

Sect 8.5 - Conversions between the U.S. and Metric System

In this day and age, the metric system is virtually worldwide. Though there was a strong drive in the 1970's for the U.S. to adopt the metric system, the U.S. never made the transition. Thus, the U.S. is the only major country that does not use the metric system. Since the metric system is accepted in the rest of the world and generally used in the Scientific and Health fields, it is important that we have the ability to convert between the two systems.

Here are some useful conversions between the U.S. and Metric Systems:

length	weight	volume	other
1 m \approx 3.2808 ft	28.35 g \approx 1 oz	1L \approx 1.06 qt	1 min = 60 s
1.609 km \approx 1 mi	454 g \approx 1 lb	1L \approx 33.8 fl oz	1 hr = 60 min
2.54 cm = 1 in	1 kg \approx 2.2 lb	3.785 L \approx 1 gal	1 hr = 3,600 s
1 m \approx 1.0936 yd	908 kg \approx 1 ton		$F = \frac{9}{5}C + 32^\circ$
			$C = \frac{5(F-32^\circ)}{9}$

We will use the same techniques of constructing a unit conversion factor to convert between the two systems.

Convert the following. Round to the nearest hundredth if needed:

Ex. 1 Convert 45 mi to ____ km.

Solution:

Since 1 mi \approx 1.609 km, then $1 \approx \frac{1.609\text{km}}{1\text{mi}}$.

So, $45 \text{ mi} \approx \frac{45\text{mi}}{1} \cdot \frac{1.609\text{km}}{1\text{mi}} = \frac{72.405}{1} \text{ km} = 72.405 \text{ km} \approx 72.41 \text{ km}$.

Ex. 2 Convert 6501 g to ____ lb.

Solution:

Since 1 lb \approx 454 g, then $1 \approx \frac{1\text{lb}}{454\text{g}}$.

So, $6501 \text{ g} \approx \frac{6501\text{g}}{1} \cdot \frac{1\text{lb}}{454\text{g}} = \frac{6501}{454} \text{ lb} = 14.3193\dots \text{ lb} \approx 14.32 \text{ lb}$.

Ex. 3 Convert 84 qt to ___ L

Solution:

Since $1 \text{ L} \approx 1.06 \text{ qt}$, then $1 \approx \frac{1 \text{ L}}{1.06 \text{ qt}}$.

So, $84 \text{ qt} \approx \frac{84 \text{ qt}}{1} \cdot \frac{1 \text{ L}}{1.06 \text{ qt}} = \frac{84}{1.06} \text{ L} = 79.2452... \text{ L} \approx 79.25 \text{ L}$.

Ex. 4 Convert 12,192 cm to ___ ft

Solution:

There is no direct conversion from centimeters into feet so we will have to work this out in two steps. Here are two different ways of working the problem:

Method #1:

(cm \rightarrow in) We will first convert to inches and then to feet:

Since $2.54 \text{ cm} = 1 \text{ in}$, then $1 = \frac{1 \text{ in}}{2.54 \text{ cm}}$.

So, $12,192 \text{ cm} = \frac{12,192 \text{ cm}}{1} \cdot \frac{1 \text{ in}}{2.54 \text{ cm}} = \frac{12,192}{2.54} \text{ in} = 4800 \text{ in}$.

(in \rightarrow ft) Now, convert the inches to feet:

Since $12 \text{ in} = 1 \text{ ft}$, then $1 = \frac{1 \text{ ft}}{12 \text{ in}}$.

So, $4800 \text{ in} = \frac{4800 \text{ in}}{1} \cdot \frac{1 \text{ ft}}{12 \text{ in}} = \frac{4800}{12} \text{ ft} = 400 \text{ ft}$.

OR

Method #2:

(cm \rightarrow m) We will first convert to meters and then to feet:

k h da meters \leftarrow d \leftarrow c m

So, $12192 \text{ cm} = 12192 = 121.92 \text{ m}$

(m \rightarrow ft) Now, convert the meters to feet:

Since $1 \text{ m} \approx 3.2808 \text{ ft}$, then $1 \approx \frac{3.2808 \text{ ft}}{1 \text{ m}}$.

