
COMPOSTING MANUAL FOR SCHOOLS

A HOW-TO MANUAL FOR FAYETTE COUNTY
PUBLIC SCHOOLS



APPLICATION

School Name: _____

School Address & Phone Number: _____

Composting Primary Contact: _____

Primary Contact Phone Number: _____

Class/group/organization who will take primary ownership of compost: _____

Step 1: Decide what type of compost you would like. Schedule a time for your Bluegrass Greensource environmental educator to conduct a 55 minute *What is Compost* ppt and activity (Appendix I) with students taking primary ownership of campus compost.

For elementary vermicompost, conduct *Playing with Worms* activity (Appendix II).

For middle/high vermicompost, conduct *Worm at Work* activity (Appendix III).

For kitchen compost, see Step 2.

Step 2: Determine the scope of your compost. Decide whether you want to use a retrofitted Herbie composter or a barrel compost tumbler. For either, you will need at least two (preferably three) compost units: adding stage unit, limbo stage unit, finishing stage unit.

For Herbie composters, contact your Bluegrass Greensource environmental educator.

For barrel compost tumbler, see *Barrel Compost Tumbler* (Appendix IV) for cost, ideas and possible vendors.

Step 3: Complete *Forming an Action Plan* (Appendix V) to help develop your compost program.

Step 4: Schedule a site visit with the following to review action plan:
cafeteria manager, team leader, 2-3 students, Child Nutrition supervisor, FCPS Energy & Sustainability Curriculum Coordinator, Bluegrass Greensource environmental educator, , Principal and Head Custodian/Campus Foreman.

Step 5: Conduct *Compost Survey* (Appendix VI) with students and teachers to determine baseline and background knowledge.

Step 6: Choose and utilize lessons, labs and activities from Appendix VII. Consider conducting a *Compost Tour* (Appendix VIII) for students in your school.

Step 7: Read over this manual carefully to understand the many benefits of your compost, required maintenance to ensure longevity and health of your compost, design instructions, funding options and core

content-based lesson plans to help you convert your campus rain garden into an engaging learning tool.

X

Teacher Primary Contact

X

Principal

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I. Contacts

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Goals of this Manual

- To provide a model for initiating and implementing a school composting program
- To help schools reduce their waste stream and increase their recycling rate
- To teach students, our future community decision-makers, the importance of responsible solid waste disposal and the environmental advantages of composting

You will find strategies for initiating and developing a plan, routine steps of the composting operation, promotional activities, as well as KY core-content aligned lessons and resources for curriculum connections.

I. What Is Composting? What Are the Benefits of a Compost?

Greens and Browns of Composting

Composting is an acceleration of the decomposition process (see Appendix X, *Inside a Compost Pile*). In compost jargon, food scraps are referred to as “greens” and bulking materials (such as newspaper, dry leaves or shredded paper) are called “browns”. In a compost pile, a ratio of 15:1 brown (or greater) gives the decomposers a balanced diet; alternating layers of browns and greens helps maintain this ratio. The drier, bulkier browns help the compost pile stay light and loose, allowing air to circulate more freely. Foods (green) have a high moisture content, and are usually wet enough to keep the pile moist. Regular turning of the pile aerates it and mixes up the browns and green (see Appendix IX: *Frequently Asked Questions About Composting*).

Schools can help the environment and their community when they compost food scraps. A school composting program will:

- Reduce the school’s solid waste stream
- Recycle natural resources
- Reduce nitrogen loading to the local sewage treatment facility
- Educate the school community about benefits of composting
- Create a useful product (finished compost) for gardening and landscaping projects

There are far-reaching benefits of a composting program for the Fayette County school community. Within the classroom, science concepts related to composting are easily integrated into science, math, social studies and language arts curricula. Taking responsibility for the solid waste stream at school empowers students by giving them a specific action to help their community and earth. Students develop a sense of school pride by taking steps toward becoming a “green school” (a school that practices wise use of natural resources). Students may spread the compost message and be instrumental in starting composting at home or in their neighborhood.

People often have preconceived ideas and fears about composting. For example, they may be concerned about odors that might attract animals or pose safety issues (see Appendix IX, *FAQ: Frequently Asked Questions About Composting*). A thoughtfully-planned school composting program, from the nuts and bolts of the actual composting process to establishing a culture of composting, can successfully address these issues.

II. How Do I Get Started?

Getting Started

The idea for a school composting may come from teachers, an administrator, parents, a Bluegrass Greensource environmental educator, school Go Green/Environmental Club, SEE KY team or a cafeteria manager. A program might be started by interested parents bringing the idea to their PTA/PTSA or the school administration. A school's SEE KY team or Bluegrass Greensource environmental educator might initiate it as part of a solid waste disposal alternative. A team of teachers could build a composting program into the science, social studies, practical living curriculum.

Regardless of who initiates the program, you need to have the support of the school administration and school cafeteria management. Be sure to talk about your ideas for starting a compost program with your administration and cafeteria staff, and include them in the planning and completion of *Forming an Action Plan* (Appendix V). Be sure to schedule the Step 4 site visit at a time when your administrator can attend.

Developing a Plan and Gathering Support

Talk up the topic of composting and you'll probably find other staff members or parents who are supportive of the idea. Learn as much as you can about what is involved in school composting so you can speak knowledgeable about the process and clearly define the scope of your program. It is okay (and in fact, recommended) to start with a classroom vermicomposting or small kitchen composting program and develop your program in phases. Schools differ in the way they develop new programs; follow your school and administrator's protocol. Follow these steps for developing a successful program:

1. Share your ideas and seek out others who may be supportive of the idea.
2. Recruit a core group of people to develop the idea and take ownership of your composting program. Be sure to actively include your FCPS cafeteria manager in your planning and solicit feedback, suggestions or helpful hints.
3. Clearly define the scope of your project and carefully work with your group to complete *Forming an Action Plan* (Appendix V).
4. Get support from all components of your school and community (including FCPS Energy & Sustainability Curriculum Coordinator and Bluegrass Greensource environmental educator)

The Role of Students

Students are the target audience for your composting program. Depending on the scope of your program, some or all of your students will be part of your program. Your students will be your advocates for your program.

It is important to begin educating students about composting before your program begins. As any teacher knows, new routines are best established by introducing them at the beginning of the school year or well before the new routine begins.

Recruit a group of ten to twelve students to become the core composting team. With adult supervision, two students per day can handle the daily tasks of the composting operation.

It is important to keep the student body motivated and involved as possible.

The Role of Kitchen Staff

It is critical that you discuss the needs of the cafeteria manager and kitchen staff with them. The kitchen staff may already be placing food preparation scraps in one barrel, and it may just be a matter of providing a second receptacle (barrel) for packaging wastes such as plastic or foam trays. **Make it easy for them with clear signage.** Food scraps such as vegetable peelings, coffee grounds and old produce can be easily deposited into a separate barrel.

Respect their time and ability to make good decisions; ask for suggestions about what would work best for them.

If your school is a FCPS Fruit & Vegetable School, be sure to carefully coordinate with your Cafeteria Manager and Head Custodian the best way to collect fruit and vegetable scraps for your school compost.

The Role of Custodial and Grounds Staff

Your head custodian and custodial staff should be carefully and respectfully consulted when selecting a location for your outdoor kitchen composting bins so that practical considerations can be addressed. It would be easier for your custodial staff to fit the compost jobs into their schedule if they know what is being asked of them ahead of time. Appealing to the skills of the custodial staff and being considerate of their time will go a long way in recruiting them as composting advocates. Having students actively involved is a learning experience for the students and alleviates the burden from the custodial staff. Work with the Director of Maintenance to discuss ways to incorporate new expectations (however small) into the custodial routines.

Promoting Your Composting Program

Promoting your program can go a long way toward getting voluntary participation and raising awareness. Consider the following times/events as opportunities for promoting your composting program:

Compost Awareness Week
America Recycles Week (the week that includes November 15)
Earth Day (April 22)
International Compost Awareness Week (the first week of May)
Compost Poster Content
School Composting Club

Composting Equipment

All parts of the composting process have to be in place before you can begin daily operation; that will decrease the chances for things to go wrong. When you prepare and plan well, you present the image of a well thought-out

program—good public relations for the school composting program. However, recognize that no matter how well you plan, there may be kinks to be ironed out as you proceed.

The tools you will need are below. For vendor options and more, please see *Compost Design & Maintenance* section of this manual.

- Compost bins (refurbished Herbies or compost tumblers) See *Compost Design & Maintenance* section.
- For refurbished Herbie, a garden fork
- Compost Thermometer (can be checked out from Bluegrass Greensource)
- A steady supply of brown, bulking material such as dry leaves, newspaper, shredded paper, sawdust)
- Labeled food waste receptacles

Below are items that are preferred, but not required:

- Scale that measures in one pound increments
- Clip board with record sheets (See Appendix XI: *Composting Recording Sheet*)



Mansfield Middle School

Mansfield Middle School, in Mansfield, Connecticut, initiated a school-wide composting program in the fall of 2000 with its 650 fifth through eighth graders. 4,168 pounds of food scraps mixed with 3 to 4 cubic yards of wood chips and leaves produced roughly 1.5 cubic yards of compost in the first year of operation.

IV. Compost Design & Maintenance

Vermicomposting

Vermicomposting can be a great way to introducing students to compost on a small, classroom scale. This technique is great for simple room composting and provide the classroom(s) with the ability to reduce their waste stream in a fun way! Students enjoy watching them grow and eat. These worms are great to use with life cycle lessons too! Red Wigglers are a great species of worm to use because they consume a lot of organic material and reproduce many worms in a short amount of time creating worms castings along the way!

Materials:

Two 10 gallon Plastic Tubs
One 10 gallon Plastic Tub Lid
Drill and 3/16 drill bit
Brick or three small rocks
A few cups of soil - not bagged soil,
but rather soil from a garden or spot outside.
Shredded Paper
Red Wigglers (30-100 worms)
Do not use Night Crawlers! They smell!
Spray Bottle
Trowel



To Build One:

We use a two bin system for vermicomposting. Begin with a small 10 gallon bin and drill a row of holes along the top edge of the bin and about ten holes in the bottom. Also, drill several holes in one of the lids. Take the second bin and put several rocks inside. Then take the other bin that now has holes in it and place on top of the rocks in the second bin. The rocks will prop the inside bin up and allow any extra moisture to drain and collect at the bottom. Next take the soil, shredded paper, a few food scraps and put in the bin and arrange in a pile in the center of the bin. Cover any food with paper! This is very important to prevent fruit flies or the smell of food in contact with air. Then take the worms and put in the bin. Right away you will notice that the worms will start disappearing into the paper and center pile. Leave the lid off until all the worms disappear into the center pile. Then spray with water until all the paper is moist, not wet! Check the bin every few days and add paper and water slowly as needed and add food sparingly. Food scraps can be added every couple weeks.

Food Scraps to Add:

Banana peels, apple cores, vegetable scraps, egg shells, coffee grounds (paper filter too!)

Food Scraps to NOT ADD:

Citrus: oranges, lemons, ect.

Meat

Milk

Fats/Oil

As time goes on you will find that the worms will make small brownish material called worm castings. Eventually, these castings will need to be harvested. Once your bin is about half full of worm castings it is time to harvest! To harvest these castings use a tarp and spread out the contents of the bin out (worms and all!). Then separate the worms from the material and restart the bin using the worms and a small amount of worm castings. The separated castings are great to use mixed in existing soil at an outside garden or inside and outside planters too! Plus any liquid from the bottom of the second bin can be used on inside plant especially! This liquid is call "compost tea" and is packed with great nutrients that plants love. Dilute this with water and feed to any indoor plant!

Trouble Shooting:

Q: "What if it my bin starts stinking?"

A: Check to make sure any food put into the bin is covered with paper material. This may be an indication that it is too wet; check moisture level. Worms love it moist, not drenched.

Q: "What if the worms start escaping?"

A: Check to make sure the correct foods are being put into the bins. Check moisture level.

Q: "What if I find mold in my bin?"

A: Moisture level to high. Open the bins and expose it to sunlight or air to dry out the bin.

Q: "What if there are fruit flies present in the bin?"

A: Fruit flies indicate that there is exposed food that is not buried beneath shredded paper. Open bin and cover exposed bin. The bin can be set outside letting any remaining flies out. Be aware that extreme cold or heat can be detrimental to the health of your worms!

Q: "Where can I get worms?"

A: Wal-Mart does have Red Wigglers most of the year in the Fishing/Hunting Section. Or many site online will send you worms in the mail, directly to your school address. One pound of Red Wigglers should start your bin out great. Make sure the day they arrive you will be able to put them in the bin! Google: Red Wigglers.

If you have any other questions or concerns contact your schools assigned Bluegrass PRIDE Environmental Educator.

Kitchen Composting:

The kitchen staff at your school will play an important and invaluable role in collecting food prep. Food prep includes any leafy greens or fruit scraps left behind as food is prepped for lunch service. These can be collected in a sealed bucket until but into the appropriate composting system the same day.

Examples of Collected Kitchen Food Prep:

Raw Scrap Vegetables: lettuce, tomatoes, onions,
cabbage, carrots, celery...
Raw Scrap Fruits: Bannana, strawberry, blueberry,
apple, oranges, pear, grape....



If you are collecting this material for a Vermicompost Bin –
no citrus or acidic fruit or vegetables please!

Herbie Composter Method:

Advantages for using the Herbie Method:

Herbie container is free and using a recycled container!
Simple to use and contain compost

Disadvantages of the Herbie Method:

Keeping moisture level balanced can be tricky. (ie: lid blowing open and letting rain in)
Prone to vandalism or disappearing



These “Herbie’s” are free of charge for any school, contact your school’s Bluegrass Greensource Environmental Educator for more information.

To use your recycled Herbie compost bin just follow these easy steps:

1. Make sure you discuss where this device will go on school grounds. Also, keep in mind the attractiveness of this device to succumb to vandalism. Any composting device should be useful and convenient for composting, but be installed and secured to a site place that would be less likely to be vandalized.
2. Place the compost bin in an out of the way part of your school landscaping. If the location is convenient to your school garden or school rain garden you will be more likely to use the bin and provide additional potential for learning and discovery for students. Make sure you discuss where this device will go on school grounds. Also, keep in mind the attractiveness of this device to succumb to vandalism. Any composting device should be useful and convenient for composting, but be installed and secured to a site place that would be less likely to be vandalized.
3. Secure your “Herbie” Composter to the designated site.
4. As you garden, add any organic wastes generated to the compost bin. Material will break down faster if it is chopped into small pieces about 2-4” long. Leaves, grass clippings, sod, weeds that have not set seeds, kitchen vegetable wastes, egg shells, coffee grounds, manure (not from cats or dogs), landscape clippings, shredded paper or cardboard all can be used to make compost. Any diseased or insect infested materials should not go into your compost bin. Continue adding materials until your bin is $\frac{3}{4}$ full.
5. Keeping the lid closed and any food covered with grass or paper will help deter animals. Also make sure never to add eggs, meat or dairy products to the bin as these will create unpleasant odors and attract animal pests.
6. Once the bin is $\frac{3}{4}$ full, lift the compost bin off the pile and relocate it just to the side of the pile. Use a garden fork to move the material into the bin again, this will turn (mix) and aerate the pile. Re-secure the bin to the ground.
Aerating will allow much needed oxygen into the pile. This oxygen will allow a healthy composting pile to exist and speed the rate of decomposing material.

7. Aerate every 1-2 weeks is best!

Tip! Another method to aerating the pile is to use a Composting Hand Crank Tool. This tool can easily be found online. (Search Google for "Compost Crank")

8. After 2-6 weeks the turning process can be repeated to finish the composting process. The volume of the compost will shrink as it breaks down. If the material in the bin becomes dry throughout you may need to sprinkle a little water on top to moisten the ingredients and speed up the process. The compost should feel damp, not wet.
9. Your compost will be 'finished' when it is fine and crumbly like coarse potting soil or fine mulch. You can sift out any larger particles that have not broken down and add them back to the bin for the next batch. The amount of time required to make compost will vary widely depending upon the materials, the outdoor temperature, and the frequency of turnings. If you are impatient you can speed the process by moving the bin and turning the pile every two weeks.

Source: <http://www.ca.uky.edu/agc/pubs/ho/ho75/ho75.pdf>

Barrel Tumbler

Using a Barrel Tumbler to compost is another great method for composting. This device requires the same ratio of browns to greens, but aerating the material is done easier than the Herbie method.

Advantages of Using a Barrel Tumbler:

- Rotation of the organic material is done simply.
- With it's enclosed sides, a tumbler, like any enclosed bin, will do a better job of retaining moisture in those hot arid summer days. Conversely, they also help in keeping excess moisture out in the rainy season, which can keep a pile that has a lot of "wet" material, like grass clippings, from starting to smell.
- Especially those bins that stand above ground, make it hard for rodents and other critters to find their way into the compost pile, and the goodies you have stored there.
- While this varies a lot based on the individual design, many of them are considerably easier to get material in and out of.
- While many gardeners don't mind a free standing compost pile, many enclosed bins including tumblers provide a cleaner, tidier look.

