Lesson 1-1
What materials are in our garbage?

Lesson Overview
1. Timeframe: 4 class periods 2. 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. **SEP *Planning and carrying out an investigation***: *Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.* **SEP *Asking questions***: *Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships.* **DCI *PS1.A***: *(PS1.A by grade 2) Different kinds of matter exist. You can distinguish materials by their observable properties.* **CCC *Patterns***: *Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena and designed products.* **CCC *Systems and system models***: *A system can be described in terms of its components and their interactions.* 3. Overview Day 1 • Students, in groups, make observations about a pile of school lunch garbage (unit phenomenon). Students sort garbage into categories based on observed patterns. • In a class discussion of the categories identified by groups, students think as scientists to emphasize the properties of materials and patterns. • Students complete their first entry in the Science and Engineering Notebook (SEN). Day 2 • Students make predictions about what will happen to the properties of materials in each garbage category over time.

- Students share their predictions about what happens to garbage over time.
- Students watch Video Lesson 1-1: Virtual Landfill Field Trip about landfills and write questions in their SEN.
- Assign Homework 1-1.

Day 3

- Students, in groups, share Homework 1-1 by comparing home garbage observations to find similarities and differences.
- Through a class discussion, the teacher models the home lunch garbage by placing sticky notes on the board to create a class display. This display illustrates the components of a system.
- Small groups name the components of a school or community garbage system and arrange the components on sticky notes to show how the components work together to get rid of garbage.
- Students add school and community sticky notes to the display to describe how the systems and components interact. Students' experiences with creating the garbage disposal system is an introduction to the crosscutting concept, systems and system models.
- Students ask questions about the garbage systems and add them to their SEN.

Day 4

- Students arrange all of their questions about garbage from Lesson 1-1 (from SEN).
- Students determine which of their questions are testable in a classroom and share with their group.
- Through a teacher-led discussion, students place their questions on the DQ Board and link the questions together to form the DQ, *What happens to our garbage?*

Materials

For each student:

- 1 Science and engineering notebook (SEN)
- 1 Pencil
- 1 Pair of plastic gloves
- 1 Pair of safety goggles
- 1 Copy of Homework 1-1: What Materials Are In Our Home Garbage? (Day 2)

For each group:

- Tools to handle garbage, such as a rake, tongs, etc.
- 1 Pad of sticky notes
- 1 Small pile of lunch garbage (make sure to include the following materials: fruit, plastic utensils, aluminum foil, etc.)

For the class:

- Tarp(s) to cover floor
- Video Lesson 1-1: Virtual Landfill Field Trip (Day 2)
- Optional: camera to take pictures

Preparation

- Grouping: Place students into groups. These groups will stay together throughout most of the unit. The group size should be at least 3 and not more than 5 students. Typically, there are 6 groups per classroom.
- Garbage: Arrange to display a small pile of garbage for each group of students. The garbage piles should contain a mixture of food (fruit especially) and non-food materials, ideally from the school's lunch garbage.
- Save some non-food materials (e.g., plastic utensils, aluminum foil) from the garbage piles for Lesson 2-1 when students assemble their landfill bottles.
- Storage: Make arrangements for storing the student work that will be generated throughout the unit.

Additional Resources

- A day in the life of your garbage and recyclables in Sunnyvale, California: https://www.youtube.com/watch?v=TOpYa5OKGgY
- Teacher fact sheet, What is a landfill: : https://www.teachervision.com/environmental-science/landfill-combustion-unit-environment-activities-classroom
- Sorting garbage game: http://www.naturebridge.org/garbology.php

Safety

- When assembling the piles of garbage for the activity, make sure not to include broken glass or sharp objects.
- Ensure the garbage has as little liquid as possible.
- Direct students to wear plastic gloves and protective goggles and to use tongs for handling the garbage.
- Direct students to wash their hands after handling the garbage.
- If students have allergies (nuts, mold, etc.), consult the school nurse before proceeding with the garbage sort.
- Students should wash their hands after handling garbage.

Introducing the Lesson

Making Observations of the Garbage Phenomenon

Have the garbage piles prepared and set out for each group before class starts. Be prepared for a range of reactions from students to the garbage. Students may be excited, grossed out, and/or overwhelmed by the garbage. Your enthusiasm for the garbage and the unit is important and will be infectious. Students who are apprehensive about the garbage will look to your enthusiasm as a guide and students who are excited will look to your enthusiasm for

confirmation. Tell students that they will be observing garbage today that comes from their school's cafeteria.

