RECYCLING CURRICULUM TEACHER HANDBOOK

Nevada Recycles

Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Bureau of Sustainable Materials Management

nevadarecycles.nv.gov

Dear Educator,

NDEP is providing a free Recycling & Waste Reduction Curriculum to assist you in planning lessons about solid waste management and recycling. This curriculum is composed of a series of interdisciplinary lessons through which students learn the importance of reducing, reusing, and recycling. Lessons are aligned to 5th grade Common Core and NGSS standards, but may be adapted to any level.

There are some great opportunities to apply for grants and receive acknowledgements for recycling programs within your classroom. NDEP offers a statewide Recycled Art Contest every fall for the public to create works of art made from reused materials. This is a great time to introduce your students to reuse and recycling topics, and then create a project to enter into the contest as a class or individually. Prizes vary each year. In addition, the Clark County School District (CCSD) offers a $1,000 scholarship for high school seniors to participate in the Green Ambassador Program (GAP). The CCSD and GAP are also funding sustainability programs in classrooms located in Southern Nevada by providing up to $1,000 grants.

Please provide any feedback you have regarding this curriculum. We are constantly updating these lessons to ensure proper education and reduce public confusion regarding solid waste management. We appreciate the time and effort that you put into using these lessons in your classroom.

If you require any assistance or need clarification regarding this curriculum or recycling, please contact one the two recycling coordinators for the State of Nevada:

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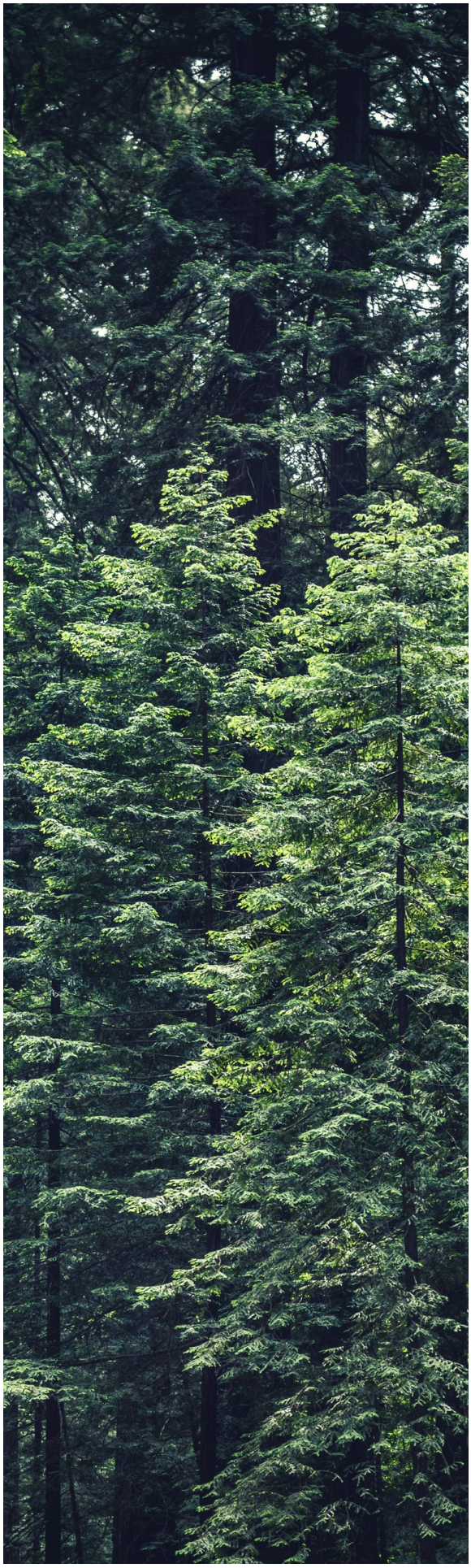

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Introduction

Have you ever wondered what the future looks like?

Duration

Preparation time: 10 minutes
Activity time: 40 minutes

State Standards

Common Core
ELA-Literacy.L.5.1, L.5.2, SL.5.1, RF.5.4, W.5.1, W.5.2
Next Generation Science
5-ESS3-1, 5ESS3.C

Student Handouts

Exercise 1: A Reflection on *Just a Dream*

Background

This lesson will provide an introduction to how our everyday actions impact the environment. Prior knowledge of environmental issues such as improper waste disposal, overfishing, and deforestation will better prepare students for understanding the scenes discussed in *Just a Dream.*

Summary

Students will read and answer questions about Chris Van Allsburg's *Just a Dream* to see how a person's everyday actions can impact the environment.

Objectives

Students will:

- Learn about different environmental issues around the world
- Discuss the themes of *Just a Dream* and observe how the main character's perspective changes throughout the story

Materials

- Exercise 1 in the Student Workbook
- *Just a Dream* by Chris Van Allsburg

Making Connections

Activities like drinking from a disposable water bottle, using a plastic grocery bag, and driving instead of walking are likely things that students do often in their everyday lives. This lesson acts as an introduction to how our activities have environmental impacts in many different ways.

Discuss with students their daily routine. Do they keep the water on when they brush their teeth? Are they using a paper bag instead of a reusable bag for their lunches? Questions like these can help spur discussion about how our habits affect the world around us.

The Activity

1. Pass out the handout and give students time to answer question 1: "How do your everyday activities like flushing the toilet or throwing away trash affect the world and those around you?" Allow time for discussion.
2. Read *Just a Dream* either out loud to the class, give the students their own copies to read independently, project the book in the front of the room and have students read aloud, or any other method deemed fit.
3. As the students read, ask guided questions to ensure reading comprehension (questions on the next page).
4. After the class is done reading, have the students answer the rest of the questions on the handout. Give them time to discuss their answers with their classmates or with the whole class.

Guided Questions

1. At the beginning of the story, Walter think that life will be much easier in the future, with

robots and machines to help us do everything. Do you agree or disagree? Why? What do you think the future will be like?

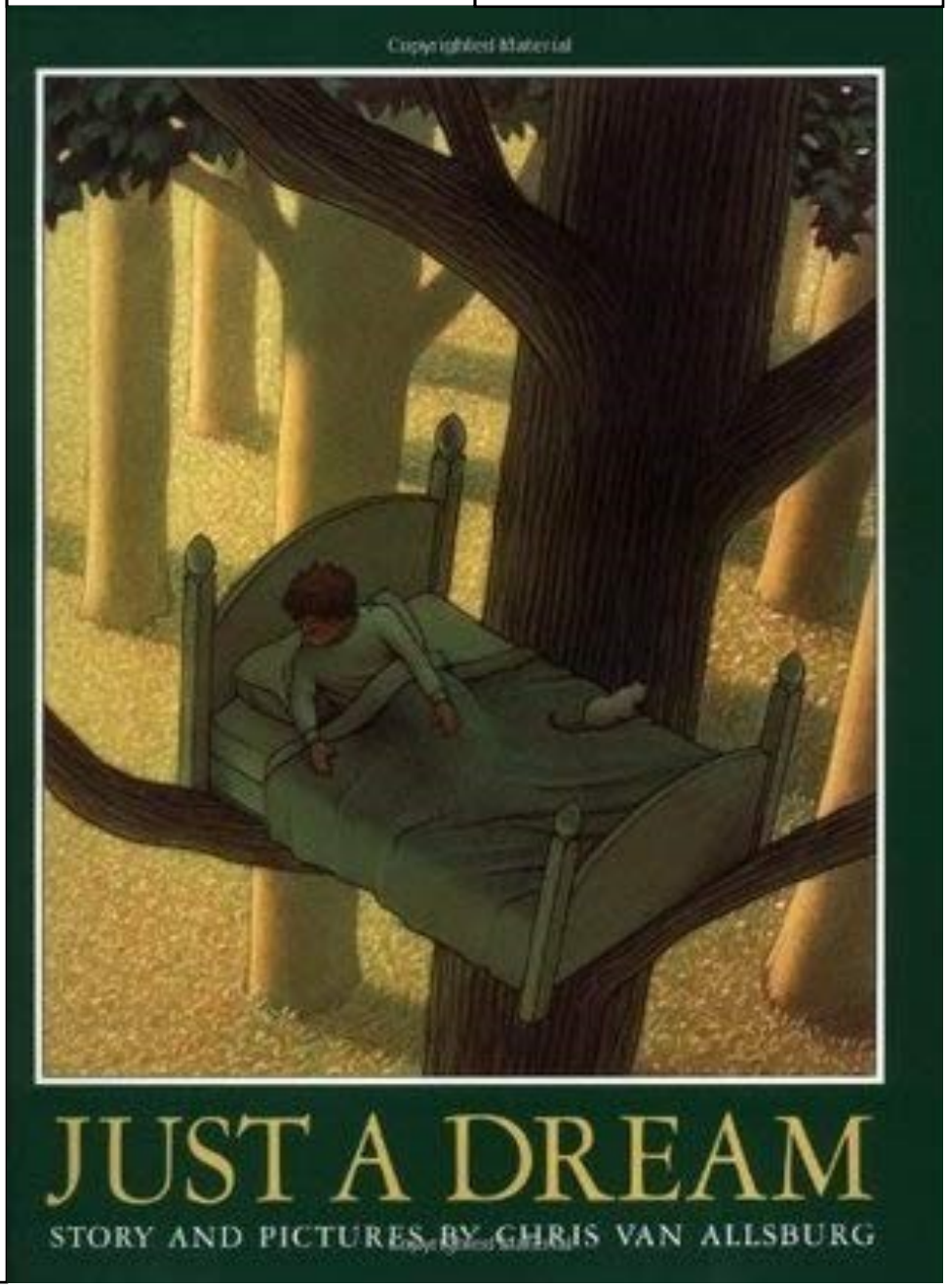
2. As you read the story, pause at several scenes from Walter's dream journey and discuss the issues described (ex: Why do you think there are no more fish in the sea in Walter's dream?).

