

# Let's Build a Worm Bin!

Grades K-5

## Lesson Summary

Students set up a worm bin and learn the important role worms play in the process of decomposition and making compost.

## Overview

In this lesson, students will:

- Discuss the role of red worms in decomposition and waste reduction.
- Prepare a worm home.
- Measure worms and weigh worm food.

## Time 🕒

60-90 minutes to prepare. 40-60 minutes for the lesson.

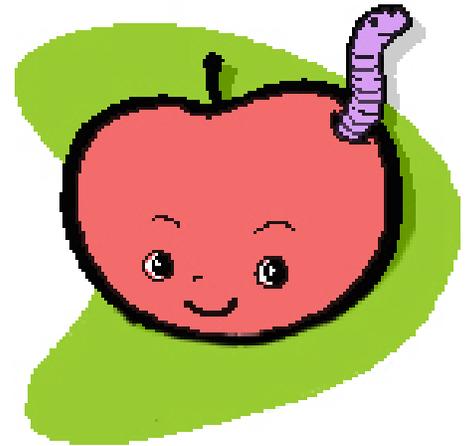
## Background

Composting with worms, also called *vermicomposting*, is the process of using Red Wiggler worms to transform food scraps into a nutrient rich fertilizer known as *castings*. Vermicomposting helps reduce the amount of waste going to the landfill, the amount of methane released into the atmosphere from landfills, and our dependence on chemical fertilizers.

Vermicomposting can be done inside or outside; is odorless if done correctly; and does not require a lot of labor or space. Building a worm home is simple. All that is needed is a bin, some worms, shredded newspaper for bedding, and organic material like leftover food scraps. Maintenance of the bin requires some monitoring and controlling, though not much.

Red Wigglers are commonly used in vermicomposting, because they are space and temperature tolerant, and they reproduce quickly. Most importantly, Red Wigglers can eat organic matter equaling half of their body weight every day.

Having a worm bin in the classroom is a fun and engaging learning experience and can reduce the amount of garbage your classroom generates. Vermicomposting is a great tool for teaching about habitats, nature's cycles, and the responsibilities associated with caring for living things.

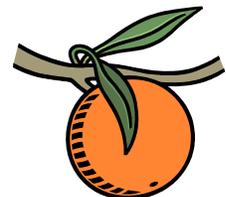


## Vocabulary

- Vermicomposting
- Red Wigglers
- Castings
- Fertilizer
- Compost
- Landfill

## Materials

- *The Dirt on Composting* and *Composting with the FBI* student fact sheets—1 per student
- Plastic storage tub and lid
- Red wiggler worms
- 10 sheets of newspaper
- Spray bottle of water
- 1/2 cup of food scraps chopped into small pieces (to prevent smell, use only plant-based food scraps!)
- Rulers
- Scale





### Preparation

- Read background information on first page
- Have students read: *The Dirt on Composting* and *Composting with the FBI* fact sheets. (for younger students, introduce relevant concepts from fact sheets)
- Copy *Record Sheet* and *Worm Menu* so that each student has one. See sample at end of lesson.
- Save a small amount of leftover plant-based foods from lunch. Cut into small pieces and keep in an airtight container.
- Poke breathing holes into lid of plastic tub.

### Pre-Activity Questions

Ask students:

1. What is a landfill? (*Big hole in ground where garbage is buried*)
2. What are decomposers? (*Creatures that live in the soil and break down organic matter into compost*)
3. What is compost? (*Crumbly, dark soil that helps plants grow*)
4. How does compost help plants grow? (*It provides nutrients*)
5. How does composting reduce the amount of garbage we make? (*Keeps organic matter out of the landfill*)
6. If “vermi” means “worm” in Latin, what does “vermicomposting” mean? (*Composting with worms*)
7. What do we know about worms? (*They live underground, they eat our leftover food, they can eat half their weight every day*)
8. What do worms eat? (*plant-based foods like fruits, vegetables and bread*)
10. Name some examples of plant-based food that you might have after lunch? (*Bread crusts, fruit peels, carrot tops*)
11. What happens to the leftover food after worms eat it? (*It gets digested and comes out of the worms’ bodies as “castings”, or compost which are like vitamins for the soil.*)

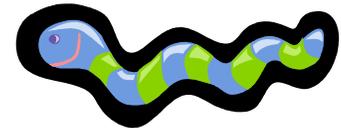
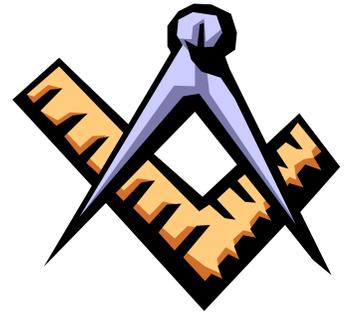


### Procedure

1. Explain that the class is going to keep worms as pets, so that students can observe decomposition.
2. Ask students what all animals need to survive? (*food, water, shelter, air*)
3. Explain how each need will be met in the worm bin
  - Shelter- bin and newspaper bedding
  - Food- leftover food scraps (*fruits, vegetables, and bread*)
  - Water- moistened newspaper
  - Air- air holes should be punched into the bin
4. Show students bin and explain that it will be the worm home.



