Unit Title: Let's Reduce, Reuse and Recycle! **Date Developed/Last Revised:** 6.12.13 **Unit Author(s):** E. Akana, H. Espinda, E. Kam [Adapted from: L. Okita, K. Taboada, J. Nojo, N. Beerman]	**Grade Level:** 2 **Time Frame:** 13 hours **Primary Content Area:** Science

UNIT DESCRIPTION:

This unit uses an inquiry-based approach to investigate the importance of the 3 R's (Reduce, Reuse, and Recycle). Students will learn about biodegradable and non-biodegradable materials and explore the process of worms as decomposers that break down biodegradable materials as part of the food chain. Students will learn about the benefits of vermicomposting and use the Engineering Design Process to invent a usable product from recyclable materials and to construct worm bins. They will conduct on-going research and create tables and graphs using the data they collected over a few months.

Big Ideas (Student Insights that Will Be Developed Over the Course of the Unit):

- It is important to reduce, reuse and recycle
- Composting helps to recycle some materials such as leftover food and newspaper
- We each need to do our part to keep our environment safe and healthy

Essential Questions (Questions that Will Prompt Students to Connect to the Big Ideas):

- Why is it important to reduce, reuse and recycle?
- What are the benefits of composting?
- What are our roles in sustaining a healthy environment?

	BENCHMARKS/STANDARDS/LEARNING GOALS
Science	SC.2.8.2 - Earth Materials - Identify the limited supply of natural resources and how they can be extended through conservation, reuse, and recycling SC.2.3.1 - Interdependence-Describe how animals depend on plants and animals SC.2.1.1 - Scientific Inquiry – Develop predictions based on observations SC.2.1.2 - Scientific Inquiry – Conduct a simple investigation using a systematic process safely to test a prediction SC.2.6.1 - Nature of Matter-Identify ways to change the physical properties of objects
Technology	CTE: Standard 1: TECHNOLOGICAL DESIGN: Design, modify, and apply technology to effectively and efficiently solve problems

Engineering	CTE: Standard 1: TECHNOLOGICAL DESIGN: Design, modify, and apply technology to effectively and efficiently solve problems
Mathematics	CCSS.Math.Content.2.MD.A.1 – Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes. CCSS.Math.Content.2.MD.A.4 - Measure to determine how much longer one object is than another, expressing the length difference in terms of a standard length unit CCSS.Math.Content.2.MD.D.10 - Draw a picture graph and bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems using information presented in a bar graph
English Language Arts and Literacy	CCSS.ELA-Literacy.SL.2.1* - Participate in collaborative conversations with diverse partners about *grade 2 topics and texts* with peers and adults in small and larger groups. *This is intended as a supporting standard. *Collaborative Conversations Checklist*— a student self- and peer-evaluation checklist that can be used to formatively assess this standard—is attached to this unit overview.
STEM Competencies	Indicator 2.4: Analyzes conflict and applies methods of cooperative resolution An effective community contributor who is STEM literate will • Recognize problems, provide appropriate input, and help the group resolve conflicts when working on scientific, mathematical, and engineering investigations together Indicator 3.3: Generates new and creative ideas and approaches to developing solutions A Complex Thinker who is STEM literate: • Raises questions about the world and seeks information through careful observations, investigations, and experiments • Uses creativity to generate new and innovative solutions • Validates conclusions and/or generalizations with accurate data based

LESSON SEQUENCE

	Lesson Title/Description	Learning Targets (What Students Will Know and Be Able to Do)	Assessments	Time Frame
1	**Introduction to the 3 Rs (Reduce, Reuse, Recycle)**	Students will understand that there are natural resources on Earth that are limited in supply and will not last forever. Students will be introduced to the 3Rs – Reduce, Reuse, Recycle - and understand the importance of conservation on planet earth.	**Formative:** • Group discussions • Class Charts: Identifying 3Rs- Cause and Effect	1 hour
2	**Scientific Inquiry: Plant Life Cycles**	Students will use the scientific inquiry process to make predictions, collect data, share results and reach conclusions about what a plant needs to live. Students will learn how scientists set up valid experiments and collect data over a period of time. Students will learn about the life cycle of a plant. Students will be able to compare the measurement of their plant's length to another student's plant's length and then determine the difference, using cm or inches.	**Formative:** • Group discussions • Graphic organizer to record what plants need to grow • Student worksheet: *Scientific Inquiry: Plant Investigation* **Summative:** The student illustrates the stages of the life cycles (e.g., germination/birth, growth, reproduction and death) of a plant, pointing out some details that distinguish each stage	1 hour for discussion 1 hour to set up and begin the investigation 15-30 minutes for observations and scientific sketches to track the plant's growth (this can be done daily or every other day.)
3	**Introduction to Food Chains**	Students will explain how some animals depend on other plants and animals. Students will describe how a simple food chain works (sun, producer, consumer, decomposer).	**Formative:** • Teacher pre-assessment of content, inquiry and process skills • Group discussions • Student worksheets: o *What Do Animals Need?* o *The Food Chain Game* **Summative:** The student describes how different animals use plants and/or animals (e.g., for food, for building nests)	1 hour for initial discussion and more time for follow-up activities

4	**Natural Resources: Where Does Our Trash Go?**	Students will be able to identify the various natural resources on planet earth. Students will recognize land as a limited, natural resource. Students will understand how reusing and/or recycling various objects can help to conserve natural resources.	**Formative:** • Class discussions • Science journals • Student Worksheet: *Conservation, Reuse and Recycling Vocabulary Review worksheet*	1 hour for initial discussion and more time for follow-up activities
5	**Engineering a New Product**	Students will construct a bar graph using the physical properties of recyclable items. Students will use the bar graph to solve problems. Students will use the Engineering Design Process to design a functional item that solves a problem using recyclable materials.	**Formative:** • Bar graph • Class Discussions • Science Journals	2 hours for steps 1-4 2 hours for steps 5-6 30 minutes for step 7
6	**Composting With Worms**	Students will observe and understand the relationship between resources and the output of the ecosystem. Students will ask and research questions about the most effective design for worm bins. Students will determine the components that a worm bin should include. Students will illustrate their thinking in detailed blueprints with all parts appropriately described and labeled. Students will create an ecosystem for their worms and live and thrive in. Students will compare designs, determine which is most effective, and modify their bins to produce better results. Students will measure the design effectiveness based on the overall health of the worms. (e.g., size, amount, activity level, etc.)	**Formative:** • Group discussions • Observations and data collection • Class Charts: Identifying 3Rs- Cause and Effect	1-2 days

COLLABORATIVE CONVERSATIONS CHECKLIST

CRITERIA	**MET - ☺**		**NOT MET - 😐**	
Name of Student: Name of Peer:	Student	Peer	Student	Peer
I participated in collaborative conversations with my teacher, class and/or partners.				
I spoke respectfully (no interrupting), took turns when speaking, and listened to others with care.				
I used comments made by others to link my ideas to theirs.				
I asked for clarification or explanation when I was confused or didn't understand.				

Note: This checklist may be used with any or all of the lessons in this unit, as the teacher chooses.

