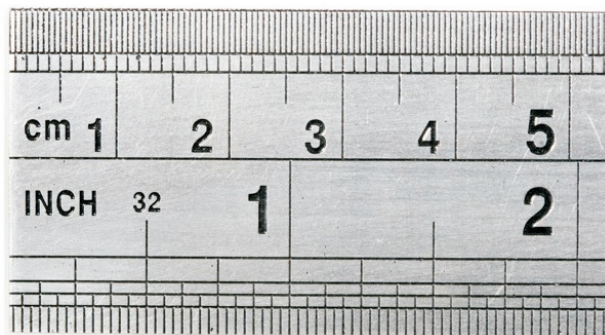


Use U.S. and Metric Measurements

THERE ARE two customary systems of measurement used in our country: the U.S. system and the metric system. It is critical to understand both systems and how to convert from one system to the other. Being familiar with these systems is useful in a variety of professions and for certain tasks in home ownership.



Objectives:



1. Explain U.S. and metric linear measurement.
2. Explain U.S. and metric area measurement.
3. Explain U.S. and metric volume measurement.
4. Explain U.S. and metric weight measurement.

Key Terms:



metric system
unit equations

Understanding U.S. and Metric Linear Measurement

There are two customary systems of measurement used in our country: the U.S. system and the metric system. The **metric system** has the advantage of being a decimal measuring system. The equivalents that are used to make conversions within each system are called **unit equations**.

The method of using equations to make conversions involves arranging the unit equation as a fraction so the given units will cancel and the desired units will remain. For example, to change 28 miles/gallon to kilometers/liter, you would do the following computations:

$$28 \text{ miles/gallon} \times (1 \text{ gallon}/3.785 \text{ liters}) \times 1.6093 \text{ kilometers}/1 \text{ mile}$$

By canceling out the gallons and the miles, the answer will be kilometers/liter. $28 \times (1.6093 \text{ kilometers}/3.785 \text{ liters}) = 11.91 \text{ kilometers/liter}$. Review and study the following tables of measurement equivalents and conversion units.

TABLE 1. Common U.S. Linear Units and Equivalents

12 inches (in.)	1 foot (ft.)
3 ft.	1 yard (yd.)
16.5 ft.	1 rod (rd.)
5.5 yd.	1 rd.
320 rd.	1 mile (mi.)
280 ft.	1 mi.
1,720 yd.	1 mi.
1 furlong (fur.)	1/8 mi.
1 fur.	660 ft.

TABLE 2. Metric Linear Units and Equivalents

1 kilometer (km)	1,000 meters (m)
1 hectometer (hm)	100 m
1 decameter (dam)	10 m
1 decimeter (dm)	0.1 m
1 centimeter (cm)	0.01 m
1 millimeter (mm)	0.001 m
1 m = 10 dm = 100 cm	1,000 mm

After studying the above tables, make sure that you can:

1. Add and subtract mixed linear measurements.
2. Measure and record linear distances.
3. Convert various linear measurements.

It is strongly suggested that you practice some calculations before moving on. Some practice examples are provided for you.

U.S. and Metric Linear Measurements

Add and simplify:

1. 5 yd., 1 ft., and 11 in. + 3 yd., 2 ft., and 3 in. = _____
2. 4 yd., 2 ft., and 6 in. + 7 yd., 1 ft., and 4 in. + 2 yd. and 6 in. = _____

TABLE 3. U.S.-Metric Conversion Units

1 in.	25.4 mm
1 in.	2.54 cm
1 ft.	30.48 cm
1 ft.	0.3048 m
1 yd.	0.9144 m
1 rd.	5.029 m
1 mi.	1.6093 km
1 fur.	201.168 m
1 mm	0.03937 in.
1 cm	0.3937 in.
1 m	3.281 ft.
1 km	0.6214 mi.

Subtract:

3. 3 yd., 1 ft., and 8 in. – 1 yd., 2 ft., and 10 in. = _____

4. 2 yd., 1 ft., and 11 in. – 1 yd., 2 ft., and 7 in. = _____

Using a ruler with U.S. and metric units, measure the lines in problems 5 and 6.