5. Prepare the bedding.
  - Hand out half a sheet of newspaper to each student and have them tear into strips about ½” to 1” wide.
  - Place bedding in bin and spray with water bottle until it is about as moist as a wrung out sponge.
6. Pass out to students the *Record Sheet* and *Worm Menu* and ask students to fill out the menu. Older students can alphabetize this list. (*Worms can eat all plant-based foods like vegetables, fruit, and bread products. Although they can eat animal products like meat, cheese, and eggs, don't put those in worm bins because of the bad smell they will produce.*)
7. Students will now fill out the *Record Sheet*. Ask them to weigh and record the total amount of worms put into the bin so that they can compare it to the total weight of food put into the bin. Ask them to observe how long it takes for this initial food to decompose. Have them check every day or couple days.
8. Now it's time to add the worms and the food to the bin:
  - Place worms in the moist bedding near the bottom of the bin. Include soil from box of worms if available. Place a handful of food near worms and cover with newspaper.
  - Add dry shredded newspaper on top.
9. Let your students get to know their worms. Hand each pair of students a worm and ask them to carefully observe, describe, and measure the worm when extended to its full length. Develop a chart with students to record and compare lengths of 20 worms.
  - Younger students can visually compare longer and shorter worms.
10. For ongoing maintenance, feed the worms every three to seven days, always burying the food under paper. Do not overfeed. Add more paper as needed to cover food and soak up excess moisture.



### Discussion/ Questions

1. What do worms need to survive? (*shelter-bin; food-leftover lunch or snacks; moisture-dampened bedding; air- fluffed newspaper and air holes in bin*)
3. What did we learn about worms? (*They help break down leftover food into compost and reduce our garbage.*)
4. How do you feel about worms now that you know more about them? Do you like them? Why or why not?
5. What is the average length of the worms? How many worms are shorter than 2 inches? How many are longer?
6. How much do the worms weigh? How much does the food weigh?
7. Make a prediction of how long it will take the worms to break down the food.

### Extensions

- Have students make a collage of “worm food” cut out of magazines and newspapers. Ask students to sort foods into categories.
- Have students write a short story about “A Day in a Worm’s Life” or a conversation between two worms in the worm bin.



# A Visit to the Worm Doctor

Symptom	Causes	Remedy
<b>Strong, bad smell</b>	Not enough air circulation	Fluff bedding, make sure air holes are not blocked.
	Overfeeding	Feed worms less food and/or less often
	Improper food added	Remove animal products
<b>Fruit flies</b>	Food exposed	Bury food completely
	Too much food	Feed worms less food and/or less often
<b>Dead worms</b>	Bin too moist or dry	Adjust moisture or bedding levels
	Not enough food	Add more food
<b>Ants in bin</b>	Too dry	Add spritz of water
		Put sticky ant trap on legs of bin
		Put legs of bin in water
<b>Mites</b>	Too moist in bin	Avoid adding food with a lot of moisture



# Record Sheet

Date	Weight of Food	Type of Food	Weight of Worms	Length of your Worm

## Worm



## Menu

DO feed worms: Food from Plants 	DON'T feed worms: Food from Animals 
Apple cores	Hamburgers

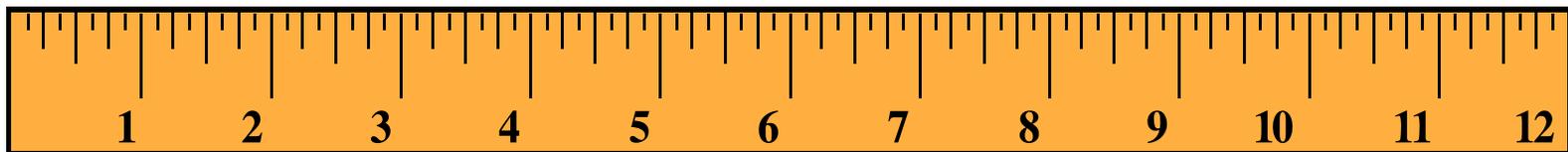
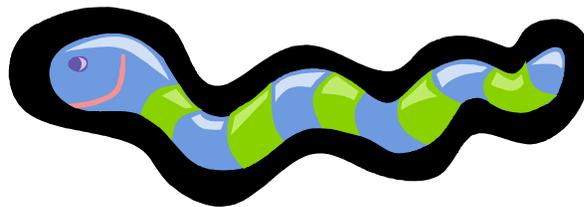
# How Long Are Worms?