Assign students to groups of 3-5 for the unit. Have groups form a circle around each garbage pile. Give students a minute to observe and talk about the garbage without any prompts.
To facilitate group discussions about the contents of the garbage, ask the groups to answer the questions: *What do you observe? What materials do you observe?*

As you circulate through the groups, you can use these additional prompts to
Think about materials:
- *What is garbage?*
- *Where is your garbage from today's lunch?*
- *What materials are in your garbage?*

Ask questions:
- *When you look at this pile of garbage, what do you wonder?*
- *What questions come to your mind?*

Carrying Out the Lesson

Group Investigation: Sorting Garbage into Categories

Distribute tools for students to handle garbage, e.g., gloves, rakes, tongs, etc. Make sure each student has on gloves and safety goggles, and knows how to handle garbage, e.g., don't touch it with bare hands.

Tell groups that we noticed many different types of materials in the garbage. Tell students they will be sorting their garbage pile into smaller piles or categories.

Describe the task:
- Groups should decide on some ways they want to sort the garbage.
- Groups will sort their garbage pile into smaller piles or categories. These smaller piles are sorted by a particular category that the group decided upon.
- Begin to sort their garbage in these smaller categories.

☑ **SMALL GROUP CHECK! Categories and Properties of Garbage**
Give the groups a few minutes to talk about their categories and begin sorting their garbage. After groups have begun sorting, circulate among the groups. Listen to the talk in groups before asking questions. If group members are talking about the garbage and their sorting, consider just listening and resist interjecting a question. If groups are sorting their garbage in silence, consider asking one of the following prompts to encourage talk.

Possible teacher prompts to guide student thinking:
- *Why are you grouping these materials together?*
- *Why didn't you include that material in this category?*
- *What is similar about the materials in this category?*
- *What is different about the materials in each category?*

If students have difficulty coming up with categories, give the following example: *Your group may decide to create a category with all of the garbage that is paper. What is similar about the materials in this category?* (All of the materials are white, smooth, dull, etc.)

Possible teacher prompts to EXTEND student thinking:
- *Do some materials in different categories overlap? How?*
- *If you were given a new material, how would you know which category it belongs to?*

If you have access to a camera, have the groups photograph their sorted garbage. Pictures can be added to the Driving Question (DQ) Board later.

Teacher Background: Properties

The activity of sorting garbage into categories allows students to separate the garbage materials based upon observed properties (e.g., hardness, texture, color, etc.). Do not introduce or define the term "properties" until after students have sorted the garbage into categories. Allowing students to categorize the garbage grounds their understanding of properties in a specific, real-world context. After the experience, apply the term "properties" to the understanding.

Don't be concerned if students are not using the words "properties" and "patterns" to talk about their garbage. This lesson serves as an introduction to these ideas, and it will take time for students to use these words in their oral and written production. What is most important is that students use the ideas of properties and patterns in this lesson.

The DCI *Measurements of a variety of properties can be used to identify materials* appears in Unit 1 and subsequent units. The progression of the DCI throughout the unit enables students to demonstrate their understanding that a material can be identified by its properties. For now, being able to articulate the understanding that materials have properties is adequate.

Identifying and Using Patterns to Define Properties of Materials

Bring the class together for a discussion about how they sorted their garbage materials into categories. Ask each group to share one of the categories of garbage they created while sorting.

Use the class discussion about their categories to introduce the idea of properties and patterns. Let students know how scientists use properties to identify materials. *I noticed that you created a group of garbage that is shiny. Scientists also sort and organize materials into categories. You categorized those materials together because they are all shiny. Scientists have a word for describing materials. The description is called the "property" of the material. A property is a description of a material that can be used to identify the material.*

Encourage students to think of their categories in terms of properties, using a soda can as an example by asking:

- *What is the property of this soda can?* (shiny, hard, bendable)
- *What is another property of this soda can?*
- *How can a property help you sort the garbage into categories?*
- *What are some properties of the materials in another category?*

Other examples of categories with properties include cardboard (brown color, dull, somewhat bendable), paper (white color, dull, bendable), and plastic (clear and white color, dull, not bendable, some are opaque, some are transparent).

