Measurement

8

SECTION 8.4

Converting Between the Two Systems and Temperature

Objectives

A Convert between the U.S. and Metric systems.

B Convert temperatures between the Fahrenheit and Celsius scales.

A Converting Between the U.S. and Metric Systems

Converting Between the U.S. and Metric Systems

Because most of us have always used the U.S. system of measurement in our everyday lives, we are much more familiar with it on an intuitive level than we are with the metric system.

We have an intuitive idea of how long feet and inches are, how much a pound weighs, and what a square yard of material looks like.

The metric system is actually much easier to use than the U.S. system.

Converting Between the U.S. and Metric Systems

The reason some of us have such a hard time with the metric system is that we don't have the feel for it that we do for the U.S. system.

We have trouble visualizing how long a meter is or how much a gram weighs.

Converting Between the U.S. and Metric Systems

The following list is intended to give you something to associate with each basic unit of measurement in the metric system.

1. A meter is just a little longer than a yard.

2. The length of the edge of a sugar cube is about 1 centimeter.

3. A liter is just a little larger than a quart.

4. A sugar cube has a volume of approximately 1 milliliter.

5. A paper clip weighs about 1 gram.

6. A 2-pound can of coffee weighs about 1 kilogram.

Converting Between the U.S. and Metric Systems

The following table includes the most common conversion factors between the metric and the U.S. system of measurement.

TABLE 1

ACTUAL CONVERSION FACTORS BETWEEN THE METRIC AND U.S. SYSTEMS OF MEASUREMENT

The relationship between	is	To convert one to the other, multiply by
Length		
inches and centimeters	2.54 cm = 1 in.	$\frac{2.54\text{ cm}}{1\text{ in.}}$ or $\frac{1\text{ in.}}{2.54\text{ cm}}$
feet and meters	1 m = 3.28 ft	$\frac{3.28\text{ ft}}{1\text{ m}}$ or $\frac{1\text{ m}}{3.28\text{ ft}}$
miles and kilometers	1.61 km = 1 mi	$\frac{1.61\text{ km}}{1\text{ mi}}$ or $\frac{1\text{ mi}}{1.61\text{ km}}$

Converting Between the U.S. and Metric Systems cont'd

TABLE 1

ACTUAL CONVERSION FACTORS BETWEEN THE METRIC AND U.S. SYSTEMS OF MEASUREMENT

The relationship between	is	To convert one to the other, multiply by
Area		
square inches and square centimeters	$6.45\ cm^2 = 1\ in^2$	$\frac{6.45\ cm^2}{1\ in^2}$ or $\frac{1\ in^2}{6.45\ cm^2}$
square meters and square yards	$1.196\ yd^2 = 1\ m^2$	$\frac{1.196\ yd^2}{1\ m^2}$ or $\frac{1\ m^2}{1.196\ yd^2}$
acres and hectares	$1\ ha = 2.47$ acres	$\frac{2.47\ acres}{1\ ha}$ or $\frac{1\ ha}{2.47\ acres}$
Volume		
cubic inches and milliliters	$16.39\ mL = 1\ in^3$	$\frac{16.39\ mL}{1\ in^3}$ or $\frac{1\ in^3}{16.39\ mL}$
liters and quarts	$1.06\ qt = 1$ liter	$\frac{1.06\ qt}{1\ liter}$ or $\frac{1\ liter}{1.06\ qt}$
gallons and liters	3.79 liters $= 1$ gal	$\frac{3.79\ liters}{1\ gal}$ or $\frac{1\ gal}{3.79\ liters}$
Weight		
ounces and grams	$28.3\ g = 1\ oz$	$\frac{28.3\ g}{1\ oz}$ or $\frac{1\ oz}{28.3\ g}$
kilograms and pounds	$2.20\ lb = 1\ kg$	$\frac{2.20\ lb}{1\ kg}$ or $\frac{1\ kg}{2.20\ lb}$

Converting Between the U.S. and Metric Systems

There are many other conversion factors that we could have included in Table 1.

We have listed only the most common ones.

Example 1

Convert 8 inches to centimeters.

Solution:

Choosing the appropriate conversion factor from Table 1, we have

$$8 \text{ in.} = 8 \text{ in.} \times \frac{2.54 \text{ cm}}{1 \text{ in.}}$$

$$= 8 \times 2.54 \text{ cm}$$

$$= 20.32 \text{ cm}$$

B Temperature

Temperature

In the U.S. system we measure temperature on the Fahrenheit scale.

On this scale, water boils at 212 degrees and freezes at 32 degrees.

When we write 32 degrees measured on the Fahrenheit scale, we use the notation

$32°F$ Read, "32 degrees Fahrenheit."

In the metric system the scale we use to measure temperature is the Celsius scale (formerly called the centigrade scale).

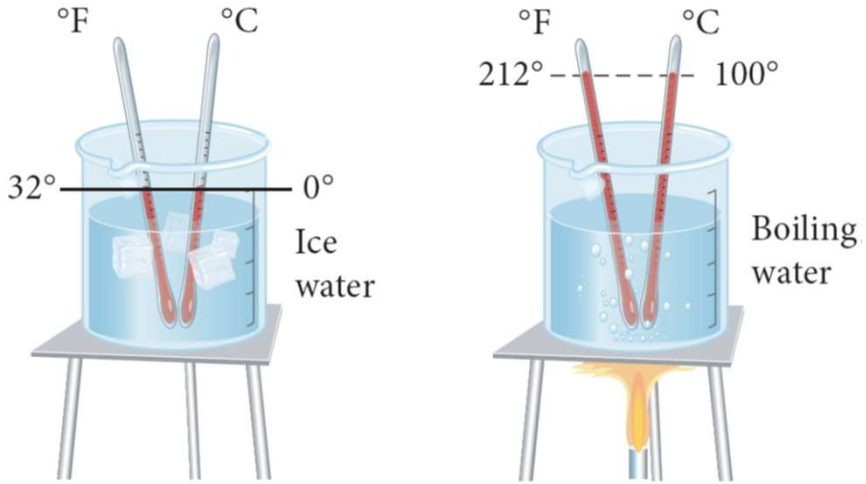
Temperature

On this scale, water boils at 100 degrees and freezes at 0 degrees.

When we write 100 degrees measured on the Celsius scale, we use the notation

100°C

Read, "100 degrees Celsius."



Temperature

Table 2 is intended to give you a feel for the relationship between the two temperature scales.

TABLE 2

To Convert From	Formula In Symbols	Formula In Words
Fahrenheit to Celsius	$C = \frac{5}{9}(F - 32)$	Subtract 32, multiply by 5, and then divide by 9.
Celsius to Fahrenheit	$F = \frac{9}{5}C + 32$	Multiply by $\frac{9}{5}$, and then add 32.

Example 6

Convert 120°C to degrees Fahrenheit.

Solution:

We use the formula

$$F = \frac{9}{5}C + 32$$

and replace C with 120.

When $\longrightarrow$ $C = 120$

the formula $\longrightarrow$ $F = \frac{9}{5}C + 32$

becomes $\longrightarrow$ $F = \frac{9}{5}(120) + 32$

Example 6 – *Solution*

cont'd

$$F = 216 + 32$$

$$F = 248$$

We see that 120°C is equivalent to 248°F; they both mean the same temperature.