Disadvantages of Using a Barrel Tumbler:

- Can be expensive to purchase (\$150-\$300)
- Must find a place on school grounds that will accommodate one
- Prone to vandalism

Procedure:

1. Make sure you discuss where this device will go on school grounds. Also, keep in mind the attractiveness of this device to succumb to vandalism. Any composting devise should be useful and convenient for composting, but be installed and secured to a site place that would be less likely to be vandalized.



2. Composting Barrels can be obtained online or potentially locally during growing season. To find one online, search Google for “Barrel Composter.” Follow the Composting Directions that are included with the purchase of the Compost Barrel Tumbler.

Suggestions on Makers of Compost Barrel Tumbler:

Tumbleweed, Sterling, Compost Wizard brands all have good designs of composting barrel tumblers.

Day to Day Composting

Student and staff volunteers will need to be trained in the daily routine of processing the food scraps. Scheduling these tasks depends on the school lunch schedule, Fruit & Vegetable Snack schedule, the availability of students and volunteers and what works best for kitchen and custodial staff involved.

Daily Tasks

A team of two or three students, supervised by an adult, can carry out the following daily tasks in about fifteen minutes.

Task 1 Collect Food Scraps

Food scraps should be deposited into special containers located in the cafeteria (and classrooms for Fruit & Vegetable Snack schools). Students or staff retrieve the special food waste containers from the cafeteria, kitchen and classrooms and consolidate the contents into one barrel that has been lined with a plastic bag.

Other sources of food scraps are the Family Consumer Science classroom, teachers’ lounge, any classroom or office equipped with kitchen facilities and areas where students routinely eat snacks.

Task 2 Transport Food Scraps to Bin

The barrel is wheeled out to the bins. Students need to pick up garden fork (if used) on their way.

Task 3 Spread Food Scraps

The easiest way to manage the food waste is to line the food waste barrel with a plastic trash bag. Secure the bag around the rim with a bungee cord. Students or staff can then lift the bag out of the barrel into the compost bin. Food should be spread somewhat, not piled high in the center.

Task 4 Layer with Bulking Material

Depending on how much “green” material you have, try to include 15 times as much brown (carbon heavy, bulking) material like newspaper strips, dry leaves, or

shredded paper. All of the food should be completely covered by the brown bulking material, making it less attractive to animals. The lid, of course, needs to be latched.

Task 5 Clean Up

Students or staff should use rags or water (if available) to wipe off the garden fork and barrel and return the barrel to the cafeteria.

Weekly Tasks

Temperature

Take the temperature of your compost with a compost thermometer. The optimal temperature for your compost is 120 - 175 degrees Fahrenheit. If the temperature falls below 120 degrees before most of the decomposition has occurred, it is a sign that the balance of food, moisture, air and bulking materials needs to be adjusted. Usually, a drop in temperature indicates it's time to turn or aerate the pile. See Appendix XII *Composting Problems and Solutions*.)

Turning the Pile

Ideally, the bulking (brown) material helps maintain air circulation in the pile. However, eventually pockets of oxygen will be used up by the microbes, causing a decrease in available oxygen and the population of microbes (the workers of your compost). The drop in compost temperature is the best indicator of this happening. Turning a pile simply means mixing up the materials. The easiest way to achieve this manually is to use a garden fork to mix or turn the crank of the barrel tumbler compost. This moves the materials from the cooler edges of the pile into the center. Also, a fresh blast of oxygen is introduced into the pile. The “green” material and “brown” material are mixed. Within a few days, the newly-turned pile's temperature should rise back up to 120-175 degrees Fahrenheit.

You Have Compost

In a school composting system, many pounds of food can be turned into useful finished compost over the course of a school year. Remember, the total amount of food material (food wastes plus bulking material) is reduced by as much as two thirds during the composting process.

A successful composting process will result in dark, crumbly, pleasant smelling compost. The nutrients and salt content of the compost depends on the types of foods that are included. Processed foods are high in salts. Especially for this reason, it is critical that the compost be allowed to **cure** before it is put into use. Just because the compost looks and smells like soil doesn't necessarily mean that it is chemically stable. Finished compost should have a **near neutral** pH and be **low** in unstable nitrogen (ammonium nitrogen) and soluble salts. **Curing** is simply letting the pile rest while the composting process finishes. Getting a soil sample analyzed is the best way to determine the compost usability. To get a free standard soil analysis on your compost, contact Tresine Logsdon at tresine.logsdon@fayette.kyschools.us or 619-6472.

There are many uses for finished compost. It will have varying levels of potassium, phosphorus and nitrogen, all important nutrients. It is best to use the finished compost product as a soil amendment or a top dressing for existing plants. Your compost would be perfect for areas around your school's trees, shrubs or other perennials or even on your school vegetable, herb, native plant, butterfly or rain garden.

Program Evaluation

Your team should meet regularly to evaluate the implementation and success of your compost operation. Feedback from various staff members will help address the following questions:

- Is the daily processing of food scraps running smoothly?
- Are the bins and equipment in good condition?
- Are the students and staff volunteers working well?
- What is the general attitude of the students and staff about the composting program?
- What adjustments can be made to make the process more efficient?
- How can we recognize and celebrate our accomplishment thus far?

V. Compost Funding

The capital expense of a composting program (bins and tools) will vary depending on the materials you select. It will cost something, but it doesn't have to be a budget-buster. After the initial purchase, realize that composting is a low-cost process. There is very little maintenance. In fact, a compost program can be cost-saving as food waste is a significant portion of your school's waste stream by reducing the tipping fee.

The funding that you will need to design, build and maintain a school compost will vary depending on the design, size and location, but funding opportunities are often abundant in central KY. *Don't forget that if your school chooses to use refurbished LFUCG Herbies, they are free of charge.*

To find an updated list of grants for your composting program from state and national organizations, go to Environmental Education in KY's website for grants at www.eeinkentucky.org and click on the grants link in the bottom right corner of the page.

For information on a LFUCG Neighborhood Community Sustainability Grant from the Department of Environmental Quality, contact Louise Caldwell-Edmonds at (859) 425-2804 or louisec@lexingtonky.gov.

Remember- FCPS offers assistance and support for grants. All schools who want to apply for a grant must complete the Intent to Apply form that can be found in the Staff Portal under Grants Writing and Accounting Offices Center. The process for grants development and submission is below.

All grants, regardless of funding amount **must** be approved by the superintendent, **prior** to submission. That approval process begins with the grant writing resource specialist. This is a five part process: 1) Finding a funding opportunity/grant; 2) Intent to apply process; 3) Proposal development; 4) Proposal approval; and 5) Proposal submission.

1. **Finding a grant:** There are a lot of funding opportunities out there. However the key is finding an opportunity that 1) is a good fit for your idea, and 2) for which the school/district is eligible to apply. The district grants staff has a limited amount of time to devote to researching opportunities. Because of this, the funding opportunities' database has been developed and is being updated. If you have a project for which need funding, please check the database first. Once you find a possible funding source, get the ok from your principal or supervisor to proceed with the intent to apply process.
2. **Intent to Apply Process:** When you have found a grant, please notify the grants specialist as soon as possible by email (susan.davis@fayette.kyschools.us) and attach the Intent to Apply form. The grants specialist will respond to let you know whether or not to proceed with proposal development. This step in the process is critical for a variety of reasons. Sometimes only one proposal per district can be submitted; sometimes schools or the district are not eligible; if there are matching requirements or positions created, the Board of Education must approve prior to submissions. Once you have the ok to proceed, then it's onto proposal development.
3. **Proposal Development:** The grants specialist cannot write every proposal in the district. However she can provide technical assistance to those developing proposals. Please do not hesitate to contact the grant specialist with questions.
4. **Proposal Approval:** When your proposal is almost complete, please contact the grants specialist, who will facilitate the process that cumulates with the superintendent's approval to submit. This process takes time and involves multiple departments, so please allow plenty of time for this (ideally 5 working days).
5. **Proposal Submission:** Please assume that you are responsible for submitting your proposal to the funding source. The details of this can be discussed with the grants specialist.

VI. Using Your Compost as an Engaging, Core Content Based Learning Tool

It is critical that students be actively engaged and involved in the planning, design, building and maintenance of your campus composting program and that your school have a long-term plan for which group, team or grade will take proud ownership of your composting program (Ms. Thompson's 5th grade class, Ms. Lawson's 7th grade science classes, Mr. Smith's Earth Science class or the Go Green/Environmental Club).

Browse the many lesson plans provided in Appendix VII.

To find other school rain garden resources and lesson plans in addition to the ones provided in this manual, go to Greening Schools website at **www.greeningschools.org/resources/view_cat_teacher.cfm?id=73** and filter by grade.

Your Energy & Sustainability Curriculum Coordinator will help you navigate the planning, design, build and maintenance of your school composting program. If you have any questions, please contact Tresine Logsdon at tresine.logsdon@fayette.kyschools.us.

VII. KY Core Content addressed by the planning, designing, building and maintenance of a school composting program

Elementary

SC-05-2.3.1

Students will:

- describe the circulation of water (evaporation and condensation) from the surface of the Earth, through the crust, oceans and atmosphere (water cycle);
- explain how matter is conserved in this cycle.

Water, which covers the majority of the Earth's surface, circulates through the crust, oceans and atmosphere in what is known as the water cycle. This cycle maintains the world's supply of fresh water. Students should have experiences that contribute to the understanding of evaporation, condensation and the conservation of matter.

SC-04-4.7.2

Students will:

- describe human interactions in the environment where they live;
- classify the interactions as beneficial or harmful to the environment using data/evidence to support conclusions.

All organisms, including humans, cause changes in the environment where they live. Some of these changes are detrimental to the organism or to other organisms; other changes are beneficial (e.g., dams benefit some aquatic organisms but are detrimental to others). By evaluating the consequences of change using cause and effect relationships, solutions to real life situations/dilemmas can be proposed.

PL-05-3.1.4

Students will describe consumer actions (reusing, reducing, recycling) and identify ways these actions impact the environment (e.g., conserving resources, reducing pollution, reducing solid waste).

PL-05-4.2.1

Students will explain how and why personal responsibility and good work habits (e.g., school attendance, honesty, cooperation) are important at home, school and work.

SC-04-2.3.2

Students will describe and explain consequences of changes to the surface of the Earth, including some common fast changes (e.g., landslides, volcanic eruptions, earthquakes), and some common slow changes (e.g., erosion, weathering).

SC-04-4.6.1

Students will analyze patterns and make generalizations about the basic relationships of plants and animals in an ecosystem (food chain).

Plants make their own food. All animals depend on plants. Some animals eat plants for food. Other animals eat animals that eat the plants. Basic relationships and connections between organisms in food chains, including the flow of energy, can be used to discover patterns within ecosystems.

Middle School

PL-08-3.1.4

Students will describe consumer actions (reuse, reduce, recycle) and explain how these actions impact the environment (e.g., conserving resources, reducing pollution, reducing solid waste, conserving energy).

PL-08-4.2.1

Students will describe individual work habits/ethics (e.g., following directions, problem-solving, time management, respect, self-discipline, punctuality) and explain their importance in the workplace.

SC-08-3.4.4

Students will describe and explain patterns found within groups of organisms in order to make biological classifications of those organisms.

Observations and patterns found within groups of organisms allow for biological classifications based on how organisms are related.

SC-08-4.6.5

Students will:

- describe the relationships between organisms and energy flow in ecosystems (food chains and energy pyramids);
- explain the effects of change to any component of the ecosystem.

Energy flows through ecosystems in one direction from photosynthetic organisms to herbivores to carnivores and decomposers.

SC-08-4.7.1

Students will describe the interrelationships and interdependencies within an ecosystem and predict the effects of change on one or more components within an ecosystem.

Organisms both cooperate and compete in ecosystems. Often changes in one component of an ecosystem will have effects on the entire system that are difficult to predict. The interrelationships and interdependencies of these organisms may generate ecosystems that are stable for hundreds or thousands of years.

DOK 3

SC-08-4.7.2

Students will:

- explain the interactions of the components of the Earth system (e.g., solid Earth, oceans, atmosphere, living organisms);
- propose solutions to detrimental interactions.

Interactions among the solid Earth, the oceans, the atmosphere and living things have resulted in the ongoing development of a changing Earth system.

DOK 3

High School

SC-HS-4.7.2

Students will:

- evaluate proposed solutions from multiple perspectives to environmental problems caused by human interaction;
- justify positions using evidence/data.

Human beings live within the world's ecosystems. Human activities can deliberately or inadvertently alter the dynamics in ecosystems. These activities can threaten current and future global stability and, if not addressed, ecosystems can be irreversibly affected.

SC-HS-4.7.3

Students will:

- predict the consequences of changes to any component (atmosphere, solid Earth, oceans, living things) of the Earth System;
- propose justifiable solutions to global problems.

Interactions among the solid Earth, the oceans, the atmosphere and living things have resulted in the ongoing development of a changing Earth system.

PL-HS-4.2.1

Students will identify individual work habits/ethics (e.g., individual/team responsibilities, willingness to learn, integrity, respect, confidentiality, self-discipline, problem-solving, punctuality, communication skills) and explain their importance in the workplace.

PL-HS-3.1.4

Students will compare consumer actions (reuse, reduce, recycle, choosing renewable energy sources, using biodegradable packaging materials, composting) and analyze how these actions impact the environment (e.g., conserving resources; reducing water, air, and land pollution; reducing solid waste; conserving energy).

SC-HS-4.6.4

Students will:

- describe the components and reservoirs involved in biogeochemical cycles (water, nitrogen, carbon dioxide and oxygen);
- explain the movement of matter and energy in biogeochemical cycles and related phenomena.

The total energy of the universe is constant. Energy can change forms and/or be transferred in many ways, but it can neither be created nor destroyed. Movement of matter between reservoirs is driven by Earth's internal and external sources of energy. These movements are often accompanied by a change in physical and chemical properties of the matter. Carbon, for example, occurs in carbonate rocks such as limestone, in the atmosphere as

carbon dioxide gas, in water as dissolved carbon dioxide and in all organisms as complex molecules that control the chemistry of life.

SC-HS-4.6.10

Students will:

- identify the components and mechanisms of energy stored and released from food molecules (photosynthesis and respiration);
- apply information to real-world situations.

Energy is released when the bonds of food molecules are broken and new compounds with lower energy bonds are formed. Cells usually store this energy temporarily in the phosphate bonds of adenosine triphosphate (ATP).

During the process of cellular respiration, some energy is lost as heat.

Appendix I- What Is Compost Activity

Worm Diner



Grades K-4

Meets Grades K-4 Standards

Lesson Summary

Students learn what to feed red worms in a compost bin.

Overview

In this lesson, students will:

- Distinguish plant-based foods from animal-based foods.
- Create a chart that serves as a menu of foods red worms can eat.

Time

30-45 minutes for lesson

Background

Compost is nutrient rich soil created from the breakdown of food and plant scraps. By turning leftover food waste into compost we can continue nature's cycle of returning nutrients back to the earth. Compost helps plants grow strong and healthy without the use of chemical fertilizers and reduces the amount of waste sent to landfills.

Compost can be made at school or home using a worm bin. A worm bin is easy to make and creates a perfect place for red worms to eat **plant-based food** scraps and excrete them into *castings* or compost. Castings is just a fancy word for worm poop! If you're feeding worms in a worm bin, only give them plant-based foods like fruits, vegetables and dry bread. Although worms can eat meat and dairy products, it takes them a long time to do so, and these lingering animal foods will make a smelly mess in your worm bin! For this reason, we treat red worms in a bin like they are **vegans**. A **vegan** is someone or something that only eats plant-based foods. A vegan is also an **herbivore**. Red worms cannot eat metal, glass or plastic, so it's important to keep these items out of a worm bin. Too many foreign objects in a worm bin, including trash like Styrofoam, are harmful and may cause worms to stop producing compost.

Unlike worm compost bins, the green bins that the City of San Francisco has provided to residents for curbside pick up, can accommodate all food scraps including animal-based foods. In fact, the green bins can accept anything that came from a plant or an animal. This includes items like meat, bones, milk cartons, dirty pizza boxes, used paper napkins and eggshells. While worm compost bins are a great way to learn about the natural cycle of decomposition, and create nutrient rich castings for use on houseplants or in gardens, San Francisco's green bin system is an effective way to divert thousands of tons of organic matter from the landfill. Compost created from the green bin system is used at local wineries and farms and helps rebuild the topsoil in a natural manner free of synthetic chemical fertilizers.



