LiveWell Kids
Garden and Nutrition Program

Lesson 3: Soil, Sodium and Minerals
All Living Things Need Nutrients

OBJECTIVES

By the end of this lesson, students will:

- Understand the role of minerals in the garden and our bodies.
- Understand soil structure and composition.
- Identify three main soil types and their capacity to hold water.
- Learn the characteristics that make up a healthy growing medium.
- Understand the benefits of composting and vermiposting (worm composting.)
- Understand the four components needed for successful compost.
- Observe and understand the contents of a compost pile and worm bin.
- Learn about sodium and how the amount we eat affects our health.
- Increase ability to make healthy food choices by knowing how to interpret the Nutrition Facts Label.

SUPPLIES

- Supplies to bring from the shed to the garden:
    - Nutrition laminates:
        - Nutrition Facts Label: Fresh Potato/ Potato Chips
        - 2 Sets of Sodium Relay flashcards (1 blue-dot set and 1 yellow-dot set)
        - Answer Key for Sodium Relay game
        - High Sodium label
        - Low Sodium label
    - Garden laminates:
        - "Do the Rot Thing…Compost!"
        - Landfill
        - Decomposers in the Compost Pile
        - Compost Cycle
        - Worm Bin
    - 2 Paper tray labels
    - Sanitizing wipes
    - 1 Teaspoon
    - 2 Cafeteria trays
    - 2 Compost samples from the composter
    - Book: *Compost Stew*
    - Magnifying lenses
    - Tweezers
    - Clipboards

- Supplies to bring from classroom to garden - *arrange with teacher ahead of time*:
    - Paper - one piece per student
    - Writing tools such as crayons, colored pencils, markers

PREPARATION

- Refer to the "Background and Preparation" document for details about preparing for this lesson one week prior and the day of. It is posted on the website and the inside of the shed door.
- Allow **30 minutes** for set-up and preparation the day of the lesson.

SET-UP INSTRUCTIONS

1. SET UP THE COMPOST OBSERVATION ACTIVITY (recommended – picnic tables):
   - Set up with magnifying lenses, sanitizing wipes, clipboards, paper and drawing tools.
   - Use the dry erase markers to draw an example on the whiteboard of what they might see in the compost bin and place the whiteboard at the station.
   - Gather a scoop of compost from the composter and spread it on the cafeteria trays. Set them on the table with the magnifying lenses around them.
   - If you have compost in various stages, prepare the trays to show the different stages of compost as it decomposes.
   - Place the laminate "*Decomposers in the Compost Pile*" and the book *Compost Stew* on the table.

   (See section titled "Compost Observation Activity" for details about how to operate the station.)

2. SET UP THE SODIUM RELAY ACTIVITY:
   - Set up a station in an area with open space to move around.
   - Set up two paper trays with "High Sodium" and "Low Sodium" labels placed in front.
   - Have in hand two sets of "Sodium Relay" flashcards (blue-dot and yellow-dot cards.)
   - Volunteer will be a few feet in front of the students with the High Sodium/ Low Sodium trays close by.
   - Have students sit down in two lines.
   - Volunteer will place a deck of cards in front of each team.
   - One team gets blue-dot cards, and the other team gets yellow-dot cards.

   (See section titled, "Nutrition Activity: Minerals We Eat" for details about how to play the game.)

INTRODUCTION & MINDFUL BREATHING (1 MINUTE)

- Introduce yourself and other volunteers.
- Guide students through a mindful breathing exercise.
- Explain the purpose of this third lesson is to better understand soil, compost, and the role of minerals in the garden and our bodies.

Sample Script

"*Hi everyone, my name is _____. Welcome back to your school garden for the third lesson of the year. First, let's start with a mindful breathing exercise. Please close your eyes, or look down at the ground, and slowly take a deep breath in, pause for a moment, and slowly let it out. Let's do it one more time, deep breath in, pause, and slowly let it out. Now open your eyes. How do you feel?* **(Allow a few students to respond.)**

Good job everyone. During this lesson, we'll be talking about nutrients in the soil and in our bodies. Minerals are nutrients that are an important part of soil. People need minerals too. In fact, we eat them with the help of plants."

GARDEN: COMPOST AND VERMIPOST (8 MINUTES)

The garden section has four discussion parts and 1 activity:

1. Composting: Definition & Benefits
2. Ingredients for a Compost Bin / Tumbler
3. How to Make Compost
4. Vermiposting

Activity: Compost Observation (Occurs at the same time as the Nutrition activity.)

