Worm Garden
Teacher Guide

AGRICULTURE IN THE CLASSROOM PEI

Teacher Evaluation Form

We would really appreciate any input or feedback regarding your experiences with the activities. Any suggestions will enable us to develop a better program.

Worm Garden Educational Coordinator: _____

Name and School: _____

Contact Information (email and telephone): _____

_____

Grades and Subjects you used with the Worm Garden: _____

_____

1) The educational coordinator was knowledgeable about the subject matter.

- Strongly Agree
- Agree
- Disagree
- Strongly Disagree

2) The educational coordinator explained things in a way that students could understand.

- Strongly Agree
- Agree
- Disagree
- Strongly Disagree

3) I (teacher) understood the goals of the lessons.

- Strongly Agree
- Agree
- Disagree
- Strongly Disagree

4) I (teacher) understood the goals and vision of the Worm Gardens.

- Strongly Agree
- Agree
- Disagree
- Strongly Disagree

5) The course content was interesting and relevant.

- Strongly Agree
- Agree
- Disagree
- Strongly Disagree

6) The class activities helped students build skills and understand the content.

- Strongly Agree
- Agree
- Disagree
- Strongly Disagree

7) I (teacher) would be interested in requesting the Worm Garden again.

- Strongly Agree
- Agree
- Disagree
- Strongly Disagree

8) Did the students make the connection of composting to eliminate food waste? _____

_____

_____

9) Do you think it would be beneficial to have the educational coordinator return to your classroom? Please explain. _____

_____

_____

10) If you could change one thing about the lessons, what would it be?

_____

_____

_____

11) Additional comments. _____

_____

_____

Thank you for your participation.
Note: Your evaluation will be shared with PEI Agriculture in the Classroom and the educational coordinator you evaluated.

Contact: info@aitc-pei.ca
You can also mail your completed forms to: **PEIAGSC, 420 University Avenue, Farm Centre, Suite 113, Charlottetown PE C1A 7Z5**

Worm Garden Contract

This is to confirm that _____ of _____ School has taken responsibility for the PEIAITC Worm Garden, effective, _____ for agricultural education activities.

All parts, not including vermicompost, activity books and materials are to be returned to the PEI-AITC upon completion of the school term/ agreed upon duration. The Worm Garden will be returned/picked up near the end of the school year. This Worm Garden is required for future use in other classrooms across Prince Edward Island.

If in the event of damages to the Worm Garden there will be a financial settlement and agreement made. Please ensure the Worm Factory 360 is properly cared for and maintained to the best of your abilities.

If there are any questions or concerns with the Worm Garden please contact PEI-AITC at anytime.

_____
Teacher Name

_____
Erin McCardle
Educational Coordinator

_____
Teacher Signature

_____
Date

_____
Date

AGRICULTURE IN THE CLASSROOM | EN CLASSE PEI

Permission to Take Pictures

I, _____ at_____ School give permission to PEI-AITC to take pictures in my classroom of my students learning with the Worm Garden. I understand that the pictures maybe exhibited on their websites and/or publications.

_____ _____

Teacher Date

In this guide...

Your Worm Garden Package Includes:

- Worm Garden
- The Worm Garden Starter Kit
- Worm Garden Teacher Guide
- 1 "What To Feed Your Worms" mini-poster
- 1 "Student Roles" mini-poster
- Additional Activities and Resources
- 1 copy of *Alex's First Seed*
- *Alex's First Seed Activity Book*

Students exploring a homemade worm garden at Ag Adventure Days 2018.

Things to Return after the Program:

- Worm Garden
- The Worm Garden Starter Kit
- Worm Garden Teacher Guide
- Teacher Evaluation
- Permission Form signed
- Worm Garden Contract

Introduction

The AITC-PEI Vermicomposting Program is a hands-on resource that complements many learning outcomes including the importance of healthy soils, biodiversity and biological interactions, sustainability, and nutrition in a fun and interactive way! The purpose of this project is to engage students in a fun and interactive science experience while teaching them about farming, nutrition, soil, food waste, biodiversity and food security.

What is Vermicomposting?

Vermicomposting is a composting process in which various types of worms such as red wrigglers, white worms, and earthworms are used to break down organic waste into compost. With the help of fungi and bacteria, the worms eat up the organic waste and then poop it out resulting in rich vermicompost. The resulting decayed material can then be used as a plant medium or soil amendment which increases the soils organic matter and improves biodiversity.

Why Vermicompost?

1. Reduce your food waste!
2. Add valuable nutrients back into the soil!
3. Improve biodiversity!
4. Great opportunity for inquiry and learning!
5. Promote healthier food choices

Building Your Vermicomposter

Refer to the Worm Factory 360 Startup Guide for assembly instructions.

Preparing Your Worm Habitat (aka Worm Bin)

To build a home, you'll need:

- Worm Garden
- Worms - red wrigglers, white worms, and/or earthworms
- Moist, fluffy worm bedding such as shredded newspaper, egg cartons or leaves and garden soil
- Worm food (healthy snacks given by students)
- Appropriate air and moisture conditions

Only the bottom working tray is lined with 1 or 2 full sheets of dry newspaper!

Preparing Your First Working Tray

The following steps are for the preparation of the first working tray only:

1. Place 1 or 2 sheets of dry newspaper along the bottom of the first working tray (the tray directly above the collection tray).
2. To make the bedding, soak half the block of coir in 1 cup of water until it begins to break apart and is moist. Wring out the excess water. The coir should be moist not wet. Then mix the coir with 1/2 bag of shredded newspaper and 1/2 bag of pumice and 1 tbsp. of minerals.
3. Store the unused coir, pumice, and minerals for later use in additional trays.
4. Mix 1 or 2 cupfuls of soil or compost with the bedding mixture.
5. Spread freshly mixed bedding evenly on top of the dry newspaper.
6. Place 2 handfuls of food scraps on top of the bedding in one corner of the tray.
7. Carefully place the worms on the prepared bedding.
8. Moisten 5 to 10 full sheets of newspaper to place on top of the bedding and food.
9. Place the lid on top of the composter.
10. Set aside the remaining trays until needed.

Adding Additional Working Trays

It may take one or two months for the bottom working tray to become full. Once it is full (within a half inch from the top), another working tray must be added to the top of the vermicomposter.

When adding a new working tray to the vermicomposter, the tray should be prepared as follows:

1. Remove the lid and moist newspaper cover.
2. Place an empty tray on top of the first tray.
3. Cover the bottom of the tray with prepared bedding and add 2 or 3 handfuls of food. Place the moistened newspaper on top of the food and bedding and replace the lid.
4. Use these same steps when adding third working tray.

Prepared worm bedding containing soil and shredded newspaper

DID YOU KNOW?

Worm bedding serves multiple purposes:

- Controls the level of moisture in the bin
- Provides extra food (if needed)
- Provides space for reproduction
- Contains odor
- Provides temporary relief if the conditions are not optimal

Managing the Vermicomposter

As the compost processes, you will notice changes within your vermicomposter. The compost will begin to shrink, turn a dark coffee color, and the texture will become more granulated. As this process continues, the worms will work into the upper working trays, leaving behind worms, worm castings aka poop, broken down organic matter, bedding and other organisms. This is **vermicompost**!

As the compost is produced, gravity pulls moisture through the trays and with it, nutrient rich particles; this liquid is called **leachate**. The leachate eventually lands in the collection tray at the bottom of the vermicomposter. It can be drained at any time during the composting process by placing a small plastic container under the spigot and turning the valve. It is a good idea to pour the collected leachate into another contained to add oxygen before using.

DID YOU KNOW?

The leachate can be used for multiple purposes:

- It can be applied directly to outside plants
- It can be diluted with one part water to one part leachate and applied to houseplants
- It can be recycled back through the vermicomposter if the contents in the tray are dry

Feeding Your Worms

How do worms eat?

Worms do not have teeth to break down their food! Instead, they rely on the help of microorganisms to decompose their food first. Once the food is soft enough to suck into their mouth using their powerful pharynx it continues to be digested in their small gizzards.

Remember to always cover the food with newspaper bedding!