Vocabulary

- Plant-based food
- Animal-based food
- Compost
- Vegan

Materials

- Examples of food scraps such as apple cores, carrot tops, half eaten toast, beans, pasta, meat, cheese, etc. Use actual samples of food or the drawings included in this lesson plan.
- *Worm Diner Take-Out Menu* worksheet: One copy for each student. (Gr. K-1)
- Crayons or markers
- *The Dirt on Composting* Student Fact Sheet (Gr. 3-4) and Reading Comprehension Questions
- Gram Scale
- Tape





Preparation

- Read background information.
- Prepare examples of the different food scraps listed above.
- Locate a place to sort the food items with students. A desk or floor will work if you are using actual food samples. You can also use a two-column chart to tape on the food scrap drawings. *See sample at the end of the lesson plan.*
- Have students read the Student Fact Sheet, *The Dirt on Composting*, and have them answer the reading comprehension questions.

Pre-Activity Questions

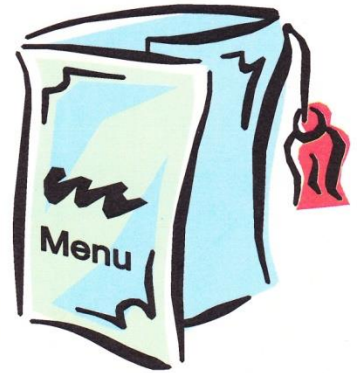
Tell students they are going to learn how to feed their leftover food to worms in a worm bin. But first explain that they need to learn where food comes from.

1. What kinds of foods do you like to eat? (*Take all answers*)
2. What is this food made from? (*Take all answers, but the main answers are animals and/or plants. Explain that cheese and milk come from cows and that fruits and vegetables come from plants.*)
3. What fruits or vegetables are in your snack or lunch today?
4. Do they come from plants? (*Yes*)
5. Are there any foods in your snack or lunch like meat, bologna, cheese or milk?
6. Where do these foods come from? (*Animals like cows and chickens*)
7. Do these animal-based foods come from plants? (*No*)

Classroom Activity

1. Tell students that today they are going to learn how to feed their pet worms that live in the class worm bin. Just like all living things, red worms need air, water, and food to live.
2. Tell students they are going to pretend to open up a Worm Diner or restaurant. They will need to make a menu that lists foods that worms can eat. This is what will be fed to the worms living in the worm bin.
3. Explain to students, that worms do not have teeth. Instead, they scoop up their food with their mouth and swallow it whole. Explain that although worms can eat any thing that came from a plant or animal, that the worms eating at the Worm Diner are *vegans*. A vegan is someone or something that only eats foods from plants. That means that these worms should only eat plant-based food like fruits, vegetables, beans, nuts, and grains like rice and wheat that get turned into pasta, bread, cookies and crackers.
4. Explain that if you feed animal foods at the Worm Diner, that the food in the worm bin will get very smelly and stinky before the worms can eat it. The worms that will eat at the Worm Diner need students to make sure the food on the menu is only made from plants.

5. Begin sorting the foods into two piles by holding up one of the food samples. Ask students if the food comes from an animal or a plant and then ask them if it should be served at the Worm Diner.
6. Place foods that worms can eat in a pile labeled "Worm Diner—Yes," and the foods that worms cannot eat in a "Worm Diner—No" pile. Encourage active student participation by giving individual students a food item and asking them to place it into the correct pile
7. Ask students to make a chart with pictures and words that shows what to feed and what not to feed the red worms.
 - Brainstorm a list of items that are common in students' snacks and lunches; write each item on a separate scrap piece of paper; place all the scrap papers in a hat/container and let students each take one.
 - Ask students to draw their item and write its name underneath the drawing.
 - Use the sample chart at the end of the lesson plan or create your own large chart on butcher paper that includes two columns and the headings "Okay to Feed Worms" and "Not Okay to Feed Worms."
 - Have students glue their drawings in the appropriate column.
 - Hang the chart by your worm bin.



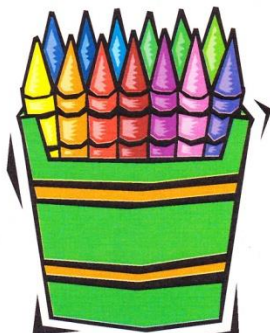
Discussion Questions

1. What happens to the food after the worms eat it?
(*They poop it out! Just like all living things, red worms take in nutrients when they eat food, and they excrete or give off "waste."*)
2. Explain that worm poop is called *compost* and it is full of nutrients. Compost is very good for our earth and helps plants grow big and strong. Compost from a worm bin can be collected and placed in a garden or flowerpots.
3. How can red worms help our class reduce what we throw in the garbage? (*They can eat our leftover food that comes from plants.*)
4. Before snack or lunch, divide the class into four teams. Ask each team to bring back one scrap of food about the size of an apple core. These food scraps will be fed to the worms.

Follow-up Activity

1. Write numbers 1 to 6 on note cards or 3"x5" scrap papers and tape them on the top of the worm bin lid, so they create a six-section diagram that students can use as a guide for feeding worms and tracking where the food was placed.
2. Gather food scraps collected by each team; weigh out a half-pound of scraps and bury them in section 1 of the worm bin.
3. Emphasize with students that it is important not to overfeed the worms.





For younger students:

1. Tell students that you need their help a Take Out Menu for the worms.
2. Remind students that worms will only eat food from plants.
3. Give each student a *Worm Food To Go* worksheet and tell him or her to color only the plant-based foods. Ask students to count and write down the number of plant-based food that can be fed to worms.

For older students:

1. Keep a class worm journal next to the bin for students to record data and copy into their own journals.
2. As a class, decide what type of data you will record. Students could record the weight of food added each week, what section of the bin the food was added, and type of food added.
3. After a month, students should use the data to answer questions like: *What plant-based foods do red worms seem to prefer? How much food did the red worms eat in one week? In one month?*

Extensions

- Discuss the differences between feeding worms in a bin in class, which only eat plant-based foods, and using San Francisco's green bin system that accepts all food from plants or animals. Explain that the difference is the green bin takes all things that once came from a plant or an animal. The green bin system uses a different method to break down the food into compost, which is why it can take animal-based foods too.
- Obtain a copy of the poem "Sarah Cynthia Sylvia Stout" by Shel Silverstein from the Internet or library. Read the poem to the class and ask students to identify which items described in the poem could have been composted in a worm bin.

CA State Standards

Gr. K Science 1a • Math A1.1

Gr. 1 Science 1c • Math S1.1

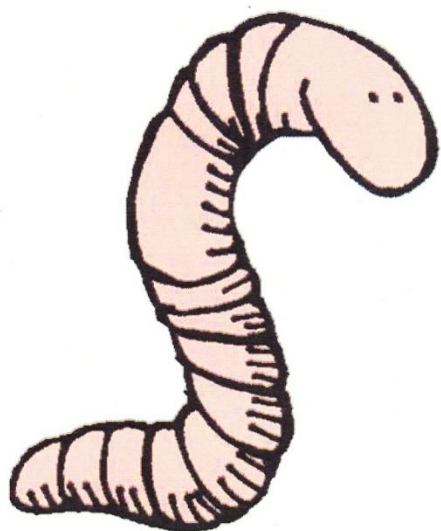
Gr. 2 Science 3e • Math S1.1

Gr. 3 Language Arts R2.3 • Math N2.8, MG1.1

Gr. 4 Science 2c • Language Arts R2.2 • Math N3.0



WORM DINER



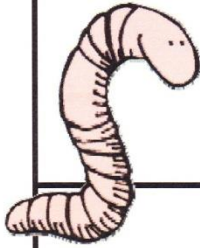
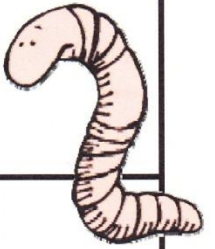
YES!

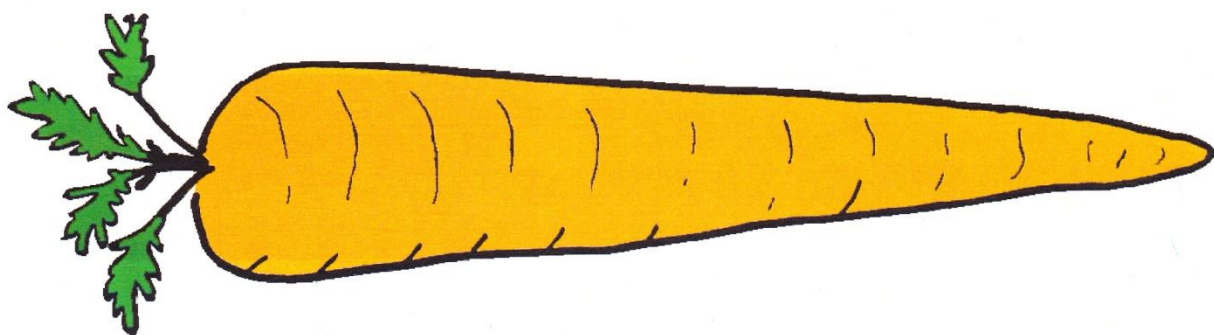
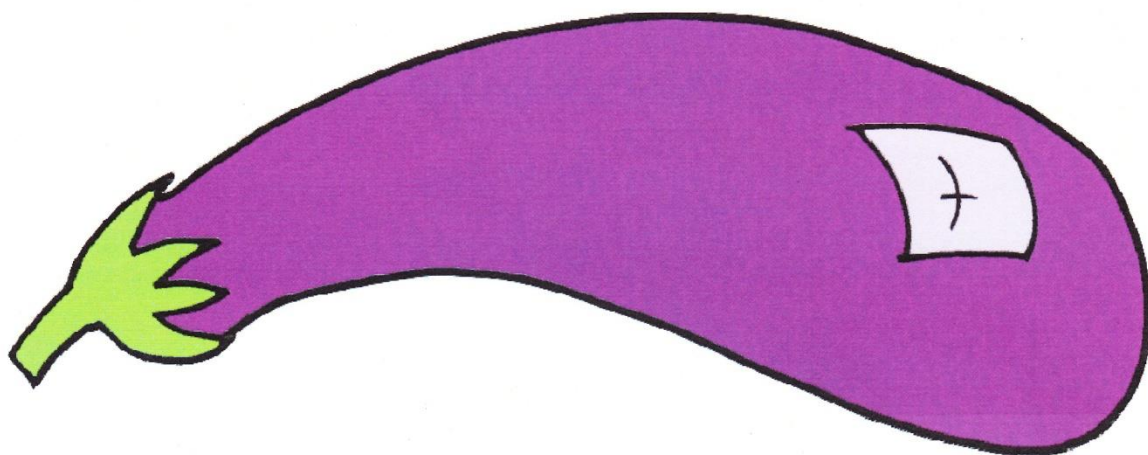
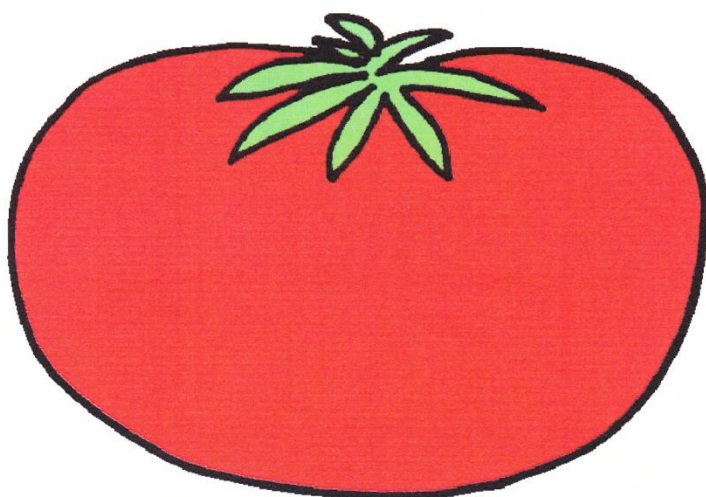
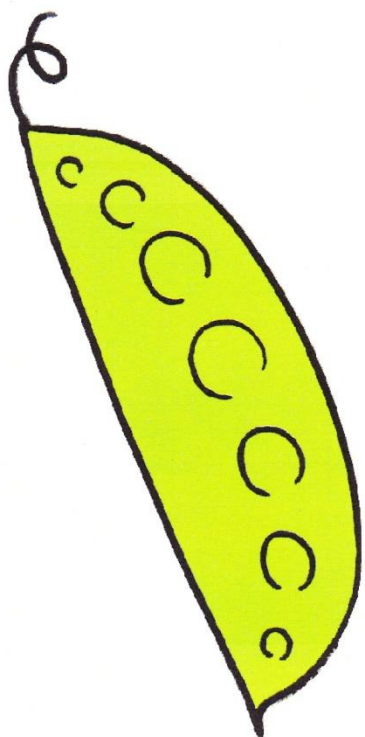
WORM DINER

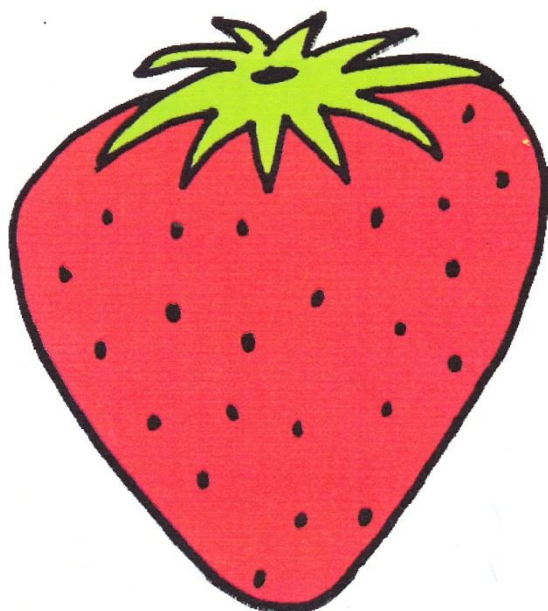
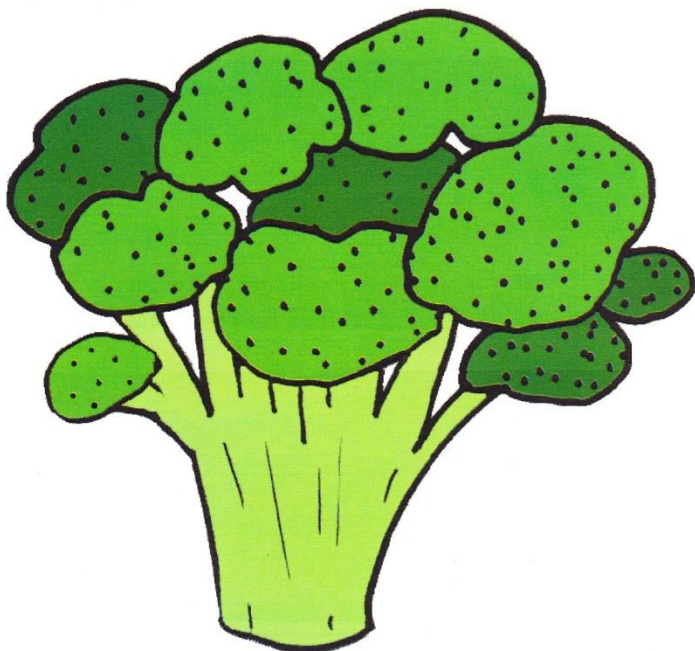
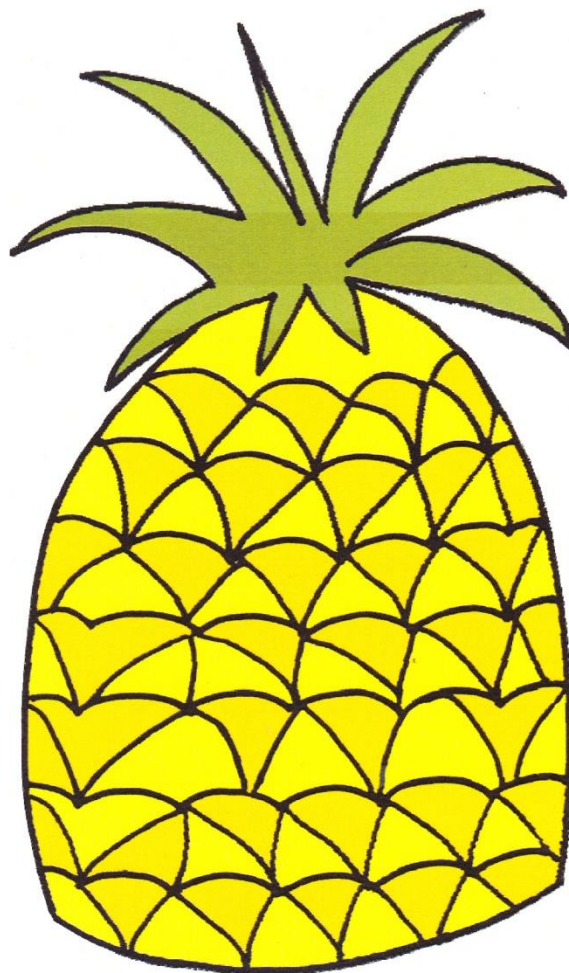
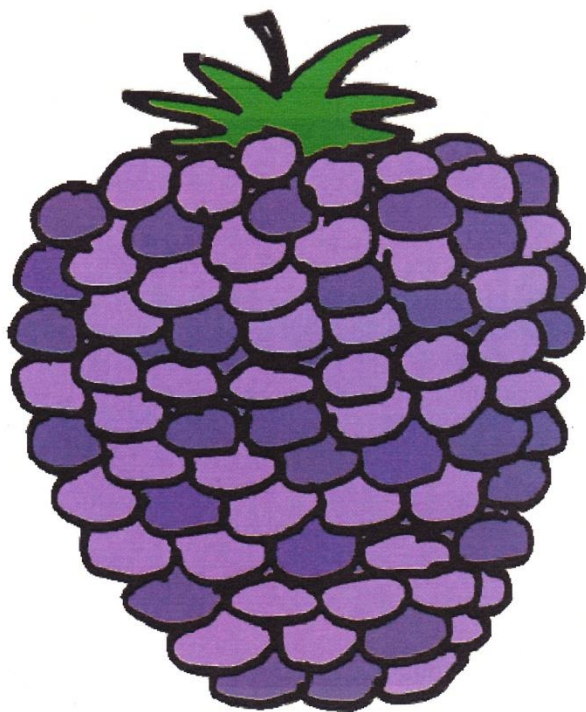
NO!