Worm  
Length

5"																				
4"																				
3"																				
2"																				
1"																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

Worm #



# Let's Build a Worm Bin! CA Standards K-5



## Kindergarten

<b>Mathematics</b> ♦ A.1.1	Identify, sort, and classify objects by attribute and identify objects that do not belong to a particular group.
	♦ MG1.1 Compare the length, weight, and capacity of objects by making direct comparisons with reference objects.
<b>Science</b> ♦ 4d	Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept...students will compare and sort common objects based on one physical attribute.

### Abbreviations

**Language Arts:** R=Reading; W=Writing; LC= Language Conventions; LS=Listening/Speaking  
**Math:** N=Number Sense; A=Algebra; MG=Measurement/Geometry; S=Statistics/Data Analysis;  
 MR=Mathematical Reasoning



## Grade 1

<b>Mathematics</b> ♦ MG 1.1	Compare the length, weight, and volume of two or more objects by using direct comparison or a nonstandard unit.
	♦ S 1.1 Sort objects and data by common attributes and describe the categories.
<b>Science</b> ♦ 2	Plants and animals meet their needs in different ways. As a basis for understanding this concept:
♦ 2b	Students know both plants and animals need water, animals need food, and plants need light.
♦ 2c	Students know animals eat plants or other animals for food and may also use plants or even other animals for shelter and nesting.

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## Grade 2

<b>Mathematics</b>	
◆ N 6.1	Measure the length of an object to the nearest inch and/or centimeter.
◆ S 1.1	Record the numerical data in systematic ways, keeping track of what has been counted.
◆ S 1.4	Ask and answer simple questions relate to data representations.
<b>Science</b>	
◆ 4e	Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept...students will construct bar graphs to record data, using appropriately labeled axes.
<b>Language Arts</b>	
◆ R 2.7	◆ Interpret information from diagrams, charts, and graphs.

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## Grade 3

<b>Mathematics</b>	
◆ MG 1.1	Choose appropriate tools and units (metric and US) and estimate and measure the length, liquid volume, and weight/mass of given objects.
<b>Science</b>	
◆ 5	Scientific progress in made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept...students will:
◆ 5c	Use numerical data in describing and comparing objects, events, and measurements.
◆ 5e	Collect data in an investigation and analyze those data to develop a logical conclusion.
<b>Language Arts</b>	
◆ LC 1.9	Arrange words in alphabetical order.

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## Grade 4

<b>Science</b> ♦ 2c  ♦ 6b  ♦ 6e	Students know decomposers, including many fungi, insects, and microorganisms, recycle matter from dead plants and animals.  Measure and estimate the weight, length, or volume of objects.  Construct and interpret graphs from measurements.
<b>Language Arts</b> ♦ R 1.2	Apply knowledge of word origins, derivations, synonyms, antonyms, and idioms to determine the meaning of words or phrases.

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## Grade 5

<b>Science</b> ♦ 6  ♦ 6a  ♦ 6g	Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept...students will:  Classify objects in accordance with appropriate criteria.  Record data by using appropriate graphic representations (including charts, graphs and labeled diagrams) and make inferences based on those data.
<b>Language Arts</b> ♦ R 1.2	Use word origins to determine the meaning of unknown words.

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# The Dirt on Composting!

## Decomposers Help our Planet

What do millipedes, banana slugs, worms, and mushrooms have in common? They are all

**decomposers** or living things that eat **organic matter**. Organic matter includes pieces of plants and animals that were once alive and are now in a state of rotting or **decay**. This includes leftover food like orange peels, half-eaten sandwiches, and apple cores. When decomposers eat organic matter, they pass it through their bodies and break it down into **compost**.

Compost looks like dirt or **soil** and is the color of dark chocolate. It is crumbly and smells clean and fresh like the earth after it rains. Compost acts like a vitamin pill—it adds important vitamins or **nutrients** to the soil. Just like people need vitamins to stay strong and healthy, so do plants. When the soil is full of nutrients, more plants are able to grow. Compost can help produce more food for people in a natural and earth friendly way.

