PERFECTLY DECOMPOSED! (1 HOUR
TO BEGIN, SEVERAL 15 MINUTE OBSERVATION BLOCKS OVER THE NEXT WEEK, AND 30 MINUTES TO WRAP UP)

In this activity, students will place foods in different environments and observe the rate at which those foods decompose.

OVERVIEW

Topic: Decomposers, ecosystem processes

Real-World Science Topics:

- An exploration of the environmental factors that affect food decomposition
- An exploration of how living organisms decompose organic matter

Objective

Students will gain an understanding of how different variables affect the rate at which foods decompose.

Materials Needed for Teacher Demonstration

- apple (or other fruit that oxidizes, such as avocado)
- knife
- cutting board
- lemon
- two bowls

Materials Needed for Student Teams

- sliced fruit (such as apple, pear, strawberry, or banana slices)
- sealable plastic baggies
- paper plates
- spray bottle with water
- markers
- colored pencils
- magnifying glass

Teacher Preparation

Immediately before class begins, prepare sliced fruit for teams and place fruit in sealed plastic bags. Be sure each team receives three sealed bags of fruit (for example, three bags of apples). Different teams can receive different types of fruit, but each type of fruit should be distributed to at least two teams. (For example, at least two teams should have apples, two teams should have bananas, and so on.)

Standards Met

NATIONAL SCIENCE STANDARDS ADDRESSED

CONTENT STANDARD A:

As a result of activities in grades 5–8, all students should develop

- Abilities necessary to do scientific inquiry
- Understandings about scientific inquiry

CONTENT STANDARD C:

As a result of their activities in grades 5–8, all students should develop an understanding of

- Populations and ecosystems
- Diversity and adaptations of organisms

CONTENT STANDARD F:

As a result of activities in grades 5–8, all students should develop an understanding of

- Personal health
- Populations, resources, and environments

CONTENT STANDARD G:

As a result of activities in grades 5–8, all students should develop an understanding of

- Science as a human endeavor
- Nature of science

NATIONAL MATH STANDARDS ADDRESSED

- Understand patterns, relations, and functions.
- Analyze change in various contexts.
- Apply appropriate techniques, tools, and formulas to determine measurements.
- Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.
- Communicate their mathematical thinking coherently and clearly to peers, teachers, and others.
- Recognize and apply mathematics in contexts outside of mathematics.

NATIONAL TECHNOLOGY STANDARDS ADDRESSED

CREATIVITY AND INNOVATION

Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology. Students:

- Apply existing knowledge to generate new ideas, products, or processes
- Identify trends and forecast possibilities

COMMUNICATION AND COLLABORATION

Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others. Students:

- Contribute to project teams to produce original works or solve problems

Sources

National Science Education Standards

http://books.nap.edu/html/nses/overview.html

National Council of Teachers of Mathematics

http://standards.nctm.org/document

National Educational Technology Standards

http://www.iste.org/standards/nets-for-students/nets-student-standards-2007.aspx

STEPS FOR *PERFECTLY DECOMPOSED!*

1. **Warm-Up Activity:** Set up the cutting board, knife, apple, and lemon at the front of the classroom. Ask students what will happen to the apple once you cut it into slices. (Some students will suggest that the apple will turn brown.) Cut the apple into slices and distribute the slices between two bowls. Slice the lemon and squeeze at least half of the lemon into only one of the bowls. Toss the lemon with the apple slices. Ask students what they think will happen to the apple with lemon on it. Pass the bowls around the classroom and allow students to observe any differences between the fruit in each bowl.

2. As students pass the bowls around, explain that all foods eventually *decompose*, which means that they rot or break down. Decomposition can depend on how a food item interacts with its environment. Food can be broken down initially by chemical reactions. For example, when apples are exposed to oxygen, a chemical reaction takes place called *oxidization*. This causes the apple to turn brown. Students should start to notice that the apples in one bowl are turning brown, but the apples in the bowl with the lemon are not. Explain to students that some things slow down the decomposition of food, while other things make it happen more quickly. The lemon in the second bowl helps slow down the process of oxidization.

