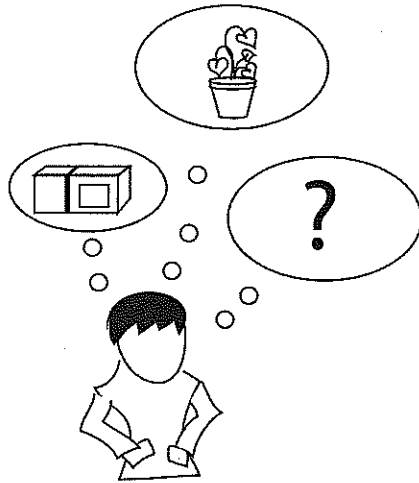


Lesson 3

Evaluating Needs and Creating Criteria



Part 1 Preparation: 5-10 minutes
Lesson: 45-50 minutes

Part 2 Preparation: 5-10 minutes
Lesson: 55-60 minutes

Vocabulary

- ◆ Consumer
- ◆ Criteria
- ◆ Engineering Design Process
- ◆ Evaluate
- ◆ Function
- ◆ Material
- ◆ Modify
- ◆ Overpackaging
- ◆ Packaging engineer
- ◆ Property
- ◆ Source reduction
- ◆ Structure

Guiding Question:

- ◆ *How will the needs of our plant and the needs of the consumer affect our plant package design?*

In this lesson, students will

- ◆ determine the needs (requirements for growth) of the plant for which they are designing a package.
- ◆ determine the needs of the consumer for whom they are designing the package.
- ◆ list the properties of the materials available for their plant package designs.
- ◆ discuss these materials in regard to their abilities to meet the needs of the product and/or the consumer.

Students learn that

- ◆ packaging engineers must take into consideration the product being packaged as well as the needs of the consumer.
- ◆ the functions of a package are directly related to the needs of the product and the consumer.
- ◆ the materials chosen to create a package must match the needs of the product and the consumer.

Objectives

Students will be able to

- ◆ identify and explain the needs of the product (a plant) and of the consumer.
- ◆ identify and explain the package functions required to meet the needs of the product and the consumer.
- ◆ identify properties of the materials to be used in the design and evaluate how well they will meet each need of the product and the consumer.
- ◆ brainstorm ways that the two base packages and other materials could be modified to meet the needs of the product and the consumer.

Tie-In Science Content

- ◆ Different materials have different properties.
- ◆ Requirements for growth of a plant include air, sunlight, water, and nutrients.
- ◆ Plants have different parts (which may include roots, stems, leaves, flowers, pods, and bark) with different functions.

Overview

Planning Ahead: If you grew plants during your science lessons, plan to use them for observations in this lesson and to be packaged during the design challenge in Lesson 4. If you did not grow plants, plan to purchase one small plant for every group three students in your class and one extra plant for demonstration purposes. The extra plant will act as an example of an unhealthy plant, so you should not tend to it for several days. See below for some suggested plants. Alternatively, you could grow plants from seed. See the list on p. 69 for seed suggestions. Also, ask students to bring in empty 2-liter plastic bottles and/or juice cartons. These base packages will be used in both Lesson 3 and Lesson 4.

In the Lesson 4 design challenge, students choose to redesign and “Improve” either a half-gallon juice carton or a plastic 2-liter bottle so that the containers become appropriate packages for containing and selling a plant. In order to successfully complete the design challenge, students must understand the needs of the specific product (a plant), the needs of the consumer, and the materials available to them.

In the first part of this lesson, students review the requirements for growth of a plant. Students will identify the structures of a plant, noting that each structure has a function that helps the plant survive and fulfill its requirements for growth and reproduction. As a class, students use their observations of the leaves, stem, and possibly several other parts of a plant to create a rubric for assessing plant health. This rubric will be used in Lesson 4 to assess how well students’ package designs meet the needs of the plant. Students then consider the needs of the consumer who might purchase their plant package. Finally, taking both the needs of the plant and the consumer into consideration, students decide which functions of a package should be included in their designs.

In Part 2 of this lesson, students examine the materials available for designing their plant package and discuss the properties of these materials. The materials include the two “base”

packages (a juice carton and a plastic bottle) students can choose to improve upon. Based on their observations and predictions about the effectiveness of each base package, groups choose which base package they will work with in Lesson 4. Students also list and discuss the properties of the other materials available to them for altering or adding to their base packages.

Background

Many factors influence plant growth and development, including nutrients, water, air, temperature, and access to sunlight. The requirements for growth vary from species to species. Certain species of plant are more suited for classroom growth than others. The following is a list of plants/seeds suggested for use in this unit.

- ◆ Wisconsin Fast Plants (*Brassica rapa*)
- ◆ Radish Seed, a root vegetable of the Brassicaceae family (*Raphanus sativus*)
- ◆ Mung Bean (*Vigna radiate*)
- ◆ Lima Bean (*Phaseolus lunatus*)
- ◆ Green Pea Seeds (*Pisum sativum*)

Package designs are tailored to meet the needs of the product and the target consumer. Some packages are designed for point of sale (as they are in this unit), while other packages are designed primarily for shipping. The functions that are included in the design of the package are determined by the end use of the package, the product, and the intended consumer.

Student Learning

Look for the following misconceptions:

- ◆ Any material can be used for any package design.
- ◆ Packages are only designed to attract consumers.
- ◆ Packages are only designed to contain products.