What to Feed Your Worms

- Anything green! Especially the leafy parts.
- Fruits
- Vegetables
- Coffee Grounds and Filters
- Tea Bags
- Black and White Newspaper, Brown Paper
- Crushed Eggshells

What Not to Feed Your Worms

- Citrus such as lemons, limes, or oranges
- Fats, Oils and Salad Dressings
- Breads and Cereals
- Salts including any seasoned foods
- Meat
- Processed Sugars
- Garlic and Onions

Hang the **"What To Feed Your Worms" poster** near or on your Worm Factory as a reminder!

Preparing Your Worms Food

Food scraps can be added directly to your worm bin, however **pretreating** the food scraps will make it easier for the worms to digest. There are several different ways to prepare foods:

- **Chop** food finely with a knife or food processor. Food is first broken down by microorganisms and then ingested by worms. By finely chopping the scraps, the surface area of the food increases, enabling the microbes to colonize and break down the scraps faster.
- **Freeze** (and then thaw food). When food is frozen, the water in each cell expands, breaking the cell well which speeds up decomposition.
- **Microwave** (and then cool food). Like freezing, microwaving can speed up the decomposition process by denaturing the cells.

Managing The Conditions in Your Worm Garden

Feeding Guidelines

Ensure that your worm are fed regularly, as they can eat up to half their body weight in a day! Always remember to cover the food scrapes with newspaper bedding to repel fruit flies and decrease odor. As your garden matures and your worm population expands you will be able to add greater amounts of food more frequently.

If you notice that your worms are eating the food quickly, you can add more food scrapes. However, if you notice that there is a lot of food left over, try adding a bit less to the bin. If the worms cannot eat their food quickly enough it will rot, causing the oxygen level in the bin to drop and the worms to suffer.

Moisture Control

Worms require a moist environment to properly absorb dissolved oxygen therefore try to consistently keep the bedding moist. However, there should be no standing pools of water.

To check the moisture level in the bin, remove a small amount of bedding material from the bottom of the bin and squeeze it in your hand. If more than one or two drops of water is released or if the bin starts to smell sour, it is probably too wet; add more bedding. If the bedding is too dry; add more water.

Oxygen

Worms should have airflow in the bin. Ensure that there is no extra rotting food, this can cause the oxygen level in the bin to drop. Make sure the bedding is not hardened, as it can prevent airflow through the soil.

Space

The worms should not be crowded in the bin, there should be ample bedding with space between it. If the bin becomes overcrowded, transfer some of the worms to another tray.

Optimum Temperature

Worms will survive at temperatures between 6°C and 30°C but thrive at temperatures between 15°C and 26°C. Keep your vermicomposter in a cool, dry area, out of direct sunlight!

Ensure that responsibilities are shared throughout the class by designating student roles. Roles may include:

- **Feeders**: prepare food, and feed worms each week.
- **Waterers**: check moisture level of the bin and adjust if needed.
- **Observers**: record any changes that occur in the bin, such as the formation of cocoons, or presence of other insects.
- **Doctors**: check that the worms are actively indulged in the scraps while ensuring that there is no excess of rotten foods, molds, fungi, or fruit flies
- **Bedding Collectors:** harvest the compost

When your bin is operating correctly, you should notice:

- Minimal or earthy smell
- Large number of worms at various stages of development
- No fruit flies
- Small quantities of other insects
- Worms skin is glistening
- Accumulation of worm castings/poop
- Sufficient space for worms
- Bedding is disappearing overtime
- Moist bedding
- Mold on some foods

If your bin is not operating correctly:

- Bin smells sour
- Worms look dry
- Bedding and castings are dry
- Water is accumulating in the bin
- Bin is overrun by a particular insect such as fruit flies or ants

Laminate and hang your **"Student Roles" poster** on or near your vermicomposter

Image taken from http://runwildmychild.com/wormery/

Harvesting Vermicompost

There is no exact point in which vermicompost is to be harvested. If the material is dark and contains small chunks of matter, it is ready to use. However, the longer it is processed, the better quality it will be. To harvest the compost:

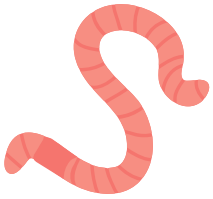
1. Remove the lid and turn it upside down next to your composter. Remove all the trays except the finished tray at the bottom. Place the trays on the lid.
2. Remove the finished bottom tray and place it on top of the trays stacked on the lid. The finished tray should be directly on top of the current feeding tray.
3. Check the collection tray for any worms that may have fallen in or compost buildup. Remove and build up or worms placing them if the feeding tray.
4. Drain the leachate (if there is any) and flush the spigot with water to ensure it is not clogged.
5. Replace the stack of trays onto the base. The finished tray should be on top.
6. Leave the lid off, allowing light to enter the tray causing any of the remaining worms to migrate downward to the lower feeding trays.
7. Using your hands, or hand rake loosen the compost, pulling it away from the edges to form a hill. Leave the compost sit for a few hours.
8. Begin to remove the compost by scooping it out of the tray until you encounter any worms. Repeat this process several times, allowing the worms time to migrate downward.
9. Once all the compost is removed the tray is ready to be reused or set aside for later use.

A student exploring worms at Ag Adventure Days 2018

How to Use Vermicompost

Vermicompost can be directly mixed with potting or garden soil, acting as a plant medium or soil amendment that increases the soils capacity to retain water, and replenish valuable organic nutrients into the soil. Plants that grow in this rich soil will thrive, yielding more abundant crops, resistant to disease.

Fun Facts About Earthworms!



- Worms do not have eyes! They have receptor cells which they use to determine if they are in or close to light! They do not like sunlight and will eventually die if exposed for too long!
- Worms can live to 15 years of age and begin to reproduce at only a few months old!
- Worms have five hearts!
- Worms do not have teeth! Instead, they suck their food into their mouth via their powerful pharynx and have a powerful gizzard which helps grind their food!
- Worms do not have lungs! Instead, they breathe through their skin and must always remain wet for dissolved oxygen to absorb into their skin.
- Earthworms can replace lost or damaged segments of their bodies. Although this ability depends greatly on the species, the amount of damage and location of the lost segment!

Kindergarten - Grade 2 Activity

Worm Pipecleaner Craft!

Objective: Create a three-dimensional model of a worm using the principles of art and design.

Curriculum Links:

Kindergarten

Creative Development

1.2 - express ideas and feelings creatively through artistic expression.

Grade 1

Visual Arts: *Creating and Presenting*

CP1.1 - create two- and three-dimensional works of art that express feelings and ideas inspired by personal experiences

CP1.2 - demonstrate an understanding of composition using principles of art and design to create narrative art works or art works on a theme or topic

CP1.3 - use the elements of art and design in art works to communicate ideas, messages, and understandings

CP1.4 - use a variety of materials, tools, and techniques to respond to design challenges

Grade 2

Visual Arts: *Creating and Presenting*

CP2.1 - create two- and three-dimensional works of art that express feelings and ideas inspired by personal experiences

CP2.2 - demonstrate an understanding of composition using principles of art and design to create narrative art works or art works on a theme or topic

CP2.3 - use the elements of art and design in art works to communicate ideas, messages, and understandings

CP2.4 - use a variety of materials, tools, and techniques to respond to design challenges

Materials:

- Pipecleaners
- Beads
- Googly eyes
- Liquid Glue

Activity/Procedure:

1. Each student will create their own worm with the materials provided.
2. Have students choose the color of pipecleaner they would like to use.
3. Begin by folding the pipecleaner in half (Fig. 1).
4. Thread 14 beads of choice through the end containing the non-folded end.
5. Push the beads up to the folded ends (Fig. 2).
6. Fold both end up (Fig 3).
7. Tuck the non-folded ends of the pipecleaner back through the beads (Fig 4).
8. Apply two small googly eyes to either side of the pipecleaner at the folded end via liquid glue.
9. Press the eyes into the pipecleaner until dry (Fig. 5).

