



# Lesson: All About Aluminum

**Grade:** 4-5

**Subject:** Science, English  
(extension activity)

**Objectives:**

Students will:

- use magnetism, appearance, and mass to differentiate between aluminum, tinned, and bimetal cans
- complete a math worksheet on the properties of metals
- understand the connection between natural resources used in manufacturing and recycling and the waste associated with each process

**Teaching Time:** 50-60 minutes

**Materials:** for each group of 4 to 5 students: small magnets, samples of aluminum, tinned and bimetal cans (see Background for examples); pan balance, and gram weights; worksheet, (Continued...)

Lesson Concept: South Carolina Department of Health and Environmental Control: *Action for a Cleaner Tomorrow* (1996)



## Background:

Metals have a very high rate of recycling across the nation when compared to other materials. Historically, metals have been conserved and recycled longer than other materials because they generally exist in large quantities such as car bodies and the various types of metals that are easy to identify and separate.

Steel is produced by adding carbon to iron and it is the most widely used and recycled metal today. Recycling Steel saves about 74% of the energy needed in virgin production.

Aluminum makes up 8% of the Earth's crust, the third most common element after oxygen and silicon. The energy saved by making aluminum cans from recycled aluminum is about 95%\*. Not only does recycling conserve natural resources, but also recycling takes these materials out of the waste stream, reducing the amount of trash put into our landfills. (\*Note: Teachers should also be aware that aluminum production uses a vast amount of energy compared to other types of packaging like paper or plastic and while the energy savings from recycling is good, it is still intensive and there are still pollutants created during the recycling process--as with recycling of all types of materials).

In this lesson, students will examine the properties of metal cans that they use every day. There are three general categories of metal cans: aluminum, tinned, and bimetal. Bimetal refers to a can with steel lids enclosing an aluminum body (some tuna cans, small juice cans, tennis ball cans, and many soda cans). Tinned cans are actually 99% steel with a thin coating of tin (soup cans).

## Procedures:

- **Who knows what soda cans are made of?** Most students should answer aluminum. **Does anyone know what is special about aluminum? One special feature is that it is easily recycled. In fact, it can be recycled over and over again just like glass!**
- Today we are going to investigate the different kinds of metals used to make cans. We will record our findings on a table.
- Show the transparency, Metal Mania. Using the transparency, 3 cans (one of each metal-type), a magnet, a pan balance and gram weights, demonstrate how to identify the type of metal used in the can.
- Divide the class into groups of 4 or 5 and distribute the worksheet, "Discovering Metals" to each student. Set up stations in the room so that groups can practice separating cans by (a) using magnets, (b) observing differences in appearance, and (c) weighing.

## Reflection/Response:

- Review findings from procedure as a whole class.
- Have students complete the math problems on Discovering Metals individually.

## Extensions:

- Visit the local recycling center.
- Challenge students to research the process of making aluminum cans and write a report. What raw material is used in making aluminum? Identify the geographic regions where the raw materials come from.

### **Oregon Common Curriculum Goal:**

**Science:** Physical Science: Force and Motion

- Understand fundamental forces, their forms, and their effects on motion

**Mathematics:** Calculations and Estimations

- Demonstrate conceptual meanings for addition, subtraction, multiplication, and division

### **Grade 5 Benchmark:**

- Students will determine whether or not a magnet will attract a certain substance.
- Perform calculations on whole numbers, fractions and decimals using paper, pencils and calculators.

“Discovering Metals” (one per student); worksheet, “Facts about Metal”; transparency, “Metal Mania”

*NOTE: This activity could be done as a whole group demonstration or individualized assignment.*

## Answers to Discovering Metals

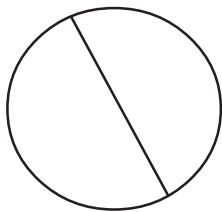
1. A.  $95\% - 74\% = 21\%$   $95\% - 34\% = 61\%$

b.  $61\% + 21\% = 82\%$

2. Aluminum

3.

51%  
Recycled  
Materials



49%  
Virgin  
Materials

4. 156 hours in 6.5 days

$156/26 = 6$  pounds of steel

5. 294 hours of television watching



# Overhead: Metal Mania

<b>Aluminum</b>	<b>Bimetal</b>	<b>Tin (99% Steel)</b>
<p>Not attracted to magnet</p> <p>Bottom does not have a rim and has a finely brushed, polished appearance</p> <p>Body is shiny, silver and smooth with no seams</p> <p>Label is usually spray-painted on, and usually says "all aluminum can"</p> <p>Lightest weight</p>	<p>Body is attracted, but lids are not</p> <p>Bottom has a rim and is not finely brushed or polished</p> <p>May or may not have seams</p> <p>Usually spray painted</p> <p>Heavier weight</p>	<p>Attracted to a magnet</p> <p>Bottom has a rim</p> <p>Body has rings or ribbing, always has a seam</p> <p>Normally has a paper label</p> <p>Heaviest weight</p>





# Worksheet: Facts About Metal

Student Name: \_\_\_\_\_

- **Aluminum is extremely efficient to recycle.** It requires 95% less energy to recycle when compared to the virgin production of aluminum and produces 95% less air and water pollution. However, mining and producing virgin aluminum causes a lot of pollution, thus it is important to use it as wisely as possible.
- **Recycling one ton of aluminum**, is equivalent to not releasing 13 tons of carbon dioxide (a green house gas) into the air. In comparison, recycling one ton of newspaper is equivalent to not releasing 2.5 tons of carbon dioxide into to the air.
- **Aluminum that is recycled** makes it back onto the store shelf as another can in about six weeks. An aluminum beverage can contains an average of 51% recycled material.
- **Compared to the virgin production of steel**, recycling one pound of steel saves enough energy to power a 60 watt light bulb more than 26 hours. Recycling one aluminum can saves enough energy to run a television for 3 hours.
- **Recycling one ton of steel** reduces air pollution by 86% and water pollution by 76% and saves 74% energy and 40% of the water that would have otherwise been used. It also reduces the need for virgin materials by 90%.

**The following resources are used to produce one ton of aluminum:**

8,766 pounds of bauxite	1,020 pounds of petroleum coke	966 pounds of soda ash
327 pounds of pitch	238 pounds of lime	197 million BTUs of energy

**The pollutants created are:**

3,290 pounds of red mud	2,900 pounds of carbon dioxide (a green house gas)
81 pounds of air pollutants	789 pounds of solid wastes

1. a. If recycling paper produces 74% less air pollutants and 35% less water pollutants, what is the difference between each of these and the amount of air and water pollutants that recycling aluminum saves?  
  
b. How many more air and water pollutants does aluminum recycling save when compared to paper recycling? (Hint: add the two differences from the question above to get one total).
2. Recycling which material (aluminum or paper) helps prevent more green house gases?
3. Draw a pie chart to illustrate how much recycled material gets used in making a new beverage can. (Hint: the rest of the pie chart should indicate the amount of virgin aluminum still being used in production).