Look for the following insights:

- ◆ The properties of the product and the properties of packaging materials both need to be considered when designing a package.
- ◆ The design of a package also depends on the needs of the target consumer.
- ◆ Not all materials are appropriate for all packages.
- ◆ Materials can be modified to meet package criteria.





Teacher Tip

If you grew plants as a part of your science unit, plan to use them for observations in this lesson and for the design challenge in Lesson 4. If you did not grow plants for science class, you should purchase plants or consider growing plants from lettuce seed, radish seed, or beans.



Teacher Tip

Plan Ahead: Each group of students will need both a half-gallon juice carton and a 2-liter plastic bottle. Ask students to begin bringing in these materials for use in both Lesson 3 and Lesson 4.



Basic Lesson

Use *Functions of Our Plant Package* {3-3} instead of {3-2}.

Lesson 3

Part 1: Materials

For the Class

- ◆ vocabulary cards from *Functions of Packages* {2-1} through {2-4} (from Lesson 2)
- ◆ 1 plant, unhealthy
- ◆ chart paper
- ◆ {3-1} *Rubric: Evaluating Plant Health* as a transparency
- ◆ {3-2} *Functions of Our Plant Package* as a transparency

For Each Group of Three Students

- ◆ 1 plant, healthy (see Background on p. 69 for plant species suggestions)

Copy For Each Student

- ◆ {3-1} *Rubric: Evaluating Plant Health*
- ◆ {3-2} *Functions of Our Plant Package*

Part 1: Preparation

1. Plan to have students work in groups of three.
2. Create transparencies of *Rubric: Evaluating Plant Health* {3-1} and *Functions of Our Plant Package* {3-2}.
3. If students grew plants as a part of a science unit, use them for observations in this lesson and in Lesson 4. If students did not grow plants, purchase some (or consider growing them on your own if you have time; lettuce, radishes, or beans work well). Each group of students needs one plant. An additional plant will be needed for demonstration purposes.
4. The plants should be separated into individual pots or cups (as opposed to flats). Be sure that the container holding each plant fits inside of the juice carton and 2-liter plastic bottle. Containers that are approximately 2" x 2" x 2" (5.1 x 5.1 x 5.1 cm) are ideal, as they provide space around the container for students to use when creating their packages.
5. In order to accurately complete Level 1 of *Rubric: Evaluating Plant Health* {3-1}, students will need to observe an unhealthy plant. Pick the least healthy out of all the plants you have acquired for this lesson and do not water or tend to it for a few days so that there is a visible difference between this plant and the healthy plants to be used by students.
6. Post the *Functions of Packages* {2-1} through {2-4} vocabulary cards used during Lesson 2.



Teacher Tip

The size of the container that the plants are grown in should not exceed 2" x 2" x 2" (5.1 x 5.1 x 5.1 cm) or the size of a small cup (3 or 5 oz. (88.7 to 147.9 ml)). This will allow for the plant to fit inside either the half-gallon (1.9L) juice carton or the 2-liter plastic bottle. It will also leave room for students to add cushioning or structures within their package design to stabilize the plant.



Teacher Tip

As an extension activity, after completing *Rubric: Evaluating Plant Health* {3-1}, work together with students to meet the unhealthy plants' requirements for growth. Nursing the plant back to health becomes an informative exercise for students.

Lesson 3



Teacher Tip

You may want to begin the lesson by rereading Chapter 5, "A Trip to the *Souq*," in the storybook to remind students of what Fadil and Bashira learned about package design.



Teacher Tip

Journals: If your students already use a journal to record data and observations from their science lessons, consider having them expand this journal to include engineering. Many of the worksheets found within this unit could be pasted into a Science/Engineering journal, or used as a template for data collection. Alternatively, questions found on worksheets and within the lessons themselves could be recorded and answered directly within the journals.

Part 1: Introduction

1. Explain to students that in this lesson, they will continue to ask questions about products, consumers, and functions of packages, specifically thinking about the plant package they will be designing. Ask:
 - ◆ **Do you remember what Fadil's neighbor encouraged him to do at the end of the story?** *He asked Fadil to design plant packages to sell on his cart at the souq.*
2. Explain to students that they will be working to design a plant package to sell to consumers; they will pick up where Fadil left off at the end of the story.
3. Review with students how Fadil designed his plant package by asking:
 - ◆ **What happened to the plant that Fadil and Bashira put in their first package design?** *It became shriveled.*
 - ◆ **Why do you think the plant became shriveled?** *Because the package did not meet the needs of the plant. It did not get the air, sunlight, water, and nutrients that it needed.*
 - ◆ **How did they solve this problem?** *They used the Engineering Design Process to "Improve" their first box design; they changed their design so that it also met the needs of the plant.*

Lesson 3

◆ **Besides the needs of the plant, what are some other things Bashira and Fadil thought about when they designed their package?** *Who would be getting the package (the consumer), the functions that the package needed to serve, etc.*

◆ **What are some of the functions of packages that you have learned about so far?** *Contain, communicate, carry, display, dispense, preserve, protect.*

4. Explain to students that they will need to think of all these factors as they begin to “Ask” good questions about their plant package designs. Post the Guiding Question of this lesson for students:

◆ **How will the needs of our plant and the needs of the consumer affect our plant package design?**

Smart board

5. Have students think about ways to judge their plant package designs. Ask:

◆ **After we design our plant packages, how will we know if they are successful?** *We will know they are successful if the plants remain healthy while in the package; if consumers buy the package, etc.*

Students may come up with the ideas listed above on their own. If they do not, guide them to understand that the health of the plant is a reflection of the way the package meets the needs of the plant, and the response from consumers is a reflection of whether the plant package meets the consumer’s needs.

