Metric System

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Since the beginning of commerce and trade, a standardized system of measurements has been essential. To be effective, such systems, which include measures of distance, volume, and weight, must be **uniform**, **easy to remember and work with**, and **widely accepted**. Although the metric system is widely used throughout the world today, we continue to make considerable use the English system in the United States. In this section, we will investigate the English and Metric Systems, how they were developed, and how they work. If you are not familiar with the metric system, you will be amazed at how easy it is to remember and how simple it is to use.

The English System and Early Systems of Measurement

The system of measurements that we know as the English system did not come from England. Rather, it evolved over thousands of years from a variety of cultures all around the world. The main problem with early systems of measurement was lack of standardization, which was undoubtedly compounded by the vanity and arrogance of kings who ruled with absolute authority instead of compassion and common sense. Can you picture King Henry I of England, who defined the **yard** as the distance from the tip of his nose to the tip of his outstretched thumb?

Many early units of measure were named after and represent body parts. For example, the cubit, which is used extensively in the Bible, represented the length of the forearm or six handbreadths. But whose forearm is the standard of measure? To make matters worse, there were several different cubits. The Babylonian cubit, based upon the length of the forearm, ranged from 20.65 to 21.26 inches. The Egyptians, using six handbreadths, had two cubit measures, the Common and the Royal, which ranged from 17.70 to 20.64. The Hebrews also had two cubits, one of which was known as the common cubit and the other, which was one full handbreadth longer than common cubit.

Many of the units of measure that are commonly used today have an interesting history. Consider the foot. The question that certainly arose was, “Whose foot should be used for the standard?” The obvious answer was, “The king’s foot!” Since the king’s actual foot could obviously not be used in the workplace, accurate representations of the king’s foot were needed. [Note: do you think this is why we call these representations “rulers”?] Several problems resulted from this. How accurate were these representations? How could this “foot” be subdivided to measure distances smaller than a foot? What happened to the “foot” when the king died, especially when the new king decided that *his* foot should be the new standard of measure for the foot? Can you imagine the problems that arose in the world of business of that day among kingdoms far and near, using the “feet” of different kings as their not-so-standard unit of distance?

An early attempt to standardize these measurements was made by the Romans who introduced the **mile**, the **milia passuum**. The Romans defined the milia passuum to be 1000 double-steps (about 5000 feet) of their marching legions, and so it remained for about 1000 years. But then the English defined the acre to be the amount of land that a yoke of oxen could plow in one day and the furlong to be the length of a furrow plowed across a square 10-acre field. They further agreed that a furlong would be 220 yards. But the furlong did not divide evenly into the Roman mile, so Queen Elizabeth lengthened the mile to an even 8 furlongs, which was established in 1593 by British Parliament to be the statute mile (that is, 8 x 220 x 3 = 5280 feet in one mile).

The following is a summary of measures from the English system with abbreviations and conversion units.

English System

Distance	Volume (Liquid)	Weight
Inch (in)	Teaspoon (tsp or t)	Ounce (oz)
Foot (ft)	Tablespoon (tbsp or T)	Pound (lb)
Yard (yd)	Ounce (oz)	Ton (T)
Rod (R)	Cup (c)	
Furlong (fur)	Pint (pt)	
	Quart (qt)	
	Gallon (gal)	
1 ft = 12 in	1 tbsp = 3 tsp	1 lb = 16 oz
1 yd = 3 ft = 36 in	1 oz = 2 tbsp = 6 tsp = 1/8 c	1 short ton = 2000 lb
1 statute mi = 5280 ft	1 pt = 16 oz = 2 c	1 long ton = 2240 lb
1 nautical mi = 6079 ft	1 gal = 4 qt = 8 pt = 16 c = 96 oz	

Notice that there is no consistency among the abbreviations in the English system. As examples, notice that the abbreviation for “inch” is the first two letters of the word, while the abbreviations for “foot” and “yard” are the first and last letters of the word. The abbreviations for “rod” and “ton” are only one capital letter, while the abbreviations for “furlong” and “gallon” consists of three lowercase letters. Finally, where did we get abbreviations of “oz” for “ounce” and “lb” for “pound”? (The answer to this question goes back to the latin words for ounce and pound (libra).

