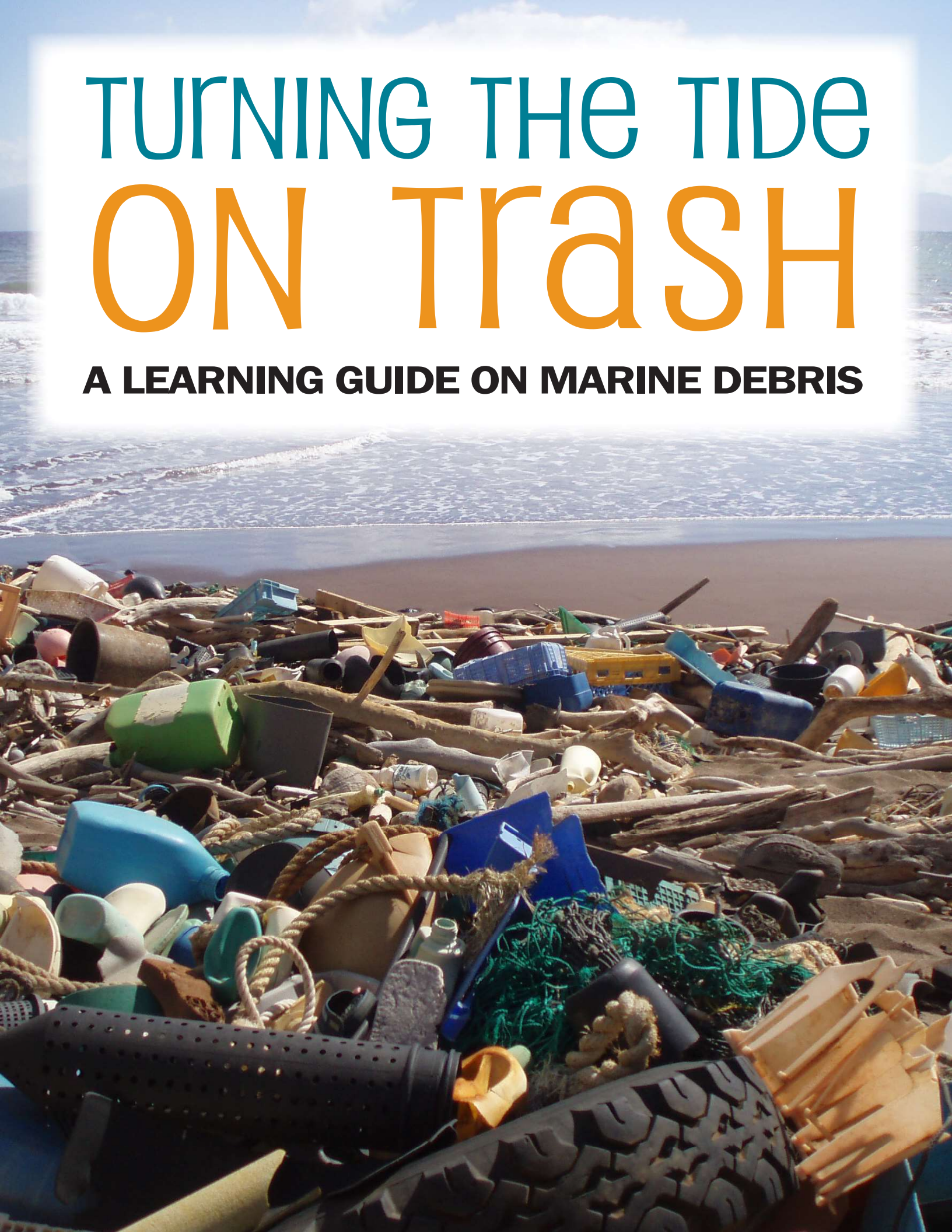
