



Stackable Instructionally- embedded Portable Science (SIPS) Assessments Project

Grade 5 Science Unit 1 Student Profile Matter and Its Interactions April 2023

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SIPS Grade 5 Science Unit 1 Student Profile

The Stackable, Instructionally-embedded, Portable Science (SIPS) Assessments 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. The student profile is intended to build science educators' understanding of the targeted student learning outcomes and how they are situated in the context of year-long instruction to promote and inform the intentional selection of curricular materials and design of instructional opportunities to achieve these outcomes for all students. In addition, the end-of-unit profile can support discussion with students, parents, and guardians about the Unit 1 topic of interest "Matter and Its Interactions" and the knowledge, skills, and abilities to which teaching and opportunities to learn will be based.

The Stackable, Instructionally-embedded, Portable Science (SIPS) Assessments Unit 1 student profile provides a description of:

1. The **prior learning opportunities** and necessary **prior knowledge and skills** that students are expected to have acquired for all three dimensions—Science and Engineering Practices (SEPs), Disciplinary Core Ideas (DCIs), and Crosscutting Concepts (CCCs)—before engaging in Unit 1, "**Matter and Its Interactions.**" These prior learning opportunities and knowledge and skills serve as entry points to the unit to ensure readiness and to foster understanding of new and increasingly sophisticated learning experiences. This section also includes an explanation of how prior learning, knowledge, and skills will be built upon in the unit.
2. The **knowledge, skills, and abilities students are expected to learn and demonstrate by the end of the unit** when provided with opportunities to integrate scientific and engineering practices with important disciplinary core ideas and crosscutting concepts to scientifically investigate and understand natural phenomena and solve important science and engineering design problems.
3. The **learning experiences in Unit 2 that allow students to build from and expand their learning in Unit 1** to effectively engage in the SEPs to sense-make using acquired scientific knowledge and understanding of the CCCs in the context of multiple DCIs. This section highlights key connections among important scientific ideas, practices, and concepts that students investigate as they progress from one unit to the next.

The following sections describe prior learning, knowledge skills and abilities to be developed during the unit, and how these knowledge skills and abilities prepare students to deepen their science learning in Unit 2. The content in these sections uses the dimensional appendices of the NGSS (i.e., Appendix E, F, G), the performance expectations articulated in the NGSS, and the content of the Unit Maps being co-developed by educators and SIPS personnel.

1. Prior Learning Opportunities

By building familiarity with ideas related to the conservation and particulate 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 focuses on physical changes in matter. Unit 2 focuses on matter and energy flows in ecosystems. By building

familiarity with ideas related to the conservation and particulate nature of matter early in the year, students are prepared to put this knowledge to work in investigating various life and Earth systems in later bundles.

2. End-of-Unit Learning Outcomes

Measurement targets are narrative descriptions that integrate the DCIs, SEPs, and CCCs into a single statement representing what is to be taught and assessed in each unit. The SIPS Measurement Target for this unit is:

- Students are able to apply Science and Engineering Practices with emphasis on **developing and using models** and **planning and carrying out investigations including evaluating evidence using mathematics and computational thinking** related to the **scale of the structure and properties of matter, including whether or not matter is conserved, and to identify materials and mixtures based upon their properties or results of a reaction before and after mixing.**

Students will 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. The DCIs and CCCs work together in allowing students to think of scales that are too small to be seen without magnification (particles/molecules) and to use their understanding of substances' properties to reason about causes and effects that underlie their observations. Through developing/using models and planning/carrying out investigations, students will gain experience developing models in physical science, and planning/conducting investigations (with an emphasis on measurement and representing data) about matter and properties of matter.

DCI

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 particulate 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.

CCC

Over the course of Unit 1, students will consider and use Cause and Effect relationships to investigate changes (or lack of changes) that occur when substances are mixed. They will also use and compare properties of substances to identify/determine the type of substance (using cause-and-effect reasoning to make determinations of a substance's identity). Regarding the SPQ CCC, students will gain experience with reasoning about quantity (e.g., use standard units when measuring properties of substances and objects) and scale (thinking about objects that are very small, e.g., particles too small to be seen without magnification).

