

Measurement Conversions

Unit 10 Overview: 8 lessons

Students convert within one measurement system. Metric units go by powers of ten, so changing kilometers to meters, or grams to kilograms, moves the digits: 2.9 km = 2,900 m and 270 cm = 2.7 m. Customary units do not, so students use the facts (12 inches in a foot, 3 feet in a yard, 16 ounces in a pound, 4 quarts in a gallon) with fractions: $2\frac{1}{3}\text{ ft} = 28\text{ in}$. They fill in tables, compare amounts in two units by writing both in one unit, and solve conversion stories in two and three steps. In some states the unit also takes in units of time and elapsed time, choosing a metric unit and estimating before measuring, and measuring to the nearest sixteenth inch and millimeter. Ask “will there be more or fewer of the new unit?” before every conversion.

THE UNIT, DAY BY DAY

Day 1	Pre-Check	What students already know, before the first lesson.
Day 2	10.1 Metric length	I can convert metric lengths.
Day 3	10.2 Metric mass and liquid volume	I can convert metric masses and liquid volumes.
Day 4	10.3 Customary length	I can convert customary lengths with fractions.
Day 5	10.4 Customary weight and capacity	I can convert customary weights and capacities.
Day 6	10.5 Units of time and elapsed time ★	I can convert units of time and find elapsed time.
Day 7	10.6 Multi-step conversion stories	I can solve conversion stories with more than one step.
Day 8	10.7 Choose a unit, estimate and measure ★	I can choose a metric unit, estimate and measure.
Day 9	10.8 Measure to the sixteenth inch and millimeter ★	I can measure to the nearest sixteenth inch and millimeter.
Day 10	Unit Review	The review, to go over together.
Day 11	Unit Test	Form A; Form B (other numbers) is for a retest.

★ Taught in 5th grade in some states. Skip these lessons if yours teaches them in another grade; animalmath.com/standards shows your state's list.

GET READY FOR THE UNIT

- Meter sticks, yardsticks, a tape measure, and rulers marked in sixteenths of an inch and in millimeters
- A kitchen scale in grams and ounces, a 1 kilogram bag and a 1 pound bag
- A liter bottle, beakers marked in milliliters, and cup, pint, quart and gallon containers
- The Teaching Clock, or a geared clock, and blank time lines
- A wall chart of the conversion facts, metric and customary

HOW EACH LESSON GOES

- 1. Warm up** (5 min)
 - 2. Teach** (10 min)
 - 3. Try it together** (10 min)
 - 4. Practice** (15 min)
 - 5. Exit ticket** (5 min): a quick check on the lesson.
- Each lesson page ends with the Animal Math sheets, makers, tools and quizzes for it. “Sheet 3” is the third worksheet of a pack; a color pack prints each sheet again in black and white.

CHECKING AS YOU GO

PRINTABLE	Pre-Check: Day 1, with a key	EXIT TICKET	Exit Tickets: one a lesson, two to a page
PRINTABLE	Unit Review: the day before the test	PRINTABLE	Unit Test: Forms A and B, with keys



Measurement Conversions

Lesson 10.1: Metric length

GOAL Students convert metric lengths with decimals. To a smaller unit they multiply by 10, 100 or 1,000, and every digit moves that many places left ($2.9 \text{ km} = 2,900 \text{ m}$); to a bigger unit they divide, and the digits move right ($270 \text{ cm} = 2.7 \text{ m}$).

About 45 minutes

I can convert metric lengths.

