Stackable Instructionally-embedded Portable Science (SIPS) Assessments Project

Grade 5 Science
Unit 1 End of Unit Assessment Design Patterns
Matter and Its Interactions
July 2023

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SIPS Grade 5 Unit 1 End of Unit Assessment Design Patterns (5-PS1-1, 5-PS1-2, 5-PS1-3, 5-PS1-4)

Grade 5 SIPS Design Pattern for 5-PS1-1

Element	Description
Knowledge and Practices (DCI, SEP, CCC)	In this task, students: • describe that matter of any type is made of particles too small to be seen and even then, can be detected by other means. • develop and use models to demonstrate understanding of the core ideas. The crosscutting concept of applying scale, proportion, and quantity using standard units is the organizing concept for these DCIs.
Performance Expectation	**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.]*
Knowledge, Skills, & Abilities (KSAs)	**KSA1:** Develop a model to describe that matter is made up of particles. **KSA2:** Use a provided model to describe that matter is made up of particles. **KSA3:** Use a provided model to describe that matter is made of particles too small to be seen. **KSA4:** Develop a model to describe that matter is made of particles too small to be seen.
Student Demonstration 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 describe the particles in the two conditions (e.g., before and after stirring). • Correctly identifies and describes relevant relationships between components of the model. • Uses the model to describe the phenomena presented.
Work Product	• Develop a model to describe phenomena. • Complete a model.

	- Selected response - Constructed response
Task Features	- The task focuses on performances for which students' opportunity to learn has prepared them. - The task is based on the assessed KSA(s) and driven by a high-quality scenario that focuses on a phenomenon or design problem. - The task scenario is grounded in the phenomena and problems being addressed. - The task provides ways for students to make connections of meaningful local, global, or universal relevance. - The task scenario is sufficient, engaging, relevant, and accessible to a wide range of students. - The task is accessible, appropriate, and cognitively demanding for all learners, including students with disabilities, students who are English learners, or are working below or above grade level. - All prompts within a task are fair and equitable and include a range of presentation and response modes. - The task requires students to use scientific reasoning and process skills to produce evidence that can be used by educators to make inferences about student learning. - The task requires students to use reasoning and integrate multiple dimensions (i.e., SEP, DCI, CCC) to support sense-making about phenomena or problems. - The task uses information that is scientifically accurate. - The task uses active voice and present tense. - The task is written at or below grade level. - The task requires students to develop a model to depict matter being made up of particles. - The task requires students to use data to be used as evidence to support the idea that even though matter is made of particles too small to be seen, matter can still exist and can be detected by means other than seeing.
Variable Features (Aspects of an assessment task that <u>can be varied</u> to shift complexity or focus.)	- Complexity of scientific concept(s) to be modeled. - Domain-specific vocabulary and definitions. - Phenomena addressed in the scenario, including but not limited to: - Adding air to expand a basketball. - Compressing air with a syringe. - Dissolving sugar in water. - Mixing baking soda in vinegar. - Evaporating salt water. - Frozen popsicle vs melted popsicle.

	• Format of "real-world" phenomena under investigation: image, data, text, combination.
	• Function of the model:
	  ○ To explain a mechanism underlying a phenomenon.
	  ○ To predict future outcomes.
	  ○ To describe a phenomenon.
	  ○ To generate data to inform how the world works.
	• Degree to which components of the model are provided.
	• Model may be student-created or provided for revision or creation.
	• Representation of model.
	• Use or purpose of the model.
	• Type of model (e.g., physical/virtual).
	• What matter is being modeled.
	• States of matter represented and/or included.
	• Number of states of matter presented.
	• Comparisons of states of matter.
	• Similarity of properties in comparisons of states of matter.