6. Explain that in this part of the lesson, students will have the chance to think carefully about what it means for a plant to be “healthy” so that they will be able to fairly judge the health of their plants after they have been in their packages for several days. Students will also have the chance to think about the needs and wants of consumers who might purchase their plant packages.

A vertical black bar with a white square at the top containing a stylized white line and a black dot. Below the square, the text "Lesson 3" is written vertically in white.

Lesson 3

Part 1: Activity

1. Explain to students that as they begin to think about the needs of the plant, they are delving further into the “Ask” step of the Engineering Design Process. You may want to post *The Engineering Design Process* {4-1} so that students can visually reference which step they are working on.
2. Guide students to list the requirements for growth of a plant. Ask:
 - ◆ **What do plants need in order to grow?** *Air, light, water, and nutrients.*
 - ◆ **How will you know if the plant’s requirements for growth are being met?** *The plant will look healthy, it will be green, the stem will be firm, etc.*
3. Agree that students can look to the parts of the plant to determine whether or not it is healthy. Review with students the parts of a plant that they learned about in science (e.g., roots, stems, leaves, flower, bark, and wood).
4. As a class, discuss each part of the plant and why it is important. Create a “Structure and Function” chart similar to the one below. Feel free to add any additional plant structures students have studied, or omit plant structures students have not studied as needed.
5. Reinforce that each plant structure has a function that helps the plant to survive and fulfill its requirements for



Teacher Tip

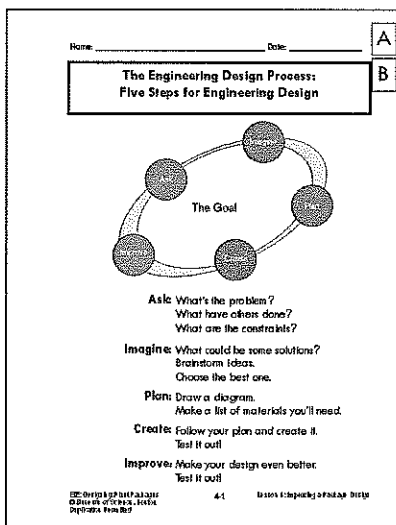
The plant structures and functions taught in your science class may not exactly match the list shown in the chart below. To be consistent, modify this lesson as appropriate and review only the parts with which students are familiar. For example, some science units include bark and wood as plant structures. Feel free to add them to the “Structure and Function” chart.



English Language Learners

Show students a picture of a plant with its parts labeled to help them with the vocabulary necessary for completing the “Structure and Function” chart.

Post chart created during Sci class.



Structure and Function	
Structure	Function
Root	Water absorption and transport
Stem	Support, water transport
Leaves	Food production
Flower/pod	Reproduction

Lesson 3



Teacher Tip

Plan to use the same plants (possibly ones that students grew in science class) for observations in this lesson and for the design challenge in Lesson 4.



Teacher Tip

If students are not familiar with using rubrics, explain to them that a "rubric" is a way to rate or score something. All of the designs or results are judged against a common set of goals.



Teacher Tip

Carefully consider whether to add "flowers" to your plant health rubric. Flowers of many plants bloom and fade quickly. When judging the health of students' plants after they have been in the package, you want to be sure that any changes in the health of the plant can be attributed to the packaging, not the natural growth cycle of the plant.



English Language Learners

Create a list of vocabulary that students may need in order to describe the healthy and unhealthy plants for the rubric. Include colors, textures, and visual descriptors. Then ask students to pick which descriptors they would use in each section of the rubric.

growth and reproduction. This is similar to how the functions of a package help meet the needs of the product.

6. Distribute one plant to each group of three students. Give students time to observe their plant. Ask:

◆ **Is this plant healthy? How do you know?**

7. Explain to students that they are going to create a scoring sheet, or rubric, for plant health. Explain that students will use this rubric in Lesson 4 to assess the health of their plant after it has been inside their package design. Ask the class:

◆ **As we look at a plant and try to figure out how healthy it is, which parts should we observe?** *The leaves, stem, possibly other parts like roots, pods, and/or flowers.*

8. Show students *Rubric: Evaluating Plant Health* {3-1}. The parts of the plants that students decide to use for determining whether the plant is healthy will become the categories in the far left column of the rubric.

9. Explain that there are three levels on the rubric; Level 3 represents a typical healthy plant. This is the level students want to achieve for the plants inside their package designs.

10. Start creating the rubric by having students observe their plants and asking:

◆ **What do the leaves of a healthy plant look like?** *Answers vary depending on plant species. Possible answers include green, white lines, firm, waxy.*

				A
				B
Rubric: Evaluating Plant Health 	Level 3 Healthy			
	Level 2 Somewhat Healthy			
	Level 1 Unhealthy			
Plant Part	Leaves	Stem	Other:	
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Lesson
6

11. If students need further guidance in order to create the rubric, try asking the following questions:
 - ◆ **What color is this plant part?**
 - ◆ **What shape is this plant part?**
 - ◆ **What does this plant part feel like? Is it firm or soft?**
 - ◆ **Should we note any other descriptions?**
12. Place students' descriptions of the healthy plant's leaves in the Level 3 column, in the "Leaves" row.
13. Complete the rest of the Level 3 column for the other plant parts in a similar way.