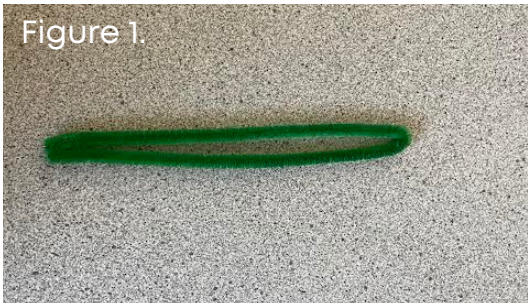


Figure 1.


Figure 2.


Figure 3.


Figure 4.

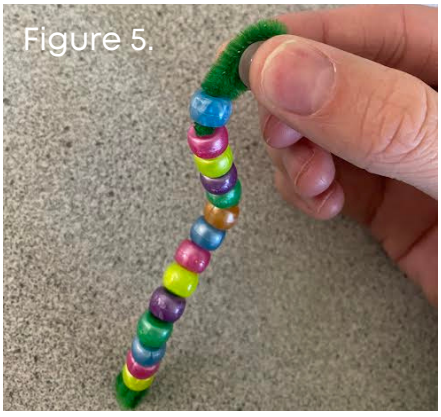


Figure 5.

Kindergarten Activity

Counting with Worms!

Objective: Apply number sequences to count the number of worms in the dirt.

Curriculum Links:
Early Numeracy:
1.1 - Count in a variety of ways

Health and Physical Development:
3.3 - engage in and complete activities independently; and seek assistance as necessary

Materials:

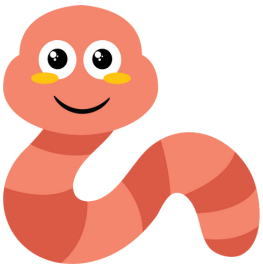
- **Counting Worms** worksheet
- Pencil

Activities/Procedures:

1. Each student is given a **Counting Worms** worksheet.
2. Have students complete the worksheet, counting the number of worms in each pile of dirt.
3. Extension Activity: To extend this activity beyond the classroom, students may count and record the number of worms they can see in the worm garden within their school.

Conclusion: The student should have a stronger understanding of the number sequence, and be able to apply this knowledge in a variety of ways to count various objects.

COUNTING WORMS!



I see _____
worm in the dirt.

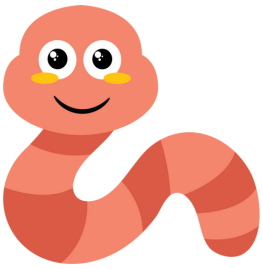
I see _____
worms in the dirt.

I see _____
worms in the dirt.

I see _____
worms in the dirt.

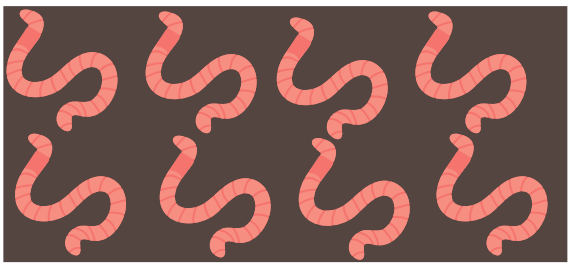
I see _____
worms in the dirt.

COUNTING WORMS!



I see _____
worm in the dirt.

I see _____
worms in the dirt.

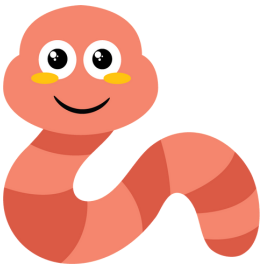


I see _____
worms in the dirt.

I see _____
worms in the dirt.

I see _____
worms in the dirt.

COUNTING WORMS!



I see 1 worm in the dirt.

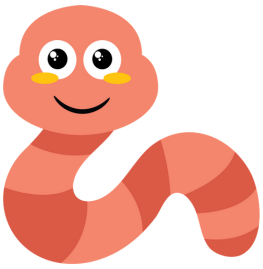
I see 2 worms in the dirt.

I see 3 worms in the dirt.

I see 4 worms in the dirt.

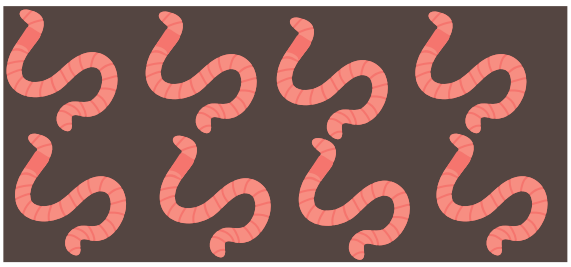
I see 5 worms in the dirt.

COUNTING WORMS!



I see 6 worm in the dirt.

I see 7 worms in the dirt.



I see 8 worms in the dirt.

I see 9 worms in the dirt.

I see 10 worms in the dirt.

Grade 1 Activity

Make a Mini Vermicomposter!

Objective: Create a three-dimensional model of the Worm Garden while using the elements of art and design.

Curriculum Links:
Visual Arts*:*
CP1.1 - create two and three-dimensional works of art that express feelings and ideas inspired by personal experiences
CP1.3 - use the elements of art and design in art works to communicate ideas, messages, and understandings
CP1.4 - use a variety of materials, tools, and techniques to respond to design challenges
Science: *Materials, Objects, and Our Senses*
PS - 1 - create a model or toy from scrap material

Materials:

- Recycled yogurt containers
- Paint
- Cardboard
- Soil
- Shredded newspaper

Activity/Procedure:

1. Each student should be given two yogurt containers. Drill holes in the bottom of one container to allow for drainage.
2. Paint the outside of the second container and let dry.
3. Place a small object such as a rock in the painted container and set the other container containing the holes inside. This is to allow for air circulation and drainage.
4. Place a piece of paper towel at the bottom of the inner container to prevent the worms or soil from escaping.
5. Prepare the worm bedding by shredding newspaper into small strips and wet the paper thoroughly with water. Squeeze out the excess water from the newspaper and mix it with a small amount of soil.
6. Place the bedding in the inner container, fluffing it up.
7. Place a small number of worms in the bin, approximately 5 worms.
8. Add a small amount of worm food (roughly have the worms weight) such as an orange peel.
9. Cut a template of the top of the worm container with a small tab out of cardboard.
10. Place the cardboard lids inside the inner container.
11. Students are now ready to take their worms home or keep them in the classroom.

Conclusion: Using the principles of art and design, students should have produced a mini vermicomposter that expresses individual artistic abilities.

Measuring with Worms!

Objective: To develop an understanding of measurement as a process of comparing while using inch worms as a non-standard unit of measure.

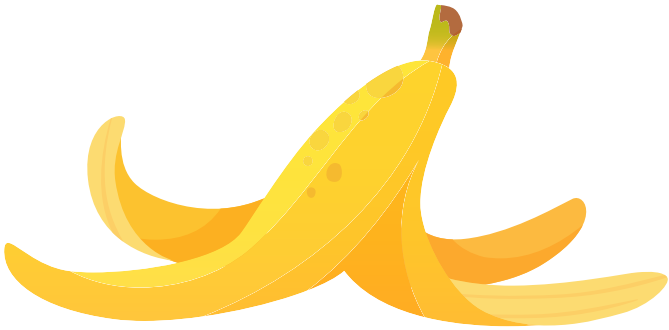
Curriculum Links:
Mathematics: *Shape and Space*
SS1 - demonstrate an understanding of measurement as a process of comparing by: identifying attributes that can be compared, ordering objects, making statements of comparison and filling, covering, or matching

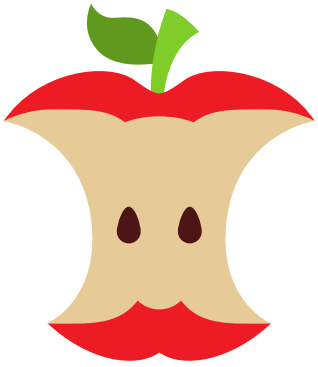
Materials:
- **Inch Worms** worksheet
- Pencil
- Scissors
- **Optional:** Ruler

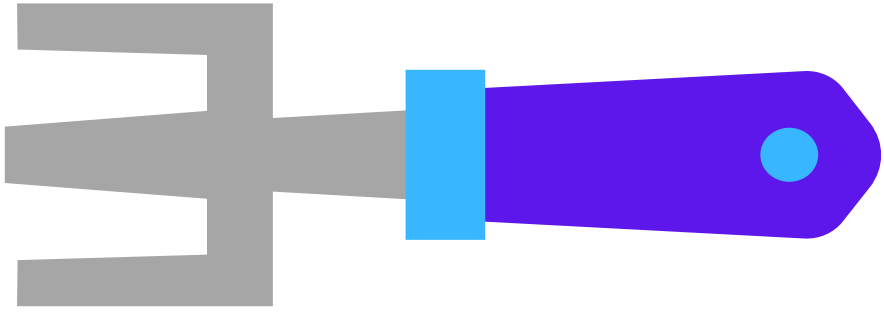
Activities/Procedures:
1. Cut out the composting tool pictures and worms.
2. Students are to practice measuring the composting tools using both the worm pictures provided and their rulers.
3. Students are to record their measurements on the recording sheets provided.

