

Processing Effects

AIM

To construct knowledge about the environmental effects of our food-processing system.

SCIENTIFIC PROCESSES

- discuss, consider, think through, apply

OBJECTIVES

Students will be able to:

- discuss the process of making applesauce;
- list and explain the trade-offs of processing food;
- describe energy sources and byproducts of a snack-manufacturing system;
- deliver an informational presentation about a method for food processing with minimal effect on the environment.

OVERVIEW

In this lesson, students continue to gain knowledge about the environmental effects of our farm-to-table system. The lesson begins with a review of the Lesson 22 homework, including a discussion of the apples-to-applesauce flowchart. Next, the class takes a more detailed look at one byproduct of the pickle industry — the brine. The class reads about how a scientist is trying to solve a problem with pickle brine and considers the trade-offs that might be involved. Then, students take on the role of food processor. Working in small groups, students play the role of executives of a snack company, X-tremely Healthy Snacks. The company has an environmental mission. The executives' job is to run a profitable company, yet minimize its impact on the environment. The company wants to launch a new snack. They are in the prototype phase and need to design a system to manufacture the snack with a minimal effect on the environment. The CEO of the group presents this design to the board of directors.

MATERIALS

For the class:

- (Optional) *Pickles* teacher recipe (p. 274)

For each group:

- Chart paper
- Markers

For each student:

- *Environmental-Impact Analysis* student reading (p. 346)
- *Processing Flowchart Organizer* activity sheet (p. 351)

- *In a Pickle* student reading
- *Snack Assessment* student reading
- *Snack-System Design* activity sheet
- LiFE Log

PROCEDURE

Before You Begin:

- Remind students to bring in their homework from Lesson 22, including the *Environmental-Impact Analysis* student reading and the completed *Processing Flowchart Organizer* activity sheet.
- Review and make copies of the *In a Pickle* and *Snack Assessment* student readings and the *Snack-System Design* activity sheet.
- If you have not already done so, post the Module Question and the Unit 4 Question at the front of the classroom.

MODULE QUESTION

What is the system that gets food from farm to table, and how does this system affect the environment?

UNIT QUESTION

What are the environmental effects of our farm-to-table system?



QUESTIONING

1. Review the Module and Unit Questions

Review the Module and Unit questions with students. Explain that in this lesson the class investigates environmental effects of food processing.



THEORIZING

2. Discuss Processing Homework

Have students take out their LiFE Logs and their homework from Lesson 22. *What are some facts you learned about fruit processing? Does it have an effect on the environment? How is energy used in the process?* Compile a list on the board.

What did you learn about food waste? What happens to all of the apple peels, cores, and seeds? What trade-offs are there when the food waste is used to make vinegar? What about making paper from apple waste? What do you think the trade-offs are? (Energy to make the paper. It doesn't take many trees, but it still takes energy.) Invite student volunteers to share with the class whether they would make apple waste into paper or feed it to animals. Have them read what they wrote in their LiFE Logs and explain their decisions.

Tell students that now they are going to learn about one example of scientists working with food manufacturers to try to solve a food-processing problem.



SEARCHING

3. Read about Pickle Brine

Distribute the *In a Pickle* student reading. Engage students in a brief discussion of the class pickle-making experience. *What ingredients did we use to make pickles?* If students need to be reminded, have one student read the ingredient list of the *Pickles* teacher recipe. *Do you think that any of these ingredients could have an impact on the environment?*

Have students turn to the student reading. Invite volunteers to take turns reading paragraphs aloud. After students have finished reading, ask them if they can think of any trade-offs in using the enzyme. *Do you think that getting the clay from the riverbed would have an impact on the environment? How important is it to pack pickles in brine?* (Very important. People don't like soggy pickles.) *If you were a pickle manufacturer, what would you do? Would you want to use the clay? What if you lived near the river on the Georgia/Florida border? Would you want someone to take the clay away?* Have students explain their answers.



THEORIZING

4. Design a Snack

Distribute the *Snack Assessment* student reading and the *Snack System Design* activity sheet to students. Have students work in small groups. Tell each group to select a CEO. The other group members are part of the design team. The CEO is responsible for presenting the group's design to the class. The class plays the role of members of the board of directors of X-tremely Healthy Snacks.

As a class, review the questions on the activity sheet. Tell students to use these questions to guide their design and presentation. Have students outline their presentations on chart paper. Review and discuss each outline with the group members. Allow students time to revise their outlines.

5. Finalize Presentation

Encourage students to consider the best verbal and visual ways to present their information. They may wish to include drawings as well as text. Ask them to think about what will make their presentation interesting, lively, and engaging. Remind them that the board of directors wants evidence that their design is "green."

Brainstorm a list of presentation tips. Record them on the board. Tips might include: organize what you are going to say; organize your presentation materials; explain the problem you solved; explain your solution.

6. Present to Board

Outline the presentation procedure. Tell students that the CEO of each group will present to the board. At the end of each CEO's presentation, the board can ask questions. You will be moderator and monitor the time.

7. Homework

As homework, ask students to think about the presentations. Have them write in their LiFE Logs and describe the design system they believe would minimize the environmental effects of making the snack. Tell students to explain why they came to this conclusion.



Name _____

Date _____

In a Pickle

Commercial pickle packers had a problem — pickle brine can harm the environment. Seriously. Think about the ingredients in the brine. Salt, or salt water, can get pickle producers in a pickle.