5. _____ (to the nearest centimeter and $\frac{1}{4}$ inch)

_____ cm

_____ in.

6. _____ (to the nearest 0.1 centimeter and $\frac{1}{8}$ inch)

_____ cm

_____ in.

Make the following conversions:

7. 2 ft. 3 in. = _____ yd.

8. 150 cm = _____ in.

9. 6 ft. 8 in. = _____ m

10. _____ yd. = 156 m

11. 4,132 yd. = _____ mi.

12. 25 km = _____ mi.

13. _____ mi. = 690 ft.

14. _____ rd. = 2.5 mi.

U.S. and Metric Area Measurement

In business applications, it is necessary to know how to convert U.S. and metric measurements when calculating areas. Study and review the following tables of measurement equivalents and conversion units.

TABLE 4. U.S. Area Units

144 square inches (sq. in.)	1 square foot (sq. ft.)
9 sq. ft.	1 square yard (sq. yd.)
30.25 sq. yd.	1 square rod (sq. rd.)
160 sq. rd.	1 acre (A)
43,560 sq. ft.	1 A
640 A	1 square mile (sq. mi.)
36 sq. mi.	1 township (twp.)

TABLE 5. Metric Area Units

1 square centimeter (cm ²)	100 square millimeters (mm ²)
1 square decimeter (dm ²)	100 cm ²
1 square meter (m ²)	100 dm ²
10,000 m ²	1 hectare (ha)
1 m ²	10,000 cm ²
100 m ²	1 are (a)
100 a	1 ha

After studying the above tables, make sure that you can:

- ◆ Add and subtract mixed area measurements
- ◆ Convert from one type of measurement to another
- ◆ Solve word problems (showing work)

It is strongly suggested that you practice some calculations before moving on. Some practice examples are provided for you.

U.S. and Metric Area Measurement

Add or subtract:

1. 1,420 sq. in. + 160 sq. in. = _____ sq. ft.
2. 4 A – 420 sq. rd. = _____ sq. rd.

Make the following conversions:

3. 110.0 A = _____ m²
4. 196 sq. in. = _____ sq. ft.
5. 120 sq. rd. = _____ sq. ft.
6. 75 A = _____ ha

TABLE 6. U.S.-Metric Conversion Units

U.S. Measurement	Metric Measurement
1 sq. in.	6.452 cm ²
1 sq. ft.	0.0929 cm ²
1 sq. yd.	0.8361 m ²
1 sq. mi.	259 ha
1 sq. mi.	2.589 square kilometers (km ²)
1 sq. rd.	25.293 m ²
1 A	40.47 a
1 A	0.4047 ha
1 cm ²	0.1549 sq. in.
1 m ²	1549 sq. in.
1 m ²	10.76 sq. ft.
1 m ²	1.196 sq. yd.
1 ha	2.471 A
1 a	119.6 sq. yd.

7. _____ $\text{cm}^2 = 67.0 \text{ sq. in.}$
8. $675 \text{ M}^2 =$ _____ sq. yd.
9. $6 \text{ M}^2 =$ _____ cm
10. $850 \text{ m}^2 =$ _____ a

Complete the following problems, showing all your work:

11. A 10-10-10 fertilizer needs to be applied at the rate of 300 pounds/acre. At this rate, how much fertilizer is needed for a garden with 5,600 square feet?
12. A farmer sold 8.5 acres to a realtor for \$2,500/acre. If the realtor developed the area and sold 12,342 square foot lots for \$4,500 per lot, how much profit did the realtor make?
13. A crop farmer hires custom combining for his corn.
 - a. Which of the following proposals is better?
 - \$1,382.75 for 95.4 acres
 - \$1,471.25 for 40.0 acres
 - b. What is the difference between the two offers?



UNDER INVESTIGATION...

LAB CONNECTION: Overcoming Conversion Aversion

Let's assume you are an assistant analyst for a consulting firm that has been asked to evaluate a new product by John Deere. Deere believes its new equipment will reduce the corn crop loss during harvesting by 25 percent. Your firm's more experienced analysts have performed the calculations a number of times and come up with a reduction of 50 percent.