Secondly, notice that there is no consistency among the conversion numbers. There are 12 inches in a foot, 3 feet in a yard, 5280 feet in a mile, unless it is a nautical mile, in which case there are 6079 feet. The systems of volume and weight have equally meaningless conversion numbers. These numbers are difficult to remember for anyone having to learn the system, and extremely difficult to work with for everyone, even for those who are familiar with the system. Finally, there seems to be no connection between distance, volume, and weight in the English system, except that the unit of ounces is used in both as a volume and weight.

Contrast this to the metric system!

The Metric System

The origin of the metric system stands in stark contrast to that of the English system. Whereas the English system evolved over time and cultures, the metric system, known also as System Internationale (SI), was created systematically by French scientists in the 1790's during the Napoleonic reign. While the units of measure and abbreviations in the English system are unrelated, the units and abbreviations in the metric system are interrelated, systematic, and easy to remember. Best of all, each conversion within the metric system is a power of 10.

The basic unit of distance in the metric system is the **meter (m)**, which is slightly more than a yard (approximately 39.37 inches). The basic unit of volume is a **liter (l)**, which is slightly more than a quart. The basic unit of mass (comparable to what is used in the English system as a measure of weight) is the **gram (g)**. A gram is the approximate mass (or weight) of a paper clip.

The **meter** was defined by the French scientists to be one ten-millionth of the distance from the equator to the North Pole. [Note: How do you think they measured this? With a **yard**stick??] More precisely, the meter is also defined in terms of light wavelengths. Specifically, the meter is defined to be 1,670,763.73 wavelengths of a spectral yellow light emitted by Krypton gas.

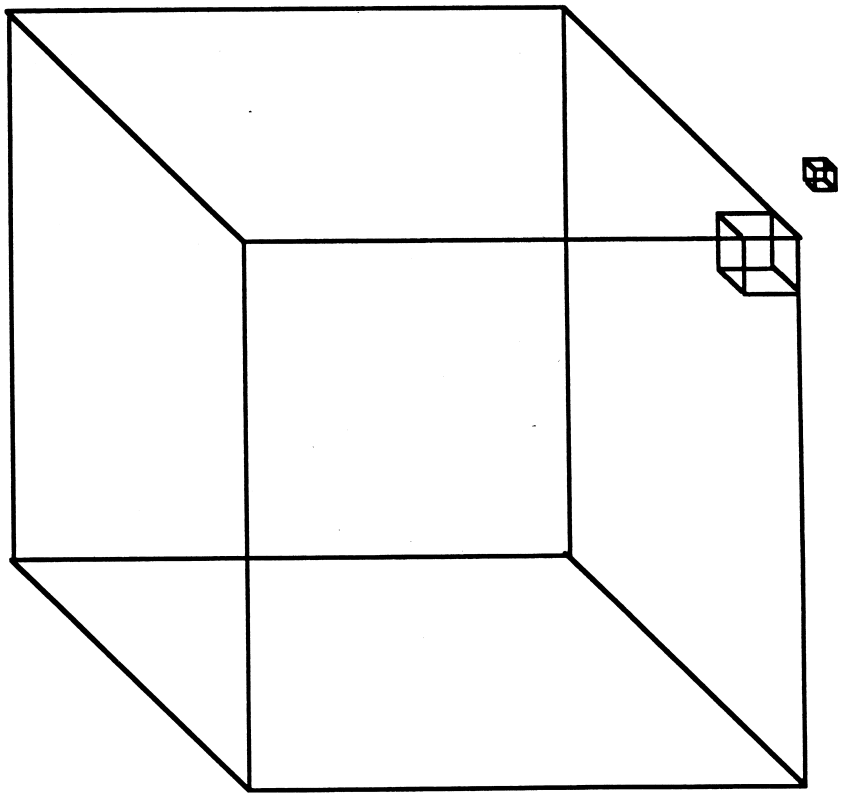
To measure distances smaller than a meter, the meter is subdivided into smaller units: tenths of a meter (**decimeter**), hundredths of a meter (**centimeter**), thousandths of a meter (**millimeter**), millionths of a meter (**micrometer),** etc. Distances larger than a meter are measured in units that are 10 meters (**decameter**), 100 meters (**hectometer**), 1000 meters (**kilometer**), 1,000,000 meters (**Megameter)** etc. Altogether, there are several dozen such prefixes for even larger and smaller measurements, but for business and scientific purposes it is sufficient to list the main ones here. The prefixes, their abbreviations, and values are summarized on the following **metric line**:

Prefix:	**Mega**	**Kilo**	**Hecto**	**Deca**	**Basic Unit**	**Deci**	**Centi**	**Milli**	**Micro**
Abbrev:	**M**	**k**	**h**	**dc**		**d**	**c**	**m**	**mc/μ**
Value	**1,000,000**	**1,000**	**100**	**10**	**1**	**1/10**	**1/100**	**1/1,000**	**1/1,000,000**

When measuring volumes in the metric system, the liter is the basic unit of measure. To measure volumes that are more or less than a liter, larger or smaller units are created in exactly the same way as for the meter: 1,000,000 liters (**Megaliter**), 1000 liters (**kiloliter**), 100 liters (**hectoliter**), 10 liters (**decaliter**), tenths of a liter (**deciliter**), hundredths of a liter (**centiliter**), thousandths of a liter (**milliliter**), millionths of a liter (**microliter**), etc.

The basic unit of mass (weight) in the metric system is the gram. When measuring masses (weights) that are larger or smaller than a gram, larger or smaller units are likewise created: 1,000,000 grams (**Megagram**), 1000 grams (**kilogram**), 100 grams (**hectogram**), 10 grams (**decagram**), tenths of a gram (**decigram**), hundredths of a gram (**centigram**), thousandths of a gram (**milligram**), millionths of a gram (**microgram**), etc.

Not only are the units of distance, volume, and consistent within the metric system, they are also interrelated. Unlike the English system, where there is no connection between units such as inches/feet and pints/gallons, there *is* a connection between meters, liters, and grams. Remember that the basic unit of distance in the metric system is the meter. Imagine a cubic meter (that is, a cube whose sides are each one meter), filled with water at 4° C.



Such a large cube filled with water will be extremely heavy, take a cube that is one-tenth of a meter or one decimeter (see upper right corner in the cube) on each side, filled with liquid. This **cubic decimeter** represents a volume of **one liter**.

Now, take one tenth of each side of the cubic decimeter (the smallest cube pictured). Since one tenth of one tenth is one one-hundredth (centi-), this forms a **cubic centimeter**. The mass (weight) of this cubic centimeter is **one gram** and its volume is one **milliliter**.

Converting Within the Metric System

To convert measurements within the metric system is a simple matter of multiplying or dividing by 10, 100, 1000, etc. Even simpler, it is a matter of moving the decimal point to the left or right. The first step is to draw a "metric line" with the basic unit in the center, marking off six units to the left and six units to the right. (Note: unless Mega and micro are needed, the basic unit and three units to the left and right will be enough.)

|-------|-------|-------|--------|---------|---------|---------|---------|---------|-------|-------|-------|
M **k** **h** **dc** **basic unit m, l, g** **d** **c** **m** **mc/µ**

To convert from one unit to another simply count the number of places to the left or right, and move the decimal in that direction that many places.

Example 1: **Convert**

a) 6.5 m = _____ cm
b) 6.5 l = _____ cl
c) 6.5 g = _____ cg

Solution: In each part of this example, you are converting from the the basic unit "m," "l," or "g" to a unit with prefix "c" for "centi." Each of these is a move of **two** spaces to the **right**, so in each part, you must move the decimal two places to the right. They are essentially the same problem!

a) 6.5 m = **650 cm**
b) 6.5 l = **650 cl**
c) 6.5 g = **650 cg**

Example 2: **Convert**

a) 6.5 cm = _____mm
b) 6.5 ml = _____l
c) 6.5 g = _____kg
d) 6.5 mg = _____ mcg

Solution:

a) You are converting from the prefix "c" for centi to "m" for milli, which is one space to the right. You must move the decimal one place to the right: 6.5 cm = **65 mm.**
b) You are converting from the prefix "m" for "milli" to the basic unit "l," which is three spaces to the left. You must move the decimal three places to the left: 6.5 ml = **0.0065 l.**
c) You are converting from the basic unit "g" to "k" for "kilo", which is three places to the left. You must move the decimal three places to the left: 6.5 g = **0.0065 kg.**
d) You are converting from "m" for "milli" to "mc" for "micro", which is three places to the right. You must move the decimal three places to the right: 6.5 mg = **6,500 mcg.**

|---------|---------|---------|----------|----------|----------|
k h dc basic unit d c m
m, l, g