14. Next, reveal the unhealthy plant. Ask:
 - ◆ **Do you think this plant is healthy? Why or why not?**
15. Have students observe the unhealthy plant and record their descriptions in the Level 1 column. You might use the questions from Step 11 as a guide.
16. Complete Level 2 of the rubric with descriptions of plant parts that fall between Level 1 (unhealthy) and Level 3 (healthy).
17. Explain that students have considered the needs of the product (the plant), but now they need to think about the needs of the consumer. Ask:
 - ◆ **Have you ever bought something?**



Teacher Tip

See *Rubric: Evaluating Plant Health {3-1 Key}* for an example rubric. The benchmarks in your rubric will depend on the plant species you use. Answers in this lesson plan and in the rubric are only general suggestions.



English Language Learners

Provide students with a list of adjectives they can use to describe the plants such as firm, green, floppy, etc. as they make their observations.



Teacher Tip

For a more detailed explanation of the functions of a package, refer to the Lesson 2 Background section (p. 53).



Teacher Tip

You could create a more dynamic and interactive stage for the questions in Step 17 by setting up a miniature grocery store in your classroom, or taking a field trip to a grocery store. Have students focus on one item (breakfast cereal, for example). Ask which they would buy, what helped them decide which cereal to buy, and what important information is listed on the package.



Basic Lesson

Use *Functions of a Package* {3-3} instead of {3-2}.

- ◆ **What helped you decide which product to buy?** *The way it looked, cost, the information on the box, etc.*
- ◆ **What do consumers need to know from a package?** *They need to know what is in the package (what the product is), what makes the product special or attractive to buy, how to care for the product once it is purchased, etc.*
- ◆ **How might these consumer needs be reflected in our plant package design?** *We might need to write directions for plant care on the box, write what type of plant it contains, make a window so the consumer can see the plant, etc.*

Record students' answers on a piece of chart paper.

- Have students review the cards from *Functions of Packages* {2-1} through {2-4} to remind them of the functions their package design might need to include.
- Show students the overhead transparency of *Functions of Our Plant Package* {3-2} and give each student a copy. Guide students to think about the discussions the class has had about the needs of the plant and the needs of consumers. Check the boxes that students feel will be important to their plant package. In the right column, explain why these functions are important.
 - ◆ **Contain:** The plant must be contained inside of the package so that it stays safe and so that consumers can easily purchase and transport it.

Lesson 3

Name _____ Date _____



Functions of Packages

Contain:
To keep within a space.

Communicate:
To transfer or share information.

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24

Lesson 2: Your Packaging Engineer

Name _____ Date _____



Functions of Packages

Carry:
To hold or support while moving.

Display:
To present or show for viewing.

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24

Lesson 2: Your Packaging Engineer

Name _____ Date _____



Functions of Our Plant Package



Directions: Put an X in the boxes next to the functions that your plant package needs to meet. Put an E in the boxes next to the functions that will NOT be included in your package design. Then explain why the functions will or will not be important to your plant package design.

Function	Why is this function important to our plant package?
<input type="checkbox"/> Contain	
<input type="checkbox"/> Carry	
<input type="checkbox"/> Communicate	
<input type="checkbox"/> Display	
<input type="checkbox"/> Dispense	
<input type="checkbox"/> Protect	
<input type="checkbox"/> Preserve	

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34

Lesson 3: Creating Needs and Creating Clients

- ◆ **Carry:** This helps keep the plant upright during transport and allows the package to be easily held.
- ◆ **Communicate:** This is necessary to explain to the consumer how to care for the plant and meet its need for air, sunlight, water, and nutrients.
- ◆ **Display:** This helps to show off or highlight the plant.
- ◆ **Dispense:** Our package does not need to dispense a product.
- ◆ **Protect:** This will keep the plant from tipping over or being crushed.
- ◆ **Preserve:** This will help the plant meet its requirement for air, sunlight, water, and nutrients.

20. Return to the overhead of *Functions of Our Plant Package* {3-2}. Ask:

- ◆ **Which functions will help meet the needs of the plant?**
- ◆ **Which functions will help meet the needs of the consumer purchasing a plant?**

Highlight the functions intended to meet the needs of the plant in one color, and those intended to meet the needs of the consumer in another.

21. Explain that *Rubric: Evaluating Plant Health* {3-1} and the functions that students just identified as being important to their plant packages will be the criteria, or standards, by which they judge their plant package designs.



Teacher Tip

You may need to clarify for students that the “dispense” function does not apply to packages that allow the consumer to pick up/remove the product. Rather, it refers to a package that (usually through some mechanical action) gives out specific amounts of a product.



Teacher Tip

Students may want to include and consider the needs of the merchant selling the product as additional criteria by which they will judge their package designs. In many cases, the needs of the merchant may overlap with the needs of the consumer, but if students identify a need specific to the merchant, they should feel free to add it to the list.



Basic Lesson

Use *Functions of Our Plant Package* {3-3} instead of {3-2}.

