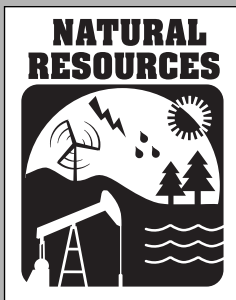# Highest and Best Use of Resources

OBJECTIVES:

Students will:
1. explain the 4Rs hierarchy.
2. classify ten items that were destined for the garbage, recycling or compost bin into the 4Rs hierarchy.
3. construct a graph to explain the results of categorizing items that were destined for the garbage, recycling, or compost bin.
4. convert data into fractions and percentages.

STANDARDS: Science and Mathematics

SKILLS: Analysis, classification, construction, description, problem solving

SETTING: Classroom

TIME: 50 minutes

VOCABULARY:
Garbage
Hierarchy
Litter
Organic
Waste prevention

Introduction

Overview:

In this lesson, students will learn about the 4Rs hierarchy (Reduce, Reuse, Recycle, Rot/Compost) by bringing in waste items from home that they will classify into groups according to the 4Rs hierarchy. They will justify why they placed each item into its category in writing and report their findings to the class.

Teacher Background:

The 4Rs are placed in a hierarchy: Reduce, Reuse, Recycle and Rot/Compost. The most important practice is to reduce waste by not creating waste in the first place. Reuse is next in the hierarchy because if an item is reused, resources are not required to produce the same item again. Recycle is next in the hierarchy since this extends the life of existing resources by turning old materials into new products. Composting is a human-controlled way of recycling food and yard waste into fertilizer for plants.

See "Teacher Background," Lesson 3, for more on the 4Rs hierarchy.

Materials:

Students:
- ❏ Three to four items from home that were destined for the garbage, recycling, or composting bin
- ❏ "Group Predictions" worksheet (one per student)
- ❏ "Highest and Best Use of Resources" worksheet (one per student)

Teacher:
- ❏ Bags (one per group of four)
- ❏ Items to supplement what the students bring to class so that each group will have ten items (and at least two from each of the 4Rs categories)
- ❏ "Group Predictions" worksheet overhead
- ❏ "Waste Characterization of Alameda County" overhead (garbage can with percentages can be found in Lesson 2)
- ❏ 4Rs pictographs (found in Lesson 3)
- ❏ Rubric overhead
- ❏ Rubrics (one per student)

Preparation:

The in-class activity will need to be done two days after the initial in-class discussion because you will need to see what kind of items to bring into class to supplement what the students bring from home.

Discussion

1. Ask the students what the 4Rs are and whether one is more important to practice than another. Guide the students toward putting the 4Rs in the correct hierarchy (order) and explain what a hierarchy is. (You can have student volunteers post the 4Rs pictographs in its hierarchy.)

2. Discuss Reduce choices. (What we need, how much we use, etc.).

3. Discuss with the students that many items of waste need not be discarded in landfills. Some items may be reused for the same or different purpose; other items can be recycled. Gardens can be greatly improved by using compost as a natural fertilizer to amend the soil. Compost is made by decomposing organic materials.

4. Discuss why it's important to practice the 4Rs (conservation of natural resources).

5. Show an overhead of the lesson rubric and review the expectations for this lesson.

Procedure

For Homework:

1. Have students bring three or four items from home that were destined for the garbage, recycling or compost bin to class. Remind students that the items should be cleaned or rinsed.

In-Class:

2. Organize the students into groups of four. Give each group a bag with at least ten waste items (at least two from each category; you may need to supplement the bag with additional items). Hand out the student worksheet "Group Predictions." Have the group quickly estimate what percentage of their items can be reduced, reused, recycled, composted or placed in a landfill and record their predictions on the student worksheet.

3. Explain that the goal is to classify the items according to the 4Rs hierarchy. This means making the best choice for each item even though there may be more than one choice. Review the definitions of reduce, reuse, recycle and rot/compost.

4. Put up the overhead of the student worksheet "Highest and Best Use of Resources," and model how to complete it. Pass out one worksheet per student, and have them fill it out.

5. In groups, ask students to compare their predictions to the data they have collected. Have the groups discuss why their predictions and results were similar or not.

6. On the back of their worksheet, assign each student to justify in a paragraph why each of the items were placed in that category. Model or scaffold how to write this paragraph, if necessary, to the class.

Sample scaffold:

We placed _____ in the **reduce** category

because _____.

_____ were in the **reuse** category

because _____.

_____ were in the **recycle** category

because _____.

_____were in the **rot/compost** category

because _____.

_____ were in the **landfill** category because

_____.

Wrap-Up

1. As a class, call on volunteers from groups to discuss and report their findings. Ask the class to agree or disagree with a few examples by putting their thumbs up if they agree or thumbs down if they disagree with the group's choice. If there is disagreement, discuss the best use of the item (reduce, reuse, recycle, rot/compost).