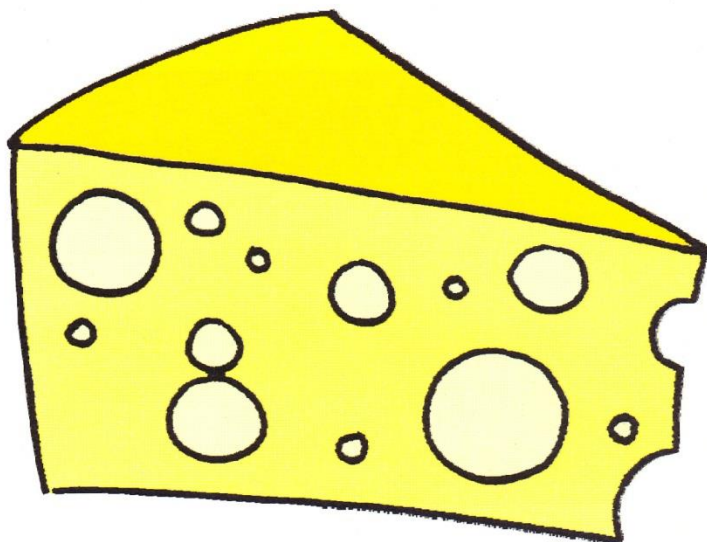
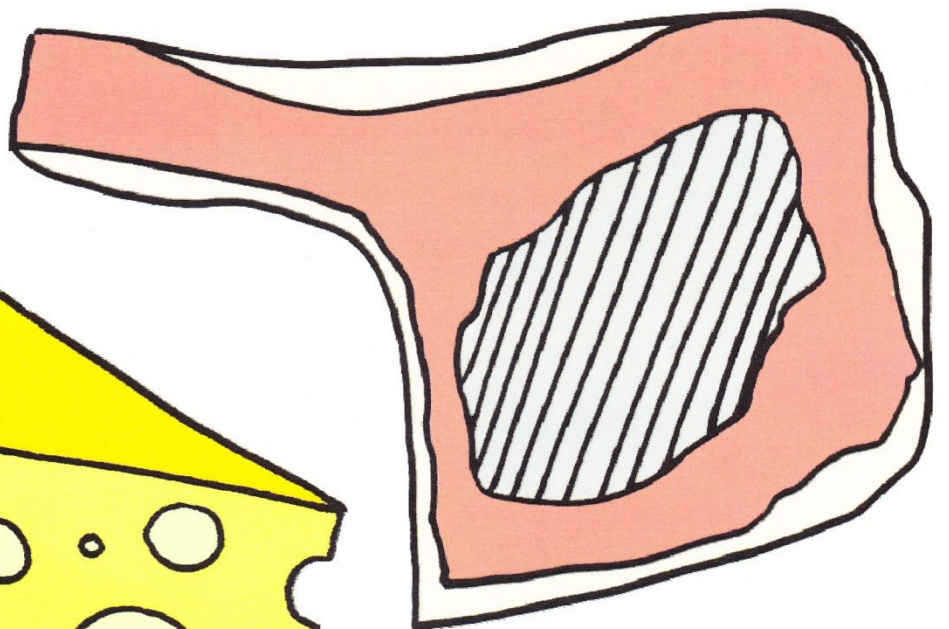
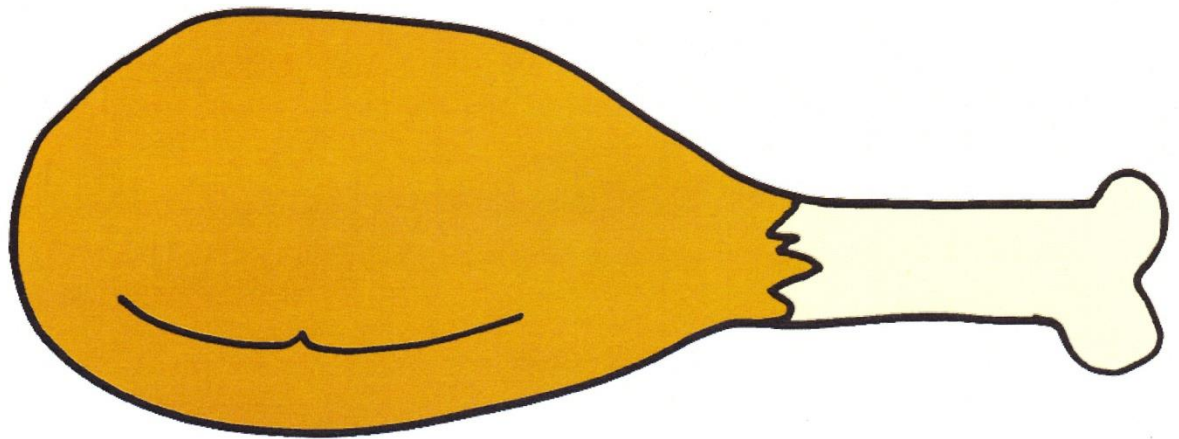
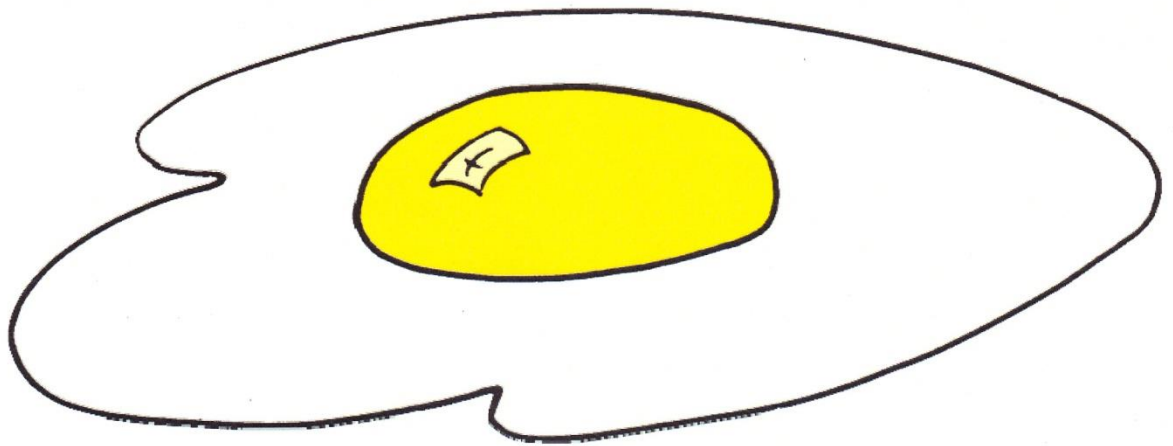


WORM DINER MENU

 YES!	NO! 





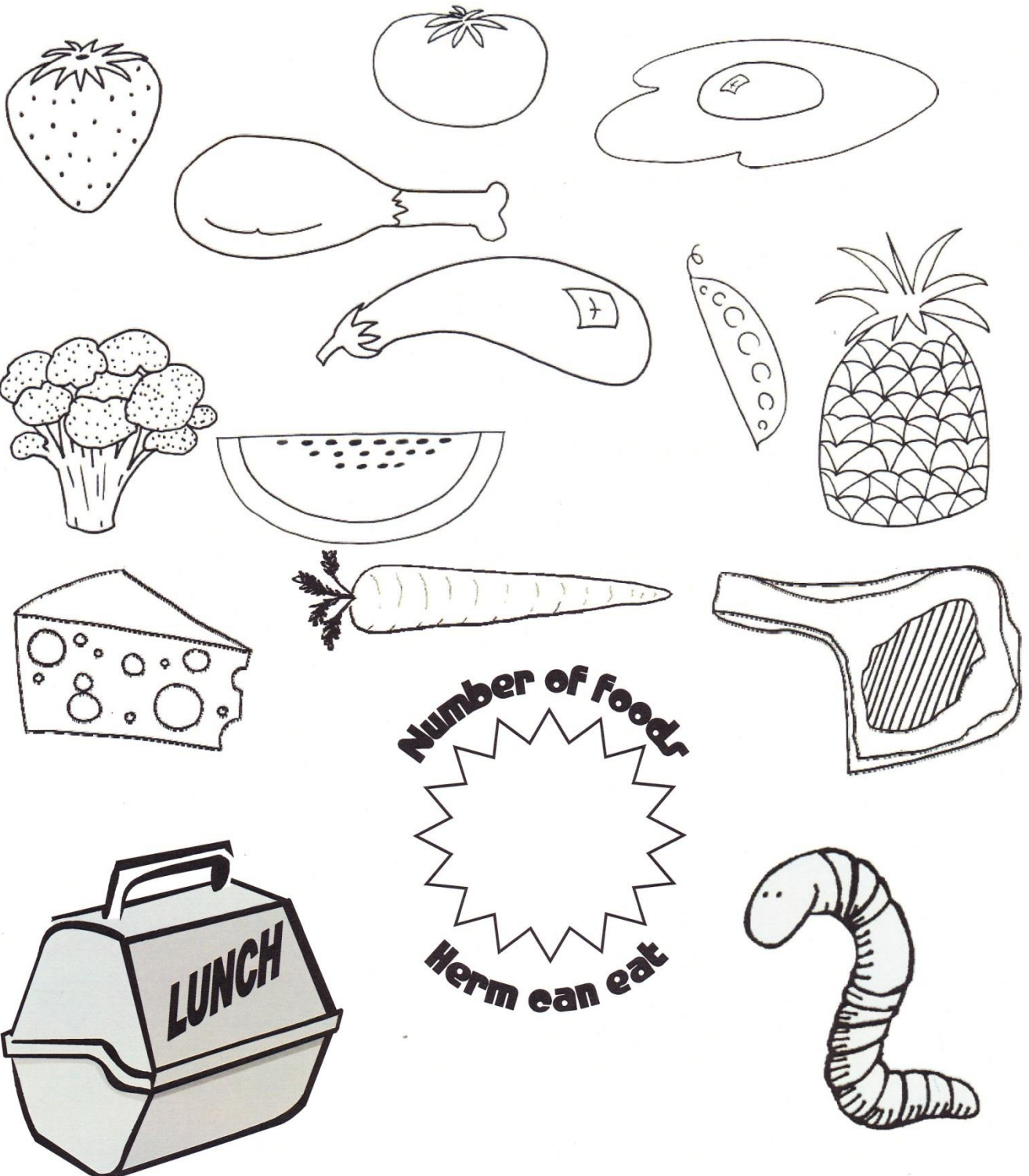


Worm Diner Take-Out Menu



Name _____ Date _____

Herm the Worm is hungry! Help him choose food by coloring ONLY the foods that come from plants. Then count the number of plant-based foods Herm the Worm can eat. Write this number in the star below.



Appendix II- Warming up to Worms Activity

Name _____

Date _____



Warming up to Worms

Place your worm on a damp paper towel where you can gently observe it.

1. What color is the worm? _____
2. What shape is the worm? Describe it. _____

3. How does the worm's skin feel? _____

4. Gently turn the worm over. Is there a difference between the top side and the bottom side? Describe what both sides are like.

5. Can you tell which is the front end of a worm and which is the tail? How do you know? _____



6. Observe your worm with a hand lens.

What do you notice that you could not see before?

7. Does a worm have....

Eyes? _____ Ears? _____

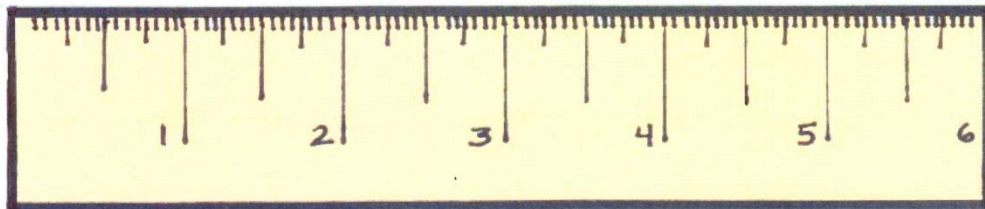
Legs? _____ Nose? _____

Mouth? _____

8. How does your worm move? Does it ever move backwards?

9. Hold a worm in your hand. What does it do? _____

10. How long is your worm? _____



Appendix III- Worms at Work Activity

Classroom Activity

Grades 4-8



Worms at Work



Objective

To teach students that food scraps and yard trimmings can be made into compost instead of being thrown away.



Activity Description

Students will create a compost bin using worms and food scraps and monitor changes in the bin over time.



Materials Needed

- Large plastic bin (about 8 to 16 inches deep) with holes in the bottom for aeration
- Tray for underneath the bin
- Two bricks or other large sturdy objects
- 9 to 14 pounds of newspaper
- One bag of potting soil
- 1 pound of red worms
- Food scraps (such as bread, vegetables, fruits, eggshells, grains, coffee grounds, tea bags) Do NOT include meat, bones, mayonnaise, fish, peanut butter, candy, or nonfood items
- Tarp or drop cloth
- Bucket or other carrying container
- Household gloves (optional)
- Copy of *Vermicomposting Data Sheet* for each student



Key Vocabulary Words

Compost
Vermicomposting
Castings
Decompose
Bedding
Organic



Duration

Setup: 1 hour
Follow-up: 15 minutes to
1 hour on an occasional
basis



Skills Used

Computation
Observation/classification
Motor skills



Activity

Step 1: Explain to the class what compost is and how it is made (refer to the Teacher Fact Sheet titled *Composting* on page 141). Discuss the use of worms, the need for and use of organic waste, and other vocabulary words. During the course of this lesson, inform students of good and bad foods to use in composting, as well as the reason why it is better to compost than to throw food scraps away.

Step 2: Place bin on top of two bricks and put tray under bin.

Step 3: Have the students tear each sheet of newspaper lengthwise into strips that are 1 to 3 inches wide and place half of the pile in the bin.

Step 4: Have the students multiply the number of pounds of newspaper by 3 to determine the total amount of water needed (a pint of water weighs a pound, and a gallon of water



Journal Activity

Have students write a poem, such as a limerick, that describes what compost looks like and how it feels when touched.

weighs 8 pounds). Then add half of the water to the bin with newspapers.

Step 5: Sprinkle two handfuls of soil and the rest of the newspaper and water. Have the students mix the contents well and distribute evenly in the bin.

Step 6: Gently place the worms on top of the bedding, spreading them evenly. Keep the bin uncovered so the students will see the worms moving down into the bedding to avoid light.

Step 7: Use the attached data sheet to record all activities surrounding the worm bin, including the date the bin was set up, the number of worms (or pounds of worms) added to the bin, and the number of people contributing food scraps (number of people in the class). For the remainder of steps for this activity, have students record the date and day food is added, includ-

ing the type of food and its weight, as well as the amount of water added. The compost bin should always remain moist.

Step 8: Use food scraps that you brought from home or that you asked students to bring from home or save from school lunch, and have students add them to the bin. Food can be added daily, weekly, or monthly. Do not overload the system; bury food relatively evenly amongst the different "plots." On the data sheet, instruct students to keep track of how much food they are providing the worms and where it is placed (see diagram on data sheet).

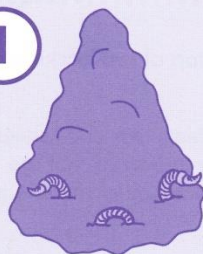
Step 9: Place a sheet of newspaper over the top of the bin to prevent flies from circulating near the area. Store the bin in a cool place out of direct sunlight, and keep the lid tightly shut.

Step 10: Have students check the bin frequently as they add food scraps to see the changes that occur. After a period of 3 to 6 months, depending on the size of the container, most of the food and bedding will be transformed into worm castings, the nutrient-rich waste materials that worms excrete.

