KSA1: Develop a model to describe that matter is made up of particles.

5-PS1-3, KSA2: Use observations and measurements as evidence to explain the identification of material.

5-PS3-1, KSA1: Identify and/or describe what observations and/or measurements are appropriate to identify materials based on their properties in a given investigation.

Cross-performance Expectations Related KSAs

5-PS1-1 & 5-PS1-2, KSA1: Use information, evidence, and particle arrangement models of matter to provide evidence of particles too small to be seen when a phase change occurs.

Student Demonstrations of Learning

- Develops a model that accurately represents the observable phenomena.
- Develops a model to describe that even if matter cannot be seen, it still exists as small particles that can be detected.
- Develops a model in which the scale of the model components is relevant to various objects, systems, and processes
- The model and response accurately describes the particles in the two conditions (e.g., before and after stirring).
- Correctly uses quantitative and qualitative data to identify materials based on their properties.
- Completely and appropriately explains, using evidence, that materials can be identified based on their observable and measurable properties.

Work Products

- Complete a model.
- Interpretation of data.
- 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
• Context or content. • Age appropriate. • Appropriate for different groups. • Makes sense of complex ideas in creative ways. • Vary the degree of challenge or complexity within prompts.	• Provide visual diagrams and charts. • Make explicit links between information provided in texts and any accompanying representation of that information in illustrations, equations, charts, or diagrams. • Activate relevant prior knowledge. • Highlight or emphasize key elements in text, graphics, diagrams, and formulas. • Use outlines, graphic organizers, unit organizer routines, concept organizer routines, and concept mastery routines to emphasize key ideas and relationships. • Give explicit prompts for each step in a sequential process.	• Solve problems using a variety of strategies. • Sentence starters. • Embed prompts to "show and explain your work".

SIPS Assessments Complexity Framework Components

Prompt	**A.1** Degree and nature of sense-making about phenomena or problems			**B.1** Complexity of the presentation			**B.2** Cognitive demand of response development			**B.3** Cognitive demand of response production		
	Low	Moderate	High	Low	Moderate	High	Low	Moderate	High	Low	Moderate	High
1 Part A		**X**		**X**			**X**				**X**	
1 Part B		**X**		**X**				**X**				**X**
2		**X**			**X**		**X**				**X**	
3		**X**			**X**				**X**		**X**	

Rubric Considerations

- Accuracy of the model.
- Sophistication of the explanations.
- Completeness and accuracy of response.

Assessment Boundaries

- Students are not expected to know that matter is made of atoms and molecules.
- Students are not expected to explain the properties of the particles.
- Students are not expected to apply proportional reasoning skills (Note: should not be included, as students learn proportions in grade 6, CCSSM[1]).
- Density should not be included.
- The task does not include the atomic-scale mechanism of evaporation and condensation or defining the unseen particles.
- Mass and weight are not distinguished.

Common Misconceptions

- **5-PS1-1**
  - Evaporation or dissolution destroys particles and their associated mass.
  - Constituent particles of a solid are completely still.
  - Particles expand when heated.
- **5-PS1-2**
  - 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.
- **5-PS1-3**
  - 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.

Possible Technical Terms for Task

- matter, solid, liquid, gas, particle, property, water vapor, heat transfer, condensation, solubility, physical properties

[1] National Governors Association Center for Best Practices, Council of Chief State School Officers. (2010). Common Core State Standards for Mathematics. Washington DC: Author.

Common Core State Standards for Literacy

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)**
- **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)**
- **W.5.9** Draw evidence from literary or informational texts to support analysis, reflection, and research. **(5-PS1-2), (5-PS1-3)**

Common Core State Standards for Mathematics

Mathematical Practice

- **MP. 2** Reason abstractly and quantitatively. (**5-PS1-1), (5-PS1-2), (5-PS1-3**)
- **MP.4** Model with mathematics. **(5-PS1-2), (5-PS1-3)**
- **MP.5** Use appropriate tools strategically. **(5-PS1-2), (5-PS1-3)**

Mathematics

- **5.MD.A.1** Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real-world problems. **(5-PS1-2)**

Task Notes

SIPS Assessments Complexity Framework

	Component	Complexity		
		Low	Moderate	High
Connections to Curriculum and Instruction	**A.1 Degree and nature of sense-making about phenomena or problems**	• Requires one or two dimensions • One dimension may have a greater degree of emphasis than another • Requires previously learned ideas or concepts	• Requires integration of two dimensions in the service of sense-making • Requires integration of same or different combinations of dimensions as represented in the PE bundle • Requires a combination of previously learned ideas or concepts and newly presented information	• Requires integration of three dimensions in the service of sense-making • Requires integration of same or different combinations of dimensions as represented in the PE bundle • Requires a combination of previously learned ideas or concepts and newly presented information
Characteristics of the Tasks	**B.1 Complexity of the presentation**	• The amount and type of information provided in the scenario supports limited simple connections among ideas or concepts • Provides few, simple graphics/data/models • Includes definitions or examples • Phenomenon or problem presented in a concrete way with high level of certainty	• The amount and type of information provided in the scenario supports multiple evident connections among ideas or concepts • Provides graphics/data/models • Limited use of definitions or examples • Phenomenon or problem presented with some level of uncertainty	• The amount and type of information provided in the scenario supports multiple and varied complex connections among ideas or concepts • Provides complex graphics/data/models • Phenomenon or problem presented with high-degree of uncertainty
	B.2 Cognitive demand of response development	• Requires well-defined set of actions or procedures • Requires a connection or retrieval of factual information • Response requires a low level of sophistication with routinely encountered well-practiced applications	• Requires application of ideas and practices given cues and guidance • Requires drawing relationships and connecting ideas and practices • Response requires a moderate level of sophistication with typical but relatively complex representation of ideas and application of skills	• Requires selection and application of multiple complex ideas and practices • Requires high degree of sense-making, reasoning, and/or transfer • Response requires a high level of sophistication with non-routine or abstract representation of ideas and application of skills

B.3 Cognitive demand of response production	• Responses include selection from a small set of options presented as text (e.g., word, short phrase) or other formats (e.g., a simple graphic or process)	• Responses include one or more sentences or a paragraph, a moderately complex graphic, or multiple steps in a simple or moderately complex process	• Responses include multiple paragraphs, multiple graphics of at least moderate complexity, or multiple steps in a complex process