

## Determining the Density of Solids

### Background Information

Density is a physical property of a substance that is often useful in identifying the substance. This is because the density of a substance always remains the same at a given temperature and pressure. Density may be thought of as how heavy an object is for its size, or the ratio of an object's mass to its volume.

In this investigation you will determine the density of several solid objects by measuring their mass and volume and then using the formula  $D = M/V$ . Since you have had practice finding mass, volume, and density in previous laboratory investigations, a minimum of directions will be given.

### Problem

How can the density of a solid object be determined?

### Materials (per group)

Triple-beam balance	Metric ruler	Steel sphere
Graduated cylinder	Unweighted wood cube	Rock
Overflow can	Metal cube	Wood object (cylinder, pyramid, etc.)

### Procedure

1. Find the mass and volume of the wood cube using the appropriate measuring instruments. Record the values in the Data Table. Calculate the density and record.
2. Repeat step 1 to find the density of the wood object, the metal cube, the steel sphere, and the rock. Record all information in the Data Table.

### Observations

DATA TABLE

Mass (g)	Volume (cm <sup>3</sup> or mL)	Density (g/cm <sup>3</sup> or g/mL)
Wood cube		
Wood object		
Metal cube		
Steel sphere		
Rock		

## Conclusions

1. How do the densities of the wood cube and the other wood object compare?  
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2. Assuming that the wood cube and the other wood object are made of the same type of wood, what can you conclude about the effect of a substance on the density of an object made from that substance? \_\_\_\_\_  
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3. How do the densities of the wood cube and the metal cube compare?  
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4. Based on your answer to question 3, what can you conclude about the effect of the shape of an object on its density? \_\_\_\_\_  
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5. How do the densities of the metal cube and the steel ball compare?  
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6. Based on your answer to question 5, are the metal cube and the steel ball made of the same metal? Explain. \_\_\_\_\_  
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7. Based on your data, what can you conclude is true of the density of an object that floats in water? \_\_\_\_\_  
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Name \_\_\_\_\_ Class \_\_\_\_\_ Date \_\_\_\_\_

**Critical Thinking and Application**

1. Since heating usually causes expansion, what effect would heating a substance probably have on its density? \_\_\_\_\_  
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2. How could you use the same method that was used in this investigation to find the density of an irregular solid that dissolves in water, such as a lump of sugar.  
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3. If you were asked to calculate the density of a penny, you might have difficulty because the small amount of water displaced by one penny might not be measurable. How would you go about calculating the density of a penny?  
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**Going Further**

Design an experiment to find out if a 25-cent coin has more silver or copper in it. The density of copper is  $8.9 \text{ g/cm}^3$  and the density of silver is  $10.5 \text{ g/cm}^3$ . Perform the experiment and compare your results with those of your classmates.