

Chapter 5

All About Composting

Chapter Focus:

This chapter offers an introduction to the basics of composting. The Activities give students hands-on experience with decomposer organisms and natural decomposition, even if there is no access to an outdoor compost bin or indoor worm bin. The information presented in this chapter focuses on waste reduction through recycling *organics* (things that were once alive or came from something that was alive) into compost, which is a dark, crumbly, porous, soil-like material used in gardening.

Let's Break It Down

If you follow the three R's — reducing waste before it happens, reusing what you can, and recycling everything you can — you will notice that you have a lot less garbage. If you look closer at what's left in your trash, you will see that some of it consists of food scraps and soiled paper such as napkins and towels. To reduce your waste even further, you can recycle these materials by turning them into compost.



What Is Composting?

You can think of composting as speeding up the way that nature recycles organics. In nature, when a leaf falls to the forest floor, it is slowly broken down over a long period of time and consumed by a host of creatures ranging from worms and insects to microorganisms, such as bacteria and fungi. The elements in the organic materials are recycled back into the natural system to be used by other organisms. When we compost our organic materials, we speed up the natural process by controlling the ingredients and conditions that the decomposer organisms need to thrive. This is done by monitoring the mix of materials, moisture, air, and heat. The finished compost is a nutrient-rich soil amendment that has special properties essential for growing healthy plants and building healthy soil. Because it slowly releases nutrients, holds water, and promotes beneficial soil life, compost is a great alternative to synthetic fertilizers.



Why Is Composting Important?

You might be wondering why food scraps and other organic material like paper, leaves, and yard waste don't just naturally turn into compost at the landfill. It's because when they are layered and compacted with other trash, they lack the oxygen needed to properly decompose. Rather than break down and return their nutrients to the soil, the organics interact with the other materials in the landfill to create toxic liquids and gases that can leach into the surrounding environment. By composting, we help the environment by cutting down on the amount of organic waste disposed of in landfills, reducing the amount of fuel needed to transport the waste, and keeping the nutrient cycle going without the use of synthetic fertilizers.

How Does It Work?

In the city, it is recommended that you make compost in a commercial or homemade compost bin. You can also compost indoors using red wiggler worms in a ventilated bin. Although anything that was once alive can be composted, in school or garden settings you should only compost things that come from plants, like fruit and vegetable scraps, coffee grounds and tea bags, grass clippings and yard wastes that have not been sprayed with pesticides or herbicides. Many paper products that don't go into the recycling bin can also be composted. Please refer to NYC Compost Project literature for a list of additional items that can be composted.



Over time, decomposer organisms will turn your organics into nutrient-rich compost. Compost acts as an excellent soil conditioner and can be mixed into street tree beds, added to flower and vegetable gardens, mixed with potting soil for indoor plants, or spread onto lawns.



Where to Get Help: NYC Compost Project

The NYC Compost Project (nyc.gov/wasteless/compostproject) was created by the NYC Department of Sanitation in 1993 to provide compost education and outreach to NYC residents, nonprofit organizations, schools, and businesses.

Funded and managed through the Department of Sanitation's Bureau of Waste Prevention, Reuse and Recycling, the NYC Compost Project programs are carried out by Department-funded staff at host sites in each borough.

Each NYC Compost Project location offers a home composting demonstration site, a compost telephone helpline, and provides compost-related literature, workshops, and classes for residents, teachers, landscapers, and other interested parties.

NYC Compost staff and volunteers regularly disseminate composting and recycling information at thousands of community events, and offer low-cost compost bins for sale to NYC residents.



All About Composting

What's in My Waste?

Time:

20 – 30 minutes

Subjects:

English Language Arts,
Science, Math

Vocabulary:

biodegradable, compost,
decompose, landfill, reduce,
reuse, recycle,

Goals and Objectives:

After examining items from a classroom trash can or from their own lunchroom waste, students will learn how certain waste items can remain in landfills for decades, if not centuries, before they are fully broken down. Through a mathematical exercise and scientific reasoning, they will connect this information to their own lives and identify ways to reduce, reuse, recycle, and compost.

Teacher's Note:

*Prepare a garbage bag filled with clean samples from each of the categories on the **What's in My Waste? Worksheet**. Be sure to wash all items before placing in the bag. You may want to keep the compostable items separate. See nyc.gov/recycle for info on what to recycle in NYC.*

Materials:

- **Gloves** (for handling the bag of garbage)
- **Recyclable and reusable items** (glass bottle, plastic bottle, aluminum can, milk carton)
- **Non-recyclable items** (plastic garbage bag, plastic six-pack holder, Styrofoam® container, drink pouch)
- **Compostable items** (fruit rind, vegetable peeling, tea bag, paper plate, napkin)
- **Scale** (optional)
- Copies of the **What's in My Waste? Worksheet**

Activity

Following this Activity are adaptations for Beginner, Intermediate, and Advanced.

Teacher Prep:

If this is your first Activity from this chapter, read the **Chapter 5 Introduction**. Refer to the **Glossary** for definitions of vocabulary words.

Warm Up:

Class Discussion: Determine students' prior knowledge and understanding of waste and waste management, particularly the concepts of reducing, reusing, recycling, and composting.

Suggested Discussion: What type of things can you think of that might get thrown out in the trash? Which of those items can be reused? Share some examples of when you have reused an item instead of discarding it. Which items can be recycled? How would you describe composting? What kinds of items could be composted? Do you know anyone who composts? Why is it important to reduce, reuse, recycle, and compost?

Exploration:

1. Distribute the ***What's in My Waste? Worksheet***.
2. Show the class the garbage bag and explain that they will be sorting the contents into four categories, items that can be: reused, recycled, composted, and landfilled.
3. Ask the class to help sort the items and to list them under the appropriate category (or categories) on their handouts.
4. Explain that certain items take a very long time to break down. Glass is made from molten sand and does not decompose; it can last millions of years. Plastic items, like cups and toys, can last 250 years. Aluminum cans may last 200 – 500 years. Remind them of the importance of reusing and recycling.
5. Explain how it takes a few weeks to several months for most food scraps to decompose under the right conditions. Explain that biodegradable items, including food scraps, do not fully decompose in a landfill because the items are compacted and there is a lack of air, water, and sunlight, which play important roles in the decomposition process.
6. Have the students list the number of each type of item found in the garbage bag. Ask them to think about the amount of time it would take for the item to decompose when exposed to air and light and remind them that the air is pressed out when the items are compacted in a landfill.
7. Have students weigh each item and list the weight on their worksheets. Have the class calculate the total weight of each line.
8. Ask the students to answer the questions on the back of the ***What's in My Waste? Worksheet***. Remind the class that by composting food scraps and by reusing and recycling other items, they can reduce the amount of waste sent to a landfill.

Expanded Exploration:

Engage the class in a discussion about New York City's waste and how the daily decisions each one of us make directly impact this problem. Why is it important to think about our waste? What ways can we be more environmentally responsible? What items can be composted? What are the benefits of composting?

Adaptations for Different Grades

Choose level most appropriate for your class.

Beginner:

Follow the Activity instructions.

Include a **read aloud** component from the *What's in My Waste? Worksheet* or with the definitions of vocabulary words from the **Glossary**.

Consider modifying this Activity by using samples from the cafeteria trash. This would focus the lesson on the waste surrounding just one meal of their day.

Ask the class to draw what they imagine a landfill looked like a hundred years ago and what they imagine a landfill looks like today. Then ask the class to illustrate a compost pile or bin. Encourage them to share their drawings with the class.

Intermediate:

Follow the Activity instructions.

Encourage the students to use the *What's in My Waste? Worksheet* to list items they throw away each day or each week in the trash at home or at school. Have them identify which items came from plants and inform them that these can be recycled by turning them into compost. Alternately, conduct the Activity by looking at what is in a bag of trash from the school cafeteria. Discuss ways to reduce the amount of food scraps being sent to a landfill. If their family or school doesn't currently compost, what are some ways students could begin doing so? Let students know that they can also bring certain food scraps to neighborhood drop-off locations. (See nyc.gov/wasteless and search for "food waste drop off" for a current list.)

Ask the class to write an article about ways New Yorkers can reduce the amount of food scraps sent to a landfill. If time and resources allow, the students could revise their articles and compile their work into a book or post their articles online on the school website or as a class blog

Advanced:

Follow the Activity instructions.

Incorporate a **research and writing** component. Ask the class to research the types of materials that can be composted (find out on nyc.gov/wasteless/compost). What percentage of waste could be diverted from a landfill by composting? What composting methods are practiced today?

Have the students use the *What's in My Waste? Worksheet* to conduct a waste audit of the garbage and recycling bags in their home, classroom, or school cafeteria, either by observing what is in the bags or by physically sorting and weighing the materials. What are the students' plans for composting their organic waste?

Students could create brochures, PowerPoint presentations, or a class blog to share their findings and explain why composting is an important strategy for managing organic waste.

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All About Composting

What's in My Waste? Worksheet

Name _____ Date _____

Examine the contents of the garbage bag. Each item can be reused, recycled, composted, or landfilled. Categorize and sort the items into groups. List the items in the table below.

Reuse	Recycle	Compost	Landfill

Consider the amount of time it would take for each type of item to break down when exposed to air and sunlight. Other variables, such as moisture and temperature, also affect the rate of decomposition. It takes longer for the items to decompose when compacted in a landfill, where there is a lack of oxygen and sunlight. Weigh each item and mark your sheet each time you find an item that is listed below.

Item	Quantity	Weight per Item	Total Weight	Approximate Break Down Time (when exposed to air and light)
glass bottle				no one knows exactly how long
plastic bottle				no one knows exactly how long
plastic six-pack holder				450 years
aluminum can				200 – 500 years
plastic cup				250 years
rustproof steel can				50 years
plastic garbage bag				10 – 20 years
paper plate				5 years
milk or juice carton				3 months
this piece of paper				2-4 weeks
most vegetarian food scraps				a few weeks to a year
TOTALS				

Please answer the following questions, using what you discovered from the first part of this Activity.

1. How many items could be composted?
2. What is the weight of food scraps that could be composted instead of dumped in a landfill?
3. How many items could be reused?
4. What is the total weight of items that could be reused?
5. How many items could be recycled?
6. What is the total weight of items that could be recycled?
7. What is the total approximate amount of time it would take for everything to decompose?
8. List the items you had in your lunch today, including the food and its packaging.
9. Which items from your lunch could be composted?
10. What items do you consume regularly that could be composted instead of thrown away?
11. Calculate the approximate weight of food scraps you have left over each week?
12. List three ways to compost your food scraps.
13. Even though biodegradable items eventually decompose, why do you think composting is important?

All About Composting

Beginning to Understand That Nature Recycles

Time:

20 minutes

Vocabulary:

decompose, leaf litter, millipede, nature, nutrients, sow bug

Subjects:

English Language Arts, Science

Goals and Objectives:

Students will read a poem, discuss decomposition in nature, and write a poem about the decomposition process.

Materials:

- Copies of a grade-level appropriate poem: ***Nature Recycles*** by Joel Smith; ***Compost*** by L. Mark Finch; or ***This Compost*** by Walt Whitman
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Activity

Following this Activity are adaptations for Beginner, Intermediate, and Advanced.

Teacher Prep:

If this is your first Activity from this chapter, read the **Chapter 5 Introduction**. Refer to the **Glossary** for definitions of vocabulary words. Review the ***Decomposers in a Compost Pile Tip Sheet*** (in Chapter 5, Activity 5).

Warm Up:

Class Discussion: Determine students' prior knowledge and understanding of recycling in nature.

Suggested Discussion: What, if anything, is recycled in nature?

Exploration:

1. Distribute an appropriate grade-level poem to the class.
2. Discuss examples of poetic devices such as alliteration, rhyming couplets, and onomatopoeia in the poem.

3. Ask the class:
 - What is being recycled in the poem?
 - Who are nature's recyclers and what do they do?
 - What are the nutrients and why are they important?
 - How does each part of the poem relate to the other parts?
 - What is leaf litter?
4. Encourage students to write their own poems about how nature recycles.
5. Invite the students to read their poem out loud to the class or to share their poems with a partner. Students can illustrate their poems with drawings, photos, or pictures cut out from magazines. Display the poems on a bulletin board or the school website.

Expanded Exploration:

Ask the class if they have ever seen decomposition in nature. What are some examples of decomposition in nature that they have seen or would like to see?

Adaptations for Different Grades

Choose level most appropriate for your class.

Beginner:

Follow the Activity instructions.

Include a **read aloud** component from ***Nature Recycles*** by Joel Smith. You may also cut a copy of the poem into strips and have individuals or pairs of students read each section to the class. Be sure to define words in ***Nature Recycles*** that students may not know, such as *nutrients* and *leaf litter*. Have the students incorporate illustrations into their poems and to share them with the class.

Intermediate:

Follow the Activity instructions using the poem, ***Compost*** by L. Mark Finch (or other grade-level appropriate poem about decomposition).

Help the students get started on writing their own poem by suggesting that they include certain vocabulary terms, such as *decompose* and *nutrients*. Encourage students to research other facts and organisms to include in their poems.

Advanced:

Follow the Activity instructions using the poem, ***This Compost!*** by Walt Whitman. Have students list examples of the imagery of death and decay. Ask students to write a brief essay on whether this poem is positive or negative. The students could research and read other poems about decomposition. Give the class the option of writing a poem individually or working in small groups. Encourage the students to share their work with the class. Post students' work on a bulletin board or the school website.

All About Composting

Nature Recycles

BY JOEL STONE

Used by permission of the Wisconsin Department of Natural Resources.

1



Here is a tree with its many parts.
It has leaves and branches, a trunk, roots and bark.

2



The leaves in the fall turn from bright green to brown.
As the weather turns cooler, they fall to the ground.

3



First one leaf will fall and then many more,
As leaves become leaf litter on the forest floor.

4



Who'll clean up this mess? What shall we do?
Here come nature's recyclers, nature's clean-up crew.

5



Why do they clean up this leaf litter mess?
'Cause dead leaves have nutrients that they like the best.

6



Nutrients are like food, found in things living and dead.
Without them nothing could grow, and all life would end.

7



Let's meet nature's recyclers and see how they toil.
As they break down leaf litter and add nutrients to soil.

8



This is a *slippery slug*, a snail with no shell.
It cleans floors of gardens, lawns and forests as well.

9



This is a *mushroom*, a plant that's not green.
It breaks down leaf litter and keeps the woods clean.

10



This is a *worm*. What does it do?
It digs under the leaves and chews them up, too.

11



This is a *beetle* with a hard black shell.
It chomps all the leaves on the ground where they fell.

12



This is a *sowbug* that hides in the dark.
It munches on dead plants in your garden and park.

13



This is a *millipede*; try counting its feet.
It crunches up plants and keeps the ground neat.

14



So nature's recyclers, as they crunch, munch, and chew,
Break leaves into pieces that become nutrients, too.

15



Nutrients in the soil make trees big and strong.
They're sucked up the tree roots when spring comes along.

16



Nutrients are like food, and for trees they are good.
They help make new leaves, strong branches, and wood.

17



And so, last year's brown leaves that were part of the tree,
Were changed into food to make the new leaves you see.

All About Composting

Compost

BY L. MARK FINCH

Published by Prairie Poetry (prairiepoetry.org), which selects submissions from authors whose work reflects the spirit of the Great Plains.

When I've left my husk and you've had your weep,
Toss me out on the compost heap.
Mix me in with the leaves and such
And sprinkle some water — it won't take much.
Stir well with a fork, or whatever you've got,
Do what it takes to help me rot.

And when I've become a rich, dark soil
Plow me in, and I'll start my toil
Of nourishing worms, and likewise roots
And pushing up some tender shoots
Of grass, and veggies, and bushes and trees
Perches for birds, and banquets for bees.

I'll make plants fruit! I'll grow food for critters!
I'll raise up some corn, and you can make fritters!
It'll be lots of fun — I can just hardly wait!
To nurture new life will really be great.
And I'll laugh at you some, if I get on your shirt
And you get annoyed and start calling me "dirt."