Conclusion: Students should exhibit a better understanding of how to use non-standard and standard techniques to measure.

Composting Tools: Measure with the worm rulers or with standard measurement rulers.







Name: _____

Non-Standard Measurement

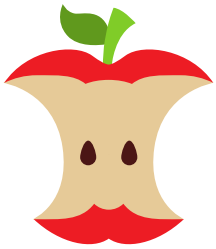
Inch Worms

Use your worm ruler to measure the composting tools to the nearest whole. Record your measurements and answer the following questions.

Compost bin: _____ worms

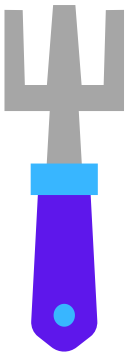
Newspaper: _____ worms

Banana Peel: _____ worms



Apple Core: _____ worm

Glove: _____ worms



Rake: _____ worms

Which compost tools are the longest? _____

Which compost tool is the shortest? _____

Name: _____

Standard
Measurement

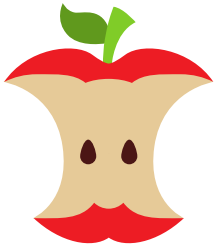
Inch Worms

Use your worm ruler to measure the composting tools to the nearest whole. Record your measurements and answer the following questions.

Compost bin: _____ cm

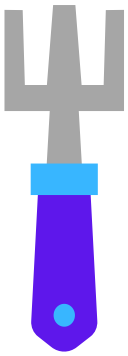
Newspaper: _____ cm

Banana Peel: _____ cm



Apple Core: _____ cm

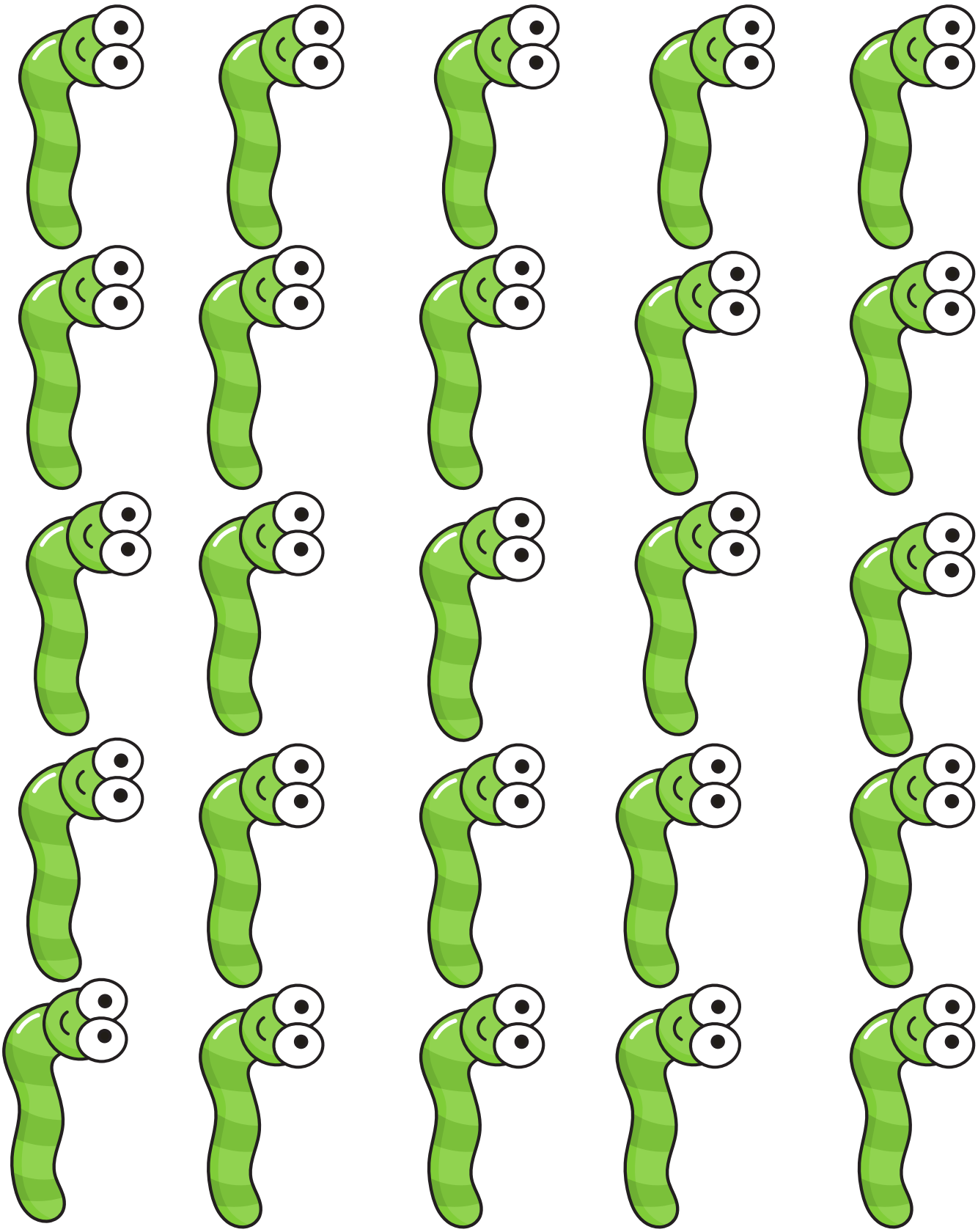
Glove: _____ cm



Rake: _____ cm

Which compost tools are the longest? _____

Which compost tool is the shortest? _____



Name: Answer Key

Non-Standard Measurement

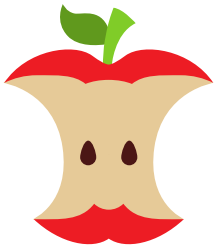
Inch Worms

Use your worm ruler to measure the composting tools to the nearest whole. Record your measurements and answer the following questions.

Compost bin: 3 worms

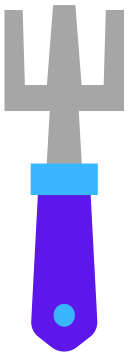
Newspaper: 2 worms

Banana Peel: 2 worms



Apple Core: 1 worm

Glove: 2 worms



Rake: 3 worms

Which compost tools are the longest? Compost bin and rake

Which compost tool is the shortest? Apple Core

Name: Answer Key

Standard
Measurement

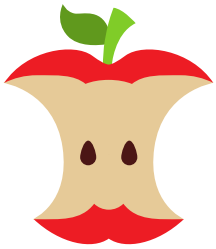
Inch Worms

Use your worm ruler to measure the composting tools to the nearest whole. Record your measurements and answer the following questions.

Compost bin: 12 cm

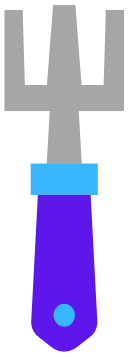
Newspaper: 7 cm

Banana Peel: 9 cm



Apple Core: 5 cm

Glove: 7 cm



Rake: 11 cm

Which compost tools are the longest? Compost bin

Which compost tool is the shortest? Apple core

Grade 2 Activity

The Lifecycle of an Earthworm

Objective: To explore and describe the lifecycle of an earthworm.