THE LESSON

- 1 Warm up** (5 min) Quick: 4.8×100 , $0.7 \times 1,000$ and $63 \div 10$. Which way did the digits move each time?
- 2 Teach** (10 min) Write the facts: $1 \text{ km} = 1,000 \text{ m}$, $1 \text{ m} = 100 \text{ cm}$, $1 \text{ cm} = 10 \text{ mm}$. A kilometer is long, so in meters the number gets bigger: $2.9 \text{ km} = 2.9 \times 1,000 = 2,900 \text{ m}$, and $1.45 \text{ m} = 145 \text{ cm}$. To a bigger unit the number gets smaller, so divide: $270 \text{ cm} = 270 \div 100 = 2.7 \text{ m}$, and $45 \text{ mm} = 4.5 \text{ cm}$. Last, $6,040 \text{ m} = 6.04 \text{ km}$, not 6.4 km .
Say: "Bigger unit to smaller: more of them, so I multiply. Smaller to bigger: fewer, so I divide."
- 3 Try it together** (10 min) Pairs measure a desk in meters, centimeters and millimeters, then fill in a table of kilometers and meters for 1, 0.8 and 4.15.
- 4 Practice** (15 min) Students do the metric lengths on sheets 1 and 3 of Measurement Conversion Word Problems, then the units table on sheet 5 of Multiplying and Dividing by Powers of Ten.
- 5 Exit ticket** (5 min) Students do **Exit Ticket 10.1** and circle a face beside the "I can" line. On question 1, look for 4,300 m and 2,060 mm; 430 means 100 was used for kilometers, and 206 means centimeters were found. On question 2, look for 5.6 m and 7.5 cm; 56,000 or 750 means the student multiplied.

Need help? Slide the digits in a place value chart, one place for each 10.

Ready for more? A race is 21.1 km long. How many meters? How many centimeters?

GET READY

- A meter stick and centimeter rulers that show millimeters
- A place value chart from thousands to thousandths
- Whiteboards and markers

WORDS TO USE

kilometer (km): 1,000 meters

millimeter (mm): a tenth of a centimeter

power of ten: 10, 100, 1,000 and so on

ASK

- Is the new unit bigger or smaller?
- Which power of ten links the two units?
- How many places do the digits move?

WATCH FOR

Writes 2.9 km = 2,900 m. Zeros after the point change nothing. Move the digits three places.

Uses 100 for every metric change. Write the facts at the top and find the two units.

Multiplies when changing to a bigger unit. Ask: will there be more meters or fewer?

ON ANIMAL MATH

PRINTABLE

Measurement Conversion Word Problems: sheets 1 and 3, the metric lengths

PRINTABLE

Multiplying and Dividing by Powers of Ten: sheet 5, the units table

TOOL

Measuring Tool: Measure With Meter Stick, then Centimeter Ruler

QUIZ

Measurement Conversions Quiz: the Metric Length level

EXIT TICKET

5th Grade Measurement Conversions Exit Tickets: Exit Ticket 10.1

Measurement Conversions

Lesson 10.2: Metric mass and liquid volume

GOAL Students convert kilograms and grams and liters and milliliters with decimals (1 kg = 1,000 g, 1 L = 1,000 mL): 4.6 L = 4,600 mL and 380 g = 0.38 kg. They fill in tables and compare two amounts by writing both in the same unit.

About 45 minutes

I can convert metric masses and liquid volumes.

THE LESSON

- 1 Warm up** (5 min) Pass the kilogram bag around. How many grams is half of it? A tenth of it?
- 2 Teach** (10 min) Kilo means 1,000 and milli means a thousandth. Fill in a liters table: 1 L = 1,000 mL, 4.6 L = 4,600 mL, 0.75 L = 750 mL. To kilograms, divide by 1,000: 380 g = 0.38 kg, and 1,025 g = 1.025 kg. Compare 1.9 L and 1,090 mL: 1.9 L is 1,900 mL, so 1.9 L > 1,090 mL.
Say: "To compare, I write both amounts in the same unit, usually the smaller one. Then the numbers tell me which is more."
- 3 Try it together** (10 min) Pairs fill in a kilograms and grams table for 1, 5.5 and 0.08, then compare 6.2 kg with 6,020 g, and 0.5 L with 500 mL.
- 4 Practice** (15 min) Students do the metric comparisons on sheet 2 of Measurement Conversion Word Problems (problems 11, 14, 17 and 20) and the grams, kilograms, liters and milliliters on sheet 3 (problems 6 to 9 and 11).
- 5 Exit ticket** (5 min) Students do **Exit Ticket 10.2** and circle a face beside the "I can" line. On question 1, look for 2,400 and 650 g; 240 or 65 means 100 was used, not 1,000. On question 2, look for 3.5 L > 3,050 mL and 0.4 kg = 400 g; < means 3.5 and 3,050 were compared as they stand, or 3.5 L was read as 3,005 mL, so write it as 3,500 mL first.