As the class identifies different materials' properties in their categories, prompt thinking about the pattern of similarities and differences in the properties by asking:

- *What patterns do you observe across the categories chosen by the different groups?* (all groups sorted plastic into one category and paper into another, all groups separated soft and hard plastic into different categories)
- *What patterns do you observe within each category?* (the paper materials are bendable; the metal materials are hard; the food materials smell; the plastic materials are white or clear)

As students identify and use patterns to think about their categories, emphasize patterns as a way of organizing our observations. For example, *We found some patterns in our observations of the garbage materials. Scientists make many observations to look for and find patterns. Noticing patterns can lead scientists to ask new questions about why and how these patterns occurred.*

Science and Engineering Notebook (SEN) Entry: Recording Data about Properties of Garbage Materials

Tell students, *Scientists always keep a journal with records of their work. You are going to keep one for this class just as they do. Your Science and Engineering Notebook, or SEN, will be a record of your thinking and learning in science. To keep a good record, your SEN should be well organized, with the entries in the order you make them and a date for every entry.*

The writing you do in your SEN is not formal writing. This means it does not have to be in paragraphs and will not be graded for grammar, spelling, or punctuation. However, your notes should be clear enough that you can come back to them later and be able to read and remember what you were thinking.

Tell students that they will make a new entry in their SEN to reflect on the investigations. Remind students to write the date so that they can keep track of the data they record over time.

CLASS CHECK! Categories and Properties of Garbage

Have students answer the following questions in their SEN individually.

QUESTIONS:

1. What are the categories of garbage that your group chose?
2. What are the properties of each category of garbage?
3. Based on what you now know about properties, would you change the categories your group chose? If yes, what would be your new categories?

EXTENSION:

4. Think of two objects that you use in your everyday life. What are the properties of each object? How are the properties of the two objects similar or different?

Collect the SENs to get a sense of students' initial ideas about how properties can be used to identify materials. Since students should be familiar with some property descriptors from the K-2 grade band, use the responses to determine the extent to which students are entering the unit with expected prior learning. Specifically, look for the following:

a) Are students able to distinguish materials between categories (e.g., food materials, plastic materials)?
b) Are students able to identify properties of materials within and across categories (e.g., hard, shiny, smooth)?

You could also use responses to identify which students may need additional support in the upcoming lessons.

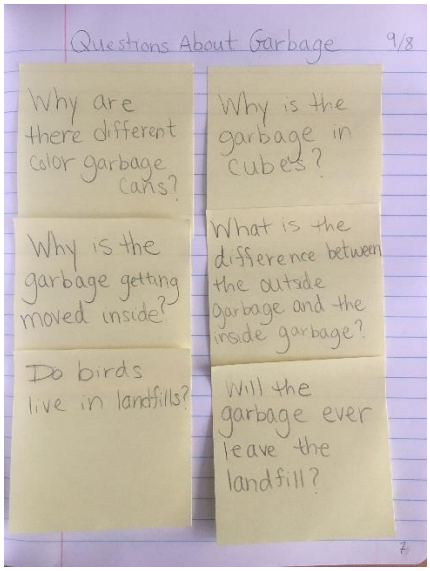
Break – end of class period 1

Resume during the next class period:

SEN Entry: Predicting How Materials May Change Over Time
Have groups use categories to make predictions about how materials will change over time. Direct students to talk with their group about the following prompt and to write their answers in their individual SEN. Remind students to write the date. Display the prompts: 1. List the garbage categories. 2. Make a prediction about what will happen to the materials in each category. Allow several minutes for students to talk about and write their predictions. After groups have begun, circulate and listen to the talk in groups. Provide support as needed. Possible SEN entry: Category: Plastic → Prediction: Disappears because plastic is a hard material. (*) Category: Fruit → Prediction: Gets mushy because food rots. Category: Metal → Prediction: Changes color because I've seen rusty metal cans outside. (*) (*) Accept all reasonable predictions, even if they are inaccurate. Call on a few students to share their predictions with the class.
Setting Up SEN for Landfill Field Trip (Live or Virtual)
Tell students, *We can begin to check our predictions with a virtual field trip to the landfill.* Pass out 1 pad of sticky notes to each group and have students prepare SEN for the virtual landfill field trip. Describe, *We will be taking a look at what happens to garbage materials once the garbage leaves the classroom. We will be going on a virtual field trip by watching a video to see where the garbage ends up. As you watch the video, think about questions you have. After the video you will write down your questions on sticky notes, and stick them in your SEN.* *First, we will set up our SEN by writing the date and giving a title to the entry: Date - XX	Title - Questions about garbage.*
SEN Entry: Making Observations that Lead to Questions from Landfill Field Trip (Live or Virtual)
Show Video Lesson 1-1: Virtual Landfill Field Trip.

Tell students, *Wow, the landfill is a really interesting system! I have lots of questions after watching this video. For example, one of the questions I added to my SEN is, How long will the garbage be in the landfill?* Demonstrate writing your question on a sticky note and attaching the sticky note into your SEN. Give students time to write questions on sticky notes and stick them into their SEN.

Sample SEN Entry:



If needed, show the video again to prompt more questions.

