Measurement

Unit 11 Overview: 10 lessons

Students learn how the units of one system compare: kilometers, meters, centimeters and millimeters; kilograms and grams; liters and milliliters; miles, yards, feet and inches; pounds and ounces; gallons, quarts, pints and cups; and days, hours, minutes and seconds. They record each relation in a two-column table, change a larger unit to a smaller one by multiplying, and compare two amounts by writing both in the smaller unit. Then they find elapsed time across the hour, and start and end times, and solve measurement stories in all four operations, with number line and bar diagrams, fractions and decimals. Measurement comes after the fraction and decimal units, so its stories can use them. Some states add measuring to the nearest eighth inch and millimeter, and choosing a unit and a tool.

THE UNIT, DAY BY DAY

Day 1	**Pre-Check**	What students already know, before the first lesson.
Day 2	**11.1** Metric length	I can convert metric lengths.
Day 3	**11.2** Metric mass and liquid volume	I can convert metric masses and liquid volumes.
Day 4	**11.3** Customary length	I can convert miles, yards, feet and inches.
Day 5	**11.4** Customary weight and capacity	I can convert customary weights and capacities.
Day 6	**11.5** Units of time	I can convert units of time.
Day 7	**11.6** Elapsed time	I can find elapsed time and end times.
Day 8	**11.7** Measurement stories	I can solve measurement stories.
Day 9	**11.8** Stories with fractions and decimals	I can solve stories with fractions and decimals.
Day 10	**11.9** Measure to the eighth inch and millimeter ★	I can measure to the nearest eighth inch and millimeter.
Day 11	**11.10** Choose a unit and a tool ★	I can choose a sensible unit and tool.
Day 12	**Unit Review**	The review, to go over together.
Day 13	**Unit Test**	Form A; Form B (other numbers) is for a retest.

★ Taught in 4th 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 in inches (with eighths) and centimeters (with millimeters)
- A kitchen scale, a 1 kilogram bag, a 1 pound bag and a liter bottle
- Cup, pint, quart and gallon containers, and water or rice to pour
- The Teaching Clock, or a geared clock, and blank time lines
- Two-column table templates and a wall chart of the conversion facts

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

PRINTABLE **Unit Review**: the day before the test

EXIT TICKET **Exit Tickets**: one a lesson, two to a page

PRINTABLE **Unit Test**: Forms A and B, with keys

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Measurement

Lesson 11.1: Metric length

GOAL Students learn how kilometers, meters, centimeters and millimeters compare (1 km = 1,000 m, 1 m = 100 cm, 1 cm = 10 mm), fill in two-column conversion tables, and change a larger unit to a smaller one by multiplying.

I can convert metric lengths.

About 45 minutes

THE LESSON

1. **Warm up** (5 min) Hold up a meter stick. Ask how many centimeters are in it, and how many meter sticks long the classroom might be.
2. **Teach** (10 min) Show 1 centimeter on a ruler and the 10 small marks in it: 1 cm = 10 mm. Then 100 centimeters make the meter stick, and 1,000 meters make a kilometer. Fill in a table of meters and centimeters: 1 m is 100 cm, so 3 m is 300 cm and 13 m is 1,300 cm. Then 3 km = 3 × 1,000 = 3,000 m, and 8 cm = 80 mm. Last, 3 m 45 cm is 300 + 45 = 345 cm.

   > **Say:** "One of the bigger unit is many of the smaller one. To change to the smaller unit, I multiply by how many fit in one."

3. **Try it together** (10 min) Pairs measure a desk with a meter stick, in centimeters and then in millimeters. Then they fill in a table of kilometers and meters for 1, 3 and 12.
4. **Practice** (15 min) Students do the metric problems on sheet 1 of Measurement Conversion Word Problems: the table, then lengths in the smaller unit and in two units (problems 5 to 9, 11 to 13, 16 and 17). Early finishers find how many millimeters are in a meter.
5. **Exit ticket** (5 min) Students do **Exit Ticket 11.1** and circle a face beside the "I can" line. On question 1, look for 40 and 70 millimeters; 400 and 700 means 100 was used, not 10. On question 2, look for 9,000 m and 2,000 cm; 900 m or 200 cm means a zero is missing, so write the fact (1 km = 1,000 m) first.

