

Building a Worm Bin

LESSON 4

Objectives

The students will:

- Learn about a simple organism (a worm) and its environment.
- Follow directions in feeding worms.
- Observe stages of a worm's life cycle.
- Discuss how worms affect plant life.



Materials

- Materials for a worm bin (see pages 4-5).
- "How to Build and Maintain a Worm Bin."

Procedure

1. Discuss how animals help people. Ask students for ideas on how animals help people. In particular, ask them how worms help people. (Worms help plants grow and people eat plants.) Worms help plants grow by:

- Eating food waste.
- Recycling the food waste into nutrients (fertilizer) for the soil.
- Digging holes in the ground to spread air and water through the soil.

Tell the students that worms help turn our leftover food into nutrient-filled soil. After the worms digest the food scraps, they leave their manure, called "castings," in the soil. Their castings are filled with nutrients that can help plants grow. Without worms, the soil would not be as healthy and plants would have more difficulty growing. Without plants, animals and people wouldn't have food to eat.

Tell your students you are going to build a home for worms, and keep the worms as helpers in your classroom. The worms will recycle food waste into fertilizer for a garden.

2. Build a worm bin. Building a worm bin is simple and fun! It's also a fantastic way to teach kids about basic issues in life science. A worm bin is a clean and contained activity that you can easily do indoors. Through it all, students learn to be respectful of the earth and to care for the environment.



National Standards Addressed



LIFE SCIENCE

Characteristics of organisms.

- Needs of organisms.
- Structure and function.
- Behavior and senses.

Life cycles of different organisms.

Organisms and their environments.

- Organisms' effects on their environment.

Properties of earth materials.

- Soils



Procedure (continued)

Follow the instructions on pages 4 and 5 on how to build a worm bin. You will need to use red wiggler worms. You can buy them through Internet sites and have them sent to you through the mail.

It will take four to six months before you can harvest your first worm castings (the material used as fertilizer). You can use the worm castings in a school garden or in a container garden in your classroom or distribute them to the students to take home and use in their home gardens.

3. **Observing your worms.** Use your worm bin to teach students how to make scientific observations about living organisms. Some activities you can do include:

- Measure the worms when you first get them, and over the next few weeks. Keep a chart to see how the worms grow. After more babies are born from cocoons, measure the adults and the babies to see the contrast in size.
- Keep an eye out for cocoons. When you find some, carefully take them out of the worm bin to measure them and make drawings of them. Discuss how there are approximately three eggs inside each cocoon, and each egg holds a baby worm. Carefully return the cocoons to the soil.
- Observe how worms move. Take a worm out of the bin and put it on a moist paper towel. Watch it move. Have students suggest different words to describe their movement. Put the worm back into the bin after a few minutes to keep it healthy.
- Observe worms and dirt. Take a moist paper towel and make a narrow, winding trail of soil on it. Place a worm on the towel and see whether or not it follows the soil trail. Ask the students to consider why it does this or not. Put the worm back into the bin when you are done.
- Observe how worms react to dark. Place a worm on a moist paper towel. Cover part of the towel with a dark piece of paper. Does the dark area attract the worm or not? Put the worm back into the bin when you are done.
- Observe how worms react to light. Place a worm on a moist paper towel. Darken the room. Shine a flashlight from one direction onto the worm. How does the worm react to the flashlight?
- Observe how worms react to cold. Place a worm on a moist paper towel. Place one ice cube near the worm. As it melts, the cold spreads on the paper towel. How does the worm react to the cold water? Place the worm back into the bin.

4. **Teaching with your worm bin.** Here are ideas you can discuss with your students as you create the worm bin, take care of the worms over several months and harvest the worm castings to use as fertilizer.