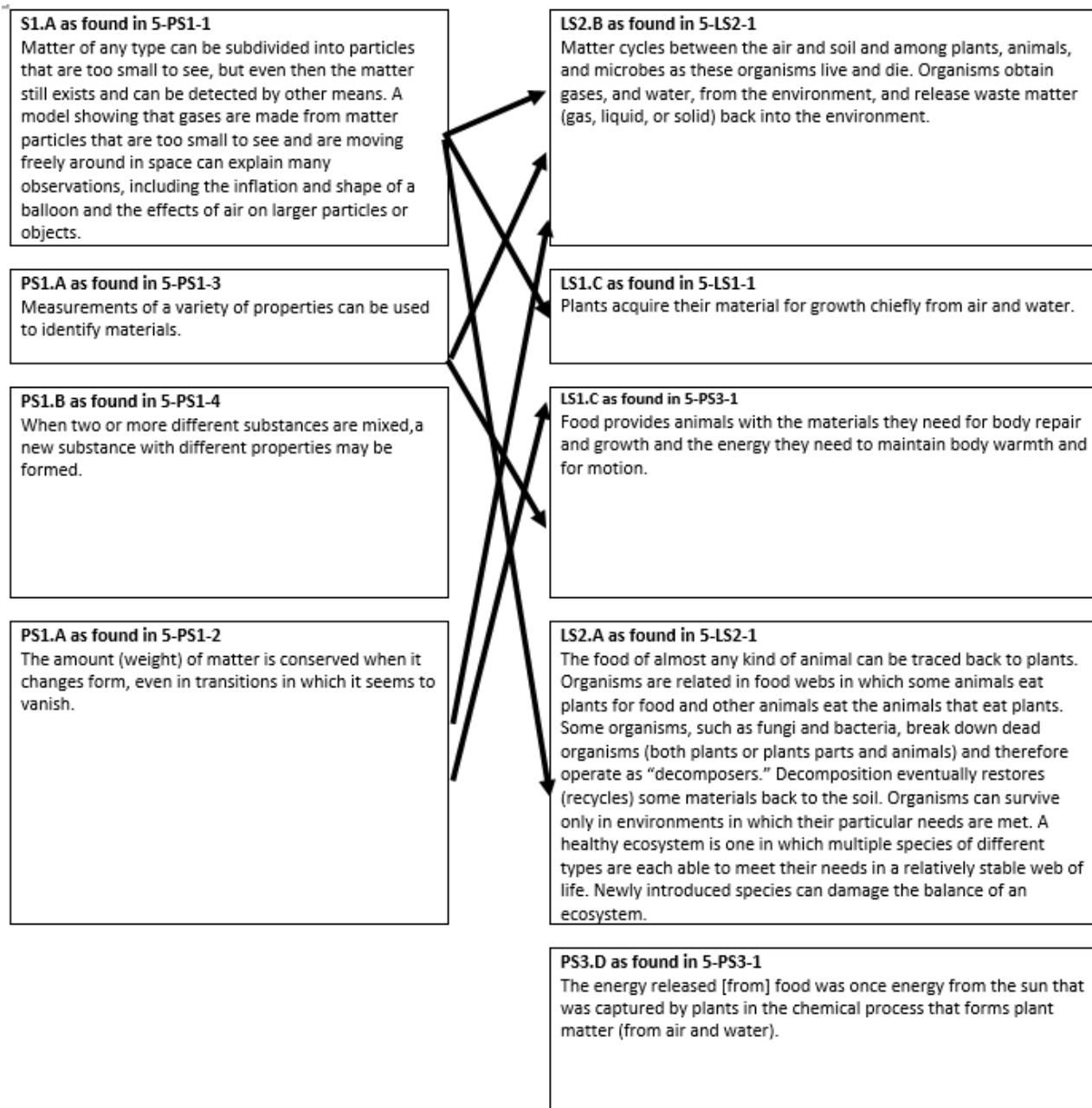
SEP

Over the course of this unit, students will engage in Developing and Using Models (e.g., developing a model that accurately represents that substances in different states of matter are made up of particles that are too small to be seen). Students will also use the information provided in a model to accurately explain that regardless of the amount of a substance, it is made up of particles that are too small to be seen. Students will engage in Planning and Carrying out investigations such as describing the procedure for an investigation to determine what happens during the mixing of two or more substances. They will make appropriate observations and/or measurements to produce data about the properties of substances before and after they are mixed. Regarding the Using Mathematics and Computational Thinking SEP, some examples of students' engagement in the practice will be to measure properties of substances (e.g., mass/weight) and generate graphs and/or representations of data about properties of substances before and after they are mixed.

3. Connections to Unit 2 Learning Opportunities

DCI

Unit 1 deals with structure and properties of matter. Knowing that matter is made up of particles too small to be seen and that mass is always conserved will help students to build towards concepts in Unit 2 where students will learn about where plants get their food from and describe the movement of matter within and between biotic and abiotic elements of an ecosystem.



CCC

Unit 1 CCCs focus on Cause & Effect and Scale, Proportion, and Quantity. In contrast, Unit 2 CCCs focus on Energy & Matter (“Energy can be transferred in various ways and between objects.” and “Matter is transported into, out of, and within systems.”) and Systems and System Models (“A system can be described in terms of its components and their interactions.”). Although the specific CCCs in Unit 1 do not necessarily prepare students for the different Unit 2 CCCs, the inclusion of CCCs in Unit 1 can be a starting point for students to understand that they will use the CCCs throughout the year to understand and make sense of phenomena.