In an act of relative desperation, the manager of the Analysis Department has given you the opportunity to evaluate the information, expressing concern about the other members of the department having an aversion to the conversion of large area measurements. The manager hints that if you do not have such an aversion and perform the proper calculations, which lead to the desired conclusion, you will certainly be in line for a promotion to analyst or perhaps even senior analyst if senior management is sufficiently impressed.

You are highly motivated as you know this will result in a considerable pay increase, extra benefits, and prestige in the company. You are also confident that you can solve the problem correctly because of the excellent training you received in the business department of your high school.

1. Read and evaluate the written results of the two field tests.
2. Write equations and ratios that will provide accurate and desirable results.
3. Write out each step you would take to solve this problem, clearly showing the results of each calculation and conversion.
4. After arriving at the correct answer, draw a box around it, and verify that the proper measurement is included.

14. A new subdivision project takes a strip of crop land 9 rods wide and 250 rods long from the side of your farm. How many acres did you lose from production?
15. A variety of fruit trees require a growing area of 15 feet by 21 feet. How many trees can be planted in a 20-acre orchard?

U.S. and Metric Volume Measurement

Several U.S. and metric conversion measurements are needed to perform volume calculations. Study and review the following tables of measurement equivalents and conversion units.

TABLE 7. U.S. Volume Units

Liquid measurements:	
1 pint (pt.)	16 ounces (oz.)
2 pt.	1 quart (qt.)
4 qt.	1 gallon (gal.)
31.5 gal.	1 barrel (bbl.)
7.48 gal.	1 cubic foot (cu. ft.)
Dry measurements:	
2 pt.	1 qt.
8 qt.	1 peck (pk.)
4 pk.	1 bushel (bu.)
1 bu.	1.25 cu. ft.
Household measurements:	
1 teaspoon (tsp.)	$\frac{1}{6}$ fluid ounce (fl. oz.)
3 tsp.	1 tablespoon (tbs.)
1 tbs.	$\frac{1}{2}$ fl. oz.
1 cup (c.)	8 fl.oz.
2 c.	1 pt.

TABLE 8. Metric Volume Units

Solid volume:	
1 cubic centimeter (cm ³)	1,000 cubic millimeter (mm ³)
1 cubic meter (m ³)	1,000,000 cm ³
1,000 cm ³	1 cubic decimeter (dm ³)
1,000 cm ³	1 liter (L)
1 cm ³	1 milliliter (ml)
Liquid volume:	
1 ml	0.001 L
1 centiliter (cl)	0.01 L
1 deciliter (dl)	0.1 L
1 decaliter (dal)	10 L
1 hectoliter (hl)	100 L
1 kiloliter (kl)	1,000 L

After studying the above tables, make sure that you can:

1. Add and subtract mixed volume measurements
2. Convert various volume measurements
3. Solve word problems involving volume measurements; show work

U.S. and Metric Volume Measurement

Add or subtract:

1. 5 gal., 3 qt., and 2 pt. + 6 gal., 2 qt., and 1 pt. = _____
2. 8 gal., 2 qt., and 5 pt. – 3 qt. and 1 pt. = _____

Make the following conversions:

3. _____ qt. = 48 fl. oz.
4. 55 cm³ = _____ sq. in.
5. 10 sq. ft. = _____ sq. in.
6. 16 L = _____ qt.
7. 86 pk. = _____ bu.
8. 12 gal. = _____ pt.

Complete the following problems, showing all of the work:

9. Gasoline is selling for \$1.26 per gallon. What would be the cost of 28 liters of gasoline?
10. How much wettable powder would be put into a 250-gallon tank if 12 gallons of water were applied per acre and 1.5 pounds of commercial product were applied per acre?
11. The owner of an orchard has 25 bushels of apples to sell. How many bags containing 1 peck and 1 quart of apples can be prepared for sale?
12. A landscaping plan includes the placement of 123 cubic feet of pine bark. What will be the total cost for the pine bark if it is sold in three cubic feet bags for \$2.85 per bag?
13. If one cubic foot of storage space holds 0.75 bushels, what diameter would a 20-foot high round steel bin have to be to store 8,500 bushels of grain?