Don't call on students to share their questions at this point. Students will eventually use their questions to form the Driving Question (DQ) Board on Day 4.

Inform the class, *We have a lot of questions about garbage to answer. As you think of more questions, add them to your SEN. Remember to always date your entries.*

Assigning Homework 1-1

Assign homework assignment Homework 1-1: What Materials Are In Our Home Garbage?

Break – end of class period 2

Resume during the next class period:

Finding Patterns of Similarities and Differences in Home Garbage Through Homework 1-1

Direct students to turn to a partner and share their responses to questions 2 and 3 in Homework 1-1.

☑ **CLASS CHECK! Categories and Properties of Garbage Follow-Up**

Review properties, as needed, based on students' SEN entries. If the class would benefit from additional examples of properties, ask students who answered the extension question to share examples of everyday objects and their properties.

Call on a couple of pairs to share their homework responses with the class. Prompt students to find similarities and differences in how families get rid of garbage.

Describing the Home Garbage Components to Introduce Systems

Use student responses about their home garbage handling system by using sticky notes and arrows to build a visual display. This display shows how the home garbage flows from one container to the next until it reaches the landfill. Students will later add arrows to indicate the flow of the school and community garbage. See sample display below. Be aware that your classroom diagram may look different, as students may have additional elements not shown in the example.

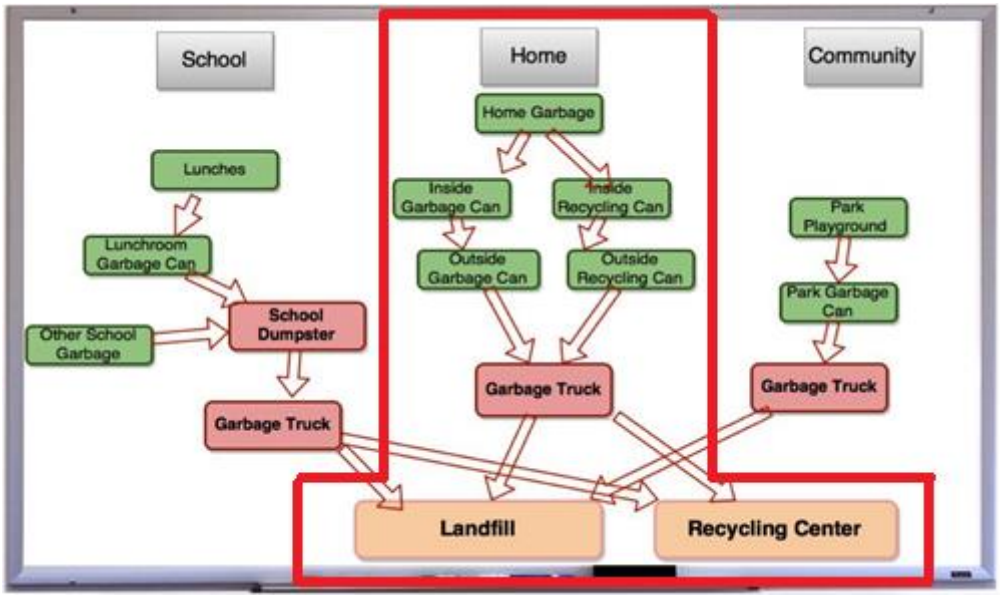
Tell students, *In Homework 1-1, we made observations about our home garbage. We compared how our home garbage is similar and how it is different from one home to another. Now, let's think further about our home garbage.*

Teacher suggested prompts:

- *What is the first thing that happens to garbage at home?*
  (throw out garbage in a can and some into a recycling can)
  Add "inside a garbage can and inside a recycling can" to the classroom display.
- *What happens to the garbage in the garbage cans?*
  (carry to outdoor garbage and recycling cans)
  Add "outside garbage and recycling cans" to the classroom display.
- *What happens to the garbage in the outdoor garbage can?*
  (picked up by garbage truck)
  Add "garbage truck" to the classroom display.
- *What happens to the garbage in the garbage truck?*
  (smashes the garbage, drives to landfill or city dump)
  Add "landfill" to the classroom display.

All of the parts you just named, the inside garbage can, outside garbage can, garbage truck, and landfill, are called components. When components work together, they make a system. So what we created on the board represents a system for handling our home garbage.

Sample display (see red outline):



Describing School and Community Garbage System Components Using Sticky Notes

Following the home lunch garbage example, direct groups to identify the components of their assigned system (see table below) and figure out how the components work together. Groups write the components of their assigned system on sticky notes and arrange them on a piece of paper. Groups draw arrows to show how the components interact.