When dogs track me in Winter, my name will be Mud
But when Spring comes around, I'll be in each bud.
Hug a tree in the Summer, and pat on its bark,
Rest yourself in its shade — say, "You're looking good, Mark!"
If you miss me in Autumn, well heck — look around
I'll be in the leaves, the river, the ground.

Sprinkle me some where the wildflowers grow, and
I'll be in the trilliums, pushing up through the snow
And I'll be in the worms when the young robins feed
And provide a soft cradle for each dying plant's seed.
When a fish eats a worm (if the robins are sharin')
There's a good chance I'll fly in the wings of a heron.

Whatever you do, don't build me a tomb —
I haven't been bad! Don't lock me in a room!
I want to be free — instead of riding my bike, I'll
Go out and pedal on Life's great cycle
And I'll get around, all over this Earth,
Following the path of life, death and rebirth.

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All About Composting

This Compost

BY WALT WHITMAN
(1819-1892)

Something startles me where I thought I was safest,
I withdraw from the still woods I loved,
I will not go now on the pastures to walk,
I will not strip the clothes from my body to meet my lover the sea,
I will not touch my flesh to the earth as to other flesh to renew me.

O how can it be that the ground itself does not sicken?
How can you be alive you growths of spring?
How can you furnish health you blood of herbs, roots, orchards, grain?
Are they not continually putting distemper'd corpses within you?
Is not every continent work'd over and over with sour dead?

Where have you disposed of their carcasses?
Those drunkards and gluttons of so many generations?
Where have you drawn off all the foul liquid and meat?
I do not see any of it upon you to-day, or perhaps I am deceiv'd,
I will run a furrow with my plough, I will press my spade through
the sod and turn it up underneath,
I am sure I shall expose some of the foul meat.

Behold this compost! behold it well!
Perhaps every mite has once form'd part of a sick person — yet behold!
The grass of spring covers the prairies,
The bean bursts noiselessly through the mould in the garden,
The delicate spear of the onion pierces upward,
The apple-buds cluster together on the apple-branches,
The resurrection of the wheat appears with pale visage out of its graves,
The tinge awakes over the willow-tree and the mulberry-tree,
The he-birds carol mornings and evenings while the she-birds sit on
their nests,
The young of poultry break through the hatch'd eggs,
The new-born of animals appear, the calf is dropt from the cow, the
colt from the mare,
Out of its little hill faithfully rise the potato's dark green leaves,
Out of its hill rises the yellow maize-stalk, the lilacs bloom in
the dooryards,
The summer growth is innocent and disdainful above all those strata
of sour dead.

What chemistry!
That the winds are really not infectious,
That this is no cheat, this transparent green-wash of the sea which
is so amorous after me,
That it is safe to allow it to lick my naked body all over with its tongues,
That it will not endanger me with the fevers that have deposited
themselves in it,

That all is clean forever and forever,
That the cool drink from the well tastes so good,
That blackberries are so flavorful and juicy,
That the fruits of the apple-orchard and the orange-orchard, that
melons, grapes, peaches, plums, will none of them poison me,
That when I recline on the grass I do not catch any disease,
Though probably every spear of grass rises out of what was once
catching disease.

Now I am terrified at the Earth, it is that calm and patient,
It grows such sweet things out of such corruptions,
It turns harmless and stainless on its axis, with such endless
successions of diseas'd corpses,
It distills such exquisite winds out of such infused fetor,
It renews with such unwitting looks its prodigal, annual, sumptuous crops,
It gives such divine materials to men, and accepts such leavings
from them at last.

[illegible]

All About Composting

Finding Evidence of Composting in Nature

Time:

20 – 30 minutes

Goals and Objectives:

Students make scientific observations about decomposition in nature.

Subjects:

English Language Arts, Science

Vocabulary:

compost, compost piles, decompose, nutrients, organic

Teacher's Note:

This Activity takes students out of the classroom to locate and identify evidence of decomposition in nature. They will get their hands dirty and discover natural areas where organic material is breaking down. The ideal seasons for this Activity are fall and early spring, when leaves are still on the ground.

Materials:

- **Outdoor area** with decomposing materials
 - **Gloves**
 - **Rake**, shovel, or long stick
 - **Bags** to hold the materials collected by the class
 - **Paper** or journal for students to record their findings
-

Activity

Following this Activity are adaptations for Beginner, Intermediate, and Advanced.

Teacher Prep:

If this is your first Activity from this chapter, read the **Chapter 5 Introduction**. Refer to the **Glossary** for definitions of vocabulary words.

- Find a local park or other suitable area for an outdoor walk that has decomposing leaves, twigs, brush, logs, or other plant materials on the ground.
- Make sure students are wearing appropriate clothing for an outdoor activity.

Warm Up:

Class Discussion: Determine students' prior knowledge and understanding of *decomposition*.

Suggested Discussion: What are organic materials? What happens to organics in nature over time? Compare and contrast composting with decomposition in nature.

Exploration:

Elicit Student Predictions:

- How can you tell when something is decomposing? Describe signs of decomposition, such as evidence of bugs, insects, and changes to the plant material.
- How does decomposition happen?
- What evidence of decomposition might you observe?
- What locations may show more decomposition than others?
- How can you tell when something is decomposing?
- Describe signs of decomposition, such as evidence of bugs, insects, and changes to the plant material.

Procedure:

1. Lead students on a nature walk. Look for areas with leaves, twigs, logs, brush, etc. on the ground.
2. Encourage students to find indicators of decomposition on and under the plant material.
3. Record indicators of decomposition. Sketch and describe these findings, including bugs, insects, moisture, color, temperature, type of material, and other observations.

Additional Discussion:

- a. What materials were breaking down?
- b. What were some distinguishing features of the decomposition?
- c. What are some observations you've made in your journal?

Conclusions: Students share their observations with the whole group.

Expanded Exploration:

Ask students to list all of the different variables that could have affected decomposition (bugs, insects, moisture, time, temperature, etc.). Have the class brainstorm, plan, and perform experiments that test the impact of each variable on the samples you brought back to the classroom.

Adaptations for Different Grades

Choose level most appropriate for your class.

Beginner:

Follow the Activity instructions.

While you are outside, ask each student to collect five leaves in various states of decomposition. Once they return to the classroom, students can glue their leaves onto a piece of construction paper in sequence from least decomposed to most decomposed.

Spray the collections with hairspray or acrylic to prevent further decay. Or observe and discuss how the items in the displays continue to decompose over time.

Intermediate:

Follow the Activity instructions.

Engage students formally in the scientific method as they begin to look at factors affecting decomposition in outdoor plant materials. Ask them to present and discuss their hypotheses, ideas for analysis, and final conclusions.

Prompt hypothesis development with these sample questions:

- Does composting occur by itself?
- What are some variables that speed up the rate of decomposition?
- What conditions are most conducive to the decomposition process?
- How do moisture and oxygen affect the decomposition process?

Ask the students to write reports of their findings and work in small groups to present ideas for experiments. Have the class vote on which follow-up experiments to conduct. Once the experiments are complete, have a class discussion about the elements of a successful compost pile.

Advanced:

Follow the Activity instructions and have the students work in small groups. Have each group select different types of organic material — such as sticks, flowers, leaves, wood chips, bark, or paper — and chart the rate of decomposition.

Have the students make predictions about how various environmental conditions (size of organic matter, exposure to air, moisture levels, and composition of organic matter) will impact decomposition, and which organic items will decompose most quickly.

Ask the teams to design and conduct follow-up experiments. They should record their observations in data journals. Students can make drawings or take photographs of the various stages of decomposition to accompany their written descriptions. Final results and conclusions can be presented in a written report and as a PowerPoint or display board presentation.

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All About Composting

Learning How to Compost Outdoors

Time:

30 – 60 minutes

Subjects:

English Language Arts, Science

Vocabulary:

bacteria, carbon, compost, compost piles, decompose, fungi, macroorganism, microorganism, nutrients, nitrogen, organic

Goals and Objectives:

Students use a reading assignment, an optional video, and add organic waste to a compost bin to explore how organic materials can be converted into finished compost (a natural soil amendment).

Teacher's Note:

*This activity offers instruction on how to make compost using an outdoor bin. The NYC Compost Project in each borough offers free consultations to schools interested in setting up outdoor compost bins. See **Chapter 5, Activity 7** for instructions on how to create an indoor worm compost bin.*

Materials:

- **New York City Outdoor Composting Guide**
 - Compost bin
 - Gloves
 - Organic materials
 - Pitchfork or shovel
 - “Home Composting” section of ***Without You It’s All Just Trash Video*** (optional; available on nyc.gov/wasteless)
 - Copies of ***What’s Rotting Away Compost Log*** (in **Chapter 5, Activity 10**)
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Activity

Following this Activity are adaptations for Beginner, Intermediate, and Advanced.

Teacher Prep:

If this is your first Activity from this chapter, read the **Chapter 5 Introduction**. Refer to the **Glossary** for definitions of vocabulary words.

- Consult with the NYC Compost Project in your borough to determine the best style and location for your compost bin, or where there is an outdoor compost bin that you can visit.
- Identify and designate an accessible area for an outdoor compost bin, or plan a visit to a compost site. Search nyc.gov/wasteless to find compost demonstration sites in NYC.
- Gather organic materials for the compost bin, using the **New York City Outdoor Composting Guide** for guidance on appropriate “greens” and “browns.”

Warm Up:

1. **Class Discussion:** Determine students' prior knowledge and understanding of how to compost outdoors.

Suggested Discussion: What types of materials could be added to a compost bin? How do the materials decompose? Do we need to add worms or other organisms to ensure that the material added to the bin properly decomposes?

2. Ask the class "What is a microorganism?" "What is a macroorganism?" Refer to the **Glossary** for definitions. Explain that microorganisms and macroorganisms, in addition to water and oxygen, help turn organic material into finished compost. These organisms are naturally present in the environment and will thrive in a compost pile.
3. Review the **New York City Outdoor Composting Guide** with the class. If time and equipment availability allow, you may also want to watch the "Home Composting" section of the ***Without You, It's All Just Trash Video***.
4. Ask your students, "Why do people compost their organic waste?" Be sure to discuss how composting organic materials can help reduce the amount of waste that is dumped into landfills.
5. Explain to the class that they are going to add their organic waste to a compost bin. They will then conduct experiments to observe what happens to their waste and learn how the composting process works.

Exploration:

Questions: How is finished compost made? What kinds of waste should be composted in a small scale composting operation? Scientifically, how does composting happen?

Elicit Student Predictions:

- Which variables and environmental conditions influence the process of composting?
- How long will it take for specific items to break down?

Procedure:

1. Explain to the class, "We are going to add our own organic waste to a compost bin to better understand how composting works. The first step is to collect organic materials. Since I knew we were going to be doing this Activity, I brought a few things we can compost: (describe with your actual list of compostable items). We'll use these to start our compost bin."
2. Bring the class to the compost bin. Go through the steps outlined in the **New York City Outdoor Composting Guide** with the class, allowing students to take turns putting material into the compost bin.
3. Explain, "Periodically, we'll stir the material in the compost bin to make sure the decomposers get enough air, and can do the hard work of consuming and breaking down the organic material. We will also need to make sure that the organic material stays as moist as a wrung-out sponge. So, we'll check back and add more dry or wet materials as needed to the bin."
4. Continue to explain to the class, "We'll add organic materials to the compost bin twice a week until it is full. Each time we add material, we'll check to see what is happening to the organics we've put in. When you see that that material has begun to decompose, please be sure to record your observations."

5. Have the students write about and draw what they witness in the bin or pile. You may want to use the chart ***What's Rotting Away Compost Log*** in **Chapter 5, Activity 10**.
6. Continue observing the materials in the compost bin. (At some point, you may need to stop adding organic material to the bin to ensure that there is room to stir the materials.) Eventually, the compost bin will yield dark, nutrient-rich soil.

Guided Questions: How can we tell when all the organic material has fully decomposed? How do we know when to harvest the finished compost from the bin? What materials decompose the fastest? What conditions seemed best for decomposition? Why?

Conclusions: Students record their observations and predictions and share their results with the whole group.

Expanded Exploration:

Engage students in a discussion about composting and what they learned while managing their own bin. Why is composting important? How does composting locally help the environment? How can finished compost be used? Have students apply their conclusions by creating informational posters, video PSAs (public service announcements), or PowerPoint presentations.

Adaptations for Different Grades

Choose level most appropriate for your class.

Beginner:

Follow the Activity instructions.

Include a **read aloud** component from the ***New York City Outdoor Composting Guide***. Be sure you define words they may not know. Explain the elements of a scientific experiment, informing the class that they will test the compost in different situations, making predictions, observations, and drawing conclusions. Then have students create how-to books that describe the steps of the experiment

Intermediate:

Follow the Activity instructions.

Engage students formally in the scientific method, asking students to present and discuss their hypotheses, ideas for analysis, and final conclusions. Include a **writing** component in which they describe their reasoning. Have students work in teams to investigate composting specific types of organic material.

1. The compost starter group adds autumn leaves (or another organic ingredient) to the compost bin.
2. The watering group adds appropriate amount of water to the bin and mixes when necessary.
3. The food scraps group adds collected food scraps and other materials to the bin.
4. The mixing group aerates the compost bin as needed.
5. The recording group takes notes on these steps and records observations.

The final product will be fully decomposed finished compost. The class can add this compost to amend the soil for indoor plants, horticultural areas in the schoolyard, or in nearby street tree beds.

Advanced:

Follow the Activity instructions, dividing students into small groups. Have each group select a different type of organic material — such as fruit, vegetables, leaves, wood chips, paper, etc. — to chart the rate of decomposition and its variables.

The student teams will record their observations in journals. Along with drawings of their observations, they could take photographs of the various stages of decomposition. The teams will present their final results to the class using a display board or PowerPoint presentation.

All About Composting New York City Outdoor Composting Guide

What you need to know to start outdoor composting in New York City.

The Department of Sanitation's **Bureau of Waste Prevention, Reuse and Recycling** encourages residents to compost yard trimmings and food scraps in their own backyards and community gardens.

This kind of composting is not only the least expensive way to manage organic waste, it also recycles nutrients close to where they can best be used.

Although New York City backyards and gardens are often smaller than their suburban counterparts, they provide plenty of room for a compost bin!

Here are the six steps to begin composting, right here in New York City — no matter how small your outdoor space.

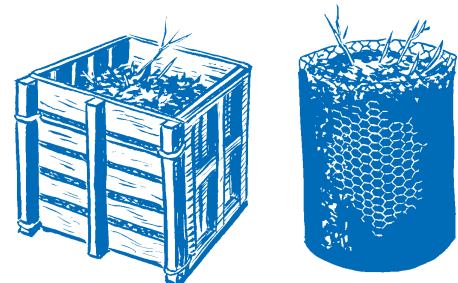


Step 1...set up your bin

Compost bins are really just containers for your compost pile that serve to keep warmth and moisture in, and keep pets, rodents, and other pests out. They also help keep your pile sightly, tidy, and compact, which can be especially important in small yards. People set up compost bins on terraces, roof gardens, patios, next to outdoor garbage cans, in courtyards, side alleys, and community gardens.

Choose a compost bin based on the space you have available for composting, the materials you want to compost, your budget, and the amount of time you want to spend tending your pile. Visit nyc.gov/wasteless/compost to find out about NYC Compost Project demonstration sites or to obtain more information about buying or building a compost bin.

Holding units are the simplest types of bins but shouldn't be used for food scraps because they lack adequate protection against rodents. Therefore, holding units should only be used for composting leaves and garden trimmings. You can construct your own using inexpensive or recycled wood, chicken wire, or cinder blocks. Simply add the appropriate organic materials to your holding bin and let the material decompose. This method requires little work, but can take from six months to a year to make finished compost. If you want to regularly add additional leaves and garden trimmings, you will need to either speed up the decomposition process or add more than one holding unit.