3. Walter's ideas change drastically over the course of the story. What does he learn from his dream?

Just a Dream—Chris Van Allsburg

This lesson is based on the story *Just a Dream* by Chris Van Allsburg. The following is a book summary provided by Houghton Mifflin Publishers:

- Young Walter is a careless boy who tosses litter on the grass, thinks recycling is a waste of time, and mocks his neighbor, Rose, for her delight in the tree she has just received for her birthday. Walter longs to live in the future, which he imagines to be full of robots, tiny personal planes, and machines that make life easier.
- One night when he falls asleep, his wish to live in the future comes true. However, his dreams carry him into a future not filled with the robots and machines he believes will make life better, but instead ravaged by the careless mistakes of the past.
- Walter travels in his sleep to the midst of an endless garbage dump on his own street, to a tree in a forest that is about to be cut down, to the top of a smokestack belching pollution, to the middle of a fishless sea, and to other places that show him possible negative versions of the future.
- When he wakes up, he is a changed boy. On his birthday, he asks for a tree, which is planted near Rose's birthday tree.
- When he falls asleep that night, he dreams of the future again. In this dream, he is shown a different version—instead of a world of robots and machines, laundry hangs on the line, a man mows his lawn with an electric mower, and Walter is delighted to see that the two little trees have grown tall and strong in the clean air.



Exercise 1: A Reflection on *Just a Dream*—KEY

1. How do your everyday actions like flushing the toilet or throwing away trash affect the world and those around you?

Answers will vary

2. What kind of environmental issues does Walter see in his dream about the future? How does seeing those issues change Walter's ideas about the world?

Answers can include too much waste disposal, deforestation, air pollution, overfishing, ocean pollution, drought, and any other responses deemed fit. Seeing these issues in his dream urges Walter to separate his recyclables, stop littering, and plant tree. Walter begins to care more about how his everyday actions impact the environment.

3. What changes can you make in your everyday life to reduce the impact you have on the environment (recycling more, using a reusable lunchbox, etc.)?

Answers will vary

Photo by Bas Emmen on Unsplash

Landfills

Imagine if all of the trash you produced in the past year was buried in your backyard.

Duration
Preparation time: Activity I - 30 minutes activity II - 5 minutes
Activity time: Activity I - 45 minutes, Activity II - 45 minutes

State Standards
Next Generation Science
5-ESS3-1, ESS3.C
Common Core
Math.Content.5.NBT.A.4, Math.Content.5.NBT.B.5

Student Handouts
Exercise 2: The Journey of Trash
Exercise 3: Layers of Landfills
Exercise 4: How Much Trash Do You Make?
Exercise 5: Dumptown and Recycle City

Vocabulary
municipal solid waste, landfill, transfer station, per capita, leachate, vector, groundwater, unlined landfill, lined landfill, landfill liner, geotextile fabric

Background
This lesson will discuss how landfills are built and what problems they face to protect human health and the environment. This lesson will also discuss how much trash is produced per capita. Students will understand that humans impact the environment but that communities can use science to protect Earth's resources and the environment.

Summary

Students create lined and unlined landfill models and calculate how much waste they generate.

Objectives
Students will:

- Describe how and where their trash is disposed
- Explain how a lined landfill protects human health and the environment
- Calculate how much waste they dispose

Materials

1. Exercises 2-5 in the Student Workbook
2. Each small group will need 1 prepackaged "Unlined Landfill" kit and 1 prepackaged "Lined Landfill" kit. The teacher will also use both kits to model for the students.

Unlined Landfill Kit Materials

- 1 clear two liter plastic soda bottle, with top cut off a third of the way up
- 2 cotton balls
- 2 inch nylon square
- 1 rubber band
- 2 cups dirt, split evenly in two
- 1 cup shredded paper
- 1 cup water

Lined Landfill Kit Materials

- 1 clear two liter plastic soda bottle, with top cut off (cleaned after using in the unlined landfill kit)
- 2 cups dirt, split evenly in two
- 1 cup shredded paper
- 1 cup small aquarium gravel
- 5 inch x 5 inch diameter circle of modeling lay
- 5 in diameter circle of a plastic trash bag
- 1 plastic straw
- 1 cup water

Making Connections

Discuss what trash students threw away yesterday, and what trash has accumulated up to the point of this lesson. Did your students eat a meal before class and throw anything away? Include the types of trash and the types of packaging.

Discuss with students the following leading questions:

- What happens to the trash after it goes in the lunch room garbage can?
- How does it get in the garbage truck?
- Where does the garbage truck take it?
- Where does it ultimately end up?

Have students read and fill out exercise 1, then continue onto the landfill modeling.

Activity I: Landfill Model Procedure

1. Have the students assemble into

small groups and pass out one "Unlined Landfill" kit to each group. Place cotton balls in the neck of top. Cover the cotton balls by attaching the nylon square with a rubber band.

2. Add 1 cup of soil inside the base. This represents the ground.
3. Add shredded paper on top of the ground soil. This represents the MSW (municipal solid waste).
4. Add another 1 cup of soil to the model. This represents the daily cover. Discuss the reasons for daily landfill cover, including odor control, fire control, and vector control. Your model should look similar to this picture:
5. Place the top upside down in the base.
6. Pour water into the landfill model. The water passing through the cotton balls and nylon represents rainfall. Discuss how the water can flow through the landfill.

7. Define leachate. Connect leachate with the flow of water through the landfill.
8. Discuss problems associated with the unlined landfill. Ask students to brainstorm ways to improve the process. Explain to students how science, technology, engineering, and math have allowed us to improve the way we use and manage landfills. One solution to prevent toxic leachate leaking into the ground water is to line the landfill.
9. Empty out the old style landfill and dispose of the dirt outside. Use the same bottles to model the lined landfill.
10. Add 1 cup of soil to the base of the model to represent the ground.
11. Add the modeling clay disk to the model. When doing this, be sure to press the clay to the sides of the bottle to form a seal. (This will be important later.)
12. Add the precut plastic circle to form the liner.
13. Add the aquarium gravel.
14. Add the plastic drinking straw to the model. Explain that pipes are included in this layer for collection and treatment of leachate.
15. Add the precut circle of the material representing the geotextile fabric.
16. Add a layer of soil to the model. Compare the anatomies of the two types of landfills up to this point.
17. Add water to the model. Pouring water into the landfill model illustrates the concept of leachate recovery.
18. In a lined landfill, the liner structure is designed to trap leachate and prevent it from seeping into the groundwater. In the model, the clay disk should prevent the water from flowing through the landfill.
19. After cleaning up the models, have students fill out exercise 2 for the different layers in both the unlined and lined landfills.

Activity II: Waste Generation

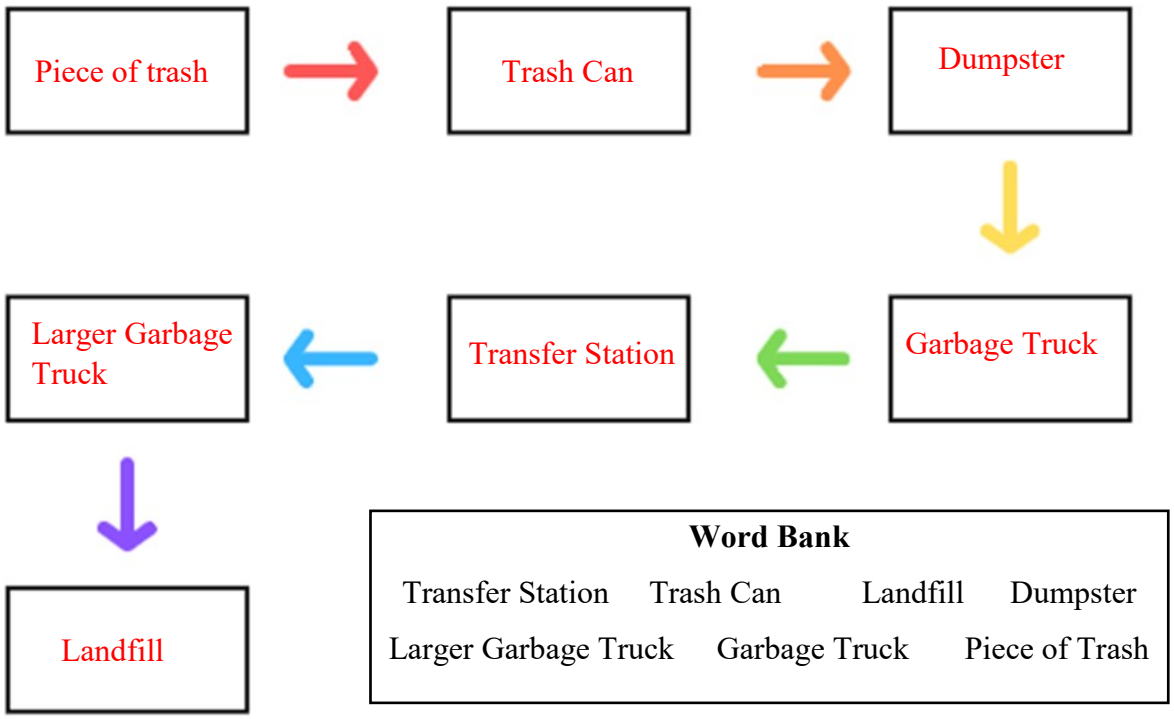
- Exercise 3 dives into how much waste Nevadans generate. The student worksheet can be completed in groups, as homework, or individually.
- Exercise 4 utilizes the EPA website for children. This activity can also be completed in the classroom individually or as a group, or completed as homework.

Exercise 2: The Journey of Trash from your Trash Can to the Landfill - KEY

A **landfill** is where our trash, also referred to as **municipal solid waste** (MSW), is buried. There are two different types of landfills: an **unlined landfill**, which does not have a liner, and a **lined landfill**, which has a liner system underneath all of the MSW. Lined landfills are a great example of using science, technology, engineering, and math to improve the safe placement and compaction of the public's trash. Once the garbage truck picks up your trash can, they either bring the waste to a **transfer station** or deliver it straight to the landfill. A transfer station is a location where trash trucks and residents unload their trash and then the trash is reloaded onto a larger truck to be sent to a landfill. This reduces the amount of trips that garbage trucks have to take to the landfill if the landfill is located far away from the city.