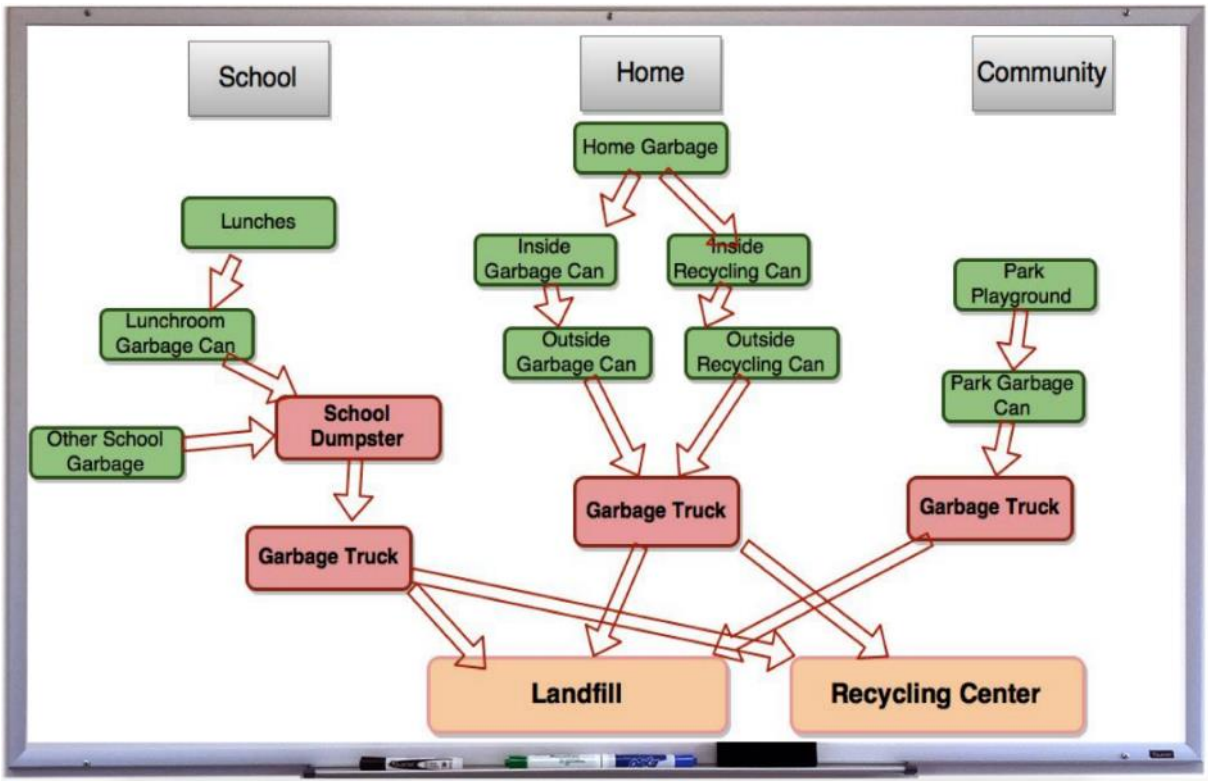
Group	System
1, 2 and 3	School garbage system and removal from the school
4, 5 and 6	Community garbage (e.g., park) and removal from the community

As groups work, circulate and ask questions that focus on components of a system and how the components work together.

When groups finish, add school and community garbage to the class display (see sample display below) by having one of the groups from each system transfer their sticky notes to the board. Ask other groups if they identified similar components and their interactions until the class comes to a consensus.

Ask students, *What is similar and different about each of the systems?* (Similarities: all 3 systems have the landfill and garbage truck as components; Differences: recycling and not-recycling components)

Sample display:



Describing a System by its Components and Their Interactions

Describe what the class developed, *On the board, we made a model that describes several garbage disposal systems: the school lunch garbage, home garbage, and other community garbage (e.g., from parks). This display shows the components of each system. Arrows connect one component to another when the components work together. It also shows how garbage flows into, through and, in some cases, out of one component system and into another.* Ask, *For example, the garbage trucks carry garbage from where to where?*

Say, *When scientists and engineers decide on a system and show the components and their interactions, that's a system model. Our class made a system model today that contains several systems that connect together, making one larger system. We see examples of systems everywhere.*

Ask students to suggest other examples of systems that they encounter in their daily lives.