   Explain that when food continues to sit, tiny living things in the environment called *microorganisms* start to eat away at the food, and this causes it to break down further. These organisms that break down other living things are known as *decomposers*. Tell students that in this activity they will explore different variables that can affect the rate at which food decomposes.

3. Divide students into teams and distribute the materials and Student Handouts. Have students brainstorm different variables that might affect food decomposition. If students have trouble thinking of variables, provide them with the following list:

   Sample variables:

   - high temperature/low temperature environment
   - dry/moist environment
   - exposure to air/sealed bag
   - high light/low light exposure

   Once teams have decided on a variable they will test, have them record the variable on their Student Handouts.

4. Have students decide how they will manipulate the variable in their investigation. They should decide which areas of the classroom they will use to carry out their investigations and which materials they will need. Have students write out a list of materials and procedures on their Student Handouts. Also, have students list which things should remain constant for all fruit samples in their investigation.

If students need assistance, provide the following options:

Variable	Procedure	Materials	Things that should remain constant
Temperature	Observe fruit in high, medium, and low temperature environments. Examples: next to a heater, on a table at room temperature, and in the refrigerator	Refrigerator, heater, paper plates	Amount of light, exposure to air
Moisture	Observe fruit that is sprayed with water. Examples: controlled fruit (no water), fruit sprayed with water once per day, and fruit sprayed with water twice per day	Spray bottle with water, paper plates	Amount of light, temperature, exposure to air
Exposure to air	Observe fruit in sealed containers. Examples: controlled fruit (sitting out on a plate), fruit in a sealed plastic bag, and fruit in a sealed bag with holes punched in it	Sealed plastic bag, knife or scissors (to cut holes), paper plate	Temperature, amount of light
Light	Observe fruit in high, medium, and low light environments. Examples: fruit in front of a light bulb, fruit in front of a dimmed light bulb, and fruit in a dark area (such as a closet)	Light bulb, dark construction paper, scissors, tape, closet space, paper plates	Temperature, exposure to air

5. Once procedures are approved, allow students to set up their investigations. Distribute the colored pencils. Students should observe and sketch the appearance of all fruit samples initially. Tell students they will observe their samples each day for a week. Remind students that they should be sure to devote the necessary attention to their samples each day. For example, the group studying the effects of moisture on the fruit might need to spray the fruit with water at the beginning and end of each school day.

6. **Wrap-up Activity:** Have students analyze the results of their investigation. Did some fruit samples decompose more than others? Bring the class together and have teams present their fruit samples and conclusions with the class. As a class, decide which samples decomposed the least? Which decomposed the most? Which variables slowed the decomposition? Which variables accelerated it? Do students notice any decomposers on the fruit (such as fruit flies or mold)? Explain to students that decomposers play an important role in the ecosystem. They help break down living things, such as rotting fruit, dead trees, and dead animals. Ask students what they think would happen if decomposers did not break down all of this material. Tell students that, aside from clearing out space, decomposers digest and recycle material so that it can be used for other things. For example, when foods are broken down, they provide nutrients for soil.

Perfectly Decomposed! Extension Activities

1. Have students create a compost pile in an area outside of the school. Students can collect old items from their lunches or the cafeteria to contribute to the pile. Have students observe how the compost pile changes over time. Students can perform research on composting and present this research to the class.
2. Share with students the "myth" of the hamburger from a fast-food restaurant that sat on a woman's bookshelf for one year and did not decompose. Ask students whether they think this story is true. Then, ask students how they could test this myth. Repeat the investigation from this activity using foods from the cafeteria or a local fast-food restaurant. It may be best to extend the observation period. Discuss with students why these foods might decompose more slowly than fruits.

What is decomposition?