Related Websites

http://themes.pppst.com/greenplanet.html

- Links to free presentations for kids and teachers in PPT format

http://www.wartgames.com/themes/science/reduce-reuse-recycle.html

- Reduce Reuse Recycle for Kids: Free Games & Activities
- Links to Waste & Garbage Games

http://www.ollierecycles.com/uk/html/explore.html

- Join Ollie and his friends to learn more about the 3Rs
- A quiz is provided at the end of each section

http://www.epa.gov/recyclecity/

- Scenario: You are Dumptown's new City Manager! When you begin, you'll see Dumptown at its worst — it's littered, polluted, and nothing is being recycled or reused.
- You have 10 programs to work with. Each time you try out a new one, you can see immediately how the Dumptown landscape changes. You also see how much waste you are saving from going into the landfill.

http://www.howtocompost.org/

- A hub for all composting information, including articles and links covering all topics about composting and organic gardening.

http://www.sciencemuseum.org.uk/onlinestuff/games/wasted.aspx

- Scenario: Stop the rubbish from taking over your life! Your bedroom's under threat. The local landfill site has shut down. From now on all your plastics junk stays in your room, unless you recycle it or give it away. Can you keep your pile from reaching the ceiling? Decide: should you recycle it OR sell/give it away?

http://www.worm-farming.com/save-the-planet.html

- Informational articles, including "*Worms Can Save the Planet*"

Unit Title: Let's Reduce, Reuse and Recycle! Lesson Title: Introduction to the 3Rs (Reduce, Reuse, Recycle) Date Developed/Last Revised: 6.12.13 Unit Author(s): E. Akana, H. Espinda, E. Kam	Lesson #: 1 Grade Level: 2 Primary Content Area: Science Time Frame: 1 hour

PLANNING (Steps 1, 2, & 3)

1. Standards/Benchmarks and Process Skills Assessed in this Lesson:

SC.2.8.2 – Earth Materials – Identify the limited supply of natural resources and how they can be extended through conservation, reuse and recycling.

2A. Criteria- What Students Should Know and Be Able to Do:

Students will:

- Understand that there are natural resources on Earth that are limited in supply and will not last forever.
- Be introduced to the 3Rs – Reduce, Reuse, Recycle – and understand the importance of conservation on planet earth.

2B. Assessment Tools/Evidence:

Formative:

- Group discussions
- Class Charts: Identifying 3Rs – Cause and Effect

3. Learning Experiences (Lesson Plan)

Driving Questions:

- What are the 3Rs?
- Why are they important?
- What can we do to make a difference?

Materials:

- Chart paper, markers

Handouts/Other Resources:

- Website: http://www3.canisius.edu/~grandem/reducereuserecycle/Digital_Book_2011.html

Procedure:

1. Have students look around the classroom and make observations. Ask: Do you see anything in this room that is natural? Who made it? A human? Nature? So, was it made

naturally or was it invented?

2. Discuss how many of the objects were invented/created/designed/engineered to help humans – to make things faster, better, stronger, safe, etc.

3. Ask: So what *does* exist on planet earth that was not engineered by a human?

4. List students' suggestions on a chart paper to post, update and use throughout the unit.

5. Discuss: How long will these natural objects last? What happens to all of these inventions around us once it's old and broken? Where does it go if we don't want it anymore?

6. Continue discussion: What can we do to help? Can we make a difference?

7. Introduce the 3Rs or lead a discussion toward the 3Rs: What are the 3Rs? Has anyone heard of them? Make a KWL chart (or use another type of graphic organizer).

8. Create a Cause and Effect Chart: What would happen if no one reduced, reused or recycled anything?

9. Use this site to further explain and show the students what might happen to earth if no one reduced, reused or recycled. It includes 17 kid-friendly pages and videos about the 3Rs. Great resource to introduce or review the 3Rs with your students.

http://www3.canisius.edu/~grandem/reducereuserecycle/Digital_Book_2011.html

TEACHING & ASSESSMENT (Steps 4, 5, 6, &7)
Completed by teacher after instruction has taken place

4. Teaching and Collecting of Evidence of Student Learning:
Teacher Notes:

5. Analysis of Student Products/Performances - Formative:
Teacher Notes:

6. Evaluation of Student Products/Performances – Summative (Not necessary for every lesson):
Teacher Notes:

7. Teacher Reflection: Replanning, Reteaching, Next Steps:
Teacher Notes:

Unit Title: Let's Reduce, Reuse and Recycle! Lesson Title: Scientific Inquiry: Plant Life Cycles Date Developed/Last Revised: 6.12.13 Unit Author(s): E. Akana, H. Espinda, E. Kam	Lesson #: 2 Grade Level: 2 Primary Content Area: Science Time Frame: • 1 hour for discussion • 1 hour to set up and begin the investigation • 15-30 minutes for observation and scientific sketches to track the plant's growth (this can be done daily or every other day)

PLANNING (Steps 1, 2, & 3)

1. Standards/Benchmarks and Process Skills Assessed in this Lesson:

SC.2.1.1 – Develop predictions based on observations
SC.2.1.2 – Conduct a simple investigation using a systematic process safely to test a prediction
SC.2.4.1 – Explain how plants and animals go through life cycles
(Note: this lesson only focuses on plants)
CCSS.Math.Content.2.MD.A.4 – Measure to determine how much longer one object is than another, expressing the length difference in terms of a standard length unit.

2A. Criteria- What Students Should Know and Be Able to Do:

Students will:

- Use the scientific inquiry process to make predictions, collect data, share results and reach conclusions about what a plant needs to live.
- Learn how scientists set up valid experiments and collect data over a period of time.
- Learn about the life cycles of a plant.
- Be able to compare the measurement of their plant's length to another student's plant's length and then determine the difference, using cm or inches.

2B. Assessment Tools/Evidence:

Formative:

- Group discussions
- Graphic organizer to record what plants need to grow
- Student worksheet: *Scientific Inquiry: Plant Investigation*

Summative:

The student illustrates the stages of the life cycles (e.g., germination/birth, growth, reproduction and death) of a plant, pointing out some details that distinguish each stage.

Advanced	Proficient	Partially Proficient	Novice
Classify plants by the details of their life cycles	Explain how plants go through life cycles	Give an example of a plant life cycle	Recall that plants go through life cycles

3. Learning Experiences (Lesson Plan)

Driving Questions:

- What do scientists do?
- How can we set up a valid experiment to find out more about plants?
- What is the life cycle of a plant?

Materials:

- Seeds, soil, containers (1 per student)
  Suggestions for containers: foam cups with holes in the bottom to allow drainage

Handouts/Other Resources:

- Student worksheet: *Scientific Inquiry: Plant Investigation*

Procedure:

1. Ask: What do plants need to grow?

2. List questions that students have about plants. Option: Use a KWL chart or other graphic organizer.

3. Guide students toward a question that can be investigated. Option: Use a graphic organizer.

4. Ask questions to get your students thinking about what they want to investigate. Example questions can include (and will vary based on the chosen investigation):
   - What could we do that would cause the plant to grow taller?
   - What factors might affect how tall a plant grows?

5. Discuss: What makes a testable question?
   - Choose a question from the students' list that is testable and can be investigated via a class experiment.

6. Students need to have an understanding of a valid experiment. Ask and discuss the following questions to guide students toward this understanding.
   - What do scientists do when they are conducting an investigation and are trying to find an answer to a question?
   - What materials do we need? How should we collect our data?
   - Should we use the same seed? Why?
   - Should we use the same amount of soil? The same type of soil?
   - The same amount of water?
   - Where should we put the plants? In the class? Where in the class? Outside?
   - What tools will we use to measure/quantify the data?
   - If we want to compare the results from different teams, how do we make sure that the

comparisons are valid? (Each team should follow the same steps.)

Emphasize: As scientists, we each need to control our investigations so that we can compare results accurately.

7. Pass out the Student worksheet: *Scientific Inquiry: Plant Investigation* and have students fill it out during the investigation. (Please feel free to edit and revise the worksheet at your discretion)

8. Set up the "Plant Life Cycles" experiment with your students. For example, if the class wants to investigate whether adding fertilizer makes plants grow taller, then half the class would add fertilizer to their plant and half the class wouldn't; keep the same amount of soil, light, water, etc. (you are changing only one variable).