There are several problems that landfills have to be aware about to protect the environment from the waste that they store. Here are some examples:

- When water flows through a landfill, it picks up toxic substances from the waste. This tainted water is called **leachate**, or the toxic liquid that seeps from the trash in a landfill, and can flow through the landfill. Leachate may lead to **groundwater** contamination, which is a problem because most of our drinking sources in our communities come from the groundwater. While older landfills do not have a protective layer in place, new landfills are required to line landfills with a plastic liner to prevent the leachate from reaching to groundwater.
- Another issue that landfill managers face is **vectors**, or pests that are attracted to landfills and that spread disease, such as mosquitos, mice, or birds. Landfills must cover the trash daily to prevent odors that attract these vectors.
- Landfill managers deal with the trash that you send to the landfill. There are many unsafe items that people put in their trash can, such as **hazardous** chemicals, waste that can pose a hazard to human health or the environment. What can you put in the trash that could harm the landfill employees or the environment?



Word Bank

Transfer Station Trash Can Landfill Dumpster

Larger Garbage Truck Garbage Truck Piece of Trash

What happens to trash after it goes in the garbage can?

The janitor will take the trash to the dumpster where the garbage truck will pick it up. The garbage truck will either go straight to the landfill or to a transfer station, where all of the trash will be loaded into a larger garbage truck to take the trash to the landfill.

How does it get in the garbage truck?

The janitor will bring the trash to the dumpster where the garbage truck will pick up the trash. At home, the trash would be put in the trash can for the garbage truck to pick up.

Where does the garbage truck take it?

Either to the landfill or to the transfer station.

Where does it ultimately end up?

Buried in a landfill.

What are the benefits of using a lined landfill?

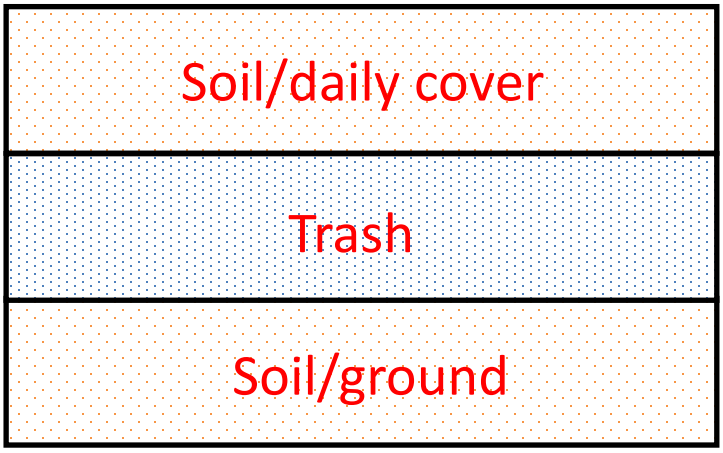
A liner in a landfill prevents leachate from contaminating the groundwater.

Why is it important to prevent leachate from getting into the groundwater?

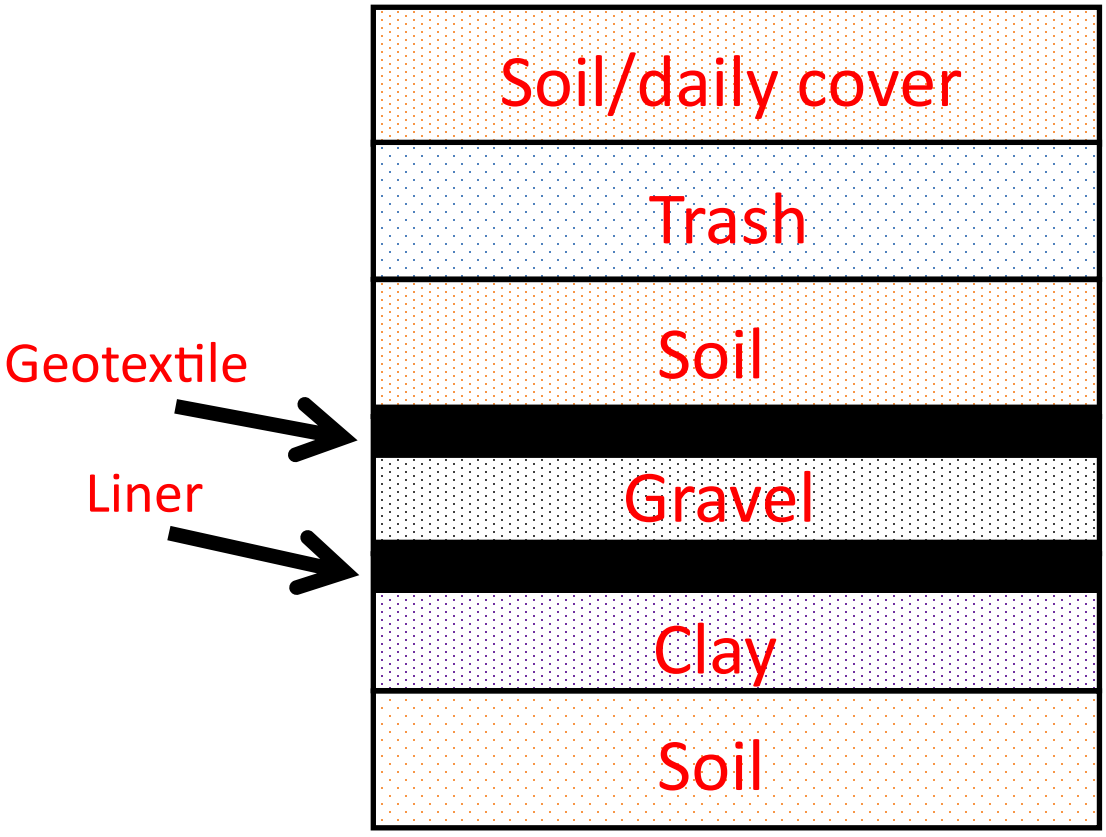
Most of the public drinking sources come from groundwater.

Exercise 3: Layers of Landfills - KEY

Unlined Landfill



Lined Landfill



Exercise 4 - How Much Trash Do You Make? - KEY

In 2017, Nevada produced about 7.4 pounds of MSW a day per capita. This is based on the following calculations:

Nevada produced 4,062,637 tons of waste in 2017. The US Census Bureau estimates that Nevada's population was 2,998,000 in 2012.

3,222,167 tons / 2,998,000 people = about 1.36 tons per person per year

1.07 tons * 2,000lbs/ton = 2,700 lbs. per person per year

2,150lb /365 days in a year= 7.4 lbs. per person per day

Of the 7.4 lbs. created per person each day in Nevada, only 1.5 lbs. are recycled, while 5.9 lbs. are buried in a landfill. This is based on Nevada's 2017 recycling rate of 20.7%.

Let's see how much trash you make!

How many students are in your class? _____

How many people live in your city? _____

How many people live in Nevada? _____

You may use a calculator to solve the following problems, but must write out every equation.

Note: Answers will be dependent on number of students in your class and number of residents in your city.

1. Calculate the waste produced by the students in this class each day, in **pounds**. Round your answer to the nearest **tenth place**. _____
2. Calculate the waste produced by the people in your city each day, in **pounds**. Round your answer to the nearest **whole number**. _____
3. How much trash is produced in Nevada per capita each day, in **tons**? Round your answer to the nearest **whole number**. __11,093 tons___
4. Calculate the waste produced by the people city each week, in **tons**. Round your answer to the nearest **hundreds place**. _____
5. Calculate the waste produced by the people in your city each month, in **tons**. Round your answer to the nearest **tenth place**. _____
6. Calculate the waste produced by the people in city each year, in **tons**. Round your answer to the nearest **hundreds place**. _____

Exercise 5: Dumptown and Recycle City – KEY

On a computer that has access to the internet, please visit

http://www.epa.gov/recyclecity/mainmap.htm.

Find the landfill within the city. Use the information you find to answer the following questions:

1. When Recycle City was called Dumptown, the Old Landfill was used. What was put in the landfill?
   Everything. All waste was put in the same "hole" in the ground.

2. What happened when poisonous liquids (caused by the trash) seeped into the soil?
   The groundwater became contaminated.

3. When Dumptown became Recycle City, how did the government fix the groundwater problem?
   They built a "Pump-and-Treat" plant to filter and purify the water.

4. When Recycle City set up its New Landfill, they also set up a Materials Recovery Facility. What does this facility do?
   A Materials Recovery Facility removes the reusable and recyclable materials from the trash. In addition to promoting recycling, it reduces the amount of waste that ends up in the landfill.

5. Besides the reduction of waste, what is the biggest difference between the Old Landfill and the New Landfill?
   The New Landfill uses a liner system to prevent contaminated water (leachate) from seeping into the earth and groundwater.

6. Please describe each of the five layers in a landfill liner.

   Layer 1 – the bottom is composed of at least two feet of clay.
   Layer 2 – a sheet of strong, flexible, thick plastic is placed over the clay.
   Layer 3 – gravel that contains pipes to collect leachate.
   Layer 4 – geotextile fabric to protect the pipes.
   Layer 5 –soil is placed on top to protect the liner from the waste.

7. Which landfill is better for the environment? Why?
   The New Landfill is better for the environment. The structure calls for a liner system that keeps the hazardous materials from touching the earth. The liner also keeps the leachate from entering the groundwater that may be used for human consumption. The landfill contains less waste because reusable and recyclable materials have been removed.

Photo by Thomas Van Der Vennet on Unsplash

Waste Decomposition

How long will our trash really be here?

Duration

Preparation time: 5 minutes
Activity time: 40 minutes

State Standards

Next Generation Science
5-ESS3-1, 5-ESS3.C

Student Handouts

Exercise 6: Waste Decomposition

Vocabulary

Decompose, recycle, reuse, reduce, photodegrade

Background

This lesson will discuss the amount of time it takes for waste to decompose. Students should begin to understand the different types of product materials and recognize what items can and should be recycled, and what types of materials should be avoided (like Styrofoam). It will encourage students to reduce the waste they produce, reuse items as best as possible, and recycle the things that they can.

Summary

By reading about waste decomposition and observing the decomposition timeline of certain types of everyday items, students will learn how long trash actually lasts and how it decomposes at different rates depending on where it is.

