Density Blocks

P1-1010

CONTENTS:

6 metal cubes in storage box. From lightest to heaviest:

- Aluminum
- Zinc
- Iron
- Brass
- Copper
- Lead

INSTRUCTIONS:

Density is the ratio of an object's mass to its volume.

$$Density = \frac{Mass}{Volume}$$

To find an object's density, you must know its mass and its volume. Mass can be measured with a triple-beam or electronic balance. Volume can be found in two ways, by direct measurement or by displacement.

1. **Direct measurement:** These metal cubes make it easy to use this method of finding volume. The cubes have 2cm sides. The volume of the cube is 2cm3, or 8cm3. There is a deviation of each side of 0.03cm on either side of 2.0 cm. If measuring with a metric ruler your density may be lower than normal, the more accurate in measuring the cube, the more accurate your density will be.

2. <u>Displacement:</u> The volume of regular or irregular objects can be found by this method. Add water to a graduated cylinder and record the volume. Place the object in the water and record the new volume. The difference in volume is the volume of the object.

Density has units of mass/volume, such as g/cm^3 or g/mL. Normally, the density of solid objects is measured in g/cm^3. Note: $1mL = 1cm^3$.

Students often confuse density with mass and volume. This equal-volume set can help clarify the differences. Mass is the amount of matter in an object. Heavier objects have more mass. The lead block has more mass, more "stuff", than the aluminum block.

<u>Volume</u> is the amount of space an object occupies. The blocks are all the same size. Their volumes are equal.

Since the lead block has more mass in the same volume, it is more dense. The density of lead is higher than the density of aluminum.

RESULTS:

You can expect some variation from one set to the next. The metal samples used to make the cubes may have small amounts of other elements, and that can affect their densities. This is particularly true of Iron, which can be any of several different types of cast iron.

Typical density values are listed here, along with the standard deviation from a sampling of 16 sets. Standard deviation describes the amount of variation among the different samples. Larger standard deviations indicate more variation. Your deviation may differ.

	Perfect Density (g/cm^3)	Standard Deviation (can be higher based on non-precise cube measurement)
Aluminum (Al)	2.8	0.058
Zinc (Zn)	7.0	0.144
Iron (Fe)	7.9	0.256
Brass (Br)	8.3	0.133
Copper (Cu)	9.1	0.234
Lead (Pb)	11.6	0.366

RELATED PRODUCTS:

Density Rod Set (P1-1020): The aluminum rod floats in cool water and sinks in warm. The PVC rod does the reverse! Use density and thermal expansion to explain this discrepant event.

Triple Beam Balance (02-7500): 610g capacity, accurate to 0.1g.

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