Offer one or two examples of systems and their components:

- bicycle (pedals, wheels, handlebars, gears, chain, rider)
- public transportation (buses, passengers, bus drivers, bus tickets)
- the postal service/mail system (letters, stamps, conveyer belt, postal workers)
- shopping mall (stores, vendors, customers, escalators, shopping bags, merchandise)

Say, *Since the world is very large and too complicated to think about all together, scientists and engineers find it useful to define and model specific systems that they wish to study. They include in their system the components, or the things directly involved in the phenomenon or problem they are studying.*

Connecting Crosscutting Concepts to Observations of Garbage

Make explicit the crosscutting concept of system and system models by prompting student thinking.

Ask:

- *What did we do today?*
  (We developed a system model of school, home, and community garbage.)
- *Why was it helpful to think about garbage as a system?*
  (Because it helps us think about the components and interactions we are interested in learning about.)

Tell students, *System and system models is a crosscutting concept. Crosscutting concepts are ideas that scientists use to better understand phenomena.*

Post on the wall the list of NGSS crosscutting concepts, highlighting system and system models. Suggest that by the end of the year students will have had lots of experience with all the crosscutting concepts on the list.

SEN Entry: Asking Questions about Garbage Systems

Tell students, *Thinking about garbage handling as a system might have made you think of more questions. Remember how we write down our questions on sticky notes and store them in our SEN? Think about new questions you have. Write them down on new sticky notes and stick the notes in your SEN.*

Allow time for students to write down questions on sticky notes and place in their SEN.

Break – end of class period 3

Resume during the next class period:

Teacher Background: Unit Driving Question (DQ)

The lunch garbage sorting and the virtual landfill field trip prompt student questions based on their authentic experiences with the phenomenon of garbage. The modeling of garbage-handling systems provides more context for the interacting systems of garbage. The unit is about explaining the phenomenon of garbage and answering the questions that students raise about garbage.

This class period establishes the Driving Question (DQ) of the unit, *What happens to our garbage,* and introduces some of the sub-questions of the unit. As the unit progresses, students ask additional questions that further link scientific understanding to explain the phenomenon of garbage. The lesson questions have been determined in advance, but the students do not know that. From their point of view, they are generating unique questions. Because asking questions is a science and engineering practice that is central to the unit, it is important to encourage student questions.

As you facilitate the discussion, prompting students to write and share their questions about garbage, try to elicit the following questions that will be addressed in subsequent lessons. If students do not come up with these or related questions, it is okay. There will be opportunities later in the unit to elicit these questions. This should not become a "guess what's in my head" activity. The discussion should feel natural, spontaneous, and be inspired by genuine curiosity from students based on what they have experienced in their lives and in the unit so far.

- Do garbage materials change in a landfill? (Lessons 2-1, 3-1, 3-3, and 4-2)
- Do materials change if they are crushed? (Lesson 2-2)
- What happens to materials that we can't see anymore? (Lesson 2-3)
- What is that smell? (Lesson 3-2)
- What happens to materials when they are mixed? (Lesson 4-1)

Arranging Questions on Sticky Notes

Tell the class, *We have been gathering questions for a few days now. Find the questions on sticky notes in your SEN. Place all of your sticky notes in front of you on your desk.*

Allow time for students to arrange their questions. Provide affirmations for the great questions they have asked.

Asking Testable Questions

Inform the class that next we will plan and carry out investigations to answer some of these questions, *Which of your questions do you think we could investigate further by an investigation we can carry out in the classroom? Can you refine or simplify any of your questions so that we could investigate them directly?* Provide an example and a non-example:

- Can we send garbage into the Sun and see what happens to the garbage there? You might respond, "A good question but we can't investigate because in school we have no way of moving garbage to the Sun or making observations of what happens to garbage on the Sun."
- What happens to bananas in the landfill system? You might respond, "A good question that we can investigate because we can bring bananas into the classroom and make observations of what happens to the bananas over time."

Direct students to look at their sticky note questions and put a star next to the questions that they can investigate in the classroom. If none of their questions can be investigated in the classroom, students can come up with additional questions or refine existing ones to questions that can be investigated in the classroom.

Tell students, *All questions are valid, but some can be answered by investigations. In school we can only carry out limited investigations. Some questions can't be investigated at school because schools have limits of tools, time, space and cost.*

Direct students to talk in their groups to:

1. Share questions that can be investigated with the group
2. Choose a list of questions to answer or investigate further
3. Be ready to share with the class

Linking Student Questions to Form Driving Question, *What Happens to Our Garbage?*

Ask the class, *What questions do you have about garbage? Let's start with the testable questions you shared.*

Call on students to populate the Driving Question (DQ) Board using the following procedure:

