

Buried Treasure Lesson 3: The Energy of Decay

Lesson Overview:

In this lesson, students explore how decaying organic matter can be harvested as a source of energy. After brainstorming ways that old metal, plastic, and paper can be a resource, students are challenged to find use for an old piece of fruit. Next, students view a video to discover how organic material is harvested as an energy source. Finally, by completing a well designed investigation, students observe conditions that promote the most rapid decay of a piece of fruit.

Objectives:

Students will describe physical properties of objects.

Students will explain how waste can be turned into energy.

Essential Questions:

How can waste be turned into energy?

Materials:

- Fruit that decays rather quickly (e.g. banana) (3 for each group of students)
 - Note: Use fruit that has been bruised, damaged, or partially eaten as this will decay at a faster rate than fruit that has not been touched.
- Sealed plastic bags/bins to reduce odor and pests (2 for each group of students)
- Container with lid filled with dirt (1 per group of students)
- Refrigerator
- Goggles (1 per student)
- Gloves or tongs (1 per student)
 - determine if children have latex allergies before providing gloves
- Magnifying glasses (1 per student)
- Crayons or colored pencils
- Journals
- Video Landfill Gas to Energy from <http://www.thinkgreen.com/landfill-gas-to-energy>
- Student Page: The Energy of Decay Writing Task

Time Frame: 1 initial session with additional observation days

Instructional Activities (may include formative assessment within the lesson):

1. Ask students to think about how the following items can be useful: an old metal soup can, old plastic milk jug, and an old newspaper. Brainstorm and discuss.
2. Provide students with an additional challenge. Ask them to identify some possible uses for an old piece of fruit. Brainstorm and discuss.

3. Show students a video from the ThinkGreen.com website on how decaying material can be harvested as an energy source.
4. Review the basics of the process by helping students understand the following diagram:



Discuss how this process is an example of a fourth R: Reduce, Reuse, Recycle, and Recover. Recovering involves converting waste into useful products. Explain how large amounts of waste in a controlled environment like a landfill can generate enough methane gas that can be captured and used as an energy source.

*Special Note to Teachers: You may also want to mention composting as an additional example of recovering resources. A special kind of red worm can aid in turning organic matter into rich soil. While this process, called vermiposting, is too slow for large-scale efforts, composting is an eco-friendly way to make use of vegetable waste and get some great garden soil at the same time.

5. Allow students to investigate the conditions that produce the most rapid decay of a banana. Discuss the variables that will change in the investigation (e.g. one banana will be placed in a plastic bag/bin at room temperature, another buried in dirt inside a container with a lid, and another placed in a plastic bag/bin in the refrigerator labeled clearly as an experiment.). Be sure that the bag has plenty of air/oxygen in it before it is sealed. Students can press the bag lightly to feel the air. Discuss how decomposition requires oxygen in the process. Discuss the variables that will stay the same in the investigation (e.g. the type of fruit, the frequency of observation). Ask students to predict which banana will decay the fastest and explain the reason why they think so. You will likely get a difference of opinion, so record all the hypotheses and the reasoning behind them.
6. Allow students to observe the banana using a magnifying glass every 2-3 days for 2 weeks and record their observations in a journal using both pictures and words. Encourage students to use all of their senses EXCEPT taste as they record their observations. To avoid contact with bacteria, students should NOT handle the decaying fruit directly. Be sure students wear goggles and use gloves and tongs as a safety precaution while opening the containers and observing the fruit. Use non-latex gloves for all students if any students have a latex allergy. During storage, keep food in a sealed airtight container to reduce odor and pests.

7. As an extension, repeat the investigation with a different fruit such as a peach or pear.

Lesson Assessment:

- Students respond to the following writing prompt: Explain how a pear in a landfill can be like a buried treasure. Does the response show complete understanding of how organic matter is converted to energy, partial understanding, or no understanding?
- Assess the thoroughness of student observations recorded in their journals. Do students use both pictures and words?

Reflection:

Ask students to explain orally to a partner their response to the essential question: How can waste be turned into energy? Select partner groups to share responses with the whole class.

Standards Correlation:

This lesson may be used to address the National Science Education Standards listed below.

NSES 4BPS1.1: Observable properties

NSES 4BPS1.2: Materials and their properties

NSES 4FSPSP3.3: The supply of many resources is limited