Recycling Plastics

OBJECTIVES:

Students will:

1. identify and sort a variety of plastic products and distinguish which types can be recycled in their community.
2. observe and describe the properties of different types of plastic.
3. list ways to reduce or reuse plastics that cannot be recycled.

STANDARDS: Science

SKILLS: Analysis, classification, description, problem solving

SETTING: Homework assignment and Classroom

TIME:
Classroom: 50 minutes
Homework: 10 minutes

VOCABULARY:
Petroleum
Plastic

Introduction

Overview:

In this lesson, students will learn about different types of plastic by collecting and examining examples of plastic from home. They will identify the seven different types of plastic, observe and record the properties of each plastic type, and research which types they can recycle in their community.

Teacher Background:

Today, most plastic is made from natural gas and crude oil; both are classified as nonrenewable resources. Plastics are made by linking tiny molecules together in long, repeating chains, which form polymers. Plastic makes up a growing portion of the products we use every day ranging from food packaging and beverage bottles to the outer shells of TVs, boats, and automobiles.

Different polymers make up different types of plastic. Each type can be categorized based on observable properties unique to that type of plastic. The plastic industry has developed an identification system to label and divide plastic into seven groups with different properties using a number code on the bottom of the container. Some plastic types are flexible; others are rigid. Some plastics are translucent, transparent, or opaque, and many have different densities. Each type melts at a different temperature. These properties determine various uses for different types of plastic.

Most plastic is recyclable in theory, but many types of plastic are not economical to collect for recycling. In addition, the properties that make plastic useful also make it a difficult waste item if it is not recycled. Reducing the need for and purchasing of plastic products conserves nonrenewable natural resources as well as other resources used during the extraction of fossil fuels (crude oil and natural gas). It also helps prevent a common source of litter and pollution in the environment.

Materials:

Students:

- ❑ At home: bring examples of different types of plastic, e.g., bottles, wrappers, packaging pellets, cups, etc.
- ❑ "Types of Plastic" handout (one per student)
- ❑ StopWaste.Org *Recycling Guide* (one guide per pair of students)
- ❑ "Plastics at Home" worksheet

Teacher:

- ❑ Examples of different types of plastics (water bottle, detergent bottle, yogurt container, plastic bag, etc.)
- ❑ "Types of Plastic" handout overhead
- ❑ Rubric overhead
- ❑ Rubrics (one per student)

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Preparation:

Call to request a set of StopWaste.Org *Recycling Guide*s at the Recycling Hotline at 1-877-786-7927 or at **www.StopWaste.Org**. Begin collecting examples of different plastic types several days before lesson.

Assign students to bring in a variety of plastic items from home the day before the lesson.

Be prepared to put students in pairs for part of the activity.

You may need to collect and redistribute plastic items to each pair of students.

ACTIVITY

Discussion

1. Ask the students to describe how they use plastic at home or school.

2. Have students state why they think some plastic items can be used many times, while others must be disposed of after one use. For example, plastic baggies are not as rigid as a reusable plastic container.

3. Describe how different types of plastic have different characteristics or properties such as being rigid or flexible.

4. Show an overhead of "Types of Plastic." Explain to the students the different types of plastic. Show students examples of each type of plastic and where to look for the numbered code on the bottom of the container.

5. Explain that plastic is made from crude oil, which is a nonrenewable natural resource. These resources need to be conserved because they are limited in availability. Explain that nonrenewable resources such as oil take millions of years to form; so once they are used up, they cannot be replaced.

6. Ask students to share what they do with plastics at home or school after use. Are they recycled or thrown away?

7. Tell the students that they will be learning about the properties of different plastic types while researching which types can be recycled in their community.

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

Procedure

1. Homework (day before activity): Assign students to bring in different types of plastic. Have them collect a variety of items, e.g., one plastic water bottle, one food wrapper, one beverage container, one film canister, etc. Encourage students to collect different colors, shapes, and forms.

2. Put students into pairs and pass out the handout "Types of Plastic" to each student and give each pair an *Alameda County Recycling Guide*.

3. Ask the students to share their plastic items from home with their partner (walk around the room and distribute plastic items to pairs of students that do not have an adequate variety).

4. Using their handout, ask students to locate the code and identify the type of plastic for each item brought from home. Then sort the samples into those that can be recycled in their community and those that cannot. Have them refer to their *Recycling Guide* for a list of plastics commonly accepted for recycling by cities in Alameda County. Have students observe the different characteristics of each type of plastic, e.g., stiffness, transparency, color, etc.

5. Ask some students to present their findings to the class such as what type of plastic they identified, specific properties or characteristics, and whether it can be recycled in their community.

