

# Worms

## Overview

In this exercise, students working in pairs will build a habitat for earthworms. They will feed and water their worms, observe their behavior and, if they keep them long enough, they should see their population increase. Worms play the role of decomposers in the cycling of matter and energy flow through ecosystems. This exercise is presented first in the series because it is a long-term project.

## North Carolina Standard Course of Study

Competency Goal 4: The learner will investigate the cycling of matter.

4.01 Describe the flow of energy and matter in natural systems.

- Energy flows through ecosystems in one direction, from sun through producers to consumers to decomposers.
- Matter is transferred from one organism to another and between organisms and their environments.
- Water, nitrogen, carbon dioxide, and oxygen are substances cycled between the living and non-living environments.

4.02 Evaluate the significant role of decomposers.

7.02 Investigate factors that determine the growth and survival of organisms including:

- light
- temperature range
- mineral availability
- soil/rock type
- water
- energy

## Textbook References

### McDougal Littell

These concepts are covered in Unit D, Chapter 1—energy flow in Section 1.2 (pp 16-21) and cycling of matter in Section 1.3 (pp 22-29).

### Prentice Hall

These concepts are covered in Chapter 12—energy flow in Section 12.1 (pp 420-425) and cycling of matter in Section 12.3 (pp 432-437).

## Background

Rather than rewrite what has already been written, we suggest you read *Recycle with Earthworms: The Red Wiggler Connection* (Grossman and Weitzel, 1997), included in your kit. This booklet is an easy read and is an excellent source on red wiggler worms

and how to care for them. As the students work through the unit, use opportunities that arise to discuss things like mineral and elemental composition of soils, natural cycles of matter, the important roles worms play in aerating the soil and the decomposition of matter, and what would happen if these processes did not occur.

## **Materials**

\*Materials to be supplied by the teacher or the students are marked with an asterisk.

### **Materials for the teacher**

- Ticket for ordering worms
- Utility knife

### **Materials for small groups**

- Bedding material—use one of the following (to be purchased with the Lowe’s Home Improvement Center gift card supplied in the kit):
  - compost and manure
  - mushroom compost
  - organic humus
  - peat moss (aka sphagnum moss)
  - WARNING—avoid products that contain fertilizer or ‘seed starter’
- Cornmeal
- Spray bottle
- \*Tub to mix worm bedding
- \*Newspaper to be shredded (enough to shred a volume approximately equal to the peat moss)
- \*Water

### **Materials for each pair of students**

- Instruction sheets for preparing worm homes (black line masters at the end of this exercise)
- 1 plastic screen
- 1 rubber band
- 2 sheets of black construction paper
- 1 spoon, plastic
- Cornmeal, 1 heaping spoonful
- 15 red wiggler worms
- Rubber gloves for students who prefer to use them
- \*2 clean 2-liter soda bottles
- \*Tape
- \*Scissors

## **Preparation**

- Directions for preparing worms habitats:
  - Each pair of students will need two 2-liter plastic soda bottles. These bottles must be cleaned and rinsed thoroughly several times (no sticky soda or

detergent residue, please). They should then be cut according to the following diagrams. An adult should start each cut with a sharp blade, and then the students can finish the job with scissors.

- Prepare section A by removing the base at the ‘hip’ of a 2-liter bottle (Figure 1). When turned upside down, this will be the main chamber where the worms will live. Recycle or discard the section marked x.

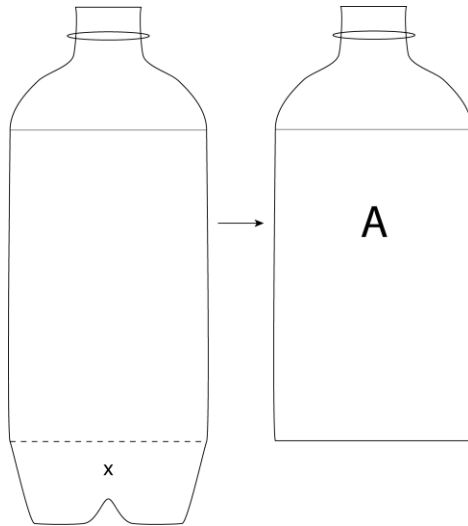


Figure 1. Cutting a two liter bottle for section A.

- Cut section B 15 cm from the bottom of a second bottle (Figure 2). This will become the base of the worm habitat. Recycle or discard section ‘x.’