2. Put up the overhead "Waste Disposal in Alameda County" (from Lesson 2). Lead a class discussion regarding ways to decrease (keep waste out of the landfill) the waste that's currently generated in Alameda County. Ask the students whether they think it's important to try to reduce the amount of waste we make and if so, why. If necessary, lead a class discussion about the importance of conserving natural resources by practicing the 4Rs hierarchy.

Final Assessment Ideas

Have the students create a comic strip showing a character demonstrating different ways to practice the 4Rs. For example, a person buying bananas at the grocery store and choosing not to bag the bananas would demonstrate the concept of reduce. The comic strip should include four frames, one for each of the 4Rs, and they should be placed in the correct hierarchy.

Extensions:

Empty the contents of the classroom garbage can onto the floor, and have students classify the items according to the 4Rs hierarchy. Brainstorm ways to reduce the amount of items by practicing the 4Rs in class. If there is a lot of scrap paper, create a scrap paper bin for the classroom that can be used for art projects, etc.

Have groups discuss any items that could not be reused, recycled or composted. Ask them to share what these items are made out of or what natural resources are needed to produce the item. Discuss the value of these natural resources. Brainstorm ways to save resources by buying differently and making choices that help reduce waste.

Teacher Materials:

California State Content Standards

The standards below represent broad academic concepts. This lesson provides connections to these academic concepts through hands-on activities and exploration. This lesson is not designed for a student to master the concepts presented in the standards. Additional lessons in the classroom that build on this lesson or the standard(s) ensure that students will have the opportunity to master these concepts.

SCIENCE	CONTENT STANDARDS
Grade 4	**Investigation and Experimentation** 6.e. Students will construct and interpret graphs from measurements.
Grade 5	**Investigation and Experimentation** 6.a. Students will classify objects (e.g. rocks, plants, leaves) in accordance with appropriate criteria.
MATHEMATICS	**CONTENT STANDARDS**
Grade 4	**Mathematical Reasoning** 2.3. Students will use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams and models, to explain mathematical reasoning.
Grade 5	**Mathematical Reasoning** 2.3. Students will use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams and models, to explain mathematical reasoning.

Highest and Best Use of Resources Rubric

A rubric is a scoring tool that defines the criteria by which a student's work will be evaluated. This rubric is provided to assist you in setting expectations for students and assessing their performance and engagement during the lesson based on specific tasks. Ideally, a rubric is developed with the cooperation of the students. Two blank rows have been provided for you and your class to develop and add your own assessment criteria.

Category	4	3	2	1
Graph	Graph is completely accurate and labeled.	Graph is generally accurate and labeled.	Graph is mostly inaccurate and occasionally labeled.	Graph was not attempted.
Classification and justification	All items are justifiably in the appropriate 4Rs category.	Most of the items are justifiably in the appropriate 4Rs category.	Some of the items are justifiably in the appropriate 4Rs category.	None of the items are justifiably in the appropriate 4Rs category.
Mathematical reasoning	All of the data was correctly converted into fractions and percentages.	Most of the data was correctly converted into fractions and percentages.	Some of the data was correctly converted into fractions and percentages.	None of the data was correctly converted into fractions and percentages.

Group Predictions

Directions: Look at your bag of items and estimate/predict the percentage of items that will fit into the following categories:

Percent of items that can be **reduced**_____%   Percent of items that can be **recycled** _____%

Percent of items that can be **reused** _____%   Percent of items that can be **composted** _____%

List: Group each item into one of the five categories listed below.
Write the name of each item in a blank space with a number.

REDUCE	REUSE	RECYCLE	ROT/COMPOST	LANDFILL
1.	1.	1.	1.	1.
2.	2.	2.	2.	2.
3.	3.	3.	3.	3.
4.	4.	4.	4.	4.

Bar Graph: Write the name of each item from the table above in one of the blank spaces below.
Using your pencil, shade in each used space to see a bar graph.

4					
3					
2					
1					
	REDUCE	REUSE	RECYCLE	ROT/COMPOST	LANDFILL

Conclusions: As a group, convert the data above into fractions and percentages.

	Fraction (# of items in category) ÷ (total # of items)	Percentage
REDUCE	÷	%
REUSE	÷	%
RECYCLE	÷	%
ROT/COMPOST	÷	%
LANDFILL	÷	%

Name:_____   Date:_____

Student

Highest and Best Use of Resources

Directions: Justify why you placed each item into its category by completing the paragraph below:

We placed_____ in the **reduce** category because_____

_____.

_____were in the **reuse** category because_____

_____.

_____were in the **recycle** category because_____

_____.

_____were in the **rot/compost** category because_____

_____.

_____were in the **landfill** category because_____

_____.

Name:_____ Date:_____

Vocabulary:

Garbage: things that people throw away.

Hierarchy: a ranking system according to relative importance.

Litter: waste materials that are carelessly discarded or put in the wrong place.

Organic: materials that were once living or material produced by a living organism such as food, leaves, plant trimmings, hair, clothing fibers, paper, etc. Organic may also be used to describe food grown using sustainable agricultural methods.

Waste prevention: not making so much waste in the first place.