Step 11: In order to harvest the compost, or humus, for use (if you choose to), you must change the bedding and temporarily remove the worms. Spread out a tarp or drop cloth in an open area and dump out the entire contents of

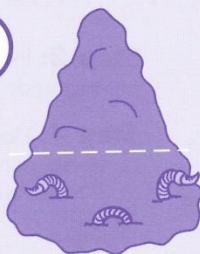
Step 11: How To Harvest Compost

1



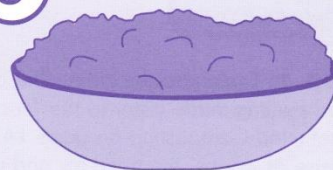
Divide compost materials into several cone-shaped piles (larger on the bottom).

2



Scoop off the material from the top of the piles.

3



Put the castings into a container to carry out to the garden.

the bin. Have students help you divide the materials into several cone-shaped piles (larger on the bottom, so the worms will burrow into it and avoid the light). Direct students to scoop off the material from the tops of the piles, and put the castings into a container to carry out to the garden (see illustration on the previous page for help). Repeat this procedure until most of the compost is harvested.

Step 12: Have students put worms back in the bin, along with any uncomposted food and old bedding. Your class can start a new stock of bedding and add in any additional worms to begin the process again.

Step 13: Create a garden in which to use the compost as a soil amendment, or use the compost on the schools' beds or lawn.

NOTE: Other critters may make their way into the compost bin. Many are beneficial, including mold, bacteria, sow bugs, beetle mites, white worms, snails and slugs, flies, round worms, and millipedes. You do NOT want the following in your bin, however: flat worms, ground beetles, centipedes, ants, and pseudo scorpions. If you find any of these organisms, start over.



Assessment

1. Ask students to define and describe decomposition.
2. Ask students why it is beneficial to compost items instead of throwing them away.



Enrichment

Ask the students to make observations about the worm bin each week. Do smaller pieces of food tend to break down faster than larger ones? What does the compost smell like? What organisms do they notice? Are the worms multiplying?

1. Have students take the temperature of the worm bin once a week to determine the variations that occur while food is composted. Use a thermometer that can measure up to 170°F. Have the students create bar graphs showing the increase or decrease in temperature over time.
2. Let students use a pH paper to test the acidity of the worm bin once a week. Does the pH change based on the foods that are added? Have the students keep a record of the foods that are added and the pH and chart a graph showing the correlation. If the soil is too acidic, the worms may try to leave the bin. Try adding a little lime.
3. Give students gloves to gently examine the critters inside the bin once a week. You might also examine a sample of the soil under a microscope (at the beginning of composting, bacteria are present that help break down the food; later larger organisms such as sow bugs and round worms play a larger role.) Obtain an identification guide to invertebrates and insects and see how many you can identify. Have students draw the different kinds of critters and discuss the differences in each (number of legs, body parts, function).

Average weight buried per day: _____

Appendix IV- Barrel Compost Tumbler

Barrel Tumbler

Using a Barrel Tumbler to compost is another great method for composting. This device requires the same ratio of browns to greens, but aerating the material is done easier than the Herbie method.



Advantages of Using a Barrel Tumbler:

- Rotation of the organic material is done simply.
- With its enclosed sides, a tumbler, like any enclosed bin, will do a better job of retaining moisture in those hot arid summer days. Conversely, they also help in keeping excess moisture out in the rainy season, which can keep a pile that has a lot of "wet" material, like grass clippings, from starting to smell.
- Especially those bins that stand above ground, make it hard for rodents and other critters to find their way into the compost pile, and the goodies you have stored there.
- While this varies a lot based on the individual design, many of them are considerably easier to get material in and out of.
- While many gardeners don't mind a free standing compost pile, many enclosed bins including tumblers provide a cleaner, tidier look.

Disadvantages of Using a Barrel Tumbler:

- Can be expensive to purchase (\$150-\$300)
- Must find a place on school grounds that will accommodate one
- Prone to vandalism

Procedure:

1. Make sure you discuss where this device will go on school grounds. Also, keep in mind the attractiveness of this device to succumb to vandalism. Any composting device should be useful and convenient for composting, but be installed and secured to a site place that would be less likely to be vandalized.
2. Composting Barrels can be obtained online or potentially locally during growing season. To find one online, search Google for "Barrel Composter." Follow the Composting Directions that are included with the purchase of the Compost Barrel Tumbler.

Suggestions on Makers of Compost Barrel Tumbler:

Tumbleweed, Sterling, Compost Wizard brands all have good designs of composting barrel tumblers.

Appendix V- Forming a School Compost Action Plan

- I. You will need to maintain as close to a 15:1 (or higher) brown:green ratio in your compost as possible.
- a. Brown items: newspaper strips, shredded paper, dried leaves, dead garden material (carbon heavy)
 - b. Green items: food items (nitrogen heavy)

Specifically, what green and brown items will be included in your compost?

Brown (carbon heavy):

Green (nitrogen heavy):

- II. What will be used to collect the food (green) and brown items?

- III. Who will be responsible for collecting the food (green) and brown items?

Who will be responsible for taking the green and brown items to the compost, rinsing the buckets and returning buckets to cafeteria/classrooms?

- IV. What container method will you use for your compost (Herbie, barrel tumbler, etc)?

- V. How will students be actively involved (collecting green and brown items, cranking, etc)?

- VI. Where will finished compost go on campus?

Appendix VI- Compost Survey

Compost Survey

The goal of the Compost Survey is to assess the experience, knowledge, and attitudes of your students as they apply to composting. The overall scores on the two parts are designed to give you a general idea of student knowledge about composting and should be used along with teacher observation to determine your compost education strategies. The items on the survey can also generate an interesting discussion about composting.

The survey can be given shortly after the initiation of a school composting program and again half way through the school year or at the end of the school year. This use is similar to a pre- and post-test; the student responses are a measure of the change in their compost knowledge and attitudes over time.

The first year of a composting project may move along in fits and starts while you are finding ways to make the composting routine work. The survey could be a useful assessment tool at the start of the second year of the project with students who have been in the program for the previous year. This will give you some measure of the progress you are making with the students' grasp of the composting ideas. At that time, the survey could also be administered to students new to the program to help you decide what compost education will be needed with the new group. Students who have done composting at their elementary schools may not require as much initiation to composting concepts.

Part One **The Survey Statements**

A response of "always" is an indication of some knowledge and a positive attitude toward composting. Students can add up the number of responses in each category and multiply times a value to get their score:

never = 1 sometimes/usually = 2 always = 3

Part Two **True or False Statements**

After students complete their responses to Part Two, the teacher should take the opportunity to make this a learning experience. One way to do this is to have the students discuss their answers in groups of three; encourage them to support their answers. If a student wishes to change a response, he/she could write the new response in a different color beside the original answer. (That way, the original responses can still be tallied for the purposes of comparing pre- and post-survey scores.) The large group discussion can follow.

Another way to extend the learning value of Part Two is to use it as a springboard for further research by the students.

Answers:

True statements: # 1, 2, 4, 5, 6, 7, 9, 11, 14, 16, 18, 20

False statements: # 3, 8, 10, 12, 13, 15, 17, 19

Part One Read each statement and circle your response.

1. I compost at home.

never sometimes/usually always

2. I understand what composting is.

never sometimes/usually always

3. When I sort my lunch waste, I know what goes into the compost food barrel.

never sometimes/usually always

4. I know what happens to the food in the compost food barrel.

never sometimes/usually always

5. My friends are careful not to throw plastic utensils into the compost food barrel in the cafeteria.

never sometimes/usually always

6. After lunch if I have leftover food, I save it to eat later.

never sometimes/usually always

7. I sort my lunch waste carefully.

never sometimes/usually always

8. Sorting lunch waste is easy.

never sometimes/usually always

9. My friends sort their lunch waste correctly.

never sometimes/usually always

10. I notice when other kids sort their lunch waste correctly.

never sometimes/usually always

11. Sorting lunch waste takes only a few seconds.

never sometimes/usually always

12. After a while, kids get used to the routine of sorting their food waste.

never sometimes/usually always

13. The product from composting food waste, compost, can be useful.

never sometimes/usually always

14. If plastic accidentally lands in the food waste barrel I remove it.

never sometimes/usually always

15. I check the daily composting poster if I'm unsure what to put into the food waste barrel.

never sometimes/usually always

16. I ask a teacher or student if I am unsure about what to put into the food waste barrel.

never sometimes/usually always

Part Two Decide if each of the statements is true or false. Circle your answer.

1. The nutrients in food can be recycled.

true false

2. Paper is biodegradable.

true false

3. Plastic wrap should go into the compost.

true false

4. Changing food into soil takes several weeks or months.

true false

5. Soil is made out of organic material and sand.

true false

6. Worms are decomposers.

true false

7. Decomposers in a compost pile need oxygen.

true false

8. It doesn't matter if the compost pile is turned as long as it is wet.

true false

9. The product of a compost pile is similar to topsoil.

true

false

10. The best way to get rid of leaves is to put them in a plastic bag for trash pick-up.

true

false

II. When compost gets compacted, it can cause unpleasant odors.

true

false

12. The center of a working compost pile is very cool.

true

false

13. Compost piles are always very smelly.

true

false

14. Nature recycles.

true

false

15. People who live in apartments can't compost.

true

false

16. Composting is one way to recycle.

true

false

17. Decomposers need only food and air to do their work in a compost pile.

true

false

18. Yard scraps such as grass clippings and leaves can be composted.

true

false

19. Composting works only if it is done in a specially designed compost bin.

true

false

20. Usually, animals are not attracted to a compost bin if meat and bones are not put into it.

true

false

Appendix VII- Lessons, Labs & Activities

❖ Introductory Lesson



Compost Introductory Lessons

What Good is Trash?

This is an introductory lesson to composting designed to encourage students to rethink the way we value our trash. The three parts of the lessons can be done in a 90 minute teaching block. Alternatively, Parts One and Two can be taught as one lesson and Part Three, which introduces composting, taught as a separate lesson.

Time 90–120 minutes, depending on age group and extent of discussions.

Class of 20–25 students, divided into groups of four.

Materials

1. Five Grocery Bags, each containing: Cereal box, soda can, another metal food container, plastic food container, old piece of foil, tea bag, a cracker (in a baggie), dry leaves or grass clippings (in a baggie), ribbon or gift bow, piece of junk mail, magazine, peanut or cocoa “can” (made of foil, cardboard and plastic), plastic shopping bag, **empty** container of bug spray, flea and tick powder, fertilizer, or oil-based paint.

Note: some items are in baggies for convenience and should not be removed from the bag. For the purposes of this activity, students should sort the items without regard to the baggie.

2. Five Sets of Index Cards marked: Plastic, Metal, Paper, Household Hazardous Waste, Food, Yard Wastes and Other

3. Sheets of Scrap Paper

4. Transparencies

Make transparencies from the *Documents to Copy* section of this manual. “Soil Diagram”, page 80; “Soil and Decomposition,” page 81; “Discover Compost Animals,” page 82; “The Trash Can Diagram,” page 83.

Items below are needed for Part Three

5. Bag of food scraps

6. Bag of finished compost

7. Sample ingredients for the compost pile (leaf, grass clippings, apple core, orange peel, coffee grounds)

Motivation/Initiation

Begin the lesson by offering to sell a bag of valuable trash; it’s special because it contains packaging from some favorite products. Play up the uniqueness of this trash and entice the students to make offers. Usually no one offers to buy the trash but there may be a student who wants to play along and offers a few cents. A student might see that there is a redeemable can and offer five cents. (Who will offer \$10 for this valuable bag of trash? \$5?) Conclude that basically most of the students are not willing to pay anything for the trash. Ask them why and list their answers on the board. Examples of responses: “The trash is worthless, they can’t use it, they don’t need it.” Solicit words that describe how we feel about trash: “Disgusting, dirty, useless.” Add these words to the list on the board.

Activity

Part One **Sorting for Points**

Divide the students into five groups. Tell them they will be given a quick activity that involves sorting a bag of trash. Each bag contains trash items and a set of category cards. Groups will be given one point for each item correctly sorted by the material it is made of. Tell them that this will probably be easy so they will need only a few minutes to complete the task. The group members must discuss the items and agree on the placement of each item. Give each group of four students a bag of trash and the sorting cards. They will need about ten minutes to sort.

When all the groups have sorted their bags, list the items on the board and review with the class how each item was sorted. For each item, check for general agreement. Students may not agree but a group might be awarded a point if it can make a reasonable justification for its choice. A group member should record the points.

There will be quick agreement for many items so do a quick whip-around to award points. The tea bag will generate discussion because many students do not see the paper as biodegradable. If you use a tea bag with a plastic string or a staple, interesting solutions may arise. Packaging made of a composite of foil, cardboard and plastic (the type for canned nuts), is not easily recycled and, therefore, is trash.

A certain amount of discussion and competition among groups is okay. It will make the points seem more valuable. Tally and list the scores; most groups will have similar scores at this point.

Answers

Paper: cereal box, junk mail, magazine

Plastic: plastic food container, lid of peanut can, plastic shopping bag

Metal: soda can, metal food container, foil,

Food and Yard Wastes: cracker, dry leaves, grass clippings, teabags

Household Hazardous Waste: empty container of bug spray, flea and tick powder, fertilizer, oil-based paint

Other: peanut or cocoa can, ribbon, gift bow

Part Two **What Good is Trash?**

Now challenge the groups to earn more points by using their creativity to brainstorm a list of possible uses for each item they have sorted. Remind them that when brainstorming, all ideas are acceptable. A group member should record their ideas. Give them about 5 minutes to list ideas.

When time is up, each group can tell the class three of their ideas. The group recorder should then count their total number of ideas and add this total to the points from the sorting activity (Part One). Again, different opinions and ideas will increase the value of the items of trash.

Discussion Questions

1. What are some words that describe how we felt about the trash during the activity?
2. Make a list of the words that describe our attitude toward the trash during the activity; compare this list with the first.
3. How did our attitudes compare to the beginning of the lesson when they were offered the bag of trash for sale?
4. What changed our attitudes?

5. Why?
6. What if each point were equal to a dollar, would that affect the activity in any way?
7. What does this activity show us about how we value things?

Lead the Group to these Ideas

- 🌀 We can decide if something has value.
- 🌀 Each culture has objects and materials that it values for various reasons.
- 🌀 Trash is a valuable resource. One person's trash is another person's treasure.

Part Three **What's Composting?**

List the following types of trash on the board: Plastic, paper, food wastes, metal, yard/garden wastes, glass. On a piece of scrap paper, have each student list the types of trash in the order in which he/she thinks Americans produce the most. Have them vote to show some general reactions to the question. Then, compare their list to the figures listed on the transparency showing a diagram of a trash can indicating percentages of types of waste.

Discussion Questions

1. Are the percentages close to what you predicted?
2. What type of trash did you put as the largest percent?
The smallest? Why?
3. What surprised you? Why?

Generate a list of what happens to trash after roadside pick-up: Trash is recycled, landfilled, incinerated, composted, reused. (Virtually all Connecticut household trash is incinerated at a resource recovery facility or is sent out-of-state. Items kept separate for recycling are processed at a recycling plant.)

Define biodegradable with the students. Have students circle the items on their list that are biodegradable.

If something is biodegradable, it can be composted. Ask if anyone composts at home; who can explain what composting is?

Discuss decomposition: rotting, decaying, breaking down of organic material (part of living things) by insects, worms, fungi and bacteria (decomposers). If we composted all the biodegradable trash, what percent of the trash we produce could be composted? (Refer to trash can transparency: over 60%.)

Nature Recycles

Discuss how nature recycles nutrients in a food chain. Students can make up examples of food chains. Food chains begin with photosynthesis by plants. Each organism uses the energy it gets to function (grow and repair cells, reproduce, run, eat, etc.)

Discuss the breakdown of leaves in a forest using the transparency that shows how soil is made. What causes the leaves to break down into soil? The rate of decomposition depends on conditions such as the amount of water and oxygen and the types of decomposers. (If this is to be done as a separate lesson, students can go outside and investigate leaf litter and topsoil.)

Explain that we imitate nature when we compost, but we speed up the process by creating the conditions needed for efficient decomposition.

Show the transparency of compost animals. Ask students to name the decomposers they recognize. The discussion about the less familiar ones such as actinomycetes will depend on how much you want to get into the various types of organisms.

It is adequate for them to become aware of the general categories: fungi, bacteria, worms, insects and insect-like organisms (spring-tails, mites) and mollusks (snails). (This fits well into a unit on invertebrates.)

Have students discuss the meaning of the arrows in the diagram. Can they find any food chains?

Explain that decomposers are living organisms. Ask students to list the things all organisms need to survive: food, water, air (oxygen), shelter and space.

Show a baggie full of food scraps and a baggie of finished compost. When we compost food scraps we need to provide the right conditions for the decomposers to live and reproduce so they change food scraps into humus. Allow students to smell and touch the compost and think of words that describe it. Completely composted food results in a crumbly, earthy-smelling product.