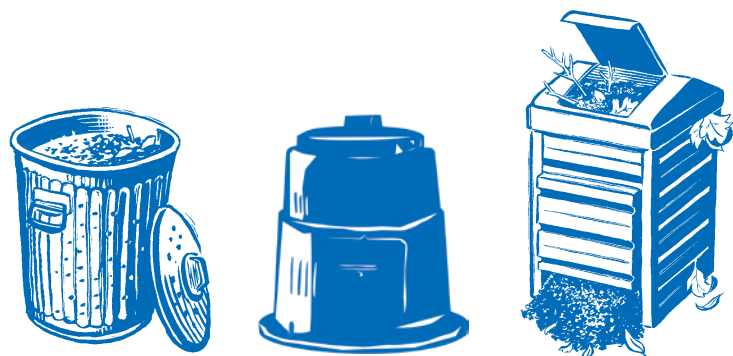


Two kinds of homemade holding units: wooden slats, and chicken wire rolled into a cylinder.

Enclosed bins are suited to handle both yard trimmings and kitchen scraps. They are most appropriate for small yards or any small space, such as a side alley, roof garden, or terrace. If you live in a multi-unit building and are placing your compost bin near outdoor garbage and recycling cans, make sure you visibly label your compost bin so that other residents do not accidentally place refuse or recyclables in it. Other options used in New York City include installing a combination lock for the compost bin.

You can construct an enclosed bin by drilling ventilation and drainage holes in the lid, sides, and bottom of a 20- or 30-gallon garbage can or barrel.

The **NYC Compost Project** sells commercially available compost bins. Visit nyc.gov/wasteless/compost to find out more.



Rodent-proofing should not be necessary if your compost bin is enclosed. However, if rats are a problem in your area, you can take additional steps to make your bin more rodent resistant:

- Add screens to areas where rats and other burrowing animals can get through.
- If your bin is placed on the soil, lay a piece of screen between the soil and the bottom of the bin.
- Turn material regularly to prevent nesting.
- In especially tough cases, add a vertical screen (6 to 8 inches into the ground) around the perimeter of the bin.

Frequently asked questions...setting up your bin

Q: Should I set up my compost bin in a sunny or shady spot?

A: It does not make a difference to the composting process whether you set up your bin in the sun or in the shade.

Q: Should I set up my compost bin on pavement or soil?

A: You can set up your bin on either concrete or soil. However, soil is preferable if you don't want to stain the concrete surface.

Step 2...add organic materials (food and yard waste)

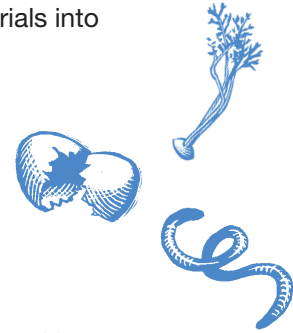
To know what to add to your compost bin, it is helpful to classify organic materials into “GREENS” and “BROWNS.”

GREENS are fresh, moist, nitrogen-rich plant materials that still have some life in them (fruit and vegetable scraps, coffee grounds, tea bags, fresh leaves, yard prunings, grass clippings, etc.).

BROWNS are dry, carbon-rich plant materials with no life in them (fall leaves, shredded paper, straw, wood chips, twigs, etc.).

If you are primarily composting “BROWNS,” shredding items such as leaves into smaller pieces and keeping the pile moist will speed up the decomposition process.

When composting “GREENS,” such as food waste or green garden trimmings, be sure to start with a layer of browns. Maintain equal amounts of greens and browns throughout the bin for successful composting. Always cover food scraps with a layer of browns to deter pests and flies. If you have space for bagged leaves, keep a supply near your compost bin throughout the year to cover food scraps. A convenient way to store kitchen scraps (before adding them to your compost pile) is to keep them in the refrigerator or freezer inside a resealable container or large zip-lock bag.



FAQ...adding organic materials

Q: Do I need to add worms to my compost bin?

A: Worms aren't crucial to the composting process — many other organisms will take care of the decomposition in the absence of worms. In an outdoor compost bin, worms will usually find their own way into the bin.

Q: Do I need to add a *bioactivator*?

A: While some gardening companies promote various products to “jump start” your compost bin, these additives are not necessary for successful composting — the microorganisms responsible for decomposition are already present on the materials you add to the pile.

If possible, keep some fall leaves on hand year-round to add to your compost bin.



What to compost...

Here are materials that are excellent for composting (aim to add equal amounts of “GREENS” and “BROWNS”). Two other ingredients — water (Step 3) and oxygen (Step 4) — are also needed to transform your compost into black gold.

GREENS

fresh, moist, nitrogen-rich materials

FROM YOUR GARDEN

- green plants and garden trimmings
- fresh leaves and flowers
- grass clippings (or recycle by leaving on the lawn)

FROM YOUR KITCHEN/HOME

- fruit and vegetable scraps
- coffee grounds & tea bags
- manure and bedding from animals that **ONLY** eat plants
- brewery waste, hops, and pomace



BROWNS

dead, dry, carbon-rich materials

FROM YOUR GARDEN

- fall leaves, small twigs, and woody prunings
- dry plant material
- straw and hay
- pine needles
- potting soil

FROM YOUR KITCHEN/HOME

- bread and grains
- egg shells
- nutshells
- corncobs
- food-soiled paper towels and napkins
- shredded newspaper
- sawdust and wood shavings (from untreated wood)
- stale beans, flour, and spices
- wood ashes
- cornstarch – and other plant-based packing materials

...and what to avoid

FROM YOUR GARDEN

- pesticide-treated plants or pesticide-treated grass clippings
- diseased or pest-infested plants
- poison ivy
- invasive weeds
- weeds with seeds
- large branches (call 311 to schedule a special removal)
- non-compostable materials such as sand or construction debris

FROM YOUR KITCHEN/HOME

- meat or fish scraps
- cheese or dairy products
- fats, grease, or oil
- cat or dog feces; kitty litter
- colored or glossy paper
- sawdust made from pressure-treated plywood or lumber
- coal or charcoal ashes
- non-compostable materials such as plastics, metals, or glass



FAQ...composting year round

Q: Can I compost year round?

A: Yes! Even though decomposition will slow down over the winter, you can continue to add food and yard waste to your compost pile. Once the weather warms, decomposition will speed up.

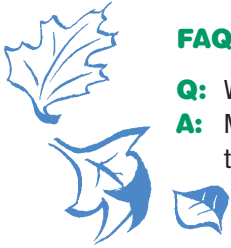
Step 3...check moisture

The ideal moisture level for your compost bin is like a wrung-out sponge: moist, but not soggy.

If composting food waste, the “GREENS” will provide the needed moisture, and the “BROWNS” will soak up some of this moisture and distribute it evenly throughout the bin.

If you are mainly composting yard waste (and therefore you have an abundance of “BROWNS”), you may need to add water. When adding water, make sure to turn the pile as you spray to evenly coat and soak the material. Leaves should glisten with moisture. Shredded paper should be wet, but not “mushy.” During the hot summer months, you may need to add extra water.

It is essential to monitor moisture levels so that your compost pile remains moist and never dries out.



FAQ...dealing with soggy compost

Q: What should I do if my compost bin becomes soggy?

A: Make sure you are adding enough dry, brown materials. Mix in “BROWNS” such as shredded paper or leaves to soak up the moisture.

Step 4...turn the compost pile



In order for the microorganisms in your pile to do their work, they need just the right combination of greens, browns, moisture, and air. Steps 2 & 3 address the first three components, so let's look at how you can get air into your compost pile.

From time to time, you should turn or aerate your compost. Take a long-handled rake, pitchfork, compost crank, or even a long stick and push it down into different parts of the pile to mix and “fluff” up the compost. Try moving the inside of the pile outward and the outer areas to the inside.

FAQ...turning compost

Q: How often should I turn my compost pile?

A: For the best results, turn your pile about once every two weeks. Turning the pile less frequently is not a problem. In composting, like cooking, you learn as you go along. Find a turning schedule that works best for you.

Step 5...check the compost

As you continue to add and mix organic materials, check on the compost to make sure there is adequate moisture, and periodically turn the pile.



Troubleshooting

Symptom: Rotten-egg odor

Problem: Excess moisture and not enough air (anaerobic conditions).

Solution: Turn pile frequently; add dry material such as fall leaves, woodchips, or shredded newspaper. Make sure bin has drainage; leave lid off to allow more air to flow.

Symptom: Ammonia odor

Problem: Too much green, nitrogen-rich material (such as food scraps, grass clippings).

Solution: Add brown, carbon-rich material (such as fall leaves, woodchips, or straw).

Symptom: Slow decomposition

Problem: Lack of moisture, lack of air, or lack of nitrogen.

Solution: Add water as needed; turn pile; add aeration tubes; add nitrogen-rich material, such as food scraps.

Symptom: Unwanted pests, flies

Problem: Wrong materials in the pile; food scraps are exposed; bin isn't rodent resistant.

Solution: Don't add animal or dairy products, grains, or fatty foods. Make sure food is well covered. Make bins more rodent resistant by adding hardware cloth to areas where animals could get through. Add a screening barrier vertically 6 to 8 inches into the ground. Keep the pile moist and turn pile more often to increase temperature and disturb nesting.



FAQ...finished compost

Q: How long will it take to make finished compost?

A: That all depends on you! Some people want to make finished compost quickly and take extra steps to speed up the process, such as cutting up large pieces of material and more frequently turning and watering their piles. This more intensive method should produce finished compost in about three months. Other people take a more relaxed approach by simply adding materials and letting nature do the rest, which should produce finished compost in a year or more.

Step 6...use your compost

Finished compost resembles dark, crumbly topsoil and should bear no resemblance to the original materials. Compost should have a pleasant, earthy smell to it.

A quick test to see if your compost is finished: Place some of the compost in a sealed plastic bag. Wait a few days. If you open the bag and it does not smell, your compost is done. If it smells rotten, put it back — it's not finished.

FAQ...using your compost

Q: Can I use compost for potting soil?

A: Yes, but not by itself. Different plants thrive in different potting mixes, but a good rule to follow is to add one part compost to two parts of potting soil.

All About Composting

Decomposer Hunt

Time:

30 – 60 minutes

Subjects:

English Language Arts, Science

Vocabulary:

bacteria, compost, decomposers, fungi, microorganism, nutrients, organic

Goals and Objectives:

Students dig into a sample of compost and learn to identify organisms in a compost pile, such as sow bugs, millipedes, and worms. Students discuss the role of the different decomposers in the breakdown process.

Teacher's Note:

This Activity requires compost containing partially decomposed materials, obtained from an active indoor or outdoor compost bin. See the Adaptations section for additional materials and Activity instructions.

Materials:

- **Trays or plastic containers** for each student or group of students
 - **Spoons** for each student
 - Enough **compost** for the entire class
 - Copies of ***Decomposers in a Compost Pile***
 - ***Decomposer Flashcards***
 - **Observation containers** (optional)
 - **Magnifying glasses** (optional)
-

Activity

Following this Activity are adaptations for Beginner, Intermediate, and Advanced.

Teacher Prep:

If this is your first Activity from this chapter, read the **Chapter 5 Introduction**. Refer to the **Glossary** for definitions of vocabulary words.

Warm Up:

1. **Class Discussion:** Determine students' prior knowledge and understanding of which organisms live in compost and how they contribute to the composting process.

Suggested Discussion: What organisms do you think we'll find while digging through the compost? What kinds of things do you think these organisms eat? How do they help with composting?

2. Lead students through ***Decomposers in a Compost Pile*** and review images on ***Decomposer Flashcards***.
3. Ask your students, "How important are these living creatures to the decomposition process? Why?"
4. Explain to the class that they will examine samples of compost to find and identify some of the organisms that live within it.

Exploration:

Elicit Student Predictions:

What organisms live in compost and how can we identify them? How do these organisms contribute to decomposition?

Procedure:

1. Fill each tray or container with a few scoops of compost and distribute to the students.
2. Students use spoons to dig through their compost looking for living organisms.
3. When students find a living organism, have them carefully put it into an observation container (if available) so that everyone can get a closer look at it.
4. Encourage the class to examine the organisms using magnifying glasses (if available). Have the students write down which of the organisms they were able to identify from ***Decomposers in a Compost Pile***.
5. Have students make sketches of the organisms they find and label any identifiable traits.
6. After the class has found and identified various organisms, discuss how these organisms help with composting.

Suggested Questions: How does each organism contribute to decomposition differently? Which of these organisms are tertiary consumers, secondary consumers, and primary consumers? Which types of decomposers are too small to see?

Conclusions: Students present their observations to the whole class.

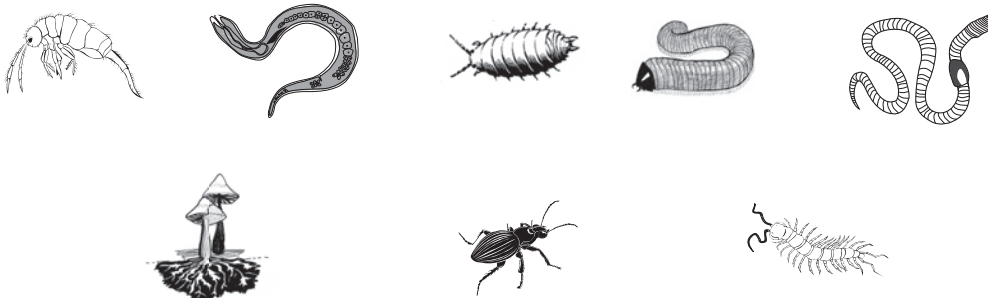
Expanded Exploration:

Discuss the importance of living organisms to the composting process. Ask the students if the organisms should be returned to the compost, and if organic materials can decompose as quickly without them.

Explore which waste disposal methods do or do not allow organic waste to decompose with the help of these organisms.

Have the students create a report or presentation educating their peers about the importance of decomposer organisms.

After the project is complete, release the organisms back into the compost.



Adaptations for Different Grades

Choose level most appropriate for your class.

Beginner:

Include a **read aloud** component in the warm-up. Be sure you define words they may not know in ***Decomposers in a Compost Pile*** fact sheet: compost, decomposers, microorganisms, etc. You can refer to the **Glossary** and the back of the ***Decomposer Flashcards*** for definitions.

Explain the importance of scientific observation in wildlife biology. Inform the class that by identifying various traits of the organisms and by drawing pictures of them they are doing what scientists do. At the end of the observation, have students create how-to books describing the steps of the experiment. Make a chart displaying and describing their drawings of the decomposer organisms.

Intermediate:

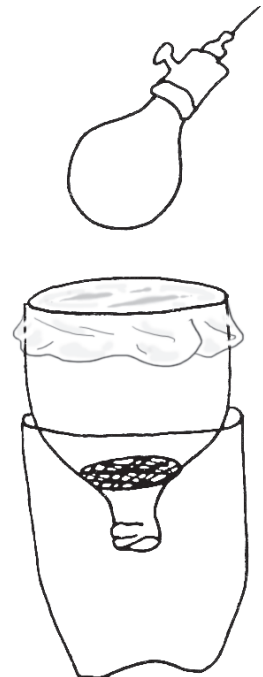
Expand the Activity by creating this extraction device which will enable the class to find smaller decomposers in the compost.

Materials:

- **Glass jar and funnel** (alternately a 2-liter plastic bottle, cut in half)
- **A bright light**
- **Wire mesh** or netting (such as a net bag for onions)
- **1-2 cups fresh compost** with partially decomposed materials

Procedure:

1. Place the wire mesh inside the neck of the funnel (or bottle) to keep the compost from falling out.
2. Place the funnel inside the neck of the glass jar. If you're using a plastic bottle, turn the top half upside down and place it into the bottom half so that the neck forms a funnel.
3. Fill the funnel with compost.
4. Cover the wide top of the funnel with wire mesh, netting, or plastic wrap to keep the organisms contained.
5. Shine the light into the funnel. The organisms will try to escape from the light and make their way down the funnel and into the bottom container. Leave the light over the compost for several hours or until the decomposers are extracted.
6. After the class has separated the decomposers from the compost, have them identify the decomposers using ***Decomposer in a Compost Pile*** fact sheet and the ***Decomposer Flashcards***. Have students document their results in data journals and create reports to showcase what they have learned.



