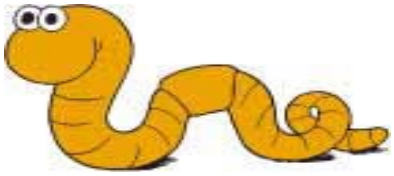
Teacher Fact Sheet

Worm Composting



Worms Make Learning Fun!

Having a worm bin in the classroom is fun! It teaches about habitats, nature's cycles, and the responsibilities associated with caring for living things. It also reduces the amount of garbage your classroom generates. Worm compost, also called worm *castings*, (or worm poop!) is full of nutrients and vitamins, which feed or *fertilize* the soil to help plants grow big and healthy. Composting is a great way to create some of the best fertilizer on Earth!

Creating a Worm Bin

Worm bins can be easily made out of second-hand plastic storage containers, shipping crates, washtubs, or old plywood. Bins must be covered on all sides, with a tightly placed top, because worms like dark and moist environments between 55-77F degrees. Wooden bins are best, as they permit aeration and drainage–two extremely important things for worms.

Generally a bin should be at least 8''to 14'' deep. Red worms are surface feeders, so try to avoid bins deeper than 14". Holes ¼'' thick must be drilled 5" to 7" inches apart on all sides of the bin. Just like us, worms need oxygen and ventilation. Holes of this size will permit aeration and drainage if the bin gets too wet.

Making Worm Bedding

Once your worm bin is built you can add bedding. Bedding can be created using shredded newspaper (in 1" to 2" strips) or shredded cardboard, or by using fallen leaves. Maple and other deciduous tree leaves make great worm bedding, with the exception of Walnut which has tannins that make worms sick. The bedding, which is bulky and high in carbon, will help balance the high nitrogen content in food scraps.

It's important to keep the bedding moist, so use a spray bottle to wet the bedding as needed. It should be as damp as a wrung-out sponge. Worms respire through their skin, and must stay moist in order to breathe. However, if it gets too wet in your worm bin, certain conditions could arise making your worm bin smelly. Just like us, worms need a balanced habitat, including shelter, air and water, in order to survive. For more information about worm bin requirements visit: www.ciwmb.ca.gov/organics/Worms

Feeding your Worms

It is very important to feed worms properly. Worms generally prefer to eat a *vegan* diet. Being vegan means only eating plant-based foods like fruits, vegetables, beans, nuts, seeds and grain products like rice, pasta and

bread. After preparing your worm bin, add a small amount of food in one corner of the bin. Check on your worms occasionally, and when the pile has been dispersed, add more food to another corner of the bin.

Worms DO prefer to eat:

Vegetable and fruit scraps, grains, coffee grounds and filters, tea bags, small amounts of bread, and other non-greasy foods.

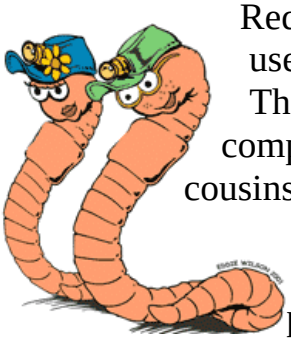
Worms DO NOT prefer to eat:

Meat, bones, dairy products, pet feces, greasy foods, and citrus peels as these peels contain a natural insecticide that could kill the worms.

Harvesting Compost

After about four months, your compost should be ready to harvest. The easiest way to do this is to push all of the castings, eaten food, bedding and worms to one side of your bin. Then, place new bedding and food on the other side of your bin and wait a few weeks for the worms to migrate over to the fresh food leaving their castings behind. Now you're ready to use some of the best natural fertilizer on Earth! With high nutrient and phosphorus levels, the compost made from worm castings is great for starting seeds, sprinkling on indoor or outdoor potted plants, planting seedlings or just tossing through your garden. Because it is so potent, only use a small amount or make "compost tea" by dissolving some compost in a gallon of water. It should be the color of iced tea. Use this tea to water plants and to spray on their leaves to fight pests.

Finding Worms



Red worms are preferred for use in classroom worm bins. They require less space in comparison to their earthworm cousins and do an excellent job of breaking down food scraps. To start, purchase about one pound of live worms for your bin. Here are resources for getting worms and building supplies to make a bin:

- **Organic Landscaping**
  www.organic-landscaping.com
  (415) 551-WORM
- **Cosmo's Red Worms**
  www.alcasoft.com/cosmos
  (415) 759-7874
- **Worm SF**
  www.WormSF.org
  (415) 425-1746
- **Foothill Worm Ranch**
  www.foothillwormranch.com
  (925) 484-4192
- **SCRAP (Scroungers Center for Reusable Art Parts)** http://www.scrap-sf.org
  (415) 647-1746
- **Building Resources**
  http://www.buildingresources.org
  (415) 285-7814

Worm Lesson Plans

SF Environment offers fun lesson plans! To download this free standards-based curriculum, go to **www.sfenvironment.com** and click on **School Education**. Visit the **Teachers Lounge** and look for lesson plans there. Or just click here: http://www.sfenvironment.com/aboutus/school/teacher/lesson_plans.htm
You can also visit the following websites for more information:
www.ciwmb.ca.gov/vermi
www.gardenfortheenvironment.org

Student Fact Sheet C-1

The Dirt on Composting!

Decomposers Help our Planet

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

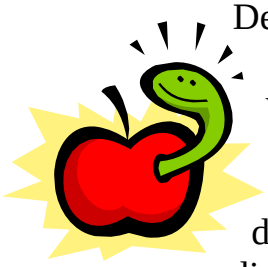
Compost looks like dirt or **soil** and is the color of dark chocolate. It is crumbly and smells clean and fresh like the earth after it rains. Compost acts like a vitamin pill—it adds important vitamins or **nutrients** to the soil. Just like people need vitamins to stay strong and healthy, so do plants.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

Nature's Way of Recycling

Out in nature, decomposers live under logs, rocks, and leaves. They feast on organic matter and leave behind nutrient rich compost for meadows, forests, and mountains. This is nature's way of recycling!

Decomposers can live in many different places, including our backyards. Since decomposers help in a process called **composting**—where the natural process of decay is sped up—some people create homes for decomposers by layering leftover food and yard clippings in piles outside. These are called **compost piles** and with all the different layers, they can look like backyard lasagna!

Earth Builders

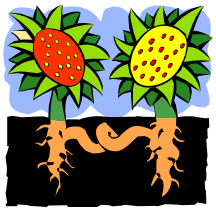


Decomposers living in the compost pile—such as worms and pill bugs—have important jobs. They help keep the pile warm, they dig, they chew, and they digest our leftover food into compost. For instance, earthworms pass food through their bodies and leave behind **castings** or nutrient rich pieces of crumbly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

Food Comes from the Earth

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

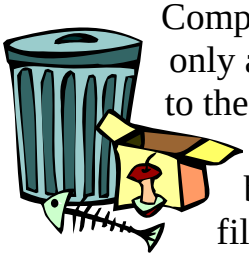
Happy Topsoil



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

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

Garbage Graveyards



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

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

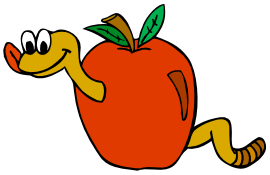
Trash Gas

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

Let's Help Nature!

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

Visit these websites:
www.ciwmb.ca.gov/kidstuff



Student Fact Sheet C-2

Composting with the FBI!

Vitamins for the Earth

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

The FBI hard at work

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

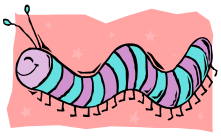
F is for Fungus

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

B is for Bacteria

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

I is for Invertebrates



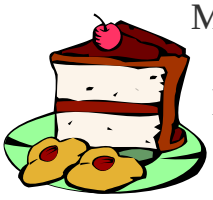
Invertebrates are animals that do not have a backbone. They wriggle, crawl, and slide their way through the compost pile. Invertebrates break down organic matter by chewing and grinding. Slugs, snails, spiders, worms, beetles, mites, ants, and sow bugs are some important members of the invertebrate work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

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

Let's Help Nature!