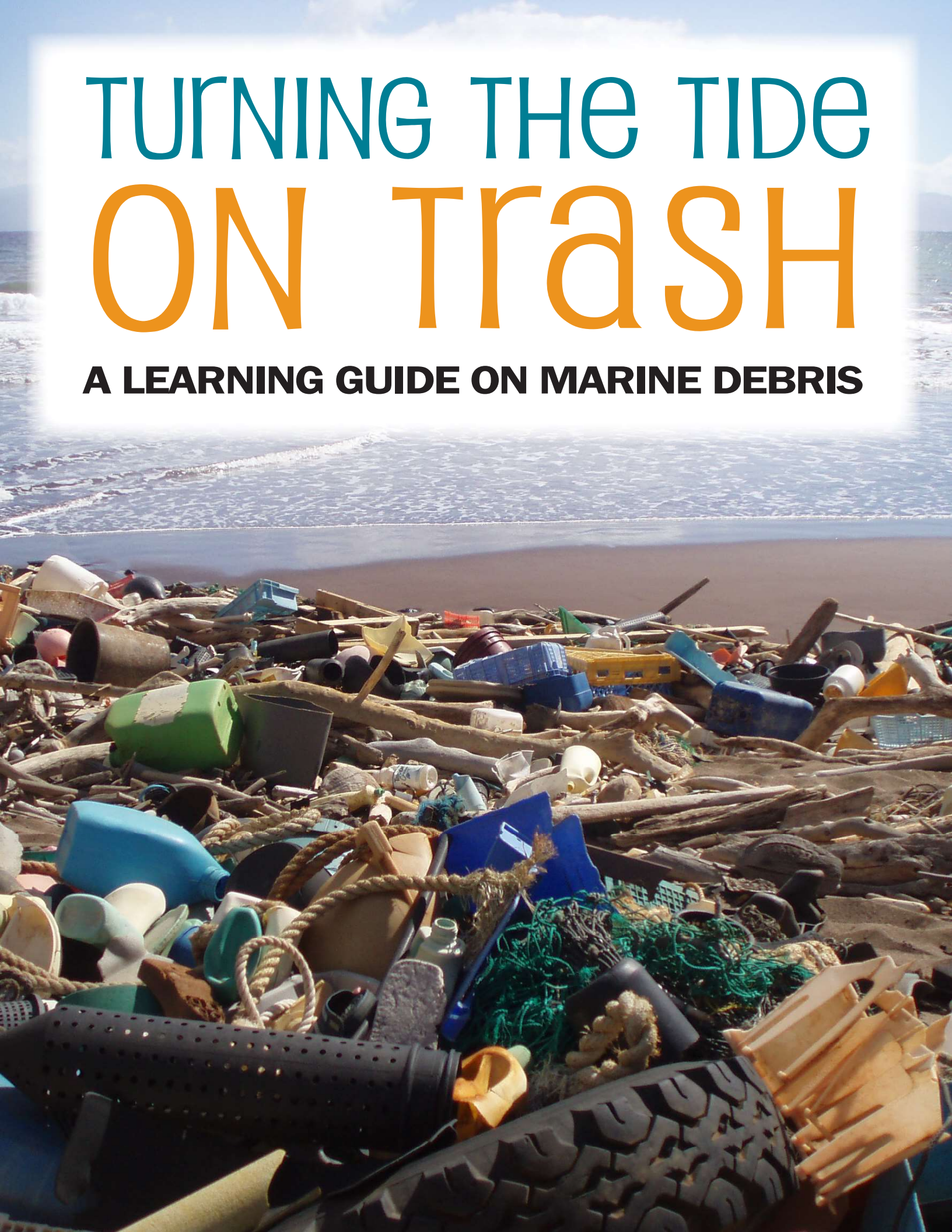