9. Collect data over a period of time to allow students to see the complete life cycle of a plant.
   - Have students record their observations by using *scientific sketches that include labels and standard units of measurement.
   - Compile the data from each student/group into a class chart. (This will vary depending on the investigation.)
   - Analyze the data during a class discussion.

*Scientific Sketches: your students need to know that they are scientists and that scientist must draw what they see as accurately as possible. Example: if they cannot see the worm smiling, they should not be drawing a smiling worm or other unobserved details. An example of a Scientific Sketch Rubric is attached. Modify the rubric to fit the needs of your students. Option: have students take photos of their plants each day to record the plant's growth.

Scientific Sketch Rubric:

Criteria:	Points Earned	Points Possible
The drawing realistically and effectively depicts the specimen.		2
The drawing includes only those features that were actually observed and not inferred.		2
Relevant details are included: size (length, width and height in metric), colors, textures, and shapes.		4
Perspective of drawing provides the most detail.		2
Each drawing is labeled by name.		2
All the parts of the scientific drawing is/are clearly and accurately labeled.		2
The drawing is of an appropriate size and scale.		2
A very precise scale and proportion is used consistently. The scale is stated and uses the metric system.		2
Total Points: 18 points/drawing		18
Comments:		

10. Discuss: What happens when plants die? What do you see? Where did/does the plant go?

11. Students will reflect on what they learned in their science journals. Journal entries can include:
    - Scientific sketches with labels and measurements of the seed, the plant parts and the plant growth.
    - Describe what they see and make predictions on what will happen and why.
    - Illustrate the stages of the life cycle of a plant.

Note: Options for assigning partners for the Math Question on the Student worksheet: *Scientific Inquiry: Plant Investigation* include:

1. Assign a student from the control group with a student from the experimental group.
2. Assign a student from the control group with another student from the control group, and assign a student from the experimental group with another student from the experimental group.

Control group: plant is exposed to normal conditions.
Experimental group: plant is exposed to the same normal conditions as the control group except for the variable being tested (fertilizer, amount of water, type of soil, etc.)

TEACHING & ASSESSMENT (Steps 4, 5, 6, &7)
Completed by teacher after instruction has taken place

4. Teaching and Collecting of Evidence of Student Learning:
Teacher Notes:

5. Analysis of Student Products/Performances - Formative:
Teacher Notes:

6. Evaluation of Student Products/Performances – Summative (Not necessary for every lesson):
Teacher Notes:

7. Teacher Reflection: Replanning, Reteaching, Next Steps:
Teacher Notes:

Name of Scientist: _____ Date: _____

Scientific Inquiry: Plant Investigation

QUESTION:

_____

_____

_____

HYPOTHESIS:

IF _____,

THEN _____

BECAUSE_____

_____

MATERIALS NEEDED:

PROCEDURE:

_____

_____

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_____

DATA:

- Record your observations. What do you see?
- Draw a scientific sketch of what you see. Make it look like the actual object.
- Include labels and measurements.
- What are you now wondering about? Write at least two questions for each date.

Date	OBSERVATIONS	SCIENTIFIC SKETCHES	QUESTIONS
	Length of plant = _____		
	Length of plant = _____		
	Length of plant = _____		
	Length of plant = _____		

Date	OBSERVATIONS	SCIENTIFIC SKETCHES	QUESTIONS
	Length of plant = _____		
	Length of plant = _____		
	Length of plant = _____		
	Length of plant = _____		

CONCLUSION:

- Based on your data, what is your answer to the question?
- Was your hypothesis supported by data?
- Use evidence from your data to support your conclusion.

_____

_____

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MATH QUESTION: How does the length of your plant compare to the length of your partner's plant?

1. Input the needed data for your plant and your partner's plant.
2. Circle the plant that is longer.
3. Calculate the difference.

DATE	My Plant's Length (cm)	My Partner's Plant Length (cm) Partner's Name: _____	Difference in Length (cm)

Whose plant grew the most? _____

Why do you think one plant grew longer than the other plant?

_____

_____

_____

Unit Title: Let's Reduce, Reuse and Recycle! Lesson Title: Introduction to Food Chains Date Developed/Last Revised: 6.12.13 Unit Author(s): E. Akana, H. Espinda, E. Kam	Lesson #: 3 Grade Level: 2 Primary Content Area: Science Time Frame: 1 hour for initial discussion and additional time for follow-up activities

PLANNING (Steps 1, 2, & 3)

1. Standards/Benchmarks and Process Skills Assessed in this Lesson:

SC.2.3.1 – Interdependence – Describe how animals depend on plants and animals

2A. Criteria- What Students Should Know and Be Able to Do:

Students will:

- Explain how some animals
  - depend on only plants for food (herbivores).
  - depend on both plants and animals for food (omnivores).
  - depend on only other animals for food (carnivores).
- Describe how a simple food chain works (sun, producer, consumer and decomposer).

2B. Assessment Tools/Evidence:

Formative:

- Group discussions
- Student worksheets
  - *What Do Animals Need?*
  - *The Food Chain Game*

Summative:

The student describes how different animals use plants and/or animals (e.g., for food, for building nests).

3. Learning Experiences (Lesson Plan)

Driving Question:

- How do animals depend on plants and other animals?

Handouts:

- Student worksheet: *What Do Animals Need?*
- Student worksheet: *The Food Chain Game*

Procedure:

1. Discuss the following questions to generate students' present understanding of plants and

animals. Use a KWL chart or a similar graphic organizer to document students' present understanding.

- Do plants usually grow in a container in the classroom like our plants?
- Where do plants usually live and grow?
- So, where do they live in nature? What lives around them?
- Who needs plants? Why?

2. Discuss: What did you learn in Lesson 2? Summarize the student's findings from Plant Life Cycles (lesson 2).
   - Example: We learned that plants need a certain amount of sunlight, water and soil/nutrients to grow. Some plants need more sun than others. Some plants need less water than others. Plants and other living organisms that live in different places need different things.

3. Discuss: What do animals need? Record students' answers on a class chart or have individual students fill in the attached worksheet, *What Do Animals Need?"*

4. Discuss the following questions:
   - Has anyone heard of a food chain?
   - What is a chain? Is anyone wearing a chain today? Have a student share their necklace with the class to show how the parts connect to make a whole.
   - So if this chain has connected parts, what might a food chain look like?
   - Use your students' plants to discuss which food chain it belongs to.
     - If it were grown outdoors in nature, who would eat it? Who gets energy from eating it?
   - Use *The Food Chain Game* to show your students different examples of food chains. (You could choose to have a class discussion, assign teamwork or individual work).

   The Food Chain Game – an interactive online game that allows you to drag the parts of the food chain to the correct place. When the chain is complete, it will come to life and you can watch the food chain in action!
http://www.sheppardsoftware.com/content/animals/kidscorner/games/foodchaingame.htm

The Food Chain Game includes the following food chains:

- It is shown in the correct order from producer > consumer > decomposer
- Only the two Full Chains contain a decomposer – mushrooms and bacteria
- Simple Chain: flower, caterpillar, bird
- Bigger Chain: acorns, mouse, snake, mouse
- Marine Chain: algae, small fish, big fish, shark
- Mixed Chain: flower, insect, small fish, big fish, seagull
- Full Chain: plant, grasshopper, lizard, eagle, mushrooms
- Full Marine Chain: plankton, fish, jellyfish, turtle, shark, bacteria
- Chain with Human: plankton, mussel, small fish, big fish, human

5. Students complete *The Food Chain Game* worksheet
   - Worksheet includes the 7 food chains from the website.
   - Note: only the two Full Chains include decomposers.
   - Students will then create their own food chain and include worms (decomposers).

