

**TEACHING KATE
TEACHING KIDS ABOUT THE ENVIRONMENT**

**WHERE DID IT COME FROM; WHERE SHOULD IT GO?
(RECYCLING)**

Grade Level: 5

Time Required: 7+ class periods

SC Science Standards

This lesson plan was correlated with only the grade level specified unless otherwise noted.

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*Note: This activity serves to introduce the reasoning behind setting up a recycling program.

Purpose

Students will gain an understanding of aluminum as a valuable, recyclable natural resource that they use everyday. They will experience setting up a school-wide recycling program for aluminum cans from the juice and soda machines within the school. They will also learn that recycling aluminum can save energy and reduce the amount of trash going into our land fills.

Skills

Analyzing, application, discussing, inferring, making analogies, observation, ordering and arranging, restructuring, summarizing.

Concepts

All humans consume products and will affect the availability of renewable and non-renewable natural resources. Recycling can help to maintain and extend the productivity of our vital natural resources. Recycling will help to meet the needs of a growing human population, while at the same time provide funds for school related activities, such as field trips.

Materials Needed

aluminum cans	art supplies
poster boards	catalogs
trash bags	trash cans with can crushers
magnets	telephone directories
storage trailers	worksheets
pencils	paper

Definition of Terms

<u>Aluminum</u>	An extremely light weight metal that is stronger than steel.
<u>Bauxite</u>	A mineral which is composed of 45% to 60% aluminum. We get aluminum from this mineral.
<u>Flexible</u>	Very easy to bend.
<u>Landfill</u>	Areas that have been set aside as dumping sites for trash.
<u>Mineral</u>	A naturally occurring inorganic crystalline material found in the earth's crust.
<u>Non-renewable</u>	Substances that cannot be replaced during this geological age.
<u>Recycle</u>	To use old products to make a new product and the use of the new product.
<u>Red Mud</u>	The waste material that is left over after the aluminum has been extracted from bauxite.
<u>Renewable</u>	A naturally occurring raw material that can be replenished.
<u>Rigid</u>	Firm; not easy to bend.

Before the Session

Gather all materials needed for the lesson. Make all necessary plans for getting the resource person. Make copies of the activity pages to be used.

Background Information

Alumina ore is found most readily in a mineral called bauxite. Bauxite consists of 45 to 60 percent alumina. For every ton of alumina extracted from bauxite, there is an almost equal amount of leftover material. This material, called red mud, is collected in large holding ponds. If the red mud were to leak, it would contaminate water supplies, but it is not currently classified as a hazardous waste substance by the Environmental Protection Agency. Researchers are looking for alternative uses for the red mud, such as making it into bricks, kitty litter or ceramics, but so far none have proven to be economically feasible.

Reprocessing (recycling) used aluminum is almost 95% more efficient than processing new aluminum from bauxite.

If people in the United States recycled all the aluminum cans they currently throw away each year, they would save enough energy to power a city the size of Baltimore, Maryland for one year.

Aluminum is used extensively in the construction of cars, airplanes, boats and other vehicles, making them lighter and more fuel efficient.

Though not all in minable locations, aluminum is the third most abundant element in the earth's crust.

Aluminum is used in many products, from siding for houses and trays for T.V. dinners to high-way signs.

Since 1972, the aluminum industry has reduced the amount of aluminum needed to make each aluminum can by almost one third.

Aluminum can be remelted and reformed into new products over and over again without losing its strength.

Suggested Lesson Plan

Day 1

1. Background information will be imparted and a discussion/brainstorming session on the pros and cons of recycling in general will follow. Ideas will be written down on chart paper for future reference.

Day 2

1. Students will be placed in groups of 3 or 4. They will be given an aluminum can to examine and try to answer the following questions:
 - a. which parts of the can are more rigid and which are more flexible?
 - b. how many separate pieces seem to make up the can?
 - c. from what material is it made?
 - d. is it made of more than one material?
 - e. how is the can manufactured?
2. Give a copy of the activity page How Aluminum Cans are Made from *Project Learning Tree* to each group. They will read and discuss the written description of the 6 steps involved in making an aluminum can and match each step to the correct picture.
3. Review the correct sequence with the students. Let them go back to the original 5 questions and make sure that they understand the answers. How many separate pieces make up the can?
(3) Why are some parts more rigid or flexible? (Different thickness of aluminum.)