Grades	COMPOSTING: DEFINITION & BENEFITS
K-5th	• Definition of *composting* - In a controlled environment, such as a compost bin, we copy nature's process of plant materials breaking down into useful nutrients for growing plants[1]. • Three Benefits of composting[2]: 1. Reduces waste 2. Beneficial to soil 3. Saves money

Grades	BENEFIT #1: COMPOSTING REDUCES WASTE Laminate – *Landfill*
K - 2nd	• Everything that we put in the trash ends up in a place called a *landfill*. o In landfills, the trash is buried in the ground for many years and is of no use to anyone; it's just taking up space. o Imagine what it would look like and smell like if all your trash from home was buried in the backyard! • When we compost, we put less waste into landfills. • Just like reusing and recycling, we can think of composting as nature's recycling.

3rd – 5th	• Where would plant materials go if they didn't go in compost?
	  ○ If students say "trashcan," then ask: Where does the trash from the trashcans go when the trash trucks have taken it away?
	  ○ Answer: When plant materials go in the trashcan and get picked up by the trash trucks, they end up as waste, in a landfill with other trash, instead of becoming useful nutrients for our gardens and yards.
	• Trash buried in landfills doesn't break down to become compost, but just stays there for many years. (Show "Landfill" laminate.)
	  ○ This smells bad and could cause air, soil and water pollution.
	• We use our limited natural resources, such as *gas* (for the trash trucks) and *land* (for the landfills), to transport and process all this trash.
	  ○ This would be greatly reduced if all the plant material went into the compost!

Grades	**BENEFIT #2: COMPOSTING IS BENEFICIAL TO SOIL** Laminate - *Compost Cycle*

K – 2nd	• Compost contains ***nutrients*** that are vital to a healthy soil, just like nutrients are vital to your body.
	• What are nutrients?
	  ○ A *nutrient* is a substance found in food that provides the nourishment we need to grow and thrive.[3]
	• How do the nutrients get into the soil?
	  ○ Scavengers and decomposers break down organic matter into smaller and smaller pieces until it's in a useable form for plants to access the nutrients.[4]
	• Compost is an example of the ***nutrient cycle*** at work.
	  ○ The ***nutrient cycle*** is the natural process of nutrients being recycled from dead matter to living matter in a constant loop.[5]
	  ○ The image (on laminate) shows how the nutrient cycle happens when people compost – this is called the ***compost cycle***.[6]

3rd – 5th	• Compost contains ***macroorganisms*** and ***microorganisms***[7].
	• What is the difference between a macroorganism and a *microorganism*?
	  ○ Macroorganisms are organisms that are large enough to see, such as pill bugs (also called sow bugs or rollie pollies), earthworms or centipedes.
	  ○ Microorganisms are organisms that are so tiny, that you need a microscope to see them.
	  ○ Both types of organisms break down organic matter and consume each other into a usable form of nutrients for plants.
	• Compost improves the texture of garden soil.
	• By adding compost to our soil, it replenishes nutrients that have been removed from the soil by other plants.
	• The image (on laminate) shows how the nutrient cycle happens when people compost – this is called the ***compost cycle***.
	• It also adds moisture that all living things need to survive, and weighs down the soil, keeping it from blowing away or being rinsed away.
	• Compost is loose and crumbly, which contributes to aerating the soil, vital to supporting the life of soil inhabitants.

Grades	BENEFIT #3: COMPOSTING SAVES MONEY
K-5th	• The healthier our soil is, the healthier our plants will be. • When we make compost, we use it to **amend,** or *improve the health of* the soil. o If we didn't make compost, we would have to buy it from the nursery to amend our soil. • Therefore, by making it ourselves through composting, we can save money.

Grades	INGREDIENTS FOR A COMPOST BIN/TUMBLER Laminate – *"Do the Rot Thing…Compost!"*