- What is the worm's environment like? How does the worm's body match well with its home?
- How do plants get food (nutrients) from the soil?
- What are the basic needs of the worm (e.g., air, water and food)? Any animal's environment must meet its basic needs or it will not be able to survive. How does the worm bin meet the worm's basic needs?
- Keep a record of observations about the bin. What changes do you see in the appearance and volume of the bedding? (See "How to Build and Maintain a Worm Bin" under the "Changes You'll See in the Bin" section for more information.)
- How many weeks does it take after you release the worms into the bin for you to see cocoons? Take the cocoons out of the bin and make drawings of them, then put them back into the bin. What observations can you make about the cocoons?
- Plants also have basic needs. Identify the needs of plants and discuss how some

Procedure (continued)

- environments can meet these needs and how other environments cannot.
- Taking care of the soil: Soil, worms and people all need healthy nutrients (food) to survive. Soil can turn healthy or sick depending on what goes into it. Identify some human activities that make the soil healthy or sick.
- Recycling: Composting with a worm bin is a great way to recycle! Worms take your food scraps and turn them into something very useful. What are some other great ways to recycle?

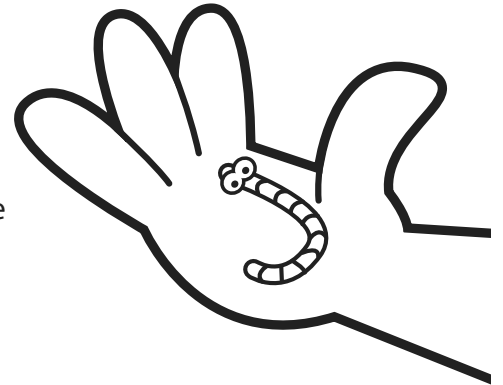
Extension Activities

These are activities that are fun and educational. They relate to the theme of “The Chicken and the Worm” and help kids learn letters, numbers, colors, etc.

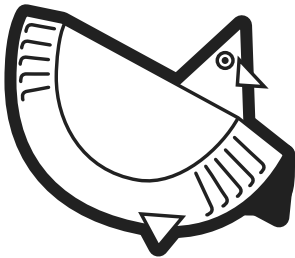
Teaching Letters

Do you know one other thing worms are useful for? Worms can help you learn your letters! Worms are wiggly creatures that like to fold themselves up in different shapes. Sometimes you can see them in the shape of letters!

- If you have a worm bin, take a worm and put it in the palm of your hand. Watch it for a few minutes and see what shapes it moves itself into. Do any of them look like letters?
- If you don't have a worm bin, take some brown pipe cleaners. Pretend each pipe cleaner is a worm. What letters can you shape the worm into? Now try to make some letter shapes with your body!



Paper Plate Chicken



1. Take a paper plate. Write each student's name on the top side of the plate. Then use paint to decorate the bottom side of the plate. Encourage students to use a pattern to decorate the plate.
2. Let the plate dry, then fold it in half so painted side is on the outside.
3. Cut a large triangle out of one color of construction paper. Cut three smaller triangles out of a different color of construction paper.
4. Glue or staple the large triangle to one side of the folded edge of the paper plate. This will be the head. Draw an eye or glue a googly eye on each side of the head.
5. Glue one smaller triangle to the head. This will be the beak.
6. Glue the two other small triangles to the bottom of the rounded edge of the paper plate. These will be the feet.
7. Your paper plate chicken should be able to stand up on its own.

Creating a Menu for the Worm Café

“Can we feed this to the worms?” This is a question you'll get all the time when you have a worm bin in class. Have your students create a picture menu that you can place on or above your worm bin.

Your students can create the menu by cutting out pictures of food from magazines and creating a collage. Or the students can draw pictures of the foods and paste them on paper in whatever menu format you like. Be creative and encourage the children's artistic expression! The menu will serve as a reminder to pre-readers and all young children of what sorts of food the worms can eat.

Painting with Worms

Materials:

- Cooked spaghetti noodles
- Various colors of paint
- Shallow bowls to pour paint in
- Black or brown construction paper (to represent soil)

This is a great fine motor activity for young children. The noodles represent the worms, and the children can wiggle the noodles on the paper to represent the movement of the worms. This activity fires up a child's imagination to consider what it might be like to be a worm underground.

Cook enough noodles so each child has a small handful to work with. Cover the floor with newspaper and have the students wear smocks or clothes they can get paint on. Put ¼ inch of paint in a bowl, using separate bowls for each color. Have the children dip a noodle into the paint, then place the noodle on the paper and wiggle it around to imitate the movement of a worm. Have children use a new noodle for different colors of paint. Don't let the children eat the noodles or the paint!

