# LESSON 12.2

# LESSON 12.1

## Measurement Benchmarks

You can use benchmarks to estimate measurements.

The chart shows benchmarks for customary units of measurement.

**Benchmarks for Some Customary Units**

| | | | | | |
|---|---|---|---|---|---|
| ⊢1 ft⊣ about 1 foot | ⊢1 yd⊣ about 1 yard | about 1 cup | about 1 gallon | about 1 ounce | about 1 pound |

Here are some more examples of estimating with customary units.

- The width of a professional football is about __1 foot__.
- A large fish bowl holds about __1 gallon__ of water.
- A box of cereal weighs about __1 pound__.

The chart shows benchmarks for metric units of measurement.

**Benchmarks for Some Metric Units**

| | | | | | |
|---|---|---|---|---|---|
| about 1 centimeter | about 1 meter | about 1 milliliter | about 1 liter | about 1 gram | about 1 kilogram |

Here are some more examples of estimating with metric units.

- The width of a large paper clip is about __1 centimeter__.
- A pitcher holds about __1 liter__ of juice.
- Three laps around a track is about __1 kilometer__.

## Customary Units of Length

A ruler is used to measure length. A ruler that is 1 foot long shows 12 inches in 1 foot. A ruler that is 3 feet long is called a yardstick. There are 3 feet in 1 yard.

**How does the size of a foot compare to the size of an inch?**

**Step 1** A small paper clip is about 1 inch long. Below is a drawing of a chain of paper clips that is about 1 foot long. Number each paper clip, starting with 1.

1   2   3   4   5   6   7   8   9   10   11   12

**Step 2** Complete this sentence.

In the chain of paper clips shown, there are __12__ paper clips.

**Step 3** Compare the size of 1 inch to the size of 1 foot.

There are __12__ inches in __1__ foot.

So, 1 foot is __12__ times as long as 1 inch.

# LESSON 12.3

## Customary Units of Weight

Ounces and pounds are customary units of weight. A ton is a unit of weight that is equal to 2,000 pounds.

A slice of bread weighs about 1 ounce. Some loaves of bread weigh about 1 pound.

**How does the size of 1 ounce compare to the size of 1 pound?**

**Step 1** You know a slice of bread weighs about 1 ounce. Below is a drawing of a loaf of bread that weighs about 1 pound. Number each slice of bread, starting with 1.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
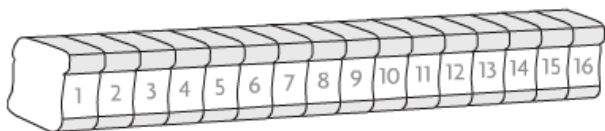
**Step 2** Complete this sentence.

In the loaf of bread shown above, there are ___16___ slices of bread.

**Step 3** Compare the size of 1 ounce to the size of 1 pound.

There are ___16___ ounces in ___1___ pound.

So, 1 pound is ___16___ times as heavy as 1 ounce.

**LESSON 12.4**

## Customary Units of Liquid Volume

Liquid volume is the measure of the space a liquid occupies. Some basic units for measuring liquid volume are **gallons, half gallons, quarts, pints, cups,** and **fluid ounces**. The table at the right shows the relationships among some units of liquid volume.

| |
|---|
| 1 cup = 8 fluid ounces |
| 1 pint = 2 cups |
| 1 quart = 2 pints |
| 1 half gallon = 2 quarts |
| 1 gallon = 4 quarts |

**How does the size of a gallon compare to the size of a pint?**

**Step 1** Use the information in the table. Draw a bar to represent 1 gallon.

| 1 gallon |
|---|

**Step 2** The table shows that 1 gallon is equal to 4 quarts. Draw a bar to show 4 quarts.

| 1 quart | 1 quart | 1 quart | 1 quart |
|---|---|---|---|

**Step 3** The table shows that 1 quart is equal to 2 pints. Draw a bar to show 2 pints for each of the 4 quarts.

| 1 pint | 1 pint | 1 pint | 1 pint | 1 pint | 1 pint | 1 pint | 1 pint |
|---|---|---|---|---|---|---|---|

**Step 4** Compare the size of 1 gallon to the size of 1 pint.

There are ___8___ pints in ___1___ gallon.

So, 1 gallon is ___8___ times as much as 1 pint.

**LESSON 12.5**

## Line Plots

Howard gave a piece of paper with several survey questions to his friends. Then he made a list to show how long it took for his friends to answer the survey. Howard wants to know how many surveys took longer than $\frac{2}{12}$ hour.