Example 3: Convert
a) 0.054 m = _____mm
b) 780 kl = _____l
c) 60 mg = _____kg

Solution: a) You are converting from the basic unit "m" to milli "m," which is three spaces to the right. You must move the decimal three places to the right: 0.054 m = **54 mm.**
b) You are converting from the prefix "k" for "kilo" to the basic unit "l," which is three spaces to the left. You must move the decimal three places to the left: 780 kl = **780,000 l.**
c) You are converting from the milli "m" to "k" for "kilo", which is six places to the left. You must move the decimal six places to the left: 60 mg = **0.00006 kg.**

Example 4: A woman is running the 5 k race (which means "kilometers")to raise money for the American Cancer Society. If the steps that she takes in the race are approximately one meter in length, approximately how many steps does she take in running the race?

Solution: Convert 5 km = _____ m
Move the decimal three places to the right.
Answer = 5000 m. or approximately **5000 steps.**

Example 5: In a canned goods drive for Feed the Hungry, 300 people collect an average of 25 cans of food per person, which average 305 grams per can. Approximately how many kilograms of food were collected in the drive?

Solution: Multiply 300 x 25 x 305 = 2287500 grams
Now, convert 2287500 g = _____kg.
Move the decimal three places to the left.
Answer = **2,287.5 kg.**

Example 6: A swimming pool at the YMCA is has a volume of 7500 cubic meters. How many liters of water are in the pool?

Solution: Each cubic meter of water contains 10 x 10 x 10 or 1000 liters of water.
There are therefore 7500 x 1000 or **7,500,000 liters** of water.

English to Metric Conversions and Metric to English Conversions

1 inch = 2.52 centimeters	1 centimeter = 0.3937 inches
1 foot = 0.3048 meter	1 meter = 39.37 inches
1 mile = 1.6093 kilometers	1 kilometer = 0.62137 mile
1 quart = 0.9464 liter	1 liter = 1.0567 quarts
1 gallon = 3.785 liters	1 liter = 0.2642 gallon
1 ounce = 28.35 grams	1 gram = 0.03527 ounce
1 pound = 0.4536 kilograms	1 kilogram = 2.2046 pounds

The key to converting from the English to metric or metric to English system is to know the conversion numbers from the system you are given to the system to which you are converting. If you have that conversion number, then you can always multiply. The examples that follow will illustrate. Keep in mind that **these conversion numbers are NOT exact, and when they are used, a round-off error is inevitable.**

Example 7: Convert

a) 500 ft. = _____m.
b) 500 mi. = _____km.
c) 500 gal. = _____l.
d) 500 lb. = _____kg.

Solution: In each part of this example, you are converting English system to metric system. Conveniently, each of the conversion numbers are given above.

a) Multiply 500 ft x 0.3048 = **152.4 meters.**
b) Multiply 500 mi x 1.6093 = **804.65 kilometers.**
c) Multiply 500 gal x 3.785 = **1892.5 liters.**
d) Mulitply 500 lb x .4536 = **226.8 kilograms.**

Example 8: Convert

a) 3500 m. = _____in.
b) 40 km. = _____mi.
c) 2000 l. = _____qt.
d) 3500 g. = _____oz.

Solution: In each part of this example, you are converting English system to metric system. Conveniently, each of the conversion numbers are given above.

a) Multiply 3500 m x 39.37 = **137795 inches.**
b) Multiply 40 km x 0.62137 = 24.9268 miles (round to **24.93 miles**).
c) Multiply 2000 l x 1.0567 = **2113.4 quarts.**
d) Multiply 3500 g x 0.03527 = **123.445 ounces.**

In the previous examples, the conversion numbers were conveniently given. What must be done if the necessary conversion numbers are NOT given? Answer: Convert what you have to the other system in the most convenient way, then convert to the appropriate unit. When converting within a given system, remember that when you are converting from larger to smaller units (like feet to inches), you multiply by the conversion number (like multiply times 12). When converting from a smaller to larger units (like inches to feet), you divide by the conversion number (like divide by 12). Also remember that the results are NOT exact, and using different methods will frequently result in different round-off errors.

Example 9: Convert 3500 m. = _____ft.

Solution: First convert from meters to inches, then from inches to feet.
3500 m x 39.37 = 137795 inches.
To convert from inches to feet, you must divide by 12.
137795 inches ⁄ 12 = **11,482.92 feet** or approximately **11,500 feet**.