Decomposition is the process by which an organism breaks down or decays. This can be caused by various factors in the environment, such as chemical reactions, natural forces, or decomposers. For example, an apple could be knocked to the ground and bruised by strong winds, then oxidized by oxygen in the air, and then eaten and broken down by worms and other organisms in the environment. All living things eventually decompose, but the rate at which this takes place can be delayed or accelerated, depending on factors in the environment.

What are decomposers?

Decomposers are organisms that break down dead or decaying organisms. Some decomposers include vultures, worms, flies, and fungi. Decomposers play a vital role in the ecosystem. The breaking down of dead material is important because it would build up around us quite rapidly if it were not consumed. For example, if dust mites did not consume dead skin cells, the human population would quickly suffocate in piles of our own flaked-off skin! The waste from decomposers is also helpful. Microorganisms such as bacteria and fungi break down plant material and release important nutrients into Earth's soil. This is a fundamental principle of composting.

What factors affect the rate of decomposition?

Many environmental factors speed up or slow down the rate of decomposition. As a general rule, if more decomposers have access to a decaying organism, the organism will decompose more rapidly. Organisms stored in airtight containers are sealed off from outside decomposers, and this will greatly reduce the rate at which they break down. Also, decomposers such as bacteria and mold thrive in warm, dark, and moist environments. Because of this, they will break down organisms more rapidly in warm, dark, and moist places. The life of food items can be extended by storing them in cool, dry areas such as refrigerators.

Key Vocabulary

decomposer: an organism that breaks down the remains of a decaying or dead organism; examples include worms and fungi

microorganism: an extremely small living organism

organism: a living thing

PERFECTLY DECOMPOSED! TEACHER HANDOUT

1. In this experiment, you will place your fruit in different environments to observe how the fruit decomposes. In what types of environments will you place your fruit? (In other words, what variable will you test?)

   [Sample answer: I will observe how fruit decomposes in high, medium, and low temperature environments.]

2. What materials will you need to conduct your investigation?

   [Sample answer: I will use three paper plates, access to a heat vent, and access to a refrigerator.]

3. Write out a list of steps that you will follow to test your variable.

   [Sample answer: I will place all fruit samples on paper plates. Then I will place one sample in front of a heat vent in the classroom, one sample on a desk at room temperature, and one sample in the classroom refrigerator. I will observe the samples each day and draw sketches of them.]

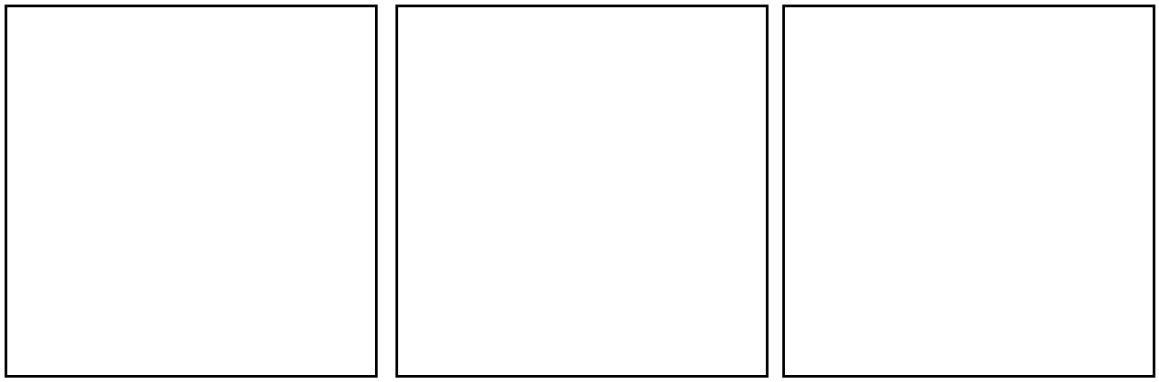
4. What things will you need to keep the same for all fruit samples?

   [Sample answer: I will keep the amount of light and air constant.]

5. Sketch the appearance of each fruit sample on the following days. Be sure to note which sample is in which type of environment.