Objectives

Students will:

- Learn key vocabulary terms
- Observe how long certain everyday items take to decompose
- Discuss how waste decomposes differently in a landfill and in Nevada
- Understand the importance of reducing, reusing, and recycling

Materials

- Exercise 6 from the Student Workbook
- *Optional: supply each material from the timeline and have students guess how long each material takes to degrade.*

Making Connections

According to 2017 data, Nevadans produce 7.4 lbs of waste per day. This waste can last for years in a landfill in Nevada. Discuss with your students some of the things they throw out on a daily basis. Are there alternative, reusable items that they could be using instead? This lesson will explore the amount of time waste takes to decompose and why it is so important to reduce, reuse, and recycle.

The Activity

1. Pass out the printed handout with both the waste decomposition information and the related questions to the class.
2. Read the handout in pairs, groups, or as an entire class.
3. Discuss the table that shows the decomposition timeline for the everyday items. Do any of the durations listed surprise you?
4. Have students answer the questions independently. Go over answers as a class.

Read the information below and then discuss the following questions on the handout.

Decomposition is the process in which materials are broken down into smaller matter. The amount of time it takes for waste to decompose varies with the location it's in. In particularly moist, humid areas of the world, decomposition occurs at a much faster rate than in colder, dryer areas. Because of this, decomposition rates in Nevada are very slow because there isn't a lot of moisture to facilitate the process.

It is unknown exactly how long plastic takes to decompose. Plastic breaks down into smaller and smaller pieces without ever breaking into simple compounds. This process is called **photodegrading** because the sun's light is what is breaking down the plastic. Small fragments of plastic are often found in the ocean and are harmful to animals and the environment.

Take a look at how long these items take to degrade.

Everyday Items	Degradation time
Banana	3-4 weeks
Paper bag	1 month
Cotton rag	5 months
Wool sock	1 year
Leather boot (or shoe)	40-50 years
Rubber sole of leather boot (or shoe)	50-80 years
Tin can	80-100 years
Aluminum can	200-500 years
Plastic 6-pack rings	450 years
Plastic jug	1 million years
Styrofoam cup	Unknown? Forever?
Glass bottle	Unknown? Forever?

As you can see, the amount of time that these items take to decompose varies. In a place like Nevada, a banana peel can take up to two years and orange peels can take six months! This is why it's important to not throw your peels into the wilderness because they don't just disappear, it can take months or years for them to fully decompose.

Additionally, in a landfill, items can take even longer to decompose because landfills are only built to store, not degrade, waste. Because of the lack of air and water, items can take much longer to degrade.

Reducing, reusing, and recycling the waste you produce is a very important way to prevent your items from ending up in the landfill and taking years to decompose. **Reducing** waste by choosing alternatives to disposal items like plastic utensils, water bottles, etc., is the best thing you can do to avoid this. **Reusing** products like clothing is another essential way to prevent things from unnecessarily ending up in the trash. And finally, **recycling** your plastics, glass, and other recyclable materials is the best way to avoid wasting resources and giving life to your old products once more.

Exercise 6: Waste Decomposition—KEY

What does it mean to decompose? Why does it take so long for items to decompose in a landfill? Remember, air and water are necessary for decomposition.

Decomposing means to break down into small elements. Landfills have very little air and water, which makes the decomposition process much slower.

Based on what you learned in class about the rate of decomposition of trash in landfills, why is it important to reduce, reuse, and recycle?

It is important to reduce, reuse, and recycle because it decreases the amount of waste that goes to the landfill and ensures products are used to their full potential.

Why are decomposition rates slower in Nevada than in other areas?
Because Nevada is very dry, decomposition rates of litter are much slower than in areas with more moisture and humidity.

Photo by Joshua Hoehne on Unsplash

Composting

There are places for food waste besides a landfill.

Duration

Preparation time: 30 minutes
Activity time: 1 hour

Compost columns should be kept for four weeks so students can see the full composting process.

Student Handouts

Exercise 7: Which Material is Which?

State Standards

Next Generation Science
5-LS2-1, 5-LS2.A, 5-LS2.B, 5-ESS3-1

Vocabulary

Compost, greens, browns

Background

Now that the students understand waste decomposition, it's time to take it a step further and discuss disposing waste through composting.

Discuss with students what they do with food waste at home—do they compost? If so, what kind of system do they use (indoor, outdoor, vermicomposting, etc.)? Gauge what kind of experience students have with composting before beginning the lesson.

Summary

Students will take a hands on learning approach to composting by creating their own composting system using food waste, paper, wood shavings, leaves, soil, and water.

Objectives

Students will:

- Learn key vocabulary terms
- Understand alternative ways of getting rid of food waste

Materials

- Exercise 7 from the Student Workbook
- 2 two-liter soda bottles per group

<u>1 Compost Kit per 3-4 students:</u>

- 1 cup water
- 1 cup soil
- 1 cup shredded paper
- 1/2 cup dried leaves
- 1/2 cup pencil shavings
- 2 1/2 cups food waste (lettuce, strawberry leftovers, any type of fruit or vegetable)
- 1 large Ziploc bag to hold the paper, leaves, pencil shavings, and food waste

Making Connections

While composting has gained popularity in recent years, there is still not a comprehensive, statewide composting service for Nevada residents. Students will learn about the process of getting rid of food waste, and learn some of the fundamentals of starting a composting system. Ask students about how much food they throw away at home. What are some alternatives to throwing this away? Could they keep food for leftovers, or start a compost pile at their own home?

Creating the Compost Column

This procedure can be done either with the students or prior to class.

1. Cut the two-liter soda bottles in half.

2. Place the top of one bottle upside down in the bottom half of the bottle. Use the top of the second bottle as a as a lid as shown below.

3. Poke several small holes in the model for oxygen and drainage.

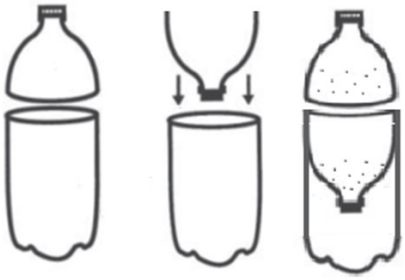
4. Put the leaves, shredded paper, pencil shavings, and food waste into the Ziploc bag.

5. Set aside soil and water for in-class activity.

The Activity

1. Divide students into groups and give each student a compost

column worksheet.



2. Give groups compost column and kit.
3. Before starting, remove the lid of the compost column so pouring the soil and compost kit contents is easier.
4. Have each group add 1 cup of soil to the compost column.
5. Scoop the Ziploc bag mixture of pencil shavings, food waste, etc. into the bag.
6. Add 1 cup of soil on top of this mixture to act as a cover layer.
7. Slowly pour the 1 cup of water into the compost column.

6. Place the lid back on the column.

7. Keep the compost columns for four weeks. At the end of these four weeks, observe how the contents transformed and are now usable soil.

8. Use soil for growing plants in classroom.

Photo by Joanna Wishard on Unsplash

Exercise 7: Which Material is Which? - KEY

Compost is organic material that can be used as soil to grow plants. It is created by mixing grass clippings and leaves, fruits and vegetables, woody material, and other natural, non-animal products together. Through proper mixing and the right amount of time, this material will decompose and turn into soil.

For general outdoor composting use the following guide:

Items that CAN go into a compost pile
Grass clippings and leaves
Newspapers
Kitchen waste
Fruits and vegetables
Woody material

Items that CANNOT go into a compost pile
Meats
Dairy products
Vegetables cooked with animal fats
Animal fat
Human and pet fecal matter

"Greens" are organic matter that contain large amounts of nitrogen. They are generally items that are freshly cut and include most of the food scraps thrown away from the kitchen (fruits and vegetables).
"Browns" are organic matter that contains large amounts of carbon. These are woody type matter including twigs, dried leaves, dead plants, and paper.

Compost Ingredients:

2½ cups food waste
½ cup dried leaves
½ cup pencil shavings
1 cup shredded paper
1 cup water
1 cup soil

List the green materials in the compost ingredients.
Food waste

List the brown materials in the compost ingredients.
Dried leaves, shredded paper, pencil shavings

List the organic materials in the compost ingredients.
Water, soil

Photo by Seth Cottle on Unsplash

Vermicomposting

Creepy, crawly and super, super important.

Duration
Preparation time: 1 hour (including vermicompost bin setup)
Activity time: 1 hour

State Standards
Next Generation Science
5-LS2.A, 5-LS2.B, 5-ESS3.C, 4-LS1-1.A, K-ESS3-1, K-ESS3-3

Student Handouts
Exercise 8: Vermiculture

Background

Recall from the previous lesson that compost is the result of the process of decomposition of organic material. Vermicomposting uses worms to break down the materials into compost. The worm castings (manure) are a vital part of the soil's nutrition.

Although it is not required, in order to complete this entire lesson, it is necessary to have worms for the students to study. If you choose to not use worms, complete only the sections that do not require worms.

Vocabulary
Vermicompost, red wiggler, anterior, posterior, segments

Summary

Students will get a closer look at one of the decomposers of the animal world by setting up a vermicompost bin and/or learning and observing worm anatomy.

Objectives

- Students will understand vermicomposting and the various methods to divert food waste from landfills

Materials

- Exercise 8 from the Student Workbook
- A 3 to 12 gallon Rubbermaid storage bin
- 50 pages of shredded UNCOLORED newspaper for bedding
- 2-4 cups of soil/sand (can be potting soil or from outside)
- Red wiggler worms (approximately 2 pounds of worms for every pound of food waste)
- Paper towels
- Magnifying glass

Making Connections

Review what students learned last lesson about composting. Explain to students how vermicomposting is a type of composting that uses worms to break down the material. Vermicomposting is generally a quicker process than the traditional composting that was demonstrated in the previous lesson. All animals need 3 things to survive: air, water, food. Worms like humans, cannot not survive without enough air, water and food. Food, air and water are also the perfect conditions for insects and bacteria to grow. Insects and bacteria help the worms to decompose the food waste.

Setting Up a Vermicompost Bin

1. Clean the Rubbermaid storage bin to remove any residue that could harm worms.
2. Tear the newspaper into 1/2" to 1" strips.
3. Place strips into a separate container and add water until bedding feels like a damp sponge—moist but not dripping.
4. Add strips to Rubbermaid bin, making sure they are fluffy (not packed down). Bin should be 3/4 full of newspaper strips.
5. Add the 2-4 cups of soil to the bin over the newspaper.
6. Add the worms.
7. Feed the worms approximately 3 times their weight per week (2 lbs worms = 6 lbs food/week). When feeding them, make sure to bury the food scraps under the bedding.