Example 10: Convert 3500 mi. = _____m.

Solution: First convert from miles to km, then from km to meters.
3500 mi x 1.6093 = 5632.55 km.
To convert from km to meters, move the decimal 3 places to right.
5632.55 km = **5,632,550 m.** (approximately)

- OR - First convert from miles to feet, then from feet to meters.
3500 mi x 5280 = 18,480,000 ft.
18,480,000 ft x 0.3048 = **5,632,704 m.** (approximately)

[Note: The difference in these two answers highlights the fact that if the conversion numbers are only accurate to four digits, then the answers also are only accurate to four digits. We can conclude that the answer is approximately 5,633,000 m.]

Example 11: Convert 20 kl. = _____gal.

Solution: First convert from kl to liters, then from liters to gallons.
20 kl = 20,000 liters.
20,000 l. x 0.2642 = **5284 gallons.** (approximately)

Example 12: Convert 35 ml. = _____oz.

Solution: First convert from ml. to liters, then from liters to quarts, from quarts to pints, and finally from pints to ounces. (There must be a better way!)
35 ml = 0.035 liters
0.035 liters x 1.0567 = 0.0369845 quarts
0.0369845 quarts x 2 = 0.073969 pints x 16 = 1.183504 or **1.18 ml**.

Example 13: The woman (see Example 4) who is running the 5 k race to raise money for the American Cancer Society is wondering how far is the run in miles. Express the distance of the 5 k race in miles.

Solution: Convert 5 km = _____ mi.
5 km. x 0.62137 = 3.10685 miles.
Answer = approximately **3.1 miles**.

Example 14: In order to finish in the top three of a 5 k race (see previous exercise), a woman needs to run a 7-minute mile. If she maintains this pace consistently throughout the race, how long will it take her to finish, and how long will it take her to run each kilometer of the race?

Solution: From the previous exercise, the race is 3.1 miles. If it takes 7 minutes to run 1 mile, this will take 3.1 x 7 or **21.7 minutes** to run 3.1 miles, which is equivalent to 5 kilometers. Now, divide 21.7 minutes (total time) by 5 kilometers, which is 4.034 minutes per kilometer. To maintain this pace, she should run about **4 minutes per kilometer**.

Example 15: Because of a drought in Africa, Feed the Hungry needs to provide food for 225,000 people for six months. If each person to be fed needs 500 grams of food per day in order to survive, how many kilograms of food must be collected to meet this need? How many tons of food is this? (Assume 30 days per month.)

Solution: Six months is 180 days. Multiply 225,000 x 180 x 500 grams. Because this number is so large, it may be easier to calculate this in kilograms. As you recall, to convert from 500 grams (basic unit) to kilograms, move the decimal three places to the left, which is 0.500 or 0.5 kg.
225,000 x 180 x 0.5 kilograms = **20,250,000 kg.**

Now, to convert to tons, you must first change kilograms to pounds. Since 1 kg = 2.2046 lb, multiply 2.2046 x 20,250,000 = 44,643,150 lb. Since 1 ton is 2000 pounds, and you are converting from smaller to larger units, you must divide by 2000. The answer is 44,643,150/ 2000, which is 22,321.75 tons.

Example 16: The competition pool at the YMCA in Orlando, FL. is 25 yards by 50 meters, and it has a depth of 7 feet. How many liters of water are in the pool?

Solution: It is necessary first to convert the dimensions of yards to feet and then the feet to meters. Question: How many feet are in a yard? Answer: It depends upon how many people are in the yard! Really, there are 3 feet in a yard, so 25 yards equals 75 feet. Since 1 foot = 0.3048 feet, 75 feet =

75 x 0.3048 = 22.86 meters, and 7 x 0.3048 = 2.1336 meters. The total volume of the pool is V=LWH, which is 50 x 22.86 x 2.1336 = 2438.70 cubic meters. As in Example 6, each cubic meter contains 1000 liters, so the pool contains about **2,438,700 liters** of water.