Part 2: Materials

For the Class

- ◆ chart paper
- ◆ {3-2} *Functions of Our Plant Package* as a transparency (from Part 1)
- ◆ {3-4} *Base Packages* as a transparency

For Each Group of Three Students

- ◆ bottle, plastic, 2-liter, empty
- ◆ juice carton, cardboard, half-gallon (1.9L) empty
- ◆ bag, plastic, resealable, one gallon (3.8L)
- ◆ samples of the following materials:
 - ◆ aluminum foil, approx. 2" x 2" (5.1 x 5.1 cm)
 - ◆ straw, plastic, drinking
 - ◆ cotton ball
 - ◆ overhead transparency, approx. 2" x 2" (5.1 x 5.1 cm)
 - ◆ folder, manila, file, approx. 2" x 2" (5.1 x 5.1 cm)
 - ◆ copy paper, approx. 2" x 2" (5.1 x 5.1 cm)
 - ◆ paper towel, approx. 2" x 2" (5.1 x 5.1 cm)
 - ◆ wax paper, approx. 2" x 2" (5.1 x 5.1 cm)
 - ◆ plastic wrap, approx. 2" x 2" (5.1 x 5.1 cm)
 - ◆ tape, cellophane

Copy For Each Student

- ◆ {3-2} *Functions of Our Plant Package* (from Part 1)
- ◆ {3-4} *Base Packages*



Part 2: Preparation

1. Prepare a piece of chart paper titled "Properties of Materials," as shown below:

Properties of Materials		
Material	Properties	Function

2. Make an overhead transparency of *Base Packages* {3-4}.
3. Plan to have students continue to work in groups of three.
4. Gather one half-gallon juice carton and one 2-liter plastic bottle for each group of three students.
5. Cut an approximately 2" x 2" (5.1 x 5.1 cm) square of each flat material (e.g., aluminum foil or wax paper) for each group of three students.
6. Create bags of sample materials for each group of three students. Each bag should contain 2" (5.1 cm) squares of each flat material and single items of other materials, such as cotton balls. These sample bags should help students get a sense of the materials, but should not contain enough for them to begin construction. Place all of the sample materials into a resealable plastic bag for each group.



Teacher Tip

Once the bags of sample materials have been created, they can be saved and reused in the next lesson, and each time you teach this unit.



English Language Learners

Explain to students that the word “properties” is similar to the word “characteristics” or “qualities” used in language arts class or “attributes” used in math class.



Basic Lesson

Use *Functions of Our Plant Package* {3-3} instead of {3-2}.

Part 2: Introduction

- Remind students that Fadil worked as a packaging engineer when he designed a plant package. Ask:
 - ♦ **Why did Fadil need to “Improve” his package?** *The box he used originally did not meet the needs of the plant.*
 - ♦ **How will your package designs be different from Fadil’s?** *Our packages will be for sale, not for gifts.*
 - ♦ **What process did Fadil use to improve his package?** *The Engineering Design Process.*

Explain that while students’ plant packages will have a different purpose than Fadil’s, students will still be able to use the Engineering Design Process to help them solve their problem.

- Using a transparency of *Functions of Our Plant Package* {3-2}, review the functions that students decided to include in their designs and how each function will help meet the needs of the plant and/or the consumer.
- Explain to students that in Lesson 4 they will be able to “Improve” either a half-gallon juice carton or a 2-liter plastic bottle for their plant package. The carton and bottle will be referred to as the “base” packages.
- Tell students that today they will be continuing the “Ask” step of the Engineering Design Process as they investigate the properties of the materials they will be able to use to design their plant packages.

Name _____ Date _____ A

Functions of Our Plant Package

Directions: Put an X in the boxes next to the functions that your plant package needs to meet. Put an O in the boxes next to the functions that will NOT be included in your package design. You explain why the functions will or will not be important to your plant package design.

Function	Why is this function important to our plant package?
<input type="checkbox"/> Contains	
<input type="checkbox"/> Carry	
<input type="checkbox"/> Communicate	
<input type="checkbox"/> Display	
<input type="checkbox"/> Dispense	
<input type="checkbox"/> Protect	
<input type="checkbox"/> Preserve	

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Part 2: Activity

- Guide students to think about the properties of materials that might be important to look for given this specific design challenge. Post the "Structure and Function" chart from Part 1. Ask:
 - What are the basic needs of plants? *Air, light, water, nutrients.*
 - What properties of materials might be important for meeting the needs of the plant? *Whether the materials are transparent and let light through, whether the materials retain water or are waterproof, if they let air through.*
 - What might the consumers need from this package? *Information about the plant (what kind it is, how to take care of it), a way to carry the plant home, etc.*
 - What properties of materials might be important for meeting the needs of the consumer? *Whether we can write directions on the materials, whether the materials can be molded or formed into pleasing shapes, whether the material is clear to allow for viewing the plant, etc.*
- Divide students into groups of three. Give each group a half-gallon juice carton and a 2 liter plastic bottle.
- Give students copies of *Base Packages* {3-4}. Evaluate each of the base packages. For each base, ask:



Teacher Tip

Consider allowing your students to bring in base packages of their choosing from home. Students might think that a cereal box, oatmeal container, or coffee can would be a better package to improve upon than the plastic bottle or juice carton. Whether or not you decide to be more flexible with the base package constraints, it will be important to discuss the properties of the base packages and functions they do (or do not) meet.



Teacher Tip

You may want to further discuss the base packages with your students. While the base packages are not currently appropriate as plant packages, have your students think about why they are appropriate for the product for which they are designed (e.g., juice or soda).

Structure and Function	
Structure	Function
Root	Water absorption and transport
Stem	Support, water transport
Leaves	Food production
Flower/pod	Reproduction

Name _____ Date _____

Base Packages

Directions: Fill in the chart below after looking at the two base packages available for your plant package design.

