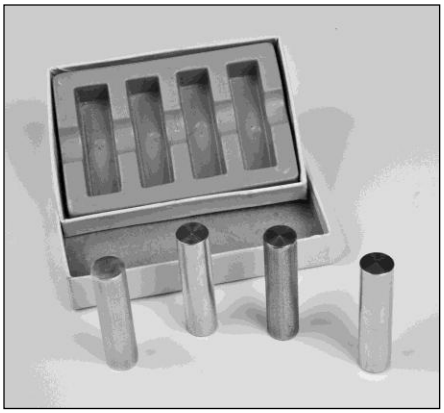
OPERATING INSTRUCTIONS

AND SUGGESTED ACTIVITIES

EQUAL VOLUME METAL CYLINDERS SET



DESCRIPTION

The Equal Volume Metal Cylinders Set consists of four identically-sized cylinders of different metals and a storage box with a fitted compartment for the samples. Each cylinder is approximately 50 mm (2") long and 12.7 mm (1/2") in diameter. The metals are aluminum, brass, copper, and steel.

BACKGROUND

The cylinders are used for measuring and comparing the densities of the four different metals. They can be used in three different ways:

- If students are not expected to calculate the volume of a cylinder, the four specimens can simply be weighed individually. Since the cylinders' volumes are all equal, the ratio of their weights gives the ratio of their densities.
- The weights and dimensions of the cylinders can be measured, the volume calculated, and the densities determined as "weight per unit volume."
- Using a balance with a specific gravity capability, each cylinder can be weighed in air and in water, and the specific gravity calculated from Archimedes' Principle.

SUGGESTED ACTIVITIES

ACTIVITY 1
COMPARISON OF RELATIVE DENSITIES

EQUIPMENT NEEDED

1	Equal Volume Metal Cylinder Set
1	Mechanical or electronic balance capable of measuring to 0.1 g

PROCEDURE

- Set up the balance on a flat, stable surface.
- Weigh each of the cylinders in turn and enter their weights into the table below:

Metal	Weight (grams)
Aluminum	
Brass	
Copper	
Steel	

Which metal sample weighed the most?_____

Which metal sample weighed the least?_____

Which metal do you think is the most dense?_____

Which is the least dense?_____

ACTIVITY 2

CALCULATING THE DENSITIES

EQUIPMENT NEEDED

1 Equal Volume Metal Cylinder Set
1 Mechanical or electronic balance capable of measuring to 0.1 g
1 Vernier caliper

PROCEDURE

- Set up the balance on a flat, stable surface.
- Use the vernier caliper to measure the length *l* of one of the cylinders. Make the measurement several times, average the values and record the average.
- Repeat the length measurement for the other cylinders.
- Use the vernier caliper to measure the diameter *D* of the one of the cylinders in several places. Average the values and record the average.
- Repeat the diameter measurement for the other cylinders.
- Weigh each of the cylinders and record the weights, *W*.
- Calculate the radius *r* for each cylinder ($r = 1/2 \cdot D$)
- Calculate the volume *V* of each cylinder using the formula $V = \pi \cdot r^2 \cdot l$
- Calculate the density *d* of each cylinder using the formula $d = W/V$.