Measurement - MASS, VOLUME, DENSITY







Measurement

Most nations use a system of <u>measurement</u> based on multiples of <u>ten</u>. Known as the <u>International</u> System of Units, this system is often abbreviated <u>SI</u>.

All <u>SI</u> standards are universally accepted and understood by scientists. The SI system is easy to use because its based on <u>powers of ten</u>. <u>Prefixes</u>; deci-, centi-, ect. are used with the names of the <u>base units</u> to indicate what power of ten should be used with the base unit.

Prefix	Symbol	Multiplying Factor
Kilo-	k	1000.0
Hecto-	h	100.0
Deka-	D	10.0
Basic Unit	Meter, Liter, Gram	1.0
Deci-	d	0.1
Centi-	С	0.01
Milli-	m	0.001

Measurement

Every type of <u>quantity</u> measured in SI has a <u>base</u> unit and a <u>symbol</u> for that unit. These names and symbols are shown in the table below.

Quantity Measured	Unit	Symbol
Length	Meter	<u>m</u>
Mass	Kilogram	kg
Volume	Cubic Meter (solid)	m ³
	Liter (liquid)	L
Time	Second	S
Temperature	Kelvin	К

Length

<u>Length</u> is the distance between two points. The SI base unit of length is the <u>meter</u> (m).

Metric rulers and meter sticks are used to measure length. Always measure <u>centimeters</u> to the <u>nearest</u> <u>tenth (0.1 cm)</u>.

Implementation0 cm12345678910What does not to scale mean?

The amount of <u>space</u> occupied by an object is called its <u>volume</u>.

If you want to measure the volume of a regularly shaped object, such as a brick, you measure its <u>length</u>, <u>width</u> and <u>height</u> and multiply the three

numbers together.

Centimeters



Millimeters

Vol. = L(cm) × W(cm) × H(cm) - the <u>units</u> would be $\underline{cm^3}$

To measure the <u>volume</u> of a <u>liquid</u>, you would use a <u>graduated cylinder</u>.

When liquid is placed into a container, it forms a <u>meniscus</u> (a curved surface that is lower in middle than at the edges).



To read the meniscus, you have to place it on a stable desk top. (NEVER read a graduated while holding it in your hand.) Read the meniscus at eye level.



Archimedes

To measure the <u>volume</u> of an irregular <u>solid</u> we use a technique called <u>water displacement</u>. An example of an irregular solid is a paperclip.

Volume = <u>ending</u> volume(mL) - <u>starting</u> volume(mL)



* Make sure the starting volume covers the object completely.*

Remember to record both the starting and ending volume.

Mass

<u>Mass</u> is a measurement of the amount of matter in an object. The SI unit for mass is the <u>kilogram</u> (kg). For measuring objects of small mass, grams (g) are used.

Mass in the laboratory will be measuring with a <u>triple-beam balance</u> in grams (g).

Remember mass and <u>weight</u> are different. Weight is the measure of the <u>force</u> of <u>gravity</u> on an object. Weight is measured in <u>Newton's</u> (N).

Mass is a <u>constant</u>, it does not change. Weight can <u>vary</u>, it changes with location.

Tutorial <u>http://www.ohaus.com/products/education/weblab/TBBentry.html</u>



Example 2



Hundreds =

Tens = _____

Ones = _____

Tenths =

TOTAL = _____ grams

Example 3



- Hundreds = ____
- Tens = _____
- Ones = _____
- Tenths = _____
- TOTAL = _____ grams

Density

The <u>mass</u> and <u>volume</u> of an object can be used to find the <u>density</u> of the material. Density is the mass per unit volume

of a material. <u>D= m/v</u>

Density is a <u>derived</u> unit. You can find it by <u>dividing</u> the mass (g) by its volume (<u>mL or cm^3 </u>). The units for <u>density</u> are either g/mL or g/cm³.

Density

Example: The mass of an object is 10.0g and the volume is $2.0cm^3$. What is the density of this object? SOLVE

1. Density = mass/volume

2. Density =

3. Density =

Density exercise #1:

1. Write formula 2. Sub in the # & units 3. Calculate answer include units

Chris determines that a piece of an unknown material has a mass of 4.9 g and a volume of 6.6 cm3. What is the density of the material, rounded to the nearest tenth.

Density exercise #2:

1. Write formula 2. Sub in the # & units 3. Calculate answer include units

Kristen finds a rock on the way to school. In the laboratory she determines that the volume of the rock is 22.9 cm3, and the mass in 40.2 g. What is the density of the rock, rounded to the nearest tenth?

Density

The density of <u>water</u> is $1.0g/cm^3$. If an object has a density <u>greater</u> than $1.0g/cm^3$ it will <u>sink</u> in water. If an object has a density <u>less</u> than $1.0g/cm^3$ it will <u>float</u>.

has a density of 7.9g/cm³, will it sink or float? __

has a density of 0.24g/cm³ will it sink or float? _____

What is the density of cork if we cut it in half?

It doesn't matter how many pieces we cut an object into, the <u>density of an object NEVER changes</u>.

Density Practice http://www.edinformatics.com/math_science/mass_volume_density.htm

Density exercise #3:

1. Write formula 2. Sub in the # & units 3. Calculate answer include units

A chemist wants to know if a certain liquid is denser than water. They need to know if it will sink rather than float. They know the density of liquid water to be 1g/ml. The liquid has a calculated mass of 15 grams. Using a graduated cylinder they find the volume to be 7.5 milliliters. Will the liquid sink or float in water? Density exercise #4: 1. Write formula 2. Sub in the # & units 3. Calculate answer include units

An engineer working in the automotive industry needs to test the viscosity of a new oil for engine lubrication. They find the mass of a 10ml sample to be 8.5 grams. What is the density of this oil? And, will it sink or float in water?