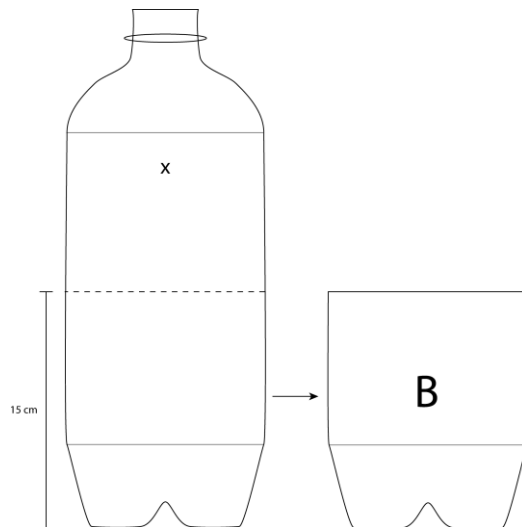


Figure 2. Cutting a two liter bottle for section B.

- To assemble the worm habitat (Figure 3), cover the mouth of A with a piece of screen and hold it in place with a rubber band. Then turn section A upside

down and insert it into section B. The screen will keep worms from escaping through the bottom of the habitat.

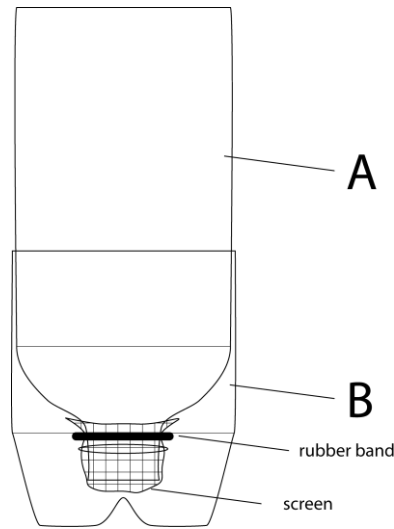


Figure 3. Worm habitat assembly.

- Add bedding (with strips of newspaper mixed in), corn meal ('starter' food for the worms), and the worms themselves. Then wrap the whole habitat with dark construction paper to keep light from penetrating. The top should be left open and uncovered.

## Procedure

- Students prepare worm homes according to directions.
- Order the worms using the ticket supplied with the kit, so that they will arrive **after** the bottles are prepared.
  - Plan ahead so that you know when you want your worms to arrive.
  - The ticket supplied is prepaid for one use only.
  - Follow the directions on the ticket. If you fax the form on a Monday or Tuesday, you should receive your worms by the end of the week. (This was true at the time this teachers guide went to press.)
- The day the worms arrive, students prepare a mixture of roughly equal parts bedding material and newspaper shredded into 1" strips. Students can work in small groups to complete this.
- Add water so that the mixture, when compressed by hand, forms a ball. The ball should be damp, but it should not drip.
- Fill the worm home with this bedding to roughly 2" from the top. (Be sure the screen is in place before adding the bedding.)
- Gently mix into the bedding one heaping spoonful of cornmeal.
- Add 15 worms. **Worms should be handled as little as possible and with moist/wet hands to keep them from drying out.** Worms breathe and excrete through their skin, so it's important to keep their skin 'happy.' (Note: the worms

should be kept in the dark until needed and then covered immediately after addition as they are very light sensitive.)

- Cover the sides of the worm home with a removable sleeve made by taping together two sheets of black construction paper, leaving the top open.
- Give them their first feeding. Bury 3 pieces (each about a square centimeter) of lettuce, apple peel, etc. below the surface. Freezing this food beforehand might help the decomposition.
- For later feedings, students could choose 2 or 3 of the following suggested foods:
  - Most fresh fruits and vegetables are acceptable (see below). Carrots, banana peels, and orange peels can take a long time to break down. Remove them if they get moldy.
  - Egg shells.
  - Coffee grounds and filters.
  - Teabags.
- Foods to avoid:
  - Meats.
  - Dairy products.
  - Oily foods.
  - Salty or highly seasoned foods.
  - Grains.
  - Smelly vegetables (broccoli, cabbage, etc.)

## Reflection/Discussion

Here are some suggestions to help guide students in their observations and/or investigations:

- What kinds of food will worms eat? Students give the teacher a list of 3 things they would like to feed their worms (in case 2 are not acceptable for some reason). They then measure the food (by weight or by volume) before giving it to the worms.
- Three to four days after feeding, observe the placement of the food and see if things have moved around or appear to have changed in a way that indicates feeding behavior by the worms.
- Look for changes in the shape, size, and/or weight of the food.
- Different groups could compare what happens to different types of food.
- Look for evidence of worm burrows.
- At about 2-week intervals, students can empty out their worm homes onto a piece of newspaper. **Worms should be handled with moist/wet hands to keep them from drying out.**
  - Empty the worm homes by turning them upside down on some newsprint (to absorb moisture and make clean-up easier). Tap the container gently so that the contents fall to the table but retain their 'sand castle' shape.
  - Before breaking up the soil, look for evidence of tunneling, castings, or other worm activity. This might be a good time to mention the usefulness of vermicomposting for gardeners and then generalize to the usefulness of worms as decomposers and aerators in our soils.