SEP

Unit 1 SEPs include Developing and Using Models, which is also used again in Unit 2. Students in Unit 1 will have had experience developing and using models to illustrate that substances are composed of particles and/or particle motion. In Unit 2 they can use their experience building descriptive models to help them as they model different concepts (e.g., movement of matter and/or energy within an ecosystem). Unit 2 also uses Engaging in Argument from Evidence, which was not used in Unit 1. However, when engaging in Argument from Evidence during this unit, students should be “support[ing] an argument with evidence, data, or a model.” In Unit 1, they will have conducted investigations to collect data that can be used as evidence for their claims, and they will have developed models to describe phenomena. These experiences working with models, data, and evidence will help prepare them for engaging in an argument that makes use of these three forms of scientific information.

Appendix A. DCI, CCC, and SEP Prior Learning Opportunities

DCIs from NGSS Appendix E: DCI Progression within NGSS

- **Prior DCI Learning from K-2** (from NGSS Appendix E: DCI Progression within NGSS; p7)
 - Matter exists as different substances that have observable different properties.
 - Different properties are suited to different purposes.
 - Objects can be built up from smaller parts.
 - Heating and cooling substances cause changes that are sometimes reversible and sometimes not.
 - Matter can change states (solid, liquid, gas) when heated, cooled, and/or mixed. [P2-PS1-1] (listed as a prior understanding in Big Idea in Unit 1)

CCC - Cause & Effect

- **Prior learning from K-2:** Students are expected to understand that events can be described in terms of cause(s) and effect(s) and have some experience identifying causes and/or effects.
 - In Grades K-2, students learn that events have causes that generate observable patterns. They design simple tests to gather evidence to support or refute their own ideas about causes. [Appendix G]
- **Prior learning from this grade band (e.g., Grades 3 & 4 and/or prior SIPS G5 units):** During Grade 3, Grade 4, and Grade 5, students are expected to become adept at identifying/testing causes and effects and to become aware that events can be correlated but yet not causally related.
 - Multiple Grade 3 and Grade 4 PEs use this CCC, so students will likely have some experience with the Grade 3-5 CCC elements, prior to starting Grade 5 and Unit 1.
 - An example Grade 4 PE that uses the same CCC element as the 5-PS1-4 CCC (i.e., students will have had experience with this CCC if they were previously taught this Grade 4 PE): *4-ESS2-1. Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.*

CCC - Scale, Proportion, & Quantity

- **Prior learning from K-2:** Students are expected to have experience describing objects in terms of a property that can be described using relative scales (e.g., bigger than..., smaller than...) and using an absolute scale to describe the property of length).
 - In Grades K-2, students use relative scales (e.g., bigger and smaller; hotter and colder; faster and slower) to describe objects. They use standard units to measure length. [Appendix G]
- **Prior learning from this grade band (e.g., Grades 3 & 4 and/or prior SIPS G5 units):** Minimal/not applicable.
 - Only 1 PE (3-LS4-1) in Grades 3 and 4 uses the SPQ CCC and it's not directly relevant/preparatory for the CCC's use in the two Grade 5 PEs for this unit.

SEP - Developing and Using Models

- **Prior learning from K-2:** Students are expected to have had opportunities to develop models (i.e., diagrams, drawings, physical replicas, dioramas, dramatizations, or storyboards) that represent concrete events. More specifically, students should be able to:
 - Distinguish between a model and the actual object, process, and/or events the model represents.
 - Compare models to identify common features and differences.
 - Develop and/or use a model to represent amounts, relationships, relative scales (bigger, smaller), and/or patterns in the natural and designed world(s).
- **Prior learning from this grade band (e.g., Grades 3 & 4 and/or prior SIPS G5 units):** During grades 3-5 students are expected to build and revise simple models and use models to represent events and design solutions.
 - 4 other PEs in Grades 3 and 4 use the practice of modeling. They are: 3-LS1-1, 4-PS4-1, 4-PS4-2 and 4-LS1-2.

SEP - Using Mathematics and Computational Thinking

- **Prior learning from K-2:** Students may have had opportunities to recognize that mathematics can be used to describe the natural and designed world(s). More specifically, students should be able to:
 - Decide when to use qualitative vs. quantitative data.
 - Use counting and numbers to identify and describe patterns in the natural and designed world(s).
 - Describe, measure, and/or compare quantitative attributes of different objects and display the data using simple graphs.
 - Use quantitative data to compare two alternative solutions to a problem.