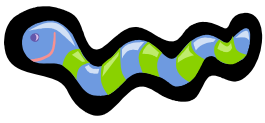
Nature is constantly filled with things that die, decay and get born anew. For instance, a dead redwood tree decaying on the forest floor provides a perfect home for a new redwood sapling to grow. This shows nature's ability to recycle organic matter. We can help nature recycle our own organic waste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

Outdoor Pile



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

Composting with Worms



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

Using the Green Cart

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

The FBI Needs You!

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

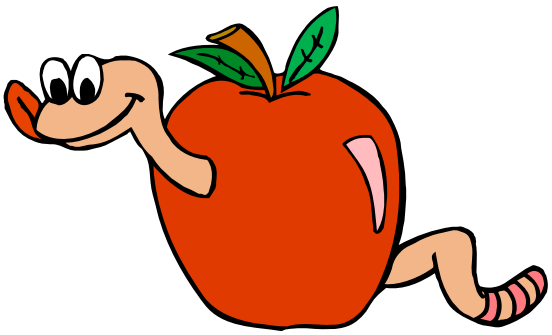
Visit these websites: www.ciwmb.ca.gov/kidstuff
http://yucky.kids.discovery.com/noflash/worm/pg000104.html

Worm Bin Presentation

Grades 2-5

Lesson Summary

Students assemble and maintain a worm bin in the classroom and learn about worms and decomposition.



Overview

In this lesson, students will:

- Learn about the 4 R's.
- Learn about decomposition
- Study worm biology
- Assemble a worm bin

Time

45 minutes for two lessons

Background

Decomposition is a magical process! It occurs thanks to billions of microorganisms such as bacteria and fungi, as well as some larger decomposers like worms and bugs. These decomposers are often called the "FBI:" fungus, bacteria and invertebrates. The FBI break down *organic matter*—things that were once alive—and turn it into smaller particles called *compost*. Compost is the waste product of decomposers and is dark brown like chocolate and smells fresh like the earth after it rains. Compost is a natural *fertilizer* that is part of nature's recycling process and it provides necessary nutrients for plants. It is free of synthetic chemicals, which are found in commercial fertilizers and can be harmful to the environment. Compost also builds up our topsoil and keeps it healthy, so we can grow more food. Decomposition, also called *rot*, is a critical part of the life cycle. Not only does it provide necessary nutrients for new life to grow, but also without decomposition, dead matter would cover the earth! Building a worm bin for your classroom to use is a great way to teach students about decomposers, the natural cycles of life and the benefits of composting.

Preparation

1. Read the entire lesson plan, which is in script form.
2. Read *Composting with the FBI* and *The Dirt on Composting* Student Fact Sheets
3. Collect and display the listed material items.

Introduction

Tell students: Today we are going to learn some ways that we can protect nature everyday.

- ❑ Who loves nature? (*Name something you love about nature*). What do you love about nature? (*Call on students for answers.)*

Vocabulary

- Decomposers
- Decomposition
- Organic Matter
- Compost
- Fertilizer

Materials

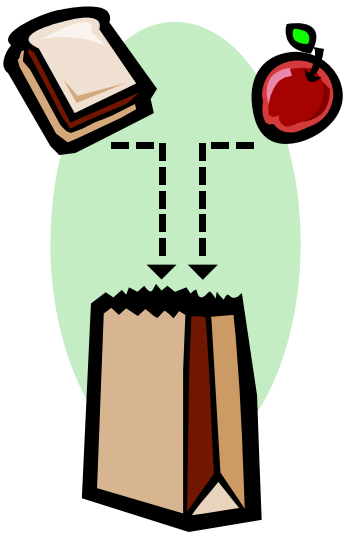
- *Composting with the FBI* Fact Sheet
- *The Dirt on Composting* Fact Sheet
- Canvas bag
- Plastic bag
- Bag of "garbage" containing:
  - Used paper,cardboard, magazine, newspaper, etc,
  - Plastic bottle
  - Aluminum can
  - Glass jar
  - Styrofoam cup
  - Plastic tub & lid with #2, 4 or 5 on bottom (yogurt or cottage cheese container)
  - ketchup packet

Nature is amazing and it provides us with the things we need in order to survive, like air, water and food. Animals and plants also need nature in order to survive. One way we can all protect nature is by reducing, reusing, recycling and composting.

- Today we're going to learn how we can compost every day with the help of some tiny creatures that are going to be your new class pets!
- Do you all want to learn about your new class pets? Great! Well I'm going to keep your pets a surprise for now and we'll find out what they will be later on.
- In the meanwhile, let's review some ways that we all can help protect nature.

Reduce, Reuse and Recycle

- Raise your hand if you've heard of the words: Reduce, Reuse, and Recycle.
- These are three ways we can help protect nature by making less garbage and using fewer natural resources. Natural resources come from nature and are used or turned into the things that we want and need to live. When we waste natural resources, we're wasting nature.
- (*Hold up bag of garbage*). I have here in my hand what looks like a bag of garbage. (*Dump out garbage on table*).
- Do you think all of these things need to be in the garbage? (*No.)*
- That's right we can reduce, reuse and recycle a lot of this stuff. For example…
- **Let's discuss REDUCE**: To reduce means to use less of something. We can reduce what we use either by using less of it,, or by not using it at all. One way to reduce is to stop using so many plastic bags. For example, when I go to the store I use a canvas bag to take home my groceries instead of taking new plastic bags *(hold up example of canvas bag).*Another way to reduce is to take only one paper towel in the bathroom instead of taking two or three. You can also choose not to take a straw for your drink, if you don't need it, and just take one ketchup packet at a time for your fries instead of grabbing a handful that you may not end up using.



- **Now let's talk about REUSE***:* To reuse means using something over and over again. For example, when you're done writing on a piece of paper, you can re-use it by flipping it over and writing or drawing on the other side. You could also take something like a small paper bag and use it again as a lunch sack. Also, sharing or swapping clothes and toys with your friends is a great way to reuse as well.
- **After reducing and reusing, it's time to RECYCLE***:* Recycling means turnings something we've used into something new. For instance, when we recycle used paper it gets made into new paper;

used glass bottles and jars get madeinto new glass bottles and jars, and used metal cans get turned intonew metal cans.

- Do you recycle at school and at home?
- Please point to the recycling bin in the classroom.
- Remember that in San Francisco, all recycling goes into the blue cart.

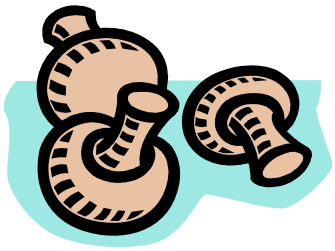
- Here in San Francisco we can recycle all paper (including old homework, cardboard, magazines, newspapers, office paper, and junk mail), glass bottles and jars, all metal cans, all plastic bottles and plastic tubs with lids #s 2, 4, 5, which are typically things like yogurt containers, and sour cream and margarine tubs. (*Hold up these items, and ask students to give a thumbs up (if the item can be recycled) and a thumbs down (if it can't*). Review correct answer. Great. Now that we've learned (*or reviewed*) how to reduce reuse and recycle, let's discuss leftover food like apple cores and banana peels; what can we do with these things to keep them out of the garbage?