****Do NOT put meat, dairy products, vegetables cooked with animal fats, animal fat, and human or pet fecal matter in the vermicompost bin****

The Activity

1. Show students the different parts of worm and allow them to fill in their handout.

2. After students are familiar with where the various parts are located, discuss the vocabulary and allow students time to write down the definitions on their handouts.

3. Read and explain all of the questions the students are to answer on their handout.

4. Pass out damp papers towels and magnifying glasses.

5. Provide each student with at least one worm and some vermicompost. **Remind students that worms are animals and are not be harmed.**

6. Allow students time to complete their handouts. Scaffold for support.

7. When students are finished, collect the materials. Worms and paper towels should be deposited back into the worm bin.

8. As a debriefing, check for understanding by asking students: *What is the difference between composting and vermicomposting? What 3 things do worms need to survive?*

9. Review key vocabulary terms.

10. Discuss the scientific method. Scientists ask questions; make hypotheses, experiment, and record results.

11. Allow students time to brainstorm their own scientific experiment with the worms. Students should write their question and hypothesis on their handout. Examples: How long it will take a worm that has been separated from the compost to return to the compost and bury itself? How long will it take for all worms, after being separated from the compost, and being placed on top to be completely buried?

Photo by Kyle Ellefson on Unsplash

Exercise 8: Vermiculture—KEY

1. Vermicomposting: B
2. Red wigglers: E
3. Anterior: D
4. Posterior: A
5. Segments: C

The anterior (head end) of the Red Wiggler is narrower than the posterior (tail end)
6. What color is the anterior? Dark reddish purple
7. What color is the posterior? Pinkish with yellow

8. Red Wigglers are made up of many rings called segments. Compare your worm to your neighbor's.
Which worm has more segments?
Answers will vary but in general, the longer worm. As a worm matures, it gets longer and develops more segments.

9. Lightly touch the worm's anterior. What does it do? It contracts abruptly.

10. Lightly touch the worm's posterior. What does it do? It contracts.

11. How does the worm feel to you when you touch it? Answers vary

12. When the worm moves forward, does it move head first or tail first? Head first

13. Put some bedding material near the worm. Watch the worm for 1- 2 minutes. Describe the worm's activity.
Answers vary

Scientific Method section 1-4
Answers vary.

Photo by Noah Buscher on Unsplash

Reduce

Why is it important to reduce waste, and how can I reduce my waste?

Duration

Preparation time: 5 minutes
Activity time: 45 minutes

State Standards

Next Generation Science
5-ESS3-1, 4-ESS3.A

Student Handouts

Exercise 9: Reduce

Background

This lesson focuses on reducing waste. After this lesson, students should understand why it is important to reduce waste, and understand how they can create less waste.

Vocabulary

Secondary packaging, waste reduction, reuse, recycle

Photo by Jon Moore on Unsplash

Summary

Students view a model that shows how secondary packaging increases waste and come up with ways to reduce their waste.

Objectives

Students will:

- Describe what secondary packaging is
- Explain why it is important to reduce waste how they can create less waste

Materials

- Exercise 9 from the Student Workbook
- 2 large measuring bowls
- 1 large bag potato chips (20oz)
- 20 small bags of potato chips (equal weight to the large bag)
- 1 roll paper towels
- 1 box of sandwich-sized zip-lock baggies
- Plastic or glass reusable food containers

Making Connections

Students are often served single serving packaging for their lunches out of convenience, for both parents and the cafeteria staff. Secondary packaging also allows for sanitary transfer of food from employees to students. The secondary packaging generates excess waste.

Ask students the following questions:

1. How is your lunch normally packed, or presented?
2. What packaging is reusable?
3. What packaging is normally thrown away afterward?
4. How can you change the packaging of your food?
5. How does the secondary packaging affect the environment? (bring into account what material the packaging was created from and how it will be disposed)

The Activity

1. Arrange a table near the front of the class with the measuring bowls and the packages of potato chips on it and discuss how the potato chips on the table are packaged (one large bag vs. 20 small bags and their outside packaging).
2. Have one of the students open and pour out the potato chips from the large bag into one of the measuring bowls. Make a quick measurement (approximate visual) of the volume of chips.
3. Have 20 other students open the small bags and pour contents into the other measuring bowl. Make a quick visual measurement of the volume of chips (approximate). Note: The vol-

umes of chips in the 2 bowls should be approximately the same.

4. Discuss the difference in the amount of packaging used to contain the same volume of chips.
5. Pass out the chips to the students on paper towels, in plastic baggies, and in reusable containers.
6. Discuss the implications of secondary packaging and waste reduction.

- Can the plastic baggies, paper towels, or reusable containers be reused or recycled?
- Are there limitations to the reuse of the secondary packaging? How does this affect waste reduction? Allow class time to work on the notebook worksheets.

One Step Further

This section takes the idea of waste reduction even further and discusses an idea known as "zero waste." To introduce the idea of zero waste, explore the following website with students:

http://disappearingpackage.com

Discuss with students the negative consequences of packaging. The following is a comprehensive list of some of these consequences.

- Often ends up as litter and debris on city streets, beaches, waterways and oceans
- Litter and debris harms and kills hundreds of thousands of birds, fish, and sea mammals every year
- Consumer energy for production (gas, oil, water, electricity)
- Can leach chemicals and produce toxic waste
- Consumes and wastes natural resources

Photo by Marina Casas on Unsplash

- Can mislead consumers regarding quantity and quality of product.
- Increases the cost of product to consumer
- Often costly for cities to clean up
- Disposable packaging fills up landfills.

Discuss some reasons why packaging is important. The following is a comprehensive list.

- protects its contents from damage in shipping
- Sanitary
- Identifies content
- Prevents or reduces theft
- Provides instruction for proper use
- Advertises product
- Convenient for consumer and retailer
- Makes product transportable
- Decreases waste from spoilage or handling

Photo by chuttersnap on Unsplash

Photo by Bernard Hermant on Unsplash

Reuse

What treasure can I create from trash?

Duration
Preparation time: 5 minutes
Activity time: 45 minutes

State Standards
Next Generation Science
5-ESS3-1, ESS3.C

Student Handouts
Exercise 10: Reuse

Background
The story, The Dumpster Diver, sets the stage for student creativity.

- "Anyone can dive for treasure in the ocean, but Steve dives for it in his neighborhood dumpster! As he delves into the trash each weekend, Steve encourages his young neighbors (aka the Diving Team) to see the potential in what other people throw away. With a little bit of imagination, trash can be transformed into treasure — and as the Diving Team soon discovers, it might even help a friend in need"

http://www.goodreads.com/book/show/932957.The_Dumpster_Diver

Vocabulary
Recycle, reuse

Summary
Students are challenged to invent a product that would have been sent to the landfill.

Objectives
Students will:

- Understand how and why individuals and communities reuse materials to conserve the Earth's natural resources
- Understand the concept of material reuse and resource conservation
- Understand that all products require energy to be created

Materials
- Exercise 10 from the Student Workbook
- The Dumpster Diver by Janet S. Wong
- Markers, crayons, or colored pencils

Making Connections
Some students may have more experience with the concept of recycling and specifically reusing than others. Keep in mind that not all students have access to recycling at home and therefore maybe unfamiliar with the various concepts of recycling. When we reuse product and materials we can save energy. There are many ways to reuse products. This lesson helps students understand the concept of material reuse and resource conservation. When we reduce production, we reduce our energy demand.

The Activity
1. Begin the lesson by reading aloud to the students The Dumpster Diver by Janet S. Wong. This story helps to activate prior knowledge and get the students interested in the topic of reusing.
2. Pass out handout and have each student select one item from the list. You can modify this list by adding or removing items. (If you chose for students to actually create their invention, consider listing only items that are readily available or have no cost).
3. At your discretion, allow students to choose their own object, especially if you decide to assign students to invent something from a household item. You can use the following list as a starting point for creating your own list if you so choose.
   - Shoe box
   - Flower pot
   - Tin Can
   - Eyeglass Lens
   - Paper towel tube
   - Newspaper
   - Tissue Box
   - Milk Container
   - Other
4. Instruct students to write their selection in the provided space on the handout. Re-explain the word reuse. Reuse means to

transform or turn the item into something new, which will have a different purpose or use.

5. Instruct the students to write the final product on the space provided. Allow students time to brainstorm.
6. Demonstrate to the students how to take one sheet of printer paper and fold it into 3 equal sections with the left panel flap over/on top.
7. Once their paper is folded, students should follow directions on handout.
8. Show the students the following example. Remind students that they are to create their own idea, not copy the example given.
9. Allow students plenty of time to create their brochure. It may be necessary to explain the terms ""who", "when", "where", "what", "how", and "why".
10. Have students share with the class or in small groups their inventions. Ask presenting students specific questions to check for understanding of key concepts. Students should be able to understand why we should reuse items rather than always buying them new.
11. If you choose, you may have the students actually create the items they invented as a follow up activity. You would need to supply students with materials and supplies. This activity could be assigned as homework instead of using class time for it.

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Photo by Jonathan Chng on Unsplash

Recycle

What materials are recyclable, and how are they recycled?

Duration

Preparation time: 5 minutes
Activity time: 45 minutes research and 45 minutes presenting

State Standards

Next Generation Science
5-ESS3-1
Common Core
ELA.Literacy-RI.5.1, RI.5.7, RI.5.9, W.5.2, W.5.7, W.5.8, W.5.9

Student Handouts

Exercise 11: Recycling Project

Background

This lesson focuses on the basics of recycling at home and at school. Materials covered include plastic, aluminum, and glass, e-waste, and steel. Paper is not covered in this lesson since it was covered in the paper recycling lesson. Because recycling programs vary across the state, it is important for students to understand how recycling works in their community. If you are unsure about what opportunities exist in your community, please feel free to contact us for information regarding recycling in your area.

Summary

Students will learn how different materials are recycled by compiling recycling research and presenting on it.