Advanced:

Follow the above Intermediate Activity instructions.

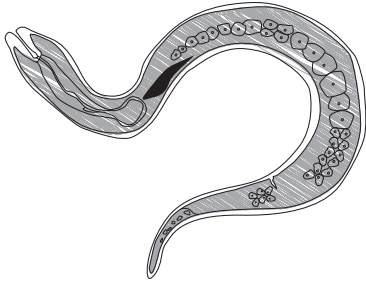
Students can work in small groups to make the extraction devices. After the class has found the decomposer organisms and identified them, ask each group to pick one of the organisms to research in more detail. Each group should find their own source material, gather data, and present their findings in a research report and presentation.

Reports should include observational drawings or photographs from the Activity. These can be included as part of PowerPoint or display board presentations.

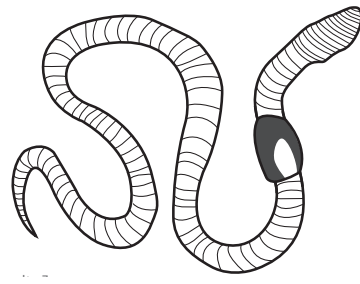
All About Composting

Decomposer Flashcards

Nematodes



Earthworm



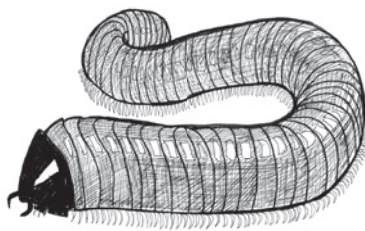
Sow Bug



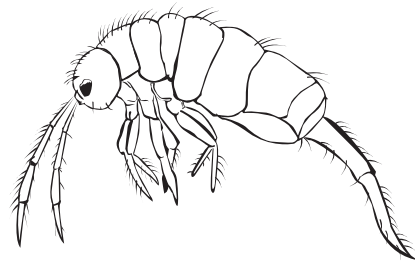
Fungus



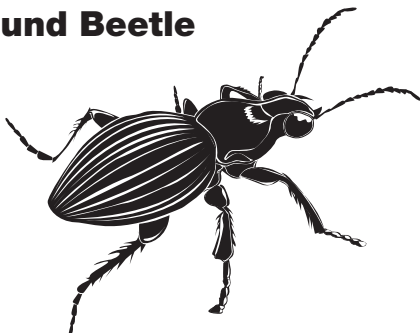
Millipede



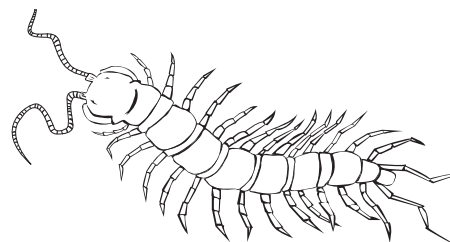
Springtail



Ground Beetle



Centipede



All About Composting

Decomposer Flashcards

Earthworm

Earthworms do the lion's share of the decomposition work among the larger compost organisms. They are constantly tunneling and feeding on dead plants and decaying insects during the daylight hours. Their tunneling aerates the compost and enables water, nutrients, and oxygen to filter down.

Nematodes

Nematodes, or roundworms, are the most abundant invertebrates in the soil. Typically less than one millimeter in length, they prey on bacteria, protozoa, fungal spores, and each other. Though there are pest forms of nematodes, most of those found in soil and compost are beneficial.

Fungus

Molds and fungi are frequently found in a healthy compost bin. The most common are mushrooms, which sometimes pop up on a cool pile. Fungi feed on decaying organic matter with tiny, hair-like hyphae that secrete enzymes that break down and simplify the organic matter. They act as an additional food source to other organisms, such as earthworms.

Sow Bug

Sow bugs and pill bugs are considered omnivores, meaning they feed on both living and dead organic matter. They shred and consume some of the toughest material, those high in cellulose and lignin (tree parts and leaves). Sow bugs that roll up like an armadillo are known as pill bugs or roly-polys.

Springtail

Springtails, along with nematodes and mites, dominate in numbers among the soil invertebrates. It's estimated that more than 80% of the organic matter on earth passes through the gut of a springtail or a sow bug on its journey to becoming topsoil. They feed principally on fungi, but also on nematodes and small bits of organic detritus.

Millipede

Millipedes are slower and more cylindrical than centipedes and have two pairs of appendages on each body segment. They feed mainly on decaying plant tissue but will eat insect carcasses and excrement.

Centipede

Centipedes are fast moving predators found mostly in the top few inches of the compost heap. They have formidable claws behind their head which possess poison glands that paralyze small red worms, insect larvae, newly hatched earthworms, and arthropods - mainly insects and spiders.

Ground Beetles

Ground beetles have many representatives lurking through litter and soil spaces. Most of them feed on other organisms, but some feed on seeds and other vegetable matter.

All About Composting

Decomposers in a Compost Pile

Compost is produced through the hard work of a number of different decomposer organisms that break down organic material and convert it into finished compost. These decomposers are naturally present on the organic materials that you add to your compost pile and also exist in the areas surrounding your compost system.

Compost Ecosystem

Decomposers in a compost pile are part of a complex compost ecosystem in which food, water, air, and shelter are provided by the material within the compost pile. If any of those essential ingredients are missing, the organisms either slow down or stop working altogether. It is this web of interdependence that is the driving force behind the production of compost.

Some organisms feed on decomposing plant materials while others feed on other organisms. The two main categories of decomposers are chemical and physical decomposers.

Chemical decomposers work by using chemicals in their bodies to break down the organic matter into simple compounds for energy. This is similar to how the acids in our stomachs dissolve the food we eat. Chemical decomposers are mostly micro-organisms that cannot be seen without a microscope. Examples of chemical decomposers include bacteria, protozoa, and fungi.

Bacteria are the most abundant of the microorganisms found in a compost pile and perform the majority of the decomposition. An important by-product of their work is the generation of heat, which can warm up the pile and attract other heat-loving organisms to assist with the breakdown process.

Physical decomposers work by feeding on the organic materials in a pile. Similar to how we use our teeth to break up large pieces of food, physical decomposers chew, grind, and squeeze the materials into smaller pieces. After digestion, they excrete waste products which are then broken down even further by the chemical decomposers. Physical decomposers are mostly macroorganisms that can be seen without a microscope. Examples of physical decomposers are worms, mites, flies, and snails.

Earthworms do a large amount of the decomposition work among the macroorganisms. Several species of worms dig tunnels and feed on the decomposing materials in the compost pile. The spaces that the worms create as they move through the compost pile allow air, water, and nutrients to circulate, creating the necessary conditions for many of the other organisms to thrive.

Compost Food Web

All of the decomposer organisms in the compost ecosystem are linked by a “what eats what” food web, wherein organisms are classified according to what they eat. There are three levels of consumers in the compost food web: primary, secondary, and tertiary. This web structure keeps the different populations under control and maintains a healthy and balanced compost pile.

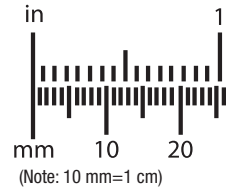
Primary (first level) consumers feed directly on dead plant materials (and other decomposers that have died) in the compost pile. This group consists of chemical decomposers such as bacteria and fungi, but also includes larger physical decomposers such as snails, slugs, beetle mites, worms, and flies.

Secondary (second level) consumers feed on primary consumers and their waste products. This group consists of physical decomposers which include springtails, mold mites, and nematodes.

Tertiary (third level) consumers feed on secondary (and sometimes tertiary!) consumers. This group consists of fast moving consumers which include centipedes, pseudoscorpions, predatory mites, and rove beetles.

compost food web identification guide

The compost food web is a way of classifying organisms according to what they eat and by what eats them! Follow the guide below to identify organisms in your compost pile and learn who may be eating whom.

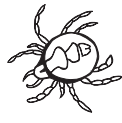


tertiary consumers

Macroorganisms that feed on secondary consumers.



Spider
(1-30 mm)



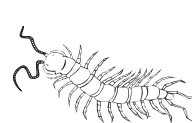
Predatory Mite
(0.5-1 mm)



Ground Beetle
(8-20 mm)



Pseudoscorpion
(1-2 mm)



Centipede
(30 mm)

secondary consumers

Macroorganisms that mainly feed on primary consumers.



Mold Mite (1 mm)



Springtail (0.5-3 mm)



Feather-Winged Beetle
(1-2 mm)



Nematode (Roundworm)
(1 mm)



Protozoa (.01-.5 mm)

primary consumers

Microorganisms that feed directly on dead plants or animals.



Woodlouse
(Roly-Poly, Sowbug)
(3-35 mm)



Green June Beetle Grub
(13.5-25 mm)



Black Soldier Fly
(20-25 mm)
& Black Soldier Fly Larva (Maggot)
(18 mm)



Slug (2-25 mm)



Beetle Mite (1 mm)



Millipede
(25-35 mm)



Earthworm
(50-150 mm)



Bacteria
(microscopic)



Actinobacteria
(microscopic)



Fungus
(some microscopic)



Snail
(2-25 mm)

organic matter

Leaves, grass clippings, other plant debris, and food scraps.



Compost pile

All About Composting

Worm Facts

Time:

20 minutes

Subjects:

English Language Arts, Science

Vocabulary:

anterior, aortic arches, bristles, clitellum, *Eisenia fetida*, esophagus, intestine, posterior, segments, vermicompost, worm casting,

Goals and Objectives:

Students learn the anatomy of the red wiggler worm and explore its role in the indoor composting process. They read *Eisenia fetida: Red Wiggler Worm* and apply the knowledge to a writing project, which can be presented to the class.

Teacher's Note:

If you have a worm bin, look at the worms with the class. This Activity can be easily shortened or expanded to suit your needs. See the suggested Activity adaptations for details.

Materials:

- Copies of *Eisenia fetida: Red Wiggler Worm*
 - Worm Bin (optional)
-

Activity

Following this Activity are adaptations for Beginner, Intermediate, and Advanced.

Teacher Prep:

If this is your first Activity from this chapter, read the **Chapter 5 Introduction**. Refer to the **Glossary** for definitions of vocabulary words.

Warm Up:

Class Discussion: Determine students' prior knowledge and understanding of composting and the role of worms.

Suggested Discussion: What is compost? Why are worms important to composting? In what kind of environment does the red wiggler worm thrive?

Exploration:

1. Engage students in a game about worm facts by quizzing them on items listed on *Eisenia fetida: Red Wiggler Worm*. Have students check their answers by reviewing *Eisenia fetida: Red Wiggler Worm*.
2. Discuss why red wigglers work well in indoor composting systems.

Expanded Exploration:

Engage the class in a discussion about the benefits of indoor composting using red wiggler worms.

Adaptations for Different Grades

Choose level most appropriate for your class.

Beginner:

Follow the Activity instructions.

Include a **read aloud** component with the definitions of vocabulary words from the **Glossary**. Then, have the students color in the picture of the red wiggler worm on ***Eisenia fetida*: Red Wiggler Worm**. Encourage them to also create original illustrations. Ask the students to write a poem or story about the red wiggler worm, which can be presented with their illustration.

Intermediate:

Follow the Activity instructions, and include a **writing** component.

Give the students a choice between two assignments:

1. The student is a nature journalist and is writing a profile piece on the red wiggler worm. Students should use the following words: vermicompost, coelomic fluid, gizzard, and compost, and include at least two of their favorite facts from the handout. They can incorporate additional words from the **Vocabulary** section for bonus points.
2. The student is a performing artist and must create a poem, song, or short play that somehow involves the red wiggler worm.

Advanced:

Follow the Activity instructions, and include a **writing and presentation** component.

Give the class a choice of two projects:

1. Make a plan for a short documentary film about red wiggler worms. Research the major differences between red wiggler worms (*Eisenia fetida*) and other earthworms (e.g. *Lumbricus terrestris*). Research can also focus on small (indoor systems) or large scale vermicomposting operations, how much material is composted, and uses for the finished compost. Students should turn in their scripts and present their documentaries to the class using storyboards to describe the scenes they would create.
2. Write and illustrate a children's book about a day in the life of a red wiggler worm. The story should demonstrate the worm's important role in indoor composting and be aimed towards teaching younger students.

All About Composting

Eisenia fetida: Red Wiggler Worm

There are over seven thousand species of earthworms; however, one species in particular is well suited for indoor composting: *Eisenia fetida*. *Eisenia fetida* (also called red wiggler worm, tiger worm, manure worm, brandling worm, and a range of other names) are an important macroorganism decomposer in both indoor and outdoor composting systems.

Red Wiggler Worm Basics

Red wiggler worms live in the upper layer of soil where they feed on microorganisms and decaying organic matter. However, unlike other species of earthworms, *Eisenia fetida* don't tunnel deeply or make permanent burrows. They reproduce quickly, thrive in habitats with high organic matter, can tolerate a wide range of temperatures and moisture conditions, and can live close to one another. An indoor worm bin mimics all of these natural conditions, which makes *Eisenia fetida* ideal for indoor composting.

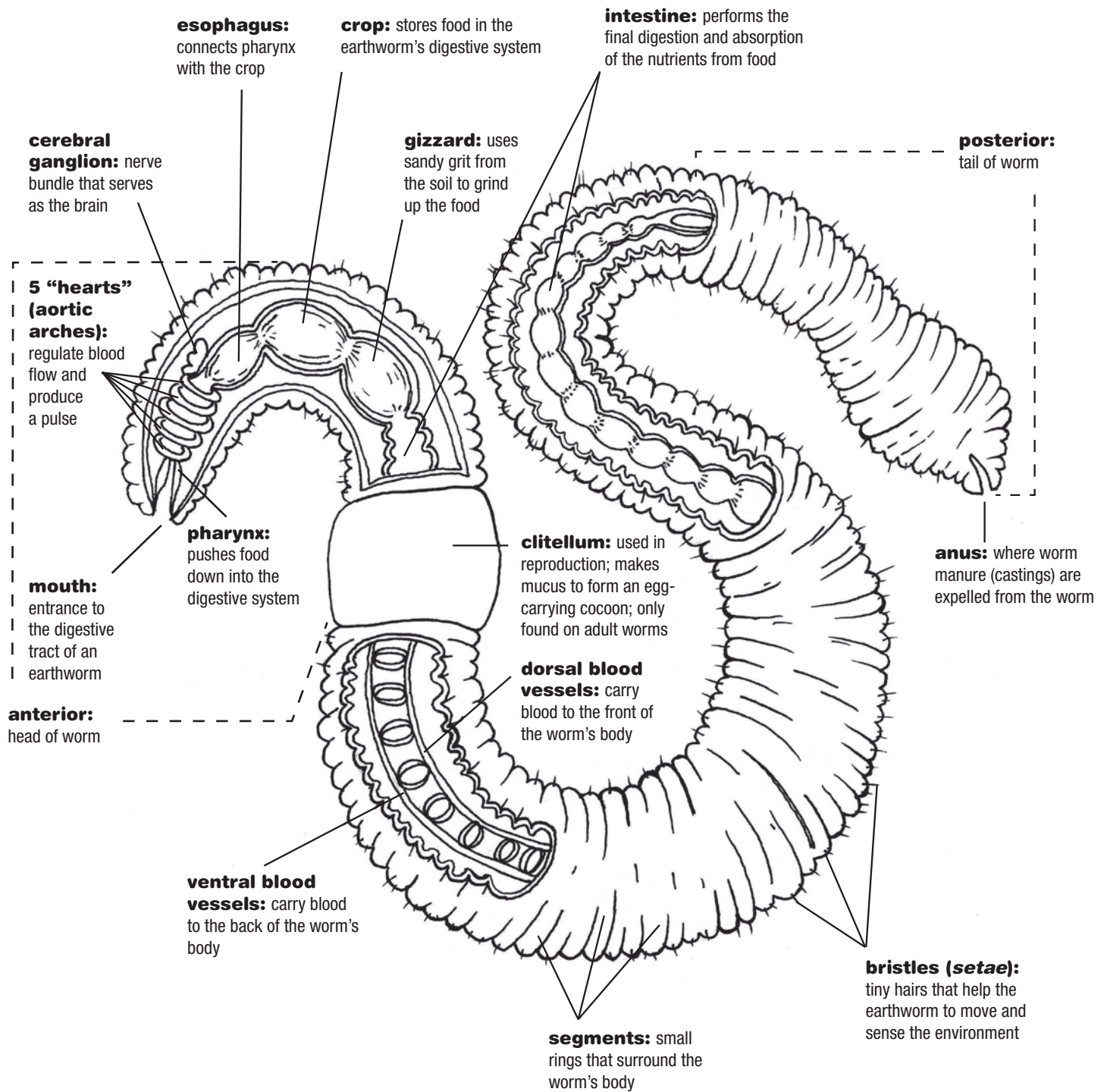
Fun Worm Facts

- Worms do not have eyes; they have cells in the front part of their bodies that can detect light.
- Worms do not have teeth; they grind up food by using the grit in their gizzard.
- Worms living in an indoor worm bin (*Eisenia fetida*) can eat half their body weight in food scraps every day!
- Worms have both male and female reproductive organs but still need another worm to reproduce.
- *Eisenia fetida* have 5 “heart-like” organs called aortic arches.
- *Eisenia fetida* start reproducing when they are about 2 months old.
- One mature worm can produce about 100 worms in a year.
- Worms live up to one year.
- Worms “breathe” through their skin, so it is very important to keep them and their environment moist, but not sopping wet as they can drown if it's too wet.
- If you hold a worm long enough, you will likely see a yellow secretion on your hand, called coelomic fluid.
- Coelomic fluid is thought to be a defense mechanism against predators as the liquid can smell bad. This bad smell is thought to be the basis of their name *fetida* or *foetida* which is the Latin scientific term used for many foul-smelling species.
- Coelomic fluid is also a way for worms to remoisten their bodies when conditions are dry.



color a wiggly worm!