Composting and Decomposition

- We can keep food scraps out of the garbage by composting them instead.
  - Composting is when we take leftover food and put it in a pile so that tiny living things in nature can *decompose* or break down this leftover food.
  - This creates compost, which is like dark soil that is full of vitamins. We'll learn more about compost later on, but in the meanwhile…
  - Let's close our eyes. Think back to the autumn when you could see piles of fallen leaves on the ground that no one raked up. Now, imagine it's the spring.
  - Are those leaves still there? What happened to them?
    - They decomposed, and were recycled back into nature. They became healthy soil that helped the tree and plants grow big and healthy.
    - The reason the fallen leaves decompose and disappear every year between fall and spring is because there are living things in nature called *decomposers* that help break down dead things. It's a good thing decomposers do this because if they didn't, our world would be covered with zillions of dead plants, animals and insects!

- There are three types of decomposers, or three things in nature that break stuff down, and they are sometimes called the FBI (*Hold up the FBI Activity Sheet- see attached*):

F

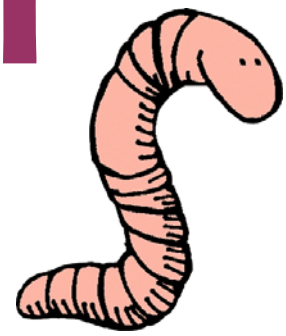


Fungi = F is for fungi. Examples of fungi are mushrooms and mold. Mold grows on rotting food. Have you ever seen old bread that has green, blue or gray fuzzy bumps on it? That's mold. You can also find mold and mushrooms outside, like on an old tree stump.

B

- **Bacteria** = B is for bacteria. Raise your hand if you've ever heard that word before. Bacteria are very tiny livings things. In fact, they are so small, that we need a microscope to see them. Another word for bacteria is "germs", which is a type of bacteria that can make you sick. But there are good bacteria too! All living things depend on bacteria to survive, and bacteria live almost everywhere: in water, soil, and even on the bodies of living things. Everyone, blink your eyes! There are bacteria living on your eyelids and eyelashes that keep your eyes clean. Now, can you all point to your intestines? There are billions of good bacteria in our gut and intestines that help us digest our food.
- **Invertebrates** = I stands for Invertebrates. Invertebrates are living things that don't have backbones. Worms are an example of invertebrates, so are beetles and centipedes, roly-poly bugs, ants and millipedes. Just like fungi and bacteria, invertebrates are decomposers and they help break things down.

I



Compost

- Decomposers like fungi, bacteria and worms are constantly breaking things down in nature. The final result of decomposers breaking things down is something called "compost," which I mentioned earlier.
  - Compost looks a lot like dirt., It's real dark like chocolate fudge and is full of vitamins or *nutrients* for plants.
  - Compost is like a vitamin pill for the soil.
  - *Hold some compost out in your hand for students to see.*
- We can put this compost around the base of plants in a garden or farm, and it will feed or *fertilize* the soil to help the plants grow big and healthy. The great thing about compost is that it's an *organic* fertilizer, which means it's a natural way of giving vitamins to plants without using man-made fertilizers that are full of chemicals made in laboratories. Using too many chemical fertilizers can poison our water and hurt the environment. The more compost we use in our gardens and farms, the healthier we can keep our food, water and land.

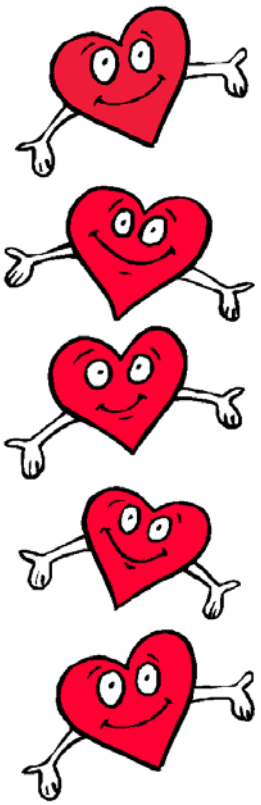
Your Pet Worms

- Now that we've talked about decomposers, can you guess who your new pets are going to be? That's right; worms! The type of worm that you'll be getting today is the red wiggler—they're red and they are like the Earth Worm's cousin.

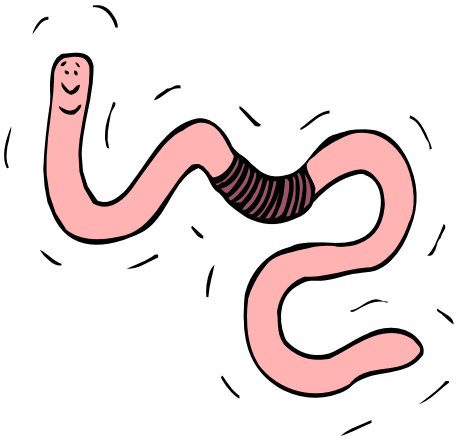
If you are going to have worms as pets, you should probably know a little bit about them so that you can take care of them properly. A worm's body is really cool … (*show worm body visual- see attached)*

Worm Biology Facts:

- First, worms have 5 hearts; that's four more hearts that any of us have!
- Worms don't have eyes; a worm "sees" by feeling things with hairs/bristles on its body.
- Worms don't have ears.
- Worms don't have lungs like we do that breathe in air for oxygen. Instead, worms breathe through their skin. It's important that a worm's skin stays wet in order for it to breathe. Worms need oxygen just like us, but without moisture, their bodies don't allow gas exchange or breathing to happen.



- Worms don't have any bones. That's why they are squirmy when they move.
- Worms have both male and female parts. This means that all worms can reproduce and have babies.
- Worms eat with a mouth that is a flap. Just like an elephant's trunk, a worm uses it's flap to scoop up their food.
- Worms don't have teeth. Instead, they grind up their food through their gizzard, which is like a stomach that has tiny pieces of sand and minerals in it. These tiny particles grind up the food in the gizzard so the worm can *digest* or get nutrients from what it has eaten. Whatever food the worm can't digest ends up passing on through the body as "castings." That's a fancy word for worm poop! These castings are what eventually become compost.
- I have one more thing to tell you about a worm's body. Raise your hand if you've ever heard that if you cut worms in half, they survive. Well, this is not true, so please do not chop them in two, because they will die!



Squirm-Worm Wiggle Activity

- (*Note: This section is fun for younger students and a good way to review the information about worms that they just learned.)*We're now going to imagine what a worm's life is like, please stand up…
- Close your eyes—since worms have no eyes, you are now blind. You don't need to see, because most of the time you'll be in the dark, under the soil.
- Your brain is very, very small. All you ever think about is eating and pooping.
- Cover your ears with your hands—but make sure you can hear what I'm saying. You can no longer hear birds or the sound of falling rain.
- Your skin is slimy and you no longer have noses to breathe. You are now breathing through your skin, and the soil keeps your skin nice and moist. Also, without noses, we can't smell.

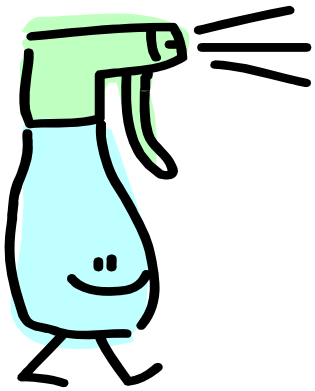
How to take care of your worms

Worms are a lot like any other kind of pet. You need to take care of them if you want happy and healthy pets.

- What do all living things need to survive? *(List student answers on board)*
- **Shelter**

  Hold up your worm bin. This will be your worms' new home or *shelter*. We are also going to make the worms a bed out of newspaper.
  - *Show newspaper; tear into 2-inch strips.* Each of you will get a piece of newspaper to tear up, and then I'll come around so you can put the paper into the bin.
  - Remember, worms don't like to be in the sunlight because it dries their skin out. Where could you put this bin in the classroom so that it's not in direct sunlight?