Ingredients for Composting

Browns and Greens

Food gives us energy and nutrients (basic elements) for building and repairing cells. Decomposers need carbon for energy; dry leaves and wood chips provide energy for decomposers. They also need nitrogen to build proteins; food scraps and fresh grass clippings are high in nitrogen. A carbon/nitrogen ratio of 30:1 is ideal. The browns are also called bulking agents and are layered between the greens to keep the materials from compacting. A light, loose mixture allows oxygen to circulate and space for decomposers to move around. Water must be provided also; most food has a high water content. If a compost pile gets too wet, it will become compacted and decrease oxygen flow. The compost bin and materials provide shelter (some protection from predators and weather conditions) for the decomposers.

Suggestions

Using samples of the ingredients (or paper or plastic representations), show how to layer the browns and greens. Visit a working compost bin, if possible, to observe contents and measure “living conditions” (temperature).

Hold up a bag of finished compost and ask if any of the students has ever purchased potting soil. How much would this bag cost in a store? Make the point that people will pay money for compost, so it has value. What could you use the compost for?

Have each student write on scrap paper why it would be beneficial to compost our food and yard wastes at home or in the community. Students may think of how they could use the compost in their gardens instead of buying soil or fertilizer.

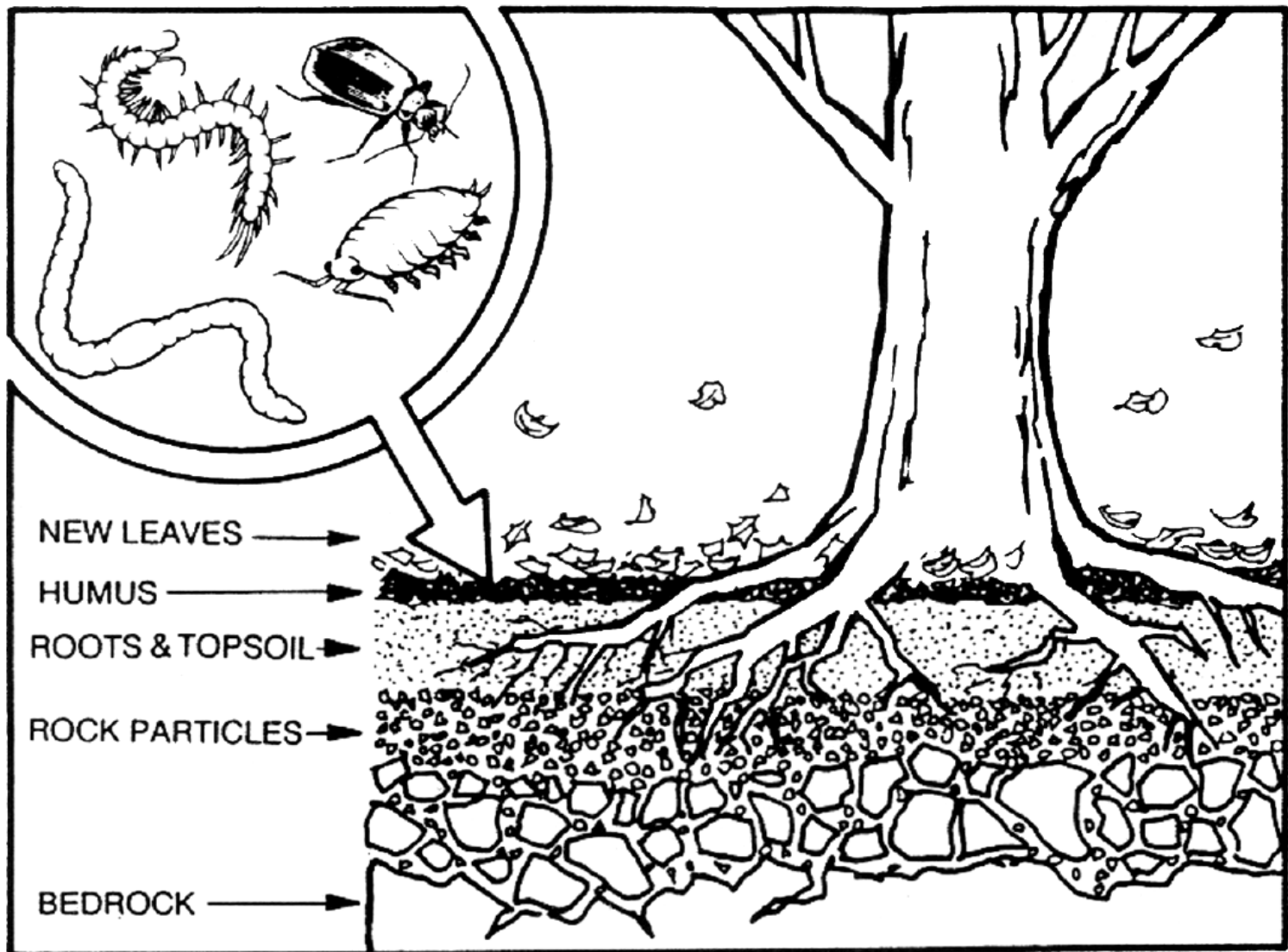
Community Composting

- ♻️ Reduces the amount of trash (the “solid waste stream”)
- ♻️ Reduces transportation costs (for transporting waste to the incinerator and goods— fertilizer, soil— to market)
- ♻️ Reduces fuel used for trash transportation and shipping goods to market.
- ♻️ Produces humus, a useful product

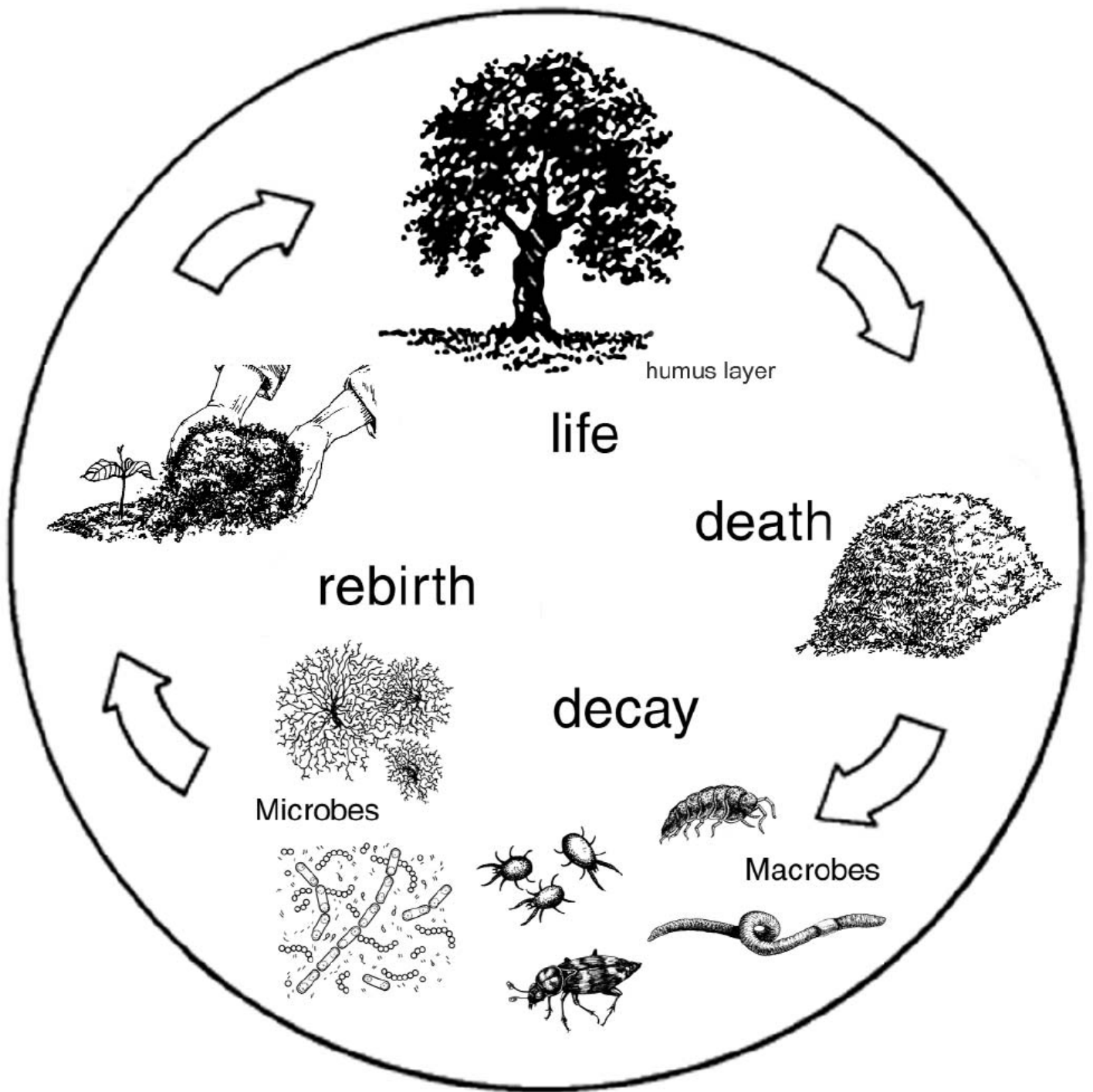
Closure

Have students write something new that each of them learned about compost or how their attitude about garbage has changed. Students can share their statements.

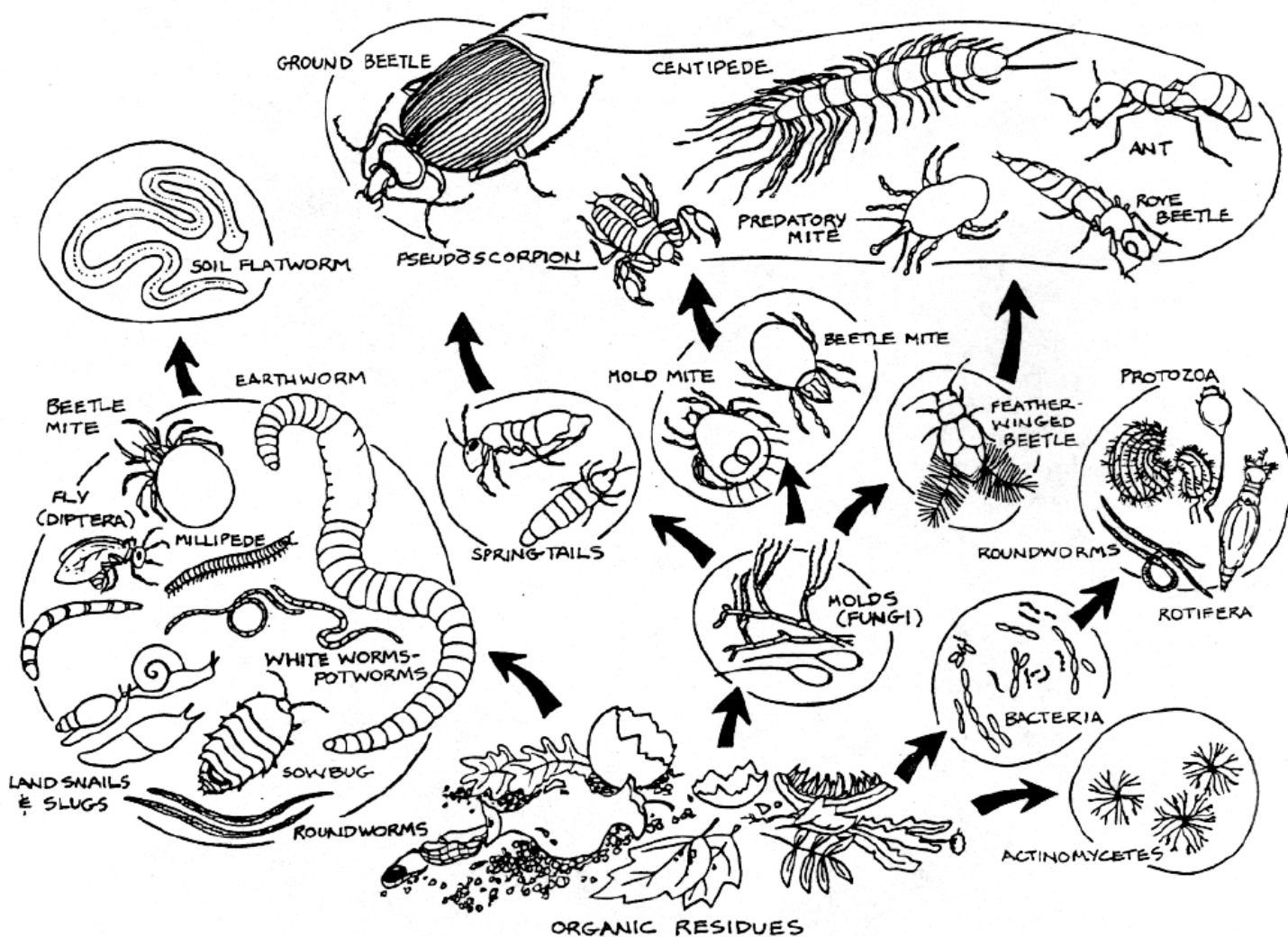
Soil Diagram



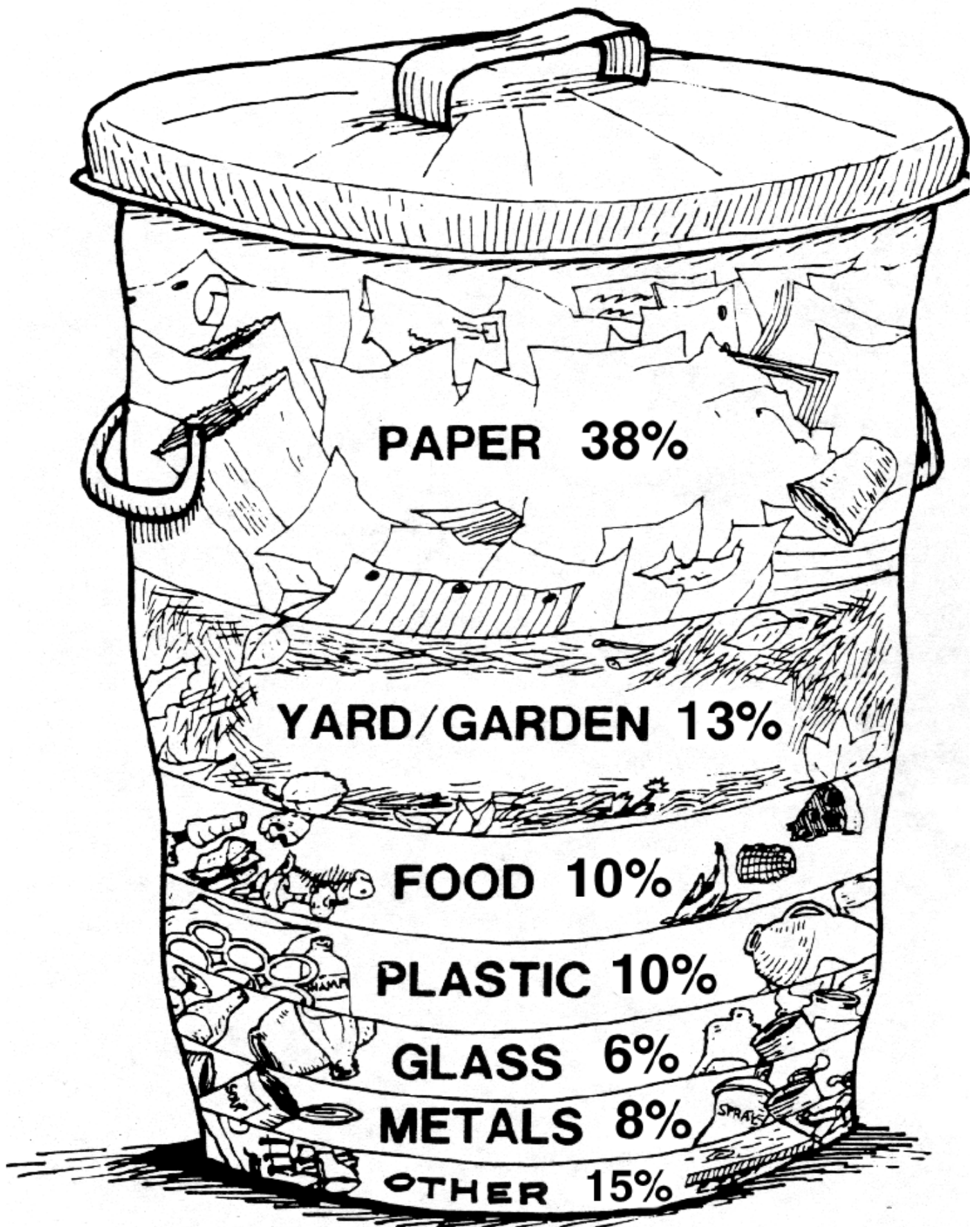
Soil & Decomposition



Discover Compost Animals



Trash Can Diagram



❖ Lessons for Compost Exhibits

Constructing Traveling Displays

This set of lessons was originally designed for a group of sixth grade teachers to use with their advisor/advisee classes as part of their environmental awareness goal. The students learn about composting by participating in the lesson and designing a compost display. Sixth-graders are old enough to translate the composting concepts into a meaningful exhibit and especially like the idea of teaching other students. Upon completion, the exhibit might be displayed in the school library, cafeteria, or at the school science fair. The exhibit could be made available on a sign-out basis for individual home-rooms or for subject area teachers to display for a week to integrate composting into their curriculum. An extension activity could be for sixth-graders to visit the elementary schools with their exhibit.