6. Students will reflect on what they learned in their science journals.
   Journal entries might include:
   - Describe how animals need different plants and animals to live and survive in their environment.
   - Make a personal connection to the food chain. What is your role in the food chain?
   - Cause and Effect: What would happen if one organism in the food chain became extinct (no longer lives)?

   Optional Research Extension: Discuss Food Webs and Biomes/Habitats/Environments
   - Which animals/organisms live in a _____?
   - Choose a habitat (desert, forest, ocean...) that your students are at least familiar with.
   - List the living organisms that students identify for the chosen habitat.
   - Discuss what each organism needs to stay alive.
     - What does the _____ eat? What eats the plant? Etc.
     - How does the _____ capture its food? Do they help one another?
     - Where does it get its water?
     - Where does it live?

Other Resources:

A. Food Chain Stacking Cup Activities

An excellent way for students to show and explain how different organisms get their needed nutrients.

http://eisforexplore.blogspot.com/2012/10/food-chain-stacking-cups.html

B. Chain Reaction – an interactive site that allows you to drag the parts of the food chain to the correct place. When the chain is correctly completed, you can watch the food chain in action!

http://www.ecokids.ca/pub/eco_info/topics/frogs/chain_reaction/play_chainreaction.cfm

It includes the following concepts:

- Omnivores, Carnivores, Herbivores.
- Plants need sun, water and soil.
- Food Chain – the order that animals feed on other plants and animals.
    - Northern Food Chain: sun—algae > crayfish/shrimp > fish > monk seal > polar bear
    - Forest Food Chain: sun—plant > grasshopper > frog > snake > owl
    - Cause and Effect: What would happen if the frog were taken out of the food chain?
        - There would be more grasshoppers and less grass. The grasshoppers would have to leave to find food elsewhere.
        - Snakes and owls would need to eat something else or leave to find food elsewhere.

C. PBS – Eeko World: Plants and Animals

Main Message: We are all connected. There are threats to plants and animals that can set off a chain reaction that will affect all others. We don't want the food chains/webs to be broken.

http://pbskids.org/eekoworld/index.html?load=plants_animals

Two animated characters discuss the following concepts:

- All plants and animals make a difference in our lives.
    - Example: Birds spread seeds that grow trees that make more oxygen for humans.
- Food Chains – a series of plants and animals linked by their food relationship.
    - Sun, producers, consumers and decomposers.
        - Sun, grass, rabbit, fox
        - Sun, corn, chicken, human
- Food Webs – a series of linked food chains
- Threats to plants and animals: chain reactions (cause and effect).
    - Endangered species
    - Logging and clearing land, pollution and dumping trash into rivers can destroy habitats.
- What can we do to help? Learning is the first step. Take action!
    - Send emails to classes around the world to learn about endangered species.
        - Hawaii is the endangered species capital of the world.
        - In Africa, rhinos have been on earth for more that 50 million years but

are now in danger of disappearing. ▪ In Eastern Asia, Northern China and Manchuria there are less that 5,000 tigers in the wild. ▪ The Pacific Northwest is a temperate forest and elk are no longer endangered. ▪ In North and South Carolina the Venus Fly Trap is endangered.
TEACHING & ASSESSMENT (Steps 4, 5, 6, &7) **Completed by teacher after instruction has taken place**
4. Teaching and Collecting of Evidence of Student Learning: Teacher Notes:
5. Analysis of Student Products/Performances - Formative: Teacher Notes:
6. Evaluation of Student Products/Performances – Summative (Not necessary for every lesson): Teacher Notes:
7. Teacher Reflection: Replanning, Reteaching, Next Steps: Teacher Notes:

Name of Scientist: _____ Date: _____

What Do Animals Need?

1. Make a list of what you THINK animals need. Why do they need it?

What Animals Need	Why They Need It

2. Do you have a pet at home? If so, describe what your pet needs in order to remain healthy. If you don't have a pet, choose one of the following: dog, cat, rabbit or fish.

_____

_____

_____

_____

_____

_____

_____

_____

Name of Scientist: _____ Date: _____

What Do Animals Need?
ANSWER KEY

Source: ScienceSaurus – A Student Handbook (red cover – grades 2-3), page 99

http://www.greatsource.com/store

Big Ideas:

- There are many different kinds of animals. All animals need the same things.
- Different kinds of animals need different amounts of water, food, and air.
    - Desert animals don't need much water. Their bodies hold water.

1. Make a list of what you think animals need. Why do they need it?

What Animals Need	Why They Need It
Nutrients	Animals get energy and nutrients from the food they eat. They get food by eating plants and/or other animals.
Water	Animals need water to drink. Without water, the body will become dehydrated and important organs will start to fail.
Air	Animals need air to breathe. Air has oxygen in it. Animals need oxygen to live and grow.
Shelter	Animals need shelter to protect themselves from heat, cold, and danger. They need space to live and raise their young.

2. Do you have a pet at home? If so, describe what your pet needs in order to remain healthy. If you don't have a pet, choose one of the following: dog, cat, rabbit or fish.

Answers should include food, water, air and shelter

Name of Scientist: _____ Date: _____

The Food Chain Game

1. What is a food chain?

_____

_____

_____

2. Create a food chain with the following organisms.
   - Include the sun to show how it delivers energy to the producers (green plants).
   - Use arrows to show how the energy flows up the food chain. ⇨
   - Be sure to put the producers first and then the consumer(s).
   - You can draw and label each organism OR just write the names of each organism in the correct sequence

A. Simple Food Chain: bird, flower, caterpillar

B. Bigger Food Chain: snake, acorns, hawk, mouse

C. Marine Chain: small fish, big fish, shark, algae

D. Mixed Food Chain: flower, seagull, small fish, insect, big fish

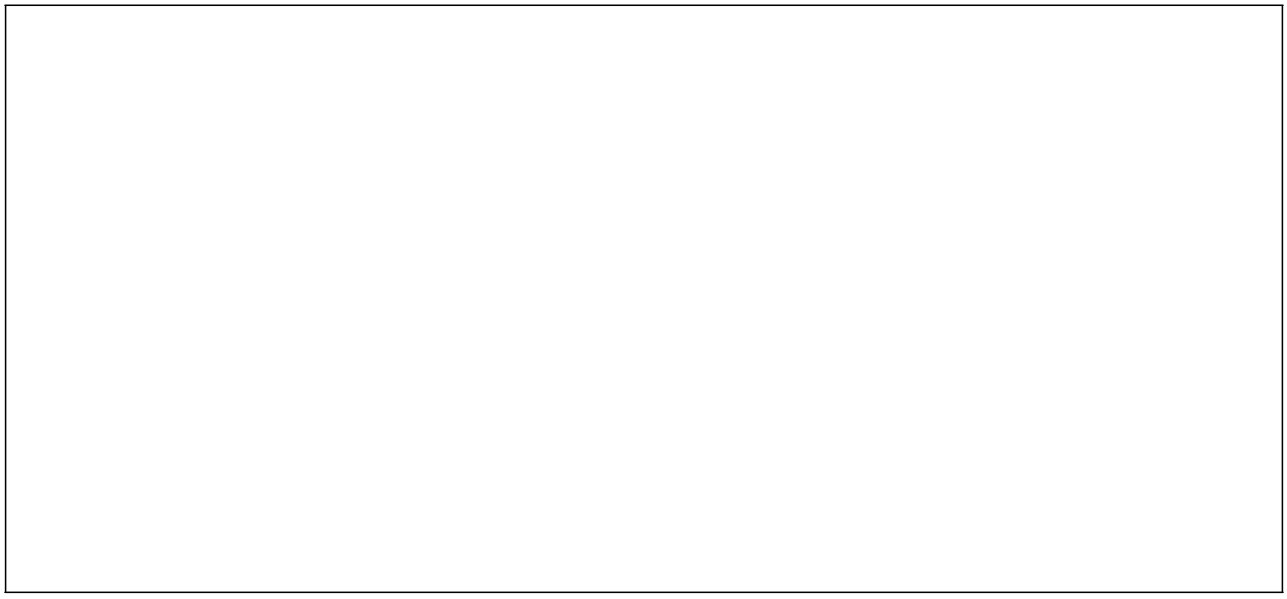
E. Full Food Chain: mushrooms, plant, grasshopper, eagle, lizard

This food chain also includes decomposers, an organism that gets energy from breaking down dead things. Decompose means to break down into smaller pieces.

