

# Chemistry 5A

## Experiment 3

### Introduction to Density

#### Introduction

The purpose of this experiment is to understand the meaning and significance of the density of a substance. Density is a basic physical property of a homogeneous substance; it is an intensive property, which means it depends only on the substance's composition and does not vary with size or amount. The determination of density is a nondestructive physical process for distinguishing one substance from another. Density is the ratio of a substance's mass to its total volume:

$$d = \frac{m}{V} = \frac{\text{mass}}{\text{volume}}$$

In the metric system the unit of density has a liquid or solid as measured in grams, or grams<sup>3</sup>. The unit volume used with solids is conventionally equal to mL, volume unit used with liquids. That is, 1 mL = 1 cm<sup>3</sup>. In this experiment you will determine the density of several liquids and compare the physical properties of these liquids.

Which is heavier, a pound of aluminum or a pound of lead? The answer, of course, is neither, but many people consider the words "heavy" and "dense" "heavy" refers to mass only. Density is the mass of a substance contained in a unit of volume. Lead is a very dense metal and contains a large quantity of matter in a small volume, while aluminum, being much less dense, contains a smaller quantity of matter in the same volume.

The volume of 200 grams of lead is 1.77 mL. The mass of lead contained in each mL is its density.

$$\text{Density of lead} = \frac{200\text{g}}{1.77\text{ mL}} = \frac{200\text{g}}{1.77\text{ mL}} = 113\text{g/cm}^3$$

The volume of 200 g of aluminum is 7.41 mL.

$$\text{Density of aluminum} = \frac{200\text{g}}{7.41\text{ mL}} = 27\text{g/cm}^3$$

From the definition of the gram and the milliliter, we can say that one mL of water at 4 °C would have a mass of exactly one gram. The density of water, then, is one gram, or 1 g<sup>3</sup>, since the volume occupied by one gram of water varies slightly with temperature; the density also varies slightly with changes in temperature.

The mass of any object is determined by comparing its mass with the mass of known object or objects (i.e., it is weighed). The volume of a liquid is measured using a graduated cylinder, a pipet, or some other

# Chemistry 51 Experiment 3 Introduction To Density

**Terry C. Jones**



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