Objectives

Students will:

- Identify what recycling opportunities are available in their community
- Understand how different materials are recycled

Materials

- Exercise 11 from the Student Workbook
- 5 poster boards
- Markers crayons or colored pencils

Making Connections

Many municipalities in Nevada offer curbside recycling. Typically curbside recycling is only available to single family residents. Apartment complexes may or may not have a dumpster for recycling. If curbside recycling is not available in your community, this lesson is still applicable.

- Identify if students currently recycle at home. Because many students have barriers to recycling at home, it is important to identify what recycling options your students have available (none, single stream curbside, or sorted curbside recycling).
- Identify if students are recycling at school and what recycling opportunities are available for students. Every school is different. Talk with administration and custodial staff to identify how your school recycles.
- Every classroom should have a separate container for recycling paper. In the cafeteria, students should have access to recycling for plastic bottles and aluminum cans. Empty milk cartons are accepted in Clark County. Review paper recycling from Lesson 6. Remind students that all paper should be placed in a separate recycling bin.
- Inform students that cardboard and paperboard are also easily recycled. Ask students to think about all the products that come in cardboard or paperboard.

The Activity

1. Divide the class into 5 groups: Plastic, Aluminum, Glass, E-Waste, and Steel
2. Each group will need a handout with questions they must answer as they research their assigned topic.
3. Allow students time to use the internet or books (if available) to research their assigned topic and answer the questions.

Option 1:

Each group is required to create a poster to encourage recycling of their assigned material to be hung in the classroom or in the hallway.

Posters should include:

- The group's assigned material (plastic, aluminum/tin, glass)
- Where/how to recycle the material
- What the material gets recycled into
- At least 1 reason to recycle their assigned material

Option 2:

At the beginning of the lesson students identified barriers to recycling plastic, aluminum, glass, e-waste, and steel. Brainstorm as a class solutions to some of the barriers. Assign each group a project to overcome an identified obstacle.

Example:

Classroom does not have recycling bin for paper. Students can decorate a cardboard box to be used as paper recycling bin for the classroom.

Photo by Gary Chan on Unsplash

Photo by Bernard Hermant on Unsplash

Names_____

Group 1: Plastic

- Use the internet to answer the following questions on a separate piece of paper. You may write or type your answers.
- Remember, each group member is responsible for answering at least 1 question.
- Answer questions using your own words. Do not copy down entire sentences from the internet.
- Remember, not everything you read on the internet is fact. Here is an example of a reliable website: http://www.epa.gov/osw/conserve/materials/plastics.htm
- Provide a source for each answer.

Use the website listed above to answer the following questions:

1. What is the largest category of plastics?
2. What percentage of the municipal solid waste (MSW) stream is plastic?
3. What was the overall percentage of recycled plastics in 2015?
4. How are plastics made?
5. How is plastic recycled? List specific steps.
6. What is the resin identification code?
7. What is source reduction?

Use other sources to answer the following questions, and make sure to cite your sources.

1. Every community recycles different types of plastics. What types of plastics are recyclable at your home and school?
2. What happens to recycled plastic? What does it become?
3. Why is it important to recycle plastic?
4. What plastics are not recyclable, or cause problems at Material Recovery Facilities (MRF)?

Names_____

Group 2: Aluminum

- Use the internet to answer the following questions on a separate piece of paper. You may write or type your answers.
- Remember, each group member is responsible for answering at least 1 question.
- Answer questions using your own words. Do not copy down entire sentences from the internet.
- Remember, not everything you read on the internet is fact. Here is an example of a reliable website: http://www.epa.gov/osw/conserve/materials/alum.htm
- Provide a source for each answer.

Answer questions using your own words. Do not copy down entire sentences from the internet.

Use the website listed above to answer the following questions:

1. What are some common uses for aluminum?
2. How many tons of aluminum for containers and packaging did Americans generate in the municipal solid waste (MSW) stream in 2011?
3. What percent of aluminum soft drink containers were recovered for recycling in 2011?
4. How is aluminum recycled? List specific steps.
5. What is source reduction?
6. How has aluminum can production improved since 1972?

Use other sources to answer the following questions, and make sure to cite your sources.

1. How does recycling cans save money and the environment?
2. How can you recycle aluminum cans at home and at school? Talk your teacher to learn your school rules about recycling aluminum cans.
3. Why is it important to recycle aluminum cans?

Names_____

Group 3: Glass

- Use the internet to answer the following questions on a separate piece of paper. You may write or type your answers.
- Remember, each group member is responsible for answering at least 1 question.
- Answer questions using your own words. Do not copy down entire sentences from the internet.
- Remember, not everything you read on the internet is fact. Here is an example of a reliable website: web-site: http://www.epa.gov/osw/conserve/materials/glass.htm
- Provide a source for each answer.

Answer questions using your own words. Do not copy down entire sentences from the internet.

Use the website listed above to answer the following questions:

1. What are some common uses for glass?
2. How many tons of glass did Americans generate in the municipal solid waste (MSW) stream in 2011?
3. What percent of glass was recovered for recycling in 2011?
4. How is glass recycled? List specific steps.
5. How does using cullet save money and the environment?
6. What percent of recycled glass is used to make new containers?
7. In addition to making new containers, how else is recycled glass used?
8. What is source reduction?
9.

Use other sources to answer the following questions, and make sure to cite your sources.

1. How can you recycle glass at home?
2. Is glass recycling available at your school? Talk your teacher to learn your school rules about recycling glass.
3. Why is it important to recycle glass?

Names_____

Group 4: Electronic Waste

- Use the internet to answer the following questions on a separate piece of paper. You may write or type your answers.
- Remember, each group member is responsible for answering at least 1 question.
- Answer questions using your own words. Do not copy down entire sentences from the internet.
- Remember, not everything you read on the internet is fact. Here is an example of a reliable website: web-site: http://www.epa.gov/osw/conserve/materials/ecycling/index.htm
- Provide a source for each answer.
- Answer questions using your own words. Do not copy down entire sentences from the internet.

Use the websites listed above to answer the following questions:

1. According to the Consumer Electronics Association (CEA), Americans now own approximately how many electronic products per household?
2. In 2009, discarded TVs, computers, peripherals (including printers, scanners, fax machines) mice, key-boards, and cell phones totaled about how many million short tons?
3. In 2009 cellphones were recycled at what rate?
4. How much e-waste is recycled?
5. What is the environmental impact of disposing electronics into the environment without any precaution?
6. What are the environmental benefits of reusing and recycling e-waste?
7. What products can be made from the materials recovered by recycling cell phones?
8. How do I recycle my cell phone, batteries, and accessories?
9. What are the social benefits of recycling cell phones (and other e-waste)?

"Electronic products are made from valuable resources and materials, including metals, plastics, and glass, all of which require energy to mine and manufacture. Donating or recycling consumer electronics conserves our natural resources and avoids air and water pollution, as well as greenhouse gas emissions that are caused by manufacturing virgin materials." - http://www.epa.gov/osw/conserve/materials/ecycling/donate.htm

Names_____

Group 5: Steel

- Use the internet to answer the following questions on a separate piece of paper. You may write or type your answers.
- Remember, each group member is responsible for answering at least 1 question.
- Answer questions using your own words. Do not copy down entire sentences from the internet.
- Remember, not everything you read on the internet is fact. Here is an example of a reliable website: website: http://www.epa.gov/osw/conserve/materials/steel.htm
- Answer questions using your own words. Do not copy down entire sentences from the internet.

Use the website listed above to answer the following questions:

1. What are some common uses of steel?
2. In 2011, the United States generated about how many tons of steel as containers and packaging in the MSW stream?
3. How is steel made?
4. What is source reduction and how does it apply to steel?
5. The steel industry in North America has been recycling steel scrap for more than how many years?
6. How is steel recycled?
7. In 2008, the steel industry recovered and recycled more than how many tons of shredded steel scrap from automobiles?
8. Can you recycle steel at home?
9. Can you recycle steel at school?
10. Why should we recycle steel?

Group 1: Plastic Answer Key

Students' answers should be in their own words.

What is the largest category of plastics? Containers and packaging

What percentage of the municipal solid waste (MSW) stream is plastic? 13 percent

What was the overall percentage of recycled plastics in 2011? 8 percent

How are plastics made? Answer will vary.

How is plastic recycled? List specific steps. Answers will vary.

What is the resin identification code? Student should answer all questions in their own words.

"The resin identification coding system for plastic, represented by the numbers on the bottom of plastic containers, was introduced by SPI, the plastics industry trade association, in 1988. Municipal recycling programs traditionally target packaging containers, and the SPI coding system offered a way to identify the resin content of bottles and containers commonly found in the residential waste stream. Plastic household containers are usually marked with a number that indicates the type of plastic. Consumers can then use this information to determine whether or not certain plastic types are collected for recycling in their area. Contrary to common belief, just because a plastic product has the resin number in a triangle, which looks very similar to the recycling symbol, it does not mean it is collected for recycling."

What is source reduction? Student should answer all questions in their own words.

"Source reduction is the process of reducing the amount of waste that is generated. The plastics industry has successfully been able to reduce the amount of material needed to make packaging for consumer products. Plastic packaging is generally more lightweight than its alternatives, such as glass, paper, or metal. Lighter weight materials require less fuel to transport and result in less material in the waste stream."

Every community recycles different types of plastics. What types of plastics are recyclable at your home and school? Answers will vary. Some recycling programs only accept bottles (#1 and #2 plastics with a "neck"), but other programs include all plastics.

What happens to recycled plastics? What does it become? Answers will vary. Many plastic bottles are recycled into new plastic bottles, although there are many uses for recycled plastics.

Why is it important to recycle plastic? Answers will vary.

Group 2: Aluminum Answer Key

Students' must answer using their own words.

What are some common uses for aluminum? Containers, packaging, automobiles, appliances

How many tons of aluminum for containers and packaging did Americans generate in the municipal solid waste (MSW) stream in 2011? 1.9 million tons

What percent of aluminum soft drink containers were recovered for recycling in 2011? "In 2011, 55 percent of aluminum beer and soft drink containers generated were recycled (about 0.7 million tons)."

How is aluminum recycled? List specific steps. "Individuals and haulers can deposit and collect aluminum used beverage containers (UBCs) at the curbside or community drop-off centers. From there, haulers take the cans to a material recovery facility (MRF), where workers separate aluminum cans from other food and beverage containers. Since most recovered UBCs are processed into new cans, it is important that processors generate only high-quality scrap. The recovered aluminum containers must be free from dirt and other foreign substances. The MRF or a scrap dealer then bales the cans, which brokers and can sheet manufacturers purchase.

