**Units of Measurementhttps:// Units of Measurementhttps://www.ipracticemath.com/learn/measurement/measurement-units**

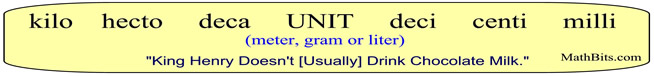
The predominant system of measurement still used in the United  
States is the English system. The English system of weights and measures

The system of measurement that is presently used by every major  
country in the world except the United States is Le Système International d’Unites (the International System of Units), which is commonly  
known as the S.I. or the metric system. The metric system originated as  
the result of a request of King Louis XVI to the French Academy of Sciences in the 1790s. Although the system fell briefl y from favor in France,  
it was readopted in 1837. In 1875, the Treaty of the Meter was signed by  
17 countries agreeing to adopt the metric system.  
Since that time the metric system has enjoyed worldwide popularity  
for several reasons. First, it entails only four base units—the meter, of  
length; the kilogram, of mass; the second, of time; and the degree Kelvin,  
of temperature. Second, the base units are precisely defined, reproducible quantities that are independent of factors such as gravitational force.  
Third, all units excepting those for time relate by factors of 10, in contrast  
to the numerous conversion factors necessary in converting English units  
of measurement. Last, the system is used internationally.  
For these reasons, as well as the fact that the metric system is used almost exclusively by the scientific community, it is the system used in this  
book. For those who are not familiar with the metric system, it is useful to  
be able to recognize the approximate English system equivalents of metric quantities. Two conversion factors that are particularly valuable are 2.54 cm for every inch and approximately 4.45 N for every pound. All of  
the relevant u

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| Metric System: | construction sign |
| The metric system is an internationally agreed decimal system of measurement created in France in 1799. The International System of Units (SI), the official system of measurement in almost every country in the world, is based upon the metric system. |

In the metric system, each basic type of measurement (length, weight, capacity) has one basic unit of measure (meter, gram, liter). Conversions are quickly made by multiplying or dividing by factors of 10. It is as simple as moving the decimal point to the right (for smaller prefixes) or to the left (for larger prefixes).

To remember the proper decimal movement, arrange the prefixes from largest to smallest:



expin1 Convert 10.25 kilometers to meters.   
Notice in the listing above that meter is three places to the right of the prefix kilo. This tells us to move the decimal point three places to the right. The answer is 10,250 meters.

expin2 Convert 650 mL to daL. [mL is milliliters and daL is decaliters].   
Notice in the listing above that the prefix deca is four places to the left of the prefix milli. This tells us to move the decimal point four places to the left. The answer is 0.0650 daL. (Note: dL is deciliters, daL is decaliters.)

expin3 Convert 750 grams to milligrams.   
Notice in the listing above that the prefix milli is three places to the right of gram. This tells us to move the decimal point three places to the right. The answer is 750,000 milligrams.

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| --- | --- |
| bulletEnglish System: | road work sign |

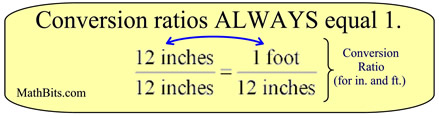
While the metric system was lawfully accepted for use in the United States in 1866, the US has not adopted the metric system as its "official" system of measurement. The US English System of measurement grew out of the manner in which people secured measurements using body parts and familiar objects. For example, shorter ground distances were measured with the human foot and longer distances were measured by paces, with one mile being 1,000 paces. Capacities were measured with household items such as cups, pails (formerly called gallons) and baskets.

Obviously this system allowed for discrepancies between measurements obtained by different individuals. A standard was eventually set to ensure that all measurements represented the same amount for everyone.

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| Length:  1 foot (ft) = 12 inches (in) 1 yard (yd) = 3 feet  1 mile (mi) = 5280 feet  1 mile = 1760 yards | Weight:  1 pound (lb) = 16 ounces (oz)  1 ton = 2000 pounds | Capacity:  1 tablespoon (tbsp) = 3 teasponns (tsp)  1 cup (c) = 16 tablespoons  1 cup = 8 fluid ounces (oz)  1 pint (pt) = 2 cups  1 quart (qt) = 2 pints  1 gallon (gal) = 4 quarts |

**Conversion Ratio (or Unit Factor):** While the Metric System simply moves the decimal point to convert between its measurements' prefixes, the English System requires a conversion ratio (or unit factor)to move between measurements. In the Metric System, the prefix itself gives the needed conversion ratio.

