## Measurement

## * Module 12 ${ }^{\text {* }}$

## Attributes and Tools

## Lesson 1 <br> Measurement Systems

## Objectives

- Identify and select appropriate units and tools from both systems, customary and metric, to measure (e.g. distance with feet/meters).
- Establish through experience benchmark prefixes of milli-, centi, deci-, deca-, hecto-, and kilo-.
- Distinguish the difference between weight and mass.
- Understand, select, and use the appropriate units and tools (metric and customary) to measure length, weight, mass, and volume to the required degree of accuracy for real-world problems.

Teacher Notes 12.1


## Get Started

- Bring an empty milk container (one gallon) and one eight-ounce cup to class.
- Ask students to imagine the container full of cold milk. Each person in a family of four drinks one glass of milk per day. Show the students the empty eight-ounce glass.
- Ask students how long they think it would take for the container to become empty. Write students' guesses on the board. Tell students they will be able to answer the question after today's lesson on measurement units. Four days


## Subtrpic l

## Expand Their Horizons

In this subtopic, students are introduced to the customary system of measurement. They learn the customary units of length, capacity, and weight and are introduced to some benchmarks and measurement tools.

Have students determine additional benchmarks for an inch, a foot, and a yard. Possible items might include a button or quarter for an inch, a shoe or football for a foot, and the length or height of a student desk for a yard.

It is, in general, more difficult for students to think of benchmarks for weight and capacity than it is for length. The weight of an object cannot be determined simply by looking at the object. For instance, two objects can be the same size and yet weigh different amounts depending on what they are made of. Capacity is also difficult because a container holding a given amount can vary in size and shape. For example, a quart container can be tall and skinny like a milk container, or it could be cylindrical like a juice can. Encourage students to read food and drink labels to get an idea of the weight and capacity of different objects.

Sometimes the best unit of measure is determined on how the measurement will be used. If consumers are shopping for a piece of furniture that fits in a certain space in a room, it is easier to go to the store with comparable dimensions, which will eliminate the need for converting units while shopping.

Most laptops are about one foot long. Some may be slightly shorter or longer, so either inches or feet are the most appropriate units of length. The distance between most major U.S. cities is measured in miles. Heights of ceilings can vary, but most are at least eight feet tall. The height can be measured in feet or yards.

A coffee mug generally holds between eight and 16 fluid ounces. Cups and fluid ounces are appropriate measures. The capacity of most perfume bottles is measured in fluid ounces. Swimming pools, regardless of their size and shape, are large. Their capacity is measured in gallons.

As mentioned in the lesson, most remote controls weigh less than a loaf of bread, that is, less than a pound. A remote control would be measured in ounces. Male elephants can weigh up to 15,000 pounds and females up to 8,000 pounds, so the weight can be measured in pounds or tons. Boxes of books would be measured in pounds. Though the size of the box and the number of books could vary, none would weigh less than a pound or as much as a ton.

## Additional Examples

1. Compare each amount using < or > .

The weight of a cow is $\qquad$ 3 lb .

A drop of water is $\qquad$ 1 fl oz .

12 in . is $\qquad$ a baseball bat.

Cows are large animals and weigh considerably more than three pounds. One fluid ounce is one-eighth of a cup, and a drop of water is less than oneeighth of a cup. A baseball bat is nearer in length to a yard than to a foot, which is 12 inches long. Twelve inches is less than the length of a baseball bat.
2. Which would be best measured in yards?

- The distance from New York to Paris
- The diameter of a dinner plate
- The length of a driveway

The distance from New York to Paris is many miles, and yards would not be appropriate. The diameter of a dinner plate is smaller than a yard. The length of a driveway would be best measured in yards. The length would be several inches but too short to be measured in miles.

## Subtapic 己

## The Metric System

## Expand Their Horizons

In this subtopic, students are introduced to the metric system of measurement. They learn the prefixes and their meanings for the metric units of length, capacity, and mass and become familiar with some metric benchmarks as well.

Review powers of 10 with students. Have students complete the table below.

| $10^{3}$ | $10^{2}$ | $10^{1}$ | $10^{0}$ | $10^{-1}$ | $10^{-2}$ | $10^{-3}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1,000 | 100 | 10 | 1 | 0.1 | 0.01 | 0.001 |

[^0]The difference between mass and weight may be confusing for students. Emphasize that weight varies from planet to planet because it is based on gravity, which also varies from planet to planet (or moon). Mass is constant, regardless of where it is in space. Since most people never leave Earth, mass and weight tend to be used interchangeably.

Kilo- means thousand. A kiloliter contains 1,000 liters. Milli- means one-thousandth. A milligram is $\frac{1}{1,000}$ gram. There are 1,000 milligrams in a gram. Centi- means onehundredth. A centimeter is $\frac{1}{100}$ meter. There are 100 centimeters in a meter.

A kilometer is a little greater than one-half mile. Buildings are not that tall, so they would be measured in meters. A slice of cheese is considerably less than the weight of a book, which is about one kilogram. It is measured in grams. A juice glass is smaller than a liter bottle. The more reasonable choice is milliliters.

The mass of a dollar bill is about a gram, and a motorcycle contains much more mass than a dollar bill. Kilograms is the better choice. The length of a grain of rice is much less than a baseball bat, which is about a meter long. Measure it in millimeters. The capacity of an eye dropper is measured in milliliters. An aquarium can hold numerous droppers worth of water. It is measured in liters.

## Additional Examples

## 1. Which is best measured in centimeters?

- The length of a pair of scissors
- The width of a strand of hair
- The height of a mountain

The width of a strand of hair is close to the width of the tip of a pencil. It is smaller than a centimeter, so it is best measured in millimeters.

A mountain is too tall to measure in centimeters.

A pair of scissors is best measured in centimeters.

## 2. Solve.

- How many millimeters are in one meter?
- How many deciliters are in one liter?
- How many grams are in a decagram?
- A gram is what fraction of a decagram?

Milli- means thousandths. There are 1,000 millimeters in one meter.

Deci- means tenths. There are 10 deciliters in one liter.

Deca- means ten. There are 10 grams in one decagram. That means that a gram is one-tenth of a decagram.

## Look Beyond

This lesson introduces students to the customary and metric systems of measurement. It lays the groundwork for the remaining lessons in this module. In later lessons students will learn to convert within the same measurement system, measure distance and weight, and solve real-world problems involving measurements.

## Connections

Nurses need to understand metric measurements of capacity and mass to correctly administer drugs to their patients. Liquid medicines are most often measured in doses of milliliters, and pills are usually measured in doses of milligrams. Overdoses, including fatal overdoses, can occur because of a misplaced decimal point.


[^0]:    Common Error Alert:
    The prefixes deci- and deca- are similar, and students may have difficulty remembering which means one hundred and which means one hundredth. Tell students that deci- ends in an " i " as do centi- and milli-. All the prefixes ending in "i" are decimal powers of 10 (less than one).