K-5th	• Every school garden in the LiveWell Kids program has a composter. (Show composter.)
	• There are four ingredients the compost bin/tumbler needs to recycle organic materials into usable compost:
	  o Air
	  o Water
	  o Organic green materials (for 3rd – 5th grades, say: "rich in the element Nitrogen")
	  o Organic brown materials (for 3rd – 5th grades, say: "rich in the element Carbon")
	• Why are these ingredients necessary?
	  o There is life in the compost bin, ***decomposers - the organisms that eat organic matter***, and all life needs food, air, and water to survive.
	  o We are feeding our decomposers – like taking care of pets!
	  o Without the decomposers, organic matter would not break down, but would just pile up.
	• There is a recipe for making compost, which is 2 parts brown materials to 1-part green materials.
	  o If we use too many greens, they can rot, making the compost bin slimy and stinky, which attracts pests.
	  o If we use too many browns, there won't be enough nitrogen (from green materials) to feed the decomposers and they will die off.
	  o The compost bin needs a balance of ingredients, just like our bodies need a balanced diet.
	• If the compost bin gets out of balance with either too many greens, or too many browns, it's easy to fix!
	  o You just add more of the other ingredient (plus water if it's dry) and stir.
	  o For example, if you have too many greens, you need to add browns.
	  o Similarly, when our diets get out of balance, we need to adjust what we eat.

Grades	HOW TO MAKE COMPOST Laminate: *"Do the Rot Thing…Compost!"*
K – 1st	• Ask: Who can give an example of *green* materials?

	○ *Green materials are the fresh plants and plant parts that get put in the compost. Here are some examples: fresh cut grass, vegetable scraps, fruit scraps, coffee grounds, manure and green leaves.* • Ask: Who can give an example of *brown* materials? ○ *Brown materials are the dried, brown plants and other non-green things that are put in the compost. Here are some examples: dried grass, brown leaves, dead flowers and plants, even paper and eggshells.* • *On the laminate, point out the F.B.I. (scavengers and decomposers),* an easy way to remember who's in the compost bin. ○ FBI is an acronym for **F**ungus, **B**acteria and **I**nvertebrates ▪ Examples include worms, millipedes and pillbugs (also called sowbugs and roly-polies), pincher bugs and centipedes.
2nd – 5th	• In the compost pile, we have scavengers, ***physical decomposers***, such as bugs, as well as ***chemical decomposers***, such as fungi and bacteria. • Decomposers eat the organic matter that we put in there, including each other![4] • Ask: "Can you name any decomposers that we might see in the compost pile?" ○ *In the compost pile, you can see: Pillbugs, pincher bugs, worms, centipedes, fungi….* • Decomposers don't all like to eat the same things. • Some of them are carnivorous, or meat eaters, while others like animal waste. • Some like dead bugs, while others prefer dry, dead plants. Fungi like to eat fruit and vegetables." • Ask: "What would happen if we didn't have decomposers?" ○ *The earth would be covered in dead plants and animals.*
Additional 4th – 5th	• Ask: "What are some other benefits to having decomposers in the compost bin?" ○ *Decomposers also help keep the compost pile warm with their body heat AND **aerate**, which means to create air spaces, in the compost as they move around.*
Additional 5th	• Ask: "How do decomposers help plants?" ○ *They decompose organic materials into smaller parts that plants can use for accessing nutrients.* • Ask: "Does anyone know the difference between a scavenger and a decomposer? Try to guess by thinking about what the word **scavenge** means." ○ *Scavengers eat dead plants and animals, breaking them into smaller pieces. This creates more surface area for the decomposers to take over and finish breaking the organic matter down into usable nutrients for plants to use.*[8]

Grades	**VERMIPOSTING** Laminate – *Worm Bin*
K – 5th	• There is more than one way to add nutrients to soil. • The school garden has a worm bin. • Worms live in this structure and are fed fresh produce scraps each week. • Gardeners call their waste "liquid gold!" It's periodically added to the garden beds for a nutrient boost.

	• Using the worms to make nutrients for the garden is called ***Vermiposting*** or ***Vermicomposting***.[9]

