SAIL Unit 1 Overview Document
Grade 5: Life Science, Physical Science
What Happens to our Garbage?

Anchoring Phenomenon (AP) for Unit: The anchoring phenomenon of the unit is that the school, home, and neighborhood make large amounts of garbage every day. This garbage persists in landfills over a long period of time. Students encounter a giant mountain of garbage from the school lunch. Students ask questions about the patterns they observe in the garbage pile.

Driving Question (DQ) for Unit: Students' group their questions and establish the Driving Question (DQ) of the unit: What happens to our garbage?

Unit Overview. As the Garbage unit progresses, students' understanding of science builds coherently as they investigate what happens to the garbage in the classroom open and closed landfill bottle systems. When the landfill bottles start to smell in the open system, students ask, "What is that smell?" (5-PS1-1 on particle nature of matter/gas). In addition, they make observations of the weight of the garbage materials when some materials (e.g., banana and orange) seem to have vanished (5-PS1-2 on conservation of weight of matter). They also ask, "What causes changes in the properties of materials in the garbage?" and "What causes smell from the garbage?" (5-PS1-4 on chemical reactions). They obtain information about microbes causing food materials to decompose and produce smell (5-LS2-1 on decomposers in the environment).

Summative Artifact and Assessment
At the end of the unit, students develop their final Model: Landfill Bottle, construct an explanation to answer the DQ, What happens to our garbage?. Students take the end of unit assessment.

Cluster 1: What do we want to know about our garbage?

Lesson 1-1: ***What materials are in our garbage?***

The lesson provides context for the unit phenomenon students will be explaining. Students as scientists make observations of a pile of school lunch garbage. After sorting the garbage into categories, students make predictions about what will happen to the properties of materials in each garbage category over time. Students make observations and ask questions about home garbage, school, and landfill garbage systems.
Through a teacher-led discussion, students place their questions on the classroom Driving Question Board and link the questions together to form the DQ, What happens to our garbage?

4 class periods
Learning Performances

- Students make observations of the properties of materials in the lunch garbage to identify materials and decide how to sort the materials into categories.
- Students make predictions about what will happen to the materials in each garbage category over time based on observed patterns of properties within the categories.

- Students ask questions to investigate what happens to the properties of materials in the lunch garbage system over time.

Cluster 2: What happens to the garbage materials?

Lesson 2-1: *Do garbage materials change in a landfill?*

Students plan and set up an investigation using landfill bottles to answer the question, Do garbage materials change in a landfill bottle system? Some landfill bottles are set up as an open system and some as a closed system. Students record initial property and weight data that they will later use as evidence for observing changes in the properties of materials and for establishing conservation of matter. Students make predictions about what will happen to the properties of the materials and the weight of the landfill bottles over time. Initial models are developed.

3 class periods

Learning Performance

Students carry out an investigation to measure the changes in properties of materials over time in a landfill bottle system.

Lesson 2-2: *What happens to materials that are crushed in the landfill?*

Students plan a crush and tear investigation by deciding how to record the properties and weight of materials. In pairs, students identify and share patterns they find in the crush and tear investigation data. Students engage in an argument that the type of material remains the same, even when the materials are crushed in a landfill. They also argue that the amount of material remains the same, even when the materials are crushed in a landfill (conservation of the weight of matter).

2 class periods

Learning Performances

- Students describe the patterns observed in the properties and the weight of materials when the materials change appearance (e.g., crushed or torn up).
- Students argue that the patterns observed in the properties of materials serve as evidence that the type of material is the same even when the material changes appearance.
- Students argue that the patterns observed in the weight of materials serve as evidence that the amount of matter is the same even when the matter changes appearance.

Lesson 2-3: *How are solid and liquids the same and different?*

Groups investigate mixing sugar and water. Students develop an individual model of solids and liquids. Through class demonstration, students model that matter is made of particles. Groups develop Model: Solids and Liquids to represent that solids and liquids are made of particles too small to see.

3 class periods

Learning Performances

- Students develop models of matter to describe that matter is made of particles too small to see.
- Students develop models of matter that matter is made of particles too small to see and use the models to describe and explain observed similarities and differences between solids and liquids.

Cluster 3: How do we smell garbage materials?

Lesson 3-1: *Do materials change or vanish in a landfill at time point 2?*

Students observe and record changes in the properties of materials in the landfill bottle systems. Students predict changes in the weights of the landfill bottle systems, and they record changes in the weights of the landfill bottle systems.

1 class period

Learning Performance

Students carry out an investigation to measure the changes in properties of materials and weight of the landfill bottle system over time in order to track matter in a landfill bottle.

Lesson 3-2: *What is that smell?*

Prompted by a scented material in the classroom, students ask questions about smell/air/gas and add their questions to the Driving Question Board. The teacher describes that gases are matter made of particles too small to see. Students develop individual Model: Air and Gas.

Students investigate and observe air effects on a balloon, a syringe, and a computer simulation. Students revise initial Model: Air and Gas based on these investigations to argue that air is matter that has weight and is made of freely moving particles too small to see.

3 class periods

Learning Performances

- Students develop models to describe that gas is a form of matter and is made of particles that are too small to see and that move freely.
- Students collect data to serve as evidence that gas has weight that can be measured.