Need help? Hold the kilogram bag and say 1,000 grams; pour the liter bottle into the beaker and watch it reach 1,000 mL.

Ready for more? A pitcher holds 2.25 L. How many 200 mL glasses can it fill? How much is left?

GET READY

- A kitchen scale in grams and a 1 kilogram bag
- A liter bottle and a beaker marked in milliliters
- Two-column table templates

WORDS TO USE

gram (g): a small unit of mass: about a paper clip

kilogram (kg): 1,000 grams

milliliter (mL): about 20 drops of water; 1,000 make a liter

ASK

- What does kilo mean? Milli?
- Which is more, 1.9 L or 1,090 mL? How do you know?
- Would you weigh a coin in grams or kilograms?

WATCH FOR

Writes 4.6 L = 460 mL. Kilo and milli both mean 1,000: move the digits three places.

Says 1.9 L < 1,090 mL because 1.9 is less than 1,090. Write both in milliliters first: 1,900 mL and 1,090 mL.

Writes 1,025 g = 1.25 kg. Divide by 1,000 and keep the 0 in the tenths place: 1.025.

ON ANIMAL MATH

PRINTABLE

Measurement Conversion Word Problems: sheet 2, problems 11, 14, 17 and 20; sheet 3, problems 6–9 and 11

QUIZ

Measurement Conversions Quiz: the Decimals and Fractions level

EXIT TICKET

5th Grade Measurement Conversions Exit Tickets: Exit Ticket 10.2

Measurement Conversions

Lesson 10.3: Customary length

GOAL Students convert miles, yards, feet and inches with fractions. To a smaller unit they multiply by the fact ($2 \frac{1}{3} \text{ ft} = 2 \frac{1}{3} \times 12 = 28 \text{ in}$); to a bigger unit they divide and write what is left as a fraction of the bigger unit ($38 \text{ in} = 3 \frac{2}{12} \text{ ft} = 3 \frac{1}{6} \text{ ft}$).

About 45 minutes

I can convert customary lengths with fractions.

THE LESSON

- 1 Warm up** (5 min) How many inches are in 6 feet? In a quarter of a foot? In three quarters of a foot?
- 2 Teach** (10 min) Customary units do not go by tens, so use the fact. To a smaller unit, multiply: $2 \frac{1}{3} \text{ ft} = 2 \times 12 + \frac{1}{3} \times 12 = 24 + 4 = 28 \text{ in}$, and $8 \frac{1}{3} \text{ yd} = 24 + 1 = 25 \text{ ft}$. To a bigger unit, divide: $38 \div 12 = 3$ with 2 inches left, and 2 of 12 inches is $\frac{2}{12} = \frac{1}{6}$ of a foot, so $38 \text{ in} = 3 \frac{1}{6} \text{ ft}$. Then $22 \text{ ft} \div 3 = 7$ with 1 left: $7 \frac{1}{3} \text{ yd}$. A mile: $\frac{1}{4} \text{ mi} = 5,280 \div 4 = 1,320 \text{ ft}$.
Say: "To a smaller unit I multiply by the fact. To a bigger unit I divide, and what is left is a fraction of the bigger unit."
- 3 Try it together** (10 min) Pairs measure the classroom door in feet and inches with the tape measure, then write its height in inches and in feet with a fraction. Then they change $1 \frac{3}{4} \text{ yd}$ to feet and 40 in to feet.
- 4 Practice** (15 min) Students fill in the yards, feet and inches table and do problems 10, 14 and 15 on sheet 1 of Measurement Conversion Word Problems, then the customary lengths on sheet 3 (problems 13, 14, 16 to 18, 21 and 22).
- 5 Exit ticket** (5 min) Students do **Exit Ticket 10.3** and circle a face beside the "I can" line. On question 1, look for 27 in and 14 ft; $24 \frac{1}{4}$ or $12 \frac{2}{3}$ means only the whole number was changed, so multiply the fraction by the fact too. On question 2, look for $1 \frac{2}{3} \text{ ft}$ and $3 \frac{1}{3} \text{ yd}$ ($20/12$ and $10/3$ are right too); 18 or 1.8 means the 8 inches left were not written as a fraction of a foot.