Curriculum Links:
Science: *Animal Growth and Changes*

1. 101 – 7 - observe and describe changes in the appearance and activity of an organism as it goes through its lifecycle

·203-2 - recognize the stages of development of the organism using applicable terminology and language
203-3 - communicate procedures and results of the investigation into the life cycle of an organism, using drawings, demonstrations, and/or written and oral descriptions
203-5 - respond to other students' ideas about an organisms' needs and changes in growth patterns

Materials:

- **The Lifecycle of an Earthworm** worksheet
- Scissors
- Glue stick
- **Optional:** Teacher may staple each students book together in top left corner

Introduction:
Briefly explain to students the following:

- Lifecycle of an earthworm using appropriate terminology

Activity/Procedure:

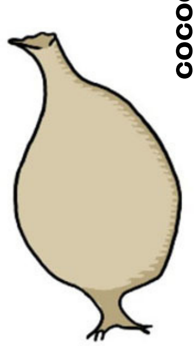
1. Have students begin by cutting out the four stages of the lifecycle and four short descriptions.
2. Students are to match the appropriate lifecycle stage with one of the four descriptions.
3. Once students have correctly matched all four stages, glue the little text blurb on each corresponding stage.
4. Arrange the lifecycle stages in chronological order and staple together.

Conclusion: Students should be able to recognize the stages of development of an earthworm and using the appropriate terminology.

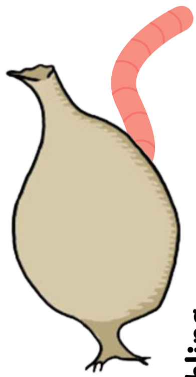
The Life Cycle of an Earthworm

Name: ______

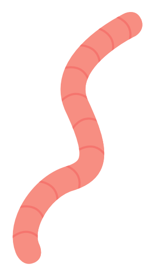
1



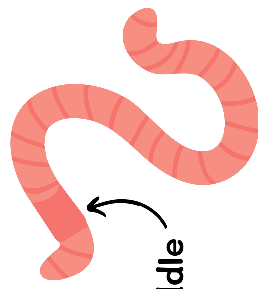
2



3



4



Adult earthworms make a cocoon and lay their eggs in it. They can lay up to 30 eggs at a time.

In about 14-21 days, tiny earthworms begin to wiggle out of their cocoon.

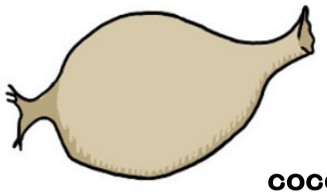
Hatchlings look like mini earthworms but are missing a saddle.

In about 2-3 months the tiny hatchlings grow into adult earthworms and lay their own eggs.

The Life Cycle of an Earthworm

Name: Answer Key

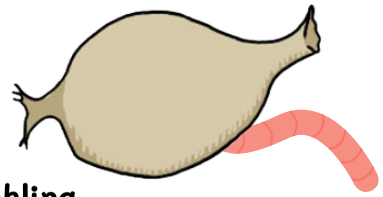
1



cocoon

Adult earthworms make a cocoon and lay their eggs in it. They can lay up to 30 eggs at a time.

2



hatchling

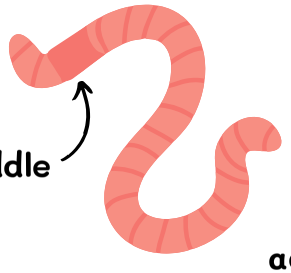
In about 14-21 days, tiny earthworms begin to wiggle out of their cocoon.

3

hatchling

Hatchlings look like mini earthworms but are missing a saddle.

4



saddle

adult earthworm

In about 2-3 months the tiny hatchlings grow into adult earthworms and lay their own eggs.

Grade 3 Activities

Determining Different Types of Soils Capacity to Retain Water

Objective: To determine what type of soil retains the most moisture and with that information, infer what conditions are optimal for earthworms.

Curriculum Links:
Science: *Exploring Soils*
100-38 - describe the effect of moisture on characteristics of the soils
200-3 - make predictions about the absorption of water by different types of soil that lead to exploration and investigation
203-3 communicate procedures and results of investigations related to test water absorption of soils, using drawings, demonstrations, and/ or written and oral descriptions

Materials:

- Four small containers each containing a small amount of different soils including gravel, sand, potting soil, and clay
- Eight 50 mL graduated cylinders
- Four funnels
- Four coffee filters
- Water
- **Soil Stations** worksheet
- Pencil
- Ruler
- **Optional:** Colored pencils to color bars in graph

Activity/Procedure:

1. Create four stations around your classroom each containing a small container of a different soil type, two graduated cylinders, funnel, and coffee filter.
2. Provide each student with a copy of the **Soil Stations** worksheet and break the class up into 4 groups.
3. Students are to generate a hypothesis regarding which soil type they think will retain the greatest amount of water.
4. At each station, set the funnel on top of one graduated cylinder and place a coffee filter in the funnel. To each filter add a small amount of soil.
5. Measure 40 mL of water into the second graduated cylinder and pour over each sample.
6. Allow time for the water to pass through the filter into the cylinder.

7. Then have groups rotate to each station recording their observations and determining the amount of water retained by each soil.
8. Individually or as a class create a chart and graph of the data. From this data, students will draw conclusions and determine whether their hypothesis was supported or not.

In-Class Discussion:

1. Which type of soil do you think is best suited for an earthworm's physical needs? Why?
2. Which type of soil do you think is least suited for an earthworms' physical needs? Why?

Conclusion: Students should have determined which soil retained the moist water and apply this information to infer about the physical needs of an earthworm.

Soil Stations Worksheet

Name: _____ Date: _____

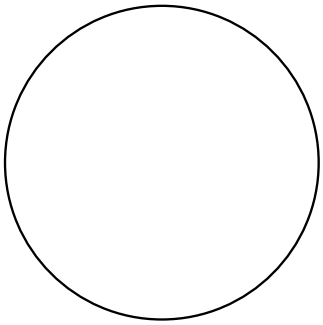
Hypothesis: _____

_____

_____

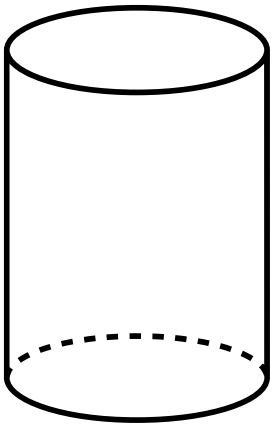
Soil Sample 1: _____

My observations:



Size of particles: _____

Color of particles: _____



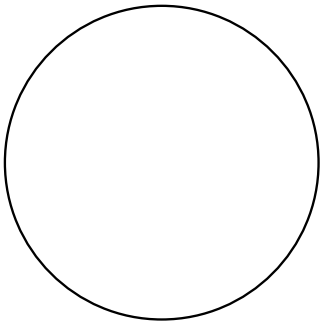
Amount of water poured in: 40 mL

Amount of water in cylinder: _____

Amount of water retained by soil: _____

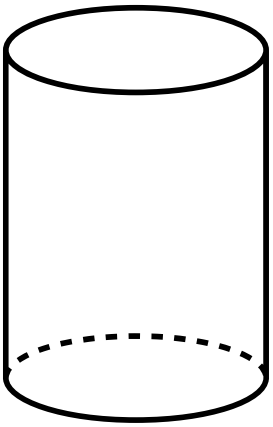
Soil Sample 2: _____

My observations:



Size of particles: _____

Color of particles: _____



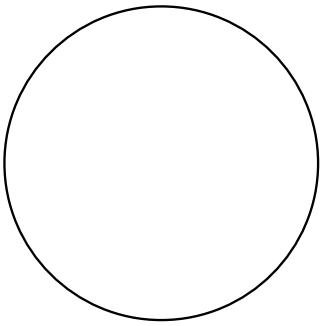
Amount of water poured in: 40 mL

Amount of water in cylinder: _____

Amount of water retained by soil: _____

Soil Sample 3:_____

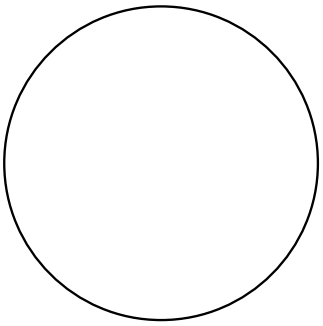
My observations:



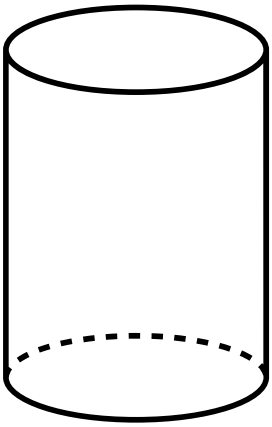
Size of particles: _____
Color of particles: _____

Soil Sample 4:_____

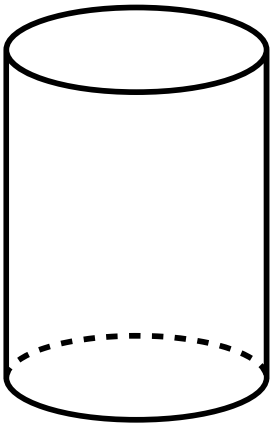
My observations:



Size of particles: _____
Color of particles: _____



Amount of water poured in: 40 mL
Amount of water in cylinder: _____
Amount of water retained by soil: _____

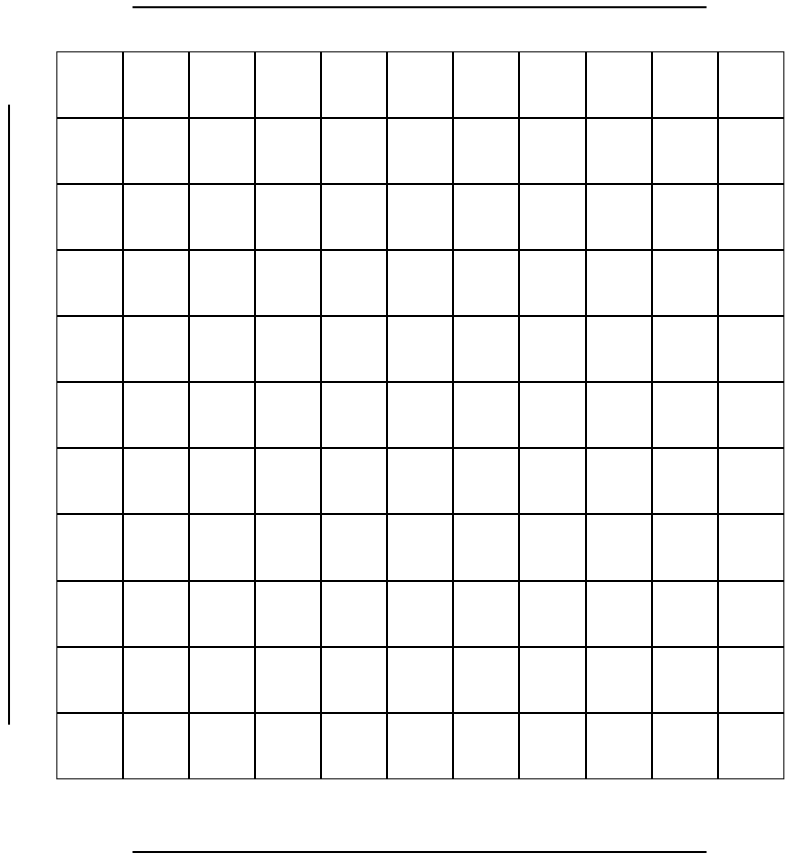


Amount of water poured in: 40 mL
Amount of water in cylinder: _____
Amount of water retained by soil: _____

Fill in the table below, using the data you collected.

Soil Sample	Amount of Water Poured in	Amount of Water in Cylinder	Amount of Water Retained in Soil

Using the table above, create a bar graph displaying the amount of water retained in the soil. Remember to label the axis and include a graph title.



Conclusion: _____

_____

_____

_____

What would increase the reliability of this experiment? _____

_____

_____

_____

_____

Banana Rot Activity

Objective: To experimentally determine how fast a banana peel decomposes over time in three different environments: in garden soil, on its own, and in your vermicompost bin!

Curriculum Links:
200-1, 200-3 - ask questions and make predictions that lead to exploration and investigation about the composition of soil
100-37, 201 - 3 - investigate and describe soil components using appropriate tools such as spoons, magnifying glasses, jars, and filters
201-5 - make and record observations and measurements in investigations related to soil composition
202-7 - propose an answer to initial question related to soil composition based on their investigations

Materials:
- Refer to the materials listed in the **Banana Rot** activity guide created by **Little Green Thumbs**

Activity/Procedure:
- Refer to the instructions listed in the **Banana Rot** activity guide created by **Little Green Thumbs**
- **TIP:** Instead of creating a jar containing a banana peel, worms and compost. You can place the banana peel directly in your class vermicomposter.

In-Class Discussion:
Refer to the potential discussion questions listed in the **Banana Rot** activity guide created by **Little Green Thumbs**

Conclusion: Students should have explored the effects of three different environments on the decomposition process and understand why vermicomposting is such an efficient process.

Grade 4 Activity

Exploring Food Chains!

Objective: To classify organisms based on their roles in a food chain.

Curriculum Links:
Science: *Habitats and Communities*
301-1 - predict how the removal of a plant or animal population affects the rest of the community
302-3 - classify organisms according to their role in the food chain
302-3, 104-6, 206-1 - classify organisms according to their role in the food chain and draw a diagram to illustrate the food chain

Materials:

- **Exploring Food Chains** worksheet
- Pencil
- **Optional:** Pencil crayons or markers

Introduction:
Briefly explain to students:

1. What a food chain is?
2. What it is used for?
3. The roles within a food chain occupied by various organisms including producer, consumer, decomposer, etc.

Activity/Procedures:

1. Have students complete the following worksheet independently, providing assistance when needed.

In Class Discussion:

1. What role do microorganisms play in the process of composting? Decomposer? Producer? Consumer?
2. If earthworms were removed from an ecosystem, how would this effect the rest of the community?

Conclusion: Students should have a better understanding of the purpose of food chains and the roles that organisms play within it.

