

# General chemistry

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# Objectifs

It aims to know and determine the density of liquid substances and the density of solid of indefinite shape and the student's ability to distinguishing between them.

The density of an object can be determined by a variety of methods. In this experiment you will practice using a balance to measure mass. In addition, you will learn how to measure volume using a graduated cylinder and a pipette and learn how to calibrate the pipette.

# I Density

## 1. Introduction

-**The volumic mass** of a liquid or solid is a physical property which characterizes the mass of a material per unit of volume. It is generally denoted by the Greek letters  $\rho$  (rho) or  $\mu$  (mu) and is determined by the relationship:  $\rho = m / V$

The unit of measurement for  $\rho$  depends on the units chosen for the mass of the homogeneous substance (m) and its volume (V). In the international system  $\rho$  is in  $\text{kg/m}^3$ , but  $\text{g/cm}^3$  (or  $\text{g/mL}$ ) and  $\text{kg/L}$  are commonly used.<sup>1\*</sup>

-**The density** of a material is, for solids and liquids, the ratio of the density of this material to that of water. For gases, density is calculated in relation to the density of air. In both cases, the density is necessarily a dimensionless number.

The density of a liquid is a measure of how heavy it is for the amount measured. If you weigh equal amounts or volumes of two different liquids, the liquid that weighs more is more dense. If a liquid that is less dense than water is gently added to the surface of the water, it will float on the water.<sup>2\*</sup>



## 2. Different methods are used to find volume of solid

In this experiment you will become familiar with how mass and volume measurements are carried out and how an evaluation of the measurements is reflected in the number of significant figures recorded. These mass and volume measurements will then be used to determine the density of (a) a metal bar (b) a salt solution by two different methods.

The density of an object can be determined by a variety of methods. In this experiment you will practice using a balance to measure mass. In addition, you will learn how to measure volume using a graduated cylinder and a pipette and learn how to calibrate the pipette.

# II Different methods are used to find volume of solid. Each method has its own degree of precision

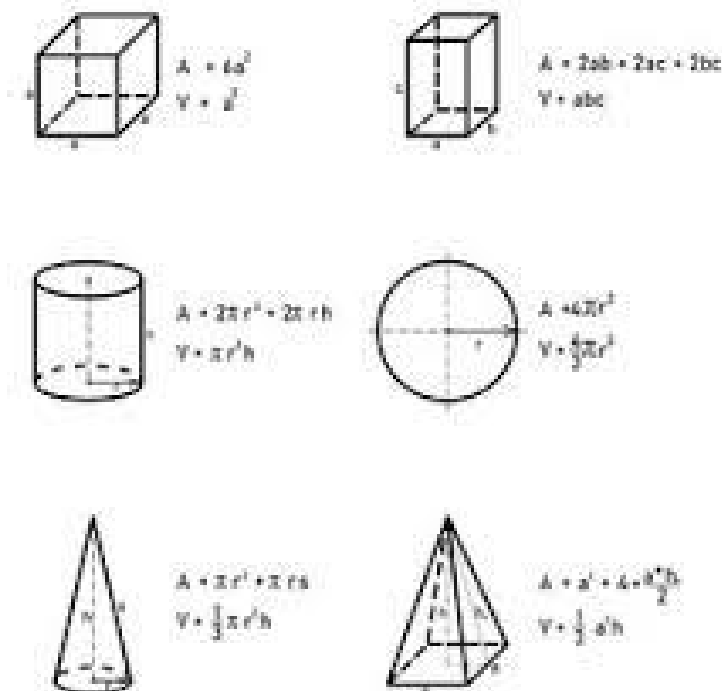
## Introduction

The density of a substance can be used to identify a liquid or solid because density is an intensive property. Intensive properties are properties that do not depend on the quantity of the substance. For example, gold, which is relatively dense, can be separated from sand, silt, and rock by panning for it in a stream because of its greater density. Density is the ratio of the mass of a substance to its volume.

