HOW THICK ARE THE WALLS OF A SODA CAN?

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DENSITY METHOD

procedure

• Calculate surface area of (cylindrical) can.

• Weigh can.

• Calculate volume of material in can using weight of can and density of aluminum.

• Use surface area and volume calculations to determine thickness.

necessary tools

• Flexible measuring tape

• Accurate scale

• Density of Aluminum – you may want to use a Periodic Table for this

• Soda (or other) can

intended audience

• This project addresses high school geometry standards. The Archimedean Method in particular can be addressed to middle school mathematics students as well.

mathematics involved

Depending on which method is emphasized and used, students will need to know some of the following:

• Surface Area of a Cylinder formula

• Relationship between weight, density and volume

• Relationship between area and volume – e.g. relationship of dimensions used to compute the volume of the hollow cylindrical can using thickness and surface area.

• Archimedean Displacement Principle

• Arithmetic

standards addressed

• G-MG.1 Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).

• G-MG.2 Apply concepts of density based on area and volume I modeling situations (e.g., persons per square mile, BTUs per cubic foot).

ARCHIMEDEAN METHOD

procedure

• Submerge can in water.

• Calculate volume of displaced water.

• Calculate surface area of (cylindrical) can.

• Use surface area and volume calculations to determine thickness.

necessary tools

• Flexible measuring tape

• Large measuring cup accurately calibrated to 5mL

• Water

• Soda (or other) can

How good are the estimates?

• The walls of US soda cans are about 0.0102cm thick.

• Using the Density Method, we got a thickness of 0.0166cm.

• Using the Archimedean Method, we got a thickness of

• How did you do? What further steps could be taken to increase the accuracy of these estimates?

simplifying hypotheses

In order to make this project accessible, several simplifying hypotheses need to be made:

• Assume the walls, top, and bottom of can have uniform thickness.

• Assume the can is actually cylindrical.

• Assume the can is made of pure aluminum if you're applying the Density Method.

related problems

• Using the density of copper and zinc, calculate the relative percentages of copper and zinc in pennies manufactured before and after 1982.

• King Hieron II of Syracuse commissioned a goldsmith to create a crown from a gold ingot. The smith made and delivered a crown to the king who suspected the smith of replacing some of the gold with less valuable silver. The king asked Archimedes to verify his suspicions. How could Archimedes prove the smith's guilt or innocence? (www.illustrativemathematics.org/illustrations/1144)

For problem set up and solution visit www.illustrativemathematics.org/illustrations/1173   For followup questions or comments email nakamaye@math.unm.edu