A photograph of a beach heavily littered with marine debris. In the foreground, there is a large pile of trash including a black tire, a blue plastic bottle, a green container, and various pieces of driftwood and plastic. The debris extends across the sandy beach towards the ocean. The background shows the ocean with waves breaking under a blue sky with some clouds. The text 'TURNING THE TIDE ON TRASH' is overlaid on the top half of the image, with 'TURNING THE TIDE' in blue and 'ON TRASH' in orange. Below the title, the subtitle 'A LEARNING GUIDE ON MARINE DEBRIS' is written in black.

TURNING THE TIDE ON TRASH

A LEARNING GUIDE ON MARINE DEBRIS

A photograph of a beach heavily littered with marine debris. In the foreground, there is a large pile of trash including a black tire, a blue plastic bottle, a green container, and various pieces of driftwood and plastic. The debris extends across the middle ground towards the ocean. The background shows the ocean with waves breaking on the shore under a clear sky. The text 'TURNING THE TIDE ON TRASH' is overlaid at the top in large, bold letters, with 'TURNING THE TIDE' in blue and 'ON TRASH' in orange. Below it, the subtitle 'A LEARNING GUIDE ON MARINE DEBRIS' is written in smaller, black, bold letters.

TURNING THE TIDE ON TRASH

A LEARNING GUIDE ON MARINE DEBRIS

TURNING THE TIDE ON TRASH

A LEARNING GUIDE ON MARINE DEBRIS



Educators, parents, students, and researchers can use **Turning the Tide on Trash** as they explore the serious impacts that marine debris can have on wildlife, the environment, our well being, and our economy.

Covering nearly three-quarters of the Earth, the ocean is an extraordinary resource. The ocean supports fishing industries and coastal economies, provides recreational opportunities, and serves as a nurturing home for a multitude of marine plants and wildlife.

Unfortunately, the ocean is currently under considerable pressure. The seeming vastness of the ocean has prompted people to overestimate its ability to safely absorb our wastes. For too long, we have used these waters as a receptacle for our trash and other wastes. Integrating the following lessons and background chapters into your curriculum can help to teach students that they can be an important part of the solution. Many of the lessons can also be modified for science fair projects and other learning extensions.

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DIVE DEEPER: Other Resources on Marine Debris

- NOAA's Marine Debris Program website: www.marinedebris.noaa.gov
- EPA's Marine Debris website: <http://water.epa.gov/type/oceb/marinedebris/index.cfm>

LESSON THREE

A Degrading Experience

Grade Level:

Grades 5 – 8

Subjects:

Language Arts, Science

Overview:

Students perform an experiment to learn how different types of debris degrade and how weather and sunlight affect the rate of degradation.

Objectives:

- To examine the degradation of debris and learn how degradation affects the persistence of debris in the marine environment.
- Students will learn that debris made from natural materials, while biodegradable, can still be considered a pollutant, and can still be harmful to the marine environment.

Vocabulary:

degradable, biodegradable, persistent, photodegradable

Materials:

Assorted pairs of trash items. The following pieces of trash are recommended: two apple cores, two paper bags, two plastic bags, two candy wrappers, two plastic cups, two waxed-paper cups, two drink boxes and straws, two paper egg cartons, two foamed plastic egg cartons, two pages of newspaper, two foamed plastic packing peanuts, two starch packing peanuts, two six-pack rings, two steel soup cans, and two glass bottles.

NOTE: All containers should be empty.

- Two large, shallow, containers (such as large dishpans)
- Two pieces of netting or screening (to cover the containers so that materials do not blow away)
- Two pieces of rope or string
- An outdoor thermometer
- Newspaper
- One copy of the “Degradation Data – Outside” handout for every month of the experiment (This includes a place to write weather observations.)
- One copy of the “Degradation Data – Inside” handout for every month of the experiment

Learning Skills:

Analyzing, Classifying, Collecting Data, Comparing and Contrasting, Experimenting, Hypothesizing, Observing.

Duration:

Two 40-minute periods for discussion, set up, and clean up; five minutes every day (for at least two months) to record weather observations; 10 to 20 minutes every week (for at least two months) to record degradation observations (Note: The longer that the experiment is continued, the more dramatic the evidence that degradation has occurred will be.)

SAFETY PRECAUTIONS

All trash objects should be cleaned and checked by the teacher before being handled by students. Avoid any sharp objects or materials containing harmful chemicals.

LESSON THREE

Activity

1. Explain to students that they will be performing an experiment to learn how trash degrades in the marine environment. Discuss the concept of degradation with students, and explain that some important signs of degradation are changes in shape, color, and size of an item. (Note: The loss of an item's ability to withstand being pulled apart also is an important sign of degradation, but this only should be evaluated at the end of the experiment so that the natural degradation process is not accelerated.)

2. Next, set up the experiment. Fill the containers half way with water. Put one of the pieces from every pair of trash in each container. Cover one container with netting or screening, and secure the covering with the rope or string. Take the covered container outdoors, and place it in an area that receives sun for as much of the day as possible. Keep the other container inside the classroom, and put it in an undisturbed area. (Note: You may want to put signs near the containers that say,

"Science experiment – Do not touch!" Be sure to inform your school's employees about the importance of not disturbing the containers.)

3. Every day, have a different student record the weather conditions in the "Weather Watch" handout. Record the outdoor temperature, the type of cloud cover there is (to determine how much sunlight the experiment is receiving), and whether or not there has been any rain or other precipitation.