	Bottle	Juice Carton
What material is the base package made from?		
What are the properties of this material?		
Check the functions that are met by this base package:	<input type="checkbox"/> Protect the plant <input type="checkbox"/> Preserve the plant <input type="checkbox"/> Will let in air <input type="checkbox"/> Will let in light <input type="checkbox"/> Will hold moisture <input type="checkbox"/> Contains <input type="checkbox"/> Conspicuously the needs of the plant <input type="checkbox"/> Carry <input type="checkbox"/> Display	<input type="checkbox"/> Protect the plant <input type="checkbox"/> Preserve the plant <input type="checkbox"/> Will let in air <input type="checkbox"/> Will let in light <input type="checkbox"/> Will hold moisture <input type="checkbox"/> Contains <input type="checkbox"/> Conspicuously the needs of the plant <input type="checkbox"/> Carry <input type="checkbox"/> Display

1. As they are right now, would either base package be a good choice for our plant? Why or why not?

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83

Evaluating Needs and Creating Criteria



Teacher Tip

Some items listed in the "Material" column of the "Properties of Materials" chart are technically objects that are made of a particular material. For example, drinking straws are objects that are made of plastic (a material). This is often a difficult distinction for students to grasp, and may warrant a lesson unto itself. For the purpose of this lesson, we have decided to simply list the supplies students have available for building their plant packages as "materials," to minimize student confusion. This will help students focus on the properties most relevant to their designs.



Teacher Tip

You may want to use a marking system (such as stars or colors) to mark properties on the "Properties of Materials" chart that students feel are particularly important for this design challenge.



Basic Lesson

Complete *Base Packages* {3-4} together as a class rather than having students work in small groups.

- ◆ **What is the material?** *Cardboard (for the juice carton) and plastic (for the plastic bottle).*
 - ◆ **What are some properties of the material?** *Plastic is flexible, waterproof, transparent, air-tight. Cardboard is bendable, easy to cut, lets some air through, etc.*
 - ◆ **Which functions of our plant package do the base packages meet as they are now? Check those that apply.**
 - ◆ **As is, would either be a good package for our plants? Why?** *Neither base package would meet all the needs of the plant as they are right now.*
4. Record students' ideas about the juice carton and soda bottle on the transparency of *Base Packages* {3-4}.
 5. Distribute the bags of sample materials that you prepared. Give students a few minutes to examine the materials before discussing them as a group.
 6. Record the name and the properties of each material on the "Properties of Materials" chart created during the Preparation section. You may want to tape actual material samples to the chart. Leave the "Function" column blank for now. If students have difficulty listing the properties of a material, try asking the following questions:
 - ◆ **Is the material clear or opaque?**
 - ◆ **Is the material stiff or floppy?**
 - ◆ **Will the material retain moisture? Is it waterproof?**
 - ◆ **Will it let air through?**

Properties of Materials		
Material	Properties	Function

7. Review *Functions of Our Plant Package* {3-2} and remind students of the criteria against which their packages will be judged.
8. Return to the “Properties of Materials” chart. For each material, ask the students which package function that material may be able to help fulfill. At this point, you do not need to have students explain how that material will address that function, only which functions it will address.
9. Record students’ ideas on the “Properties of Materials” chart in the “Function” column.
10. Briefly discuss with students the one criterion that will be used in Lesson 4 that was not already addressed in this lesson: cost. Ask students:
 - ◆ **In addition to the appearance of a package, what other factor matters to a consumer when they are buying a product?** *How much it costs.*
 - ◆ **Do you have any ideas about how we could keep the costs of our plant packages low?** *By using source reduction—using our materials wisely and not creating too much waste.*
11. Explain to students that a final factor they will include in the evaluation criteria for their plant package designs is cost. Because cost is directly related to the amount of materials used, students should try to avoid overpackaging their designs.



Teacher Tip

Encourage students to play a larger part in designing experiments for this lesson. For example, if students feel it is important to observe how writing/text shows up on each material, or how much moisture each material can retain, guide them to create an experiment so that they can collect data on these factors. Students may want to try writing the same word on each material, or soaking the materials with drops of water, etc. Students will need to address how to make a fair comparison. What data or observations will help? What methods need to stay the same? This is an excellent opportunity for allowing students to integrate and use their inquiry skills in a practical way.



Teacher Tip

You may want to show students *Plant Package Materials Cost* {4-11} as you discuss the cost criterion.




English Language Learners

Provide students with a list of adjectives they can use to describe the properties of the materials. Some descriptive words include: rigid, floppy, clear, opaque, light, heavy, flexible, stiff, etc.

Name _____ Date _____ A

Functions of Our Plant Package

 Directions: Put a in the boxes next to the functions that your plant package needs or uses. Put an in the boxes next to the functions that will NOT be included in your package design. Then explain why the functions will or will not be important to your plant package design.

Function	Why is this function important to our plant package?
<input type="checkbox"/> Contains	
<input type="checkbox"/> Carries	
<input type="checkbox"/> Communicates	
<input type="checkbox"/> Displays	
<input type="checkbox"/> Dispenses	
<input type="checkbox"/> Protects	
<input type="checkbox"/> Preserves	

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Duplication Permitted © 2002 LESSON 3 Evaluating Needs and Creating Criteria

Reflection

1. As a wrap-up to the lesson, pose the Guiding Question again. Ask:
 - ◆ **How will the needs of our plant and the needs of the consumer affect our plant package design?** *The needs of our plant and consumer will require us to address the communicate, contain, carry, display, protect, and preserve functions. Because our product is alive, we will need to be sure that it remains healthy while it is inside the package. The consumer will need a way to carry the plant home, and will need to understand how to care for the plant, etc.*
2. Have students consider how both the needs of the plant and those of the consumer will affect their design plans. Ask:
 - ◆ **We have discussed the needs of the plant and those of the consumer. Do you think one is more important than the other? Are they both equally important?**