F. Full Marine Chain: shark, turtle, plankton, fish, jellyfish, bacteria

This food chain also includes decomposers, an organism that gets energy from breaking down dead things.

G. Food Chain with Human: plankton, mussel, small fish, big fish, human



3. Create your own food chain. It must include the following:

   - One producer, _____
   - Two consumers, _____ and _____
   - One decomposer - earthworms

Label each organism. Use arrows to show the flow of energy.

4. Fill in the table below with your food chain organisms from #3.

Name of Organism	Role	How does it get its nutrients (energy)?
	Producer	
	Consumer	
	Consumer	
	Decomposer	

5. EXPLAIN how your food chain works. Describe how each animal in your food chain depends on plants and other animals.

Unit Title: Let's Reduce, Reuse and Recycle! Lesson Title: Natural Resources: Where Does Our Trash Go? Date Developed/Last Revised: 6.12.13 Unit Author(s): E. Akana, H. Espinda, E. Kam	Lesson #: 4 Grade Level: 2 Primary Content Area: Science Time Frame: 1 hour for initial discussion, more time for follow-up activities, 1 hour for follow-up discussion

PLANNING (Steps 1, 2, & 3)

1. Standards/Benchmarks and Process Skills Assessed in this Lesson:

SC.2.8.2 – Earth Materials – Identify the limited supply of natural resources and how they can be extended through conservation, reuse and recycling

2A. Criteria- What Students Should Know and Be Able to Do:

Students will:

- Be able to identify the various natural resources on planet earth.
- Recognize land as a limited, natural resource.
- Understand how reusing and/or recycling various objects can help to conserve natural resources.

2B. Assessment Tools/Evidence:

Formative:

- Class discussions
- Science journals
- Student worksheet: *Conservation, Reuse and Recycling Vocabulary Review Worksheet*

3. Learning Experiences (Lesson Plan)

Driving Questions:

- What are the natural resources on planet earth?
- What can we reuse and/or recycle to help conserve these natural resources?

Materials:

- 1-2 trashcan(s) full of actual classroom rubbish
- Smaller containers to sort the trash
- 1 pair of gloves for the teacher
- Science journals
- Premade school map (the map the office uses to direct people on campus)

Handouts:

- Student worksheet: *Conservation, Reuse and Recycling Vocabulary Review Worksheet*

Other Resources:

- Background information for teachers: Natural Resources
  - http://www.epa.gov/osw/education/quest/pdfs/sections/u1_chap1.pdf
  - http://www.deq.state.or.us/lq/pubs/docs/sw/curriculum/RRPart0201.pdf
- Composting: Nature's Disappearing Act
  http://www.teachengineering.org/view_activity.php?url=collection/cub_/activities/cub_environ/cub_environ_lesson05_activity2.xml
- Hands-on activity: Bury your Trash!
  Students bury various pieces of trash in plotted area of land outside. After two or three months, they uncover the trash to investigate what types of materials biodegrade in soil.
  http://www.teachengineering.org/view_activity.php?url=collection/duk_/activities/duk_landfill_music_act/duk_landfill_music_act.xml

Procedure:

1. Initial Class Discussion: have students discuss with answers to questions with partners and share with the class.
   - What are some of the natural resources that we have?
     - Oil, minerals, soil, water, plants, animals, air
   - Record student responses. If students don't name resources that are limited, be sure to add it to the list: water, oil, natural gas, land etc.
   - Which of these resources are limited? What makes them limited?
   - Introduce the concepts of preservation and conservation
     From hyperdictionary.com
     Preservation: [n] the activity of protecting something from loss or danger
     Conservation: [n] the preservation and careful management of the environment and of natural resources
   - Using previous student responses, identify if the resources are in fact limited, what makes them limited, and if they can be extended through preservation, conservation, or both. This class discussion is imperative for the science standard to be met.
   - Take some time to discuss land as a natural but limited resource.

2. Class Discussion:
   - What do you think is in our classroom trashcans?
   - Record student predictions.

3. Teacher, with the help of students, will sort the trash. Be sure to wear gloves.
   - How can we sort our trash into different groups?
   - Use students' suggestions as you sort the trash into different groups (no more than 4).
     - Examples: color, size, type of material

4. Determine students' present understanding of what happens to the trash once it leaves the room. Ask: Where does all this rubbish go? Try to elicit answers chronologically. For example:

- Room cleaner puts it into a larger trash bag.
- The large trash bag goes into the big container behind the cafeteria.
- The garbage truck picks up all the trash from the big container.
- The garbage truck takes it to a place where all the trash is burned/buried/etc.
- Where does our trash end up?

5. Class Discussion:
   - What happens once the garbage is in the earth? Does it disappear? Does it stay there forever? We are scientists, so what can we do to find out? Let's investigate!

6. Set up an experiment to find out what happens to the classroom trash if it's put into the earth. Be sure to include a variety of materials, including food items. To make the experiment fair, make sure that all items are left in the earth for the same amount of time and in the same location. (Not all items need to be buried in the same location; however, they cannot be moved once buried.) Optional: The same amount of each item is buried.

7. In their science journals, students will create scientific sketches (see lesson 2 for specific information and rubric for scientific sketches) of their trash item. Option: take photos.
   - Draw and label the items as accurately as possibly. It should look like what they see.
   - Be sure to use standard units of measurement (e.g., cm vs. inches) and label all measurements with units.
   - Describe what the item is made of.
   - Safety: use gloves when handling trash items.

8. Record where the trash items will be buried on the school campus map. Bury the item several feet down in the soil in the chosen spot on campus. Glue map into science journals.

   Burying Option #1: Use a nylon stocking
   - Place one item of trash into a nylon stocking.
   - Tie the nylon with string before adding the next item.
   - Draw and label the nylon to show where each student's trash item is located.

   Burying Option #2: Use an egg carton
   - Place each item into a section of an egg carton.
   - Label each section with the student's name.
   - Bury the egg carton several feet down in the soil in the chosen spot on campus.
     - If needed, you can cover the carton in a large container of soil that will remain in the classroom. Be sure it receives sunlight and water to somewhat reflect what would happen outdoors.

9. Students will reflect on what they learned about in their science journals.
   Journal entries can include:
   - Predictions of what will happen to several buried items.

- Personal connection to their role in reducing, reusing or recycling.

10. Retrieve buried items after a specified amount of time. Suggested time: wait at least 7 days before observing buried items. Be sure to rebury and observe over a longer period of time. Have students record their findings.

11. Follow-up Class Discussion: review of limited natural resources and ways to extend them.
    - What are some of the natural resources that we have discussed?
    - Record student response. If students don't name resources that are limited, be sure to add to the list: water, oil, natural gas, land, etc.).
    - Which of these resources is limited? What makes them limited?
    - Review the concept of preservation (protecting natural resources and working on ways to make more, if possible) and conservation (the act of using less, especially those resources that cannot be replenished ex. oil).
    - Using previous student responses, identify if the resources are in fact limited and what makes them limited. Identify if those resources can be extended through preservation, conservation or both. This class discussion is imperative for standard to be met.

