

Biology

Developmental Module: Measurement

Throughout this course, you will need to understand the System International (SI) and be able to perform simple SI unit conversions and measurements. The System International (SI) is a revised version of the metric system. The system is based on multiples of ten. Each unit is ten times larger or ten times smaller than the next unit.

Base Units

The base SI units are the most commonly used units. The tables below describe base units that you will commonly see throughout the Earth science course.

Length – measure of distance from one point to another

Unit	Description
meter (m)	A meter is slightly longer than a yard. <ul style="list-style-type: none">• 1 meter = 1000 millimeters (mm)• 1 meter = 100 centimeters (cm)• 1000 meters = 1 kilometer (km)

Volume – measure of the amount of space an object takes up

Unit	Description
liter (L)	A liter contains slightly more space than a quart. <ul style="list-style-type: none">• 1 liter = 1000 milliliters (mL)

Determining the volume of objects requires two different methods. To determine the volume of regular objects, multiply the object's length by its width and height. To determine the volume of irregular objects, you will need to use the water displacement method. This method involves submerging the object in water and subtracting the initial volume from the final volume.

Mass – measure of the amount of matter in an object

Unit	Description
gram (g)	A gram has a mass similar to one paper clip. <ul style="list-style-type: none">• 1000 grams = 1 kilogram (kg)

To determine the mass of an object use a triple beam balance.

Temperature – measure of the amount of heat an object contains

Unit	Description
degrees Celsius (°C)	<ul style="list-style-type: none">• 0°C is the freezing point of water• 100°C is the boiling point of water

To convert from Fahrenheit to Celsius use the following equation:

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$$^{\circ}\text{C} = \frac{5}{9} \times (^{\circ}\text{F} - 32)$$

SI Unit Conversions

To convert between units in the metric system, use the prefix chart below. The most common metric units you will use in this course are meters, liters, and grams. As you move to the left on the metric number line, you will move the decimal point to the left one space per unit. As you move to the right on the number line, you will move the decimal point to the right.

Prefix	Symbol	Meaning	Examples
kilo-	k	1000 times the base unit	0.001 kilometer 0.001 kiloliter 0.001 kilogram
hecto-	h	100 times the base unit	0.01 hectometer 0.01 hectoliter 0.01 hectogram
deka-	da	10 times the base unit	0.1 dekameter 0.1 dekaliter 0.1 dekagram
meter liter gram	m l g	the base unit	1 meter 1 liter 1 gram
deci-	d	1/10 of the base unit	10 decimeters 10 deciliters 10 decigrams
centi-	c	1/100 of the base unit	100 centimeters 100 centiliters 100 centigrams
milli-	m	1/1000 of the base unit	1000 millimeters 1000 milliliters 1000 milligrams

Example 1:

If you wanted to convert 6000.0 meters to kilometers, you would have to move the decimal point over three places to the left. If you have converted this correctly, you will find that there are 6.0 kilometers found in 6000.0 meters.



Example 2:

How many centigrams exist in 3.0 grams of salt? Hint: This time you have to move the decimal point to the right. If you have converted this correctly, you will find that there are 300.0 centigrams in 3.0 grams of salt.



Density

Density is the measure of how much mass is in a certain volume. To calculate the density of the object, you will need to divide mass by volume by using the following equation:

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$$D = \frac{m}{v}$$

Density always has units of grams per milliliter (g/mL) or grams per centimeter cubed (g/cm³). This density formula can be rearranged to solve for volume and mass using the following two equations:

- $m = D \times v$
- $v = \frac{m}{D}$