Example 17: **Because of evaporation and splashing of water, water level in the competition pool at the YMCA (see Example 16) is down by 3 inches. Remembering that the pool is 25 yards by 50 meters and 7 feet, how many liters of water will be needed to refill the pool?**

Solution: The volume of water to be replaced is 25 yards by 50 meters by 3 inches. Again, it is necessary first to convert all of the dimensions to meters. Of course, 3 inches (divide by 12) is 0.25 feet, and 25 yards is 75 feet. Using 1 foot = 0.3048 feet, 0.25 feet = 0.25 x .3048 = 0.0762 meters, and 75 x 0.3048 = 22.86 meters. The total volume to be replaced is V=LWH, which is 50 x 22.86 x 0.0762 = 87.0966 cubic meters. Since each cubic meter contains 1000 liters, it will take about **87,097 liters** to refill the pool.

Medical Applications—Dosages

Example 18: **a) How many milliliters are in one ounce?**
b) How many milliliters are in one tablespoon?
c) How many milliliters are in one teaspoon?

Solution: a) Beginning with 1 quart = 0.9464 liter, remember that there are 16 ounces in a pint and 2 pints in a quart. Therefore, 1 quart is 32 ounces, so
1 ounce = 1/32 quart x 0.9464 = 0.029575 liters.
To convert liters to milliliters, move the decimal 3 places to the right:
1 ounce = **29.575 milliliters**.

b) 2 tablespoons =1 ounce = 29.575 milliliters, so divide by 2:
1 tablespoon = 14.7875, round off to **15 milliliters**.

c) 3 teaspoons = 1 tablespoon = 14.7875 milliliters, so divide by 3:
1 teaspoon = 4. 929 milliliters, round off to **5 milliliters**.

Example 19: **According to a very old cold remedy, two tablespoons of medicine were to be administered three times a day. Express this dosage in milliliters, and determine how many milliliters would be administered in one week.**

Solution: 2 tablespoons equals 1 ounce, which is **29.575 milliters**.
Three dosages per day for a week will be 21 dosages per week.
29.575 x 21 = **621.075 milliliters per week**.

Example 20: **A 1.5-milliliter injection is to be administered three times a day using a 3-milliliter syringe. The medication comes in 10-milliter vials. How many syringes and how many vials will be needed in a week?**

Solution: At three injections per day, a total of **21 syringes** will be needed. Now, multiply 21 x 1.5 milliliters = 31.5 milliliters. Finally, since the medication comes in 10-milliliter vials, divide by 10, which is 3.15 vials. This will require **4 vials**. (Note: the size of the syringe was not needed.)

Example 21: **A 2.5-milliliter injection is to be administered three times a day using a 3 milliliter syringe. The medication comes in 10-milliter vials. How many syringes and how many vials will be needed in 6 months (assume a 30 day month)?**

Solution: At three injections per day, a total of 3 x 30 x 6 = 540 injections, so **540 syringes** will be needed. Now, multiply 540 x 2.5 milliliters = 1350 milliliters. Finally, since the medication comes in 10-milliliter vials, divide by 10, which is **135 vials**.

Example 22: **At a certain hospital, on the average, 120 patients are administered injections of six milliliters of a certain medicine, four times a day. How many liters of the medication will be needed by the hospital in a 30-day month?**

Solution: 6 milliliters x 4 x 30 x 120 = 86,400 milliters.
To convert to liters, move the decimal 3 places to the left.
86,400 milliters = **86.4 liters.**

EXERCISES

1. Give the names and abbreviations of the metric units on the following "metric line."

1,000,000		1,000	100	10	Basic	1/10	1/100	1/1000		1/1,000,000
Name _____		_____	_____	_____	_____	_____	_____	_____		_____
Abbrev _____		_____	_____	_____	_____	_____	_____	_____		_____

2. Convert each of the following metric to metric units.

a) 1 m. = _____ cm.
b) 1 l. = _____ kl.
c) 50 cg. = _____ mg.
d) 50 cm. = _____ km.
e) 0.05 kg = _____ dg.
f) 0.05 dg. = _____kg.
g) 4000 hl. = _____ l.
h) 4000 g. = _____Mg.
i) 37.5 ml. = _____mcl.
j) 37.5 dg = _____ mg.

In 3 – 13, use the following to convert metric to English or English to metric units.

1 cm = 0.39 in	1 in = 2.54 cm
1 m = 39.37 in	1 ft = 0.3048 m
1 km = 0.62 mi	1 mi = 1.6 km
1 liter = 1.06 qt	1 qt = 0.946 liter
1 kg = 2.2 lb	1 lb = 0.45 kg
1 gram = 0.035 oz	1 oz = 28.35 grams

3. a) 4 mi. = _____ km.
b) 4 km. = _____ mi.
c) 25 lb. = _____ kg.
d) 25 kg. = _____ lb.
e) 700 lb. = _____ g.
f) 6000 kg. = _____tons.
g) 600 liters = _____gal.
h) 500 gal. = _____liters
i) 50 oz = _____ mg.
j) 650 ml = _____ qt.