Day 3-4

1. Inform the students that the previous day's lesson covered the steps in making an aluminum can, but before the can is made the aluminum must first be made. Therefore, today the lesson will involve looking at the process for making aluminum.
2. Give each group a copy of the activity page Aluminum Production from *Project Learning Tree*. Let them take about 15-20 minutes to read and match each step to the correct picture, thus putting the process in the correct sequential order.
3. After the students have figured out the order of the steps involved, let them make a visual presentation of how aluminum cans are made beginning with bauxite in the ground and ending with the finished product. They can use the activity pages for help.
4. Posters can be displayed in the classroom or hall.

Day 5-6

1. Introduce the recycling part of the lesson. Discuss the background information concerning energy efficiency.
2. Visit an aluminum recycling plant if one is accessible from the school. Otherwise, ask a resource person from any nearby recycling plant to visit and give a talk on recycling. Even though the recycled product may be different, the principles are very much alike and the results from recycling would be similar.

3. Let students create posters that will teach others about the need to recycle aluminum cans. They can use previous activity pages, information from charts, class discussion and/or the resource person. Posters should be placed throughout the school, especially in the areas where soda and juice machines are located. The posters will serve as a kick-off to the recycling project.

Day 7+

1. Students will begin to make plans to start a school-wide aluminum can recycling project. Some of the steps involved would include the following:
 - a. get permission from the principal.
 - b. let other teachers know and ask for their support.
 - c. find out the price of the trash cans with can crushers on top, the number of trash cans needed and the total cost for the cans.
 - d. solicit money from the PTA for the purchase of the trash cans.
 - e. use telephone directories to contact various sites which buy cans. Find out the amount they pay per pound, the hours and days of operation and whether or not pick-up services are available.
 - f. make arrangements to have cans stored (an old trailer for hauling cans with would work well) until they can be picked-up or hauled once or twice monthly.
 - g. be sure to have trash cans set up in the areas where all soda and juice machines are located.
 - h. keep a record of the number of pounds and amount of money collected each time. A wall chart or poster board will be posted in the classroom to chart earnings.
 - i. decide as a group/class what the proceeds from the project will be used for. (Must be school related.)

Application

It is important that students understand the controversy concerning landfills. They should be aware that recycling any product can help to alleviate this problem and at the same time save energy. Although aluminum is an abundant mineral, mining for it not only uses energy but also scars the land; by recycling, the need for mined ore is reduced and so is the energy used to ac-

quire it. Less energy is required to recycle used aluminum products into new products than to produce them from newly mined ore. Therefore, recycling helps the environment by reducing energy use, mining of the land and the number of landfills needed.

Extension

1. Have a neighborhood recycling drive once a month.
2. Recruit the aid of local businesses.
3. Expand efforts to include plastic bottles.

Resources Available

Aluminum Recycling: America's Environmental Success Story. The Aluminum Association. Washington, D.C.

Call Me Can. 18 minute video tape may be borrowed from Modern Talking Picture Service, 1-800-243-6877.

Project Learning Tree. 1994. American Forest Foundation, 1111 19th Street N.W., Washington, D.C.

Prepared by: Johnnie Mae Pressley

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HOW ALUMINUM CANS ARE MADE

STUDENT PAGE

HOW ALUMINUM CANS ARE MADE

- 1 Cup Forming**—The process starts with an aluminum coiled sheet which is fed through a press that punches out shallow cups.

- 2 Redrawing & Ironing**—Cups are fed into an ironing press where successive rings redraw and iron the cup and reduce side-wall thickness to get a full length can. The bottom is domed to obtain strength required to withstand internal pressure.

- 3 Trimming**—Cans are spun as a cutting tool trims the rough shell from the inside.

- 4 Necking & Flanging**—Cans are necked in at the top to reduce can diameter and flanged to accept the end.

- 5 Ends are stamped** out of a pre-coated aluminum coiled sheet. Compound is added to assure a perfect seal between can and end at our customer's plant.


- 6 Ends are fed** through a high precision press where rivet making, scoring, and tabbing occur in consecutive operations.

