I. Objective

1. Estimate densities of common materials based on measurements of mass and volume.

II. Introduction

Density is defined and the amount of mass per unit volume. Note that since water's nominal density is 1.0 g /cm^3 , 1000 g (1 kg) occupies a space of 10 cm^3, which is exactly the definition of a liter. So for water, density can be expressed equivalently in terms of: 1.0 g/cm^3 or 1.0 g/mL. Anything that floats on water has a density less than water or < 1.0 g/cm^3. We can use a scale to measure mass but determining the volume of irregularly shaped objects is tricky. One relatively simple way to find the volume of small objects is to measure the fluid displaced by that object. This can be difficult for objects that displace less than a few milliliters of water but can usually be done quantitatively with a series of small graduated cylinders.

III. Materials

Electronic scale, assorted small graduated cylinders: 50, 100, 250 mL, objects to measure

IV. Prelab Definitions

1. density

2. displacement

3. gram

4. kilogram

5. liter

6. milliliter

V. Lab Procedure

1. Without making any measurements, rank the following from heaviest to lightest:

Table 1: Density Ranking								
Material	water	wood	plastic	glass	iron	aluminum	granite	basalt
Rank								

2. Devise a procedure for calculating density and proceed to find the density of the following objects.

3. The procedure for liquids might need an extra step. Explain why.

4. Now follow your procedure for all the objects in your bag by measuring mass and volume and calculating the resulting density.

Table 2: Density Data								
Material	water	wood	plastic	glass	iron	aluminum	granite	basalt
mass in gm								
volume in mL								
density in gm/mL								

Table 3: Density data								
Material	ice	leaf	feldspar	pumice	quartz	paper clip	paper	anything
mass (g)								
volume (mL)								
density (g/mL)								

VI. Lab Discussion

1. Which objects' density were the most challenging to determine? Explain why.

2. How would you determine the density of very large objects, like a tree or car?

3. How does temperature affect density?

4. Will temperature affect the density of a liquid, metal, rock or piece of wood in the same way? Explain why or why not.

Lab courtesy of Dr. Jim Washburne