Density = Mass / Volume

The units of density are normally expressed as g/mL or g/cm<sup>3</sup>. (A mL and a cm<sup>3</sup> are different expressions of the same unit, 1 mL = 1 cm<sup>3</sup>). [1][1]\*

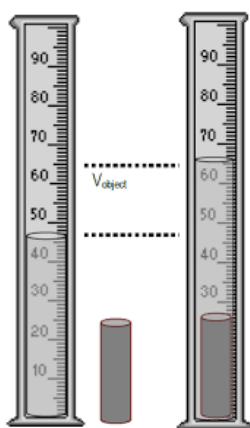
### 1.1- volume by geometry :



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## 2. 2- Volume by water displacement:

For less defined shapes, volume can be determined by water displacement. Volumes of liquids such as water can be readily measured in a graduated cylinder. To use the water displacement method, an object (in this case, a small metal cylinder) is inserted into a graduated cylinder partially filled with water. The object's volume occupies space, displacing liquid and raising the water level. The difference between the two volumes, before and after the object was inserted, is the object's volume. To find the volume, it is necessary to determine the displacement of water, i.e., the difference between the volume of water with the unknown solid and the volume of water present initially in the graduated cylinder (in the manipulations above, this volume was 50 mL).  $V_{\text{solid}} = V_{\text{real+solid}} - V_{\text{real}}$  represents the volume of the solid (mL).  $V_{\text{real+solid}}$  represent the volume of water and solid (mL).  $V_{\text{real}}$  represents the volume of water placed in the graduated cylinder initially (mL). Finally, the density value can make it possible either to identify an unknown substance or, if the substance is known, to check the quality of the manipulations.



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### **Remarque :**

#### SAFETY PRECAUTIONS

Take special care in inserting the bar into the graduated cylinder. **Donot drip it in! The glass cylinder may break.**

Pipetting should always be done using a suction device. **Never suction by mouth.**

# III Practical work

## MATERIALS

50 mL beaker

25 mL pipette

25mL graduated cylinder Suction Device

Balance Metal Ruler

## CHEMICALS

Distilled water

Salt Solution

## 1. I. Density of water and a salt solution :

Check the mass of the samples using the electronic balance.

### 1.1. I. Method I: Pipette

Use the 50mL beaker for determining the mass of water.- Tare the scale- With a clean 20 or 25ml volume tripped piped the solution into the beaker and reweigh. Calculate the density of water and the salt solution

### 1.2. I. Method 2: Graduated Cylinder- :

Determine the mass of a graduated cylinder and pour in a volume  $V_1$  mL of water.- Weigh mass of the assembly (graduated cylinder and water). Calculate the density of the sample

## 2. II. Density of A Metal

different methods are used to find volume of metal

### 2.1. II. Method I : Graduated Cylinder

1. Insert the metal into a graduated cylinder with enough water so that the metal is immersed. Note and record as precisely as possible the initial water level, and the water level after the metal is immersed. Read the lowest point of the meniscus in determining the water level and estimate the volume to one digit beyond the smallest scale division.
2. Discard the water and repeat this measurement twice with a different initial volume of water.
3. Calculate the density of the metal.



a) II. Method II: Ruler :

1. Measure the dimensions of the metal bar with a measuring stick ruled in centimeters and record the measured values. 2. Calculate the volume of the bar from these dimensions. Note that the bar is cylindrical in shape, therefore, the formula for the volume of a cylinder should be used:  $V = abc$  or  $V = a^3$ . 3. Calculate the density of the metal bar.

**3. III. RESULTS :Complete the following table**

	Methode with graduated cylinder	Methode with pipet	Methode with ruler
	m(g) V(ml) d	m(g) V(ml) d	m(g) V(ml) d
Water			
Salet solution			
Metal bar			
Metal Ball			
Metal Undefiend form			



## IV Exercice

What is the formula for density?

- Density = mass  $\times$  volume
- Density = mass / volume
- Density = mass + volume
- Density = mass - volume

## V Exercice

When two materials that have different densities, like oil and water, encounter one another, they will

- Exchange densities.
- Separate according to their densities
- the ration of the density of this materials to that of water

# VI test de tri

## VII Exercice

To calculate the density ,we need to calculate the volume. What do we need forthat ?

- Graduated cylinder
- Pipette
- beaker
- thermometer

# Conclusion

Through applied work the student concludes that chemistry is present in our daily lives ,and therefore to know the sizes ; weight , and densites of objects and matrials, and all the physical-chemical properties of materials.The student must carry out pratical work to reach the goal.

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