12. Class discussion: Land as a natural but limited resource. What did you learn from the Burying the Trash activity? Make a connection to benchmark SC.2.8.2 – Earth Materials – Identify the limited supply of natural resources and how they can be extended through conservation, reuse and recycling.

13. Have students complete the *Conservation, Reuse and Recycling Vocabulary Review Worksheet*. They can work independently or with partners. Have students share out their definitions, examples and non-examples, and discuss with the class.
    Optional: in the box where the vocabulary word is identified, have students draw a picture to represent the word.

TEACHING & ASSESSMENT (Steps 4, 5, 6, &7)
Completed by teacher after instruction has taken place

4. Teaching and Collecting of Evidence of Student Learning:
Teacher Notes:

5. Analysis of Student Products/Performances - Formative:
Teacher Notes:

6. Evaluation of Student Products/Performances – Summative (Not necessary for every lesson):
Teacher Notes:

7. Teacher Reflection: Replanning, Reteaching, Next Steps:
Teacher Notes:

Conservation, Reuse and Recycling Vocabulary Review Worksheet

Word: Conservation	Definition
Example	Non-Example

Word: Reuse	Definition
Example	Non-Example

Word: Recycling	Definition
Example	Non-Example

Unit Title: Let's Reduce, Reuse and Recycle! Lesson Title: Engineering a New Product Date Developed/Last Revised: 6.12.13 Unit Author(s): E. Akana, H. Espinda, E. Kam	Lesson #: 5 Grade Level: 2 Primary Content Area: Science Time Frame: • 2 hours for steps 1-4 • 2 hours for steps 5 & 6 • 30 minutes for step 7

PLANNING (Steps 1, 2, & 3)

1. Standards/Benchmarks and Process Skills Assessed in this Lesson:

SC.2.6.1 – Nature of Matter: Identify ways to change the physical properties of objects
SC.2.8.2 – Earth Materials: Identify the limited supply of natural resources and how they can be extended through conservation, reuse and recycling
CCSS.Math.Content.2.MD.D.10 – Draw a picture graph and a bar graph (with a single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems using information presented in a bar graph (See Common Core State Standards for Mathematics Glossary, Table 1)
CTE: Standard 1: Technological Design: Design, modify, and apply technology to effectively and efficiently solve problems

2A. Criteria- What Students Should Know and Be Able to Do:

Students will:

- Construct a bar graph using the physical properties of recyclable items.
- Use the bar graph to solve problems.
- Use the Engineering Design Process to design a functional item that solves a problem using recyclable materials.

2B. Assessment Tools/Evidence:

Formative:

- Bar graph
- Class discussions
- Science journals

3. Learning Experiences (Lesson Plan)

Driving Questions:

- What information does a picture graph or bar graph give us?
- How can we reuse, recycle or repurpose things that are thrown away?

Materials:

- Clean recyclable items that students bring from home (e.g., cardboard, plastic bottles, aluminum cans, etc.)

Handouts/Other Resources:

- Student worksheet: *Representing Data using a Bar Graph*
- Student worksheet: *Let's Reuse, Reduce and Recycle! – Engineering Design Process Journal*
- Video: excellent overview of each step of the Engineering Design Process
  - http://www.nasa.gov/audience/foreducators/best/edp.html
- Digital library with teacher-tested, standards-based engineering content for K-12 teachers to use in science and math classrooms
  - http://www.teachengineering.org/engrdesignprocess.php

Procedure:

Prior to this lesson, have students bring in clean recyclable items that they would normally throw away such as containers, wrappers, cardboard, Kleenex boxes, paper towel rolls, etc.

1. Class discussion: Students will name the recyclable items and focus on their physical properties: what they are made of, size, shape, texture, color etc.

2. Class discussion: Different object have different physical properties.
   - How can we change each item? Can we change the color? How? Shape? Size?
   - What physical attributes might we classify these objects by?

   Possible Activity: Have students' sort recyclables according to different physical properties: size, shape, color, texture, smell etc. They can then identify ways to change those physical properties – combine, cut, color, rip, tear, paint and glue.
   Emphasis: It's still the same item, but the _____ has changed. It's now smaller, smoother, a different color, etc.

3. Inform students that graphs often help us organize data. The answers to our earlier questions give us some data about recyclable materials and their physical properties. As a class, decide what types of data you would like your picture graph to represent. Create a class picture graph with students. Be sure to include the following: title, categories, category label, key and data. Teacher will ask students simple put-together, take apart and compare questions.

4. Students will decide on another way to represent the data that was discussed. Students will create a bar graph to represent their data. Using their data, they will construct three questions: one put-together, one take apart and one compare, and answer them correctly. (See Common Core State Standard in section 1 for more information.)
   Student worksheet: *Representing Data using a Bar Graph*

5. Class discussion: Think about the type of trash that we throw away every day in class, at home, and when we're in public. Which items can be reused? Which items can be recycled? Which items can be repurposed? How can we reuse or repurpose these items to create something useful?

6. Engineering Challenge: Inventing with recyclable items using the Engineering Design Process
   - Student worksheet: *Let's Reduce, Reuse and Recycle! – Engineering Design Process Journal*
   - Ask, Imagine and Plan: What can I create with these recyclable materials? Have students ask then imagine and plan several ideas using the student worksheet.
   - Create, Experiment and Improve: Once students have completed a few sketches, have them choose one to create. They can test their item and improve upon their design.

7. Students will reflect about what they have learned in their science journals.
   Journal entries can include:
   - Explain how picture graphs and bar graphs help to represent information.
   - Explain ways to change the physical properties of matter.
   - Reflections on their experience using the Engineering Design Process to create a product.
   - Describe the possible impact of their design on the world, and who would benefit from it. Reflect on what items in their homes they could reuse or recycle. Determine if these items are limited. Give suggestion on how to get family members involved.

TEACHING & ASSESSMENT (Steps 4, 5, 6, &7)
Completed by teacher after instruction has taken place

4. Teaching and Collecting of Evidence of Student Learning:
Teacher Notes:

5. Analysis of Student Products/Performances - Formative:
Teacher Notes:

6. Evaluation of Student Products/Performances – Summative (Not necessary for every lesson):
Teacher Notes:

7. Teacher Reflection: Replanning, Reteaching, Next Steps:
Teacher Notes:

Name of Mathematician: _____ Date: _____

 **Representing Data using a Bar Graph** 

Directions:
1. Use the data that your class collected to draw a bar graph. You can choose what data to represent. (Do not use the same data your class used for the picture graph.)
2. Include a title, categories, appropriate labels and data.
3. Write three questions that can be answered by your data.

Draw your bar graph below:

Write questions that can be answered using your data.

1. Write a question that uses the word "total." Answer your question.

_____

_____

2. Write a question that uses the words "how many fewer." Answer your question.

_____

_____

3. Write a question that uses the words "how many more." Answer your question.

_____

_____

Name of Engineer: _____ Date: _____

 **Let's Reduce, Reuse and Recycle! - Engineering Design Process Journal** 

Performance Task: The earth has a limited amount of resources and it's up to you to help conserve natural resources by reusing and recycling what you can. Our school has collected a variety of recyclable objects and needs your help to engineer a new useful product. Your team's invention will be reviewed by at least three potential users and their feedback will help you to further refine your product. Once it is optimized and ready to be used, it will then be auctioned off to the highest bidder at the annual Save the Earth Fundraiser. All money that is made will be donated to The Nature Conservancy, a charitable organization that works to protect Hawaii's watershed forests, coral reefs, and prevent more invasive species from invading our islands. Let's do our part and help protect the plants and animals that share our world!

What is the problem?

_____

What is your task?