6. Pass out the student worksheet "Plastics at Home." Model how to complete the worksheet for one plastic item. Each student will complete their own worksheet and brainstorm ways to reduce or reuse plastics that can't be recycled in their community.

Wrap-Up

1. As a class, have students share ways to reduce or reuse plastic, especially those that cannot be recycled in their community. Make a list of their ideas on the board, and have the students vote on two or three ideas to implement in the classroom, e.g., reuse plastic bags, collect plastic bottle tops for classroom art projects, etc.

Final Assessment Idea

Have students create a template for a plastics recycling refrigerator magnet for their family that states which plastic types can be recycled in their community, some common examples of each type of plastic, and a drawing or picture of each plastic type and number.

Extensions:

Have students discuss and record the properties of different types of plastic on a chart such as whether it is opaque, colored, textured, flexible, rigid, etc. Next, have the students predict how different types of plastic can be sorted in a recycling facility based on the properties that are unique to each type.

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	**Life Science** 6.a. Students will differentiate observation from inference (interpretation) and know scientists' explanations come partly from what they observe and partly from how they interpret their observations.
Grade 5	**Investigation and Experimentation** 6.a. Students will classify objects (e.g., rocks, plants, leaves) in accordance with appropriate criteria.

Teacher

Recycling Plastics 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
Identify plastic types and whether they can be recycled	All items were correctly identified.	Most of items were correctly identified.	Some of the items were correctly identified.	None of the items were correctly identified.
List at least one creative way to reduce or reuse three plastic items from home	Ideas were exceptional and original.	Some ideas showed originality and creativity.	A few ideas showed originality or creativity.	Ideas lacked variety and creativity.

Types of Plastic

There are many types of plastic in common use. Plastics must be sorted by type for recycling since each type has different properties, such as different melting temperatures. The plastic industry has developed an identification system to label the different types of plastic containers. The system divides plastic into seven groups and uses a number code generally found on the bottom of a container.

Plastic #1: Polyethylene Terephthalate (PET or PETE)
Common uses: two-liter soda bottles, water bottles, cooking oil bottles, peanut butter jars. All residential recycling programs accept narrow-neck PET containers.

Plastic #2: High Density Polyethylene (HDPE)
Common uses: detergent bottles, milk and water jugs, grocery bags, yogurt cups. All residential recycling programs accept narrow-neck HDPE containers; #2 bags can be recycled at large grocery stores.

Plastic #3: Polyvinyl Chloride (PVC or V)
Common uses: plastic pipes, outdoor furniture, shrink-wrap, water bottles, liquid detergent containers. Recycling centers rarely take #3 PVC plastic. Look for alternatives whenever possible.

Plastic #4: Low Density Polyethylene (LDPE)
Common uses: dry cleaning bags, produce bags, trash can liners, food storage containers. Many residential recycling programs accept narrow-neck LDPE containers; #4 produce bags can be recycled at large grocery stores.

Plastic #5: Polypropylene (PP)
Common uses: ketchup bottles, aerosol caps, drinking straws, yogurt containers. Recycling centers rarely take #5 PP plastic. Look for alternatives whenever possible.

Plastic #6: Polystyrene (PS)
Common uses: packaging pellets or Styrofoam peanuts, cups, plastic tableware, meat trays, to-go clamshell containers, egg cartons, shipping blocks. Many shipping/packaging stores will accept polystyrene peanuts and other packaging materials for reuse. Cups, meat trays and other containers that have come in contact with food are rarely accepted for recycling. Look for alternatives whenever possible.

Plastic #7: Other
Common uses: three- and five-gallon reusable water bottles, ketchup bottles. This plastic category, as its name "other" implies, is any plastic other than the named #1–#6 plastic types. These containers can be several different types of plastic polymers. Most recycling centers do not take plastic #7. Look for alternatives whenever possible.

Name:_____ Date:_____

Student

Plastics at Home

Describe plastic product	Identify type of plastic (code on bottom)	Can it be recycled where you live? Yes/No	Describe some of the properties of this plastic type (e.g., flexible, rigid, transparent, etc.)

List one or two ideas for how to reduce or reuse three of the containers that cannot be recycled where you live.

1. _____

2. _____

3. _____

Name: _____ Date: _____

DEFINITIONS

Vocabulary:

Petroleum: a substance occurring naturally in the Earth in solid, liquid, or gaseous state that is composed of a complex mixture of hydrocarbons used to make products such as oil, natural gas, plastic, and fuel.

Plastic: a material made from petroleum. It can be molded, extruded, or cast into a desired shape.