

Introduction

Which is heavier: a kilogram of feathers or a kilogram of lead? Once you think about it, the answer is obvious. But this question points out an important difference between feathers and lead. Equal masses of these two substances have very different volumes.

Materials

- ▶ balance
- ▶ 100 mL graduated cylinder
- ▶ various objects

Method

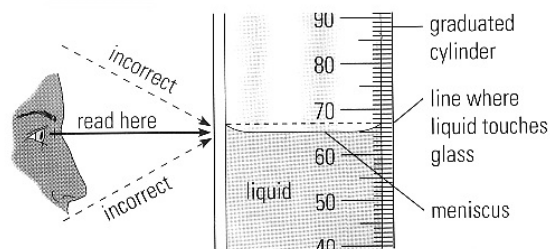
1. In your notebook, draw a data table like the one below. In the first column list the # of the object (1,2,3,...).

Object (#)	Description of Object	Mass (g)	Volume of Water (mL)	Volume of Water & Object (mL)	Volume of Object (cm ³)	Mass ÷ Volume (g/cm ³)
1						
2						

decimal places needed 1 dec. place 1 dec. place 1 dec. place 1 dec. place 1 dec. place

2. Retrieve an object from the teacher. Write a brief description of the object (ie odour, texture, ...).
3. Use a balance to measure the mass of the object.
 - (a) Record the mass of the object in your data table.
4. Pour approximately 40 mL of water into the graduated cylinder. Record the volume of water used.
5. Tilt the graduated cylinder slightly and gently slide the object into it. Return the cylinder to an upright position. If necessary, hold the object beneath the surface of the water with the tip of a pencil. Read the new volume.
 - (b) Record the combined volume of the water and the object in your data table.
 - (c) Calculate the volume of the object, and record the volume in your data table. This method of calculating the volume of an object is known as the "water displacement technique". (Hint: 1.0 mL = 1.0 cm³)

NOTE: For an accurate reading, be sure to have your eye at the same level as the top of the liquid. The upper surface curves downward where it touches the side of the container; this curved surface is called the meniscus. Read the volume at the lowest part of the meniscus.



6. Dry the object and then return it.
7. Repeat steps 2 to 6 for the remaining objects.
 - (d) Record your results in your data table.
8. Calculate the mass-to-volume ratio of each object by dividing the mass (g) of the object by the volume (cm³) of the object (i.e. $D = m/V$). This relationship is called density.
 - (e) Record the results of your calculations in the data table.

Analysis

- {5} 1. What are 2 sources of error in this lab? How did they affect your results? What could you do to eliminate these errors if you were to do the lab again?
- {2} 2. What do you notice about the densities of those objects that float compared to those that sink? Recall that the density of water is 1.0 g/cm³?
- {2} 3. Which objects, if any, do you think are made of the same material? Explain your reasoning.?
- {2} 4. In terms of the relationship between mass, volume and density, explain the difference between 1.0 kg of feathers and 1.0 kg of lead.?
- {4} 5. When rocks from the Moon were brought back to Earth by the Apollo astronauts, they were carefully analysed and stored. Suppose you are shown a rock that someone claims came from the Moon. You can't do chemical tests on the rock, in case it really is a valuable Moon rock. Explain how might you go about testing whether the rock came from the Moon?

INSTRUCTIONS

This is a formal report (QHMMOCA). I will be marking your lab mainly for (a) completeness and (b) form. But I will also be looking at the correctness of your answers as well as your grammar and spelling.