Measuring in Metric Units

**Before**

You used metric units.

**Now**

You'll measure and estimate using metric units.

**Why?**

So you can estimate the mass of a bike, as in Ex. 20.

The **metric system** is a decimal system of measurement. The metric system has units for length, mass, and capacity.

**Length**

The **meter (m)** is the basic unit of length in the metric system. Three other metric units of length are the **millimeter (mm)**, **centimeter (cm)**, and **kilometer (km)**.

You can use the following benchmarks to estimate length.

- **1 millimeter** thickness of a dime
- **1 centimeter** width of a large paper clip
- **1 meter** height of the back of a chair

**1 kilometer** combined length of 9 football fields

**Example 1** Using Metric Units of Length

Estimate the length of the bandage by imagining paper clips laid next to it. Then measure the bandage with a metric ruler to check your estimate.

1. Estimate using paper clips.

   About 5 large paper clips fit next to the bandage, so it is about 5 centimeters long.

2. Measure using a ruler.

   Each centimeter is divided into tenths, so the bandage is 4.8 centimeters long.
Lesson 2.6    Measuring in Metric Units

Complete the following exercise.

1. Estimate the thickness of this textbook in centimeters. Then use a metric ruler to check your estimate.

2. The mass of a baby is 4 ?.

3. The mass of a tack is 200 ?.

EXAMPLE 2 Measuring Mass

Find the mass of the apples.

Each kilogram is divided into tenths, so the mass of the apples is 1.5 kilograms.

You can use the following benchmarks to estimate mass.

1 milligram
   grain of sugar

1 gram
   small paper clip

1 kilogram
   textbook

EXAMPLE 3 Using Metric Units of Mass

Copy and complete using the appropriate metric unit:
The mass of a CD is 16 ?.

The mass of a CD is greater than the mass of 16 grains of sugar (16 mg), and it is less than the mass of 16 textbooks (16 kg). Because a good estimate for the mass of a CD is 16 paper clips, the appropriate metric unit is grams.

ANSWER The mass of a CD is 16 grams.

Your turn now Complete the following exercise.

1. Estimate the thickness of this textbook in centimeters. Then use a metric ruler to check your estimate.

Copy and complete using the appropriate metric unit.

2. The mass of a baby is 4 ?.

3. The mass of a tack is 200 ?.
Capacity Capacity is a measure of the amount that a container can hold. The \textbf{liter (L)} is the basic metric unit of capacity. Two other metric units of capacity are the \textbf{milliliter (mL)} and \textbf{kiloliter (kL)}.

**EXAMPLE 4 Measuring a Liquid Amount**

Find the amount of liquid in the measuring cup.

\begin{center}
\includegraphics[width=0.5\textwidth]{measuring_cup}
\end{center}

\textbf{ANSWER} The measuring cup contains 225 milliliters of liquid.

You can use the following benchmarks to estimate capacity.

- 1 milliliter = eyedropper
- 1 liter = large water bottle
- 1 kiloliter = 8 large trash cans

**EXAMPLE 5 Using Metric Units of Capacity**

What is the most reasonable capacity of a bathtub?

\begin{itemize}
  \item A. 750 mL
  \item B. 14 L
  \item C. 240 L
  \item D. 5 kL
\end{itemize}

\textbf{Solution}

Both 750 mL (750 eyedroppers) and 14 L (14 water bottles) are too little to fill a bathtub. Using 5 kL (40 large trash cans) would overfill a bathtub. That leaves 240 L (240 large water bottles), which seems reasonable.

\textbf{ANSWER} The most reasonable capacity of a bathtub is (C) 240 L.

\textbf{Your turn now} Match the object with the appropriate capacity.

\begin{itemize}
  \item 4. Tube of toothpaste: A. 8 mL
  \item 5. Large trash can: B. 175 mL
  \item 6. Bottle cap: C. 125 L
\end{itemize}
Getting Ready to Practice

1. **Vocabulary** Copy and complete: Milligrams, grams, and kilograms are metric units of \( ? \).

Copy and complete using the appropriate metric unit.

2. A tennis racket is 1.2 \( ? \) long.
3. A piece of paper is 0.1 \( ? \) thick.
4. The mass of a TV is 20 \( ? \).
5. The mass of a golf ball is 46 \( ? \).
6. A juice box contains 200 \( ? \).
7. A can of soup contains 0.4 \( ? \).
8. **Volleyball** Julia thinks that the mass of a volleyball is about 300 grams. Bailey thinks that its mass is about 3 kilograms. Who is right? Explain.

Practice and Problem Solving

Estimate the length of the object. Then measure the object using a metric ruler.

9. Your foot
10. Pencil eraser
11. This page

Find the mass of the object.

12. [Image of a scale with a mass on it]
13. [Image of a scale with a mass on it]

Find the amount of liquid in the measuring cup.

14. [Image of a measuring cup with a liquid level]
15. [Image of a measuring cup with a liquid level]

Copy and complete using the appropriate metric unit.

16. A building is 100 \( ? \) high.
17. The Hudson River is 507 \( ? \) long.
18. The width of a belt is 3 \( ? \).
19. The mass of a staple is 32 \( ? \).
20. The mass of a bike is 8 \( ? \).
21. The mass of a sock is 25 \( ? \).
22. A mug can hold 400 \( ? \).
23. A large bottle of soda holds 2 \( ? \).
Choose the letter of the most reasonable measurement.

24. What is the perimeter of a doormat?
   A. 5 cm  B. 0.3 m  C. 2.5 m  D. 30 m

25. What is the mass of a toothpick?
   F. 1 mg  G. 100 mg  H. 10 g  I. 1 kg

26. What is the capacity of a birdbath?
   A. 90 mL  B. 2 L  C. 50 L  D. 2 kL

Copy and complete the statement using 3, 30, or 300.

27. Wheelbarrows An empty wheelbarrow has a mass of about \_ \_ \_ kg.

28. Bananas Two bananas have a mass of \_ \_ \_ g.

29. Stamps A postage stamp has a mass of about \_ \_ \_ mg.

Match the object with the appropriate measurement.

    A. 20 g  B. 80 g  C. 100 cm  D. 240 mL

34. Challenge Name an object that has a large capacity and a small mass.
    Name an object that has a small capacity and a large mass.

Mixed Review

Copy and complete the statement using <, >, or =. (Lesson 2.1)

35. 4.2 ___ 2.4  36. 1.08 ___ 1  37. 2.07 ___ 2.070

Write the number in scientific notation. (Lesson 2.5)

38. 12,500  39. 350,400  40. 10,600,000

Basic Skills Use a number line to order the numbers from least to greatest.

41. 59, 51, 15, 19  42. 100, 101, 110, 10  43. 233, 322, 323, 232

Test-Taking Practice

44. Multiple Choice The capacity of a bottle of maple syrup is \_ \_ \_.
    A. 500 L  B. 25 mL  C. 10 L  D. 250 mL

45. Short Response Use benchmarks to order the measurements from least to greatest: 1 kg, 5 g, 10 kg, 50 mg. Explain your reasoning.