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. • Mass and weight are not distinguished. • Task does not include the atomic-scale mechanism of evaporation and condensation or defining the unseen particles.
Technical Terms	• Solubility, matter, particles, gas, solid, liquid, evaporation

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

Grade 5 SIPS Design Pattern for 5-PS1-2

Element	Description
Knowledge and Practices (DCI, SEP, CCC)	In this task, students: • understand that weight of matter is conserved when it changes form and regardless of what reaction or change in properties occurs, the total weight of the substances does not change. • measure and graph quantities such as weight to demonstrate understanding of the core ideas. The crosscutting concept of applying scale, proportion, and quantity using standard units is the organizing concept for these DCIs.
Performance Expectation	**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.]*
Knowledge, Skills, & Abilities (KSAs)	**KSA1:** Use observations and measurements to describe the changes in properties observed during and/or after heating, cooling, or mixing substances. **KSA2:** Use standard measurements and tools to calculate the difference between the total weight of the substances (using standard units) before and after they are heated, cooled, and/or mixed. **KSA3:** Use measurements and descriptions of weight to describe evidence to address scientific questions about the conservation of the amount of matter. **KSA4:** Measure and graph quantities to provide evidence and describe how the collected data can serve as evidence for whether the mixing of the two or more tested substances results in one or more new substances and that the total weight of matter is conserved. **KSA5:** Measure and graph quantities to describe how the collected data can serve as evidence for whether the heating of two or more tested substances results in the total weight of matter being conserved. **KSA6:** Measure and graph quantities to describe how the collected data can serve as evidence for whether the cooling of two or more tested substances results in the total weight of matter being conserved.
Student Demonstration of Learning	• Makes correct calculations. • Uses appropriate units. • Correctly uses quantitative and qualitative data to describe the quantitative and qualitative properties of the resulting substances. • Accurately measures, observes, and documents the physical properties of the substance before and after a physical or chemical

	change, and uses the data as evidence to explain any changes that occur. ● Completes an appropriate explanation, using evidence, that regardless of the type of change that matter undergoes, the mass is conserved. ● Describes the quantitative (e.g., mass, volume) and qualitative (e.g., state of matter, color, texture, odor) properties of the substances to be mixed.
Work Product	● Interpretation of data ● Complete data in tables ● Graph quantities ● Selected response ● Constructed response
Task Features	● The task focuses on performances for which students' opportunity to learn has prepared them. ● The task is based on the assessed KSA(s) and driven by a high-quality scenario that focuses on a phenomenon or design problem. ● The task scenario is grounded in the phenomena and problems being addressed. ● The task must prompt students to make connections between observed phenomena or evidence and the reasoning underlying the observation/evidence. ● The task provides ways for students to make connections of meaningful local, global, or universal relevance. ● The task scenario is sufficient, engaging, relevant, and accessible to a wide range of students. ● The task is accessible, appropriate, and cognitively demanding for all learners, including students with disabilities, students who are English learners, or are working below or above grade level. ● All prompts within a task are fair and equitable and include a range of presentation and response modes. ● The task requires students to use scientific reasoning and process skills to produce evidence that can be used by educators to make inferences about student learning. ● The task requires students to use reasoning and integrate multiple dimensions (i.e., SEP, DCI, CCC) to support sense-making about phenomena or problems. ● The task uses information that is scientifically accurate. ● The task must elicit core ideas as defined in the PE. ● The task uses active voice and present tense. ● The task is written at or below grade level. ● The task requires students to measure and describe physical quantities such as weight, time, temperature, and volume.

	● The task requires students to make observations and measurements to produce data that can serve as the basis for evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved. ● Physical properties of substances are provided.
Variable Features (Aspects of an assessment task that <u>can be varied</u> to shift complexity or focus.)	● Complexity of scientific concept(s) to be modeled. ● Domain-specific vocabulary and definitions. ● Phenomena addressed in the scenario, including but not limited to: ○ Adding air to expand a basketball. ○ Compressing air with a syringe. ○ Dissolving sugar in water. ○ Evaporating salt water. ○ Physical changes include phase changes and dissolving to form solutions. ○ Chemical changes include precipitation reactions or simple reactions involving the consumption or production of gas. ○ Change in color. ○ Change in state or texture. ○ Changes in temperature of the system or surroundings. ○ Formation of a precipitate. ○ Change in mass in an open system. ● Mathematical representations may include the weights of the substances before and after a change as well as the containers that hold the substances. ● Format of "real-world" phenomena under investigation: image, data, text, combination. ● Type of reactions or change, including but not limited to: ○ Phase changes ○ Dissolving ○ Mixing ● States of matter represented and/or included. ● Number of states of matter presented. ● Comparisons of states of matter. ● Similarity of properties in comparisons of states of matter. ● Task may include physical or chemical reactions.
Assessment Boundaries	● Students are not expected to distinguish between mass and weight.
Technical Terms	● Mixtures, physical changes, chemical changes, molecules, solutions, chemical reactions, conserved, phase changes, dissolving, weight