Color in the *Eisenia fetida* (red wiggler worm) image below to help you to identify the various parts of the worm.



All About Composting

Worm Bin Check

Time:

20 – 30 minutes

Subjects:

English Language Arts, Science

Vocabulary:

Eisenia fetida, harvesting, organic, red wiggler worms, vermicompost, worm casting

**Goals and Objectives:**

Students complete a reading comprehension assignment and learn how to maintain an indoor compost system. Working in pairs, students apply this information in role playing scenarios. If time allows, students can present their plans for making an indoor compost system in the form of illustrated how-to manuals.

Teacher's Note:

*You can shorten this Activity by reviewing certain sections of the fact sheet, **Indoor Composting with a Worm Bin** and having the class complete just one side of the handout, **Worm Bin Composting Questions**. If the questions are too difficult for your class, you may want to read the appropriate sections of **Indoor Composting with a Worm Bin** and skip to the side of the Activity handout that lists the role playing scenarios.*

Materials:

- **Indoor Composting with a Worm Bin**
 - Copies of **Worm Bin Composting Questions**
 - **Worm Bin** (optional)
-

Activity

Following this Activity are adaptations for Beginner, Intermediate, and Advanced.

Teacher Prep:

If this is your first Activity from this chapter, read the **Chapter 5 Introduction**. Refer to the **Glossary** for definitions of vocabulary words.

Warm Up:

Class Discussion: Determine students' prior knowledge and understanding of indoor composting and the importance of balancing conditions such as the amount of food, temperature, moisture, air, and the number of worms.

Suggested Discussion: What kinds of food scraps can you put into an indoor composting bin? Where should you put the food scraps in an indoor composting bin? What kinds of worms should you use? Why are the worms needed? What are some signs of an unbalanced worm bin?

Exploration:

1. Read and review *Indoor Composting with a Worm Bin*.
2. Complete one or both sides of *Worm Bin Composting Questions*.

Expanded Exploration:

Ask the students to define the nature and quantity of waste they produced that day. Students should share which portions of that material could be composted in a worm bin. Engage the class in a discussion about why it is important to understand the different elements of the waste stream when thinking about composting and recycling.

Adaptations for Different Grades

Choose level most appropriate for your class.

Beginner:

Follow the Activity instructions.

Include a **read aloud** component from *Indoor Composting with a Worm Bin*. Ask the students to illustrate the steps of setting up a worm bin and to share their illustrated guides with the class.

Intermediate:

Follow the Activity instructions and complete the handout.

Ask students to write a description of the bin they would make and where they would keep it. Be sure they include the exact location that they envision for the worm bin and the reasons why. Offer extra credit to students who share their instructions with their families and begin composting at home.

Advanced:

Follow the Activity instructions and complete the handout. Ask the students to create a display board, PowerPoint presentation, or how-to manual about setting up an indoor composting bin. Students should conduct research on commercially available and do-it-yourself indoor composting options. The manual should include a few problem scenarios with solutions as well as information on how to procure needed supplies including red wiggler worms. Offer extra credit to students who follow up on the assignment by composting at home.

Part 1

Worm Bin Composting Questions

Name _____ Date _____

1. Describe how worms breathe.
2. Why is it important to keep the bedding consistently moist?
3. What kinds of worms should you order for an indoor composting system?
What kinds of worms are not appropriate for an indoor composting system?
4. How many pounds of food scraps could two pounds of worms process in a week?
5. What is the recommended temperature for a worm bin?
6. List some items that you can compost in your worm bin.
7. How big should food scraps be when placed inside the worm bin?
8. Where should food scraps be placed inside the bin?
9. List some items that should not be composted in your worm bin.
10. How long will it take for the contents of the bin to resemble dark soil?
11. Describe how to harvest finished compost from a worm bin.
12. Why is it important to remove the worm castings from the bedding?
13. How can you use finished vermicompost?
14. List some ways to balance the conditions of the bin so that the worms continue to thrive.

Part 2

Worm Bin Composting Questions

With a partner, take turns asking each other how to solve each problem scenario.

Scenario 1: Your brother threw last week's leftovers that contained broccoli and onion into the bin and now it is starting to stink. How would you remedy this situation?

Scenario 2: You notice a few fruit flies in or near your worm bin. How do you eliminate this problem and prevent it from happening again?

Scenario 3: It's natural to have a small mite population in your bin, but lately you've been noticing many more mites than usual. Many seem to be congregating around the melon pieces you added to the bin last week. What might you do to reduce the number of mites?

Scenario 4: One corner of the bin seems particularly wet. How do you plan to fix this problem?

All About Composting

Indoor Composting with a Worm Bin

A Guide To Indoor Composting In New York City

If you don't have access to an outdoor composting area, you can compost your food scraps indoors by using red wiggler worms in a worm bin composting system.

Red wiggler worms process food scraps and decaying plant material into an excellent plant fertilizer and soil amendment called vermicompost.

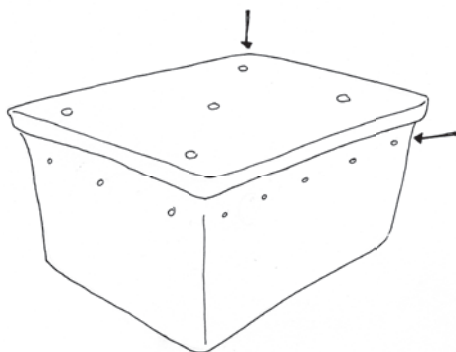
Indoor composting requires some time and attention to ensure that the worms have access to the food, water, air, and shelter they need to survive, thrive, and multiply. To start composting your food scraps indoors, you will need a bin, bedding, and some red wiggler worms. The amount of food scraps that you intend to compost will determine the quantity of worms and size of bin needed. We recommend most households start with one pound of worms. One pound of worms can process about three and a half pounds of food scraps a week.



Choosing a Worm Bin

Materials:

- One-cubic foot, shallow plastic container (8 to 12 inches deep) with a lid
- Drill
- Fine mesh screen (optional)



Directions:

- Drill at least 10 quarter-inch holes in the container top.
- Use non-toxic glue to attach fine screen over holes to keep out pests.

You can buy a worm bin, or you can make your own by adapting a plastic box or plastic storage container.

Making the Bedding Material

Materials:

- Newspaper
(Do not use glossy paper or full color paper as the toxic chemical dyes and heavy metal residues could end up in your finished vermicompost.)
- Water
- A worm bin



Directions:

- Shred the newspaper, or rip it length-wise into long strips, about one-inch wide.
- Moisten the strips with water.
- Gently squeeze out excess water from the strips so that they are wet but not dripping.
- Fluff up bedding material.

Bedding absorbs moisture, provides a place for the worms to live, and covers the food scraps. Newspaper torn into one-inch wide strips or shredded mechanically is the most common source of bedding. When first setting up your bin, fill it 2/3 full of bedding.

Because worms breathe through their skin, bedding materials should be consistently moist in order to create a comfortable habitat for your worms. Therefore, moisten the shredded newspaper with water and mix around until all paper is evenly damp, like a wrung out sponge. Paper should not drip water when squeezed.

Worms will eat both the food and the bedding. Add more bedding to the bin as needed to keep the food scraps covered and to absorb excess moisture. Food scraps are high in moisture and should keep the bedding moist. However, if your bedding seems dry, add more water with a plant mister or watering can, or add more food scraps.



Adding Worms

Materials:

- *Eisenia fetida* worms



Directions:

- Pour worms out of their container on top of the bedding.
- Put on the lid – the worms will eventually make their way down into the bedding.

To find out where to buy worms, go to nyc.gov/wasteless (see Resources>Products & Services>Kitchen and Composting).

When you order red wiggler worms from a supplier, you should look for *Eisenia fetida*, a species that will effectively recycle your food scraps and will thrive in a worm bin. These are not to be confused with nightcrawlers and other garden worms, which are usually brown or gray in color and will not survive in a worm bin.

The quantity of worms you need depends on how many pounds of “worm food” your household generates each week. **In an established bin, one red wiggler worm processes half its own weight in food scraps every day!** So, if you stock your bin with two pounds of worms, they should be able to process a pound of food scraps a day, or seven pounds a week

Worm Bin Placement

Make sure your worm bin is placed in a good location for both you and the worms. Aside from your own aesthetic preferences, red wigglers are most active when the temperature inside the bin is anywhere between 55°F and 80°F (13°C and 27°C). Common indoor placements that often meet those temperature needs include the kitchen, laundry room, or basement.

If you want to keep your worm bin outdoors, you'll need to make sure it has enough shade in the summer and plenty of insulation in the winter to maintain the desired temperature range. Water can have a negative impact on your worm bin as well, so make sure your worm bin is protected from heavy rains as the worms can drown.

What to Compost in Your Worm Bin

Materials:

- Fruit and vegetable scraps
- Coffee grounds and paper tea bags
(Remove the staples from tea bags)



Directions:

- Move some bedding to the side and add food scraps.
- Cover the food scraps with bedding material or vermicompost. Do not leave food scraps exposed on top of the bin.
- Each time you feed your worms, place the food scraps in a different area of the bin. Doing this will give you a sense of how long it takes for the food scraps to break down and how much you can add to the bin each time.

You can feed your worms small amounts every day, or their whole week's food supply at one time. All food scraps you put into the bin should be cut into 1 – 2 inch pieces.

Harvesting Vermicompost: Letting the Worms Separate the Materials

Materials:

- Newspaper
- Watering can or plant mister
- Food scraps or garden trimmings
- A bag or container to hold finished vermicompost

Directions:

- Move all the contents over to one side of the worm bed.
- Add new moistened bedding to the empty side, and start placing food scraps on that side.
- Over about a one-month period, most of the worms should move over to the new bedding, allowing you to scoop out the relatively worm-free vermicompost.



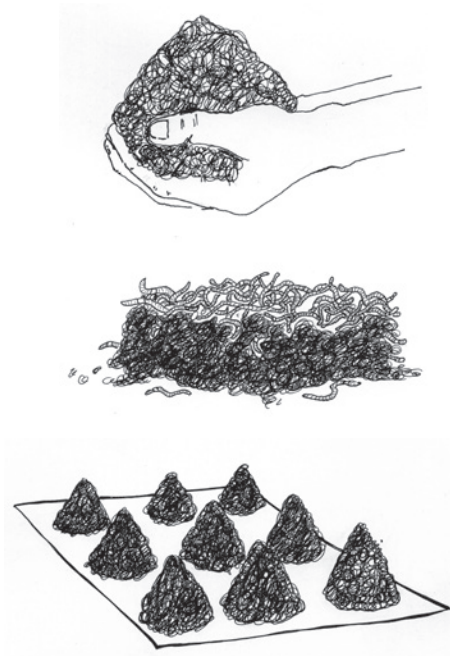
Once the worms have processed the food scraps and bedding, they leave behind dark, crumbly castings. When the bedding starts to resemble dark soil, usually about three to six months, it's time to harvest your vermicompost.

Harvesting is when you remove the vermicompost from the bin and separate the castings from the bits of bedding, food scraps, or worms that are in it. If left in the bin for too long, the castings start to become toxic to the worms.

Harvesting Vermicompost: Separating the Materials by Hand

Materials:

- Newspaper or plastic tarp
- Watering can or plant mister
- Food scraps
- A bag or container to hold finished vermicompost



Directions:

- Spread out a newspaper or tarp on the ground or on a table.
- Move bedding over to one side of the worm bin.
- Remove dark crumbly material from the worm bin.
- Make small piles of vermicompost on the newspaper.
(The worms will gather in the center of the piles to avoid bright light.)
- Brush the castings off of the top and sides of each small pile. Put this finished material in a bag or container.
- While you are waiting for worms to gather into the center of the vermicompost piles, make new bedding.
- Add new bedding to the empty side of the worm bin.
- Add fresh food scraps to the empty side of the worm bin.
- Gently harvest the castings from the outside of each pile and put the castings in a bag or container.
- Carefully remove the worms that have clustered in the center of each pile. Put them back into the worm bin.
- Scoop up any remaining vermicompost and return to the bin.
- It's alright if there are a few worms still in the castings if you are going to use it in a garden. However, if you are using it in potted plants, it's best to remove all worms.

This method is a fast (but slightly involved) way to harvest vermicompost from your worm bin.

Troubleshooting

Taking steps to avoid problems with your worm bin is often easier than getting rid of problems once they've started, so it's important to monitor your bin regularly for the problems below.

If the problem with your worm bin can't be controlled, the best solution may be to harvest the worms and start a new bin from scratch, using what you've learned from your experience to create a better bin.

Contact the NYC Compost Project in your borough with any worm bin questions or problems. See nyc.gov/wasteless/compostproject for more info.

odor problems and solutions

Exposed food. Cover food scraps with bedding.

Too much moisture. Add dry bedding so that it can soak up pooling water, particularly in wet areas. Reduce the amount of food placed in the bin.

Not enough oxygen. Add dry bedding; fluff up the bedding if it appears matted down.

Too much food; not decomposing. Break food into smaller pieces, especially hard, woody items like stems. You can also freeze and thaw food scraps to break down cell walls. Feed worms less so that they have time to go through food in the bin.

Food in bin is naturally odorous. Some foods are naturally odorous when decomposing (such as onions, broccoli, or cabbage, plants in the allium or brassica family). Therefore, remove foods that produce unpleasant odors if it bothers you. Don't add meat, bones, dairy, or oil products.

fruit fly problems and solutions

If fruit flies are a problem, you can try using flypaper traps or make your own fruit fly trap. See trapping fruit flies section (on previous page). House flies should not be attracted to your worm bin if you cover the food scraps with bedding material.

Exposed food. Bury food under bedding material; cover the contents with a dry sheet of newspaper.

Too much moisture. Avoid overfeeding; add dry bedding.

Fruit fly eggs in food scraps. Cut fruit into small pieces; wash all fruits and peels, particularly bananas and citrus. Freeze fruit before feeding to worms or microwave fruit for 60 seconds. These actions help to kill fruit fly eggs. You can also simply avoid adding fruit.

worm death problems and solutions

Dead worms decompose rather quickly; you can have a bin with no worms before you realize it.