What is the proper sequence for these pictures?

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ALUMINUM PRODUCTION



STUDENT PAGE®

ALUMINUM PRODUCTION

- 1** Most bauxite is mined in open pits called strip mines. Trees and other plants, rocks, and soil are first cleared away. Then the bauxite ore is extracted from the earth and taken to processing plants.

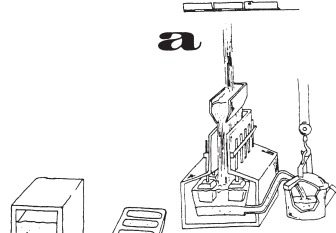
- 2** After crushers mash bauxite ore into small bits, the ore is heated to remove as much water as possible. Then the ore goes to a refinery. At this stage, a waste product called redmud is left behind.

- 3** By going through a series of chemical reactions in a refinery, bauxite is refined into a fine white powder called alumina. The refining process also creates a waste called redmud, which is made of silica, iron oxides, and other impurities from the bauxite ore. Processing bauxite produces high volumes of red mud, for which there is currently no use. Additionally, the mud must be contained to keep it from contaminating water and environmental resources.

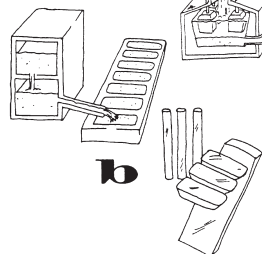
- 4** Smelters, or reduction plants, transform white alumina powder into molten aluminum. First, the powder is dissolved in a hot, liquid salt solution in a large "pot." Then an electrical current flows into the pot, causing aluminum to settle to the bottom where it is removed. This process makes aluminum very energy consumptive.

- 5** Molten aluminum is almost always alloyed (mixed with other metals and elements) to make it stronger. Then it is poured into molds to form ingots. Ingots may be long rods, huge slabs weighing 20 tons (18,144 kg), or small bricks weighing only 4 pounds (1.8 kg).

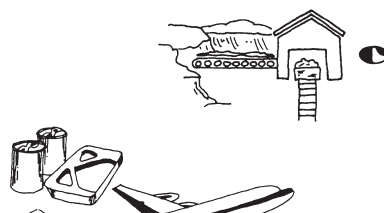
- 6** Ingots are melted and turned into products. Huge slabs of aluminum are usually rolled into sheets of varying thickness for products such as aluminum foil, airplanes, and beverage cans. Smaller ingots of aluminum may be melted and poured into molds, creating tea kettles, automobile parts, and other products.




a



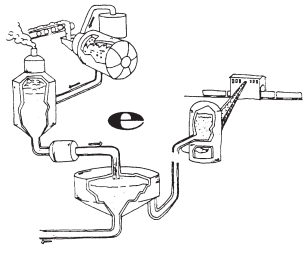
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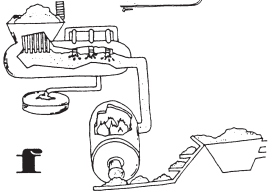
c



d



e



f

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HOW ALUMINUM CANS ARE MADE
TEACHER'S GUIDE

STUDENT PAGE®

Answer Sheet

HOW ALUMINUM CANS ARE MADE

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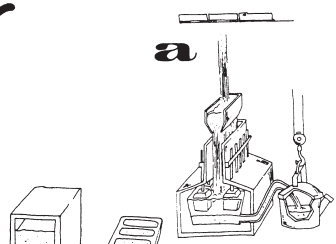
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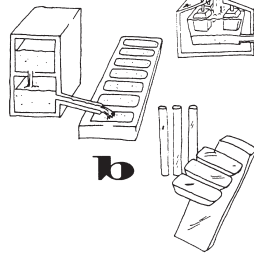
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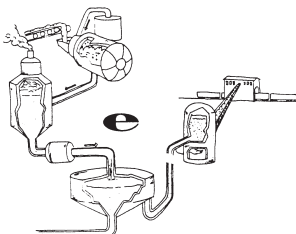
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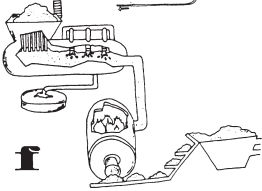
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