Ready for more? How many inches are in $\frac{3}{4}$ of a mile?

GET READY

- Rulers, yardsticks and a tape measure
- A wall chart: $1 \text{ ft} = 12 \text{ in}$, $1 \text{ yd} = 3 \text{ ft} = 36 \text{ in}$, $1 \text{ mi} = 1,760 \text{ yd} = 5,280 \text{ ft}$
- Whiteboards and markers

WORDS TO USE

foot (ft): 12 inches

yard (yd): 3 feet, or 36 inches

mile (mi): 1,760 yards, or 5,280 feet

ASK

- Is the new unit bigger or smaller?
- What fact connects the two units?
- What fraction of the bigger unit is left over?

WATCH FOR

Uses 10 or 100, as with metric units. Customary units have their own facts: 12 inches make a foot.

Writes $38 \text{ in} = 3.2 \text{ ft}$. The 2 left over is 2 inches of 12: $\frac{2}{12} = \frac{1}{6}$ of a foot.

Writes $2 \frac{1}{3} \text{ ft} = 24 \frac{1}{3} \text{ in}$. Change the $\frac{1}{3}$ foot too: a third of 12 inches is 4.

Need help? Lay rulers along a yardstick and count inches by 12s; fold a paper ruler to see a quarter and a third of a foot.

ON ANIMAL MATH

PRINTABLE

Measurement Conversion Word Problems: sheet 1, problems 1-4, 10, 14 and 15; sheet 3, problems 13, 14, 16-18, 21 and 22

TOOL

Measuring Tool: Measure With Yardstick, then Tape Measure (Feet)

QUIZ

Measurement Conversions Quiz: the Decimals and Fractions level

EXIT TICKET

5th Grade Measurement Conversions Exit Tickets: Exit Ticket 10.3

Measurement Conversions

Lesson 10.4: Customary weight and capacity

GOAL Students convert tons, pounds and ounces (1 ton = 2,000 lb, 1 lb = 16 oz) and gallons, quarts, pints, cups and fluid ounces (1 gal = 4 qt, 1 qt = 2 pt, 1 pt = 2 c, 1 c = 8 fl oz), with fractions both ways, a step at a time or with one fact for the whole chain (1 gal = 128 fl oz).

About 45 minutes

I can convert customary weights and capacities.