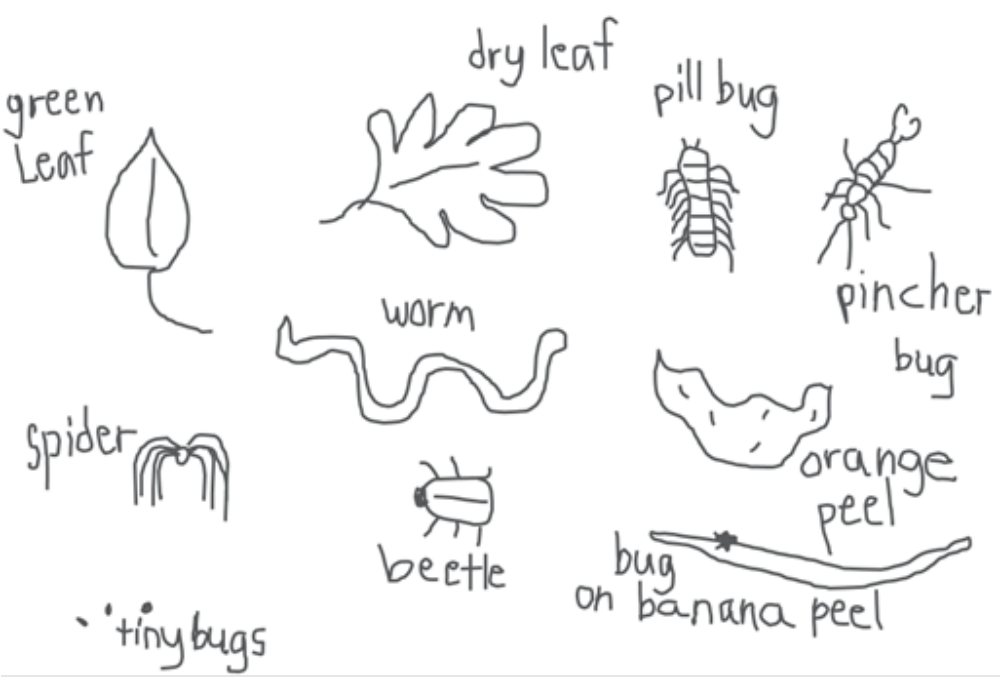
<u>Divide the class into 2 groups</u>

Split the students into two groups. Send one group with the helper/teacher to the nutrition activity and take the other group to the compost observation activity. Both activities will run simultaneously for a total of 20 minutes. Switch groups after 10 minutes.

<u>COMPOST OBSERVATION ACTIVITY</u> (10 - 18 MINUTES, depending on grade)

- Show the example drawing on the whiteboard complete with decomposers, greens and browns labeled. Point out a few examples of each.
- Show students the trays of compost, letting them know that you scooped it from their compost bin. Have them gather around the trays to observe the compost with magnifying lenses. If there isn't enough room for all students to observe at once, spend 1-2 minutes per small group before switching.
- While students wait for their turn, have them begin drawing a compost bin with greens and browns that they know could go in the compost.
- After kids have observed the compost, they can add what they observed to their drawings. Have them color and label what's in their drawing, according to compost ingredients. For example, if they choose to draw a green leaf, they can label it "greens - leaf." Older students can add "Nitrogen" next to it. Feel free to help label pictures for younger grades as needed.
- Have them label all the other components of the compost pile also, such as "air" and "water."
- Encourage them to draw specific materials like a banana peel, torn egg carton or an apple core.
- If they know the names of specific decomposers, they can also draw and label them by name, or write, "decomposer."
- If you have more than one helper or if your teacher is available, feel free to use the *Compost Stew* book to show the kids while they are waiting for their turn to use the magnifying lenses. If the students are older, they can look through the book without adult monitoring, or read it aloud to the rest of the group.
- During the compost observation, explain that there are three levels of consumers in a compost pile[10]:
    1. **First Level Consumers** are referred to as primary consumers, which feed on dead plants or animals. These are the bacteria, fungi, snails, worms, woodlice and pill bugs.
    2. **Second Level Consumers** feed on primary consumers and their waste. These are the springtails, roundworms, rotifera, mites, mold and nematodes.
    3. **Third Level Consumers** feed on secondary consumers. These are the centipedes, rove beetles, ants, pseudoscorpions and predatory mites.
- This is called a **Compost Food Web**. The different populations in the compost bin are kept under control, which makes for a healthy and balanced compost pile.

Sample drawing:



NUTRITION: MINERALS WE EAT (10 - 18 MINUTES, depending on grade)

** Occurs at the same time as the Compost Observation activity.

The nutrition section has three parts with an optional game:

1. Minerals We Eat
2. More about Sodium
3. Nutrition Facts Label – Sodium/Minerals

Optional Game: Sodium Relay

Grades	WHAT ARE MINERALS AND WHY ARE THEY IMPORTANT?
K - 5th	• Minerals are nutrients that our bodies need to keep us healthy.[11] • Minerals help us grow, have good eyesight, fight illness and form bones, muscles, skin and organs. • Our bodies can't make minerals on their own. ○ Minerals are found in soil and are absorbed by plants or eaten by animals that consume the plants.