Songs to Sing and Learn

Use some well-known tunes to sing a repetitive chorus combined with statements that students come up with about new things they have learned about worms. Have students move like worms while they sing. For example:

"Mister Worm"

(sung to the tune of "Frère Jaques")

Refrain:

Mister Worm
Mister Worm
How are you?
How are you?

Verses (make up verses based on facts that students offer):

Worms like to wiggle
Worms like to wiggle
Yes they do
Yes they do

Worms don't eat junk food
Worms don't eat junk food
No they don't
No they don't

Worms eat newspaper
Worms eat newspaper
Yes they do
Yes they do

Babies come from cocoons
Babies come from cocoons
Yes they do
Yes they do

Worms eat food scraps
Worms eat food scraps
Yes they do
Yes they do

Worms have mouths
Worms have mouths
Yes they do
Yes they do

Worms breathe through skin
Worms breathe through skin
Yes they do
Yes they do

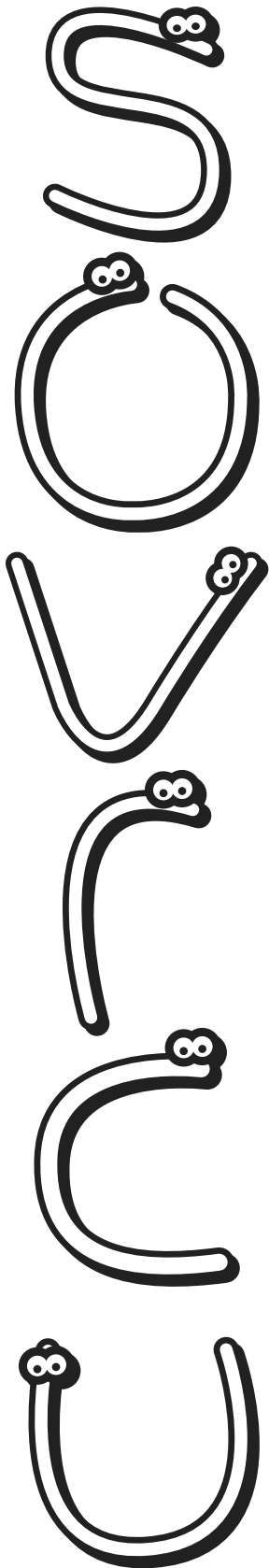
Worms don't have eyes
Worms don't have eyes
No they don't
No they don't

Worm poop helps plants grow
Worm poop helps plants grow
Yes it does
Yes it does

Match the Worm to the Letter Shape

Draw a line connecting the worm shape and matching letter.

Student's Name _____



c
o
r
s
u
v

Links To Heifer International

Vermiculture Projects Around the U.S.

Garden projects are great ways to grow organic food, provide ways for families to supplement their incomes and food supplies, and provide training in entrepreneurial skills for youth. Since garden projects do not require large areas of land, they can be carried out in urban areas as well. Heifer International supports garden projects across the U.S., including many in high-density urban areas where youth have little other opportunity to spend time close to nature. Teaching about vermiculture and the many benefits of organic fertilizer is an integral part of these garden projects. To learn more details about these projects and to see if there is a garden project near you, look up vermiculture projects on www.HeiferEducation.org.



Children's Questions about Worms

Here are some questions that kindergarten kids had after observing worms:

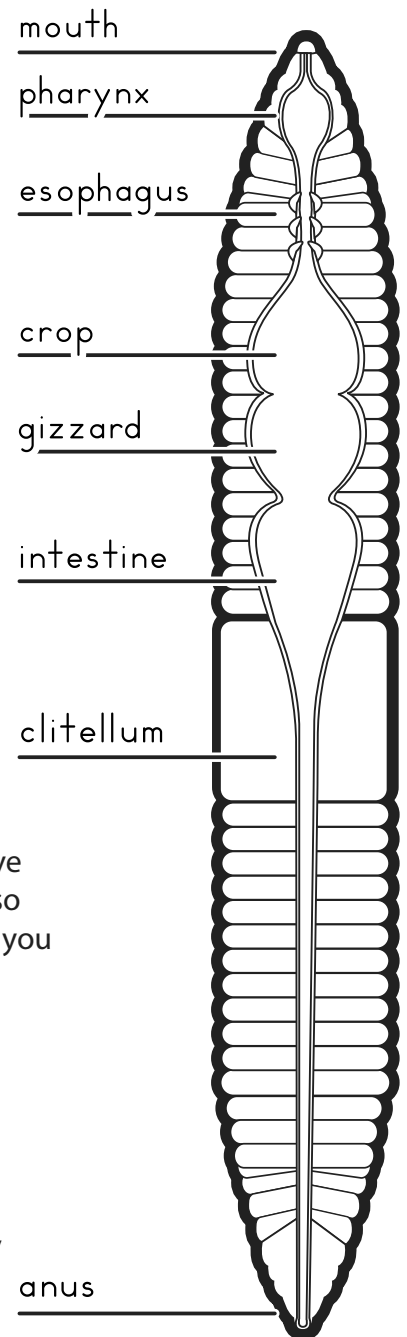
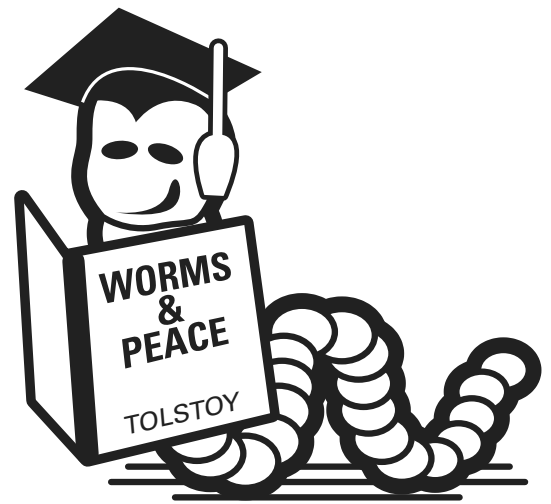
- **What do worms like to eat?**
Worms like to eat food scraps. Some of their favorites are fruit and vegetable peels, apple cores, and eggshells. They also like to eat shredded newspaper.
- **Do worms have legs?**
Worms do not have arms or legs, but they do have bristles on their body that they use to grip the soil when pulling themselves forward.
- **Why can't you hold worms for a long time?**
If you hold a worm too long in the open air, its skin could dry out. Then it wouldn't be able to breathe and it would die. So take a worm out to look at it for a minute, but then put it back in the soil!
- **What are worm castings?**
Worm castings are worm manure (poop). After worms eat their food, they poop out what they cannot use, and this is called worm castings, or worm poop.
- **Why do worms have their mouths where they wiggle?**
Worms have two ends; we can call them a head and a tail end. The mouth is at the head end. Every part of the worm's body is the wiggly part. The worm wiggles around to find food to put into its mouth to eat!
- **Do baby worms like to crawl?**
Worms don't crawl like human babies. Instead they wiggle. All worms wiggle in order to move. They wiggle to get closer to their food to eat, and to get away from other animals that might want to eat them!
- **Why do worms always have to wiggle?**
Wiggling is the way worms move from place to place. If you didn't have feet or legs, you'd probably have to wiggle to get somewhere, too. Can you think of other animals that wiggle to move? They probably don't have feet, either.
- **Why do the babies come out of the same cocoon?**
To make baby worms, the parent worm lays three or four eggs inside of a cocoon. The eggs stay in the cocoon for protection while the babies are growing. When they are ready to come out, the baby worms come out of the eggs and break through the cocoons.
- **What do worms drink?**
Worms drink water. In fact, that's all they need to drink. And they don't need very much. Worms get all the water they need from the soil and from the food scraps you put in their bin.