THE LESSON

- 1 Warm up** (5 min) Pour cups of water into a quart, and quarts into the gallon container. How many cups make a gallon?
- 2 Teach** (10 min) Draw the gallon picture: a gallon holds 4 quarts, each quart 2 pints, each pint 2 cups, each cup 8 fl oz. Multiply down the chain: $1 \text{ gal} = 4 \times 2 \times 2 \times 8 = 128 \text{ fl oz}$, so $3 \text{ gal} = 384 \text{ fl oz}$. To a bigger unit, divide: $6 \text{ c} = 6 \div 4 = 1 \frac{1}{2} \text{ qt}$. Weight: $1 \frac{1}{2} \text{ tons} = 3,000 \text{ lb}$, $15 \frac{8}{16} \text{ lb} = 16 + 10 = 26 \text{ oz}$, and $24 \text{ oz} = 24 \div 16 = 1 \frac{8}{16} = 1 \frac{1}{2} \text{ lb}$.
Say: "I find the fact that connects the two units, or multiply the facts along the chain. I multiply to a smaller unit and divide to a bigger one."
- 3 Try it together** (10 min) Pairs pour water to check that $1 \text{ qt} = 4 \text{ c}$. Then they compare 5 lb with 76 oz and 3 qt with 13 c by writing both in the smaller unit, and change 48 fl oz to cups.
- 4 Practice** (15 min) Students fill in the capacity and weight tables and compare on sheet 2 of Measurement Conversion Word Problems, then change weights and capacities with fractions on sheet 3 (problems 12, 15, 19 and 20). As a step back, sheets 3 and 4 of Measurement Conversions change whole numbers with pictures.
- 5 Exit ticket** (5 min) Students do **Exit Ticket 10.4** and circle a face beside the "I can" line. On question 1, look for 5,000 lb and 52 oz; 2,500 means a ton was taken as 1,000 lb, and $48 \frac{1}{4}$ means the $\frac{1}{4}$ pound was not changed. On question 2, look for 256 fl oz and $2 \frac{1}{2} \text{ qt}$; 128 or 64 means a step of the chain was left out, 16 means only the cup fact was used, and 40 means the cups were multiplied.

Ready for more? A truck carries $4 \frac{3}{4}$ tons. How many pounds? How many ounces?

GET READY

- Gallon, quart, pint and cup containers, and water or dried beans to pour
- A kitchen scale in ounces and a 1 pound bag
- A wall chart of the weight and capacity facts

WORDS TO USE

ton: 2,000 pounds

fluid ounce (fl oz): 8 make a cup

quart (qt): 2 pints, and each pint is 2 cups

ASK

- What fact connects these two units?
- Will there be more or fewer of the new unit?
- How many fluid ounces are in a gallon? How do you know?

WATCH FOR

Uses 1,000 pounds in a ton. A ton is 2,000 pounds. Keep the chart in view.

Changes gallons to fluid ounces with only one or two facts. Write the chain and multiply at every step.

Writes 24 oz = 1.8 lb. The 8 left over is 8 of 16 ounces: $8/16 = 1/2$ pound.

Need help? Draw the gallon picture and count the cups in it.

ON ANIMAL MATH

PRINTABLE **Measurement Conversion Word Problems:** sheet 2; sheet 3, problems 12, 15, 19 and 20

PRINTABLE **Measurement Conversions:** sheets 3–4, a step back

QUIZ **Measurement Conversions Quiz:** the Decimals and Fractions level

EXIT TICKET **5th Grade Measurement Conversions Exit Tickets:** Exit Ticket 10.4

Measurement Conversions

Lesson 10.5: Units of time and elapsed time

GOAL Students convert units of time with the facts (1 week = 7 days, 1 day = 24 hours, 1 hour = 60 minutes, 1 minute = 60 seconds), multiplying along the chain for big jumps (1 day = 1,440 minutes), and find elapsed time across noon in stories on an open time line.

About 45 minutes
★ Taught in 5th grade in some states

I can convert units of time and find elapsed time.