- **Air**
  - Everyone take a deep breath! All living things need oxygen. So, your worms will be getting air through here… *Show the air holes that you have punched into your plastic bin.*
  - Make sure that these air holes are always clear. Don't place a book on top, or shove the air holes against a wall. Our new pets need air in order to survive too!
- **Water**
  - Worms need just a little bit of water to keep their skin wet, so that they can breathe. Remember, worms breathe through their skin.
  - S*how spray bottle*. We will spray the inside of the worm bin with water about once a week. Their home should be kept moist like a wrung-out sponge, not sopping wet.
  - Worms can't swim! Just like people, they can drown. So, don't spray too much water into the bin. Just spray enough water to get the newspaper wet. *(Have student volunteer spray bin with water)*



- **Food**
  - In nature, worms usually eat dead and *decaying* or rotting plants and animals.
  - BUT, in our classroom these worms prefer to be *vegan*.
  - Being vegan means they only eat food from plants like fruits, vegetables, beans, nuts, seeds and grains like rice and wheat that get turned into food like pasta and bread.
  - Vegans do not want to eat anything that came from an animal. For example, your worms do not want to eat dairy products like cheese, butter or milk, fish, eggs, or meat.
  - Although your worms can eat these things, it takes a really long time for them to eat it, which means the worm bin will get really smelly! That's why the best things to put in the bin are fruit and vegetable peels. **Note: Although worms can eat grains, these items generally take longer for worms to break down. To prevent excess mold in your worm bin, focus on feeding your worms fruits*

and vegetables. Also, too much citrus peel can kill your worms, so avoid feeding them a lot of orange peels at one time.

Feeding our Worms

(See *Worm Diner* for more detailed lesson on feeding worms.)

- Since worms don't have teeth, we need to tear up our fruit and vegetable scraps into small pieces to make it easier for them to eat. (*Test students on what they can feed the worms by giving them examples and asking them to give a thumbs up or thumbs down.)*
- Your worms will eat about a fistful of food a week. Put the food in the corner of the bin. (*Have student volunteer add some food scraps to bin.)*
- You can keep track of where you put the food by placing a sticker on the corner where you put the food.
- After a week, check to see if the worms have eaten all of the food. If not then you can wait a little while before feeding them again. If they have eaten all of it, you can put in more food.

Last But Not Least…

- Now that we have shelter, air, water, and food, we are ready to move your pet worms into their new home. *(Dump one pound of worms into worm bin. Make sure to hold up a fist full of worms for the students to see)*
- Remember moving can be hard, so these worms might be a little stressed out. Give them time to adjust to their new home; they might take a little while in the beginning to start eating.
- Right now there are 1,000 worms in this bin; however, the worms will soon start having babies! It usually takes about 30 days for a worm to make an egg sac. 1-15 babies are born out of each egg sac. So in about a month you can start looking for eggs. The eggs sacs look like tiny light brown lemons. Once the eggs hatch, you'll be able to see really tiny baby worms!

Wrap-Up

Today we learned many ways we can protect nature. We can help by reducing, reusing and recycling and we can also compost our leftover food with the help of our new class petsRemember, the compost that our worms make will be a wonderful, natural fertilizer for plants in the garden and plants at home. Using compost instead of harmful chemical fertilizers is a very powerful way to protect nature. Composting with worms is also a great way that our class can make less garbage too! We need to work together to take care of our class worms, so that they do the important job of making compost.

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 carts 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 carts 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 cart system is an effective way to divert thousands of tons of organic matter from the landfill. Compost created from the green cart 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

Preparation

1. Read background information.
2. Prepare examples of the different food scraps listed above.
3. 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.*
4. Make copies of *The Dirt on Composting* student fact sheet for pairs of students to read, and have them answer the reading comprehension questions.

Pre-Activity Questions

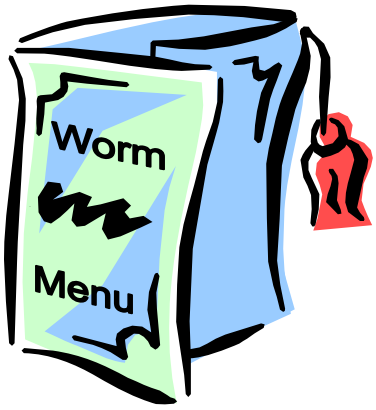
Tell students they are going to learn how to feed their leftover food to worms in a worm bin. But first explain that they need to learn where food comes from.

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)*

Class 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 kind of food out in nature, 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 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 an "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.

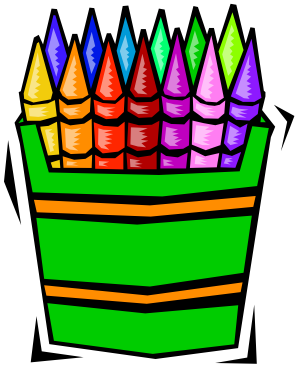


Questions/Discussion

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:

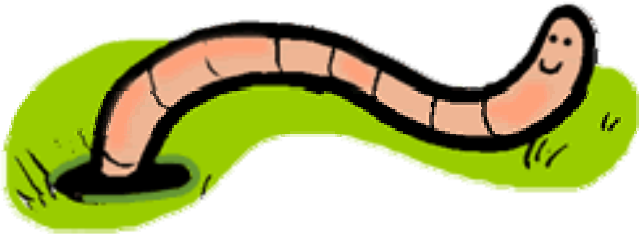
1. Tell students that you need their help preparing a Take Out Menu for the worms.
2. Remind students that worms will only eat food from plants.
3. Give each student a *Worm Food To Go* worksheet and tell him or her to color only the plant-based foods. Ask students to count and write down the number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

For older students:

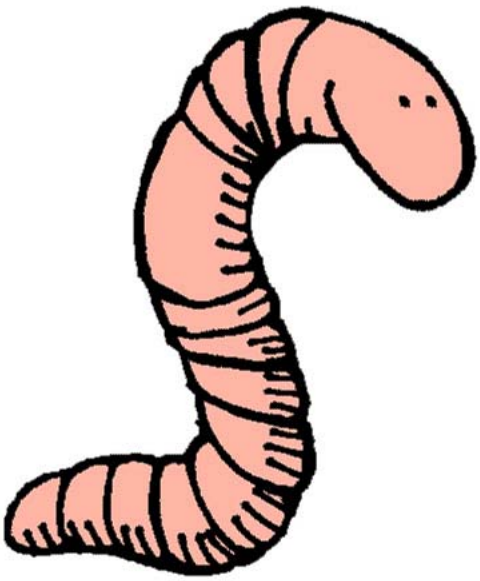
1. Keep a class worm journal next to the bin for students to record data and copy into their own journals.
2. As a class, decide what type of data you will record. Students could record the weight of food added each week, what section of the bin the food was added, and type of food added.
3. After a month, students should use the data to answer questions like: *What food 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, which only eat plant-based foods, and using San Francisco's green cart system that accepts all food from plants or animals. Explain that the difference is the green cart takes all things that once came from a plant or an animal. The green cart system uses a different method to break down the food into compost, which is why it can take animal-based foods.
- 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 poem could have composted in a worm bin.



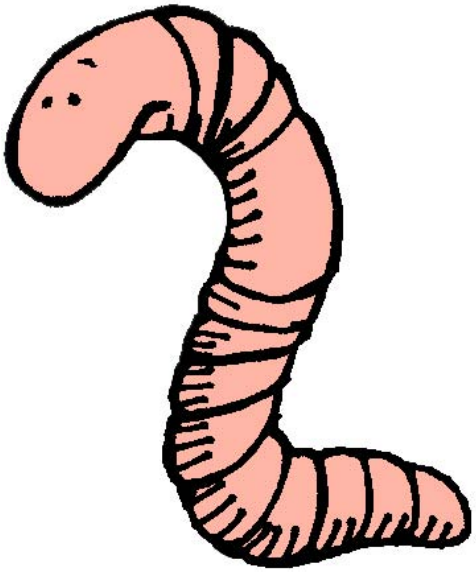
WORM DINER



YES!