However, there is no PE in K-2 that ever uses this SEP; its first introduction is in Grade 5. Therefore, it is likely that students will have minimal or no exposure to formal learning of this SEP prior to Grade 5, Unit 1.
- **Prior learning from this grade band (e.g., Grades 3 & 4 and/or prior SIPS G5 units):** During Grades 3-5 students are expected to extend quantitative measurements to a variety of physical properties and use computation and mathematics to analyze data and compare alternative design solutions.
 - No other PE in Grades 3 and 4 uses this practice.

SEP - Planning and Carrying out Investigations

- **Prior learning from K-2:** Students are expected to have had opportunities to plan and carry out simple investigations, based on fair tests, which provide data to support explanations or design solutions. More specifically, students should be able to:
 - With guidance, plan and conduct an investigation in collaboration with peers (for K).

- Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question.
- Evaluate different ways of observing and/or measuring a phenomenon to determine which way can answer a question.
- Make observations (firsthand or from media) and/or measurements to collect data that can be used to make comparisons.
- Make observations (firsthand or from media) and/or measurements of a proposed object or tool or solution to determine if it solves a problem or meets a goal.
- Make predictions based on prior experiences.
- **Prior learning from this grade band (e.g., Grades 3 & 4 and/or prior SIPS G5 units):** During Grades 3-5 students are expected to include investigations that control variables and provide evidence to support explanations or design solutions.
 - 5 PEs in Grades 3 and 4 use this practice. They are: 3-PS2-1, 3-PS2-2, 4-PS3-2, 4-ESS2-1 and 3-5-ETS1-3.

SEP - Constructing Explanations and Designing Solutions

- **Prior learning from K-2:** Students are expected to have had opportunities to design multiple simple solutions to a problem associated with wind or water and its impact on the shape of the land.
 - Students can construct a device to address a problem in a way that mimics the way plants or animals survive, grow, and meet their needs.
 - Students can develop evidence-based accounts of the way multiple solutions can address a problem.
- **Prior learning from this grade band (Grades 3 & 4):** During Grades 3-5 students are expected to include investigations that design solutions to problems using appropriate information.
 - Multiple PEs in Grades 3 and 4 use these SEPs. These include two PEs (4-ESS3-2 and 4-PS3-4) which ask students to consider multiple solutions based on how they meet criteria and constraints in the context of the impact of natural Earth processes on humans or to develop a device for energy conversion (These also integrate the Influence of Science, Engineering, and Technology on Society and the Natural World).

SEP - Asking Questions and Defining Problems

- **Prior learning from K-2:** Students have had opportunities in the context of asking questions about systems and defining a simple problem. More specifically, students should be able to:
 - Define how a new or improved object or tool can be developed.
- **Prior learning from this grade band (Grades 3 & 4):** During Grades 3-5 students should progress in their ability to define problem statements and to identify how objects or tools can be used to address the problem [Appendix F].
 - 4 PEs in Grades 3 and 4 use this practice. They are: 3-PS2-3, 3-PS2-4, 4-PS3-3, and 3-5-ETS1-1.

SEP - Analyze and Interpret Data

- **Prior learning from K-2:** Students are expected to have had opportunities to collect, record, and share observations. More specifically students should be able to:
 - Use observations (firsthand or from media) to describe patterns and/or relationships in the natural and designed world(s) in order to answer scientific questions and solve problems.
- **Prior learning from this grade band (Grades 3 & 4):** During grades 3-5 students are introduced to quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used.
 - 4 PEs in Grades 3 and 4 use this practice. They are: 3-LS3-1, 3-LS4-1, 3-ESS2-1, and 4-ESS2-2.

SEP - Obtaining, Evaluating, and Communicating Information

- **Prior learning from K-2:** Students have had opportunities to use observations and texts to communicate new information. More specifically, students should be able to:
 - Read grade-appropriate texts and/or use media to obtain scientific and/or technical information to determine patterns in and/or evidence about the natural and designed world(s).
 - Describe how specific images (e.g., a diagram showing how a machine works) support a scientific or engineering idea.
 - Obtain information using various texts, text features (e.g., headings, tables of contents, glossaries, electronic menus, icons), and other media that will be useful in answering a scientific question and/or supporting a scientific claim.
 - Communicate information or design ideas and/or solutions with others in oral and/or written forms using models, drawings, writing, or numbers that provide detail about scientific ideas, practices, and/or design ideas.
- **Prior learning from this grade band (e.g., Grades 3 & 4 and/or prior SIPS G5 units):** During Grades 3-5 students are expected to progress to evaluating the merit and accuracy of ideas and methods. [Appendix F]
 - Two PEs (3-ESS2-2; 4-ESS3-1) focus on obtaining, evaluating, and communicating information in the domain of earth and space science.