

Measurement: Things To Know

Objectives:

1. Identify units of measurement in the US Customary and Metric systems.
2. Compare attributes of objects to units of measurement of length, area, and volume.
3. Convert units of measured quantities using dimensional analysis.

Vocabulary:

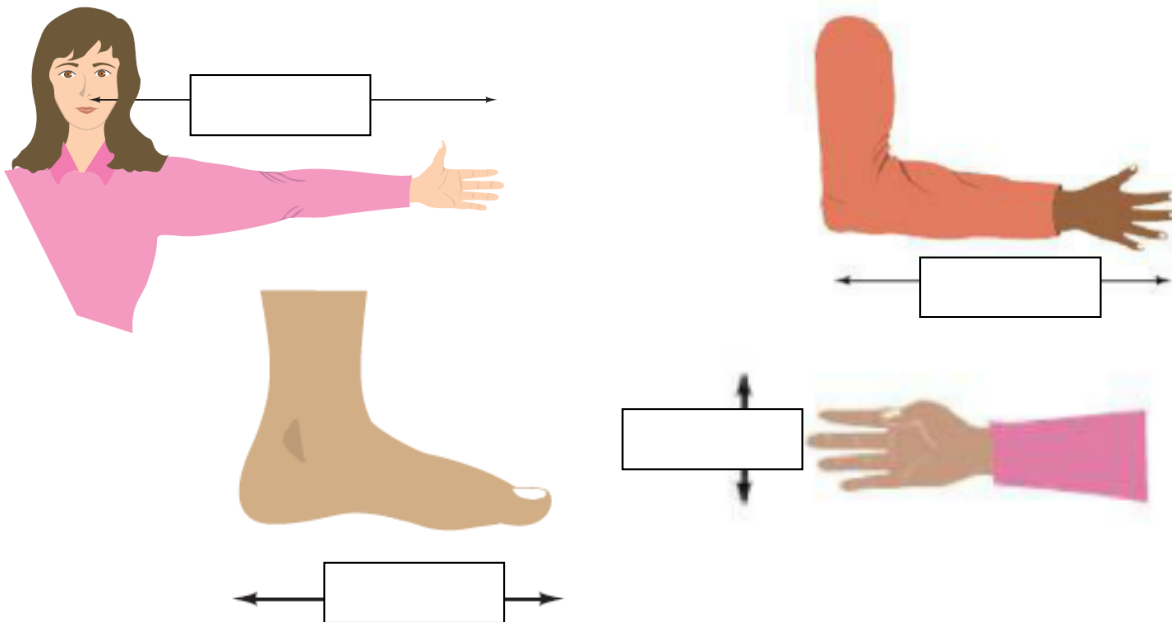
- units
- dimension
- US Customary System
- Metric System

Recall that the word *geometry* comes from the Greek language and means “to measure the earth.”

Early geometry in the ancient Babylonian and Egyptian civilizations was always very practical—archaeologists have found clay tablets, used as textbooks, filled with examples of measuring the lengths of rivers, the area of fields, and the volume of granaries.

Determining the size of an item requires that a comparison is made between the item (say, a farmer’s field) and a special size (for example, an acre of land). These special sizes are called _____.

In early times, units were defined more for convenience than accuracy. For example, many units of length correspond to parts of the human body, such as those below:



Many of these units became standardized and are still in use today. For example, horses are still measured in hands, where a hand is now equal to 4 inches.

The measurement process can be viewed as a sequence of steps (given on the next page). Though many adults think of measurement as a topic from later grades, children start learning the steps of measurement even before preschool. As soon as a child begins using the words “bigger” and “smaller,” they are using the measurement process!

The Measurement Process

1. Choose the property, or _____ (such as length, area, volume, capacity, temperature, time, or weight), of an object or event that is to be measured.
2. Select an appropriate _____.
3. Use a measurement device to _____, or otherwise provide a comparison of the object with the unit.
4. Express the measurement as the _____ of units used.