## Nature's Way of Recycling



Out in nature, decomposers live under logs, rocks, and leaves. They feast on organic matter and leave behind nutrient rich compost for meadows, forests, and mountains.

This is nature's way of recycling!

Decomposers can live in many different places, including our backyards. Since decomposers help in a process called **composting**—where the natural process of decay is sped up—some people create

homes for decomposers by layering leftover food and yard clippings in piles outside. These are called **compost piles** and with all the different layers, they can look like backyard lasagna!

## Earth Builders



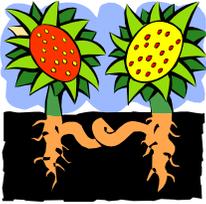
Decomposers living in the compost pile—such as worms and pill bugs—have important jobs. They help keep the pile warm, they dig, they chew, and they digest our leftover food into compost. For instance, earthworms pass food through their bodies and leave behind **castings** or nutrient rich pieces of crumbly compost that provide plants with vitamins. These castings or compost can be added to houseplants, gardens and even to farmland where farmers grow our food.

## Food Comes from the Earth



Although the earth is large, only a fraction of our land can be used for growing food. This land is called **topsoil**. Topsoil is the top six inches of soil that contains nutrients that plants need to grow. Most topsoil is covered by roads, buildings, houses, and parks. Some topsoil is unusable in areas like mountains that are too rocky or steep to grow food crops. Other times, topsoil is blown away by the wind or washed away by rain. In other situations, too much farming in one area or **over-farming**, has drained or **depleted** important nutrients from the soil. Because of this, only a small amount of topsoil is left for growing food to feed the six billion people on Earth.

## Happy Topsoil



Compost keeps our topsoil healthy in different ways. By making the soil moist, compost adds form or **structure** to the topsoil so it doesn't blow away with the wind or wash away with water. Compost also **aerates** or adds air to the soil, which allows water to sink in and reach plant roots.

By providing moisture, air and nutrients to the soil, compost makes topsoil **arable**, or able to grow food. If you have ever dug in the dirt, you know it is difficult to do when the dirt is dry and hard. Since most plants can't grow in dry, hard dirt, compost adds air and water to topsoil making it soft and moist. It is much easier for plants to grow in this arable soil.

## Garbage Graveyards



Composting leftover food not only adds nutrients and structure to the soil, it also saves space in the **landfill**. A landfill is a big hole in the ground that is filled up with trash. Landfills don't have room for air or water, because all the trash is crushed down to make space for more trash. Without air and water, decomposers can't survive, so they can't break down the food that ends up there.

Landfills are like graveyards for garbage, once garbage goes there, it stays there for a very long time. In fact, scientists estimate that it takes about eighteen years for one corn cob to decompose in a landfill instead of only a couple of months in a compost pile! When food is composted, it breaks down much faster and recycles itself into new life instead of sitting trapped in the landfill for many, many years.

## Trash Gas



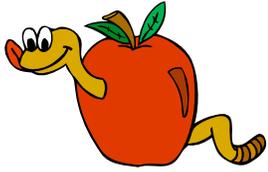
Landfills are more than just garbage dumps; they also leak harmful gases into the air that are changing the temperature of the planet!

When leftover food is trapped with no air, a gas called **methane** is created. Methane is a powerful **greenhouse gas** that traps heat from the sun. This is important because it keeps our planet warm enough so we can survive. However, if too many greenhouse gases are created, then too much heat gets trapped in the **atmosphere** or layer of air surrounding the earth. Over time, this raises the average temperature of the planet and creates serious changes in our weather. This is called **global warming** or **climate change**. Most scientists agree that global warming is already happening due to human activities like burning oil and gasoline. Dumping garbage in landfills—especially food waste—is another human activity that is leading to global warming. Since landfills don't have much room for air, a lot of methane is created and released from them. In fact, landfills are the largest source of methane in the country! Fortunately, we can reduce the amount of methane produced just by composting our food instead of tossing it in the trashcan.

## Let's Help Nature!



All of Earth's creatures depend on healthy topsoil to survive. Composting is nature's way of recycling leftover food into valuable compost. By composting whenever possible, we can add nutrients to the topsoil, save space in landfills, and help prevent global warming. Let's help nature, let's compost!



# Composting with the FBI!

## Vitamins for the Earth



Planet Earth is home to over six billion people. No matter who we are or where we live, every human being needs food to survive. From pickles to pizza, all food comes from the earth! In order to grow food, we need **topsoil**, which is the top six inches of the earth's soil. One way to keep topsoil healthy is to add **compost**. Compost looks like dirt. It is dark like chocolate, smells fresh like rain, and contains many **nutrients**, or vitamins that help plants grow. Nature creates compost with help from the FBI!

