

ACTIVITY 1: Measurements & Metrics

A. Metric Units

The International System of Measurement (SI, Le Systeme International d'Unites), commonly called the metric system is used by scientists worldwide and has been adopted as the official system of measurement by most countries. Unlike our traditional system of measurement (inch, foot, yard, mile); the metric system is based on standard units that can be easily converted by simply multiplying or dividing by ten. The standard metric unit for length is the meter. Gram is the standard unit of mass and liter the standard unit of volume. Scientists measure temperature in degrees Celsius (or Kelvin).

Table 1. Standard units of the metric system

Measurement	Standard Unit	Example
Length	Meter (m)	Height of a typical door handle (1m = approximately 39 inches)
Mass	Gram (g)	Mass of one dollar bill (1 g = 0.035 oz)
Volume	Liter (l)	Volume of large fast food soda (1 l = approximately 1qt)
Temperature	Celsius (°C)	Water freezes at 0°C and boils at 100°C

Measurements are further expressed using a superunit prefix or a subunit prefix. Superunits contain Greek prefixes to show multiples of the base unit, so they make the base unit larger. Latin prefixes, on the other hand, represent subunits and make the base unit smaller.

Table 2. Common metric system prefixes and their values

	Prefix	Symbol	Value		
Superunit	Mega	M	Million	1000000.0	10^6
	Kilo	k	Thousand	1000.0	10^3
	Hecto	h	Hundred	100.0	10^2
	Deca	da	Ten	10.0	10
Unit	Meter, Gram, Liter	m, g, l	One	1.0	1
Subunit	Deci	d	Tenth	0.1	10^{-1}
	Centi	c	Hundredth	0.01	10^{-2}
	Milli	m	Thousandth	0.001	10^{-3}
	Micro	μ	Millionth	0.000001	10^{-6}
	Nano	n	Billionth	0.000000001	10^{-9}

B. Metric Conversions

Conversions within the metric system can be made easily using a metric staircase. Each step of the staircase represents a 10-fold change in the value of the measure or a shift of the decimal point one place. Therefore, each step you move down the staircase represents multiplication by ten or a movement of the decimal one place to the right. Each step up the staircase represents a division by ten or the movement of the decimal point one place to the left. Two steps up or down the staircase represents a movement of the decimal point two places to the left or right and three steps up or down the staircase represents a movement of the decimal point three places to the left or right. Your instructor will demonstrate how to make conversions within the metric system using the staircase.

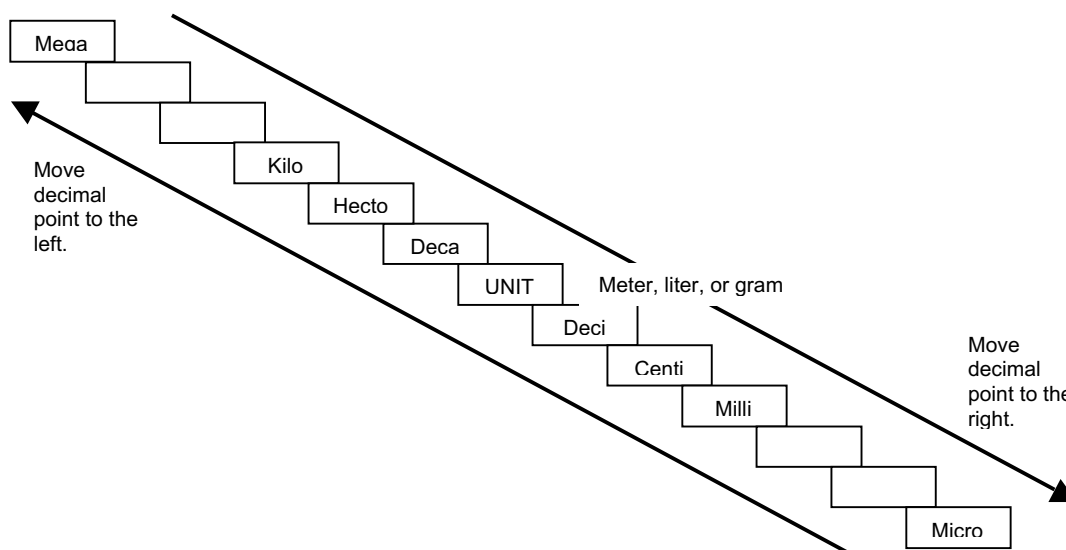


Figure 1.1. The metric staircase.

C. Measuring

On your laboratory table, you will find several measuring instruments such as a meter stick, graduated cylinder, balance, and thermometer. Familiarize yourself with these tools. Your instructor will demonstrate how each is properly used.

The best way to remember unfamiliar units of measure is to relate them to familiar objects of equivalent size. For example, one decimeter is equal to the width of a typical adult hand. Use the measuring instruments located in the classroom to create your personal metric reference list. In other words, identify two common objects that measure approximately 1mm, 1cm, 1m, 1ml, 1l, 1g, and 1kg.

Name _____

Personal Metric Reference List	
<u>Metric Unit</u>	<u>Reference Object</u>
<u>Length:</u>	
<i>mm</i>	_____
<i>mm</i>	_____
<i>cm</i>	_____
<i>cm</i>	_____
<i>m</i>	_____
<i>m</i>	_____
<u>Volume:</u>	
<i>ml</i>	_____
<i>ml</i>	_____
<i>l</i>	_____
<i>l</i>	_____
<u>Mass:</u>	
<i>g*</i>	_____
<i>g</i>	_____
<i>kg*</i>	_____
<i>kg</i>	_____
<u>Temperature:</u>	
<i>Room (°C)</i>	_____
<i>Cold Water (°C)</i>	_____
<i>Hot Water (°C)</i>	_____
<i>Body (°C)</i>	_____

* CAUTION: Do not exceed the maximum range of the balance!

Name _____

Class _____ Section _____

Date _____

Conversion Questions

- _____ 1. 950 centimeters (cm) equals how many millimeters (mm)?
- _____ 2. 950 centimeters (cm) equals how many meters (m)?
- _____ 3. 11 millimeters (mm) equals how many centimeters (cm)?
- _____ 4. 11 millimeters (mm) equals how many meters (m)?
- _____ 5. 11 millimeters (mm) equals how many micrometers (μm)?
- _____ 6. A typical human skin cell is $\sim 50\mu\text{m}$ in diameter. How big is that cell in mm?
- _____ 7. 1 inch equals 2.54 cm. How tall are you in m?
- _____ 8. 1 gallon equals 3.79 liters (l). So a half-gallon equals how many milliliters (ml)?
- _____ 9. How many kilograms (kg) does a half-gallon of pure water weigh?
- _____ 10. 1 kg equals 2.21 pounds. So a half-pound equals how many grams (g)?
- _____ 11. How much do you weigh in kg?