A conversion ratio (or unit factor) is a ratio **equal to one**. This ratio carries the names of the units to be used in the conversion. It can be used for conversions within the English and Metric Systems, as well as for conversions [between the systems.](https://mathbitsnotebook.com/Algebra1/Units/UNConversions.html) The conversion ratio is based upon the concept of **equivalent values**. In the example below, one foot is substituted for its equivalent measure of 12 inches.



|  |  |  |
| --- | --- | --- |
| expin1 Convert 84 inches to feet.  A proportion can be set up using the appropriate conversion ratio. In a proportion the product of the means equals the product of the extremes. Use this "cross multipy" concept to find the answer. | |  | | --- | | engconratio ANSWER: 7 feet | |

|  |  |  |
| --- | --- | --- |
| expin2 Find the number of cups in two gallons. There is no stated conversion for cups to gallons, so we have to be a bit more creative. Since there are 4 cups in 1 quart, and 4 quarts in 1 gallon, we can set up the conversion ratio based on "quarts". Two gallons is 8 quarts. | |  | | --- | | cups in gallon ANSWER: 32 cups | |

|  |  |  |
| --- | --- | --- |
| expin3 Convert 16 tons to pounds.  Set up the conversion ratio and solve for the missing value. | |  | | --- | | conversion83 ANSWER: 32,000 pounds | |

*NOTE: As with all mathematical problems, there are other ways to arrive at these answers. Most other methods utilize the concept of the conversion ratio, but may be written in a different manner or calculated mentally.*

nits of measurement in both systems and common Englishmetric conversion factors are presented in

**PROBLEM-SOLVING APPROACH**  
Scientifi c research is usually aimed at providing a solution for a particular problem or answering a specifi c question. Even for the nonresearcher,  
however, the ability to solve problems is a practical necessity for functioning in modern society. The use of specifi c problems is also an effective approach for illustrating basic biomechanical concepts.  
**Quantitative versus Qualitative Problems**  
Analysis of human movement may be either quantitative or qualitative.  
*Quantitative* implies that numbers are involved, and *qualitative* refers to  
a description of quality without the use of numbers. After watching the  
performance of a standing long jump, an observer might qualitatively state,  
“That was a very good jump.” Another observer might quantitatively announce that the same jump was 2.1 m in length. Other examples of qualitative and quantitative descriptors are displayed in Figures 1-5 and 1-6.  
It is important to recognize that *qualitative* does not mean *general*.  
Qualitative descriptions may be general, but they may also be extremely  
detailed. It can be stated qualitatively and generally, for example, that a  
man is walking down the street. It might also be stated that the same man is  
walking very slowly, appears to be leaning to the left, and is bearing weight  
on his right leg for as short a time as possible. The second description is entirely qualitative but provides a more detailed picture of the movement.  
Both qualitative and quantitative descriptions play important roles  
in the biomechanical analysis of human movement. Biomechanical researchers rely heavily on quantitative techniques in attempting to answer

Linear  
motion is also referred to as translatory motion, or translation.

Linear motion may also be thought of as motion along a line. If the  
line is straight, the motion is rectilinear; if the line is curved, the motion  
is curvilinear

**Angular Motion**  
Angular motion is rotation around a central imaginary line known as  
the axis of rotation, which is oriented perpendicular to the plane in  
which the rotation occurs. When a gymnast performs a giant circle on  
a bar, the entire body rotates, with the axis of rotation passing through  
the center of the bar

**General Motion**  
When translation and rotation are combined, the resulting movement is  
general motion. A football kicked end over end translates through the air  
as it simultaneously rotates around a central axis (Figure 2-2). A runner  
is translated along by angular movements of body segments at the hip,  
knee, and ankle. Human movement usually consists of general motion  
rather than pure linear or angular motion.