	○ When we eat these plants (or animals that have previously absorbed the minerals by eating plants), the minerals are passed along to us. ○ This means we get minerals through food. • Minerals are found in foods like cereals, bread, meat, fish, milk, dairy, nuts, fruit and vegetables.[12] • Some minerals that you may have heard of include: ○ **Calcium** helps build bones and teeth. ▪ Found in milk, yogurt, kale and broccoli.[13] ○ **Iron** helps carry oxygen around the body.[14] ▪ Found in beans, eggs, leafy green vegetables, whole grains, chicken and beef. ○ **Fluoride** helps prevent tooth decay (cavities)[15] ▪ Added to toothpaste and water. ○ **Sodium** regulates muscle contractions, nerve function, blood pressure and the balance of fluids in the body.[16] ▪ Found in table salt, sports drinks and many processed and restaurant foods.
Additional 4th – 5th	Some minerals are especially important for keeping our bodies healthy. These "essential minerals" include: • **Calcium** helps build bone and teeth. ○ Found in milk, yogurt, kale and broccoli. • **Phosphorous** helps maintain bone and teeth structure and also assists with our metabolism. [17] ○ Found in kidney beans, peas, asparagus and potatoes. • **Potassium** is needed for kidney and heart function and to keep muscles and the nervous system working well.[18] ○ Found in bananas, tomatoes, dried apricots, spinach and nuts. • **Sodium** helps with nervous system and food absorption. ○ Found in table salt and many packaged (chips) and prepared (pizza) foods. ○ See next section for more details. • **Chloride** helps balance fluids (water) in the body, aids digestion and is needed for proper muscle and heart function.[19] ○ Found in table salt (sodium + chloride) and shrimp. • **Magnesium** is important for muscle and nerve function, blood pressure, blood sugar levels and making protein and bone.[20] ○ Found in legumes, nuts, seeds, whole grains and green leafy vegetables (spinach). • **Sulfur** helps body repair itself after injuries.[21] ○ Found in garlic, onions, leeks, cruciferous vegetables (cauliflower, cabbage), eggs, lentils, peas and lean meat/ chicken/ fish. • **Iron** helps carry oxygen around the body. ○ Found in lean meat, seafood and poultry and nuts, lentils, white beans, kidney beans and peas. • **Iodine** makes thyroid hormones which are necessary for growth and brain development.[22] ○ Found in iodized salt, saltwater seafood, eggs and dairy products. • **Zinc** helps the immune system fight illness.[23]

	○ Found in seafood (oysters, lobster), lean red meat, poultry, beans, nuts, whole grains and dairy products. • **Chromium** helps regulate blood sugar levels (glucose).[24] ○ Found in lettuce, green beans, apples, bananas, lean meat, poultry and whole grains. ○ The amount of chromium in fruits and vegetables depends on the amount of chromium in the soil and water in which they were grown. The amount in meat depends on the animal's diet • **Selenium** helps make DNA and protects against infections.[25] ○ Found in Brazil nuts, shellfish, beans, lean meat, poultry and fortified breads and cereals. • **Fluoride** helps form teeth and bones. It also helps prevent cavities. ○ Found in fluoridated toothpaste and water. • **Copper** helps make red blood cells and keeps nerve cells and immune system healthy.[26] ○ Found in cashews, sesame and sunflower seeds, mushrooms, avocadoes, chickpeas, tofu and shellfish (oysters). • **Manganese** is needed for strong bones and energy. ○ Found in whole grains, hazelnuts, pecans, lentils, spinach, kale blueberries and pineapple.[27] **Note: The above is neither a full list of benefits nor food sources for each mineral.

Grades	**WHAT IS SODIUM AND WHY DOES THE AMOUNT WE EAT MATTER?**
K – 5th	• Sodium and table salt do NOT mean the same thing. ○ Sodium is a mineral that is found in table salt. • When sodium is an ingredient in food, it can be used for thickening, adding flavor, baking and as a preservative to prevent food from spoiling or losing its color. • Most of the sodium we eat comes from packaged and prepared foods, including food from restaurants.[28] • Our bodies need sodium, but in small amounts – a little less than 1 teaspoon of table salt each day.[29] (Show spoon so students can visualize the amount.) ○ Sodium regulates muscle contractions, nerve function, blood pressure and the balance of fluids in the body. • However, many people, including children, may eat too much sodium and this can be unhealthy for your body. ○ Two slices of pizza or a hamburger and fries can have enough sodium to fill this teaspoon. (Show teaspoon.)[30] ○ *Extra details for LWK volunteers*: Depending on age, children should eat less than 2,300 mg (X≤1 teaspoon) of sodium per day, but many tend to average about 3,300 mg a day.[31] • Foods may not taste salty, but they can still be high in sodium. ○ Pickles and some chips *taste* salty and are likely high in sodium. ○ However, packaged cookies, cereals and pizza may not taste salty, but may have a lot of sodium.

