Lab 2: Mass, Volume, and Density

1. Your instructor will show you two objects that have the same size and shape and will give you a chance to feel that one is heavier than the other. You will observe what happens when the instructor drops the lighter object into a graduated cylinder containing water.

   (a) Describe what happens when the instructor drops the lighter object into the water.

   (b) After observing the instructor's demonstration, *imagine* that the heavier object is put into another graduated cylinder containing water. *Predict* how much the water level will increase compared to the lighter object. Explain your reasoning.

   (c) Describe what actually happens when the instructor puts the heavier object into the water. Explain.

   (d) Does each *gram* of a submerged object displace a *gram* of water? What evidence do you have?

   (e) Could we measure the *mass* of a submerged object by the water displacement method? Explain.

2. Fill a graduated cylinder to the 35 milliliter (mL) mark. Drop in seven of the plastic 1 cm cubes (make sure they are fully submerged).

   (a) How much does the water level rise (in mL)?

   (b) Is 1 mL *bigger than*, *smaller than*, or *equal to* 1 cm^3? Explain. Select One

3. Construct an object of any size or shape from 12 of the plastic cubes. Use the digital scale to find the mass of this object and find the volume by multiplying 1 cm^3 by the number of cubes. Also find the mass/volume ratio by dividing the mass by the volume. Now do the same for four more objects with the different numbers of cubes and record your findings in the following table. Also do this for a single cube.

# of cubes in piece	Mass (gram)	Volume (cm^3)	Ratio of mass/volume
12			
1			

(a) Are there any pieces for which the mass/volume ratio that you obtained is the same as the mass/volume ratio that you obtained for your object made of 12 pieces?

(b) Note that the mass/volume ratio in the last column should be approximately the same number for each row. Give an interpretation of the meaning of this number, i.e. what does it tell you about the object to which it applies? (The name for this ratio is *density*, but this does not explain the meaning of it.)

4. You have a set of 2 cubes and 2 cylinders on your table. Measure the mass and volume of each of the objects and use that to determine the density of each. Enter your data into the following table:

Object	Mass (gram)	Volume (cm^3)	Density g/cm^3
Cube # 1			
Cube #2			
Cylinder #1			
Cylinder #2			

(a) Describe 2 different ways to measure the volume of these objects. Which method do you think is more accurate? Why?

(b) Do any of the objects have approximately the same density? What other similarities do you see between these objects?

(c) Some properties of matter are specific to a given object while other properties (know as *characteristic properties* are the same for any object made of a particular material. Explain why or why not each of the following is a characteristic property.

Mass

Volume

Density

5. In the following table are the densities of various materials, some that float in water and some that sink.

Substance	Density g/cm^3
Gold	19.3
Lead	11.3
Aluminum	2.7
Glass	2.5-5.9
Ice	0.92
Wax	0.9
Oak wood	0.6-0.9
Bamboo	0.3-0.4

(a) If the density of water is 1.00 g/cm^3, what can you say about the densities of objects that float or sink compared to the density of water?

(b) Now consider a can of soda. Soda cans have an irregular shape that makes it difficult to directly measure its volume. How could you determine its volume?

(c) To save time, your instructor will find the mass and volume of two unopened cans of soda, one Coke and the other Diet Coke. Record the mass, volume, and density of each below.

(d) *Predict* if each will float or sink.

(e) Your instructor will now put both cans in water. Were your predictions correct?