



Teacher's Notes

Activity 9

(Mystery Book page 79)

Making Compost

Standards: Application to "New Directions" Standards:

Activity 9

The following Delaware Department of Education "New Directions" Standards for grades six through eight are addressed (whole or in part) in this activity:

Science 1, 2, 3, 6, 8

English 1, 2, 3

Mathematics 1, 2, 4, 7-10

(See the Standards section located in this workbook for more details.)

Overview: This exercise is adapted from Learning About Waste Separation and Composting prepared for DSWA by Dr. William Mitchell, professor emeritus, University of Delaware.

This activity requires three weeks to one month to complete the composting process. While valuable lessons may be learned from as little as one week of composting, it is suggested the teacher run the activity through to completion. The first day will require approximately one class period to explain the purpose and set up the lab. Subsequent days will require a few minutes for students to collect and record data. The final day will require one, 45-minute class period for discussion of data and completion of associated tasks in the Mystery Book.

It is suggested this activity be run as a demonstration. However, teachers have had success running similar activities as a lab for small groups. A note should be made that a mini-composter takes up some space in your room. Available space may be a limiting factor depending upon your room size and layout. The mini-composters suggested for use are made from five gallon plastic buckets.

Assign students different days to collect data on the different variables and record them on a class data table mounted on a clipboard near the

composter. It will run approximately 30 days, so each student should have an opportunity to collect data. All students should record this data in their Mystery Book on a daily basis. Compost can be made from a wide range of organic wastes which are easily obtained from the home kitchen, school cafeteria, garden or lawn. Students will be more involved if they bring samples of waste from home. It will be necessary to add a bulking agent to increase pore space for oxygen.

This mini-composter experiment is an excellent lesson on cellular respiration and decomposition of organic matter. It has also been successfully used as an example of the dynamics of an ecosystem. Students monitor several of the factors which are limiting in nature, such as availability of oxygen, moisture, temperature and nutrients. Factors such as types of food sources and living space can be discussed as well.

- Purpose:**
1. Investigate the relationship between cellular respiration, temperature and oxygen consumption.
 2. Monitor data over extended periods of time.
 3. Investigate the possible affects of composting common household organic wastes as a method of waste reduction and beneficial reuse of material.
 4. Collect, tabulate and graph data.
 5. Draw conclusions from data collected.

Materials and Equipment:



Video Field Trip demonstrates this activity

- Student Mystery Book
- Overhead "How to Make a Mini-Composter"
- One mini-composter per lab station
- One wall thermometer with scale in °C and °F per lab station
- Three dial soil thermometers per lab station — 5" stem, with scale in °C and °F
- One bathroom scale or spring scale with minimum 50–100 pound capacity
- One portable atmospheric oxygen analyzer per class *
- 3/8" screen for screening compost upon completion of activity
- Small electric drying oven or microwave for determining moisture levels
- Balance with 0–450 gram capacity — standard triple beam will suffice but optional electronic balance is preferred
- One package of colored pencils per lab station

*** Note: If oxygen meter is not available, omit sections referring to oxygen analysis. This is still a useful lab!**

Assessment: It is suggested the basis for student assessments be weighted heavily on their decorum and behavior in the laboratory setting. See the Assessment section of the Teacher Workbook for suggested grading format for laboratory exercises.

Preparation: Have students bring in samples of organic waste from home. Caution students if they decide to bring in food scraps, they should avoid meat scraps and bones as they are difficult for microorganisms to decompose and also attract vermin!

Research by the Cornell Cooperative Extension Service indicates the optimum Carbon:Nitrogen (C:N) ratio for fast, hot container composting is approximately 30:1. You may wish to manipulate this ratio to some degree. The approximate C:N ratio for common substances are as follows:

CARBON:NITROGEN RATIOS OF COMMON SUBSTANCES

ITEM	C:N
sawdust	500:1
table scraps	15:1
grass clippings	20:1
fallen leaves	60:1

You want to maintain aerobic conditions. Therefore, a bulking agent such as sawdust, wood shavings, chopped woody wastes from the kitchen or vermiculite should be added to the mixture to provide air space within your compost mix. The amount of bulking agent required will vary depending upon the composition and grain size of wastes being composted. A mix of one part chopped vegetable kitchen waste, one part grass clippings and one part fine wood (not treated) shavings works well. Whatever your bulking agent, you want to have approximately 10-20 percent pore space before adjusting the moisture of your mix.

The greater the surface you can create, the better your microbes will do. Chop your compost material before mixing. This can easily be done with a common garden spade in a five gallon plastic bucket. Fill the bucket approximately one-third full with your waste to be composted. Then, chop away! The students *love* to do this part!

Adjust the moisture of your compost mix before you begin the experiment. Do this by taking a grab sample of your well-mixed compost ingredients. Obtain a sample of approximately 100 grams. Carefully obtain its mass, then place it in a drying oven or microwave it until it is

completely dry. Obtain the mass again. By using the relationship, **1 ml • 1 cm³ • 1 g**, you can calculate the percentage of the sample represented by water in the following manner:

mass of initial sample – mass of dry sample = mass of water in sample
mass of water in sample ÷ initial mass of sample = % moisture in sample

Adjust the moisture content of your compost mixture to approximately 50 percent.

NOW YOU ARE READY TO BEGIN COLLECTING DATA!!

To obtain an initial mass of compost, record the mass of the composter before and after filling with the material to be composted. Insert the soil thermometer into the probe hole in the side of the composter and record the initial temperature. Then take an oxygen reading from the center of the composter. Record the pH of the compost before beginning the experiment. Record these values for later use.

EXPECTED RESULTS: Daily temperatures in the mini-composter will reflect the material being composted. Temperatures can be expected to rise dramatically to a maximum level in the first two or three days, level off for a week or two, and then decline to ambient. At this point, it is suggested you remove the temperature probes and “shake” the composter vigorously. This will increase the surface area of the substrate and mix air into the compost. You should see the temperature rise again. This temperature rise may not be as dramatic — as high or as long — since the nutrient source is becoming a limiting factor for the microbial populations within the composter. It is suggested this procedure be repeated until there is no temperature rise. At this point, your compost is cooked!!

NOTE: Some students perform all of the tasks required for preparation with ease and need little teacher direction. In other cases, the teacher must do all the preparation. In either event, this activity is worth the effort!



Activity 2