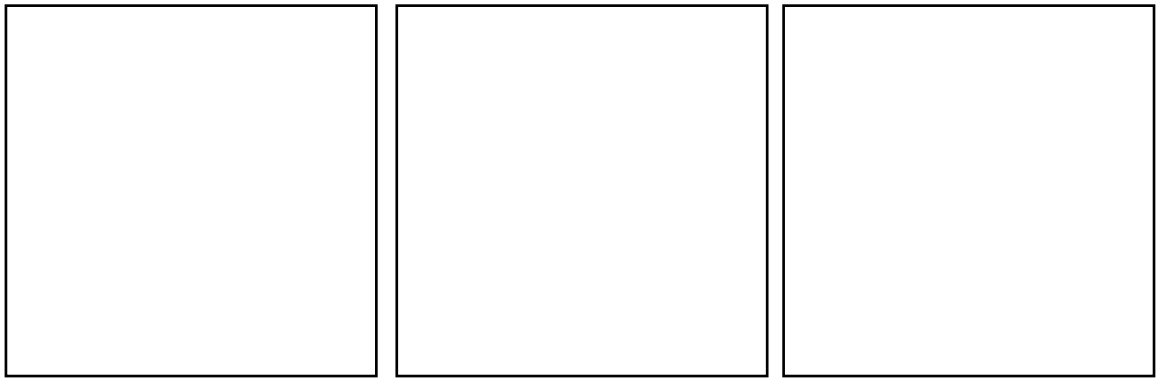
Day 1

[Sample 1: high temp] [Sample 2: room temp] [Sample 3: refrigerator temp]



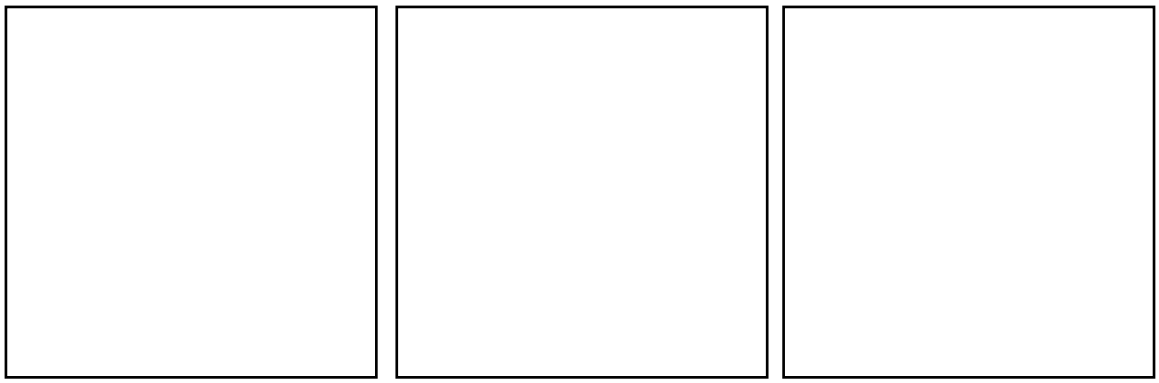
Day 2

[Sample 1: high temp] [Sample 2: room temp] [Sample 3: refrigerator temp]