Can sheet manufacturers typically have arrangements with toll processors to refine the metal and melt it

into ingots, which are solid metal blocks? The can sheet manufacturers then melt the ingots to make cans, and then sell the cans back to the beverage industry."

What is source reduction? "Source reduction is the process of reducing the amount or toxicity of waste generated. Because aluminum can be easily recycled, it has been able to reduce the amount of raw material needed to make the same product."

How has aluminum can production improved since 1972? "Data from the Aluminum Association shows that the weight of aluminum cans has decreased—in 2011, 35 cans could be made from a pound of aluminum, up from 22 cans in 1972."

Use other sources to answer the following questions.

How does recycling cans save money and the environment? Answers will vary.

How can you recycle aluminum cans at home and at school? Answers will vary. If students have single stream recycling the aluminum does not need to be separated out; otherwise, the aluminum must be separated. If students do not have curbside recycling there are generally opportunities to drop off recyclables.

Why is it important to recycle aluminum cans? Answers will vary.

Group 3: Glass Answer Key

Students' answers should be in their own words.

What are some common uses for glass? Answers may vary. Glass is generally used as a packaging container and is used for storing a variety of products.

How many tons of glass did Americans generate in the municipal solid waste (MSW) stream in 2011? 11.5 million tons

What percent of glass was recovered for recycling in 2011? 28 percent

How is glass recycled? List specific steps. "Glass collected at the curbside is usually commingled, meaning that different colors and types of glass are collected together. This glass might then be sorted by color, or other characteristics, at a materials recovery facility. Some municipal and commercial recycling programs require participants to separate clear, brown, and green glass. Although all glass is made of silica and soda, the type and quantity vary slightly with different types of glass. Different melting points and chemical incompatibility make it important to sort glass by color. Glass separated by color yield glass cullet of higher economic value. The crushed glass is called cullet, an ingredient in making new glass."

How does using cullet save money and the environment? "Cullet costs less than raw materials. Cullet prolongs furnace life and saves energy since it melts at a lower temperature. Less energy used means reduced emissions of nitrogen oxide and carbon dioxide, both greenhouse gases."

What percent of recycled glass is used to make new containers? 90 percent

In addition to making new containers, how else is recycled glass used? "High-quality cullet can be used for abrasives, aggregate substitute, bead manufacturing, decorative applications, fiberglass, frictionators (match tips), and fluxes in metal foundry work. Lower-quality cullet is increasingly used in secondary applications, such as in the manufacture of fiberglass insulation, roadbed aggregate, driving safety reflective beads, and decorative tile."

What is source reduction? "Source reduction is the process of reducing the amount or toxicity of waste that is generated. Money and resources saved by reducing the volume of glass containers help make glass more cost effective for glass container manufacturers, who face competition from aluminum and plastic container manufacturers. Using advances in design and manufacturing technology, the glass container industry continues to reduce the weight of glass containers."

How can you recycle glass at home? Answers will vary. If students have single stream recycling the glass does not need to be separated out, otherwise, glass must be separated. If students do not have curbside recycling there are generally opportunities to drop off recyclables. Not all recycling programs include glass for a variety of reasons, including the potential for broken glass to contaminate other commodities.

Is glass recycling available at your school? Answers will vary.

Why is it important to recycle glass? Answers will vary.

Group 4: E-waste Answer Key

Students' answers should be in their own words.

According to the Consumer Electronics Association (CEA), Americans now own approximately how many electronic products per household? own approximately 24 electronic products per household.

In 2009, discarded TVs, computers, peripherals (including printers, scanners, fax machines) mice, keyboards, and cell phones totaled about how many million short tons? 2.37 million short tons.

In 2009 cellphones were recycled at what rate? "In 2009, approximately 38 percent of mobile devices collected for end-of-life management were reused or refurbished, and 62 percent were recycled for material recovery."

How much e-waste is recycled? "A great deal of what is labeled as "e-waste" is actually not waste at all; rather, it is whole electronic equipment or parts that are readily marketable for reuse or can be recycled for materials recovery. In 2009, approximately 25 percent of TVs, computer products, and cell phones that were ready for end-of-life management were collected for recycling. Cell phones were recycled at a rate of approximately 8 percent."

What is the environmental impact of disposing electronics into the environment without any precaution? "Electronics are complex devices which are made of a wide variety of material constituents. Some of the constituents, such as lead, nickel, cadmium, and mercury, could pose risks to human health or the environment if mismanaged at their end-of-life. EPA is very concerned about ensuring the proper management of used electronics and has undertaken important work to increase the collection and responsible recycling of used electronics."

"As for managing electronics disposed in the US in landfills, we believe that disposal of electronics in properly managed municipal solid waste landfills does not threaten human health and the environment. The results of landfill leachate studies, suggest that currently allowed disposal of electronics — including those containing heavy metals — in modern municipal solid waste landfills are protective of human health and the environment. However, we strongly support keeping used electronics out of landfills, to recover materials and reduce the environmental impacts and energy demands from mining and manufacturing. Electronics are made from valuable resources, such as precious metals, copper, and engineered plastics, all of which require considerable energy to process and manufacture. Recycling electronics recovers valuable materials and as a result, we reduce greenhouse gas emissions, reduce pollution, save energy, and save resources by extracting fewer raw materials from the earth".

What are the environmental benefits of reusing and recycling e-waste? "Electronic products are made from valuable resources and highly engineered materials, including metals, plastics, and glass, all of which require energy to mine and manufacture them. Reusing and recycling consumer electronics conserves our natural resources and avoids air and water pollution, as well as greenhouse gas emissions that are

caused by manufacturing virgin materials."

What products can be made from the materials recovered by recycling cell phones? The plastics recovered from cell phones are recycled into plastic components for new electronic devices or other plastic products such as garden furniture, license plate frames, non-food containers, and replacement automotive parts. When the rechargeable battery can no longer be reused, the battery can be recycled into other rechargeable battery products.

How do I recycle my cell phone, batteries, and accessories? "Drop them off or mail them in. Cell phones and their accessories can be recycled easily and conveniently. Cell phone recycling programs can be accessed from every state in the United States, as well as Puerto Rico and Guam. Many cell phone retailers, manufacturers, and service providers have ongoing programs where you can drop off, or mail in your used wireless phones, regardless of the age or model. Some charitable organizations and state or municipal solid waste programs also offer cell phone recycling. In almost all cases the recycling service is provided for free."

What are the social benefits of recycling cell phones (and other e-waste)? "If the cell phone and its accessories are in good working condition, some collection programs donate them to a number of worthy charities or provide them for sale to those who need them. In addition, many reuse and recycling programs use the proceeds of their programs to benefit charitable organizations, such as domestic violence, environmental causes, children's safety, etc. Other recycling programs work with schools and other organizations to collect cell phones as fundraising ventures. The principal markets for refurbished cell phones extend beyond the US—availing access to modern communication technology to many people in developing economies with who would not otherwise be able to afford it."

Group 5: Steel Answer Key

Students' answers should be in their own words.

What are some common uses of steel? "Steel is a versatile commodity that plays a major part in everyday life- from food cans, household containers, automobiles, and office buildings. Steel makes up the largest category of metals in the municipal solid waste (MSW) and industrial waste streams."

In 2011, the United States generated about how many tons of steel as containers and packaging in the MSW stream? 2.2 million tons

How is steel made? "Steel is an alloy of iron and carbon. It is made by heating coke, a solid iron fuel, with iron ore and limestone in a blast furnace. It is produced in one of two ways: the basic oxygen furnace (BOF) process, which uses 25 to 35 percent recovered steel, and the electric arc furnace (EAF) process which uses nearly 100 percent recovered steel."

What is source reduction and how does it apply to steel? "Source reduction is the process of reducing the amount or toxicity of waste generated. The steel industry has successfully been able to reduce the amount of material needed to make the same products. According to data from AISI, over the past 25 years, the thickness of steel containers has been reduced by 30 percent, from 0.20 millimeters (mm) to 0.14 mm. Technological developments in gauge control are further reducing thicknesses to 0.12 mm. Thickness will continue to be reduced through more advanced technology and higher-quality steel. Steel for automobiles has also become more lightweight, especially given recent demand for lighter, more fuel-efficient vehicles."

The steel industry in North America has been recycling steel scrap for how many years? More than 150 years

How is steel recycled? "Steel cans and other steel recyclables are usually collected from the curbside, then hauled to a material recovery facility, where workers separate it from other recyclables and crush it in

to large bales. The bales are shipped to steel mills or foundries, where they are combined with other steel scrap and melted in a furnace to make new steel."

In 2008, the steel industry recovered and recycled more than how many tons of shredded steel scrap from automobiles? More than 14 million tons

Can you recycle steel at home? Answer will vary.

Can you recycle steel at school? Answers will vary.

Why should we recycle steel? Answer may vary. "Recovering steel not only saves money, but also dramatically reduces energy consumption, compared to making steel from virgin materials. In turn, this reduces the amount of greenhouse gases released in to the air during processing and manufacturing steel from virgin ore."

Photo by AbsolutVision on Unsplash

Paper Recycling

Recycle paper out of paper waste.

Duration
Preparation time: 2 hours
Activity time: 45 minutes

State Standards
Next Generation Science
5-ESS3-1

Student Handouts
No student handouts

Background

Students understand that paper is made from trees and that one way to save trees is to recycle paper. Because many elementary classrooms have recycling bins for paper, most students have been exposed to recycling in previous grade levels and understand the basic concepts of paper recycling. If your classroom currently does not recycle paper, talk with the administration and custodial staff to implement paper recycling in the classroom.

Summary

Students will learn how paper is recycled, and then create their own recycled paper.

