Lesson 15: Converting Measurements

You can use ratios to convert from one unit to another in either the metric or U.S. customary system.

There are a few important prefixes that will help you understand the differences between metric units.

kilo-	hecto-	deka-	deci-	centi-	milli-
thousands	hundreds	tens	tenths	hundredths	thousandths

The values of metric units are based on powers of 10. The values of units in the U.S. customary system vary.

Length

The following tables show the units of length in order from smallest to largest. They also show the relationships between units of the same system.

Metric	Conversion	U.S. Customary	Conversion
millimeter (mm) about the thickness of a penny	$1 \text{ mm} = \frac{1}{10} \text{ cm}$	**inch (in.)** about the diameter of a quarter	$1 \text{ in.} = \frac{1}{12} \text{ ft}$
centimeter (cm) about the radius of a nickel	$1 \text{ cm} = 10 \text{ mm}$	**foot (ft)** about the length of a spaghetti noodle	$1 \text{ ft} = 12 \text{ in.}$
meter (m) about the height of a kitchen table	$1 \text{ m} = 100 \text{ cm}$ $1 \text{ m} = 1000 \text{ mm}$	**yard (yd)** about the length of a baseball bat	$1 \text{ yd} = 3 \text{ ft}$ $1 \text{ yd} = 36 \text{ in.}$
kilometer (km) about the length of a 15-minute walk	$1 \text{ km} = 1000 \text{ m}$	**mile (mi)** about the length of a 20-minute walk	$1 \text{ mi} = 1760 \text{ yd}$ $1 \text{ mi} = 5280 \text{ ft}$

Mass and Weight

The following tables show the units of mass and weight in order from smallest to largest. They also show the conversion relationships between units of the same system. Remember, metric units measure mass, while U.S. customary units measure weight.

Metric	Conversion
milligram (mg) about the weight of a wing of a housefly	$1 \text{ mg} = \frac{1}{1000} \text{ g}$
gram (g) about the weight of a paper clip	1 g = 1000 mg
kilogram (kg) about the weight of a dictionary	1 kg = 1000 g

U.S. Customary	Conversion
ounce (oz) about the weight of a slice of bread	$1 \text{ oz} = \frac{1}{16} \text{ lb}$
pound (lb) about the weight of a full can of seltzer	1 lb = 16 oz
ton (T) about the weight of a small car	1 T = 2000 lb

Capacity

The following tables show the units of capacity in order from smallest to largest. They also show the conversion relationships between units of the same system.

Metric	Conversion
milliliter (mL) about what an eyedropper holds	$1 \text{ mL} = \frac{1}{1000} \text{ L}$
liter (L) about what a medium water bottle holds	1 L = 1000 mL
kiloliter (kL) about what a large wading pool holds	1 kL = 1000 L

U.S. Customary	Conversion
teaspoon (tsp)	$1 \text{ tsp} = \frac{1}{3} \text{ tbsp}$
tablespoon (tbsp)	1 tbsp = 3 tsp
fluid ounce (fl oz)	1 fl oz = 2 tbsp; 1 fl oz = 6 tsp
cup (c)	1 c = 8 fl oz
pint (pt)	1 pt = 2 c
quart (qt)	1 qt = 4 c; 1 qt = 2 pt
gallon (gal)	1 gal = 4 qt; 1 gal = 8 pt; 1 gal = 16 c

Ratios can be used to convert units of length, weight, or capacity. You must multiply the given number by the ratio that compares the two units.

▷ **Example**

How many feet are in 72 inches?

To solve this problem, you first need to remember the conversion rate from inches to feet. There are 12 inches in 1 foot. One foot, therefore, can be considered as a ratio in terms of inches: $\frac{1}{12}$.

Now you can multiply the total number of inches by this ratio. You will need to convert 72 to $\frac{72}{1}$.

$$\frac{72}{1} \times \frac{1}{12} = \frac{72 \times 1}{1 \times 12} = \frac{72}{12} = 6$$

There are 6 feet in 72 inches.

▷ **Example**

How many grams are in 5 kilograms?

You need to recall the conversion rate from grams to kilograms. There are 1000 grams in 1 kilogram. A thousand grams, therefore, can be considered as a ratio in terms of one kilogram: $\frac{1000}{1}$.

Now you can multiply the total number of grams by this ratio. You will need to convert 5 to $\frac{5}{1}$.

$$\frac{5}{1} \times \frac{1000}{1} = \frac{5 \times 1000}{1 \times 1} = \frac{5000}{1} = 5000$$

There are 5000 grams in 5 kilograms.

▷ **Example**

How many cups are in 9 quarts?

There are 4 cups in 1 quart. Four cups, therefore, can be considered as a ratio in terms of one quart: $\frac{4}{1}$.

Now you can multiply the total number of quarts by this ratio. You need to convert 9 to $\frac{9}{1}$.

$$\frac{9}{1} \times \frac{4}{1} = \frac{9 \times 4}{1 \times 1} = \frac{36}{1} = 36$$

There are 36 cups in 9 quarts.

Ratios can be used to convert units of length, weight, or capacity in real-world situations.

▷ Example

Jill and Dina make 3 gallons of lemonade for their lemonade stand. How many cups of lemonade can they sell?

To solve this problem, you first need to remember the conversion rate from gallons to cups. There are 16 cups in 1 gallon. One gallon, therefore, can be considered as a ratio in terms of cups: $\frac{16}{1}$.

Now you can multiply the total number of gallons by this ratio. You will need to convert 3 to $\frac{3}{1}$.

$$\frac{3}{1} \times \frac{16}{1} = \frac{3 \times 16}{1 \times 1} = \frac{48}{1} = 48$$

There are 48 cups in 3 gallons. Therefore, Jill and Dina can sell 48 cups of lemonade.

▷ Example

The height of the roof of the CN Tower in Toronto is 500 yards. The height of the roof of the Petronas Towers in Malaysia is 1242 feet. Joey wants to compare the heights of the structures by converting the height of the Petronas Towers to yards. How many yards tall are the Petronas Towers?

There are 3 feet in 1 yard. One foot, therefore, can be considered as a ratio in terms of yards: $\frac{1}{3}$.

Now you can multiply the total number of feet by this ratio. You will need to convert 1242 to $\frac{1242}{1}$.

$$\frac{1242}{1} \times \frac{1}{3} = \frac{1242 \times 1}{1 \times 3} = \frac{1242}{3} = 414$$

There are 414 yards in 1242 feet. Therefore, the height of the roof of the Petronas Towers is 414 yards. It is lower than the roof of the CN Tower.

◆ **TIP:** Check that your conversion correctly makes the units smaller or larger. If not, you may have reversed the ratio.