So, $121.92 \text{ m} = \frac{121.92 \text{ m}}{1} \cdot \frac{3.2808 \text{ ft}}{1 \text{ m}} = \frac{399.995...}{1} \text{ ft} \approx 400 \text{ ft}$.

Notice that the answers derived by the two ways for solving the problem were slightly different. This should make sense when one remembers that the conversions that we are using between U.S. and metric are only approximation and will introduce a small error. To minimize the error, one should not round off until the end of the problem.

Ex. 5 Convert 4730 ml to ___ c.

Solution:

There is no direct conversion between milliliters and cups so we will need to convert this in several steps. If we look at the chart, we see that $1 \text{ L} \approx 1.06 \text{ qt}$. In order to use this conversion, we will need to first convert the ml to L:

(ml \rightarrow L) k h da liters d c m

So, $4730 \text{ ml} = 4730 = 4.730 \text{ L}$ or 4.73 L

(L \rightarrow qt) Now, convert from liters to quarts:

Since $1 \text{ L} \approx 1.06 \text{ qt}$, then $1 \approx \frac{1.06 \text{ qt}}{1 \text{ L}}$.

So, $4.73 \text{ L} \approx \frac{4.73 \text{ L}}{1} \cdot \frac{1.06 \text{ qt}}{1 \text{ L}} = \frac{5.0138}{1} \text{ qt} = 5.0138 \text{ qt}$

(qt \rightarrow c) Finally, convert from quarts to cups:

Since $1 \text{ qt} = 4 \text{ c}$, then $1 = \frac{4 \text{ c}}{1 \text{ qt}}$.

So, $5.0138 \text{ qt} = \frac{5.0138 \text{ qt}}{1} \cdot \frac{4 \text{ c}}{1 \text{ qt}} = \frac{20.0552}{1} \text{ c} \approx 20.06 \text{ c}$.

Ex. 6 Convert $\frac{\$8.93}{\text{kg}}$ to $\frac{\$}{\text{oz}}$.

Solution:

(kg \rightarrow lb) First, convert from kilograms to pounds:

Since $1 \text{ kg} \approx 2.2 \text{ lb}$, then $1 \approx \frac{1 \text{ kg}}{2.2 \text{ lb}}$.

So, $\frac{\$8.93}{\text{kg}} \approx \frac{\$8.93}{\text{kg}} \cdot \frac{1 \text{ kg}}{2.2 \text{ lb}} = \frac{\$8.93}{2.2 \text{ lb}} = \frac{\$4.05909...}{\text{lb}}$.

(lb \rightarrow oz) Now, convert the pounds to ounces:

Since $16 \text{ oz} = 1 \text{ lb}$, then $1 \approx \frac{1 \text{ lb}}{16 \text{ oz}}$

So, $\frac{\$4.05909...}{\text{lb}} \cdot \frac{1 \text{ lb}}{16 \text{ oz}} = \frac{\$4.05909...}{16 \text{ oz}} = \frac{\$0.25369...}{\text{oz}} \approx \frac{\$0.25}{\text{oz}}$.

Ex. 7 Convert 50°F to ___ $^\circ \text{C}$.

Solution:

Plug 50° in for F in the formula

$C = \frac{5(F-32^\circ)}{9}$ and solve:

$C = \frac{5((50^\circ)-32^\circ)}{9} = \frac{5(18^\circ)}{9}$

$= \frac{90^\circ}{9} = 10^\circ \text{ C}$.

Ex. 8 Convert 81°C to ___ $^\circ \text{F}$.

Solution:

Plug 81° in for C in the

formula $F = \frac{9}{5}C + 32^\circ$ and

solve: $F = \frac{9}{5} \left(\frac{81^\circ}{1} \right) + 32^\circ$

$= 145.8^\circ + 32^\circ = 177.8^\circ \text{ F}$.