

Background:

The density of a substance is the mass of the substance divided by the volume it occupies

$$\text{Density} = \frac{\text{mass}}{\text{volume}}$$

Mass is defined as the amount of matter in a substance. Volume is defined as the amount of three-dimensional space occupied by a substance. Density is an intensive property. An intensive property is defined as a physical property of matter that does not depend on the sample size. In other words, breaking a sample of a pure substance into smaller pieces does not affect the density of the individual pieces. For example the density of water is 1.00 g/ml. Whether you have a drop, a glass, or a bucket of water, its density is always 1.00 g/ml. Intensive properties can be used to identify a substance. Can you list any other physical properties that you think are intensive? _____

Density of a liquid is often reported along with the temperature at which it was measured since the density of a liquid will vary with temperature.

Procedure:

- 1) To find the density of a **block or cube**, obtain the mass using a balance and the volume by using a ruler and an equation. Measure each side in centimeters and use the following formula to calculate the volume:

$$\text{Volume} = (\text{length}) \times (\text{width}) \times (\text{height})$$

- 2) To find the density of an **irregular solid**, obtain the mass by using a balance and find the volume by a method called "water displacement." Obtain a medium-sized plastic graduated cylinder (50-100 mL) and half-fill with water. Note the volume by reading at the meniscus and record this volume in the data table. Carefully tilt the graduate and allow the irregular object to slowly slide down into the water. Read the new volume at the meniscus and record it in the data table. The change in volume is due to the volume of the solid. Record the volume of the solid.
- 3) To find the density of a **liquid** obtain a 10-mL wide-mouthed glass graduated cylinder and mass on a balance. Record this in the data table. Transfer 5 mL of substance into a small beaker. Stand the massed graduate onto the lab bench and then transfer the substance from the beaker directly into the graduate being careful not to spill it down the outside of the graduate. Now mass the graduate and its contents and record the mass in the data table. Obtain the volume of the substance by reading at the meniscus.

Data: Record your data in the separate data table sheet.

Calculations: Show all work and units! Use the reverse side if necessary.

Mini-Labs: Practicing Density (Make up Lab)

Lab A: Density of Regular Objects (INCLUDE UNITS!!!)

	Foam Block	Wood block	Mystery Box
Mass (g)	0.50	4.3	
Length of Side (cm)	5.10	4.80	
Length of Side (cm)	2.78	1.69	
Length of Side (cm)	1.3	0.90	
Volume cm^3			
Density g/cm^3			

Lab B: Density of Irregular Objects (INCLUDE UNITS!!!)

	Marble	Metal Screw	Penny (4) 1
Mass (g)	5.2	4.4	(9.9) 2.5
Starting Volume of Cylinder (mL)	21.0	22.9	23.9
Final Volume of Cylinder (mL)	22.9	23.8	24.1 (25.0)
VOLUME of OBJECT			
Density			

Lab C: Density of Liquids (DO NOT DUMP OUT ANY OF THE LIQUIDS!!!) (UNITS!)

	Sample #1 Oil	#2 Salt Water	#3 Red Mystery
Mass of Empty Cylinder (g)	26.7	27.1	27.3
Mass of Cylinder with Liquid (g)	29.2	34.6	32.3
Mass of Liquid ONLY (g)			
Volume of Liquid (mL)	2.65	6.82	5.20
Density (g/mL)			

Analysis: Answer the following questions.

- Which substance had the greatest density? _____ Lowest Density? _____
- List ALL the substances that would FLOAT on Liquid Sample 3: _____

- List ALL the substances that would SINK in Liquid Sample 1: _____

- Which method would you use to find the volume of a chewed piece of gum? _____