Bin is too wet; worms are drowning. Add dry bedding; leave lid off for an hour or two to allow water to evaporate. Make sure bin is well ventilated.

Bin is too dry; worms are drying out. Lightly moisten and turn bedding; add moist foods. Make sure it's not too hot for the worms.

Not enough air; bedding and food are matted together; worms are suffocating. Fluff bin contents to aerate. Be sure bin is adequately ventilated with holes; add paper tubes or other bulky paper products such as torn up paper egg cartons to increase air flow.

Not enough food. Increase food, or reduce number of worms.

Worms not eating. Avoid adding too much food at one time. Avoid very spicy or salty foods, large amounts of citrus, or toxic ingredients like alcohol.

Bin is too hot or too cold. Worms prefer the same temperatures that people do, so it's best to keep the bin in a location where the surrounding temperature is between 55°F and 80°F (13°C and 27°C). Smaller bins are more impacted by surrounding temperatures so keep these in a location with temperature controls. The summer heat can cause problems for your worms. You can create "air-conditioning" for your worms by freezing a water bottle and placing it on top of the shredded newspaper inside your worm bin. Replace the lid and your worms will be cool all day. Take the bottle out and re-freeze it over night so you can add it to the bin again in the morning. This is only necessary if you notice worms trying to escape or if temperatures are over 85°F.

An over-abundance of mites. A small mite population is natural, but if you notice large collections of mites, you should try to remove them. Remove any food that has a congregation of mites. To reduce mites, bring bin outside and leave it open in the sun for 1 – 2 hours to dry it out a little. Repeat as necessary until mite population is reduced. To trap mites, place a slice of fresh bread in the bin, wait until mites congregate on it, and then remove the bread.

Worm Bin Checklist

Use these checklists to make sure your worm bin is functioning properly!

SIGNS OF A HEALTHY WORM BIN

- ☐ Bin smells earthy like the soil.
- ☐ Bedding is disappearing over time.
- ☐ Worm castings are accumulating.
- ☐ Worms have glistening skin.
- ☐ Sufficient air space between the bedding.
- ☐ Bin has small quantities of other critters, such as mites or little white worms.
- ☐ Fuzzy mold on some foods.
- ☐ Bin contents are damp but not soggy.
- ☐ Bin filled with fluffed up, shredded paper.
- ☐ Food is not visible when you open the bin.

SIGNS OF AN UNBALANCED WORM BIN

- ☐ Liquid dripping from the drainage holes.
- ☐ Puddles of water in the bin.
- ☐ Bedding and castings are dry.
- ☐ Castings and bedding are sticking to the worms.
- ☐ Bin has a foul odor.
- ☐ Food and bedding are matted in large clumps.
- ☐ Fruit flies present.
- ☐ Mites present in large quantities.
- ☐ Maggots present.



trapping fruit flies

Here are two kinds of fruit-fly traps you can make yourself:



1. Funnel fly trap (left). Pour some apple cider or beer into a glass jar and add a drop of detergent. Cut the corner off a plastic sandwich bag and place it into the jar; secure the plastic-bag “funnel” with a rubber band around the rim of the jar.

2. Bottle fly trap (right). Cut a small plastic water or soda bottle in half. Fill the bottom half with some apple cider or beer and a drop of detergent. Turn the top half upside down and place it into the bottom half so that the neck forms a funnel. Secure the two halves with tape.



[illegible]

All About Composting

Planting with Compost

Time:

20 – 30 minutes

Subjects:

English Language Arts, Science

Vocabulary:

compost, decomposition, mulch, nutrients

Goals and Objectives:

After completing a short reading Activity, students will apply what they have learned in an experiment comparing the growth of plants in regular soil and plants in a compost/soil mixture.

Teacher's Note:

Over a period of weeks, this Activity demonstrates the benefits of using compost for planting. Students may get their hands dirty while feeling the differences in texture between compost and soil. Choose seeds that germinate quickly, such as for marigolds, beans, and basil. For faster results, potato eyes, plant starts, or spider plantlets may also be used.

Materials:

- **Two planting containers** for each student team (reuse containers to make the planters, such as well-rinsed milk cartons or the bottom few inches of plastic bottles)
 - **Six similar seeds or two plants** per team
 - **Potting soil** (enough for each team)
 - **Compost** (enough for each team)
 - **Water**
 - Copies of **How to Use Compost**
 - **Planting with Compost Progress Log**
-

Activity

Following this Activity are adaptations for Beginner, Intermediate, and Advanced.

Teacher Prep:

If this is your first Activity from this chapter, read the **Chapter 5 Introduction**. Refer to the **Glossary** for definitions of vocabulary words.

Warm Up:

Class Discussion: Determine students' prior knowledge and understanding of what plants need to thrive, and the use of finished compost as a soil amendment.

Suggested Discussion: How do plants obtain nutrients? What does soil do for plants? What is compost? How do you know when compost is finished or ready to use? What can compost be used for and why do people use it?

Read the **How to Use Compost** tip sheet and distribute the **Planting with Compost Progress Log**.

Exploration:

Elicit Student Predictions:

How might growing plants in a compost/soil mix affect their rate of growth? What difference might there be between plants grown in a compost/soil mix compared to plants that are grown only in soil?

Procedure:

1. Group students together into teams. Distribute two planting containers and six of the same type of seeds or two plants to each team.
2. Instruct the teams to label each of their planting containers with their team name, what is being planted, the date, and the words “soil” or “soil and compost.”
3. Fill one planting container with potting soil and one container with a mixture of one part compost and four parts soil. Place three seeds or one plant in each container, following the seed packet or plant care instructions.
4. Ask the students to observe and describe the difference between the compost mixture and the potting soil. Encourage them to form hypotheses about which plant will grow faster and which will be healthier.
5. Add water to the containers and set them in an appropriate area, per seed packet or plant care instructions.
6. Have the students begin the ***Planting with Compost Progress Log*** and let them know that they will be monitoring the progress of their plants for the next few weeks.

Expanded Exploration:

Ask students why the compost is mixed with soil and encourage discussion about the benefits of composting. Some points to consider about planting with compost include:

- The coarse texture that students observed in compost helps it to act like a sponge and hold moisture.
- Mixing the compost with soil creates air spaces and gives roots room to grow.
- Compost contains beneficial microorganisms and nutrients that help plants grow.

Adaptations for Different Grades

Choose level most appropriate for your class.

Beginner:

Follow the Activity instructions and have students write down their hypotheses before they begin completing the ***Planting with Compost Progress Log***.

After they have observed significant changes in plant growth, have them write an illustrated scientific summary of their findings. It should include: Question, Hypothesis, Procedure, and Conclusion sections. Encourage the students to share their reports with the class.

Intermediate:

Follow the Activity instructions, and include a ***writing*** component.

Students should write reports that implement the scientific method. Have each team present their findings to the class using display boards or PowerPoint presentations. Encourage them to take pictures of their plants and incorporate the photos into their presentations.

Advanced:

Follow the Activity instructions.

Students can write reports that implement the scientific method. Students can develop a proposal presentation that includes their findings and offers a project plan about how to incorporate composting in their school or neighborhood.

[illegible]

All About Composting

How to Use Compost Handout

Finished Compost

Finished compost resembles dark, crumbly topsoil and should bear no resemblance to the original materials. Compost should have a pleasant, earthy smell to it. Using “unfinished” or immature material that contains food scraps can attract pests and can cause harm to young plants, so make sure your compost has fully decomposed before adding it to your garden beds.

How to Tell if Your Compost Is Finished

The simplest way to tell if your compost is mature and ready to use is by doing the “bag test.” Put a handful of moist compost into a zip-lock bag and press out the air before sealing. Leave it for three days, then open the bag. If you detect an ammonia or sour odor, the microorganisms are still at work and you need to let your compost finish curing. Test another sample of compost again in a week.

Using Finished Compost

There are various ways to utilize your finished compost. You can sprinkle compost on top or mix it into your flower and vegetable beds, gently rake compost into tree beds, blend it with potting soil to revitalize indoor plants, or spread it on top of the soil on your lawn as a soil amendment.

Compost in the Home Garden

Adding compost to your garden helps improve the structure and overall health of your soil. It is rich in organic content and as such, will retain moisture and will increase your overall earthworm and microbial population, which will serve as biological controls against unwanted pests. In addition, compost will provide a slow release of macronutrients, which means that your plantings will get a steady supply of nutrients as needed rather than a one shot injection of conventional chemical fertilizers.

usage

what to do

amending soil

Work one to two inches of compost into the top three to five inches of soil.



growing vegetables



Give your vegetable garden plenty of compost in the fall. Spread several inches of compost on top of the existing bed, then till it in come springtime.

Put a handful of compost in each hole when you're planting.

Once plants begin to grow quickly, you can add a half-inch layer of compost around the base of the plants. Provide “heavy feeder” plants such as tomatoes, corn, and squash with half an inch of compost monthly—this will result in great produce!

growing flowers

In the spring, loosen the top few inches of annual and perennial beds and mix in a one-inch layer of compost. Or in the fall, apply a one-inch layer of compost as a mulch to protect plant roots from freezing and conserve moisture.

replenishing soil in potted plants & window boxes

Even the best potting soil gets depleted of its nutrients as plants grow. To replenish nutrients, add an inch of compost to potted plants and window boxes twice a year. Or, make your own potting soil using two parts screened compost to one part sand or perlite.



Using Finished Compost

Using Compost for Gardening Projects

usage

what to do

rejuvenating lawn or turf



When establishing new turf, incorporate up to three inches of compost into the existing soil base. If possible, till to a depth of five to eight inches before seeding. Otherwise, seed directly over the compost.

On existing turf, you can treat bald spots by incorporating an inch of compost into the soil and then reseed. This will fight compaction and help suppress soil-borne diseases.

You can also topdress existing turf with as much as one-half inch finely screened compost. This is easiest with a spreader, but you can use a shovel for small areas where you want to add compost. Rake the compost evenly throughout the grass area to enable the compost to readily sift down to the soil. The compost will settle down into the soil, improving its structure and providing nutrients. Over time, this will mean less compaction, fewer bald spots, and a reduced need for synthetic fertilizers.

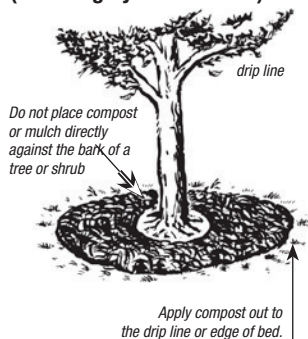
tree planting

When planting a new tree, it's best to work one-half inch to one inch compost into the top two inches of soil from the trunk of the tree out to the dripline—the outermost parameter of the tree's canopy. (See image below)

Compost used in this way serves as a substitute for the layer of organic matter that naturally exists on the forest floor: it provides organic nutrients, reduces moisture loss, and keeps the soil cool.

Don't add compost to a freshly dug hole when planting a new tree, as applying compost in this way will discourage tree roots from going beyond the hole.

tree and shrub maintenance (including nyc street trees)



Apply compost as mulch to trees and shrubs to prevent weeds and make plants more drought resistant. Spread up to two inches of compost under the tree or shrub out to the drip line (the outermost leaves on a tree) or edge of the bed. This will help reduce moisture loss and stabilize soil temperature.

You can also incorporate compost into the soil once or twice a year to provide organic nutrients. Before adding compost to compacted soils, gently cultivate the soil with a hand tool; this will prevent damage to shallow feeder roots while making nutrients more readily accessible to the trees or shrubs.

Do not place compost or mulch directly against the bark of the tree or shrub or on exposed woody roots as this could cause rot and invite pests and disease.

maintaining perennial & annual beds

Spread one to two inches of compost on top in perennial and annual beds in the early spring or fall to prevent weeds from establishing and to make plants more drought-resistant.

All About Composting

Planting with Compost

Progress Log

Name _____ Date _____

Record your observations in the Progress Log. List the date of observation and a brief description and illustration of each plant. Track the date of gestation, and measure the height of the plants.

Date	Potting Soil Description/Drawing	Compost Mixture Description/Drawing

Date	Potting Soil Description/Drawing	Compost Mixture Description/Drawing

All About Composting

Compost Balancing Act

Time:

20 – 30 minutes

Subjects:

English Language Arts, Science

Vocabulary:

aeration, anaerobic, carbon,
compost, decompose, nitrogen,
ventilation, volume

Goals and Objectives:

Students will learn how to maintain a healthy and balanced compost bin or pile. After reading sections of the **New York City Outdoor Composting Guide**, they will complete **Composting Scenarios Handout**, which offers a reading comprehension and role playing activities.

Materials:

- **New York City Outdoor Composting Guide** (in Chapter 5, Activity 4)
 - Copies of **Composting Scenarios Handout**
-

Activity

Following this Activity are adaptations for Beginner, Intermediate, and Advanced.

Teacher Prep:

If this is your first Activity from this chapter, read the **Chapter 5 Introduction**. Refer to the **Glossary** for definitions of vocabulary words.

Warm Up:

Class Discussion: Determine students' prior knowledge and understanding of composting and what goes into a compost pile.

Suggested Discussion: What kinds of materials can you compost in an outdoor bin in a dense, urban setting? What kinds of things should you not compost in that bin? How do you know if you have a healthy compost pile or not?

Exploration:

1. Read sections of the **New York City Outdoor Composting Guide**. Engage the students in a discussion about composting and why it is important.
2. Have the students work in groups to complete both sides of **Composting Scenarios Handout**.

Expanded Exploration:

Encourage the class to think about decomposition as a natural occurrence and composting as one way people can manage this process. Discuss how composting food scraps can make a significant impact on the amount of waste dumped in landfills.

Suggested Questions: What are the benefits of making compost? Have you ever seen a real outdoor compost heap or bin?

Contact your local NYC Compost Project (nyc.gov/wasteless/compostproject) to get more information on a touring a compost site near you, making an indoor worm bin, or starting an outdoor compost operation.

Adaptations for Different Grades

Choose level most appropriate for your class.

Beginner:

Follow the Activity instructions.

Depending on the reading levels of your students, you may want to skip the first half of side one of **Composting Scenarios Handout**.

After you review some problem scenarios as a class, ask the students to make posters of a healthy compost bin and an unhealthy compost bin. Encourage them to share their illustrations with the class.

Intermediate:

Follow the Activity instructions.

Go over the answers as a class and discuss other troubleshooting techniques or questions that may arise. Have each pair come up with four more problem scenarios and solutions. They can create short videos or illustrated cartoon books of the scenarios and present them to the class.

Advanced:

Follow the Activity instructions.

Encourage the students to use these materials and conduct their own research to develop a brochure or video project that simplifies what can and should not be composted and troubleshooting strategies.

All About Composting

Composting Scenarios Handout

Name _____ Date _____

Using Composting Vocabulary

You can refer to the **New York City Outdoor Composting Guide** (in **Chapter 5, Activity 4**) for help. Please fill in the blank spaces with vocabulary words listed in the box below.

carbon, nitrogen, volume, decompose, compost, anaerobic, aeration, ventilation

- _____ is a mixture of decayed organic materials.
- The amount of space a three-dimensional object occupies is called _____.
- To rot or decay are other terms for _____.
- _____ and _____ are other words that mean air circulation.
- The chemical element _____ is found in high amounts in many composting “browns” or dead and dry items for compost, like autumn leaves, straw, and hay.
- _____ is a chemical element found in high amounts in composting “greens,” including cut flowers and freshly cut grass.
- When something is without air it is _____.

What Goes In a Compost Pile

You were just elected compost coordinator for your school’s outdoor compost bin. It’s up to you to determine which items should be added or not. Write “yes” or “no” beside each item.