	• The best way to make sure you get enough minerals, but not too much sodium, is to eat a variety of fresh, whole (unprocessed) foods.
	  ○ In lesson 1, we talked about "eating from the rainbow" - meaning eating different color fruits and vegetables.
	  ○ Minerals are also in whole grain breads and cereals, lean chicken, fish and meat as well as eggs, legumes, nuts and low-fat dairy products.
	  ○ This is a good reason to eat more fresh, whole foods!

Grades	**NUTRITON FACTS LABEL - SODIUM** Laminate – *Fresh Potato & Potato Chips*

K – 5th	• Use the laminate to review the Nutrition Facts labels and compare a fresh, whole potato to potato chips.
	  ○ The objective for all grades is to understand that the Nutrition Facts Label shows there is a difference in the mineral content of these foods.
	  ○ For example, a whole potato has more iron, calcium, potassium and vitamins than a serving of potato chips.
	  ○ If you look at the ingredients list, you'll see that fat and salt are added to the potato chips. The Nutrition Facts Label shows that a serving of potato chips has more sodium and fat than a fresh potato.
	• Take home message: A whole potato has more beneficial nutrients and is lower in sodium (and fat) compared to potato chips.

Additional
4th – 5th
	• The objective is to learn how to use the Nutrition Facts label to compare mineral content.
	  ○ It's helpful for students to be familiar with the Nutrition Facts label and be aware that they can take a leading role in their own health by knowing how to find the sodium/mineral content in food.
	• Point out that each mineral has a recommended daily amount that is shown on the Nutrition Facts label.
	• It may be easier to eat handfuls of chips than a whole potato. Therefore, you may end up eating more fat and sodium from potato chips than the recommended daily amount.
	• Below are some common food additives that contain sodium that you may see on a Nutrition Facts label:
	  ○ Monosodium glutamate (MSG)
	  ○ Sodium nitrite
	  ○ Sodium bicarbonate (baking soda)
	  ○ Sodium benzoate

Grades:	**OPTIONAL: SODIUM RELAY**
K - 5th	• Students are divided into two teams and line up accordingly. • Explain that when they get to the front of the line, they will look at their card and decide whether the featured food is high or low in sodium.

	○ If high, they will run to the tray labeled "High Sodium" and put the card in there. ○ If low sodium, then they will run to the "Low Sodium" tray and place their card inside there. • Teams are racing against one another, so they will be running at the same time. • After their turn, student will go to the back of the line and the next person in line will take a card and run to a tray. • After every student has had a turn and all cards are used, count the number of correctly placed cards to determine the winning team. ○ See "Answer Key." ○ If any cards are placed in the incorrect tray, review the correct answer with students.

CLOSING (1 MINUTE)

- Bring students together to close the lesson and thank the students, teacher and other volunteers.
- Point out to them that composting is easy and they can do it at home.
- Take them to see how their garden box is growing before going back to class.
- If there is time, show them the inside of the compost bin and/or the worm bin – but NO touching the contents of the bin.
- If time allows, take some photos of some of the Compost Observation drawings (these can be considered their Reflection Page) and share with us: Mishell.Balzer@bchd.org or Tami.Kachel@bchd.org
- Thank the students for joining you today and dismiss them.

***Don't forget to report your lesson as delivered with the online form – scan here:**

Resources

[1] Hu, S. (2020, July 20). *Composting 101*. NRDC. https://www.nrdc.org/stories/composting-101
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[7] "Plant Life Cycles." *Penn State Extension*, extension.psu.edu/plant-life-cycles.

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[14] National Institutes Of Health. (2021, March 22). *Office of Dietary Supplements - Iron*. Nih.gov. https://ods.od.nih.gov/factsheets/Iron-Consumer/
[15] What is fluoride and what does it do? How much fluoride do I need? (2020). In *National Institutes of Health, Office of Dietary Supplements*. https://ods.od.nih.gov/pdf/factsheets/Fluoride-Consumer.pdf#search=%22fluoride%20consumer%20fact%20sheet%22
[16] FDA. (2020). Sodium in Your Diet. *FDA*. https://www.fda.gov/food/nutrition-education-resources-materials/sodium-your-diet
[17] National Institute of Health, Office of Dietary Supplements. (2021, March 22). *Office of Dietary Supplements - Phosphorus*. Nih.gov. https://ods.od.nih.gov/factsheets/Phosphorus-Consumer/
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