Each lesson contains a curriculum resource, lesson concept and summary, and ideas for designing a display board with students. Presented as a traveling exhibit, the display boards get viewers to think about ideas ranging from recycling resources to decomposition. The actual designing and building of the display may be done by the entire class or by a small group of students.

Of course, teachers may choose to do only a few of the lessons, selecting and modifying to suit their needs. The lessons can be adapted for all middle school grades.

The goal is to engage students in creating a series of interactive display boards that help other students learn concepts about composting and recycling.

Concepts

Students do an activity that helps them learn about a composting/ recycling concept. Each of the following lessons focuses on one theme about recycling or composting (although several concepts may be discussed); most concepts are probably not new to the students and can be done in a 30–45 minute block.

Resources

Transparencies can be made from the illustrations in the “Documents to Copy” section of this manual. Useful background information from other sources is also listed. Refer to the “Resources” section, page 85.

Display Idea

Students design and build a display about that theme. Using the ideas presented in the lesson, students either design the display together or follow instructions for a teacher-designed display, with student input. The time required for the construction of the display will vary, depending on the group. An idea for building the display board around the compost or recycling themes follows each lesson.

The display board should be instructive, interesting and interactive, focusing on one main concept. The display should have a title or question clearly printed and displayed. Using actual items and three-dimensional depictions whenever possible will make the display more attractive and interesting to viewers. Instructions should be clearly printed to explain how viewers are expected to interact with the display and how the display items should be left for the next user. Other things to consider: materials, simplicity, durability, time for construction.

Lesson 1: Rot Time

How long would it take for various items to decompose if thrown outside onto the ground?

Concepts

The amount of time it takes for an item to break down depends on the material of which it is made; if items are not disposed of properly or recycled, many items will not break down in our lifetime; the consequences would be a more unpleasant and/or dangerous environment, and already limited natural resources would be wasted.

Vocabulary

Decomposition, biodegradable

Resources

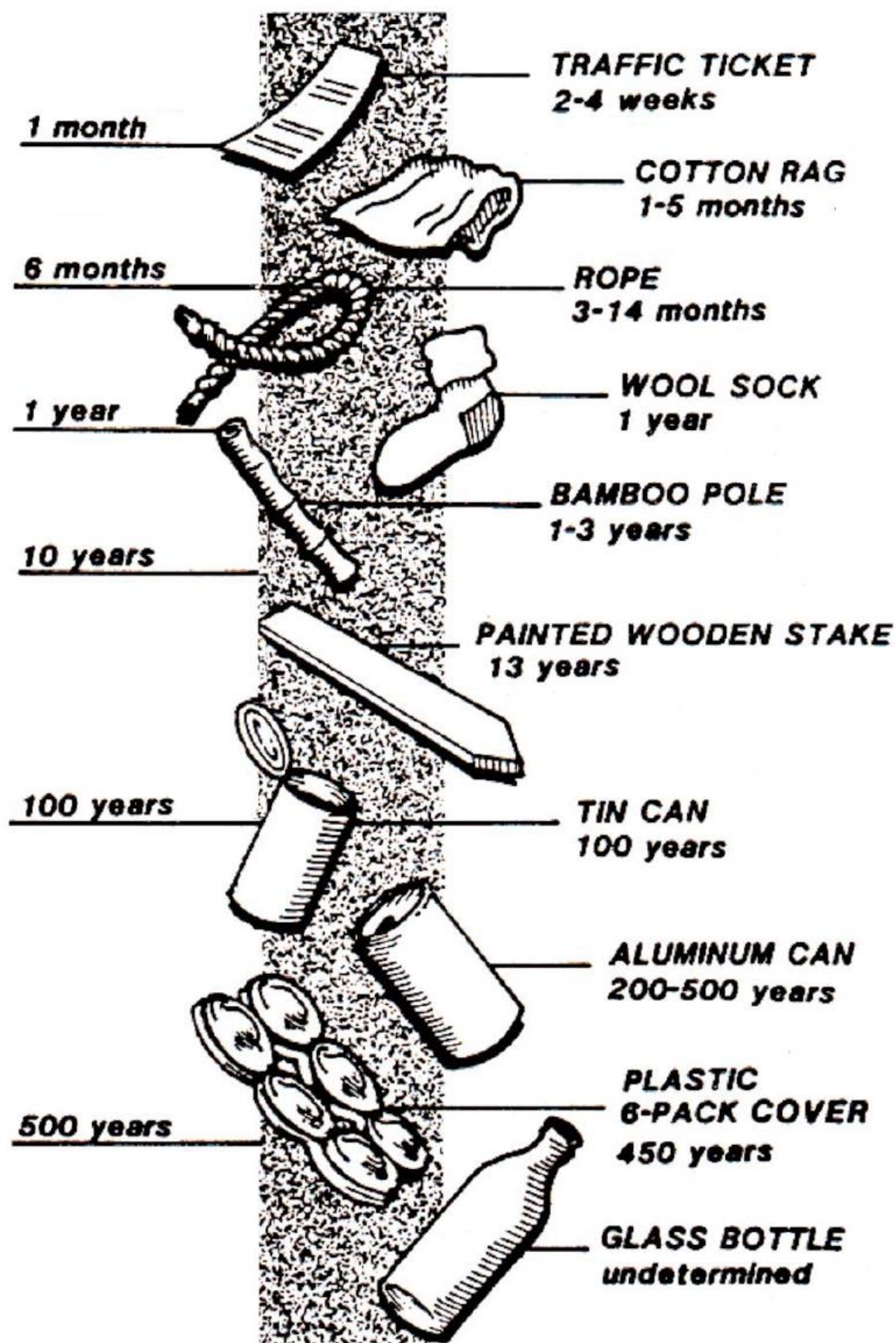
“Enduring Litter” chart, page 84, illustrates estimated years for decomposition of various items.

Lesson Summary

Students estimate decomposition time for items as they put actual items (or pictures, or labels) in the order in which they predict each would decompose; discuss the concepts (decomposition, biodegradable, recycling).

Display Idea

Students bring in actual items and place them in a box. Items are placed on hooks on the display board adjacent to the appropriate years (rot time).



Lesson 2: Compost Creatures

What are the important organisms that do the work of decomposition in a compost pile?

Concepts

Decomposers are the organisms that break down foods into their basic nutrients (ie., calcium, potassium, nitrogen, carbon) that can then be reused by plants and continue the nutrient cycle; insects, worms, fungi and bacteria decompose the food by physical activity (chewing, shredding) and chemical activities (digestion).

Vocabulary

Decomposers, decomposition, biodegradable, nutrient cycle

Resources

“[Discover Compost Animals](#),” page 82

Lesson Summary

Students search for organisms in compost material, identify, sketch and read about; discuss above concepts; students may search with the naked eye, a hand lens or by sorting through a sample of compost material with the aid of a dissecting scope.

Display Idea

Diagram or create a compost pile with real and simulated materials; student drawn pictures of decomposers are arranged throughout the pile; decomposer pictures are flipped up to reveal an information card about the organism; display could play on the idea of “most wanted” posters for a compost pile; students may think of their own title.

*** Find *Discover Compost Animals* in Introductory Lesson.**

Lesson 3: Construct a Compost Pile

What are the parts of a compost pile? What keeps a compost pile cooking?

Concepts

Decomposers are organisms (fungi, worms, insects, bacteria) that digest food/yard waste, turning it into a rich soil; the decomposers must be given the correct conditions for the composting process to work quickly (water, oxygen, food, and mass); dead leaves, wood shavings, straw or shredded paper (referred to as “browns”) provide carbohydrates for energy and spaces for oxygen to circulate; nutrients such as food scraps or grass clippings (referred to as “greens”) provide the protein necessary for cellular growth and reproduction.

Vocabulary

Decomposers, browns, greens

Resources

“[Discover Compost Animals](#),” page 82; “Backyard Composting,” pages 21–23 from *Composting Across the Curriculum*.

Lesson Summary

Students view video and/or visit the school composting bins; discuss above concepts.

Display Idea

Students construct artificial layers to fit onto a compost bin diagram (browns are represented by 24" x 6" pieces of foam core board covered with paper leaves or dried leaves glued on; greens are foam core board with paper food scraps or magazine pictures of food). Exhibit viewers must read a paragraph about constructing a compost pile, then hook the brown and green layers on the exhibit board.

Situation cards are printed that describe conditions in the compost pile requiring the exhibit viewer to select a remedy card; a reference chart about compost troubleshooting is also displayed. Figure out a clever way to let the viewer know the selected remedy is the correct one.

* Find *Discover Compost Animals* in Introductory Lesson & *Backyard Composting* in Bluegrass PRIDE Composting Bin.

Lesson 4: Cool Facts about Compost

What are some interesting facts about composting? What's happening with our school compost? (This lesson is designed for after a school composting project has been started.)

Concepts

Decomposition is the process through which living organisms digest and reduce organic material to humus; in nature, soil is created when decomposers digest dead plants and animals, recycling important nutrients (the nutrient cycle); in composting, we create an environment suitable for organisms to flourish and reproduce, causing organic materials to decompose faster; yard trimmings, food wastes and paper (a large percentage of our waste stream) can be recycled through the composting process; there are many benefits to composting.

Vocabulary

Composting, compost, biodegradable, waste stream, nutrients

Resources

"The Trash Can Diagram," page 83; copy of the school composting records showing amount of food composted; www.conservatree.com; www.epa.gov/osw

Lesson Summary

Students discuss composting at their school, what is composted, the benefits of composting, tour the school's compost bins, search for interesting facts about composting.

Display Idea

Create a "Cool Facts about Composting" display using foods and decomposers as cartoons characters who ask questions or give hints; viewer must flip up a card or open a lid to read the answer or cool fact.

*** Find *The Trash Can Diagram* in Introductory Lesson.**

❖ Compost Labs

Four hands-on compost labs, designed for 5–8 graders, investigate the processes in an active compost bin or worm bin. A lab can be done with a whole class; alternatively, they can be set up as lab stations through which small groups of students rotate (requires about 90 minutes).

Resources

LAB TITLE	DESCRIPTION	CONCEPT	TEACHER PREPARATION	MATERIALS
Lab I Fungi	Examine variety and structure of fungi samples	Fungi are important decomposers	Grow samples of fungi from compost Make copies of "Discover Compost Animals," page 82	Petri dishes Hand lenses or dissecting scopes
Lab II Animal Decomposers	Examine variety of animal decomposers	A variety of animals make up a compost food web	Select samples of compost containing compost animals; keep in small covered containers. Make copies of "Discover Compost Animals," page 82	Compost animals Compost food web diagram Petri dishes Hand lenses or dissecting scopes, probes/ toothpicks
Lab III Red Wigglers	Examine compost worms	Red wigglers decompose food in a worm bin	Start a class worm bin (or have access to an active worm bin)	Red Wigglers Worm bin Petri dishes Hand lenses or dissecting scopes
Lab IV Soil Composition	Examine different types of soils; compare to compost	Organic materials are important ingredients in soils	Collect samples of field and forest soil, unscreened and screened compost	Soil samples Petri dishes Hand lenses or dissecting scopes

Question

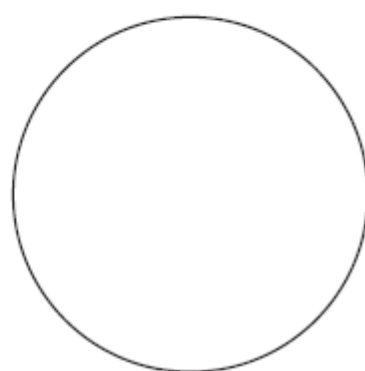
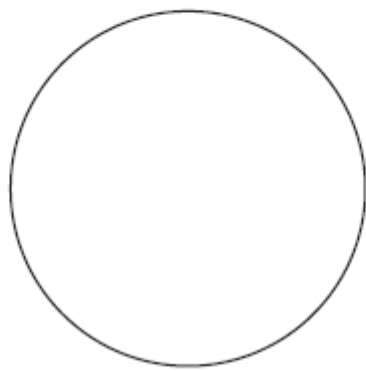
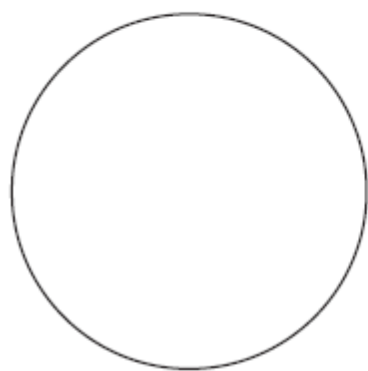
What are some of the first organisms that begin to decompose food scraps in a compost pile?

Hypothesis

What do you think?

Procedure

It takes many types of organisms to decompose food scraps in a compost pile. The food must be physically and chemically broken down. Observe the petri dishes of fungi samples under the dissecting microscope. In the circles below, sketch each type you observe.



Write a Description of the Fungi.

About Fungi

Fungi cannot photosynthesize; instead, they get their energy and nutrients from dead and dying organisms. Many kinds of fungi grow in a compost pile; some are commonly called molds. As a fungus grows, it branches out and burrows through the food scraps, breaking it up into smaller pieces. The fungus releases chemicals that soften the food scraps and make it easier for the fungi to extract the nutrients it needs.

The changes in the food scraps made by the fungus as it grows and feeds, make it easier for other compost organisms to feed. Smaller and softer food scraps are easier for fungi, bacteria and other decomposers to feed on.

Fungi are also part of a food web in a compost pile. Look at the diagram of compost organisms to identify three types of animals that feed on fungi. (The arrows in the diagram indicate the flow of energy and nutrients along the food chain.)

Conclusion

What do you think would happen if all of the fungi in a compost pile died?

Question

What are some of the animal decomposers that work in a compost pile?

Hypothesis

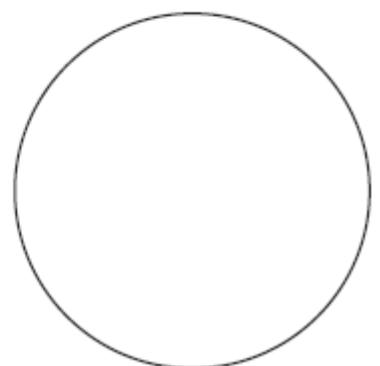
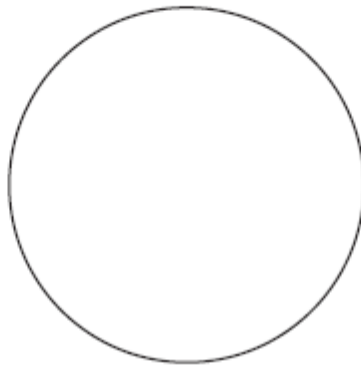
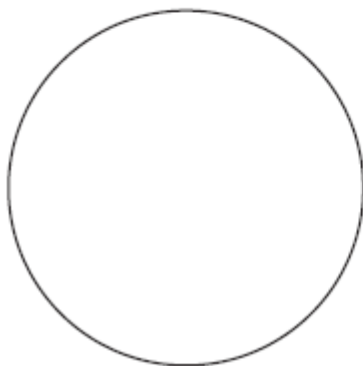
What do you think?

Procedure

Take a small sample of compost material from the tub and place it in a petri dish. Using a toothpick to gently probe through the mixture, look for tiny organisms. Use a hand lens or dissecting microscope to get a closer look.

Observations

Sketch any organisms you find in the circles below.



After you sketch, try to identify the type of organism by referring to the compost food web diagram.

Write where each organism fits into the food web. Does it feed directly on the food scraps or does it feed in the second or third level of the web?

About Decomposers

When animal decomposers burrow into food, they shred the food, pull it apart and chew it. During digestion, food bits are chemically broken down into simpler nutrients by the digestive juices. Each animal takes the nutrients it needs from its food and excretes what it doesn't need. In the compost pile, the dark, nutritious soil made from animal wastes is called compost.

Conclusion

Why do you think it's important to have a variety of decomposers in the compost pile?

Question

How do worms make soil in a worm bin?

Hypothesis

What do you think the worms are doing in the worm bin?

Procedure

Describe what you see in the worm bin.