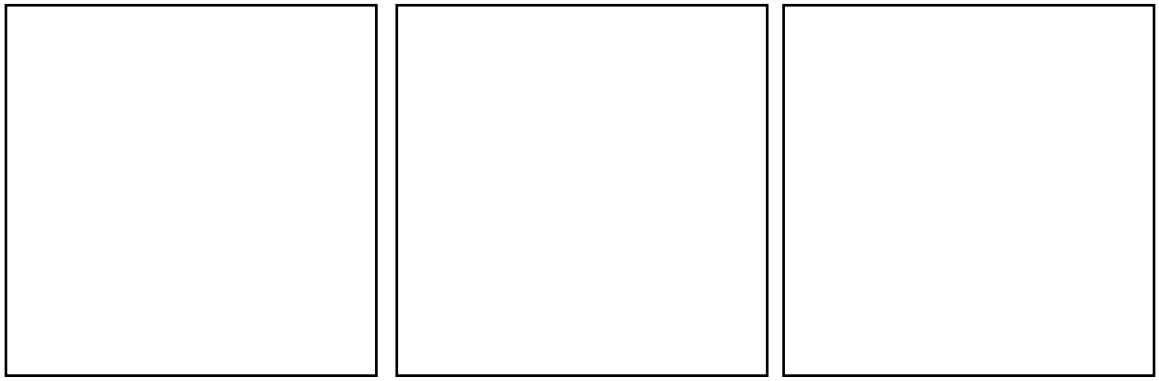
Day 3

[Sample 1: high temp] [Sample 2: room temp] [Sample 3: refrigerator temp]



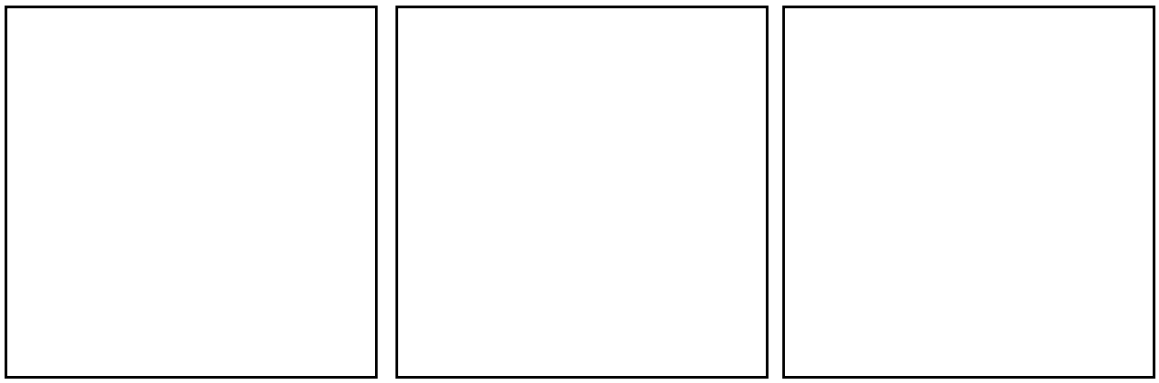
Day 4

[Sample 1: high temp] [Sample 2: room temp] [Sample 3: refrigerator temp]



Day 5

[Sample 1: high temp] [Sample 2: room temp] [Sample 3: refrigerator temp]



6. Which sample decomposed the most? Which decomposed the least? Why do you think this was the case?

[Sample answer: The fruit in front of the heater decomposed the most. The fruit in the refrigerator decomposed the least. I think this is because heat is a more suitable environment for decomposers to grow in.]

7. Which variables caused most fruits in the class to decompose the most?

[Sample answer: High temperature, high moisture, low light, exposure to air.]

8. If you wanted to keep an apple fresh for a long time, where would you keep it?

[Sample answer: I would keep it in the refrigerator, in the crisper area where there is less moisture.]

PERFECTLY DECOMPOSED! STUDENT HANDOUT

Name:

Date:

1. In this experiment, you will place your fruit in different environments to observe how the fruit decomposes. In what types of environments will you place your fruit? (In other words, what variable will you test?)

2. What materials will you need to conduct your investigation?

3. Write out a list of steps that you will follow to test your variable.

4. What things will you need to keep the same for all fruit samples?

5. Sketch the appearance of each fruit sample on the following days. Be sure to note which sample is in which type of environment.

Day 1

Sample 1: Sample 2: Sample 3:

Day 2

Sample 1: Sample 2: Sample 3:

Day 3

Sample 1: Sample 2: Sample 3:

Day 4

Sample 1: Sample 2: Sample 3:

Day 5

Sample 1: Sample 2: Sample 3:

6. Which sample decomposed the most? Which decomposed the least? Why do you think this was the case?

7. Which variables caused most fruits in the class to decompose the most?

8. If you wanted to keep an apple fresh for a long time, where would you keep it?