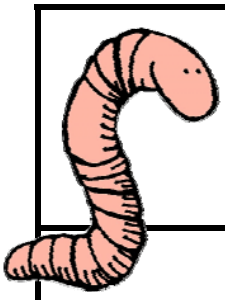
WORM DINER

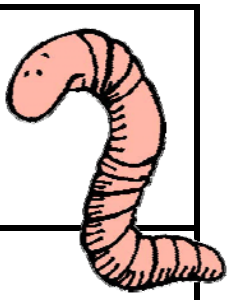
NO!



WORM DINER MENU

YES!	NO!





Worm Diner

CA Standards Grades K-2

Kindergarten

Science ♦ **1a**	Properties of materials can be observed, measured and predicted. As a basis for understanding this concept students know objects can be described in terms of the materials they are made of and their physical properties.
Mathematics ♦ **A1.1**	Identify, sort, and classify objects by attribute and identify objects that do not belong to a particular group.

Abbreviations
Math: N=Number Sense; A=Algebra; MG=Measurement/Geometry; S=Statistics/Data Analysis; MR=Mathematical Reasoning

Grade 1

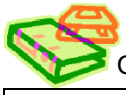
Science ♦ **1c**	Students know animals eat plants or other animals for food and may also use plants or even other animals for shelter and nesting.
Mathematics ♦ **S1.1**	Sort objects and data by common attributes and describe the categories.

Abbreviations
Math: N=Number Sense; A=Algebra; MG=Measurement/Geometry; S=Statistics/Data Analysis; MR=Mathematical Reasoning

Grade 2

Science ♦ **3e**	Earth is made of materials that have distinct properties and provide resources for human activities. As the basis for understanding this concept, students know rocks, water, plants, and soil provide many resources, including food, fuel, and building material, that humans use.
Math ♦ **S1.1**	Record numerical data in systematic ways, keeping track of what has been counted.

Abbreviations
Math: N=Number Sense; A=Algebra; MG=Measurement/Geometry; S=Statistics/Data Analysis; MR=Mathematical Reasoning



Grade 3

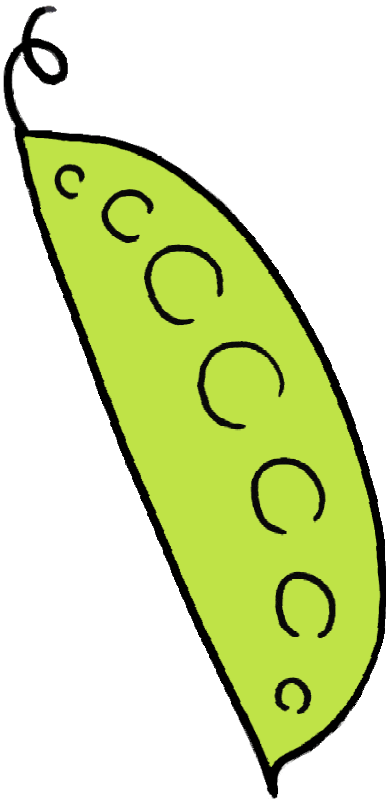
Language Arts ♦ **R2.3**	Demonstrate comprehension by identifying answers in the text.
Math ♦ **N2.8** ♦ **MG1.1**	Solve problems that require two or more of the skills mentioned above. Choose the appropriate tools and units and estimate and measure the length, liquid volume, and weight/mass of given objects.

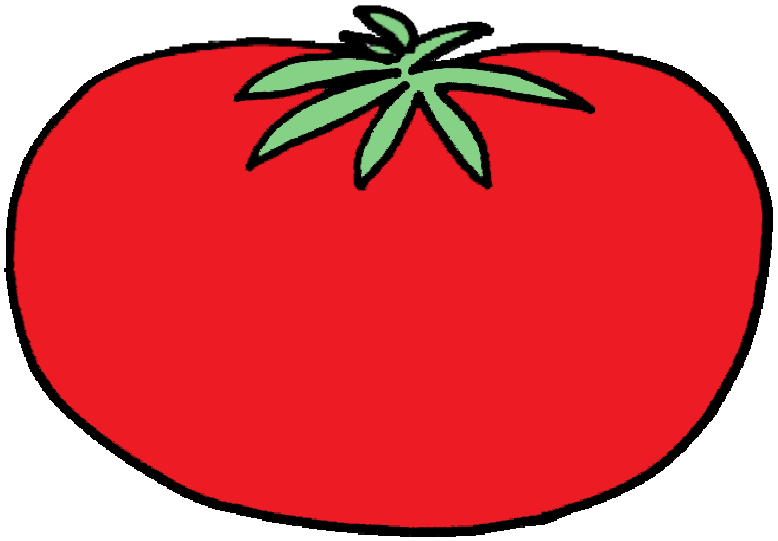
Abbreviations
Math: N=Number Sense; A=Algebra; MG=Measurement/Geometry; S=Statistics/Data Analysis; MR=Mathematical Reasoning
Language Arts: R=Reading; W=Writing; LC= Language Conventions; LS=Listening/Speaking