Carefully remove a small sample of shredded paper and a red wiggler worm from the worm bin and place them in a tray. Take a few minutes to observe the behavior and structure of the worm. You are removing the worm from its home. You may notice some behaviors that indicate that it may be uncomfortable in the tray. Be gentle with the organism; in a few minutes, return it to the worm bin and cover it with some of the paper.

Sketch the Worm.

Write three things you notice about its behavior.

About the Worm Bin

The worms used in a worm bin are red wigglers, a relative of the common earthworm. Red wigglers feed directly on food scraps, which makes them great for composting. Given the right conditions of moisture (they breathe through their skin), oxygen, and food scraps, red wigglers are very efficient decomposers. Their digestive systems break down the food physically and chemically. Their wastes, called worm castings, make soil dark and rich in nutrients.

Conclusion

Why would it be important to have a lot of worms in your garden?

Question

What are the ingredients in soil?

Hypothesis

If you had to write a recipe for soil, what would be the ingredients?

Procedure

Compare the soil samples and write your observations in the chart. (Labeled soil samples: field soil, forest soil, unscreened compost and screened compost.)

Color	Odor	Texture	Ingredients
Field soil			
Forest soil			
Unscreened compost			
Screened compost			

If you had more time, what would be some other ways to compare the soil samples?

About Soil

The formation of soil is the result of three processes, mechanical weathering, chemical weathering and the activities of soil organisms. Mechanical weathering happens when the freezing and thawing of water break down rock material into smaller and smaller pieces. Rainwater dissolving calcium salts from rock material is an example of chemical weathering.

A layer of rich, dark soil, called topsoil or humus, is found in forests and fields. There, dead plant material is decomposed in the digestive system of soil organisms, such as earthworms. Their wastes are the recycled nutrients needed for new plant growth and are the main ingredient in humus. Depending on weather conditions, it could take many years to form one inch of topsoil.

In the forests and fields, nature recycles nutrients all the time. When people compost food scraps, they are copying nature, but we speed up the soil-making process by giving the decomposers the right conditions for them to grow and reproduce quickly. The decomposers need nutrients (to form proteins for cell structures), energy, water, and oxygen. Fresh food scraps supply the nutrients; dry leaves or wood chips supply the energy. Turning the pile regularly provides spaces for oxygen to circulate. The compost pile should be kept moist, but not dripping wet. Given the right conditions, the decomposers can change more food scraps into compost.

Conclusion

How did the soil samples compare? What were some of the surprising or most interesting observations you made?

Appendix VIII: Compost Tour

Take a Compost Tour

This activity is designed to be used after the school composting program is underway to help students learn more about their school composting process.

Part One **Before the Tour**

Students show what they already know about the school composting program. It is interesting to see what preconceived ideas students have about composting.

Students should respond to questions in Part One individually; if there is time, they may discuss their answers in a small group or as a class. Part One could also be a homework assignment the night before the Compost Tour. Students could be encouraged to get family members responses after they have completed their answers to Part One.

Part Two **Take a Tour of the Compost Bins**

Materials

1. Clipboards and student worksheets: One per student
2. Equipment (used for daily composting operation): Cafeteria food barrels, food scraps in barrel, scale, weight chart, compost thermometer
3. Food Cards (one food written on each card): Salad, cheese, milk, sausage, carrots, chicken, apple, pasta, bread, peanut butter, cookies, vegetable soup, waffles and syrup, cereal
4. Compost Sequence Cards: Each step in the sequence should be printed on large construction paper or an oak tag strip

Compost Sequence Cards

1. Lunch wastes are sorted
2. Food scraps are weighed; weight is recorded on chart
3. Temperature of active bin is measured and recorded
4. Food scraps are placed in the bin
5. Dry leaves, wood shavings or wood chips are spread over the food scraps
6. Fungi, bacteria, worms and insects decompose the food
7. When bin is full, pile is moved over into the next bin

Setting Up the Tour

Talk up the tour as an adventure, perhaps wearing a sign that says "Tour Guide." Be enthusiastic and ham it up! Get the students involved in the tour. It should be fun, informative and interactive. Students should have their worksheets on a clipboard. For younger kids, you could assign a few students the role of inspectors.

Touring the Group through the Composting Process

Station One

Food Scrap Barrel in the Cafeteria

Student Involvement

Distribute food cards and have students take turns placing cards in front of the correct barrel to show they know how to sort their lunch wastes.

Station Two

Scale (wheel the barrel to the scale to weigh and record, a job for the “inspectors”)

Student Involvement

Students predict weight of food scraps, “inspector” records weight on chart.

Station Three

The School Compost Bins

Explain purpose of the multiple bins and the steps of the composting operation, from food-sorting in the cafeteria to turning the pile into the adjacent bin.

Student Involvement

Measure and record the temperature of the bins. Review the composting operation sequence by using seven students who each hold a sequence card and arrange the composting steps in the correct order. Take turns shoveling (turning over) the contents from bin #1 to bin #2. Compare contents of the bins.

Part Three After the Tour

Students return to the classroom to respond to questions on student sheet, based on information gained on the tour.

Class Discussion

Responses on student sheet, the benefits of composting, and how students can volunteer to help out with the daily composting operation.

Part One Before the Tour

Test your knowledge about composting (can be done individually, in pairs or threes)

1. What is composting?
2. Where are the school's composting bins located?
3. What types of foods should be put in our compost pile?
4. Name some cafeteria wastes that do not belong in compost.
5. List two other things you're likely to find in a bin as part of the compost process.
6. List three locations in the school where we could collect food scraps.
7. List the steps for composting food.
8. What actually decomposes the food in a compost pile?
9. What is the end product of the composting process?
10. List any general beliefs or ideas you have about composting.
11. What are the benefits of composting?

Predict

12. The weight of food scraps per day at our school _____lbs.
13. The total weight of food scraps in the compost pile so far this school year _____lbs.
14. The temperature of the compost pile _____°C _____°F

Part Two **Take a Tour of the Compost Bins**

Answer the following during the tour

15. How many bins are there?
16. Which bin has the oldest contents?
17. Why do we have multiple bins?
18. What are some of the problems we've had with the composting piles?
19. List the items you recognize in bin #1.
20. Which bin is the hottest? Why?
21. Name some of the decomposers.
22. Why are woodchips or dry leaves added to the pile daily?
23. Name two other things needed by the decomposers, besides energy & nutrients.

Part Three **After the Tour**

24. What surprised you about the compost?
25. What is some new information about compost that you learned from this tour?
26. What could be done with the compost produced from the food scraps?
27. Where did our food scraps go before we composted? Are there any problems with that?

For Further Thought

28. We all produce the food scraps in the school. Make some suggestions for sharing the responsibility for the composting operation.
29. Think of a catchy phrase or jingle to get kids to sort their food correctly or get involved in composting.
30. Respond to the following statement: Without decomposers, we could not exist.

Appendix IX: Frequently Asked Questions About Composting

People who have little or no experience with composting often have several questions about the process.

Will the compost pile smell disgusting?

No. A compost pile with the right balance of food wastes and bulking materials, moisture, and oxygen will provide a habitat that will allow the composting organisms to thrive. A working pile typically develops an earthy odor. Food scraps should not be left exposed at the top of the pile. By turning the pile frequently and spreading a layer of bulking material over the fresh food, new deposits are covered, reducing odor. Mature compost has a crumbly, moist texture and looks like dark soil. Foul odors are a sign that the pile is out of balance and requires a remedy such as more frequent turning (aeration), a change in moisture level or food supply.

Will the compost pile look unsightly?

No. The compost bin should be sturdily built of durable materials (see Appendix F, *Compost Bin Design*, page 33). A poorly-constructed or maintained bin begins to fall apart, attracting animals and becoming unsightly. Selecting a site that is behind the school building or is hidden from view by shrubs or a fence will decrease chances of vandalism. Other considerations for placement of the bins are discussed in the section entitled *The Infrastructure*, page 10.

Isn't composting dirty and messy?

No. The composting routine is most pleasant if the area is kept tidy and well maintained. Any spillage of food scraps or bulking material should be cleaned up as part of the daily tasks. Keep garden gloves and composting tools conveniently located, clean and ready to use. Access to water is helpful. Containers for food scraps must be the appropriate size for the amount of wastes expected, easily accessible and have an opening into which food can easily be scraped.

A 20 or 30-gallon trash can that is lined with a trash bag (held in place with a bungee cord around the brim) works well. The container should be on a cart or wheels for transporting to the compost bin. Containers should be emptied and rinsed daily. A covered container is required if it is necessary to hold food scraps overnight.

Can people get diseases from handling composting food wastes?

No, not typically. The heat, ranging from 130–150°F, generated by a thriving colony of decomposers, kills most pathogens. However, staff and students should wear gloves when participating in the compost operation as they may come in contact with food that has not yet decomposed into inert compost. Mature compost can be handled like soil, with or without gloves. (Wearing gloves guards against the drying effects of soil and compost on the skin.) Actively decaying organic matter contains mold spores. Children with asthma or allergies to mold should consult their physician before working with compost.

Don't compost piles attract wild animals?

No, not if managed well. A well-constructed and maintained bin is the best defense against unwanted intruders. The bin should have a latch or lid that raccoons cannot easily pry open. There are numerous designs for bins with mesh wire to eliminate rodents, but these must be maintained for maximum effectiveness. Following proper composting procedures will keep the pile cooking and odors to a minimum, attracting fewer flies and critters. Garbage dumpsters and trash compactors are usually more attractive to vermin than compost bins.

Isn't composting a lot of work?

No. Remember, the decomposers of the pile do most of the work for you. Keep the process simple and convenient. Containers for food scraps must be conveniently located and clearly labeled; students and staff need help learning the best way to separate their lunch wastes. The compost bin should be located conveniently for the efficient transportation of food wastes. (Placement of the bin near a garden may be considered, as well.) Bins must be easily accessible during winter and for delivery of bulking materials (wood chips, wood shavings, saw dust or dry leaves) by large equipment. Bulking materials should be located beside the bin. Keep materials and tools readily available. Turning the pile does take muscle and time, which requires planning ahead. A new task will more likely become routine if the process works well. Take the time to develop a well-trained and responsible compost team.

Appendix X: Inside a Compost Pile

Inside a Compost Pile

In nature, decomposition is an ongoing natural process. Dig down into the earth of the forest floor and you will find a rich, dark layer of topsoil up to several inches thick. A major component of topsoil is humus, the result of decomposition of plant and animal material that accumulates on the forest floor. Billions of decomposers convert the nutrients into humus. Fungi, bacteria and actinomycetes break down fibrous plant material. Worms and insects tunnel through the debris, shredding and chewing as they go. Leaves are broken down physically and chemically through digestive processes; the excreted material becomes humus. Without decomposers, critical nutrients would not be recycled for plant growth.

In a compost pile, people provide optimum food, moisture, and oxygen for the decomposers to grow and reproduce continually. Decomposers need nitrogen to build their cells; food scraps, grass clippings and manure are excellent sources of nitrogen. Wood chips, dry leaves and sawdust are rich in carbon, a source of energy for the decomposers. In composting jargon, the nitrogen sources are referred to as the “greens” and the carbon sources are the “browns.”

It is beneficial to maintain a ratio of 30 to 1 browns to greens in a compost pile to give the decomposers a balanced diet. Alternating layers of browns and greens helps maintain this balance.

Browns are also referred to as bulking material; the drier, bulkier materials help the compost pile stay light and loose, allowing air to circulate more freely. A compost pile that is too wet and compacted will begin to smell as the result of anaerobic (bacteria that does not require oxygen) bacterial action. A compost pile should be moist, but not soaking wet. Foods have a high moisture content, and are usually wet enough to keep the pile moist. Regular turning aerates the pile and mixes the browns and greens. It is easier to remedy a situation that is too high in carbon than one that is too high in nitrogen and has become wet and smelly.

Besides fungi and bacteria, worms, springtails, mites and beetles are among the typical decomposers in a compost pile. Working decomposers produce metabolic heat as a result of cellular respiration. Smaller food scraps provide more surface area for the decomposers to feed on, thereby increasing the composting rate. In a healthy compost pile, the temperature will gradually rise, as long as there is adequate food for the decomposers.

Appendix XI: Composting Record Sheet

Composting Record Sheet

Fill in the Dates below	List Types of Food	Weight of Food Preparation Waste	Weight of Plate Scrapings	Total Weight
Monday				
Tuesday				
Wednesday				
Thursday				
Friday				

Weekly Total = _____

Was anything in the buckets that shouldn't have been? If so what?

Appendix XII: Composting Problems and Solutions

PROBLEM	CAUSE	SOLUTIONS
Compost pile contains earwigs, slugs and/or other insects	Pile is composting correctly	Insects are a good sign of a productive compost pile
Compost pile is attracting raccoons, dogs, flies or other pests	Amount or type of greens incorrect	Avoid meats, bones, oils
	Exposed food scraps	Place food scraps in center of pile and cover completely with browns
	Compost bin needs repairs	Keep the bin well maintained
Compost isn't heating up	If it seems damp and sweet-smelling, it may be a lack of nitrogen	Mix in food scraps or other materials high in nitrogen
	Not enough moisture	Add water
	Not enough oxygen	Turn or fluff the pile
	Pile may be too small (less than a cubic yard)	Build the pile up to 3' x 3' x 3'
Temperature levels off	More food scraps needed	Add more greens
	Composting is finished	<p>If it looks dark and crumbly and smells earthy, it is time to remove compost and let it cure</p> <p>Begin a new pile</p>

PROBLEM	CAUSE	SOLUTIONS
Matted, undecomposed layers of leaves or food scraps	Compaction, poor aeration	<p>Break up layers with garden fork, or shred them, then re-layer or turn the pile</p> <p>Avoid adding thick layers of bulking materials</p>
Large, undecomposed materials	Size and composition of materials	<p>Screen out undecomposed items, shred and reuse in new pile</p> <p>Reduce particle size by shredding</p>
Compost pile has a bad odor like a mixture of rancid butter, vinegar and rotten eggs	Not enough oxygen, compaction	Turn the pile and shake material to loosen and aerate
	Not enough oxygen, too wet	Turn the pile and add coarse dry material such as leaves, wood shavings, sawdust, straw or shredded newspaper to soak up excess moisture
Compost pile has a bad odor like ammonia	Pile may have too much nitrogen	<p>Add materials high in carbon such as leaves, wood shavings, sawdust, straw or shredded newspaper</p> <p>Mix in to aerate</p>

Worm Composting

Good Food Items

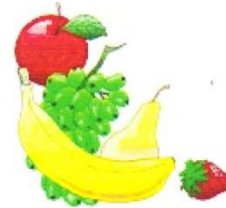
Vegetables Tea Bags

Coffee Grounds/Filters

Apples Pears

Bananas Grapes

Egg Shells



Bad Food Items

Citrus (Oranges/Lemons/Pineapple)

Fats Meats

Oils Bones

Hand Sanitizer Garbage/Trash

Onions Pizza

Dairy (yogurt/milk/cheese)

Breads/Grains Tomatoes



Word Scramble

(print to solve)

Unscramble the words. There is a clue for each. Then use the numbered letters to solve the message below.

TCNNAORIEIR (Clue: Where our trash ends up)
 13 6

EIMLPIELDS (Clue: Have two pairs of appendages on each body)
 21 14

ATOMWESRHR (Clue: Their tunneling aerates the compost pile)
 24 2

AOPTZROO (Clue: One-celled microscopic animals)
 7 19

CIMTEHPROLIH (Clue: Heat-loving)
 18 5

LECCY (Clue: Continuous)
 16 8

PITISSNLAGR (Clue: Jumps when disturbed)
 15 17

RMESODPESCO (Clue: Workers of the compost pile)
 1 9

MSUUH (Clue: Smells earthy)
 11 3

INEABRAOC (Clue: "Pee-Yew!")
 12 22

TUTINESRN (Clue: Life-giving)
 10

ICFRPHKOT (Clue: Useful tool)
 4 20,23

Composting...
 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
 21 22 23 24 !

Composting Word Search

Find the words that relate to the compost pile.

P	T	S	O	P	M	O	C	L	O	M	C	R
A	E	S	O	W	B	U	G	S	C	L	E	C
L	P	S	B	A	C	T	E	R	I	A	D	I
F	O	Y	E	E	O	N	E	A	A	T	E	L
I	U	T	O	R	R	E	T	L	H	C	C	I
S	I	N	S	O	C	G	G	B	A	A	O	H
M	S	O	G	B	N	O	B	R	A	C	M	P
R	H	T	Z	I	A	R	D	L	R	S	P	O
O	N	A	R	C	L	T	B	E	O	E	O	S
W	I	P	Q	S	B	I	P	I	S	B	S	E
T	S	D	L	O	M	N	L	I	S	I	E	M
R	E	T	T	A	M	C	I	N	A	G	R	O
Y	C	S	H	U	M	U	S	L	C	W	C	T

mesophilic

mite

sow bugs

decomposer

humus

soil

worms

mold

organic matter

carbon

nitrogen

aerobic

bacteria

springtail

fungi

compost

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