TABLE 9. U.S.-Metric Volume

U.S. Measurement	Metric Measurement
1 pt.	0.4732 L
1 qt.	0.9463 L
1 L	1.0567 qt.
1 gal.	3.7853 L
1 L	0.264 gal.
1 grain (gr.)	0.0648 gram (g)
1 oz.	28.35 g
1 pound (lb.)	453.6 g
1 lb.	0.4536 kilogram (kg)
1 g	15.432 gr.
1 g	0.03528 oz.
1 kg	2.204 lb.
1 metric ton (MT)	1.1023 ton (T.) short ton

U.S. and Metric Weight Measurement

Weight can be calculated using U.S. and metric measurement. However, several conversion factors are needed to understand U.S. and metric weight measurement. Study and review the following tables of measurement equivalents and conversion units.

TABLE 10. U.S. Weight Units

437.5 gr.	1 oz.
7,000 gr.	1 lb.
16 oz.	1 lb.
100 lb.	1 hundredweight (cwt.)
2,000 lb.	1 T
2,240 lb.	1 long ton

TABLE 11. Metric Weight Units

1 milligram (mg)	0.0001 g
1 centigram (cg)	0.01 g
1 decigram (dg)	0.1 g
1 decagram (dag)	10 g
1 hectogram (hg)	100 g
1 kg	1,000 g
1 MT	1,000 kg

After studying the above tables, make sure that you can:

1. Add and subtract mixed weight measurements
2. Convert various weight measurements
3. Solve word problems involving weight measurements; show your work

U.S. and Metric Weight Measurement

Add or subtract:

1. $8 \text{ lb. } 2 \text{ oz.} + 4 \text{ lb. } 7 \text{ oz.} + 12 \text{ lb. } 9 \text{ oz.} =$

2. $15 \text{ lb. } 4 \text{ oz.} - 6 \text{ lb. } 8 \text{ oz.} =$ _____

Make the following conversions:

3. $12 \text{ oz.} =$ _____ g

4. $6 \text{ g} =$ _____ gr.

5. $2,860 \text{ lb.} =$ _____ MT

6. $65 \text{ kg} =$ _____ lb.

TABLE 12. U.S.-Metric Weight Conversion Units

U.S. Measurement	Metric Measurement
1 gr.	0.0648 g
1 oz.	28.35 g
1 lb.	453.6 g
1 lb.	0.4536 kg
1 T	0.9072 MT

7. 18.5 lb. = _____ g

8. 3.65 t = _____ lb.

Complete the following problems, showing all of your work:

9. A grocery store ad reads “Tom Turkeys \$0.89/lb.” What would it cost for a turkey that weighs 24 pounds and 8 ounces?
10. Your popcorn produced an average yield of 3,740 pounds/acre. Convert this yield to kilograms/hectare.
11. A concrete culvert contains 26 cubic feet of concrete. How many tons does the culvert weigh?
12. A standing crop of alfalfa hay is being offered for sale. If baled hay is selling for \$80 a ton and harvesting costs are considered to be 55 percent of the total value of baled hay, what should be charged for each 75-pound bale harvested from the standing crop?

Summary:



There are two customary systems of measurement used in our country: the U.S. system and the metric system. The metric system has the advantage of being a decimal measuring system. The equivalents used to make conversions within each system are called unit equations.

It is critical to understand both systems and how to convert from one system to the other. Being familiar with these systems is useful in a variety of professions and for certain tasks in home ownership.

Checking Your Knowledge:



1. One acre has _____ square rods and _____ square meters.
2. A _____ is 36 square miles.
3. There are _____ quarts in a gallon and _____ pints in a quart.
4. One peck equals _____ pints.
5. If one peck of corn fell on the ground in an area two rods by two rods and it represents a harvest loss of 10 bushels per acre, what is the loss if one peck is found in an area four rods by four rods?

Expanding Your Knowledge:



Visit the Science Made Simple Web site: <http://www.sciencemadesimple.net/temperature.php>. Practice and play with all sorts of conversions. You can also use this site to check your practice problem answers.

Web Links:



Conversion Calculator

<http://www.worldwidemetric.com/metcal.htm>

Online Conversion

<http://www.onlineconversion.com/>

Conversion Tables

<http://www.convert-me.com/en/>