- | | | | |
|-----------------------|-------|------------------------------|-------|
| 1. Pepperoni pizza | _____ | 13. Hot dogs | _____ |
| 2. Egg shells | _____ | 14. Apple cores | _____ |
| 3. Newspaper | _____ | 15. Dead flowers | _____ |
| 4. Autumn leaves | _____ | 16. Moldy bagels | _____ |
| 5. Tea bags | _____ | 17. Poison ivy | _____ |
| 6. Coffee grounds | _____ | 18. Pesticide-treated grass | _____ |
| 7. Broccoli over rice | _____ | 19. Macaroni & cheese | _____ |
| 8. Pine needles | _____ | 20. Plastic yogurt container | _____ |
| 9. Dog manure | _____ | 21. Food-soiled napkins | _____ |
| 10. Cat manure | _____ | 22. Fruit salad | _____ |
| 11. Nutshells | _____ | 23. Coal or charcoal ash | _____ |
| 12. Popcorn | _____ | 24. Sawdust | _____ |

Solving Composting Problems

With your group, take turns role playing the scenarios below. Discuss and write down your diagnosis and solution for each one.

1. It's been an especially cold winter and my pile is not hot. I have been taking the temperature every day since I built the compost pile two weeks ago, but it has not gotten above 68°F (20°C). Isn't it supposed to be between 90°F and 140°F (32°-60°C)?

Diagnosis _____

Solution _____

2. Two nights ago, I saw some animals around my compost pile when I brought out my food scraps from dinner. I think they were eating some of the food I put in the pile last week. What should I do?

Diagnosis _____

Solution _____

3. My pile stinks like rotten eggs! Why does it smell so bad? What should I do?

Diagnosis _____

Solution _____

4. The material in my compost pile looks the same as when I first put it in there and hasn't turned into compost at all. It's been over a week, shouldn't something have happened?

Diagnosis _____

Solution _____

5. My pile stinks like ammonia. How can I make it stop?

Diagnosis _____

Solution _____

All About Composting

Tracking Decomposition in an Outdoor Pile

Time:

20 – 30 minutes

Subjects:

English Language Arts, Science

Vocabulary:

carbon, compost, decomposition, nitrogen, organic, oxygen

Goals and Objectives:

Students will learn more about composting and how temperature and moisture levels and the types of items added to the compost bin impact its progress. They will monitor compost over a period of time at their school's compost bin, or with a series of field trips to one of the NYC Compost Project demonstration sites (see **NYC Compost Project** info sheet in Chapter 6).

Teacher's Note:

This Activity requires access to an outdoor compost bin or pile over a period of weeks. If your school does not have its own outdoor compost bin, you may want to schedule a series of field trips to NYC Compost Project Community Compost sites near you. Contact your local NYC Compost Project for more information.

Materials:

- Copies of the **What's Rotting Away Compost Log**
 - **What To Compost** fact sheet
 - Scale
 - Thermometers
 - An outdoor compost bin
-

Activity

Following this Activity are adaptations for Beginner, Intermediate, and Advanced.

Teacher Prep:

If this is your first Activity from this chapter, read the **Chapter 5 Introduction**. Refer to the **Glossary** for definitions of vocabulary words.

Warm Up:

Class Discussion: Determine students' prior knowledge and understanding of composting and decomposition.

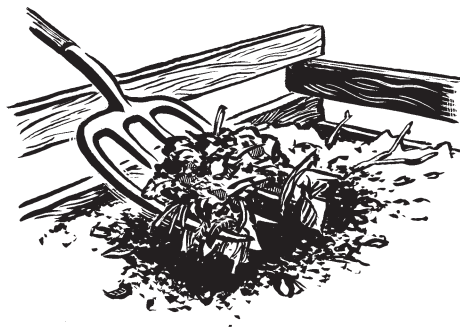
Suggested Discussion: What are the key ingredients for composting? Answers include: organic materials, food scraps, leaves, garden trimmings, carbon, nitrogen, oxygen, water, and temperature. What are some indicators of an unhealthy or unbalanced compost bin? Answers include: odor, low temperature, and slow decomposition rate.

Exploration:

1. Take your class to an outdoor bin or pile to observe the temperature, moisture, odor, and appearance of the organic materials in it.
2. Have the students take turns measuring the temperature in various parts of the pile and ask them to record this on the ***What's Rotting Away Compost Log***.
3. Remind the class that to speed decomposition, materials should be moist, not too dry and not too wet. Ask them to rate the moisture of the materials on a scale of 1 to 10, reflecting dry to wet.
4. Ask them to describe the smell of the decomposing materials. Is there an odor and if so, what does it smell like? What does this mean?
5. Refer to the ***What to Compost*** fact sheet for help about which materials to add to the pile in order to balance the conditions. Review items that fall under the "Greens" or "Browns" category. Green items include freshly cut grass and flowers, as well as fruit and vegetable scraps. Brown items include autumn leaves, pine needles, newspaper, and bread.
6. After you discuss and decide which items should be added, be sure to weigh each item before adding it to the compost pile.
7. Students should record all of these observations on the ***What's Rotting Away Compost Log***.
8. Return to the compost bin as often as possible with the class so they can help keep the compost balanced and use their observations and hands-on experience to connect how their everyday decisions about their waste can actually make a difference.

Expanded Exploration:

Encourage the class to continue composting. How can they dispose of their food scraps each day? If your school does not have an outdoor compost bin or an indoor worm bin, are there places within the school or nearby to drop off food scraps?



Adaptations for Different Grades

Choose level most appropriate for your class.

Beginner:

Follow the Activity instructions.

Include a **read aloud** component from **What to Compost** or with the definitions of vocabulary words from the **Glossary**. When they return to the classroom, have the class create posters that illustrate the different “Green” and “Brown” organic materials that can be composted. The posters can be presented to the class and displayed.

Intermediate:

Follow the Activity instructions.

Group the students into teams and give each team the option of creating a board game or a display board that explores how to balance an outdoor compost pile. It should include the difference between “Green” and “Brown” organic materials, and address the impact of temperature, moisture, and odor on a compost heap. The project should present scenarios where the player or viewer must think about how to balance the conditions of the compost bin. Encourage them to share their projects with the class.

Advanced:

Follow the Activity Instructions.

Give students a choice between three projects:

1. Write a research paper about the history of composting in NYC with predictions for the future of composting in New York City;
2. Create a board game or other kind of game that incorporates balancing the compost conditions, following the Intermediate Activity instructions above;
3. Create an art piece out of scrap materials incorporating the themes “Greens” and “Browns” and composting.

[illegible]

All About Composting

What's Rotting Away

Compost Log



Use this record sheet on a daily, weekly, or bi-weekly basis to track the temperature, moisture levels, odor, and the amount of material added to your compost pile. By monitoring your pile consistently over a few months, you will be able to observe the various states of decomposition.

Date								
Air Temperature								
Core Bin Temperature (inner core of pile)								
Moisture Level (on a scale of 1-10: 1 is very dry, 10 is too wet)								
Odor (soil, ammonia, or rot)								
Greens Added (lbs.)								
Browns Added (lbs.)								
Compost Comments								

Date								
Air Temperature								
Core Bin Temperature (inner core of pile)								
Moisture Level (on a scale of 1-10: 1 is very dry, 10 is too wet)								
Odor (soil, ammonia, or rot)								
Greens Added (lbs.)								
Browns Added (lbs.)								
Compost Comments								

All About Composting

What to Compost Handout

Mix roughly equal parts (by volume) of high-nitrogen **GREENS** and high-carbon **BROWNS**.

Without enough greens, a pile will decompose slowly; without enough browns, the pile may develop an unpleasant odor. In general, it's better to err on the side of too many browns. Chop up bulkier materials. To avoid odors or pests, bury food scraps under browns.

Two other ingredients — water and oxygen — are needed to ensure that your compost pile transforms itself into a mound of black gold.

Add Equal Parts GREENS and BROWNS

GREENS

fresh, moist, nitrogen-rich materials

FROM YOUR GARDEN

- green plants and garden trimmings
- fresh leaves and flowers
- grass clippings (or recycle by leaving on the lawn)

FROM YOUR KITCHEN/HOME

- fruit and vegetable scraps
- coffee grounds & tea bags
- manure and bedding from animals that **ONLY** eat plants

BROWNS

dead, dry, carbon-rich materials

FROM YOUR GARDEN

- fall leaves, small twigs, and woody prunings
- dry plant material
- straw and hay
- pine needles
- potting soil

FROM YOUR KITCHEN/HOME

- bread and grains
- egg shells
- nutshells
- corn cobs
- food-soiled paper towels and napkins
- shredded newspaper
- sawdust and wood shavings (from untreated wood)
- stale beans, flour, and spices
- wood ashes

Materials to Avoid

FROM YOUR GARDEN

- pesticide-treated plants or pesticide-treated grass clippings
- diseased or pest-infested plants
- poison ivy
- invasive weeds
- weeds with seeds
- large branches (call 311 to schedule a special removal)
- non-compostable materials such as sand or construction debris

FROM YOUR KITCHEN/HOME

- meat or fish scraps
- cheese or dairy products
- fats, grease, or oil
- cat or dog feces; kitty litter
- colored or glossy paper
- sawdust made from pressure-treated plywood or lumber
- coal or charcoal ashes
- non-compostable materials such as plastics, metals, or glass

Compost Troubleshooting Guide

SYMPTOM	PROBLEM	SOLUTION
rotten-egg odor	Excess moisture and not enough air (anaerobic conditions). 	Turn pile frequently; add dry BROWN material such as autumn leaves, woodchips, or newspaper. Make sure bin has drainage; leave lid off to allow more air to flow.
ammonia odor	Too much GREEN, high-nitrogen material (such as food scraps, grass clippings).	Add BROWN, high-carbon material (such as autumn leaves, woodchips, shredded newspaper, straw).
slow decomposition	Lack of moisture.	Add water while turning pile.
	Lack of air.	Turn pile; add aeration tubes.
	Lack of nitrogen; too much BROWN, high-carbon material.	Add material high in nitrogen (more GREENS), such as food scraps or grass clippings.
low pile temperature <i>(If you have a small pile, or if it is very cold out, don't be concerned if your compost is not generating heat; decomposition is still occurring, but at a slower pace.)</i>	Pile too small.	Increase pile size (space permitting).
	Insufficient moisture.	Add water while turning pile.
	Poor aeration.	Turn pile; add aeration tubes.
	Lack of nitrogen.	Add more GREENS (material high in nitrogen), such as food scraps or grass clippings.
	Cold weather.	Increase pile size, or insulate pile with straw or other material.
high pile temperature (over 140°F, 60°C)	Pile too large.	Reduce pile size.
	Insufficient ventilation.	Turn pile.
unwanted pests	Wrong materials in the pile.	Avoid meat, dairy, and fatty foods.
	Food scraps are exposed.	Make sure food is well covered.
	Bin isn't rodent-resistant.	Make bins more rodent resistant by adding hardware cloth to areas where animals could get through. Add a screening barrier vertically 6 to 8 inches into the ground; keep pile moist; turn pile more often to increase temperature and disturb nesting.

All About Composting

Learning Standards

Activity 1: What's in My Waste?

New York State Common Core Learning Standards for English Language Arts & Literacy

College and Career Readiness Anchor Standards for Writing

- Subsections 1, 2, 3 Text Types and Purposes
- Subsections 4, 6 Production and Distribution of Writing
- Subsections 7, 8 Research to Build and Present Knowledge
- Subsection 10 Range of Writing

College and Career Readiness Anchor Standards for Speaking and Listening

- Subsections 4, 5, 6 Presentation of Knowledge and Ideas

College and Career Readiness Anchor Standards for Language

- Subsections 1, 2 Conventions of Standard English
- Subsection 3 Knowledge of Language

New York State Common Core Learning Standards for Mathematics

- Subsections 1, 2 Counting and Cardinality
- Subsection 1 Operations & Algebraic Thinking
- Subsection 1 Measurement & Data

The Applied Learning Performance Standards

- A2 Communication Tools and Techniques
- A5 Tools and Techniques for Working With Others

New York City Science Scope & Sequence

7.1c, 7.2a, 7.2b, 7.2c

Human influences on the environment: negative influences.

7.3a, 7.3b

Human influences on the environment: decision making (risk/benefit).

ICT 5.2, IPS 1.1-1.4, IPS 2.1

Packaging and solid waste.

LE 3.2b, LE 7.1e, LE 7.2c,d, ICT 1.2, 1.4, 2.1-2.3, 4.1, 4.2, 5.1, 5.2, 6.1, 6.2, IPS 1.1-1.4, IPS 2.1

Environmental concerns: acquisition and depletion of resources; waste disposal; land use and urban growth; overpopulation; global warming; ozone depletion; acid rain; air pollution; water pollution; impact on other organisms.

LE 6.1c, ICT 5.1, 5.2

Renewable and nonrenewable sources of materials.

LE 7.1a,b

Describe the way that humans: a) depend on their natural and constructed environment b) have changed their environment over time.

LE 7.1b,c

Identify examples where human activity has had a beneficial or harmful effect on other organisms (e.g., deforestation).

LE 7.2b,c, LE 7.2d

Identify examples where human activity has had a beneficial or harmful effect on other organisms (e.g., deforestation).

LE 7.2c,d, ICT 5.2, IPS 1.1-1.4, IPS 2.1

Water issues: depletion; pollution.

LE 7.2c,d, ICT 6.1, IPS 1.1-1.4, IPS 2.1

Environmental toxins: pesticides and herbicides; fertilizers; organic waste.

PS 3.1b,c

Observe and describe physical properties of objects using all of the appropriate senses: size, shape, texture, weight, color, etc. Determine whether objects are alike or different.

S1.1a,b,c

Formulate questions of scientific inquiry with the aid of references appropriate for guiding the search for explanations of everyday observations.

All About Composting

Learning Standards

Activity 2: Beginning to Understand That Nature Recycles

New York State Common Core Learning Standards for English Language Arts & Literacy

College and Career Readiness Anchor Standards for Reading

- Subsections 1, 2, 3 Key Ideas and Details
- Subsections 4, 5, 6 Craft and Structure
- Subsection 11 Responding to Literature

College and Career Readiness Anchor Standards for Writing

- Subsection 3 Text Types and Purposes
- Subsection 11 Responding to Literature

College and Career Readiness Anchor Standards for Speaking and Listening

- Subsections 4, 6 Presentation of Knowledge and Ideas

College and Career Readiness Anchor Standards for Language

- Subsections 1, 2 Conventions of Standard English
- Subsection 3 Knowledge of Language
- Subsections 4, 5, 6 Vocabulary Acquisition and Use

The Applied Learning Performance Standards

- A5 Tools and Techniques for Working With Others

New York City Science Scope & Sequence

LE 5.1d,e, LE 6.1a,b

Classify populations of organisms as producers, consumers, or decomposers by the role they serve in the ecosystem (food chains and food web).

S1.1a,b,c

Formulate questions of scientific inquiry with the aid of references appropriate for guiding the search for explanations of everyday observations.

All About Composting

Learning Standards

Activity 3: Finding Evidence of Composting in Nature

New York State Common Core Learning Standards for English Language Arts & Literacy

College and Career Readiness Anchor Standards for Writing

- Subsections 1, 2 Text Types and Purposes
- Subsection 4 Production and Distribution of Writing
- Subsection 7 Research to Build and Present Knowledge
- Subsection 10 Range of Writing

College and Career Readiness Anchor Standards for Speaking and Listening

- Subsections 4, 6 Presentation of Knowledge and Ideas

College and Career Readiness Anchor Standards for Language

- Subsections 1, 2 Conventions of Standard English

The Applied Learning Performance Standards

- A1 Problem Solving
- A2 Communication Tools and Techniques
- A3 Information Tools and Techniques
- A4 Learning and Self-management Tools and Techniques
- A5 Tools and Techniques for Working With Others

New York City Science Scope & Sequence

LE 5.1d,e, LE 6.1a,b

Classify populations of organisms as producers, consumers, or decomposers by the role they serve in the ecosystem (food chains and food web).

PS 3.1b,c

Observe and describe physical properties of objects using all of the appropriate senses: size, shape, texture, weight, color, etc. Determine whether objects are alike or different.

S1.1a,b,c

Formulate questions of scientific inquiry with the aid of references appropriate for guiding the search for explanations of everyday observations.

Standards 1–1.1a, 1.1b, 1.1c, 3.1, 3.2, 3.3

The role of scientific inquiry in studying biology.

