

SORT IT OUT! (1.5 HOURS)



In this activity, students will design a procedure for separating five types of recyclable materials based on their physical properties

OVERVIEW

Topic: Sorting Recyclables

Real-World Science Topics:

- An exploration of how to use physical properties to sort materials
- An exploration of how recycling plants sort recyclable materials

Objective

Students will gain an understanding of how physical properties can be used to sort recyclable materials.

Materials Needed

- 12-15 tangram pieces (or something similar) of various colors
- at least 3 clean, empty steel cans (such as soup cans)
- at least 3 clean, empty aluminum cans (such as soda cans)
- at least 3 clean, empty 2-liter plastic bottles
- at least 3 pieces of crumpled paper
- at least 5 glass marbles (must sink in water)
- drinking straw
- 2 large, clear plastic buckets
- water
- strong magnet
- paper or cloth towels to dry wet hands

Teacher Notes

Use your discretion on the best way to conduct this activity based on the individual level of your class. For some of the younger K-1 classes, you may wish to perform some or all of the steps of the activity, encouraging children to make predictions and observations. If the group is older or more advanced in their abilities, students can take a more hands-on role in performing the related tasks. Leveled methodologies for K-1 and 2-3 grade levels are provided, where appropriate, throughout the activity. Use your knowledge of each class to determine what the best option is for your particular group.

Teacher Preparation

Place the cans, plastic bottles, crumpled paper, and glass marbles in one of the large, clear plastic buckets. Fill the second clear plastic bucket up about halfway with water or enough water to cover the aluminum cans, plastic bottles, and marbles when they are added.

Standards Met

NATIONAL SCIENCE STANDARDS ADDRESSED

CONTENT STANDARD A: SCIENCE AS INQUIRY

- Abilities necessary to do scientific inquiry
- Understandings about scientific inquiry

CONTENT STANDARD B: PHYSICAL SCIENCE

- Properties of objects and materials.

NATIONAL TECHNOLOGY STANDARDS ADDRESSED

CREATIVITY AND INNOVATION

Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology. Students:

- use models and simulations to explore complex systems and issues.

COMMUNICATION AND COLLABORATION

Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others. Students:

- contribute to project teams to produce original works or solve problems.

Sources

National Science Teachers Association

<http://books.nap.edu/html/nses/overview.html#content>

National Council of Teachers of Mathematics

<http://standards.nctm.org/document/chapter5/index.html>

National Educational Technology Standards

<http://cnets.iste.org/currstands/cstands-netss.html>

STEPS FOR ***SORT IT OUT!***



- 1. Warm-Up Activity:** Place the group of tangram shapes in front of the students. Ask them how the pile of shapes could be sorted (by color, shape, or size). Explain that they are going to pretend to work in a recycling plant and that their job is to sort the items that are going to be recycled.
- 2.** Show the bucket containing the cans, plastic bottles, crumpled paper, and glass marbles to the students. Explain that most recycling plants receive paper, plastic, metal, and glass recyclables; point out that for this activity you have replaced glass bottles with marbles, because marbles are less likely to break.
- 3.** Explain to the class that some recycling plants receive their recyclables just like they are in the bucket—all mixed up. Tell students that their job is to find a way to separate the materials in the bucket without picking each out by hand. Ask them why handpicking the materials would not be practical. They might say that it would be not be safe to handle garbage, or that it would take a lot of time to sort through all the garbage for a town.

Grades 2-3 Distribute the *Sort It Out!* Student Handout.

- 4. Grades K-1** Have the students examine the materials in the bucket. Ask them what the five types of materials in the bucket are. Write the name of each type of material on the board (glass, paper, plastic, aluminum, and steel). You may need to explain to students that the cans are made from two different types of metal (aluminum and steel). Pass around the cans of each type so they can get a feel for the differences between the two.

Discuss how the items are the same and how they are different. Pass around some of the items and invite the students to make a list of differences in the look and feel of the materials. Point out the tools that are available for you to use in the sorting process: the magnet, the straw, and the bucket of water. Ask student how they think the tools will work with the materials. Write some of the students' descriptions, ideas, and predictions on the board next to the material they describe.

Grades 2-3 Have the students examine the materials in the bucket. Ask them if they can tell you what the five types of materials in the bucket are. Write the names of each type of material on the board (glass, paper, plastic, aluminum, and steel). You may need to explain to students that the cans are made from two different types of metal (aluminum and steel). Pass around the cans of each type so they can get a feel for the differences between the two. Have students record the five types of materials under Question 1 of the Student Handout.

Discuss how the items are the same and how they are different. Pass around some of the items and invite the students to make a list of differences in the look and feel of the materials. Have them record their observations under questions 2 and 3 of the Student Handout. Point out the tools that are available for you to use in the sorting process: the magnet, the straw, and the bucket of water. Ask students how they think the tools will work with the materials. Write some of the students' descriptions, ideas, and predictions on the board next to the material they describe.