THE LESSON

- 1 Warm up** (5 min) How many hours are in 6 days? How many minutes are in 5 hours? How do you know?
- 2 Teach** (10 min) Write the chain of facts and multiply along it for big jumps: 1 day = $24 \times 60 = 1,440$ minutes, and 1 hour = $60 \times 60 = 3,600$ seconds. So 5 days = 120 hours, and $1\frac{1}{2}$ days = 36 hours. Then elapsed time across noon: a game starts at 11:35 a.m. and ends at 1:10 p.m. Jump 25 minutes to 12:00, 1 hour to 1:00, then 10 minutes: 1 hour 35 minutes.
Say: "For time I use 60, 24 and 7, never 100. I jump to the next hour, then whole hours, then the minutes left."
- 3 Try it together** (10 min) Pairs change 2 days to minutes and $\frac{1}{4}$ hour to seconds, then find how long it is from 10:55 a.m. to 1:40 p.m. and check on the Teaching Clock.
- 4 Practice** (15 min) No Animal Math sheet works with time at 5th grade size, so start a step back: sheets 3 to 5 of Units of Time, with each table carried on to seconds, then sheets 4 and 5 of Elapsed Time. Each student writes a story that crosses noon for a partner.
- 5 Exit ticket** (5 min) Students do **Exit Ticket 10.5** and circle a face beside the "I can" line. On question 1, look for 336 hours and 10,800 seconds; 14 or 180 means only one step of the chain was used. On question 2, look for 1 hr 45 min; 1 hr 85 min means an hour was traded for 100 minutes.

Need help? Move the Teaching Clock with each jump and say the time.

Ready for more? How many seconds are in a day? Show your work.

GET READY

- The Teaching Clock, or a geared clock
- Blank open time lines
- A calendar and the class schedule

WORDS TO USE

elapsed time: the time from start to end

noon: 12:00 midday: a.m. turns to p.m.

chain: the facts in a row, weeks to seconds

ASK

- Which facts get you from weeks to hours?
- Does the time pass noon?
- Where is a friendly first jump?

WATCH FOR

Uses 100 minutes in an hour. Time has its own facts: 60 minutes make an hour.

Changes days to minutes with only 24 or only 60. Go one step at a time: days to hours to minutes.

Subtracts 11:35 from 1:10 like whole numbers. Draw the time line and jump through noon.

ON ANIMAL MATH

PRINTABLE

Units of Time: sheets 3-5, a step back

PRINTABLE

Elapsed Time: sheets 4-5, a step back

TOOL

Teaching Clock: Show a.m. and p.m. and Elapsed Time, in Advanced Options

QUIZ

Measurement Conversions Quiz: the Time level

EXIT TICKET

5th Grade Measurement Conversions Exit Tickets: Exit Ticket 10.5

Measurement Conversions

Lesson 10.6: Multi-step conversion stories

GOAL Students solve conversion stories in two or three steps: they change to one unit first (usually the smaller one), then add, subtract, multiply or divide, and change back if the question asks for the bigger unit. They write each step and the answer with its unit.

About 45 minutes

I can solve conversion stories with more than one step.

THE LESSON

- 1 Warm up** (5 min) Quick facts on whiteboards: $5\text{ m} = ?\text{ cm}$, $3\text{ lb} = ?\text{ oz}$, $2\text{ qt} = ?\text{ c}$.
- 2 Teach** (10 min) Read: A roll of tape is 5 m long. Ana cuts 8 pieces, each 45 cm long. How many centimeters are left? Step 1: $5\text{ m} = 500\text{ cm}$. Step 2: $8 \times 45 = 360\text{ cm}$. Step 3: $500 - 360 = 140\text{ cm}$. Then: Each batch of muffins uses 6 fl oz of milk. How many cups do 5 batches use? Step 1: $5 \times 6 = 30\text{ fl oz}$. Step 2: $30 \div 8 = 3\frac{6}{8} = 3\frac{3}{4}\text{ cups}$.
Say: "I change to one unit first, then solve one step at a time. At the end I check that the answer is in the unit the question asks for."
- 3 Try it together** (10 min) Pairs solve two stories and write each step. A watering can holds 2.5 L, and Mo gives 6 plants 300 mL each: how many milliliters are left? A box of crackers weighs 18 oz: how many pounds do 3 boxes weigh?
- 4 Practice** (15 min) Students write each step of the stories on sheet 4 of Measurement Conversion Word Problems, then solve the multi-step stories on sheet 5 with their work shown.
- 5 Exit ticket** (5 min) Students do **Exit Ticket 10.6** and circle a face beside the "I can" line. On question 1, look for 550 mL; 2,450 means the cups were found but not taken from the 3 L, and a student stuck at $3 - 2,450$ did not change the liters to milliliters first. On question 2, look for $4\frac{1}{2}\text{ lb}$ (4.5 or $72/16$ is right too); 72 means the ounces were not changed to pounds.

