

THE EFFECT OF VOLUME ON THE DENSITY OF A MATERIAL

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Period 96

Mickey Mouse

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I. Introduction:

The purpose of this experiment is to determine if the density of a material is affected by the size of the material. In other words, this experiment was testing if a material with two different values for its volume (e.g. two different objects made from the same material) will also have two different values for its density. It is expected that there the density of the material will not be affected by the material's volume. The independent variable in this experiment is the volume of the material, while the dependent variable is the density of the material. Two important control variables in this experiment are the material and the shape of the test samples.

To perform this experiment, the dimensions of six regular cubic shapes of a certain material will be measured. The measured length, width and thickness dimensions will be multiplied to determine each shape's volume. The shapes' mass will be determined using a triple beam balance and their density will be calculated using the formula $D = M/V$. A graph of the shapes' volume and density will be plotted to visually compare the density and volume to determine if a change in the volume of the material will affect the density.

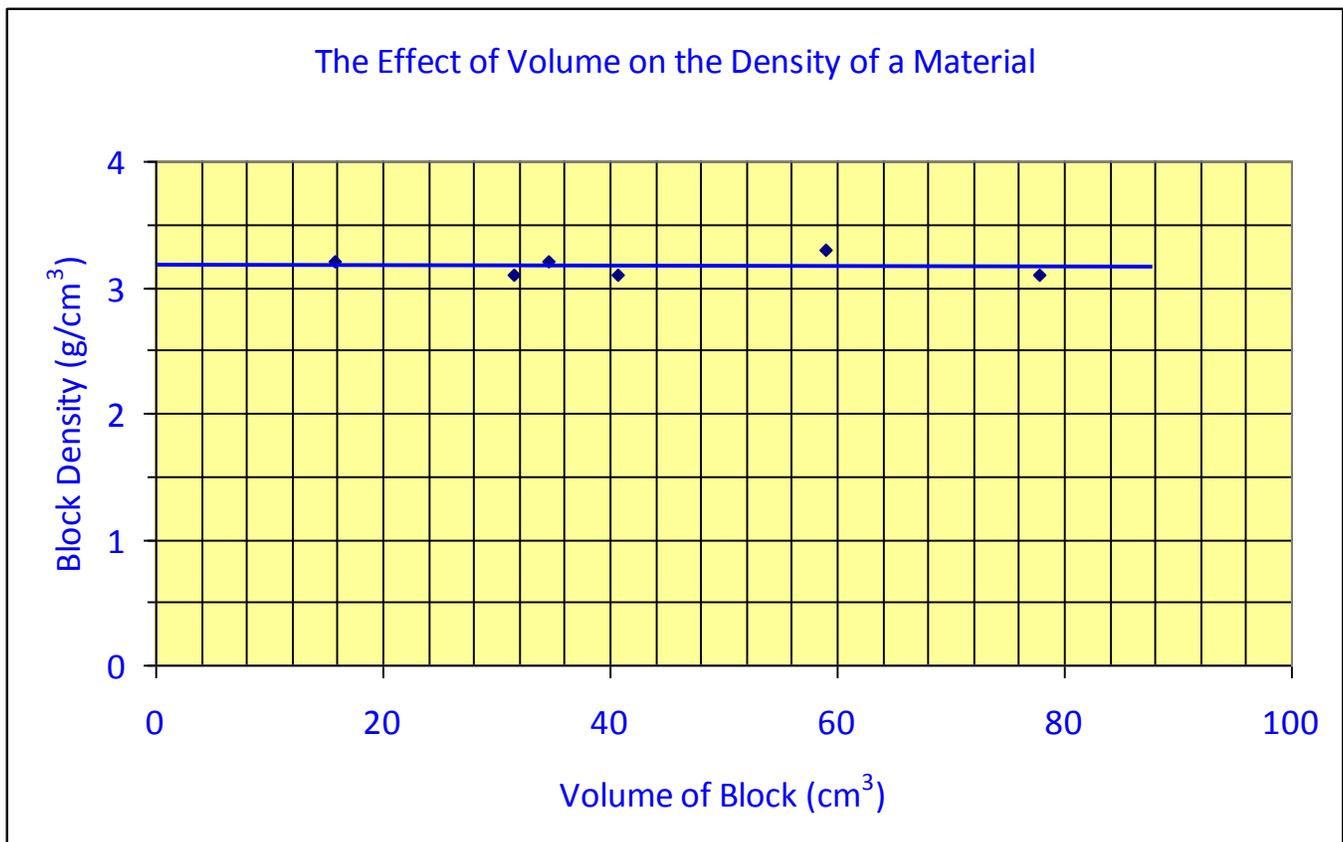
II. Equipment List:

- **6 regular cubes of different sizes but same material**
- **Triple Beam Balance**
- **Metric Ruler**

III Data/Graphs:

Table 1: Measured and Calculated Quantities for Regular Cubic Shapes of the Same Material

Block Code	Mass (g)	Length (cm)	Width (cm)	Thickness (cm)	Volume (cm ³)	Density (g/cm ³)
A	110.56	8.75	3.21	1.23	34.5	3.2
B	98.25	5.56	2.57	2.21	31.6	3.1
C					40.6	3.1
D					15.7	3.2
E					58.9	3.3
F					77.8	3.1



IV. Calculations:

Determining Volume of Block (Block A):

$$V = L \times W \times T$$

$$V = (8.75 \text{ cm}) (3.21 \text{ cm}) (1.23 \text{ cm}) = 34.548 \text{ cm}^3$$

$$V = 34.5 \text{ cm}^3$$

Determining Density of Block (Block A):

$$D = M/V$$

$$D = 110.56 \text{ g} / 34.458 \text{ cm}^3 = 3.208 \text{ g/cm}^3$$

$$D = 3.2 \text{ g/cm}^3$$

IV. Conclusion:

The results of this experiment show that changing the volume of a material does not effect the density of the material. This is clearly evident from the graph as the graph depicts a straight, nearly horizontal, line. This horizontal line indicates that even though the volume of the material can vary, its density remains constant. Also, if two blocks with very different volumes are considered – block A with a volume of 34.5 cm^3 and block F with a volume of 77.8 cm^3 – it can be seen that they had nearly the same densities (3.2 compared to 3.1 g/cm^3). Also all the values of density hovered around these same values regardless of the volume of the individual block strongly suggesting that the density of a material is not affected by the size of the material.

Although a high degree of confidence can be placed on these results due to the extreme difference in volumes having nearly no effect on the densities; this lab was not without its errors. The most likely cause of error in this lab was that it was assumed that the blocks were regular shaped. In assuming this, the volume equation $V = L \cdot W \cdot T$ was used. However, if the blocks shapes were even slightly irregular, maybe due to slanted surfaces or unevenly cut edges – which was apparent – then using this formula may give a slight error in the calculated volume of the shape. Also there was a little difficulty in lining up and holding in place the edge of the block with the

ruler. This difficulty would provide a slight uncertainty in the shape dimensions and would also result in an error in the shapes volume value. Also, any error in these volume values would directly result in errors with the density values as one is used to determine the other. None of these errors, however, are sufficient enough to lose any confidence in the conclusion of this experiment.