- Gently break apart the soil to look at the worms, search for cocoons (see the reference in the **Background** section above), and to inspect any bits of food. What has happened to the shredded newspaper?
- Count the worms. (Reproduction might take as much as 2-3 months, so students will not see the kinds of results simulated in the **Oh Deer!** and **Population Changes** activities.)
- Can the worms be measured in some way to see if they have grown in size, changed in shape, or increased in number?
  - [Measuring length is difficult because the worms change their shape so easily.]
  - [Weighing the worms is possible, but soil clinging to them must be removed or accounted for in some way.]
  - [Some worms may have matured and developed a clitellum.]

## Assessment

Students could create a report that summarizes their journal entries as if for a science magazine.

- Observations of evidence of feeding. If they were not in these containers, what would the worms eat instead and why is this important?
- Observations of what happened to the food.
- What would happen to the planet if nothing decomposed?
- What is the benefit of the worms' tunneling activities and do the students think this is helpful or harmful to plant roots/plants?
- Any changes in the population.
- A section on unanswered questions or questions that could be investigated further.
- Make a diagram of the cycling of the food (garden vegetables, worm food, worms, decomposition, nutrients for more vegetables).

## Making a Home for Your Worms

Prepare section A by removing the base at the 'hip' of a 2-liter bottle (Figure 1). When turned upside down, this will be the main chamber where the worms will live. Recycle or discard the section marked x.

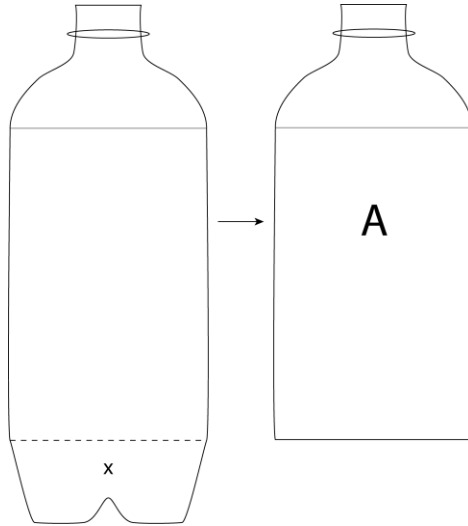


Figure 1. Cutting a two liter bottle for section A.

Cut section B 15 cm from the bottom of a second bottle (Figure 2). This will become the base of the worm habitat. Recycle or discard section 'x.'

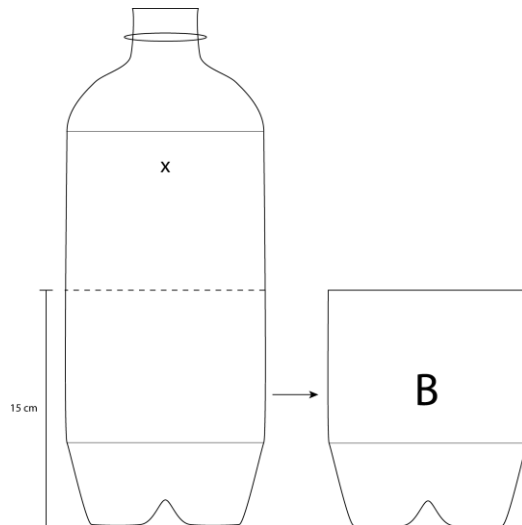


Figure 2. Cutting a two liter bottle for section B.

To assemble the worm habitat (Figure 3), cover the mouth of section A with a piece of screen and hold it in place with a rubber band. Then turn section A upside down and insert it into section B. The screen will keep worms from escaping through the bottom of the habitat.

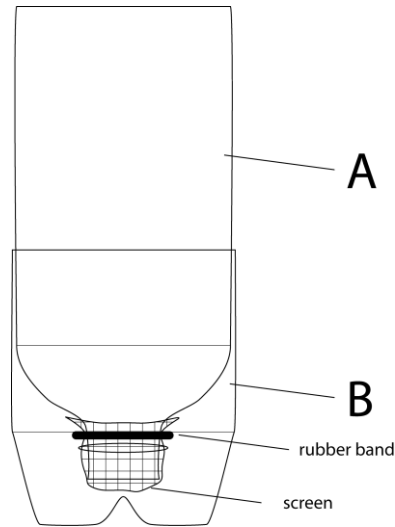


Figure 3. Worm habitat assembly.

Add bedding (with strips of newspaper mixed in), corn meal ('starter' food for the worms), and the worms themselves. Then wrap the whole habitat with dark construction paper to keep light from penetrating. The top should be left open and uncovered.