- Elicit a question from a student and have them place their sticky note with that question on the DQ Board.
- Ask students to raise their hands if they have similar questions. Each student reads their question(s) and describes how the new question connects to one already on the DQ Board. Those questions are also added to the DQ Board. As one example, *What's under that garbage pile?* and *What is that liquid stuff coming out of the garbage pile?* are connected because they relate to the materials found in garbage. These connected questions form a category. Some example categories could be questions about smell, questions about garbage materials and what will happen to them, or questions about the landfill and garbage disposal system.
- Continue eliciting questions from students. When a question in a new category is offered, put it in a separate part of the DQ Board. Then ask students if anyone else has a question that is similar. Students add their sticky note next to the connected question.
- For a student who poses a new question but does not find a link to another question, do not immediately state how the question links to one or more questions already on the

DQ Board. Instead, ask the class to help suggest a connection to another question already on the DQ Board.
- If a student asks a question unrelated to the phenomenon (e.g., who drives the garbage trucks?), acknowledge it and create a new, separate category where "interesting" questions go.
- Each student should share at least 1 question.

Ask the class, *Is there one big question that connects all the questions?*

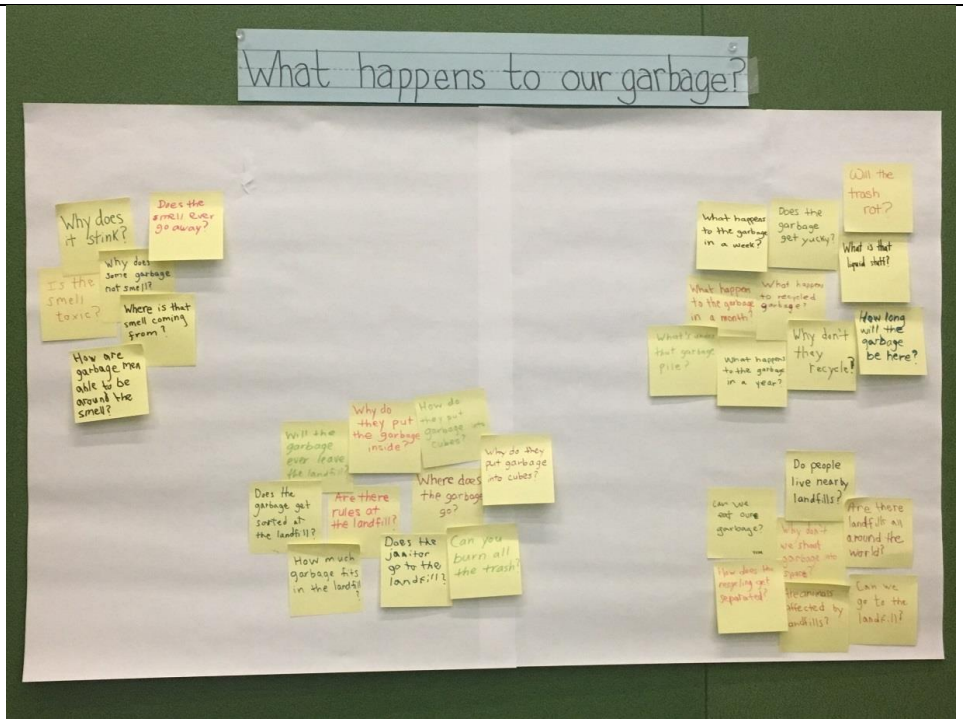
Review several questions to summarize that the questions are primarily about the garbage and what happens to the garbage. Students conclude that the big question of the unit is: *What happens to our garbage?*

Tell the class, *We will call this big question the Driving Question. It's the question that all the other questions connect to. And we call this board with all of your questions the Driving Question Board.*

Add the driving question to the top of the Driving Question Board*: What happens to our garbage?*

Finding the answer to the Driving Question is going to require finding the answers to many of our questions. Because all the questions are linked in some way, starting our investigation with any question helps us find the answer to other questions. Do we agree that this will be our work as scientists in our classroom? We will keep coming back to the Driving Question Board. We can even add new questions to the DQ Board as we investigate, What happens to our garbage?

Sample DQ Board:



Teacher Background: Creating the Driving Question (DQ) Board

The Driving Question (DQ) Board is flexible. The categories or grouping of questions can be changed throughout the unit. New questions are added as the unit progresses. The process of creating the DQ Board is meant to:

1. Include every student
2. Show that student questions are valid and connected to one bigger question that will serve as the Driving Question for the unit
3. Provide engagement and ownership of the direction and learning of the unit

Closing the Lesson

Connecting NGSS Science and Engineering Practices to Classroom Work

Have students reflect on the day's activities to make explicit the practices of asking questions and developing models. Post on the wall the list of the NGSS science and engineering practices. Point to the first two practices as you ask the following questions:

- *What did we do today?*
  (we asked questions)
- *Why did we ask questions?*
  (because we want to learn about garbage)
- *Asking questions, like you did today, is a science practice. What other practices do scientists do?*

(they do experiments)
- *What did developing the model of garbage handling help you think about?* (helps me to see all the different ways garbage is handled)

You are scientists and like other scientists, you engaged in practices today. The science and engineering practices are what scientists do.