**Time for Survey Answers (in hours)**

$\frac{1}{12}$  $\frac{3}{12}$  $\frac{1}{12}$  $\frac{2}{12}$  $\frac{6}{12}$  $\frac{3}{12}$  $\frac{5}{12}$

**Make a line plot to show the data.**

**Step 1** Order the data from least to greatest.

$\frac{1}{12}$, $\frac{1}{12}$, $\frac{2}{12}$, $\frac{3}{12}$, $\frac{3}{12}$, $\frac{5}{12}$, $\frac{6}{12}$
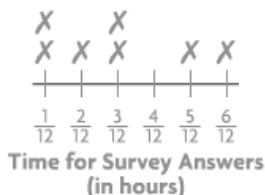
**Step 2** Make a tally table of the data.

| Survey | |
|---|---|
| Time (in hours) | Tally |
| $\frac{1}{12}$ | \|\| |
| $\frac{2}{12}$ | \| |
| $\frac{3}{12}$ | \|\| |
| $\frac{5}{12}$ | \| |
| $\frac{6}{12}$ | \| |

**Step 3** Label the fractions of an hour on the number line from least to greatest. Notice that $\frac{4}{12}$ is included even though it is not in the data.

**Step 4** Plot an X above the number line for each piece of data. Write a title for the line plot.

**Step 5** Count the number of Xs that represent data points greater than $\frac{2}{12}$ hour.

There are ___4___ data points greater than $\frac{2}{12}$ hour.

So, ___4___ surveys took more than $\frac{2}{12}$ hour.

```
    X       X
X   X   X       X   X
+---+---+---+---+---+---+
1   2   3   4   5   6
12  12  12  12  12  12
```
**Time for Survey Answers (in hours)**

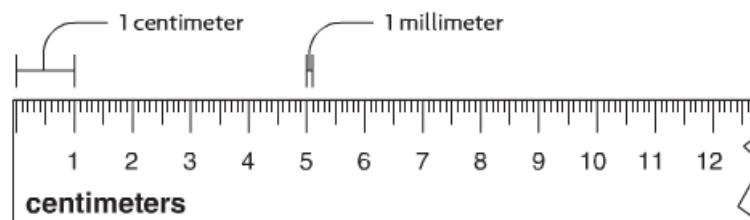## Metric Units of Length

Meters (m), **decimeters** (dm), centimeters (cm), and **millimeters** (mm) are all metric units of length. You can use a ruler and a meterstick to find out how these units are related.

**Materials:** ruler, meterstick

**Step 1** Look at a metric ruler. Most look like the one below.

1 centimeter     1 millimeter

```
1  2  3  4  5  6  7  8  9  10 11 12
centimeters
```

The short marks between each centimeter mark show millimeters. 1 centimeter has the same length as a group of 10 millimeters.

**Step 2** Look at a meterstick. Most look like the one below.

1 decimeter

```
1   10  20  30  40  50  60  70  80  90  100
```
1 meter
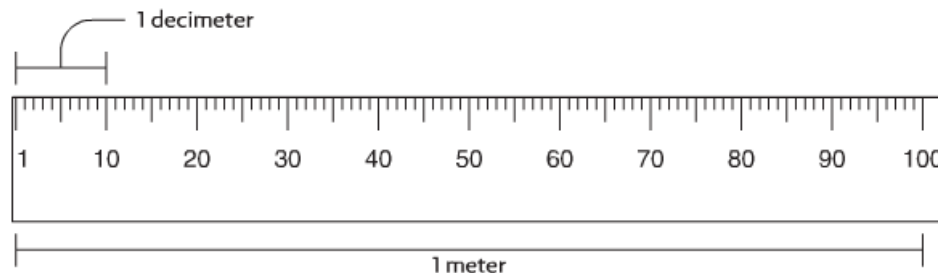
1 decimeter has the same length as a group of 10 centimeters.

**Step 3** Use the ruler and the meterstick to compare metric units of length.

1 centimeter = ___10___ millimeters      1 decimeter = ___10___ centimeters

1 meter = ___10___ decimeters      1 meter = ___100___ centimeters

**LESSON 12.6**

## Metric Units of Mass and Liquid Volume

Mass is the amount of matter in an object. Metric units of mass include grams (g) and kilograms (kg). 1 kilogram represents the same mass as 1,000 grams.

One large loaf of bread has a mass of about 1 kilogram. Jacob has 3 large loaves of bread. About how many grams is the mass of the loaves?

3 kilograms = 3 × __1,000__ grams
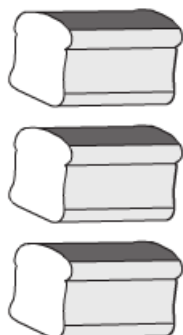
= __3,000__ grams

Liters (L) and **milliliters** (mL) are metric units of liquid volume. 1 liter represents the same liquid volume as 1,000 milliliters.

A large bowl holds about 2 liters of juice. Carmen needs to know the liquid volume in milliliters.

2 liters = 2 × __1,000__ milliliters

= __2,000__ milliliters

## Units of Time

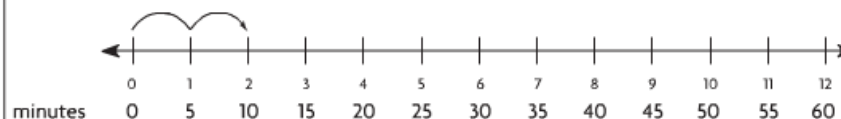Some analog clocks have an hour hand, a minute hand, and a **second** hand.