WORM FACTS

- There are over 2,700 species of worms.
- Worms do not have arms or legs.
- Worms do have a head (anterior) end and a tail (posterior) end.
- Worms do not have eyes, but they can sense light from their anterior end.
- Worms breathe through their skin. Their skin must stay moist or else they won't be able to breathe through it, and they will die. But worms can't get too wet or they will drown.
- Worms are hermaphrodites. This means every worm has both male and female reproductive organs. But they still need to find a mate in order to reproduce. All worms carry eggs, and they exchange sperm in order to fertilize the eggs.
- Worms lay their eggs in a cocoon and release the cocoon into the soil or bedding. Baby worms hatch from the eggs in the cocoon.
- One pound of red wigglers consists of about 800 to 1200 worms.

How the Worm Turns (The Worm's Digestive System)

- I have a mouth, but no teeth!
- I push the pharynx (throat) out of my mouth to grab food, then I pull it all back inside me. I wet the food with saliva.
- I push the food down the esophagus and into my crop. The crop works as a storage area for my food.
- Inside my crop I have a gizzard. The gizzard muscles use stones I have swallowed to grind up the food into small particles. The stones are so small that they are hard for humans to see. They come from the soil you added into the bin and work much like teeth to tear up the food.
- The food travels into my intestine. Here, digestive liquids break the food particles down even further. The nutrients from the food then enter my bloodstream.
- The parts of the food that my body can't use then go through my anus and come out as poop, otherwise known as worm castings. My worm castings still have lots and lots of nutrients in them.



How to Build and Maintain a Worm Bin

These are directions for building a worm bin that can hold one pound of worms. You can always build a larger bin for more worms, or build multiple bins.

The Bin

Buy a bin to keep your worms in. The bin should be:

- Plastic and come with a tight-fitting lid.
- Opaque (not see-through), because worms do not like light.
- 8-14 inches deep.
- Surface area (the area of the lid) should be at least one square foot per pound of worms.

Drill air holes into your bin.

- Drill $\frac{1}{4}$ inch holes in the lid evenly spaced, about five inches apart.
- Drill $\frac{1}{4}$ inch holes at the top of the sides of the bin (do not fill the bin above these holes).
- Drill $\frac{1}{4}$ inch holes one inch from the bottom of the bin. Space these holes about five inches apart. These holes allow for excess water to drain out in case your students put too much water in the bin.

The Bedding

Use shredded newspaper (no colored inks or glossy paper):

- Tear newspapers into strips approximately one inch wide and six inches long.
- Put the newspapers in a large plastic garbage bag, slowly add water one cupful at a time. Stop when the newspapers are wet, but not soaking. Let the newspapers sit in the water overnight. By the next day, the moisture of the newspapers should be like that of a wrung-out wet sponge.
- Put the newspapers into the bin.
- Add two handfuls of soil from outside (do not use potting soil!) and mix it in. The outdoor soil adds grit to the bedding that the worms will use to grind up their food.
- Fluff up the bedding to allow air flow. This prevents the bedding from sticking together and allows the worms to crawl through it easily.

Maintenance of the Bedding

- The bedding must always remain moist. Mist it with water at least once a week so that the moisture is like that of a wrung-out sponge.
- Fluff the bedding every so often to maintain airflow.
- Make sure the air holes in the bin are not blocked.
- Add fresh bedding every three months or so. Always keep at least a one-inch layer of fresh bedding over the worms and the food.

The Worms: Red Wigglers

Not any worms will do! For a worm bin, you will want to use red wiggler worms. These are different from the earthworms you will find in your garden.

You can find and purchase red wigglers on the Internet. Expect to pay approximately \$40 per pound of red wigglers. The company will mail you your worms. When your worms arrive, make the bedding and place it into the bin. Then release the worms into the bin. It is fun to watch them wiggle down into the bedding, exploring their new home.

Why Not Earthworms?

Red wigglers (*Eisenia fetida*) are better suited to worm bins than earthworms. Red wigglers are smaller, and thus content to live in smaller quarters. Earthworms are larger and need more space than a worm bin provides. Also, red wigglers enjoy room temperatures, but earthworms prefer colder temperatures that you find outside deep in the soil. Finally, red wigglers reproduce quickly, and thus can turn the food scraps into fertilizer faster than earthworms.