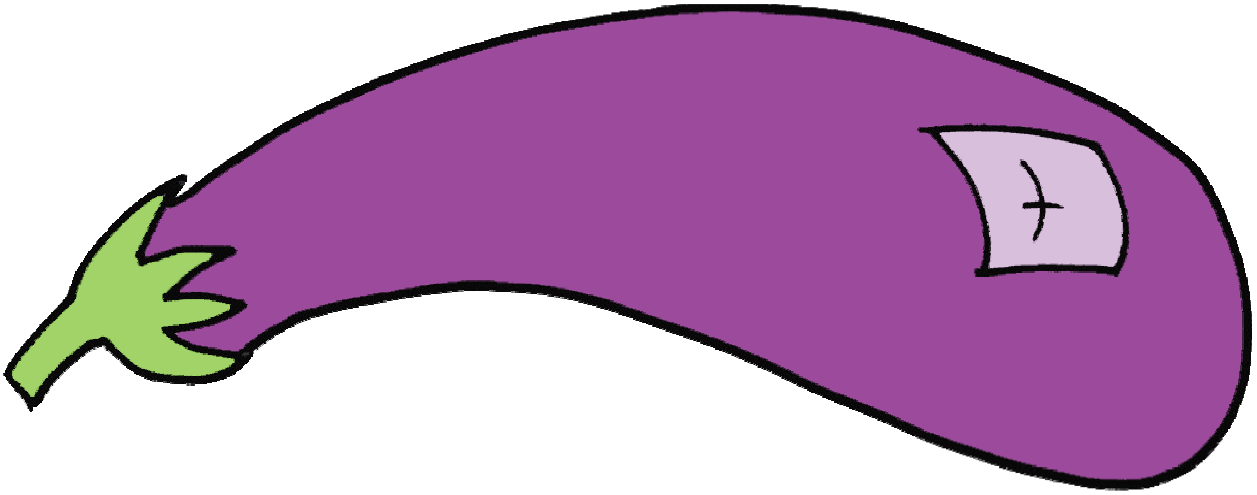
Grade 4

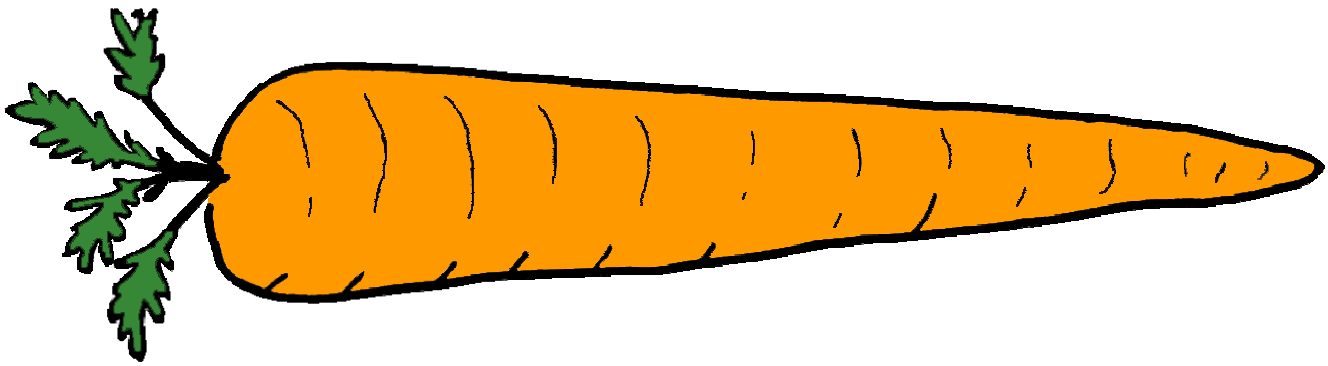
Science ♦ **2c**	Students know decomposers, including many fungi, insects, and microorganisms, recycle matter from dead plants and animals.
Language Arts ♦ **R2.2**	Use appropriate strategies when reading for different purposes (e.g., full comprehension, location of information, personal enjoyment).
Math ♦ **N3.0**	Students solve problems involving addition, subtraction, multiplication, and division of whole numbers and understand the relationship among the operations.

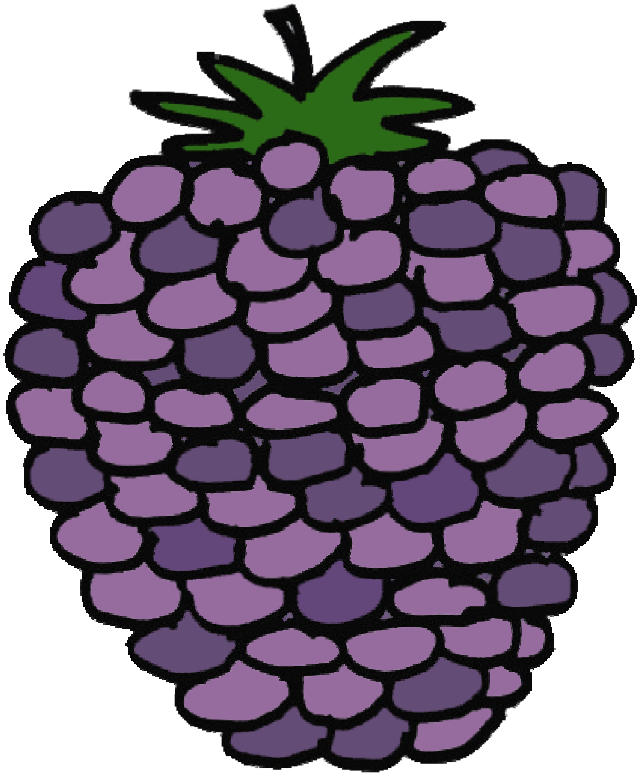
Abbreviations
Math: N=Number Sense; A=Algebra; MG=Measurement/Geometry; S=Statistics/Data Analysis; MR=Mathematical Reasoning
Language Arts: R=Reading; W=Writing; LC= Language Conventions; LS=Listening/Speaking

