Stackable Instructionally-embedded Portable Science (SIPS) Assessments Project

Grade 5 Science

Unit 2 Task 3 Specification Tool & Verification of Alignment

Matter and Energy in Organisms and Ecosystems

September 2023

Grade: 5	Unit: 2	Task Number: 3	Task Title: Cycling Through a System

NGSS Performance Expectations

5-LS2-1 Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment. [Clarification Statement: Emphasis is on the idea that matter that is not food (air, water, decomposed materials in soil) is changed by plants into matter that is food. Examples of systems could include organisms, ecosystems, and the Earth.] *[Assessment Boundary: Assessment does not include molecular explanations.]*

5-PS3-1 Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun. [Clarification Statement: Examples of models could include diagrams and flow charts.]

Phenomena or Phenomena-rooted Design Problem

- Ecosystem responses to invasive species and the importance of an ecosystem maintaining healthy ecological functions.

Scenario/Context/Situation/Boundaries

- The scenario introduces an example of an invasive species being introduced into an ecosystem.
- Students predict the impact of an invasive species.
- Students complete a model showing the interconnected relationships between organisms in a food web and provide evidence to support a claim related to a balanced ecosystem.
- Students use the model to describe the movement of energy and matter in an ecosystem.
- Students use evidence of components of a healthy ecosystem to predict the loss of an existing species or population as a result of a newly introduced species.

Variable Features to Shift Complexity or Focus

- Complexity of scientific concept(s) to be modeled.
- Domain-specific vocabulary and definitions.
- The interaction between components.
- Types of ecosystems.
- Contexts include, but are not limited to:
  - Models of energy or matter exchange (e.g., food web, food pyramid).

o   Introduction of a new or invasive species or population.

● Format of "real-world" phenomenon under investigation: image, data, text, combination.

General Description of Task/Chain of Sensemaking

- Students interpret a description including graphics, regarding an invasive species in an aquatic ecosystem to predict the impact of the introduction of new species. **[Prompt 1: 5-LS2-1, KSA4]**

- Students complete a model relating energy transfer relationships among organisms and the sun. **[Prompt 2, Part A: 5-PS3-1, KSA1]**

- Students are asked to develop a statement about energy transfer relationships among decomposers, animals, the sun, and plants in a balanced ecosystem. **[Prompt 2, Part B: 5-LS2-1, 5-PS3-1, KSA1]**

- Students describe the components' (plants, animals, decomposers) relationships in an ecosystem to explain or predict a scientific event related to the introduction of an invasive species. **[Prompt 3: 5-LS2-1, 5-PS3-1, KSA2]**

Targeted PE-related KSAs

5-LS2-1, KSA4: Use a provided model to describe the components' (plants, animals, decomposers) relationships, and interactions among the organisms within a system.

5-PS3-1, KSA1: Develop and or use a model with provided information (i.e., a specific mammal, insect, set of living things, sun) to show that energy from the sun is transferred to animals through a chain of events that begins with plants producing food and then being eaten by animals.

Cross-performance Expectations Related KSAs to Target

5-LS2-1, 5-PS3-1, KSA1: Identify the transfer of energy in the system between (components) plants, animals, decomposers, and the environment using a model.

5-LS2-1, 5-PS3-1, KSA2: Use evidence/data to construct a claim about the impact of an invasive species on relationships, and interactions among the organisms within an ecosystem.

Student Demonstrations of Learning

- Accurately describes the relationship of the components for a given phenomenon.

- Explains the relevance of each component in an ecosystem.

- Model correctly uses provided information to identify the cycling of energy between components.

- Correctly uses the model to show how variables affect the flow of energy and cycle of matter in an ecosystem.

- Correctly predicts the effect of a newly introduced species and its damage to the balance of an ecosystem.

Work Products

- Constructed response.

- Development of or use of a model to describe phenomena.
- Support an argument with evidence, data, or a model.

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		X			X			X			X	
2 Part A		X		X				X		X		
2 Part B	X			X				X		X		
3			X	X					X		X	

Rubric Considerations

- Accuracy of the model (including the scale).
- Sophistication of the explanations.
- Completeness and accuracy of response.

Assessment Boundaries

- Assessment does not include molecular explanations of the movement of matter among plants, animals, decomposers, and the environment.
- Assessment does not include molecular explanations or the biochemical mechanisms of photosynthesis.

Common Misconceptions

- **5-LS2-1**
  - Soil is the primary source of energy for plants.
  - Dead things do not have energy/nutrients and do not have value to an ecosystem.
  - Small changes to an ecosystem only have small impacts.
- **5-PS3-1**
  - Energy is not necessary for life functions.
  - Life processes destroy energy.
  - Plants obtain energy for growth from the soil (with assistance from decomposers) or human activity rather than from sunlight.
  - Energy cannot be gained from eating dead animals because dead things do not have energy.

Possible Technical Terms for Task

- energy, matter, system, organism, cycle, food chain, nutrients, bacteria, decomposer, waste, ecosystem

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), (5-LS2-1)**

Writing

- **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-PS3-1)**

Common Core State Standards for Mathematics

Mathematical Practice

- **MP.2**. Reason abstractly and quantitatively. **(5-PS3-1), (5-LS2-1)**
- **MP.4.** Model with mathematics. **(5-LS2-1)**

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