

Density

Objective: Determine the density of a variety of solids and liquids by measuring mass and volume.

Part One: Density of liquids. To determine the density of a liquid you will need to know the mass and the volume of a specific quantity of liquid. You can then use the formula $\text{density} = \text{mass} / \text{volume}$ to calculate the density of the liquid. You will need to determine the mass of a clean, empty graduated cylinder. Add liquid. Read the volume of the liquid on the scale printed on the graduated cylinder.

Measure mass in grams and volume in milliliters.

Determine the density of all of the following liquids that are available:

Water, oil, isopropyl alcohol, honey, corn syrup

Record all of your data. Create a table to summarize your results.

Create an interesting column of layered liquids pour a visible amount of honey or syrup into a 100 mL graduated cylinder. Add about 10 to 20 mL of oil. Add 10 to 20 mL of water. Finally add 10-20 mL of isopropyl alcohol. You may wish to add food coloring to the water and to the isopropyl alcohol. When your column is finished you may wish to take a photograph of the result (photo is optional).

Answer these questions:

1. Which liquid is the densest? Which liquid is the least dense?
2. What properties of the liquids, other than density, make it possible to create the layered column of liquids?
3. Why is it necessary to determine the mass of the empty graduated cylinder?
4. To what degree of precision is it possible to determine mass and volume in this laboratory?

Part Two: Density of solids. To determine the density of a solid you will first determine its mass using the balance. The metal slug can be placed directly on the balance. To determine the volume of the slug gently place it into water and measure the change in the level of the water. For this technique to work the solid must not dissolve in water. It must also be completely submerged. Because the solid has a regular geometric shape its volume will also be determined using the formula $\pi \cdot (d/2)^2 \cdot h$. Linear dimensions will be measured with calipers.

We will determine the mass of four different numbered metals or metal alloys: steel, brass, copper and aluminum. You need to determine the correct metal for each numbered sample.

Caution! Slide the metal pieces carefully into the cylinders. If you drop them the cylinder will break on the bottom.

Record all your data. Create a table to summarize your results. Use the Internet to find the densities of these metals and cite your source then determine the identities of your metal samples.

Answer these questions:

1. Which of the metals has the lowest density?
2. Which of the metals has the highest density?
3. Which technique for determining volume seems to give the best results? Explain.
4. What is an alloy?

5. Who is Archimedes and how did he measure the density of gold?