Read the remaining science and engineering practices out loud.

SEN Entry: Systems

CLASS CHECK! Garbage Disposal System
Have students answer the following question in their SEN individually:

QUESTION: Based on what you've learned about systems, what would happen to the garbage disposal system if a component were missing? Give an example to support your answer.

If students have difficulty answering the question, provide a scaffold. For example, ask the class, *What is a component of the garbage disposal system?* (e.g., garbage truck) *What would happen if there weren't enough garbage trucks?* (e.g., garbage from the dumpster could not be transported to the landfill).

EXTENSION: What is another example of a system? Identify (1) the components of the system and (2) the interactions of those components.

Collect the SENs to get a sense of students' initial ideas about systems. Specifically, look for how the components of a system are connected and work together to carry out functions. You could also use responses to identify which students may need additional support in the upcoming lessons.

Evidence Statements Lesson 1-1

LP1-1. ES
- Students use patterns in the lunch garbage to categorize materials based on their properties. They identify evidence for assigning an object to one of the categories based on similarities of the properties (e.g., color, hardness, texture, reflectivity).

LP1-1. ES
- Students use observations of patterns in the lunch garbage to make predictions of what will happen to the materials in each category over time.

LP1-1. ES

- Students write questions on sticky notes to establish the DQ of what happens to the properties of materials in the landfill system. Students identify which questions are possible to answer in the classroom.

Connections to Targeted 5th Grade NGSS Performance Expectations

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

Building Progressions

SEP *Planning and carrying out an investigation*: *Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.*

K-2: Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question.

3-5: Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.

Middle School: Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim.

SEP *Asking questions*: *Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships.*

K-2: Ask questions based on observations to find more information about the designed world.

3-5: SEP *Asking questions*: *Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships.*

Middle School: Ask questions that can be investigated within the scope of the classroom, outdoor environment, and museums and other public facilities with available resources and, when appropriate, frame a hypothesis based on observations and scientific principles.

DCI *PS1.A*: *(PS1.A by grade 2) Different kinds of matter exist. You can distinguish materials by their observable properties.*

K-2: Different kinds of matter exist and many of them can be either solid or liquid, depending on the temperature. Matter can be described and classified by its observable

properties. Different properties are suited to different purposes. A great variety of objects can be built up from a small set of pieces.

3-5: *Measurements of a variety of properties can be used to identify materials.*

Middle School: 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. Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it.

CCC *Patterns*: *Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena and designed products.*

K-2: Patterns in the natural world can be observed, used to describe phenomena, and used as evidence.

3-5: *Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena and designed products.*

Middle School: Patterns can be used to identify cause and effect relationships. Macroscopic patterns are related to the nature of microscopic and atomic-level structure. Graphs, charts, and images can be used to identify patterns in data.

CCC *Systems and system models*: *A system can be described in terms of its components and their interactions.*

K-2: Systems in the natural and designed world have parts that work together.

3-5: *A system can be described in terms of its components and their interactions.*

Middle School: Systems may interact with other systems; they may have sub-systems and be part of larger complex systems. Models can be used to represent systems and their interactions – such as inputs, processes and outputs – and energy and matter flows within systems.

Connections to CCSS for English Language Arts-Literacy

W.5.2: Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

SL.5.1: Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher- led) with diverse partners on grade 5 topics and texts, building on others' ideas and expressing their own clearly.

SL.5.1.C: Pose and respond to specific questions by making comments that contribute to the discussion and elaborate on the remarks of others.

L.5.6: Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases, including those that signal contrast, addition, and other logical relationships (e.g., however, although, nevertheless, similarly, moreover, in addition).

Name _____ Date _____

Homework 1-1: What Materials Are In Our *Home* Garbage?

1. In each box, draw and label a material that you put in your garbage at home:

 Empty Toothpaste Tube		

2. Put your home garbage materials into the categories your group chose in class.

Category from School Garbage	Home Garbage Materials That Fit This Category	Properties
Plastic (non-food)	1. Empty Toothpaste Tube 2. 3. 4.	Smooth Dull No smell White or clear

3. What does your family do to get rid of garbage?

Be ready to share your findings with the class tomorrow.