_____

Criteria:

- It must be constructed of recyclable items.
- It must have a function and serve a purpose.
- It must be durable and be able to be used more than once.

STEP 1: ASK: Ask questions that pertain to completing the performance task.

STEP 2: IMAGINE: Use your background knowledge to design a useful object made out of recyclable materials. These are the things you should consider as you create your product:

1. Is it made of materials that can be recycled? Examples: paper, cardboard, plastic, aluminum
2. Does it serve a purpose? What is its function?
3. Can it be used more than once? Can it last and be used over a period of time?

Draw your product and label the parts. Be ready to share and discuss your design and explain the rationale for your design choices. Your group will be choosing one to develop.

Materials Needed:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

STEP 3: PLAN: Draw out a diagram of your group's prototype. Remember to label your parts, state the type of material you will be using for that part, and possible measurements.

Side View:

STEP 4: CREATE: Build your prototype by following your group's design. Keep to the plan.

STEP 5: EXPERIMENT: Test the market. Is your product needed? Does it work? Share your product with at least three potential consumers.

DATA

Table 1: Consumer Feedback for Prototype #1

Name of Consumer	Would you use this product?	What do you like about it?	How can it be improved?
1.			
2.			
3.			

STEP 6: IMPROVE:

ASK: Looking at your data, answer the following questions:

- What did they most like about our product? Why?
- What did they not like about our product? Why?

IMAGINE: How will you change your prototype to make it a better product?

_____

_____

_____

_____

PLAN: Draw out a diagram of your group's 2nd prototype. Remember to label your parts, state the type of material you will be using for that part, and possible measurements.

Side View:

CREATE: Build prototype #2 by following your group's design. Keep to the plan. Use the materials listed as well as the measurements that your group decided on.

EXPERIMENT: (This is a test of your product to find out if it works.)

DATA

Table 2: Consumer Feedback for Prototype #2

Name of Consumer	Would you use this product?	What do you like about it?	How can it be improved?
1.			
2.			
3.			

Write three facts comparing Data Tables 1 and 2.

Fact 1	
Fact 2	
Fact 3	

Data Analysis: Compare the data from prototype 1 and prototype 2.

1. Was your team of engineers able to improve the product?
2. Is it ready to be auctioned off at the Save the Earth Fundraiser?

Conclusions: What changes did you make to your prototype? What effect did those changes have on your final design? (cause/effect)

_____

_____

_____

_____

_____

Do you think your product will help to raise money at the Save the Earth fundraising event? Explain.

_____

_____

_____

_____

_____

IMPROVE: If you had more time and materials, what would you do to optimize your product even more? Explain your thinking.

_____

_____

_____

_____

Unit Title: Let's Reduce, Reuse and Recycle! Lesson Title: Composting with Worms Date Developed/Last Revised: 6.12.13 Unit Author(s): E. Akana, H. Espinda, E. Kam	Lesson #: 6 Grade Level: 2 Primary Content Area: Science, Engineering Time Frame: 1-2 days

PLANNING (Steps 1, 2, & 3)

1. Standards/Benchmarks and Process Skills Assessed in this Lesson:

SC.2.1.2 – Conduct a simple investigation using a systematic process safely to test a prediction
SC.2.8.2 – Earth Materials – Identify the limited supply of natural resources and how they can be extended through conservation, reuse, and recycling
CCSS.Math.Content.2.MD.A.1 – Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.

2A. Criteria- What Students Should Know and Be Able to Do:

Students will:

- Observe and understand the relationship between resources and the output of an ecosystem.
- Ask and research questions about the most effective designs of worm bins.
- Determine the components that a worm bin should include.
- Illustrate their thinking in detailed blueprints with all parts appropriately described and labeled.
- Create an ecosystem for their worms to live and thrive in.
- Compare worm bin designs, determine which design is most effective, and modify their bins to produce better results.
- Measure the design effectiveness based on the overall health of the worms. (e.g., size, amount, activity level, etc.) Students will create a chart with 3 columns:

What is the situation/problem?	Why is it happening?	What to do?
All the worms are dying	Too hot? Too dry?	Add less food Water the bin

2B. Assessment Tools/Evidence:

Formative:

- Group discussion (inquiry questions based on what they observed and learned)
- Observations and data collection
- Class charts: Identifying the 3Rs – Cause and Effect

3. Learning Experiences (Lesson Plan)

Driving Questions:

- What is the role of the worms in the decomposition process of the food chain?
- How does this related to reducing, reusing and recycling?

Materials:

- Worm bins (containers, usually prefabricated from a distributor)
  - A simple version would be a plastic flowerpot with holes on the bottom and a dish for collecting liquid on the bottom.
- Worms (suggestion to use 1 pound per square foot)
- Filling for the worm bin: coffee grounds, vegetables, fruits, eggshells, bedding (e.g., shredded newspaper)
- Catching tray for worm juice
- Chart paper and markers
- Website for video:

http://www.ehow.com/video_8063934_begin-red-worm- composting.html

Handouts/Other Resources:

- Student worksheet: *Worms are Recyclers!*
- Student worksheet: *Scientific Inquiry – Most Effective Food for a Worm Bin*
- Student worksheet: *Mathematical Calculations – How much do I need?*
- Student worksheet: *Measurement Log*
- Book: *Worms Eat My Garbage: How to Set Up and Maintain a Worm Composting System* Mary Appelhof (author); Mary Fenton (illustrator)
- Websites:
  Come Live With Me – How to Make and Take Care of Your Own Neighborhood of Worms
  http://urbanext.illinois.edu/worms/neighborhood/index.html
  Worm Wonders – Includes a worm bin recipe, worm bin FAQs and more information
  http://www.a2gov.org/government/publicservices/fieldoperations/solidwasteunit/Documents/fiel doperations_solidwaste_wormbinFAQ.pdf
  Michigan State University – College of Education and Ameritech: Worm Bin Project Unit for Middle Elementary
  http://commtechlab.msu.edu/sites/letsnet/noframes/Subjects/science/b2u1.html - plans

Procedure:

1. Class discussion: determine students' present understanding of worms as decomposers.
   - How can worms help us to reduce, reuse and recycle?
   - What do they need to live?

2. Student worksheet: *Worms are Recyclers!*
   - Includes information about the worms' role as a decomposer in the food chain/web
   - Scientific sketch of a worm: realistic drawing with labels and measurements

3. Set up the experiment with your students. Student worksheet: *Scientific Inquiry – Most Effective Food for a Worm Bin*
    - What type of food will help the worms to produce the best vermicast for our plants?

Option: Stacked Bin System
In a 'stacked bin' system, there are three or four staked bins. Ideally, they need to fit together tight enough that larger flies can't get in and with the top bin resting on top of the castings in the tray beneath it. This is important because the worms live in the castings of the second tray from the top, migrating up to the food scraps to eat. You could try large plant-pots or some kind of stacking storage system.

1. Mix compost and scraps in the top tray and add worms.
2. Cover with something that will keep the light out and the moisture in (for example, wet newspaper).
3. Add kitchen scraps to the tray. When the tray is more than about 2/3 full with partly digested scraps, you can remove the bottom tray. Empty any casting from it and move it up to the top.
4. Make sure the casting that the worms are living in (2^{nd} tray down stays moist; you can just pour some water into the top).

TEACHING & ASSESSMENT (Steps 4, 5, 6, &7)
Completed by teacher after instruction has taken place

4. Teaching and Collecting of Evidence of Student Learning:
Teacher Notes:

5. Analysis of Student Products/Performances - Formative:
Teacher Notes:

6. Evaluation of Student Products/Performances – Summative (Not necessary for every lesson):
Teacher Notes:

7. Teacher Reflection: Replanning, Reteaching, Next Steps:
Teacher Notes:

Name of Scientist: _____ Date: _____

 **Worms are Recyclers!** 

Worms are very important in ecosystems because they recycle dead things. Worms are decomposers that get their food from dead plants and animals. They break down the dead things into tiny pieces to get the energy they need to live. They add nutrients to the soil that plants need in order to grow. Animals then eat the plants to get their nutrients. We then eat the plants and/or animals to get the energy we need to be healthy. We're all connected!