Rubric: Evaluating Plant Health

Level 3 Healthy			
Level 2 Somewhat Healthy			
Level 1 Unhealthy			
Plant Part	Leaves	Stem	Other: _____

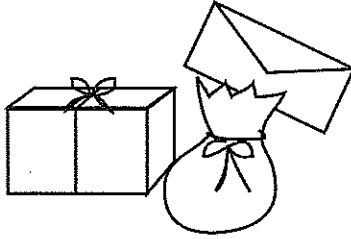
A

B



Name: _____ Date: _____

Functions of Our Plant Package



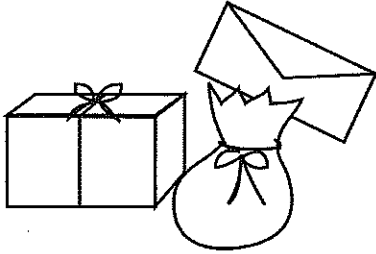
Directions: Put a in the boxes next to the functions that your plant package needs to meet. Put an in the boxes next to the functions that will NOT be included in your package design. Then, explain why the functions will or will not be important to your plant package design.

Function	Why is this function important to our plant package?
<input type="checkbox"/> Contain	
<input type="checkbox"/> Carry	
<input type="checkbox"/> Communicate	
<input type="checkbox"/> Display	
<input type="checkbox"/> Dispense	
<input type="checkbox"/> Protect	
<input type="checkbox"/> Preserve	

(1)



Name: _____ Date: _____



Functions of Our Plant Package

B

Directions: Put a in the boxes next to the functions that your plant package needs to meet. Put an in the boxes next to the functions that will NOT be included in your package design.

Function	This function helps us be sure that
<input type="checkbox"/> Contain	<i>the product stays inside the package.</i>
<input type="checkbox"/> Carry	<i>the product is easy to transport.</i>
<input type="checkbox"/> Communicate	<i>the consumer is given information or instructions about the product.</i>
<input type="checkbox"/> Display	<i>the product is highlighted by windows or the color, size, or shape of the package.</i>
<input type="checkbox"/> Dispense	<i>the product can be dispensed in specific or controlled amounts with pumps, nozzles, or spouts.</i>
<input type="checkbox"/> Protect	<i>the product does not get crushed or damaged.</i>
<input type="checkbox"/> Preserve	<i>the product is kept fresh and healthy.</i>



Name: _____ Date: _____

A

B

Base Packages



Directions: Fill in the chart below after looking at the two base packages available for your plant package design.



	Plastic Bottle	Juice Carton
What material is the base package made from?		
What are the properties of this material?		
Check the functions that are met by this base package:	<input type="checkbox"/> Protect the plant <input type="checkbox"/> Preserve the plant <input type="checkbox"/> Will let in air <input type="checkbox"/> Will let in light <input type="checkbox"/> Will hold moisture <input type="checkbox"/> Contain <input type="checkbox"/> Communicate the needs of the plant <input type="checkbox"/> Carry <input type="checkbox"/> Display	<input type="checkbox"/> Protect the plant <input type="checkbox"/> Preserve the plant <input type="checkbox"/> Will let in air <input type="checkbox"/> Will let in light <input type="checkbox"/> Will hold moisture <input type="checkbox"/> Contain <input type="checkbox"/> Communicate the needs of the plant <input type="checkbox"/> Carry <input type="checkbox"/> Display

1. As they are right now, would either base package be a good choice for our plants? Why or why not? _____



Lesson 3 Rubric

Student will be able to...	Novice 1	Apprentice 2	Proficient 3	Distinguished 4
<p>identify and explain the needs of the product (a plant) and of the consumer.</p>	<p>Student does not successfully identify the needs of the product or the needs of the consumer.</p>	<p>Student identifies and explains some needs of the product and consumer. Response is incomplete or partially inaccurate, or student requires significant support.</p>	<p>Student correctly identifies and completely and accurately explains at least two needs of the product and two needs of the consumer.</p>	<p>Student participates at proficient level and goes significantly beyond (e.g., by discussing the needs of the product or consumer in a different context).</p>
<p>identify and explain the package functions required to meet the needs of the product and the consumer.</p>	<p>Student does not successfully identify the package functions required to meet the needs of the product and the consumer.</p>	<p>Student identifies and explains some functions required to meet product and consumer needs. Response is incomplete or partially inaccurate, or student requires significant support.</p>	<p>Student correctly identifies and completely and accurately explains at least two functions required to meet the product's needs, and two functions required to meet the consumer's needs.</p>	<p>Student participates at proficient level and goes significantly beyond (e.g., by explaining the relative importance of the required package functions).</p>
<p>identify properties of the materials to be used in the design and evaluate how well they will meet each need of the product and the consumer.</p>	<p>Student does not successfully identify properties of the materials to be used in the plant package design.</p>	<p>Student identifies properties of materials and explains how they will meet the needs of product and consumer. Response is incomplete or partially inaccurate, or student requires significant support.</p>	<p>Student correctly identifies properties of materials and completely and accurately explains how they can be used to meet needs of the product and consumer.</p>	<p>Student participates at proficient level and goes significantly beyond (e.g., by identifying other materials or properties that would be useful in the plant package design).</p>
<p>brainstorm ways that the two base packages and other materials could be modified to meet the needs of the product and the consumer.</p>	<p>Student does not successfully identify any ways to use or modify the materials to meet the needs of the product or consumer.</p>	<p>Student identifies some possible ways to modify the materials. Response is incomplete or partially inaccurate, or student requires significant support.</p>	<p>Student identifies some ways to modify the materials and completely explains how modifications could help to meet the needs of the product and consumer.</p>	<p>Student participates at proficient level and goes significantly beyond (e.g., by identifying other materials or properties that would be useful in the plant package design).</p>