## The FBI hard at work



The **FBI** or **Fungus, Bacteria,** and **Invertebrates** are also called **decomposers**. Decomposers break things down. They help turn **organic matter** like decaying plants and animals, into vitamin rich compost. Compost is created when the FBI eat and digest items such as old bread, dried leaves, and banana peels. The FBI decompose food in different ways.

## F is for Fungus



When bread sits around for too long, it starts to grow a fuzzy white or green **mold**. This is the work of **fungus**, a group of **organisms** or living things that include mold and mushrooms. Like our bodies, mushrooms produce powerful chemicals that break down food. These chemicals are called **enzymes**. As mushrooms release enzymes, they are able to dissolve organic matter around them.

## B is for Bacteria



Zillions of bacteria are all around us! They are so small that we cannot see them without the help of a microscope. While some bacteria make us sick, other bacteria are used in medicine to keep us healthy. Bacteria keep our eyelashes clean, give yogurt its sour flavor, and even help bread rise. Bacteria also help make compost. For instance, one type of bacteria warms the compost pile so that other bacteria can survive. As bacteria break down organic matter, nutrients are released into the compost.

## I is for Invertebrates



Invertebrates are animals that do not have a backbone. They wriggle, crawl, and slide their way through the compost pile. Invertebrates break down organic matter by chewing and grinding. Slugs, snails, spiders, worms, beetles, mites, ants, and sow bugs are some important members of the invertebrate work force.

Each invertebrate plays a different role in the compost pile. For example, not only do sow bugs eat decaying leaves, they also carry bacteria and fungi around the pile on their rounded backs. They're sort of like taxi drivers! Snails and slugs chew rotting material into pieces small enough for other decomposers to eat, and millipedes and beetles feed directly on decaying plants and animals. Worms have a different role to play. As worms wriggle and dig through the compost pile, they **aerate**, or add air to the pile. This air helps keep the FBI alive.

## Let's Help Nature!



Nature is constantly filled with things that die, decay and get born anew. For instance, a dead redwood tree decaying on the forest floor provides a perfect home for a new redwood sapling to grow. This shows nature's ability to recycle organic matter. We can help nature recycle our own organic waste by composting at home or at school. Instead of throwing leftover food into the trashcan, we can compost it! The rich compost we create can then be used for houseplants, gardens and farms. There are several ways to compost:

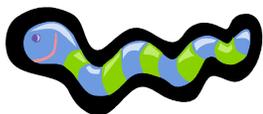
### Outdoor Pile



Many people create compost piles in their backyards that look like compost cake!

That's because outdoor piles have layers of different materials like kitchen scraps and yard waste. Piles are stirred with a shovel to bring air to the decomposers. As organic matter breaks down and decomposers move around, the pile can become hot. Some compost piles get so hot that steam comes out when they are stirred! Keeping the pile as moist as a wrung-out sponge helps decomposers survive and do their job well. It can take anywhere from about a month to a couple years to create finished compost, depending on what is put in the pile and how often it is stirred. Animal products like meat, cheese and eggs should not be put in outdoor piles because they can attract **rodents** like rats. They can however be put into the green cart.

### Composting with Worms



Worms are composting champions! One way to compost with worms is to create a worm bin that can be kept in your

classroom. Worms scoop food up with their shovel-like mouths and pass it through their bodies. What goes into a worm as a banana peel comes out the other end as crumbly compost called **castings**. Castings look like coffee grounds and are full of vitamins. Worms are **vegetarians**, which means they do not eat meat. In fact, worms do not even like to eat things like cheese or yogurt that also come from animals. If you start a worm bin, be sure to only feed them fruits, vegetables, and other **plant-based** items.

### Using the Green Cart



San Francisco is the first city in the nation where the garbage company collects and composts peoples' food waste. San Francisco residents can now put yard waste and leftover food—including all animal products—into a big green cart and place it on the curb to be picked up along with other items to be recycled. The contents of the green cart are taken to a composting facility and after three months the organic waste is transformed into compost and is ready for use. Farmers in the area then buy the compost to use on their organic farms, which grow food to feed people. By placing pizza crusts, apple cores, and banana peels in the green bins, the people of San Francisco help create new food from old food!

### The FBI Needs You!



The FBI are amazing creatures that turn waste into compost. This natural **fertilizer** builds healthy topsoil and helps protect our planet's food supply. You can assist the FBI by building a compost pile or a worm bin, and by using the green cart at home or school if you live in San Francisco. Let's help the FBI. Let's compost!