4. Every week (for a minimum of two months) have the class observe the changes in the trash items, both in the indoor and the outdoor containers. Have different students fill in the "Degradation Data" handouts every week. (Note: You may want to use a camera to take pictures of the degrading trash on a weekly basis to monitor and display changes as accurately as possible. When taking pictures, place a card with the date on it in the upper right hand corner of the photograph to keep a precise record of when the photograph was taken.)



LESSON THREE

EXTENSIONS

Six-pack rings are now made of photodegradable plastic (plastic that degrades when exposed to sunlight). Conduct an experiment to observe photodegradation. (Note: This experiment should be conducted over at least a three-month period.) Place 12 six-pack rings in an area of the classroom that will not be disturbed. Then, fasten the same number of six-pack rings outside in an area that is usually in the sun and will not be disturbed. Make sure all rings are separated, do not touch one another, and are not blocked from the sun. Every week take a six-pack ring from both locations and compare how they look and how much they stretch when pulled. Discuss the differences.

If your school is near the coast or a body of freshwater, conduct an experiment to see if trash degrades faster in water or on land. Place several trash items in a mesh bag or sack. Take these netted items to a pier, marina, or other site where the mesh bag can be tied onto a fixed object so that it hangs in the water. Make sure the trash cannot escape and that the net is tied securely so that you are not generating marine debris! (Note: If the site privately owned, be sure to check with its owner before proceeding.) Place identical pieces of trash in a plastic net and tie it to a post on land. Make sure the trash is securely fastened. Periodically compare the degradation using the procedure outlined in this lesson.

5. At the end of the experiment, spread newspaper over a large table. Divide the table into two sections and label one side “indoor” and the other “outdoor.” Retrieve both containers and place them on the appropriate sides of the table. Take each pair of trash pieces out of the containers one at a time and compare the visible differences between the “indoor” and “outdoor” pieces of trash. Then have a student try to pull apart the pieces of trash to determine if there is a difference in strength between the “indoor” and “outdoor” pieces. Ask the students the following questions.

- Which pieces of trash have degraded?
- Does whether the piece of trash was indoors or outdoors affect how much it has degraded? How?
- Which types of trash were degradable? Which types were persistent?
- Does the ability of an item to degrade

affect whether it is found in the marine environment? Based on this experiment, hypothesize how degradability affects marine debris.

6. Compare the completed “Weather Watch” and “Degradation Data” handouts. Ask the class the following questions:

- Did the weather seem to affect the rate of degradation? How?
- What weather conditions increase degradation rates?

DIVE DEEPER:

Other Resources on Marine Debris

- NOAA’s Marine Debris website:
www.marinedebris.noaa.gov
- EPA’s Marine Debris site:
<http://water.epa.gov/type/oceb/marinedebris/index.cfm>

HANDOUT

Degradation Data – Outside

Month: _____

Teachers: customize this handout based on the trash items you have in your experiment.

Item	Week 1	Week 2
Apple core		
Bag, paper		
Bag, plastic		
Candy wrapper		
Cup, Styrofoam		
Cup, waxed paper		
Drink box and straw		
Egg carton, paper		
Egg carton, foamed plastic		
Glass bottle		
Newspaper		
Packing peanut, foamed plastic		
Packing peanut, starch		
Six-pack holder		
Steel can		

Weather Watch - Week 1

Date	Temperature	Cloud Cover	Precipitation

Weather Watch - Week 2

Date	Temperature	Cloud Cover	Precipitation

HANDOUT

Degradation Data – Outside

Month: _____

Item	Week 3	Week 4
Apple core		
Bag, paper		
Bag, plastic		
Candy wrapper		
Cup, Styrofoam		
Cup, waxed paper		
Drink box and straw		
Egg carton, paper		
Egg carton, foamed plastic		
Glass bottle		
Newspaper		
Packing peanut, foamed plastic		
Packing peanut, starch		
Six-pack holder		
Steel can		

Weather Watch - Week 3

Date	Temperature	Cloud Cover	Precipitation

Weather Watch - Week 4

Date	Temperature	Cloud Cover	Precipitation

HANDOUT

Degradation Data – Inside

Month: _____

Teachers: customize this handout based on the trash items you have in your experiment.

Item	Week 1	Week 2
Apple core		
Bag, paper		
Bag, plastic		
Candy wrapper		
Cup, Styrofoam		
Cup, waxed paper		
Drink box and straw		
Egg carton, paper		
Egg carton, foamed plastic		
Glass bottle		
Newspaper		
Packing peanut, foamed plastic		
Packing peanut, starch		
Six-pack holder		
Steel can		