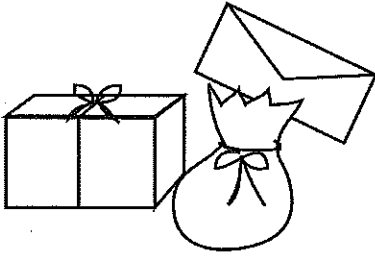
Rubric Recording Sheet-Lesson 3

Student Name	Student will be able to...							Notes
							Total Score	



Name: _____ Date: _____

Functions of Our Plant Package



Directions: Put a in the boxes next to the functions that your plant package needs to meet. Put an in the boxes next to the functions that will not be included in your package design. Then, explain why the functions will or will not be important to your plant package design.

Answer Key

Function	Why is this function important to our plant package?
<input checked="" type="checkbox"/> Contain	Keeps the plant in a given space.
<input checked="" type="checkbox"/> Communicate	Explains how to care for the plant, including the need for sunlight, water, and air.
<input checked="" type="checkbox"/> Carry	Plant stays upright during transport due to a structure (e.g., a handle) or the package has a symbol indicating how to carry the plant.
<input checked="" type="checkbox"/> Display	The color, size, shape, etc. encourages customers to buy the plant.
<input type="checkbox"/> Dispense	Pumps, nozzles, and spouts are examples of how products are designed to dispense a product in specific amounts. <i><u>This function does not apply to this package.</u></i>
<input checked="" type="checkbox"/> Preserve	Ensures the plant gets sufficient sunlight, air and water to remain healthy.
<input checked="" type="checkbox"/> Protect	Ensures that the plant does not get crushed or fall over.



Rubric: Evaluating Plant Health



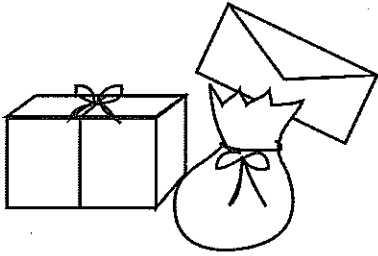
Plant Part	Level 1 Unhealthy	Level 2 Somewhat Healthy	Level 3 Healthy
Leaves	Leaves are mostly yellow or brown. Leaves are dry and crumbly.	Leaves are a mixture of green and yellow.	Leaves are dark or bright green and firm. Leaves may have minimal yellow on a leaf or two.
Stem	Plant is unable to stand up on its own. Stem is limp.	Stems hold plant up, but plant lists noticeably to one side.	Stem holds the plant up vertically. May lean to one side slightly.
Flower	Most of the petals have fallen off of the flowers. Flowers have fallen off of the plant.	Petals have fallen off of the flowers. Some flowers are missing sections of petals.	Nearly all of the petals are still on the flowers. A few may have dropped off.
Pod	Pod is yellow or brown and may be mushy.	Pod is green and yellow and may be mushy in some places.	Pod is green and firm.

Note: The content of the rubric may vary widely depending on the specific species of plant you are packaging.

Sample Rubric



Name: _____ Date: _____



Functions of Our Plant Package

Directions: Put a in the boxes next to the functions that your plant package needs to meet. Put an in the boxes next to the functions that will not be included in your package design.

Answer Key

Function	This function helps us be sure that
<input checked="" type="checkbox"/> Contain	<i>the product stays inside the package.</i>
<input checked="" type="checkbox"/> Communicate	<i>the consumer is given information or instructions about the product.</i>
<input checked="" type="checkbox"/> Carry	<i>the product is easy to transport.</i>
<input checked="" type="checkbox"/> Display	<i>the product is highlighted by windows or the color, size, or shape of the package.</i>
<input type="checkbox"/> Dispense	<i>the product can be dispensed in specific or controlled amounts with pumps, nozzles, or spouts.</i>
<input checked="" type="checkbox"/> Preserve	<i>the product is kept fresh and healthy.</i>
<input checked="" type="checkbox"/> Protect	<i>the product does not get crushed or damaged.</i>

Name: _____

Date: _____

Base Packages



Directions: Fill in the chart below after looking at the two base packages available for your plant package design.



Answer Key

	Plastic Bottle	Juice Carton
What material is the base package made from?	Plastic	Cardboard
What are the properties of this material?	transparent, air-tight, waterproof, etc.	opaque, waterproof, flexible, etc.
Check the functions that are met by this base package:	<input checked="" type="checkbox"/> Protect the plant <input type="checkbox"/> Preserve the plant <input type="checkbox"/> Will let in air <input checked="" type="checkbox"/> Will let in light <input checked="" type="checkbox"/> Will hold moisture <input checked="" type="checkbox"/> Contain <input type="checkbox"/> Communicate the needs of the plant <input checked="" type="checkbox"/> Carry <input type="checkbox"/> Display	<input checked="" type="checkbox"/> Protect the plant <input type="checkbox"/> Preserve the plant <input type="checkbox"/> Will let in air <input type="checkbox"/> Will let in light <input checked="" type="checkbox"/> Will hold moisture <input checked="" type="checkbox"/> Contain <input type="checkbox"/> Communicate the needs of the plant <input checked="" type="checkbox"/> Carry <input type="checkbox"/> Display

1. As they are right now, would either base package be a good choice for our plants? Why or why not? _____