1. Draw a scientific sketch of a worm. Make it look like what you see.
2. Include labels and measurements.
3. Caution: do not harm the worm. If needed, place a string next to or over the worm to determine its length.

Observations: What else do you see?	
Shape	
Color	
Texture	
Patterns	
Movement	

Name of Scientist: _____ Date: _____

Scientific Inquiry: Most Effective Food for a Worm Bin

QUESTION: What type of food will help the worms to produce the most fertilizer (casting)?

Choices: coffee grounds, vegetables, fruits, eggshells

HYPOTHESIS:

If _____,

Then _____

Because _____

_____

MATERIALS NEEDED:

- Worm bins (plastic containers)
- Worms – 1 pound per square foot
    - http://www.redwormcomposting.com/worm-composting/how-many-worms-is-enough/
- Filling for the bin: coffee grounds, vegetables, fruits, eggshells, bedding from shredded newspaper
- Catching tray for worm juice

PROCEDURE:

1. Place dampened newspaper in the bin.
2. Place worms into the bin.
3. Add food to one corner of the bin.
    - The food our team is using is _____.
4. Label your bin so it is clear which type of garbage is to be added.
5. Cover the bin.
6. Monitor the bins daily and add food as needed. Be sure to weigh the amount and type of food the worms are fed and record the data in a graph.
7. Record your data in the table.
8. Count the number of worms in each bin.
9. Graph the number of worms fed each type of food.

WEEKLY DATA TABLE

Date	Bin #1	Bin #2	Bin #3	Bin #4
	Coffee Grounds	**Vegetables**	**Fruits**	**Eggshells**
	# of worms: Amount of coffee ground added:	# of worms: Amount of vegetables added:	# of worms: Amount of fruit added:	# of worms: Amount of eggshells added:
	# of worms: Amount of coffee ground added:	# of worms: Amount of vegetables added:	# of worms: Amount of fruit added:	# of worms: Amount of eggshells added:
	# of worms: Amount of coffee ground added:	# of worms: Amount of vegetables added:	# of worms: Amount of fruit added:	# of worms: Amount of eggshells added:
	# of worms: Amount of coffee ground added:	# of worms: Amount of vegetables added:	# of worms: Amount of fruit added:	# of worms: Amount of eggshells added:

CONCLUSION:

- Based on your data, what is your answer to the question?
- Was your hypothesis supported by data?
- Use evidence from your data to support your conclusion.

_____

_____

_____

_____

_____

_____

_____

_____

Name of Engineer: _____ Date: _____

 **Let's Help the Worms Help Us - Engineering Design Process Journal** 

Performance Task: Help! The worms need a home so they can start the decomposition process. They're decomposers that get their food from dead plants and animals, and they are very important in ecosystems because they recycle dead things. We need them and they need us. They break down the dead things into tiny pieces to get the energy they need to live. They add nutrients to the soil that plants need in order to grow. Animals then eat the plants to get their nutrients. We then eat the plants and/or animals to get the energy we need to be healthy. We're all connected! In order to survive, the worms need the proper environment that will allow them to do their job. So, what are you waiting for? Let's help the worms!

What is the problem?

_____

What is your task?

_____

Criteria:

- It must be constructed of recyclable plastic.
- It must have a lid with holes to allow air to flow into the system.

STEP 1: ASK: Ask questions that pertain to completing the performance task.

STEP 2: IMAGINE: Use your background knowledge to design an appropriate environment for your worm to live and recycle dead things. These are the things you should consider as you create your product:

1. Is it large enough to hold the soil and other nutrients that will feed the worms?
2. Is it safe for the worms? Will they be protected from any outside threats such as birds or rainy weather?

Draw your product and label the parts. Be ready to share and discuss your design and explain the rationale for your design choices. Your group will be choosing one to develop.

Materials Needed:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

STEP 3: PLAN: Draw out a diagram of your group's prototype. Remember to label your parts, state the type of material you will be using for that part, and include possible measurements.

Side View:

STEP 4: CREATE: Build your prototype by following your group's design. Keep to the plan.

STEP 5: EXPERIMENT: Try out your worm's new home and record how effective it is in maintaining the worms.

STEP 6: IMPROVE:

ASK: Looking at your data, answer the following questions:

- What did they most like about our product? Why?
- What did they not like about our product? Why?

IMPROVE: If you had more time and materials, what would you do to optimize your product even more? Explain your thinking.

Mathematical Calculations: How much do I need?

Source: http://urbanext.illinois.edu/worms/neighborhood/index.html

Use this worksheet in conjunction with the Measurement Log.

1) How big is my bin?

Calculate the volume of the bin in cubic feet.

1. Measure the depth, width and length of my bin in inches.
2. Multiply the depth by width by length to get the cubic inches in my bin.
3. Convert it to find out how many cubic feet are in my box. A cubic foot is 1 foot deep by 1 foot wide by 1 foot long. There are 12 inches in a foot.
4. Divide the cubic inches in the bin by the cubic inches in a cubic foot to get the answer.

Example: The bin is 8 inches deep, 24 inches wide and 24 inches long.

8 x 24 x 24 = 4,608 cubic inches.

Conversion: There are 12 inches in a foot. So 12 x 12 x 12 = 1, 728 cubic inches

So how many cubic feet are in a bin that is 4,608 cubic inches? Divide the cubic inches in the bin by the cubic inches in a cubic foot to get the answer.

4,608 ÷ 1,728 = 2.67 cubic feet

2) How much bedding (newspaper) do I need?

You need 3 pounds of newspaper for every cubic foot of space, so multiply the number of cubic feet in the bin by 3.

Example: How much paper would you need for a bin that has 2.67 cubic feet of space?

2.67 x 3 = 8.01 pounds

Another option: know the size of your container in gallons (usually on the label). Multiply by 0.4 pounds of paper. This is how many pounds of paper you need to fill your container.

3) How much water do I need to add to the newspaper bedding?

The easiest and most available bedding is newspaper. Remove glossy ads because it may contain material that can harm the worms.

1. Tear the newspaper into one inch wide strips
2. Put it in a plastic garbage bag.
3. Slowly add water to the bedding. Mix it until it is moist like a wrung out sponge (moisture) to allow the worms to breathe.

For every one pound of newspaper, you'll need three pounds of water.

1 pound water = 1 pint water

So for every one pound of newspaper, you need three pints of water.

Go to http://urbanext.illinois.edu/worms/index.cfm to learn more setting up and maintaining your system.

Recommended amount of worms to start with is 1,000. 1,000 worms = about 1 pound
http://www.bae.ncsu.edu/topic/vermicomposting/facts.html

Measurement Log

Students will:

- Work in pairs, small groups, or individually to measure the dimensions of the object
- Select the appropriate measurement tool
- Measure the dimensions (Teacher will clarify the difference among length, width, and height since 'width and height' are not required at this grade level) – Only for the intent of exposing students to other dimensions and learning within the context of this activity
- Input the measurements into the table(s) below, teacher will assist with the calculations as part of completing the activity

Our Worm Bin	Measurement tool:	
Length:	Width:	Height:
Student(s) work:		

(If students want to compare their bin with others, optional additional tables are given here)

Bin #:	Measurement tool:	
Length:	Width:	Height:
Student(s) work:		

Bin #:	Measurement tool:	
Length:	Width:	Height:
Student(s) work:		