Grade 5 SIPS Design Pattern for 5-PS1-3

Element	Description
Knowledge and Practices (DCI, SEP, CCC)	In this task, students: ● describe how measurements of a variety of properties can be used to identify materials. ● use data based on observations and measurements from a given investigation to demonstrate understanding of the core ideas. The crosscutting concept of applying scale, proportion, and quantity using standard units is the organizing concept for these DCIs.
Performance Expectation	**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.]*
Knowledge, Skills, & Abilities (KSAs)	**KSA1:** Identify and/or describe what observations and/or measurements are appropriate to identify materials based on their properties in a given investigation. **KSA2:** Use observations and measurements as evidence to explain the identification of material. **KSA3:** Use observations of the properties of matter to identify a substance. **KSA4:** Use standard measurements to determine the property of a substance. **KSA5:** Make observations and measurements to identify materials based on their properties. **KSA6:** Describe how the observations and measurements provide the necessary data to identify materials based on their properties. **KSA7:** Describe how the data from a given investigation plan will be collected (e.g., quantitative measures, observations of properties).
Student Demonstration of Learning	● Calculates proportions correctly and measures accurately for valid results. ● Uses appropriate standard units. ● Correctly uses of 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.

	• Completely and accurately describes why some properties (e.g., shape) are or are not characteristic properties.
Work Product	• Interpretation of data • Tables • Graph quantities • Selected response • Constructed response
Task Features	• The task focuses on performances for which students' opportunity to learn has prepared them. • The task is based on the assessed KSA(s) and driven by a high-quality scenario that focuses on a phenomenon or design problem. • The task scenario is grounded in the phenomena and problems being addressed. • The task provides ways for students to make connections of meaningful local, global, or universal relevance. • The task scenario is sufficient, engaging, relevant, and accessible to a wide range of students. • The task is accessible, appropriate, and cognitively demanding for all learners, including students with disabilities, students who are English learners, or are working below or above grade level. • All prompts within a task are fair and equitable and include a range of presentation and response modes. • The task requires students to use scientific reasoning and process skills to produce evidence that can be used by educators to make inferences about student learning. • The task requires students to use reasoning and integrate multiple dimensions (i.e., SEP, DCI, CCC) to support sense-making about phenomena or problems. • The task uses information that is scientifically accurate. • The task uses active voice and present tense. • The task is written at or below grade level. • The task requires students to measure and describe physical quantities such as weight, time, temperature, and volume. • The task requires students to make observations and measurements to produce data that can serve as the basis for evidence that can be used to identify materials. • The task requires students to make observations and measurements to identify materials based on their properties.
Variable Features (Aspects of an assessment task that <u>can be varied</u> to shift complexity or focus.)	• Complexity of scientific concept(s) to be modeled. • Domain-specific vocabulary and definitions. • Format of "real-world" phenomena 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). - Number, type, and complexity of representations of tables, graphs, and/or data sets. - 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 include, but are not limited to: - Baking soda and other powders - Metals - Minerals - Liquids
Assessment Boundaries	- Density should not be included as a property. - Mass and weight are not distinguished. - Task may include physical or chemical reactions.
Technical Terms	Reflectivity, electrical conductivity, thermal conductivity, magnetic forces, solubility, matter, minerals, powders, conductors, classification, physical properties, chemical properties, metals, standard units (e.g., grams, liters)

