

Measurement

The National Council of Teachers of Mathematics (NCTM) recommends (and researchers concur) that a hands-on approach is necessary for teaching measurement.

It is unlikely that children can gain a deep understanding of measurement without handling materials, making comparisons physically, and measuring with tools (NCTM, 2000, p. 43).

In *Houghton Mifflin Math*, students learn about measurement by making measurements, not just by reading about them. Here are just a few examples. In kindergarten, students learn about capacity by estimating and then measuring the number of cups of beans needed to fill a mug, a box, a soup can, and a bowl. In grade 3, students are estimating whether objects weigh more or less than a pound and then using a balance scale to check. In grade 5, students are using rulers to measure to the nearest half inch.

Name _____

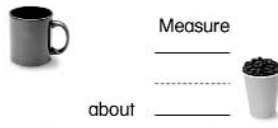
Estimate and Measure Capacity

Hands-On

1

Estimate _____

about _____



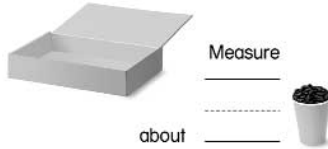
Measure _____

about _____

2

Estimate _____

about _____



Measure _____

about _____

Student Book, grade K, page 229

Lesson 7

Customary Units of Weight

Objective: Measure the weights of objects in customary units.

Vocabulary: pound (lb), ounce (oz)

Learn About It

At the Country Bakery, Mr. Macintosh sells his famous apple cookies by the pound.


Pound (lb) and ounce (oz) are customary units used when measuring weight.

Measure things that are very light—a paper clip, a key, or a slice of bread—in ounces.

Measure things that are heavy—a bicycle, a chair, or a loaf of bread—in pounds.

Customary Units of Weight

1 pound = 16 ounces




1 ounce 1 pound 16 one-ounce slices of bread have the same weight as a 1-pound loaf of bread.

Try this activity to estimate and measure weight.

Materials: balance scale, 1-pound weight

1 Find five small objects in your classroom. Predict which objects weigh less than, more than, or about one pound. Record your work.

2 Use the balance scale and the 1-pound weight to check your predictions.



372

Student Book, grade 3, page 372

Lesson 1

Measurement Concepts

Objective: Measure to a given degree of precision using appropriate tools and units of measure.

Vocabulary: precision

Materials: tape measure, ruler, Learning Tool 31

Work Together

The **precision** of a measurement is determined by the unit of measure that you use. A smaller unit produces a more precise measurement than a larger unit.

To the nearest inch, this paper clip is 2 inches long. To the nearest quarter inch, the paper clip is $1\frac{3}{4}$ inches long. The measurement $1\frac{3}{4}$ inches is a more precise measurement than 2 inches.

Work with a partner to estimate and measure lengths to the nearest yard, foot, inch, half inch, and quarter inch.

1 Estimate the length of your classroom in yards. Record your estimate.

Use a tape measure. Measure the length to the nearest yard, the nearest foot, and the nearest inch. Record your measurements.


Measurement and Precision		
Object	Estimate	Measurements
Length of room		

2 Estimate the width of your desk in feet. Record your estimate.

Use a ruler. Measure the width to the nearest foot, the nearest inch, and the nearest half inch. Record your measurements.

3 Estimate the width of your hand in inches. Record your estimate.

Use a ruler. Measure the width to the nearest inch, the nearest half inch, and the nearest quarter inch. Record your measurements.



148

Student Book, grade 5, page 148

NCTM also recommends that “measurement concepts should grow in sophistication and breadth across the grades and that instructional programs should not repeat the same curriculum year after year” (NCTM, 2000, p. 43).

To see how measurement concepts in *Houghton Mifflin Math* are developed throughout the grades, consider the concept of volume. The approach is systematic and builds on the use of concrete materials. It reflects the findings of the National Research Council.

Understanding the development of volume formulas provides an additional challenge since students must now grasp 3D concepts. However, it is helpful to build an understanding of volume as the product of area and height (NRC, 2001).

In grade 3, students explore volume by estimating and then counting the number of cubes needed to fill a box. By grade 4, students are using a standard unit of measurement for volume. In grade 5, the formula for the volume of prisms is derived by having students count the number of cubes in one layer (to get the area of the base) and then multiplying by the number of layers (the height). In grade 6, students’ use of volume formulas extends to cylinders, pyramids, and cones.

Another recommendation of NCTM concerns the teaching of both customary and metric units. NCTM (2000) advises that “students should learn both the customary and metric systems and should know some rough equivalence between the metric and customary systems.” *Houghton Mifflin Math* provides opportunities for students to make approximate conversions.

Lesson 6 Algebra Volume

Objective: Use a formula to find the volume of a cube, a rectangular prism, and a triangular prism.

Learn About It

Cedric's collection of CDs is growing. Each case is a rectangular prism, and when he stacks the cases, they form an even larger prism. Soon the "prism" of CDs will be too large for Cedric's shelf!

The **volume** of a solid figure is the amount of space the figure occupies. Volume is measured using **cubic units**. A cube measuring 1 unit on each edge has a volume of 1 cubic unit.

Try this activity to find the volume of a solid figure.

Materials: cubes, Learning Tool 17-1

- 1 Create a rectangular prism that is 2 cubes long, 3 cubes wide, and 1 cube high. Count the number of cubes. Record the data on the recording sheet.
- 2 Add a second layer of cubes on top of the figure. Record the data.
- 3 Add a third layer of cubes on top of the figure. Record the data.
- 4 Write a multiplication sentence that shows how to find the volume of each of the following:
 - a. one layer of cubes
 - b. two layers of cubes
 - c. three layers of cubes

What multiplication equation could you use to find the volume (V) of any rectangular prism with length l , width w , and height h ? Explain.

In a cube, the length, width, and height are equal and are represented by the variable s . What equation could you use to find the volume of any cube?

Student Book, grade 5, page 460

Crafty Conversions

Use your calculator to estimate conversions between metric and customary units.

1. 5 yd is about ___ m
2. 12 oz is about ___ g
3. 36 lb is about ___ kg
4. 5 mi is about ___ km
5. 10 cm is about ___ in.
6. 6 qt is about ___ L

Calculator Connection

Estimated Equivalents

Length
 1 in. is about 2.5 cm.
 1 yd is about 0.9 m.
 1 mi is about 1.6 km.

Weight/Mass
 1 oz is about 28 g.
 1 lb is about 0.5 kg.

Capacity
 1 qt is about 0.9 L.

Student Book, grade 4, page 329