

## Determination of the density of liquids and solids (regular and irregular)

### Introduction

The density of a substance measures the mass it contains in a given volume. Density is calculated using the equation:

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

### Apparatus

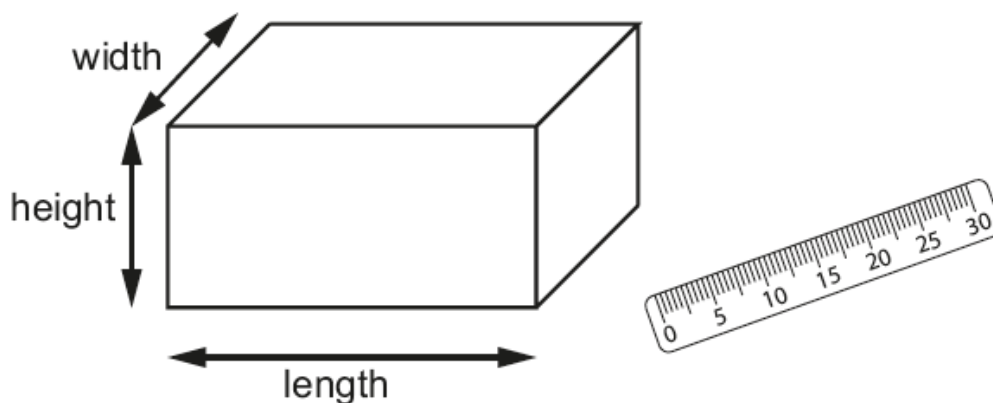
2 × regular shaped solids  
2 × irregular shaped solids  
30cm ruler  
50 cm<sup>3</sup> measuring cylinder  
water

#### Access to:

electronic balance ± 0.1 g

### Measuring the density of a regular shaped solid

#### Diagram of Apparatus



## Method

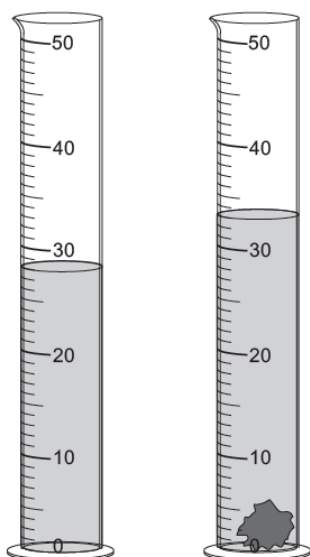
1. Record the mass of the solid.
2. Record the length, width and thickness of the solid using a ruler.
3. Repeat for cubes of different material.

## Analysis

1. Calculate the volume of the cube from:  $\text{volume} = \text{length} \times \text{height} \times \text{width}$ .
2. Calculate the density in  $\text{g/cm}^3$ .

## Measuring the density of an irregular shaped solid

### Diagram of Apparatus



## Method

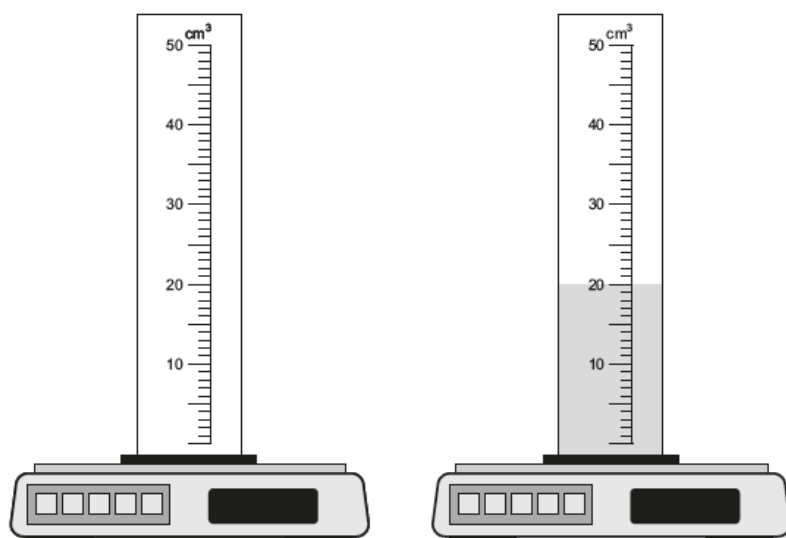
1. Record the mass of the solid.
2. Fill the measuring cylinder with water up to  $20 \text{ cm}^3$  and record the volume.
3. Gently place the solid into the measuring cylinder and record the new volume.

## Analysis

1. Calculate the volume of the solid by subtracting the original volume from the new volume.
2. Calculate the density in  $\text{g/cm}^3$ .

## Measuring the density of a liquid

### Diagram of Apparatus



## Method

1. Record the mass of the empty measuring cylinder.
2. Add  $20 \text{ cm}^3$  of water to the measuring cylinder.
3. Record the mass of the measuring cylinder with the water.

## Analysis

1. Calculate the mass of the water by subtracting the mass of the measuring cylinder (without water) from the mass of the measuring cylinder with the water.
2. Calculate the density in  $\text{g/cm}^3$ .

## Risk Assessment

Hazard	Risk	Control measure
There are no significant risks associated with this procedure		

## Teacher / Technician notes

Small pieces of Blu-Tack or plasticine or small stones can be used as irregular shaped solids.

Students should be provided with a range of regular shaped common materials, e.g. cork, wood, steel, aluminium, polystyrene, rubber or plastic. However, care should be taken with the mass of the blocks to ensure balances are not damaged.

As an extension students could investigate how the addition of a salt such as sodium chloride to water changes its density.

This practical works well run as a circus of activities.

## Working scientifically skills covered

### 2. Experimental skills and strategies

Plan experiments or devise procedures to make observations, produce or characterise a substance, test hypotheses, check data or explore phenomena.

Make and record observations and measurements using a range of apparatus and methods.

### 3. Analysis and Evaluation

Carry out and representing mathematical analysis.

### 4. Scientific vocabulary, quantities, units, symbols and nomenclature

Use SI units and IUPAC chemical nomenclature unless inappropriate.

**Use an appropriate number of significant figures in calculation.**