Need help? Act the story out with a meter stick or measuring cups, and write one step on each line.

Ready for more? Write a two-step story that changes kilograms to grams, and trade with a partner.

GET READY

- Meter sticks, measuring cups and a scale to act stories out
- Story cards
- The wall chart of conversion facts

WORDS TO USE

step: one part of the work, written as its own number sentence

same unit: both amounts in one unit, so they can be added or subtracted

ASK

- Which amounts are in different units? Which unit will you use?
- What is your first step? Your next one?
- Does your answer have the unit the question asks for?

WATCH FOR

Subtracts 360 from 5 without changing the meters. Change to one unit first: 5 m is 500 cm.

Stops after one step. Read the question again: what does it ask for? Is that what you found?

Gives the answer in the wrong unit. Underline the unit in the question and write it with the answer.

ON ANIMAL MATH

PRINTABLE

Measurement Conversion Word Problems: sheets 4-5

QUIZ

Measurement Conversions Quiz: the Multi-Step Stories level

EXIT TICKET

5th Grade Measurement Conversions Exit Tickets: Exit Ticket 10.6

Measurement Conversions

Lesson 10.7: Choose a unit, estimate and measure

GOAL Students choose a sensible metric unit (mm, cm, m or km; g or kg; mL or L) with benchmarks, estimate first, then measure length with a ruler, mass with a scale and liquid volume with a beaker, and compare each measurement with the estimate.

I can choose a metric unit, estimate and measure.

About 45 minutes

★ Taught in 5th grade in some states

THE LESSON

- 1 Warm up** (5 min) Hold up a stapler. Students write an estimate of its length and its mass, each with a unit, then compare their units.
- 2 Teach** (10 min) Model four jobs with benchmarks. A pencil case: centimeters, about 20 fingernails wide; measure it with a ruler. A math book: about 1 kg, like the kilogram bag; weigh it. The water in a vase: milliliters; pour it into a beaker marked every 50 mL. It stops one mark past 700: 750 mL. The next town: kilometers. Compare each measurement with its estimate.
Say: "First I ask what I am measuring: length, mass or liquid. That gives the kind of unit. Then a benchmark tells me which size of unit fits."
- 3 Try it together** (10 min) Pairs choose the unit and tool, estimate, then measure the length of a desk, the mass of a shoe and the water a mug holds, and record how close they were.
- 4 Practice** (15 min) Students circle the best unit and write units in sentences on sheet 1 of Estimating and Measuring, estimate and measure in centimeters and millimeters on sheet 2, and read scales and containers and solve the stories on sheet 4.
- 5 Exit ticket** (5 min) Students do **Exit Ticket 10.7** and circle a face beside the "I can" line. On question 1, look for 12 m and 3 kg; 12 cm, 12 km or 3 g means the size was not checked against a benchmark. On question 2, look for 350 mL; 300 or 400 means the mark between the numbers was not read as 50 mL.

Ready for more? Measure the hallway in meters and in centimeters. Which number is bigger?

GET READY

- Centimeter rulers, a meter stick, a scale in grams
- Beakers marked in milliliters, and water
- Benchmark cards for each metric unit

WORDS TO USE

benchmark: a thing we know the size of

estimate: a careful guess before measuring

mass: how heavy, in grams or kilograms

ASK

- Are you measuring length, mass or liquid?
- Which benchmark is closest in size?
- How close was your estimate?

WATCH FOR

Picks kilometers for a desk, or another unit far off. Hold up the benchmarks: closer to a centimeter or a meter?

Uses a liquid unit for mass, or a mass unit for liquid. Ask: are we weighing it or pouring it?

Reads each small mark of a beaker as 1 or 10. Count the marks between two numbers first.