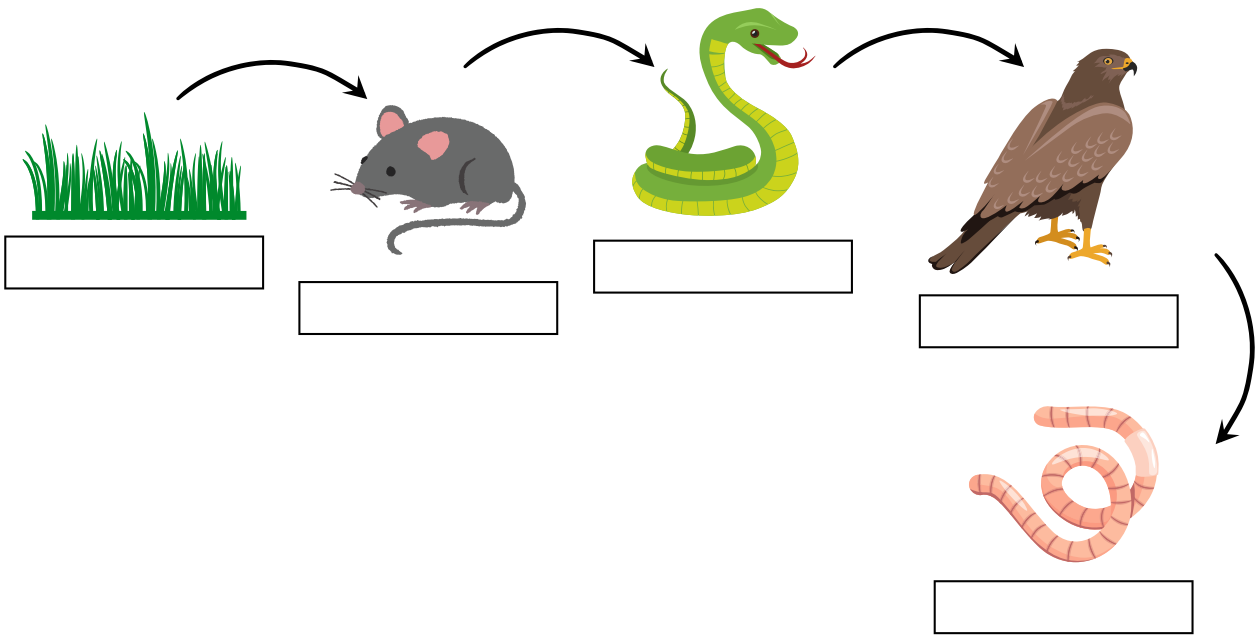
Name: _____ Date: _____

Exploring Food Chains

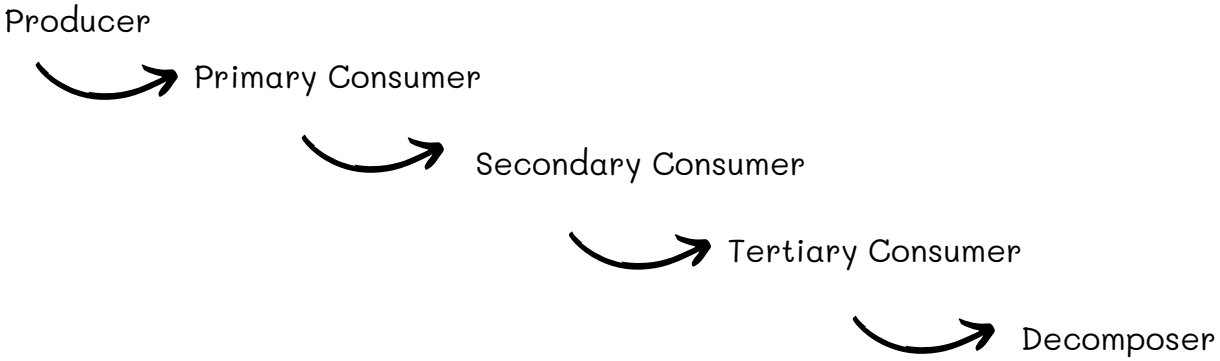
1.Complete the table below by defining the terms listed and providing an example.

Terms	Definition	Example
Ecosystem		
Food Chain		
Producer		
Consumer		
Decomposer		

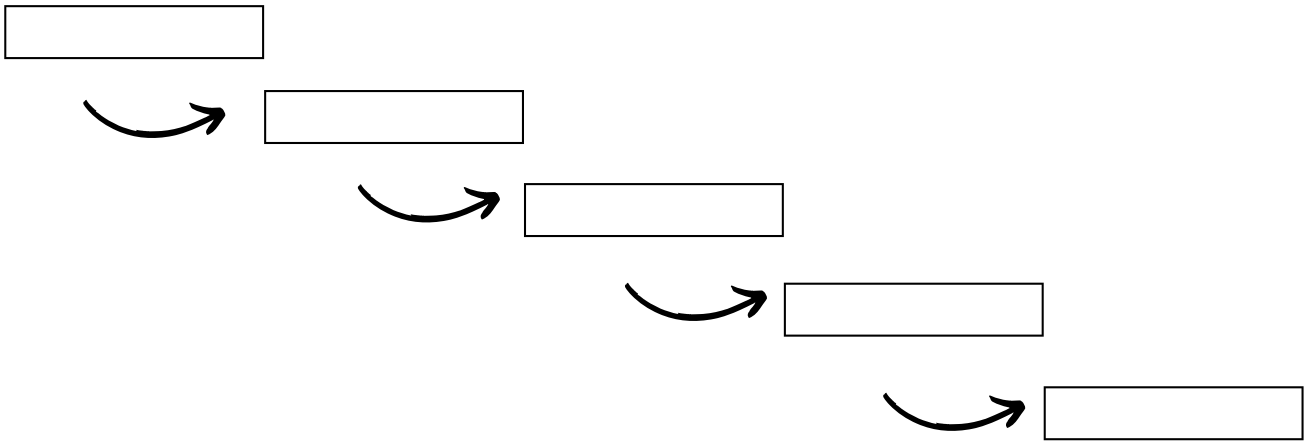
2.Complete the diagram, labelling the organisms within the food chain.



3.Match and then draw the following organisms to their role in the food chain: fungi, fox, grasshopper, frog, and grass.



4.Create your own food chain including a producer, primary consumer, secondary consumer, tertiary consumer, and a decomposer.



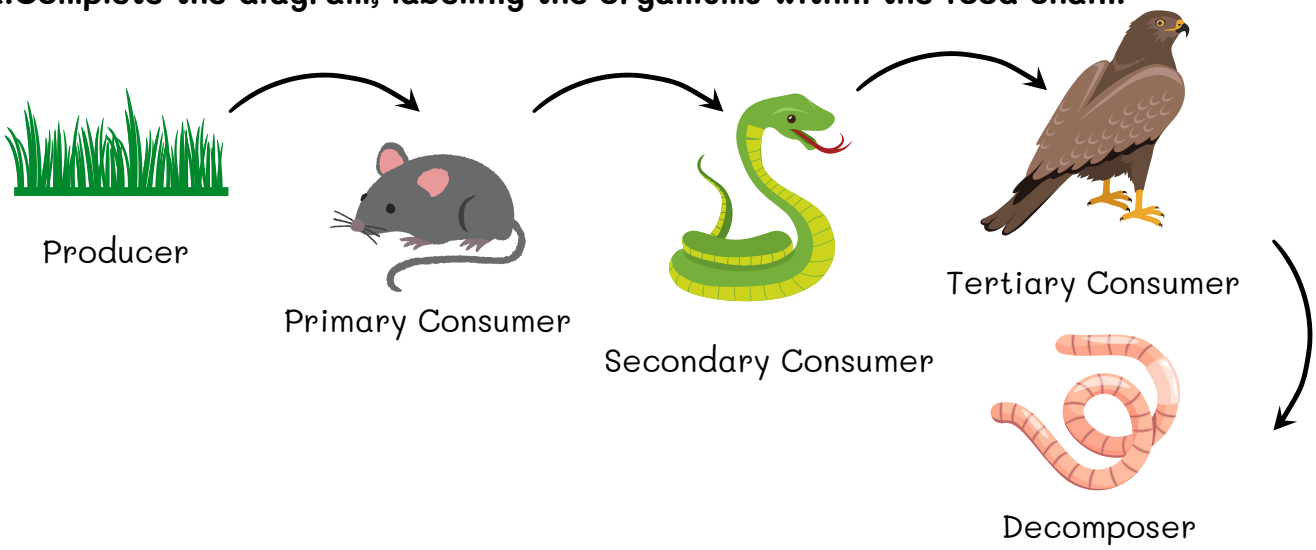
Name: _____ **Date:** _____

Exploring Food Chains

1.Complete the table below by defining the terms listed and providing an example.

Terms	Definition	Example
Ecosystem	All the living and nonliving things in an environment including their interactions with each other	Swamp
Food Chain	The path that energy and nutrients follow in an ecosystem	
Producer	An organism that uses the Suns energy to make its own	Flower
Consumer	An organism that eats another organism	Fox
Decomposer	An organism that breaks down dead plants and animals into simpler materials that enrich the soil	Earthworm

2.Complete the diagram, labelling the organisms within the food chain.



3.Match and then draw the following organisms to their role in the food chain: fungi, fox, grasshopper, frog, and grass.

Producer

Primary Consumer

Secondary Consumer

Tertiary Consumer

Decomposer

4.Create your own food chain including a producer, primary consumer, secondary consumer, tertiary consumer, and a decomposer.

Grade 5 Activity

Physical and Chemical Changes

Objective: Explore physical and chemical changes that occur during the composting process.