5. Remind students that their job is to find a way to separate the materials in the bucket without picking each item out by hand using the tools available (point again to the magnet, the straw, and the bucket of water). Ask the students what they think they should do first. Suggest beginning with the magnet. Have a volunteer use the magnet to try to pick up the items in the bucket. Point out that the steel cans are attracted to the magnet. Explain that the magnet can be used to remove all of the steel cans. Have the volunteer remove all of the steel cans with the magnet. Write, “Step 1. Use a magnet to take out the steel cans.” on the board.

Grades 2-3 Have students write this step down under Question 4 of the Student Handout.

6. Ask the students how they might remove the paper next. Students may come up with some unique solutions for extracting the paper. One of the best ways to separate the paper is simply to blow on it. The paper is generally lighter than the plastic bottles and aluminum cans. Students can use the straw for this. Have a volunteer use the straw to blow the paper. Write “Step 2. Use a straw to take out the paper.” on the board.

Grades 2-3 Have students write this step down under Question 4 of the Student Handout.

7. Ask the students what they think they should do next. If needed, suggest they use the bucket of water to see which items sink and which float. Have a volunteer place the remaining items in the bucket of water. The marbles will quickly sink, while the aluminum cans and bottles will float (because they are full of air). Point out that the sunken marbles can be removed. Invite a volunteer to pull the marbles out of the bucket. Have paper or cloth towels available to dry wet hands and for placement of the wet marbles. Write, “Step 3. Use a bucket of water to take out the marbles.” on the board.

8. The last separation is the most difficult. Plastic and aluminum have similar properties: Neither is magnetic, and both have roughly the same density. This step will likely have the greatest variety of answers. If the students are having trouble, remind them of the Warm-Up Activity. Have a volunteer sort the last items by size or shape. Write, “Step 4. Use size (or shape) to take out the plastic and aluminum.” on the board.

Grades 2-3 Have students write this step down under Question 4 of the Student Handout.

9. **Wrap-Up Activity:** Lead a discussion about the results of the activity. Ask students which materials were the most difficult to separate. Tell them that real recycling plants use some of the same techniques, but they also use high-tech devices students do not have access to. For example, real recycling plants use magnets to sort out the steel cans. On the other hand, newer recycling plants use cameras to recognize plastic bottles. The cameras tell a machine to shoot short gusts of air that blow the plastic bottles into their proper place.

STEPS FOR ***SORT IT OUT!***



Sort It Out! Extension Activities

To extend this activity, discuss which items are recycled at their school (classroom, cafeteria, etc). If possible, take a walk to find the different recycling containers and review the method that a recycling plant could use to sort that type of item.

Why recycle?

Most materials we use today are made using materials like metal (ore), trees, or sand. Taking these materials from the environment and making them into products requires a lot of energy and can hurt the environment. Cutting down trees to make paper can destroy a forest. To get the material needed to make metal, miners may remove entire hillsides. Recycling reduces the amount of energy used to make the products, and it also reduces the damage done to the environment. Some materials used in computers and other electronics might hurt people or animals. It is better to recycle those materials than to put them into the garbage dump.

What types of materials are recycled?

Many materials are recycled. At first, only common materials like paper, steel cans, and plastic were recycled. Some cities have begun recycling yard waste and using it as compost. The latest push is to recycle computers and other electronics.

How are materials sorted for recycling?

Older recycling plants need the person who is throwing an item away to sort it beforehand. This can cost a lot of money. Special trucks are needed to move the sorted garbage. Some people may not want to recycle because they need many different containers to sort the trash in their homes. More modern recycling plants are able to treat all types of items. Steel and iron are removed using magnets. Paper is sorted by spinning the recyclables in a bowl-shaped container. The paper rises to the top and is easily removed. More complicated techniques separate different types of plastics. Special scanners can “see” different types of plastics. The scanners control small bursts of air, which blow the plastics into the appropriate container. These types of scanners can also be used to sort the different colored glass bottles.

Key Vocabulary

recycle: Take something old (or used) and use it to make something new

ANSWER THE FOLLOWING QUESTIONS:

1. What are the main materials used to make the items in the bucket?

[glass, paper, plastic, aluminum, and steel]

2. How are the items in the bucket the same?

[The aluminum and steel cans are similar in size and shape.]

3. How are the items in the bucket different?

[There are many different sizes. Marbles are small, cans are medium sized, and plastic bottles are large. The paper is really light.]

4. Write down the steps used to sort the five materials.

[1. Use a magnet to take out the steel cans.

2. Use a straw to take out the paper.

3. Use a bucket of water to take out the marbles.

4. Use size (or shape) to take out the plastic and aluminum.]

Name:

Date:

ANSWER THE FOLLOWING QUESTIONS:

1. What are the main materials used to make the items in the bucket?

2. How are the items in the bucket the same?

3. How are the items in the bucket different?

4. Write down the steps used to sort the five materials.