Need help? Match each tool to a picture of what it measures, then pick a unit from the benchmark cards.

ON ANIMAL MATH

PRINTABLE

Estimating and Measuring: Length, Mass and Liquid Volume: sheets 1-2 and 4

TOOL

Measuring Tool: Measure With Centimeter Ruler

EXIT TICKET

5th Grade Measurement Conversions Exit Tickets: Exit Ticket 10.7

Measurement Conversions

Lesson 10.8: Measure to the sixteenth inch and millimeter

GOAL Students measure to the nearest eighth and sixteenth of an inch (each inch cut into 16 equal parts) and to the nearest millimeter on a centimeter ruler, write each length in simplest form, and see that smaller parts give a more exact measurement.

About 45 minutes

★ Taught in 5th grade in some states

I can measure to the nearest sixteenth inch and millimeter.

THE LESSON

- 1 Warm up** (5 min) Draw a 1 inch line. Cut it in half, then in fourths, eighths and sixteenths. How many sixteenths make a half? A fourth?
- 2 Teach** (10 min) On a ruler the longest marks are inches, then halves, fourths and eighths, and the shortest are sixteenths. Line a glue stick up with 0: it ends 11 sixteenth marks past 1, so it is $1 \frac{11}{16}$ inches. A spoon ends 10 sixteenths past 3: $3 \frac{10}{16} = 3 \frac{5}{8}$ inches in simplest form. Turn to the centimeter ruler: a domino is 4 centimeters and 8 small marks, 48 mm, or 4.8 cm.
Say: "I line up the end with 0, find the mark closest to the other end, and count the small spaces after the last whole number. Then I simplify."
- 3 Try it together** (10 min) Pairs measure a toy car and a pencil cap to the nearest sixteenth inch and millimeter, in simplest form. Then each draws a line $1 \frac{15}{16}$ inches long.
- 4 Practice** (15 min) Students measure in centimeters and millimeters on sheet 2 of Estimating and Measuring, in eighths and sixteenths of an inch on its sheet 3, and in eighths on sheet 3 of Line Plots with Fractions. Print at actual size.
- 5 Exit ticket** (5 min) Students do **Exit Ticket 10.8** and circle a face beside the "I can" line. On question 1, look for $2 \frac{3}{16}$ inches; $2 \frac{3}{8}$ means the sixteenth marks were counted as eighths, and $2 \frac{1}{8}$ or $2 \frac{1}{4}$ means the reading stopped at eighths. On question 2, look for 64 mm; 6.4 or 6 means centimeters were read.

Need help? Color a paper ruler's marks, one color for each size.

Ready for more? Measure your hand span in sixteenths and in millimeters.

GET READY

- Inch rulers marked in sixteenths, and centimeter rulers with millimeters
- Things to measure: a glue stick, a spoon, a domino, a toy car, a pencil cap
- Paper strips to make a ruler

WORDS TO USE

sixteenth inch: one of 16 equal parts of an inch

millimeter (mm): a tenth of a centimeter

nearest: the mark closest to the end

ASK

- What is the shortest mark worth?
- How many sixteenths make an eighth?
- Can the length be written in simpler form?

WATCH FOR

Starts at the end of the ruler, not at 0. Line the end of the thing up with 0.

Counts the marks instead of the spaces. Count the jumps from the last whole inch, one sixteenth each.

Writes $3 \frac{10}{16}$ as $3 \frac{5}{8}$. The small parts are sixteenths: $\frac{10}{16}$, which is $\frac{5}{8}$.

ON ANIMAL MATH

PRINTABLE **Estimating and Measuring: Length, Mass and Liquid Volume:** sheets 2-3

PRINTABLE **Line Plots with Fractions:** sheet 3

TOOL **Measuring Tool:** Measure With Centimeter Ruler, Ruler Marks Every Mark (its inch ruler stops at quarter inches)

EXIT TICKET **5th Grade Measurement Conversions Exit Tickets:** Exit Ticket 10.8