Curriculum Links:
Science: *Properties and Changes in Materials*
301-10 - identify and describe some changes to materials that are reversible and some that are not
301-12 - describe examples of interactions between materials that result in the production of a gas
301-11 - describe changes that occur in the properties of materials when they interact with each other
301-9, 205-5 - observe and identify physical changes, that can be made to an object, that changes the form or size of the material in the object without producing any new materials
301-10 - identify and describe some physical changes that are reversible and some that are not
301-12. 301-11 - describe chemical changes, that occur when materials interact with each other to form totally new materials including those that result in the production of a gas

Materials:

- **Physical and Chemical Changes of Composting** worksheet
- Pencil

Introduction:
Explain to students the following:

1. What physical and chemical changes are.
2. The relationship between composting and these changes.

Activity/Procedure:
Have students complete the provided worksheet designed to connect composting to the physical and chemical changes of substances.

Conclusion: Students should be able to determine the differences between physical and chemical changes and recognize the changes that occur within various examples.

Physical and Chemical Changes of Composting

Name:_____

Fill in the Blanks

A _____ change occurs when there is a change in the size, shape, or state of matter. A _____ change however, occurs when a new substance is produced either by combining two or more materials or a change in the physical and chemical properties. An example of a physical change includes _____. An example of a chemical change includes _____ .

Label these as chemical (C) or physical changes (P).

1. Water freezing
2. Crushing rocks
3. Dissolving sugar in water
4. Rust forming on a bicycle
5. Ice melting
6. Two chemicals are mixed together and a gas is produced
7. Grass grows
8. Milk sours
9. Cutting paper
10. Mixing salt and pepper
11. Roasting a marshmallow
12. Cooking pancakes

Label these processes associated with vermicomposting as either chemical (C) or physical changes (P).

1. Pre chopping your worms food with a knife
2. Banana peel rotting
3. Crushing eggshells
4. Cutting newspaper into strips
5. Mixing soil and newspaper
6. Freezing your worms food
7. Microwaving your worms food
8. Microorganisms breaking down organic material
9. Worms digesting food in their gizzard
10. Worms absorbing water through their skin
11. Production of worm castings
12. Production of vermicompost

Physical and Chemical Changes of Composting

Name: **Answer Key**

Fill in the Blanks

A **physical** change occurs when there is a change in the size, shape, or state of matter. A **chemical** change however, occurs when a new substance is produced either by combining two or more materials or a change in the physical and chemical properties. An example of a physical change includes **crushing a can**. An example of a chemical change includes **baking a cake** .

Label these as chemical (C) or physical changes (P).

1. Water freezing **P**
2. Crushing rocks **P**
3. Dissolving sugar in water **P**
4. Rust forming on a bicycle **C**
5. Ice melting **P**
6. Two chemicals are mixed together and a gas is produced **C**
7. Grass grows **C**
8. Milk sours **C**
9. Cutting paper **P**
10. Mixing salt and pepper **P**
11. Roasting a marshmallow **C**
12. Cooking pancakes **C**

Label these processes associated with vermicomposting as either chemical (C) or physical changes (P).

1. Pre chopping your worms food with a knife **P**
2. Banana peel rotting **C**
3. Crushing eggshells **P**
4. Cutting newspaper into strips **P**
5. Mixing soil and newspaper **P**
6. Freezing your worms food **P**
7. Microwaving your worms food **P**
8. Microorganisms breaking down organic material **C**
9. Worms digesting food in their gizzard **P/C**
10. Worms absorbing water through their skin **P**
11. Production of worm castings **C**
12. Production of vermicompost **C**

Grade 6 Activity

Connecting Microbes and Composting!

Objective: To explore a variety of microorganisms involved in the composting process.

Curriculum Links:
204-8, 300-19 - identify and use appropriate tools to examine and describe a variety of microorganisms
302-12 - describe how microorganisms meet their basic needs, including obtaining food, water, air and moving around
107-6 - provide examples of how science and technology have been involved in identifying and controlling the growth of microorganisms

Introduction:
Explain to student the following:

- What microorganisms are.
- Where they are found.
- How to identify various types of microorganisms.
- Harmful and helpful effects of microbes.

Materials:

- **Microorganisms and Composting** worksheet
- Pencil

Activity/Procedure:
Have students complete the provided worksheet designed to connect the composting process to microorganisms.

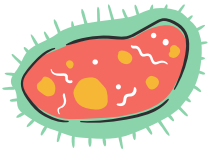
Activity Extension: If compound or electron microscopes are available to your class, collect a small sample of vermicompost from the Worm Garden and allow students to visualize the microbes in a sample of compost.

In-Class Discussion:

1. How are earthworms similar and different from microorganisms in decomposing organic material?
2. If microorganisms were entirely removed from the vermicomposter, how would this effect decomposition?

Conclusion: Students should be able to identify different classes and types of bacteria associated with compost and describe their various roles in the process of producing compost.

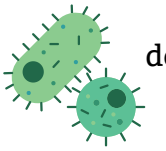
Microorganisms and Composting



Name:_____

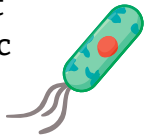
Date: _____

Fill in the blanks using the word bank below. Note that a term may be used more than once.



heat
aerobes
decomposition
Fungi
composting
carbon dioxide

Bacteria
resistant
anaerobic
water
oxygen
anaerobes



everywhere
carbon dioxide
anaerobes
organic matter
Actinomycetes

1. Microorganisms are essential to the _____ process are are found _____ in the environment.

2. There are two main classes of compost microorganisms, _____and _____ . Aerobes require _____while _____ microorganisms do not require oxygen.

3. Microorganisms break down _____ into compost and produce _____, _____, and _____.

4. There are three main types of compost microorganisms, _____ , _____ , and _____ .

5._____are single-celled organisms that break down organic material by combining it with oxygen to produce heat.

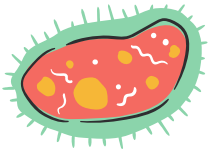
6. Actinomycetes specialize in breaking down more _____materials like proteins and cellulose.

7. _____ include molds and yeast. They break down tough organic material allowing bacteria to continue _____ .

Classify the following statements as either True (T) or False (F).

____1. Microorganisms break down organic material prior to earthworms ingesting it.
____2. All microorganisms in compost are harmful.
____3. Microorganisms such as actinomycetes are responsible for the pleasant earthy smell of compost.
____4. The distribution of microbes in soil or compost differ from one area of soil to another.
____5. Bacteria are one of the most abundant microbes found in soil.
____6. Earthworms, like microbes are important decomposers of organic material in the soil.

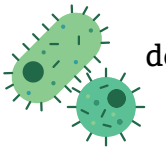
Microorganisms and Composting



Name: **Answer Key**

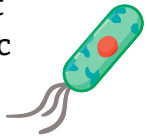
Date: _____

Fill in the blanks using the word bank below. Note that a term may be used more than once.



heat
aerobes
decomposition
Fungi
composting
carbon dioxide

Bacteria
resistant
anaerobic
water
oxygen
anaerobes



everywhere
carbon dioxide
anaerobes
organic matter
Actinomycetes

1. Microorganisms are essential to the **composting** process are are found **everywhere** in the environment.

2. There are two main classes of compost microorganisms, **aerobes** and **anaerobes**. Aerobes require **oxygen** while **anaerobic** microorganisms do not require oxygen.

3. Microorganisms break down **organic matter** into compost and produce **water**, **heat**, and **carbon dioxide**.

4. There are three main types of compost microorganisms, **Bacteria**, **Fungi**, and **Actinomycetes**.

5. **Bacteria** are single-celled organisms that break down organic material by combining it with oxygen to produce heat.

6. Actinomycetes specialize in breaking down more **resistant** materials like proteins and cellulose.

7. **Fungi** include molds and yeast. They break down tough organic material allowing bacteria to continue **decomposition**.

Classify the following statements as either True (T) or False (F).

T 1. Microorganisms break down organic material prior to earthworms ingesting it.
F 2. All microorganisms in compost are harmful.
T 3. Microorganisms such as actinomycetes are responsible for the pleasant earthy smell of compost.
T 4. The distribution of microbes in soil or compost differ from one area of soil to another.
T 5. Bacteria are one of the most abundant microbes found in soil.
T 6. Earthworms, like microbes are important decomposers of organic material in the soil.