Grade 5 SIPS Design Pattern for 5-PS1-4

Element	Description
Knowledge and Practices (DCI, SEP, CCC)	In this task, students: ● describe that when two or more different substances are mixed, a new substance with different properties may be formed. ● plan and use data from investigations to demonstrate understanding of the core ideas. The crosscutting concept of applying cause and effect relationships is the organizing concept for these DCIs.
Performance Expectation	**5-PS1-4.** Conduct an investigation to determine whether the mixing of two or more substances results in new substances.
Knowledge, Skills, & Abilities (KSAs)	**KSA1:** Given an investigation plan, students identify the purpose of the investigation, which includes providing evidence for whether new substances are formed by mixing two or more substances, based on the properties of the resulting substance. **KSA2**: Given an investigation where students must determine if mixing two substances results in a new substance, students describe how quantitative or qualitative properties of the two or more substances to be mixed will be determined and measured. **KSA3:** Collect and graph quantities such as weight to compare data from the original substances to data from the substance produced, and draw a conclusion about what changes, if any, have occurred. **KSA4:** Describe how using fair tests in which variables are controlled and the number of trials considered will produce data that can serve as the basis for evidence to determine whether the mixing of two or more substances results in new substances. **KSA5:** Conduct an investigation to determine if two substances are the same or different by collecting and graphing quantities such as weight to compare data from the original substances to data from the substance produced, and draw a conclusion about what changes, if any, have occurred.
Student Demonstration of Learning	● Accurately and completely describes the quantitative (e.g., mass, volume) and qualitative (e.g., state of matter, color, texture, odor) properties of the substances to be mixed. ● Accurately and completely describes the quantitative and qualitative properties of the resulting substances. ● Accurately and thoroughly records data before and after mixing substances. ● Identifies, tests, and uses cause-and-effect relationships to explain change. ● Accurately and completely develops a conclusion drawn from examining properties of substances.

	● Describes the properties and/or the measurements used of these properties to draw accurate and complete conclusions. ● Measures and graphs different properties of substances and describes the quantities of the properties using standard units.
Work Product	● Complete the steps of an investigation. ● Interpretation of data ● Graphs ● Selected response ● Constructed response
Task Features	● The task focuses on performances for which students' opportunity to learn has prepared them. ● The task is based on the assessed KSA(s) and driven by a high-quality scenario that focuses on a phenomenon or design problem. ● The task scenario is grounded in the phenomena and problems being addressed. ● The task provides ways for students to make connections of meaningful local, global, or universal relevance. ● The task scenario is sufficient, engaging, relevant, and accessible to a wide range of students. ● The task is accessible, appropriate, and cognitively demanding for all learners, including students with disabilities, students who are English learners, or are working below or above grade level. ● All prompts within a task are fair and equitable and include a range of presentation and response modes. ● The task requires students to use scientific reasoning and process skills to produce evidence that can be used by educators to make inferences about student learning. ● The task requires students to use reasoning and integrate multiple dimensions (i.e., SEP, DCI, CCC) to support sense-making about phenomena or problems. ● The task uses information that is scientifically accurate. ● The task uses active voice and present tense. ● The task is written at or below grade level. ● The task requires students to develop a model to depict matter. ● The task requires students to measure and describe physical quantities such as weight, time, temperature, and volume. ● The task provides an investigation plan. ● The task requires students to identify if a new substance is the result of mixing two or more substances.
Variable Features (Aspects of an assessment task that can	● Complexity of scientific concept(s) to be modeled. ● Domain-specific vocabulary and definitions.

<u>be varied</u> to shift complexity or focus.)	● Format of "real-world" phenomena under investigation: image, data, text, combination. ● Properties of substances 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. ● Compare data from the original substances to data from the substance produced. ● Convert among different-sized standard measurement units within a given measurement system and use these conversions to explain changes that occur. ● Variables that may be controlled or manipulated. ● Type of methods to determine whether the mixing of two or more substances results in new substances.
Assessment Boundaries	● Mass and weight are not distinguished.
Technical Terms	● Mixtures, substance, properties, evidence, variable, qualitative properties (e.g., state of matter, color, texture, odor)

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