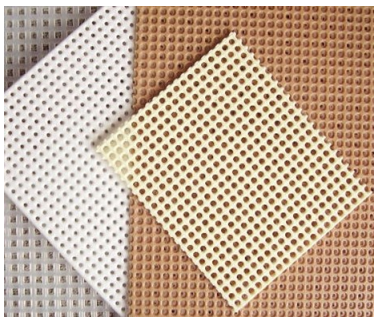
Objectives

Students will:

- Explain the paper recycling process
- Create their own recycled paper

Materials

- Roll of wax paper
- 2 newspapers
- 1 five gallon bucket (or large container)
- Paper shredder (optional)
- 1 blender or potato masher
- 6 small plastic storage containers
- 6 large bowls
- Each group will need at least 2 screens. Plastic cross stitch mesh (see image below), found at most craft stores, works well. Cut into 4x6 or 5x7 rectangles.



Making Connections

Briefly review how paper is made from trees, and introduce the lesson of paper making by showing the following videos:

https://www.youtube.com/watch?v=7IP0Ch1Va44

http://www.youtube.com/watch?v=2MUGbe6vRpo

Preparing the Activity

The Day Before:

1. Remove all glossy inserts from the paper.
2. Shred the paper using shredder or manually.
3. Place the shredded newspaper in the 5-gallon bucket.
4. Fill the bucket with water.
5. Let the paper soak overnight.
6. Cut the wax paper into sheets slightly larger than the paper making screens for each student. These will be used for the paper to dry on.

Day of:

1. Transfer the soaked paper into the 6 plastic storage containers.
2. Using a potato masher, create pulp from the newspaper. *It may be easier to mash with your hands or a blender works great for this project, if you're willing to use your blender.*
3. Place the lid on the storage container.

The Activity

The students should be divided into groups of 5.

1. Arrange the desks of each group to form one "square" table.
2. Have one student from each group come up to the front of the room to get a container of paper pulp, 2 pieces of wire screens and 1 sheet of wax paper for their group.
3. Have the students unfold the newspapers and cover the desktops.
4. Each student should write their name on their piece of wax paper using a sharpie.

   Note: It is difficult to write on the wax paper once it becomes wet.

1. Have the students place the plastic container containing the mashed paper pulp in the middle of their table and remove the lid.
2. Next, the students place their 2-quart collection bucket in front of them and below the bucket with paper pulp.
3. One at a time, students should dip the screen in the pulp until their screen is covered. Water should drip from the pulp through the screen and down into the collection bucket.
4. Next, the students should cover their collected fibers with a piece of wax paper and a second screen and squeeze off any excess water.
5. Once the excess water has been removed, set the top piece of screen aside.
6. Students should then be able to carefully peel the newly formed paper and the wax paper off the screen.
7. Set the newly formed paper somewhere flat where it can dry.
8. Keep the new paper on the piece of waxed paper while it dries.

Discussion

We created pulp by mashing up old newspaper. If you looked closely at the water after the paper had been mashed, you would have noticed small fibers.

The paper turned out to be a gray color for 2 reasons:

1. Newspaper fiber is not bleached, so it has color to begin with.
2. Newspaper has ink applied to it during printing.
3. As the paper was mashed, some of the ink came off of the paper. We could have made the paper white by bleaching the pulp with hydrogen peroxide or with chlorine bleach. Recall from the video, the paper went through a bleaching process.

Photo by Fabien Barral on Unsplash

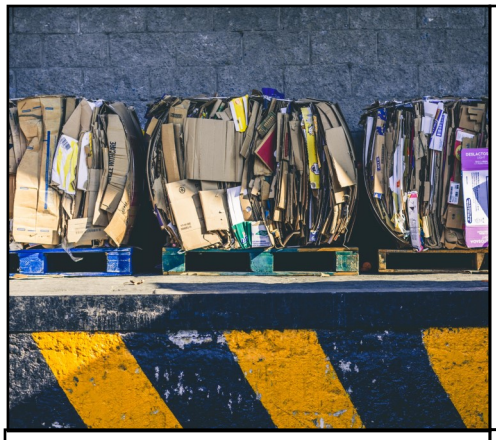


Photo by Alfonso Navarro on Unsplash

Final Assessment

How can I use what I learned?

Duration
Preparation time: 1 hour
Activity time: 45 minutes

State Standards
Common Core
ELA Literacy.W.5.1.B, W.5.2

Student Handouts
Exercise 12: Create Your Own Recycling Plan!

Background
This lesson serves as a final assessment for the NDEP's Solid Waste and Recycling unit. Students will design a waste reduction plan for their home, classroom, school, city, or state. Prior to this lesson, students should have participated in the majority of the unit. Topics covered included landfills, waste decomposition, composting, vermicomposting, reducing, reusing, and recycling.

During this unit students have been exposed to various concepts regarding recycling. Regardless of their previous backgrounds, all students should now understand the basic fundamentals of recycling.

Summary
Students summarize what they have learned throughout this lesson plan and create their own waste reduction plan.

Objectives
Students will:

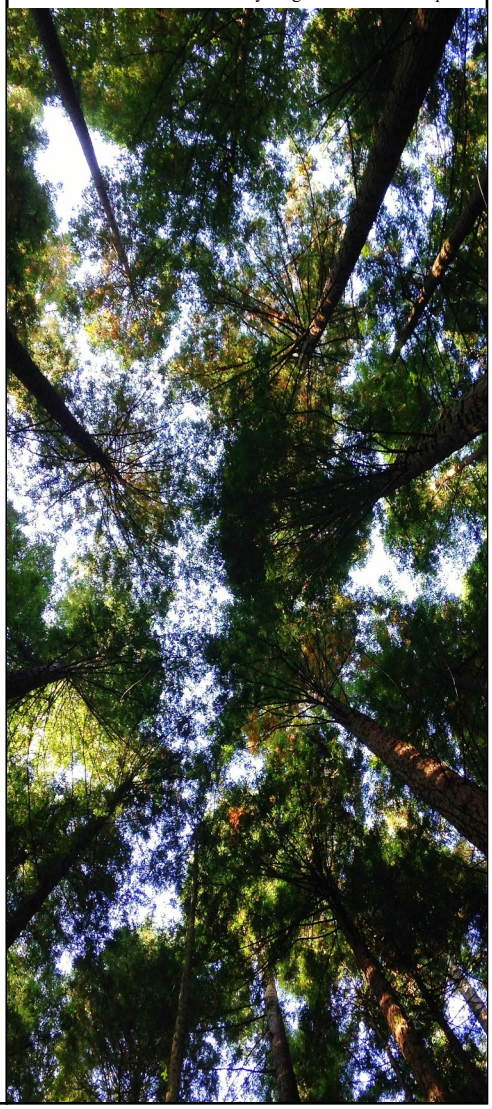
- Create their own recycling program that will reduce the amount of waste generated in their community.

Materials
- Exercise 12 from the Student Workbook
- Any other helpful lesson notes from prior lessons

Making Connections
This lesson will provide closure for the recycling and waste reduction unit. By coming up with ways to create and establish a recycling program in their community, students will be able to apply in-class lessons to real-world issues.

The Activity
1. Assign the report to students and assign a due date. This report should be all encompassing of the lessons that were presented to them.
2. Give them time in class to brainstorm ideas for potential recycling programs, and, if need be, allow them the opportunity to research information that could help them with this project.
3. that could help them with this project.

Photo by Angela Benito on Unsplash



Vocabulary

Anterior: The front end, or head, of a worm

Browns: Organic matter that contains large amounts of carbon; woody type material like twigs, dried leaves, dead plants, and paper

Compost: The organic matter that is decomposed through composting

Decompose: To break down into smaller elements

Geotextile fabric: A fabric used within a liner system to prevent large particles of soil and municipal solid waste from entering the leachate recovery system

Greens: Organic matter that contains large amounts of nitrogen; generally items that are freshly cut and includes fruits and vegetables

Groundwater: The water that is under the ground. This water is commonly used as a drinking water source. It is important in this context due to the possible contamination by leachate

Landfill: A place where our MSW is buried. There are many different types of landfills, but they all bury trash

Landfill liner: A system of physical barriers in a landfill designed to prevent toxic leachate from reaching the ground water

Leachate: The toxic liquid that seeps from the trash in a landfill. It is a potential groundwater contaminant

Lined Landfill: A landfill that has a liner system to collect leachate

Materials Recovery Facility: A specialized plant that processes recyclable materials to sell to manufacturers who will use the material to make new products

Municipal Solid Waste (MSW): Trash (or garbage) generated by people and industry

Per capita: Per person

Photodegrade: To break down an element using light (plastic is photodegraded)

Posterior: The back end, or tail, of a worm

Recycle: The process of converting waste materials into new materials and products

Red wiggler: Species of earthworm that is commonly used in vermicomposting systems to break down organic material

Reuse: The practice of using an item again for either its original purpose or to fulfill a different function

Secondary packaging: Packaging that protects both the product and the primary packaging, which is the packaging most visible to the consumer. An example of this is the cardboard box that is sent when mailing an already packaged product

Segments: The many rings worms have that contract and expand during movement

Transfer station: A place where MSW is collected prior to going to a landfill. The city collection trucks take the waste to the transfer station to unload. The MSW is then reloaded onto a larger truck and sent to a landfill

Unlined Landfill A landfill that does not have a liner system

Vector: Any animal of pest attracted to the garbage in the landfills and that spreads disease

Vermicompost: Composting food waste by utilizing worms that break down the food given to them to create soil.

Curriculum Feedback Survey

The Nevada Division of Environmental Protection, Bureau of Sustainable Materials Management values your input as you use the solid waste and recycling curriculum provided. Please take a few minutes to complete this survey so we can continue to improve the lessons provided. Your feedback is vital to continue modifying these lessons to be an integral resource for teachers across Nevada. Thank you in advance for contributing to this curriculum.

1. Please provide the following information:

- Name: _____
- School and District: _____
- Grade level: _____
- Preferred contact information (phone or email): _____
- Lessons reviewed: _____

2. Are the layouts of the lesson plans easy to read? How can the formatting improve?

_____

_____

_____

3. What lessons are most useful to use in your classroom, and what lessons can be omitted?

_____

_____

_____

4. What other lessons, components, or resources would you add to this curriculum?

_____

_____

_____

5. Would you recommend this curriculum to other teachers? Why or why not?

_____

_____

_____

6. How would you improve the teacher packet or the student workbook?

_____

_____

_____

7. How did your students benefit from these lessons? If possible, please provide pictures of student projects, samples of students papers, quotes, etc.

_____

_____

_____