US Customary System

This system comes from a number of different units from different cultures and regions that were standardized over a relatively long period of time. Comparisons between units use numbers that are accidental, rather than planned, and so using the Customary system often requires extensive memorization, and computations with cumbersome numerical factors.

Note: Some items in the tables that follow might not be on the PowerPoint. Do some research to find the answers!

Units of Length in the US Customary System

Unit	Abbreviation	Equivalent Measurement in Feet
Inch		
Foot		
Yard		
Mile		

Units of Area in the US Customary System

Unit	Abbreviation	Equivalent Measure in Other Units
Square inch		
Square foot		
Square yard		
Acre		
Square mile		

Units of Volume in the US Customary System		
Unit	Abbreviation	Equivalent Measure in Other Units
Cubic inch		
Cubic foot		
Cubic yard		

Units of Capacity in the US Customary System		
Unit	Abbreviation	Equivalent Measure in Other Units
Teaspoon		
Tablespoon		
Fluid Ounce		
Cup		
Quart		
Gallon		

In the next example, we will take a fraction or ratio, and multiply repeatedly by equivalent ratios in order to “cancel” units, so that we can rewrite a speed in miles per hour into a speed in feet per second. Pay careful attention to this method (which we’ll call **Dimensional or Unit Analysis**). You will see this again.

Example

A cheetah can run 60 miles per hour. What is the speed in feet per second?

The Metric System

This system was designed in France at the end of the 18th century in order to provide a universal system of measurement based solely on powers of ten. (Interestingly, French scientists saw this project as the democratization of measurement—the mathematician Condorcet said “The metric system is for all the people for all the time.”) It is also known as the SI system after its French name, *Systeme Internationale*.

Fundamental Units in the Metric System

Length	
Area	
Volume	
Weight*	
Temperature	

*Technically this is a unit of mass, not weight, but in many situations the distinction between mass and weight is irrelevant.

The Metric System Decimal Prefixes

In each of the units above, the following prefixes are used frequently to modify units. For example, one kilometer is equal to 1000 meters.

Prefix	Factor	Symbol
	$1000 = 10^3$	
	$100 = 10^2$	
	$10 = 10^1$	
	$1 = 10^0$	
	$0.1 = 10^{-1}$	
	$0.01 = 10^{-2}$	
	$0.001 = 10^{-3}$	
	$0.000001 = 10^{-6}$	

Example Changing Units in the Metric System

Convert each of these measurements to the unit shown:

- a. 1495 mm = _____ m
- b. 29.5 cm = _____ mm
- c. 38.741 m = _____ km

Example Estimating Weights in the Metric System

Match each term to the approximate weight of the item taken from the list that follows:

- | | |
|---|---------|
| a. Nickel | 2 mg |
| b. Compact automobile | 2 kg |
| c. Two-liter bottle of soda | 100 g |
| d. Recommended daily allowance of vitamin B-6 | 1200 kg |
| e. Size D battery | 9 kg |
| f. Large watermelon | 5 g |

Temperature

In degrees Celsius, the scale from 0 to 100 represents the difference between the freezing point of water and the boiling point of water. (Many quantities in metric units are based on water; for example, one milliliter is the space taken up by one cubic centimeter of water.)

Formulas for converting between Celsius and Fahrenheit:	

Example Converting Temperatures

Convert the following temperatures to Celsius or Fahrenheit.

- a. 50°C
- b. 14°F

Mixed Practice: Unit Analysis

Complete this page for some more practice in the Unit Analysis process. Answers are at the bottom of this page, but complete solutions will be posted to Canvas.

a. 55 feet per second is how many miles per hour? Round to tenths.

1 mile = 5280 feet

1 minute = 60 seconds

1 hour = 60 minutes

b. 40 miles per hour is how many feet per second? Round to tenths.

1 mile = 5280 feet

1 minute = 60 seconds

1 hour = 60 minutes

c. One gallon for five miles is how many dollars per day?

1 hour to travel 55 miles

1 gallon is \$3.10

1 driving day is 10 hours

d. 240 milliliters in 12 hours is how many microdrops per minute?

60 microdrops = 1 milliliter

1 hour = 60 minutes