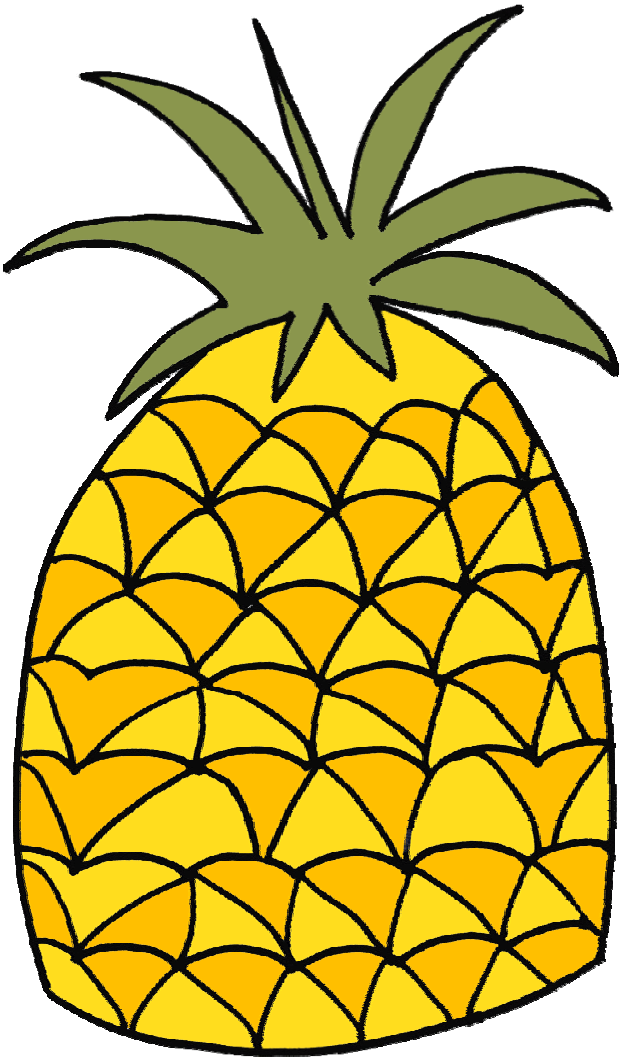


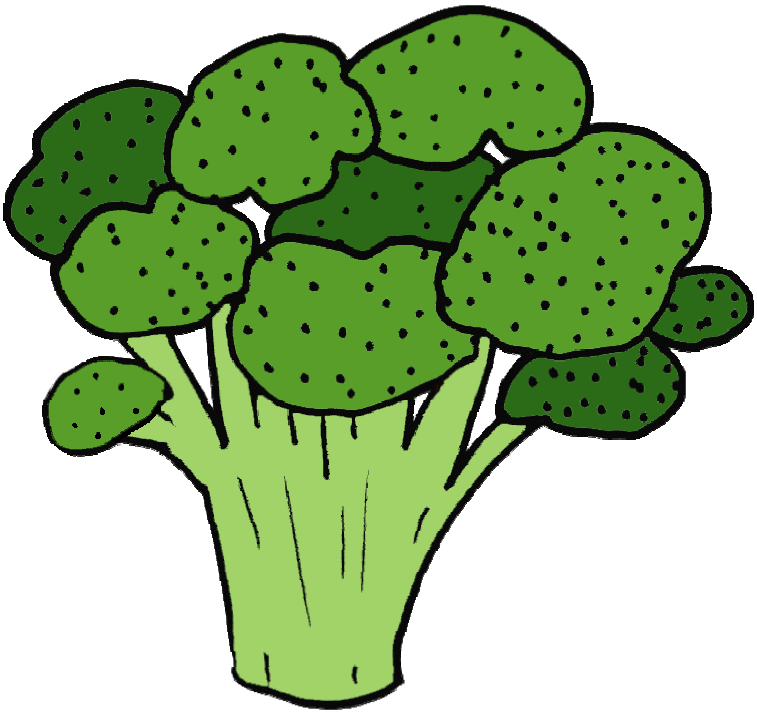


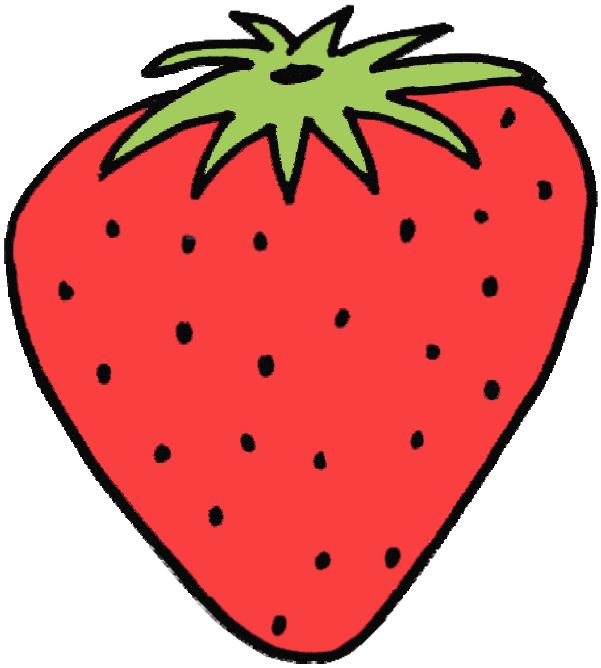


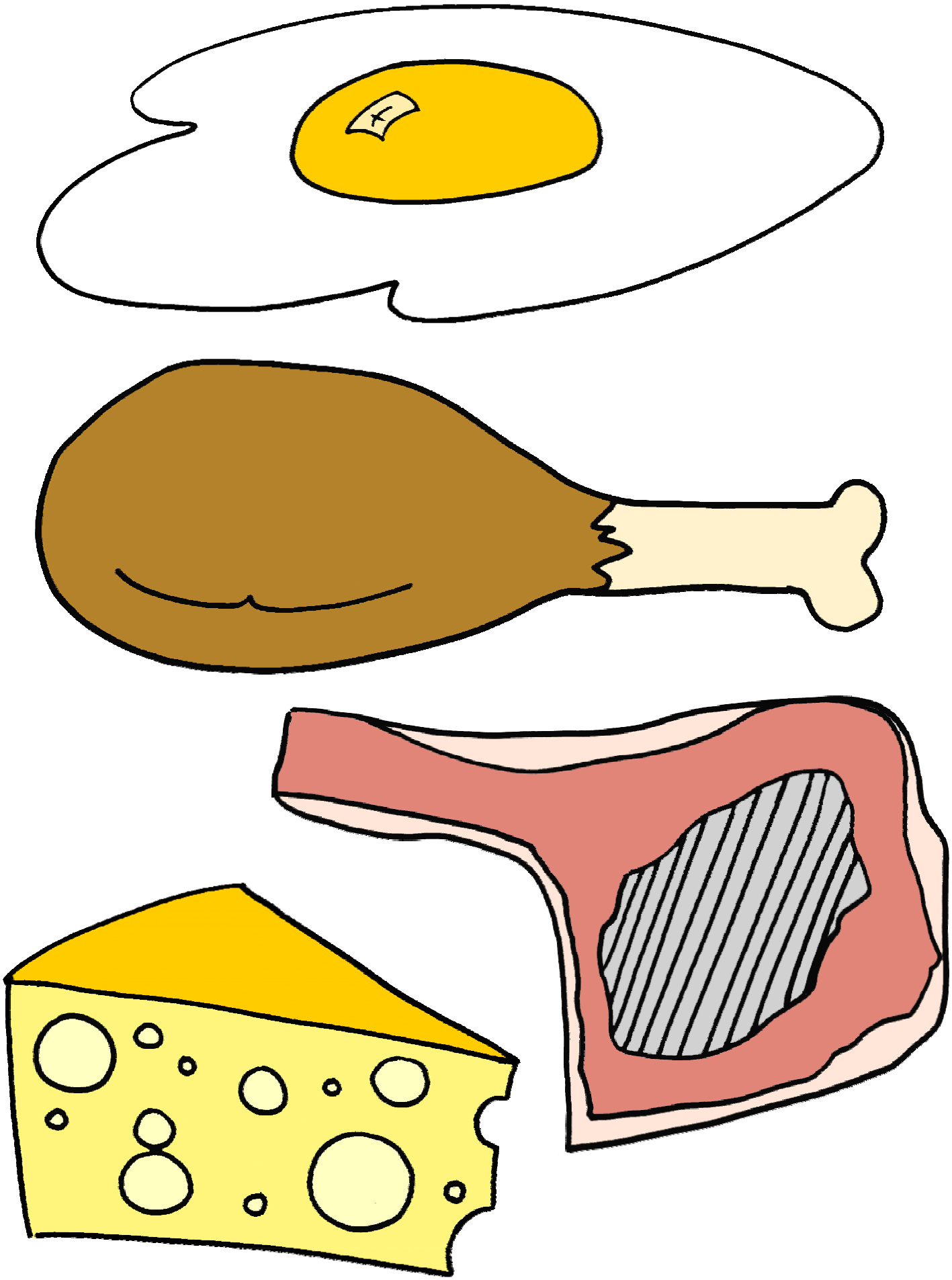










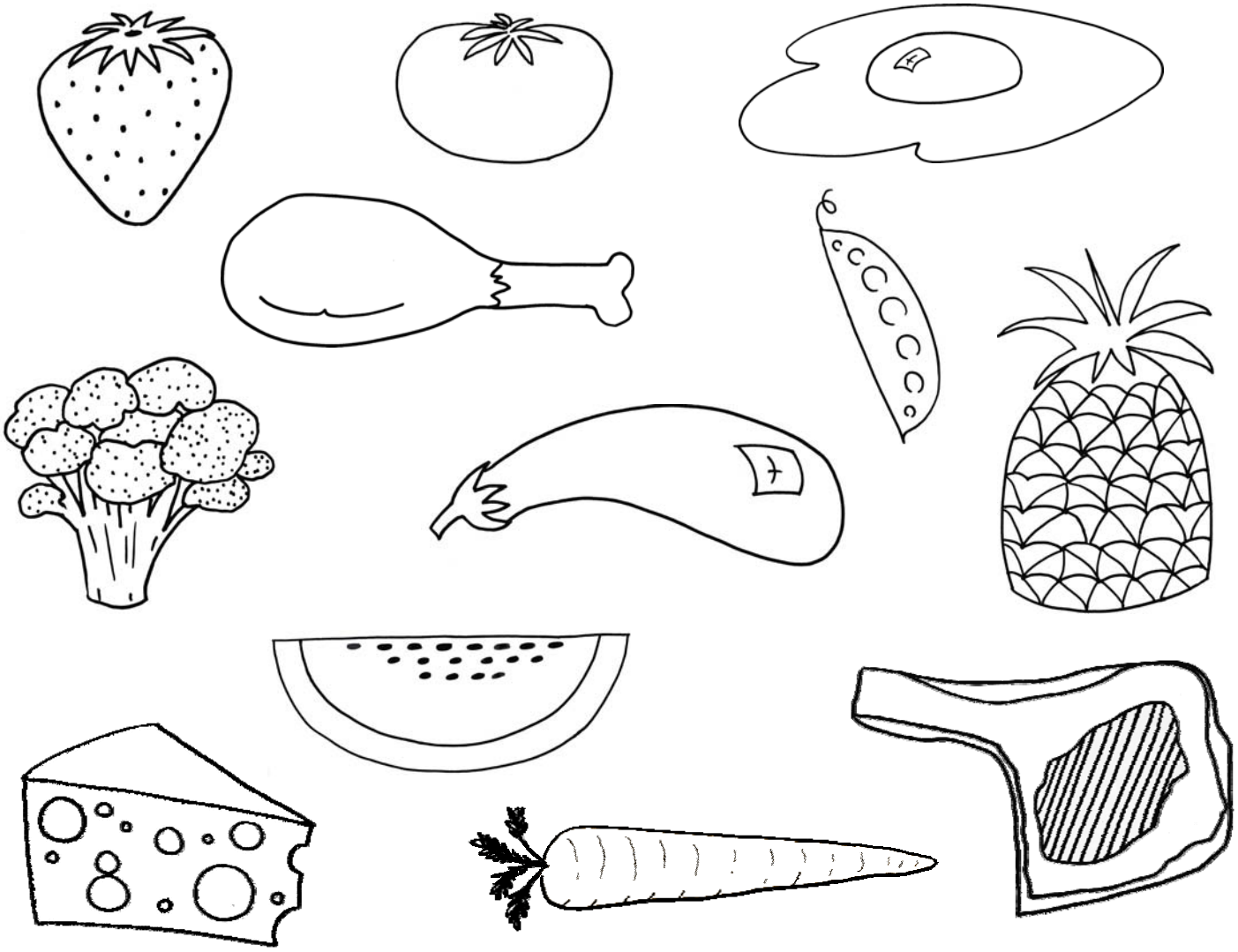


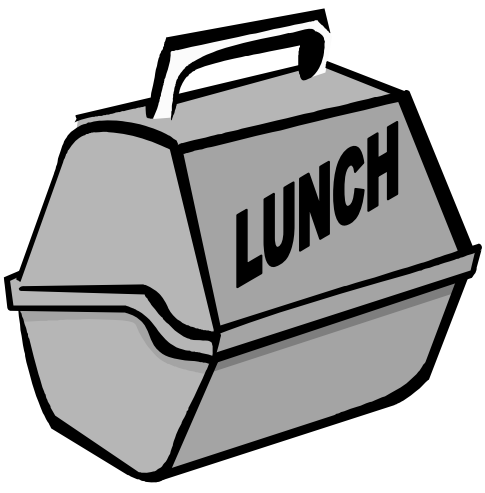
Worm Diner Take-Out Menu

SF Environment
Our home. Our city. Our planet.

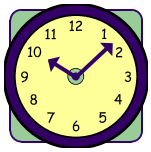
Name_____ Date_____

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.



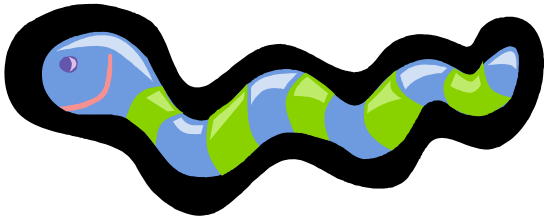


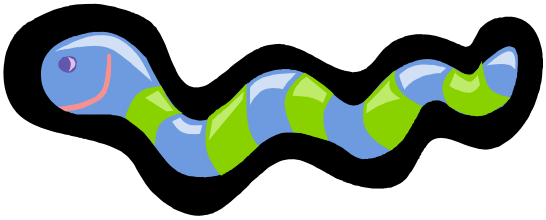
Number of foods Herm can eat