Lesson 3-3: *Do materials change or vanish in a landfill at time point 3?*

Students observe and record changes in the properties of materials and weight of landfill bottle systems. They identify patterns in data to interpret changes in properties and weight. Students argue from evidence to answer the question, *Do materials change or vanish in a landfill?* Groups develop landfill models for time point 3 and compare classroom group models with a gallery walk of landfill models.

3-4 class periods

Learning Performance

Students interpret data of the changes in properties of materials and weight of landfill bottle systems to provide evidence for the conservation of matter in a closed system compared to an open system.

Cluster 4: What causes changes in garbage materials?

Lesson 4-1: *What happens to materials when they are mixed?*

Groups complete Investigation: Rock Salt and Baking Soda. Groups complete investigation questions and interpret investigation data, and then engage in argument to answer the question, *What happens to these materials when they are mixed?*

2 class periods

Learning Performance

Students engage in an argument that a reaction may produce a new substance when substances mix, but the weight is conserved.

Lesson 4-2: *What causes changes in landfill bottles?*

Students obtain formation from media and make predictions about observations. Groups investigate microbes using an agar plate. Students construct an explanation about the cause of changes in the landfill bottle systems, including a claim, evidence, and reasoning. Groups revise and present revised Model: Landfill Bottle to class. Students answer the DQ, *What happens to our garbage?*

4 class periods

Learning Performances

- Students construct an explanation using evidence from the investigation that microbes provide the process that causes the break down (rotting) of food materials in a landfill bottle system.
- Students revise a model of the landfill bottle that includes the flow of matter into and out of the landfill bottle system, and identify the cause and effect relationship of microbes and changes in properties of food materials such as rotting, smell, and leachate.

Performance Expectations (PEs) for Unit 1: The Garbage Unit

5-PS1-3. Make observations and measurements to identify materials based on their properties.

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions. • Make observations and measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon.	**PS1.A: Structure and Properties of Matter** • Measurements of a variety of properties can be used to identify materials. (Boundary: At this grade level, mass and weight are not distinguished, and no attempt is made to define the unseen particles or explain the atomic-scale mechanism of evaporation and condensation.)	**Scale, Proportion, and Quantity** • Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume.

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.

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Using Mathematics and Computational Thinking Mathematical and computational thinking in 3–5 builds on K–2 experiences and progresses to extending quantitative measurements to a variety of physical properties and using computation and mathematics to analyze data and compare alternative design solutions. • Measure and graph quantities such as weight to address scientific and engineering questions and problems.	**PS1.A: Structure and Properties of Matter** • The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish. **PS1.B: Chemical Reactions** • No matter what reaction or change in properties occurs, the total weight of the substances does not change. (Boundary: Mass and weight are not distinguished at this grade level.)	**Scale, Proportion, and Quantity** • Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume. ***Connections to Nature of Science*** **Scientific Knowledge Assumes an Order and Consistency in Natural Systems** • Science assumes consistent patterns in natural systems.

5-PS1-1. Develop a model to describe that matter is made of particles too small to see.

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions. • Use models to describe phenomena.	**PS1.A: Structure and Properties of Matter** • Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. A model showing that gases are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects.	**Scale, Proportion, and Quantity** • Natural objects exist from the very small to the immensely large.

5-PS1-4. Conduct an investigation to determine whether the mixing of two or more substances results in new substances.

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions. • Conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.	**PS1.B: Chemical Reactions** • When two or more different substances are mixed, a new substance with different properties may be formed.	**Cause and Effect** • Cause and effect relationships are routinely identified and used to explain change.

5-LS2-1. Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment. (partial)

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models Modeling in 3–5 builds on K–2 models and progresses to building and revising simple models and using models to represent events and design solutions. • Develop a model to describe phenomena. ***Connections to the Nature of Science*** **Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena** • Science explanations describe the mechanisms for natural events.	**LS2.A: Interdependent Relationships in Ecosystems** • The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as "decomposers." Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are	**Systems and System Models** • A system can be described in terms of its components and their interactions.

NGSS Progressions of DCI K-8

2nd Grade

PS1.A: Structure and Properties of Matter

- Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature. Matter can be described and classified by its observable properties. (2-PS1-1)
- Different properties are suited to different purposes. (2- PS1-2),(2-PS1-3)
- A great variety of objects can be built up from a small set of pieces. (2-PS1-3)

PS1.B: Chemical Reactions

- Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible, and sometimes they are not. (2-PS1-4)

Middle School

PS1.A: Structure and Properties of Matter

- Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms. (MS-PS1-1)
- Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. (MS-PS1-3) (Note: This Disciplinary Core Idea is also addressed by MS-PS1-2.)
- Gases and liquids are made of molecules or inert atoms that are moving about relative to each other. (MS-PS1-4)
- In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but do not change relative locations. (MS-PS1-4)
- Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). (MS-PS1-1)
- The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter. (MS-PS1-4)

PS1.B: Chemical Reactions

- Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. (MS-PS1-3) (Note: This Disciplinary Core Idea is also addressed by MS-PS1-2 and MS-PS1-5.)

LS2.A: Interdependent Relationships in Ecosystems

- Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. (MS-LS2-1)