Feeding Your Worms

What kind of food? Worms need healthy, nutritious food. They are really quite easy to please – feed them primarily vegetable and fruit scraps cut into small pieces (approximately four cm x four cm). Have your students help you decide what food is okay to put into the bin, and what is not. Be sure to bury food scraps under a few inches of soil to avoid attracting insects to the bin.

Here are some don'ts when it comes to feeding worms:

- Do not leave the food on top of the bedding. Always bury it under a few inches of the bedding. Also, put the food in different places in the bin, not just in one area.
- Worms are vegetarians - no meat and no fish.
- Worms don't eat dairy foods.
- Avoid oily foods.
- Don't feed them junk food!
- Feed them only limited amounts of citrus.
- Don't put in rotten food – just fresh food.
- Don't put in big chunks of food – break it down into smaller pieces.

How much food?

One pound of worms will eat about ½ pound of food scraps per day, or 3-4 pounds per week. Just watch carefully how much food is left in your bin. If you are feeding the worms too much, there will be rotting food scraps in your bin. Remove the rotting food and feed them a little less.

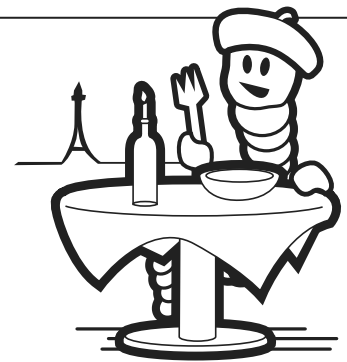
Over time, as the worms have babies, you will have more mouths to feed in your worm bin. Thus, you will have to provide slightly more food.

WARNING! If you put in more food than the worms can consume, the food will rot and the result will be an inhospitable environment for the worms. If you notice large amounts of rotting food that are not being consumed, decrease the amount of food you are putting in the bin.

The Worm Café

A WORM'S FAVORITE FOODS

- | | |
|----------------------------|---|
| • Apple peelings and cores | • Eggshells |
| • Beans | • Flowers |
| • Banana peels | • Lettuce |
| • Biscuits | • Melon rinds |
| • Carrots | • Oatmeal |
| • Cabbage | • Onion peels |
| • Celery | • Paper napkins and towels |
| • Cereal (not sweetened) | • Pizza crust |
| • Coffee grounds | • Potato peelings |
| • Coffee filters | • Tea leaves and tea bags
(remove any staples) |
| • Cornmeal | |



Be sure not to use too much acidic food.

- | | |
|----------------|---------------|
| • Grapefruit | • Lemon rinds |
| • Orange rinds | • Tomatoes |

Where to Keep the Bin

The plastic bin is highly portable. You can move it to different places, but store it at room temperature and out of direct sunlight. You can store this bin under a desk, in a closet, on a shelf – lots of places! Remember, you will have to feed the worms at least once a week, so keep it accessible.

Changes You'll See in the Bin

Over the next few months, some changes you will see include:

- After six weeks, the bedding should look darker, and it should take up less volume. (At this point you need to add new bedding. Do not remove old bedding - leave it in place).
- You will see cocoons that the worms have laid. These cocoons contain eggs.
- It will take four to six months before you will get your first harvest of worm castings.

Harvesting the Castings

How do the worms create fertilizer? The worms digest the food scraps that you put into the bin, their bodies use what they can and the waste comes out as worm castings. These worm castings are the valuable fertilizer that adds rich nutrients to the soil. Plants, in turn, use these nutrients to grow.

You will need to harvest your worm castings every three to four months. There are multiple ways to harvest the worm castings, but this is the simplest:

- Most of the uneaten food, bedding and worms will be in the top 1/3 layer of the bin. Remove this top 1/3 layer (including the worms) and put it aside momentarily.
- Remove the rest of the material from the bin. This is primarily the worm castings that you use as fertilizer.
- Put the top 1/3 of the materials (including the worms) back into the bin.
- Restock your bin with more moist bedding and some handfuls of soil from your garden.
- Some worms may get into your worm castings pile. Try to return most of them into the worm bin.