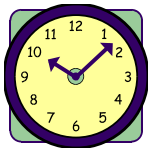


Time to Feed the Worms!

Date	Student Name	Type of Food	Weight or Amount of Food
2/6/04	Phoebe	apple cores and orange peels	One handful or 8 oz.

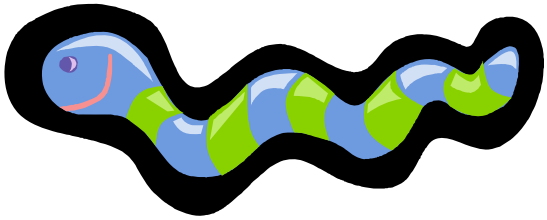


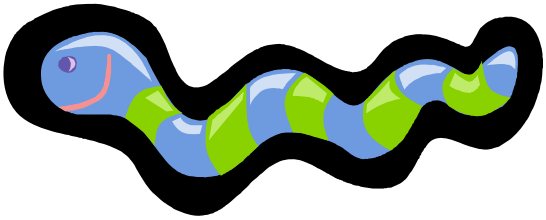




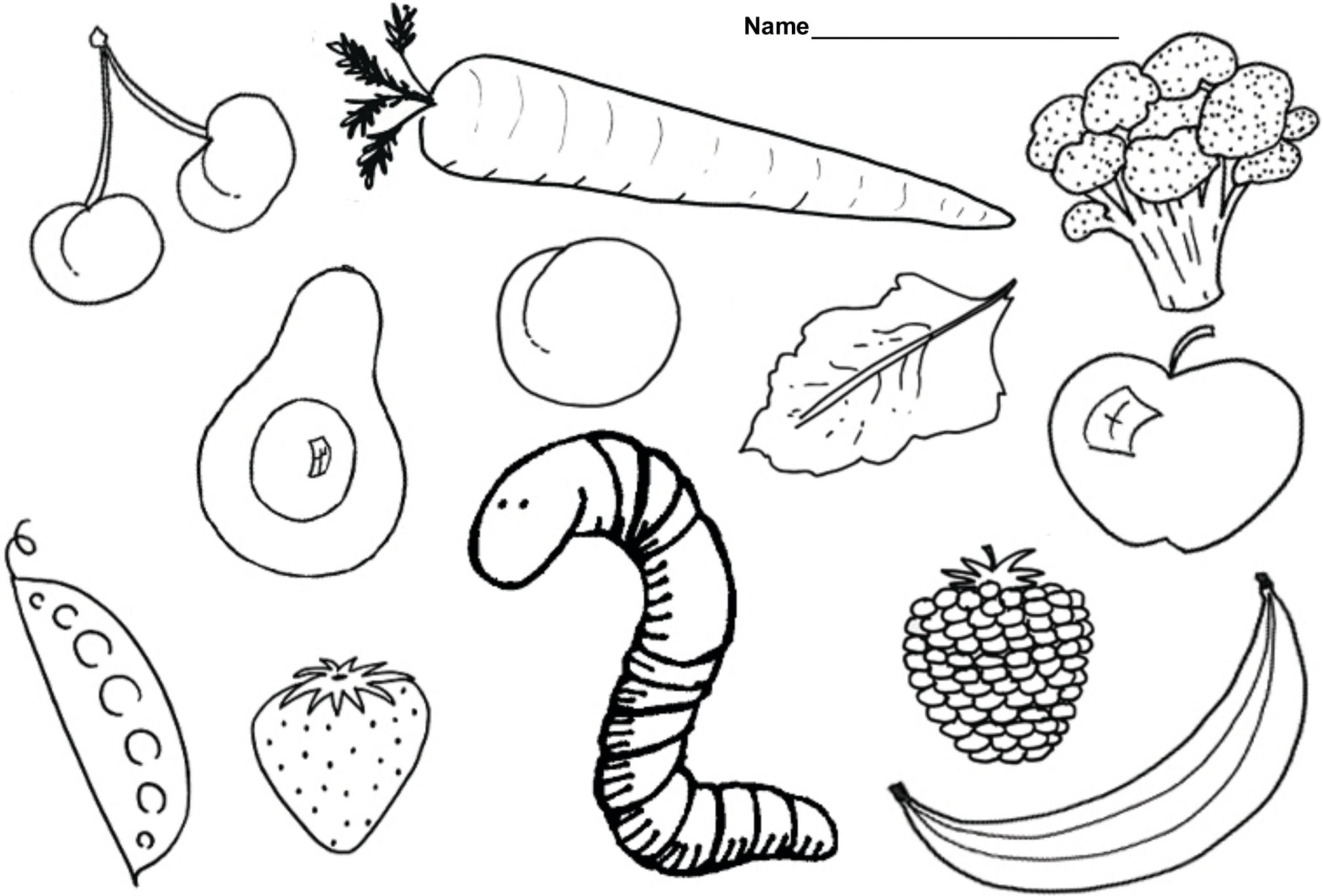
Time to Feed the Worms!

Date	Student Name	Type of Food	Weight or Amount of Food
2/6/04	Phoebe	apple cores and orange peels	One handful or 8 oz.





Name_____



Herm the Worm loves to snack on leftover fruits and vegetables!

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?_____