You may be thinking about the amount of brine you made when you made pickles and wonder how such a small amount can cause harm. Remember, though, you made about 15 pickles. What if you made 20 billion pickles? That's how many pickles Americans consume each year, according to Pickle Packers International. Imagine how much brine you would need to make 20 billion pickles!



Commercial pickle packers process pickles on a large scale. They put cucumbers in a large tank with salt, water, and spices. The pickles stay there while they ferment, which can take up to three months. After the pickles are removed, they are rinsed and put into jars. What happens to all that leftover brine?

Pickle packers can't just dump it into the soil or pour it down the drain. It might contaminate the water. Think of all the plants and animals that would be affected. Removing all the chemicals and purifying the waste is very expensive. What else can pickle packers do? They could recycle the brine and use it to store pickles. However, sometimes there is a problem when they reuse it. Sometimes the brine becomes contaminated with an enzyme that makes the pickles get soggy instead of staying crisp. No one wants a soggy pickle. The pickle packers had to figure out what to do about that enzyme.

A food-science professor at the University of Arkansas, Ron Buescher, had an idea. He looked at different materials that were already being used by the food industry. He wondered if any of them would get rid of the enzyme. He tested different substances that absorb enzymes and found one that he thought would work. It was a special kind of clay that is found in a dry riverbed on the border between Georgia and Florida.

Here's the process. After the pickles are removed from the tanks, the clay is mixed in. It settles and attracts the enzymes. Then the clay is removed from the brine, which is now free of the enzymes. The enzymes can be removed from the clay, and it can be reused on the next batch of brine. And the consumer — you — can have crisp, crunchy pickles.



Name

Date

Snack Assessment

As executives of X-tremely Healthy Snacks, your goal is to run a company that is profitable, yet minimizes its impact on the environment. You understand that making products creates waste and uses energy. You want to keep the impact low. To do this, you are looking at each part of your farm-to-market system to make sure it has a low impact, too. For example, you will buy your ingredients from farmers who use sustainable practices. Your local transportation system uses hybrid vehicles to reduce the use of fossil fuels. The cargo ships are trying out a new way of using wind power along with their engines.

You also made a promise to your customers to use the latest “green” innovations in packaging. You will work with sustainable-design consultants who develop products that can be reused or that will last a long time. They also work with 100-percent renewable resources, recycled resources, or nontoxic materials. Whenever possible, the designers choose local materials that are manufactured with renewable energy.

Food scientists in your test kitchen have been developing new energy snacks. The food scientists have developed a great-tasting dried-fruit-and-nut mix, but before you take it to market, you need to think through what you will do with all of the food waste and the energy resources you will need to produce it.

You study the ingredient list: raisins, dried apples (chopped), dried apricots (chopped), sunflower kernels, roasted peanuts, and cashews. You can buy the raisins, apples, and apricots already dried and chopped. It costs less to buy the sunflower kernels still in their hulls, but that means you need to remove the kernels before you can use them. You buy the cashews out of the shell and ready to use. It costs much less to buy roasted peanuts in the shell, but you will have to remove the shells.

You need to design a system for removing the shells from the peanuts and the hulls from the sunflower kernels. Next, think about the energy resources you will need. Here are some of the factory requirements to consider: lights, ventilation, machines for mixing, and forklifts to move the containers. You also have to consider how to keep the machines clean, how to fill the packages with the snack mix, and what to do with the shells from the peanuts and the hulls from the sunflower kernels.

Your assignment is to prepare a presentation that your CEO will give to your board of directors. Your goal is to convince them that this new snack will have a low impact on the environment. They want to hear all the details.



Name

Date

Snack-System Design

Here are some guiding questions to think about as you develop a food-processing system for X-tremely Healthy Snacks. Remember to think about energy resources you will need and how you will handle any byproducts from the manufacturing process. Be sure to include transportation, food processing, and packaging in your presentation to the board.

Transportation

- You can purchase raisins, dried apples, dried apricots, sunflower kernels, and roasted peanuts from suppliers in the United States. Cashews come from Brazil. *How will you transport these ingredients to your factory, which is located on the Mississippi River?*
- *Will there be any impact on the environment? Describe the environmental effects.*
- *After you manufacture the snack, you want to ship it to grocery stores and vending machines across the United States. How will you do this?*

Food Processing

- You buy all of the ingredients ready to use, except the sunflower seeds and roasted peanuts. *What process will you use to remove the sunflower-seed hulls and peanut shells?*
- *What energy resources will you need? Will there be an impact on the environment?*
- *What will you do with the byproducts, the empty hulls and shells?*
- *How will you mix all the ingredients to make the snack? What energy resources will you need?*
- *How will you prevent the ingredients from spilling onto the floor? What will you do with any ingredients that do spill?*
- *How will you dispose of the food waste?*
- *What resources will you use to clean the factory after the workers make this snack? Will the machines need to be washed before a different kind of snack food is made?*

Packaging

- You plan to sell this snack in three different sizes. The smallest size (2 oz.) is for vending machines. You plan to sell two other sizes (8 oz. and 16 oz.) in grocery stores. *What kind of food packaging will you use?*
- *How will you fill the packages? What energy resources and raw materials will you need to use?*
- *Will there be a label for the snack? What resources are used to make the label?*
- *How did the labels get to your factory? What energy resources were used?*