4. a) 2.5 Ml. = _____ gal.
b) 0.005 oz. = _____ mcg.
c) 0.005 ft. = _____ cm.
d) 0.075 in. = _____ mcm.
e) 35000 mcl = _____ pints
f) 340 Tons = _____Mg.

In 5 – 8, convert the units as indicated. Explain accuracy limitations and discrepancies in your answers.

5. Convert 4000 inches to meters by converting:

   a) from inches to centimeters, then from centimeters to meters.

   b) from inches to feet, then from feet to meters.

6. Convert 7.5 kilometers to feet by converting:

   a) from kilometers to meters, from meters to inches, then from inches to feet.

   b) from kilometers to miles, then from miles to feet.

7. Convert 3000 meters to feet by converting:

   a) from meters to kilometers, from kilometers to miles, then from miles to feet.

   b) from meters to inches, then from inches to feet.

8. Convert 5000 grams to pounds by converting:

   a) from grams to kilograms, then from kilograms to pounds.

   b) from grams to ounces, then from ounces to pounds.

5-8 Recap. In Exercises 5-8, what can be done if more accuracy is needed?

9. A man signs up to run a 25 k (kilometer) race to raise money for the American Heart Association. Express this distance in miles.

10. If the man in the previous exercise runs a 6-minute mile consistently throughout the race, what will be the average time for each kilometer, and how long will it take him to run the race?

11. Compassion International is collecting food for 150,000 refugees in the Sudan. If there is a need to provide 600 grams of food per person for two months (30 days per month), how many kilograms of food will be needed? Express this amount in tons of food.

12. a) How many gallons of water will it take to fill a kiloliter container?

    b) How much does this container of water weigh in kilograms?

    c) How much does the container weigh in pounds?

13. Water is to be stored for hurricane relief in 55-gallon cylindrical drums. How many of these drums would be needed to store 300 kiloliters of water?

14. A 2-milliliter injection of a medication is to be administered three times per day for 30 days. How many milliliters of the medication will be needed? If the medication is dispensed in 10-milliliter vials, how many vials will be needed?

15. A patient takes 300 mg of a medication twice per day for six weeks. How many grams will be needed?

16. A hospital estimates that, on the average, 300 patients will be administered injections of five milliliters of a particular medicine, three times a day. Approximately how many liters of this medication will the hospital use in a 360-day year?

ANSWERS

(Not guaranteed 5/27/16)

1.

	1,000,000		1,000	100	10	Basic	1/10	1/100	1/1000		1/1,000,000
Name:	**Mega**		**Kilo**	**Hecto**	**Deca**	**Meter Liter Gram**	**Deci**	**Centi**	**Milli**		**Micro**
Abbrev:	**M**		**k**	**h**	**dc**		**d**	**c**	**m**		**mc/μ**

2a) 100; b) 0.001; c) 500; d) 0.005; e) 500; f) 0.000005; g) 400000; h) 0.004; i) 37500; j) 3750.

3a) 6.4; b) 2.48; c) 11.25; d) 55; e) 315000; f) 6.6; g) 159; h) 1992; i) 1417500; j) 0.689.

4a) 662500; b) 141750; c) 0.1524; d) 1905; e) 0.0742; f) 306.

5a) 101.6; b) 101.6; Appears to be accurate to four decimal places.

6a) 24,606.25; b) 24,552; Appears to be accurate only to three decimal places, approx.=24,600.

7a) 9820.8; b) 9842.5; Appears to be accurate only to two decimal places, approx.=9800.

8a) 11; b) 10.9375. Appears to be accurate only to two decimal places, approx.=11.

Recap: If more accuracy is needed, then a more accurate value of the conversion numbers must be used (see page 7).

9. 15.5 mi.

10. 3.72 min per km; 93 minutes total.

11. 5,400,000 kg; 5940 tons.

12a) 265 gal; b) 1000 kg; c) 2200 lb,

13. 1445.45 drums.

14. 12 vials.

15. 25.2 grams.

16. 1620 liters.