There are 60 seconds in a minute. The second hand makes 1 full turn every minute. There are 60 minutes in an hour. The minute hand makes 1 full turn every hour. The hour hand makes 1 full turn every 12 hours.

hour hand —
second hand —
minute hand

**You can think of the clock as unrolling to become a number line.**

hours    0  1  2  3  4  5  6  7  8  9  10  11  12

The hour hand moves from one number to the next in 1 hour.

minutes  0  5  10  15  20  25  30  35  40  45  50  55  60

The minute hand moves from one number to the next in 5 minutes.

**Use the table at the right to change between units of time.**

| Units of Time |
| --- |
| 1 minute = 60 seconds |
| 1 hour = 60 minutes |
| 1 day = 24 hours |
| 1 week = 7 days |
| 1 year = 12 months |
| 1 year = 52 weeks |

1 hour = 60 minutes, or 60 × 60 seconds, or __3,600__ seconds.

So, 1 hour is __3,600__ times as long as 1 second.

1 day = 24 hours, so 3 days = 3 × 24 hours, or __72__ hours.

1 year = 12 months, so 5 years = 5 × 12 months, or __60__ months.

## Problem Solving • Elapsed Time

Opal finished her art project at 2:25 P.M. She spent
50 minutes working on her project. What time did
she start working on her project?

| Read the Problem | | |
|---|---|---|
| **What do I need to find?** | **What information do I need to use?** | **How will I use the information?** |
| I need to find Opal's start time. | End time: __2:25 P.M.__<br><br>Elapsed time: __50__ minutes | I can draw a diagram of a clock.<br><br>I can then count back 5 minutes at a time until I reach 50 minutes. |
| **Solve the Problem** | | |
| I start by showing 2:25 P.M. on the clock.<br>Then I count back 50 minutes by 5s.<br><br>**Think:** As I count back, I go past the 12.<br>The hour must be 1 hour less than the ending time.<br><br>The hour will be __1 o'clock__.<br><br>So, Opal started on her project at __1:35 P.M.__ | | |

## LESSON 12.10

## Mixed Measures

Gabrielle's puppy weighs 2 pounds 7 ounces. What is the weight of the puppy in ounces?

**Step 1** Think of 2 pounds 7 ounces as 2 pounds + 7 ounces.

**Step 2** Change the pounds to ounces.
   Think: 1 pound = __16__ ounces

So, 2 pounds = 2 × 16 ounces, or __32__ ounces.

**Step 3** Add like units to find the answer.

So, Gabrielle's puppy weighs __39__ ounces.

$$\begin{array}{r} 32 \text{ ounces} \\ + 7 \text{ ounces} \\ \hline 39 \text{ ounces} \end{array}$$

Gabrielle played with her puppy for 2 hours 10 minutes yesterday and 1 hour 25 minutes today. How much longer did she play with the puppy yesterday than today?

**Step 1** Subtract the mixed measures. Write the subtraction with like units lined up.
   Think: 25 minutes is greater than 10 minutes.

$$\begin{array}{r} 2 \text{ hr } 10 \text{ min} \\ - 1 \text{ hr } 25 \text{ min} \\ \hline \end{array}$$

**Step 2** Rename 2 hours 10 minutes to subtract.
   1 hour = 60 minutes
So, 2 hr 10 min = 1 hr + 60 min + 10 min, or __1__ hr __70__ min.

$$\begin{array}{r} 1 \quad 70 \\ \cancel{2} \text{ hr } \cancel{10} \text{ min} \\ - 1 \text{ hr } 25 \text{ min} \\ \hline 0 \text{ hr } 45 \text{ min} \end{array}$$

**Step 3** Subtract like units.
   1 hr − 1 hr = 0 hr; 70 min − 25 min = __45 min__

So, she played with the puppy __45__ minutes longer yesterday than today.

# LESSON 12.11

## Algebra • Patterns in Measurement Units

**Use the relationship between the number pairs to label the columns in the table.**

| ? | ? |
|---|---|
| 1 | 8 |
| 2 | 16 |
| 3 | 24 |
| 4 | 32 |

**Step 1** List the number pairs. _1 and 8; 2 and 16; 3 and 24; 4 and 32_

**Step 2** Describe the relationship between the numbers in each pair.

_The second number is 8 times as great as the first number._

**Step 3** Look for a relationship involving 1 and 8 in the table below.

| Length | Weight | Liquid Volume | Time |
|---|---|---|---|
| 1 foot = 12 inches<br>1 yard = 3 feet<br>1 yard = 36 inches | 1 pound = 16 ounces<br>1 ton = 2,000 pounds | 1 cup = 8 fluid ounces<br>1 pint = 2 cups<br>1 quart = 2 pints<br>1 gallon = 4 quarts | 1 minute = 60 seconds<br>1 hour = 60 minutes<br>1 day = 24 hours<br>1 week = 7 days<br>1 year = 12 months<br>1 year = 52 weeks |

So, the label for the first column is ___Cups___.

The label for the second column is ___Fluid Ounces___.