Standards 1–1.2a, 1.2b, 1.3a, 1.3b, 2.1, 2.2, 2.3a, 2.3b, 2.3c, 2.4, 3.4a, 3.4b, 3.4c, 3.5a, 3.5b

The methods of science.

All About Composting

Learning Standards

Activity 4: Learning How to Compost Outdoors

New York State Common Core Learning Standards for English Language Arts & Literacy

College and Career Readiness Anchor Standards for Reading

Subsection 1	Key Ideas and Details
Subsections 4, 5	Craft and Structure
Subsection 10	Range of Reading and Level of Text Complexity

College and Career Readiness Anchor Standards for Writing

Subsection 2	Text Types and Purposes
Subsection 4	Production and Distribution of Writing
Subsection 7	Research to Build and Present Knowledge
Subsection 10	Range of Writing

College and Career Readiness Anchor Standards for Speaking and Listening

Subsections 2, 4, 6	Presentation of Knowledge and Ideas
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The Applied Learning Performance Standards

- A1 Problem Solving
- A2 Communication Tools and Techniques
- A4 Learning and Self-management Tools and Techniques
- A5 Tools and Techniques for Working With Others

New York City Science Scope & Sequence

LE 5.1d,e, LE 6.1a,b

Classify populations of organisms as producers, consumers, or decomposers by the role they serve in the ecosystem (food chains and food web).

PS 3.1b,c

Observe and describe physical properties of objects using all of the appropriate senses: size, shape, texture, weight, color, etc. Determine whether objects are alike or different.

S1.1a,b,c

Formulate questions of scientific inquiry with the aid of references appropriate for guiding the search for explanations of everyday observations.

Standards 1–1.1a, 1.1b, 1.1c, 3.1, 3.2, 3.3

The role of scientific inquiry in studying biology.

Standards 1–1.2a, 1.2b, 1.3a, 1.3b, 2.1, 2.2, 2.3a, 2.3b, 2.3c, 2.4, 3.4a, 3.4b, 3.4c, 3.5a, 3.5b

The methods of science.

All About Composting

Learning Standards

Activity 5: Decomposer Hunt

New York State Common Core Learning Standards for English Language Arts & Literacy

College and Career Readiness Anchor Standards for Reading

Subsection 1	Key Ideas and Details
Subsections 4, 5	Craft and Structure
Subsection 10	Range of Reading and Level of Text Complexity

College and Career Readiness Anchor Standards for Writing

Subsection 2	Text Types and Purposes
Subsection 4	Production and Distribution of Writing
Subsection 7	Research to Build and Present Knowledge
Subsection 10	Range of Writing

College and Career Readiness Anchor Standards for Speaking and Listening

Subsections 2, 4, 6	Presentation of Knowledge and Ideas
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The Applied Learning Performance Standards

- A1 Problem Solving
- A2 Communication Tools and Techniques
- A4 Learning and Self-management Tools and Techniques
- A5 Tools and Techniques for Working With Others

New York City Science Scope & Sequence

LE 5.1d,e, LE 6.1a,b

Classify populations of organisms as producers, consumers, or decomposers by the role they serve in the ecosystem (food chains and food web).

PS 3.1b,c

Observe and describe physical properties of objects using all of the appropriate senses: size, shape, texture, weight, color, etc. Determine whether objects are alike or different.

S1.1a,b,c

Formulate questions of scientific inquiry with the aid of references appropriate for guiding the search for explanations of everyday observations.

Standards 1–1.1a, 1.1b, 1.1c, 3.1, 3.2, 3.3

The role of scientific inquiry in studying biology.

Standards 1–1.2a, 1.2b, 1.3a, 1.3b, 2.1, 2.2, 2.3a, 2.3b, 2.3c, 2.4, 3.4a, 3.4b, 3.4c, 3.5a, 3.5b

The methods of science.

All About Composting

Learning Standards

Activity 6: Worm Facts

New York State Common Core Learning Standards for English Language Arts & Literacy

College and Career Readiness Anchor Standards for Reading

Subsections 1, 2	Key Ideas and Details
Subsection 4	Craft and Structure
Subsection 7	Integration of Knowledge and Ideas
Subsection 10	Range of Reading and Level of Text Complexity
Subsection 11	Responding to Literature

College and Career Readiness Anchor Standards for Writing

Subsections 2, 3	Text Types and Purposes
Subsection 4	Production and Distribution of Writing
Subsections 8, 9	Research to Build and Present Knowledge
Subsection 10	Range of Writing
Subsection 11	Responding to Literature

College and Career Readiness Anchor Standards for Speaking and Listening

Subsections 1, 2	Comprehension and Collaboration
Subsections 4, 5, 6	Presentation of Knowledge and Ideas

The Applied Learning Performance Standards

A2	Communication Tools and Techniques
A3	Information Tools and Techniques
A5	Tools and Techniques for Working With Others

New York City Science Scope & Sequence

7.1c, 7.2a, 7.2b, 7.2c

Human influences on the environment: negative influences.

7.3a, 7.3b

Human influences on the environment: decision making (risk/benefit).

PS 3.1b,c

Observe and describe physical properties of objects using all of the appropriate senses: size, shape, texture, weight, color, etc. Determine whether objects are alike or different.

LE 3.2b, LE 7.1e, LE 7.2c,d, ICT 1.2, 1.4, 2.1-2.3, 4.1, 4.2, 5.1, 5.2, 6.1, 6.2, IPS 1.1-1.4, IPS 2.1

Environmental concerns: acquisition and depletion of resources; waste disposal; land use and urban growth; overpopulation; global warming; ozone depletion; acid rain; air pollution; water pollution; impact on other organisms.

LE 5.1d,e, LE 6.1a,b

Classify populations of organisms as producers, consumers, or decomposers by the role they serve in the ecosystem (food chains and food web).

LE 7.2c,d, ICT 6.1, IPS 1.1-1.4, IPS 2.1

Environmental toxins: pesticides and herbicides; fertilizers; organic waste.

All About Composting

Learning Standards

Activity 7: Worm Bin Check

New York State Common Core Learning Standards for English Language Arts & Literacy

College and Career Readiness Anchor Standards for Reading

Subsections 1, 2	Key Ideas and Details
Subsection 4	Craft and Structure
Subsection 10	Range of Reading and Level of Text Complexity
Subsection 11	Responding to Literature

College and Career Readiness Anchor Standards for Writing

Subsection 2	Text Types and Purposes
Subsections 7, 9	Research to Build and Present Knowledge
Subsection 10	Range of Writing
Subsection 11	Responding to Literature

College and Career Readiness Anchor Standards for Speaking and Listening

Subsection 2	Comprehension and Collaboration
Subsections 4, 6	Presentation of Knowledge and Ideas

The Applied Learning Performance Standards

A2	Communication Tools and Techniques
A5	Tools and Techniques for Working With Others

New York City Science Scope & Sequence

7.1c, 7.2a, 7.2b, 7.2c

Human influences on the environment: negative influences.

7.3a, 7.3b

Human influences on the environment: decision making (risk/benefit).

ICT 5.2, IPS 1.1-1.4, IPS 2.1

Packaging and solid waste.

LE 5.1d,e, LE 6.1a,b

Classify populations of organisms as producers, consumers, or decomposers by the role they serve in the ecosystem (food chains and food web).

LE 7.2c,d, ICT 5.2, IPS 1.1-1.4, IPS 2.1

Water issues: depletion; pollution.

LE 7.2c,d, ICT 6.1, IPS 1.1-1.4, IPS 2.1

Environmental toxins: pesticides and herbicides; fertilizers; organic waste.

PS 3.1b,c

Observe and describe physical properties of objects using all of the appropriate senses: size, shape, texture, weight, color, etc. Determine whether objects are alike or different.

S1.1a,b,c

Formulate questions of scientific inquiry with the aid of references appropriate for guiding the search for explanations of everyday observations.

Standards 1-1.1a, 1.1b, 1.1c, 3.1, 3.2, 3.3

The role of scientific inquiry in studying biology.

Standards 1-1.2a, 1.2b, 1.3a, 1.3b, 2.1, 2.2, 2.3a, 2.3b, 2.3c, 2.4, 3.4a, 3.4b, 3.4c, 3.5a, 3.5b

The methods of science.

All About Composting

Learning Standards

Activity 8: Planting with Compost

New York State Common Core Learning Standards for English Language Arts & Literacy

College and Career Readiness Anchor Standards for Reading

Subsections 1, 2	Key Ideas and Details
Subsection 4	Craft and Structure
Subsection 10	Range of Reading and Level of Text Complexity
Subsection 11	Responding to Literature

College and Career Readiness Anchor Standards for Writing

Subsections 2, 3	Text Types and Purposes
Subsection 4	Production and Distribution of Writing
Subsection 7	Research to Build and Present Knowledge
Subsection 10	Range of Writing

College and Career Readiness Anchor Standards for Speaking and Listening

Subsections 4, 5, 6	Presentation of Knowledge and Ideas
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College and Career Readiness Anchor Standards for Language

Subsections 1, 2	Conventions of Standard English
Subsection 3	Knowledge of Language

The Applied Learning Performance Standards

A5	Tools and Techniques for Working With Others
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New York City Science Scope & Sequence

7.1a, 7.1b

Human influences on the environment: positive influences.

7.1c, 7.2a, 7.2b, 7.2c

Human influences on the environment: negative influences.

7.3a, 7.3b

Human influences on the environment: decision making (risk/benefit).

LE 5.1d,e, LE 6.1a,b

Classify populations of organisms as producers, consumers, or decomposers by the role they serve in the ecosystem (food chains and food web).

LE 7.1b,c

Identify examples where human activity has had a beneficial or harmful effect on other organisms (e.g., deforestation).

LE 7.2b,c, LE 7.2d

Describe the way humans: depend on their natural and constructed environment; have changed their environment over time.

LE 7.2b,c, LE 7.2d

Identify examples where human activity has had a beneficial or harmful effect on other organisms (e.g., deforestation).

PS 3.1b,c

Observe and describe physical properties of objects using all of the appropriate senses: size, shape, texture, weight, color, etc. Determine whether objects are alike or different.

S1.1a,b,c

Formulate questions of scientific inquiry with the aid of references appropriate for guiding the search for explanations of everyday observations.

Standard 1–1.1a, 1.1b, 1.1c, 3.1, 3.2, 3.3

The role of scientific inquiry in studying biology.

Standard 1–1.2a, 1.2b, 1.3a, 1.3b, 2.1, 2.2, 2.3a, 2.3b, 2.3c, 2.4, 3.4a, 3.4b, 3.4c, 3.5a, 3.5b

The methods of science.

All About Composting

Learning Standards

Activity 9: Compost Balancing Act

New York State Common Core Learning Standards for English Language Arts & Literacy

College and Career Readiness Anchor Standards for Reading

Subsections 1, 2	Key Ideas and Details
Subsection 10	Range of Reading and Level of Text Complexity

College and Career Readiness Anchor Standards for Writing

Subsection 2	Text Types and Purposes
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College and Career Readiness Anchor Standards for Speaking and Listening

Subsection 2	Comprehension and Collaboration
Subsections 4, 6	Presentation of Knowledge and Ideas

College and Career Readiness Anchor Standards for Language

Subsections 1, 2	Conventions of Standard English
Subsection 3	Knowledge of Language

The Applied Learning Performance Standards

A1	Problem Solving
A2	Communication Tools and Techniques
A5	Tools and Techniques for Working With Others

New York City Science Scope & Sequence

7.1a, 7.1b

Human influences on the environment: positive influences.

7.1c, 7.2a, 7.2b, 7.2c

Human influences on the environment: negative influences.

7.3a, 7.3b

Human influences on the environment: decision making (risk/benefit).

ICT 5.2, IPS 1.1-1.4, IPS 2.1

Packaging and solid waste.

LE 3.2b, LE 7.1e, LE 7.2c,d, ICT 1.2, 1.4, 2.1-2.3, 4.1, 4.2, 5.1, 5.2, 6.1, 6.2, IPS 1.1-1.4, IPS 2.1

Environmental concerns: acquisition and depletion of resources; waste disposal; land use and urban growth; overpopulation; global warming; ozone depletion; acid rain; air pollution; water pollution; impact on other organisms.

LE 5.1d,e, LE 6.1a,b

Classify populations of organisms as producers, consumers, or decomposers by the role they serve in the ecosystem (food chains and food web).

LE 6.1c, ICT 5.1, 5.2

Renewable and nonrenewable sources of materials.

LE 7.1a,b

Describe the way that humans: depend on their natural and constructed environment; have changed their environment over time.

LE 7.1b,c

Identify examples where human activity has had a beneficial or harmful effect on other organisms (e.g., deforestation).

LE 7.2b,c, LE 7.2d

Identify examples where human activity has had a beneficial or harmful effect on other organisms (e.g., deforestation).

LE 7.2c,d, ICT 6.1, IPS 1.1-1.4, IPS 2.1

Environmental toxins: pesticides and herbicides; fertilizers; organic waste.

All About Composting

Learning Standards

Activity 10: Tracking Decomposition in an Outdoor Pile

New York State Common Core Learning Standards for English Language Arts & Literacy

College and Career Readiness Anchor Standards for Writing

Subsection 2	Text Types and Purposes
Subsection 4	Production and Distribution of Writing
Subsection 7	Research to Build and Present Knowledge

College and Career Readiness Anchor Standards for Speaking and Listening

Subsections 1, 2	Comprehension and Collaboration
Subsection 4	Presentation of Knowledge and Ideas

College and Career Anchor Standards for Language

Subsections 1, 2	Conventions of Standard English
Subsection 3	Knowledge of Language

New York State Common Core Learning Standards for Mathematics

Subsections 1, 2	Counting and Cardinality
Subsection 1	Operations & Algebraic Thinking
Subsection 1	Measurement & Data

The Applied Learning Performance Standards

A1	Problem Solving
A2	Communication Tools and Techniques
A4	Learning and Self-management Tools and Techniques
A5	Tools and Techniques for Working With Others

New York City Science Scope & Sequence

7.1a, 7.1b

Human influences on the environment: positive influences.

7.1c, 7.2a, 7.2b, 7.2c

Human influences on the environment: negative influences.

7.3a, 7.3b

Human influences on the environment: decision making (risk/benefit).

ICT 5.2, IPS 1.1-1.4, IPS 2.1

Packaging and solid waste.

LE 3.2b, LE 7.1e, LE 7.2c,d, ICT 1.2, 1.4, 2.1-2.3, 4.1, 4.2, 5.1, 5.2, 6.1, 6.2, IPS 1.1-1.4, IPS 2.1

Environmental concerns: acquisition and depletion of resources; waste disposal; land use and urban growth; overpopulation; global warming; ozone depletion; acid rain; air pollution; water pollution; impact on other organisms.

LE 5.1d,e, LE 6.1a,b

Classify populations of organisms as producers, consumers, or decomposers by the role they serve in the ecosystem (food chains and food web).

LE 6.1c, ICT 5.1, 5.2

Renewable and nonrenewable sources of materials.

LE 7.1a,b

Describe the way that humans: depend on their natural and constructed environment; have changed their environment over time.

LE 7.1b,c

Identify examples where human activity has had a beneficial or harmful effect on other organisms (e.g., deforestation).

LE 7.2b,c, LE 7.2d

Describe the way humans: depend on their natural and constructed environment; have changed their environment over time.

LE 7.2b,c, LE 7.2d

Identify examples where human activity has had a beneficial or harmful effect on other organisms (e.g., deforestation).

LE 7.2c,d, ICT 6.1, IPS 1.1-1.4, IPS 2.1

Environmental toxins: pesticides and herbicides; fertilizers; organic waste.

PS 3.1b,c

Observe and describe physical properties of objects using all of the appropriate senses: size, shape, texture, weight, color, etc. Determine whether objects are alike or different.

S1.1a,b,c

Formulate questions of scientific inquiry with the aid of references appropriate for guiding the search for explanations of everyday observations.

Standard 1-1.1a, 1.1b, 1.1c, 3.1, 3.2, 3.3

The role of scientific inquiry in studying biology.