Need help? Point to the meter stick for each fact: 100 centimeters in it, 10 millimeters in each centimeter.

Ready for more? A race is 10 km long. How many meters is that? How many centimeters?

GET READY

- A meter stick and centimeter rulers that show millimeters
- Two-column table templates
- A map with a 1 kilometer walk marked

WORDS TO USE

kilometer (km): 1,000 meters; about a 12 minute walk

millimeter (mm): a tenth of a centimeter

convert: change a measurement to another unit

ASK

- Which unit is bigger? Will you get more or fewer of the smaller unit?
- How many centimeters are in 1 meter?
- What do you multiply by to change kilometers to meters?

WATCH FOR

Divides instead of multiplying, so 3 km becomes a smaller number. Ask: a kilometer is long. Will it take more meters or fewer?

Uses 100 for every metric change. Write the facts at the top (1,000, 100, 10) and check the units.

Writes 3 m 45 cm as 3,045 cm. Change the meters first (300 cm), then add the 45.

ON ANIMAL MATH

PRINTABLE **Measurement Conversion Word Problems**: sheet 1, the metric problems

TOOL **Measuring Tool**: Measure With Meter Stick, then Centimeter Ruler

QUIZ **Measurement Conversions Quiz**: the Metric Length level

EXIT TICKET **4th Grade Measurement and Conversions Exit Tickets**: Exit Ticket 11.1

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Measurement

Lesson 11.2: Metric mass and liquid volume

GOAL Students change kilograms to grams and liters to milliliters (1 kg = 1,000 g, 1 L = 1,000 mL), fill in tables, write mixed amounts like 5 kg 400 g in grams, and compare two amounts by writing both in the smaller unit.

I can convert metric masses and liquid volumes.

About 45 minutes

THE LESSON

1. **Warm up** (5 min) Pass around a paper clip and the kilogram bag. Ask how many paper clips might have the same mass as the bag.
2. **Teach** (10 min) Kilo means 1,000: 1 kg = 1,000 g and 1 L = 1,000 mL. Fill in a table of liters and milliliters: 6 L = 6,000 mL and 8 L = 8,000 mL. Then 14 kg = 14,000 g. Compare 2 kg and 2,300 g: 2 kg is 2,000 g, so 2 kg < 2,300 g. Last, 5 kg 400 g is 5,000 + 400 = 5,400 g.

   > **Say:** "A kilogram is 1,000 grams and a liter is 1,000 milliliters. To compare, I write both amounts in the smaller unit."

3. **Try it together** (10 min) Pairs fill in a kilograms and grams table (1, 8, 11) and a liters and milliliters table (1, 9, 20). Then they compare 7,500 mL with 8 L, and 4,600 g with 5 kg.
4. **Practice** (15 min) Students do the kilograms and grams half of sheet 4 of Measurement Conversions (pounds come in lesson 11.4), then the metric comparisons on sheet 2 of Measurement Conversion Word Problems (problems 11, 14, 17 and 20). Early finishers try sheet 3, problems 6 to 9.
5. **Exit ticket** (5 min) Students do **Exit Ticket 11.2** and circle a face beside the "I can" line. On question 1, look for 12,000 g and 15,000 mL; 1,200 or 1,500 means 100 was used, not 1,000. On question 2, look for 2 L > 1,950 mL; < means 2 was compared with 1,950 without changing the liters, so write 2 L as 2,000 mL first.

Need help? Hold the kilogram bag while saying 1,000 grams, and the liter bottle while saying 1,000 milliliters.

Ready for more? A water cooler holds 12 L 600 mL. How many milliliters is that? How many cups of 300 mL can it fill?

GET READY

- A 1 kilogram bag and a paper clip
- A liter bottle and a measuring jug marked in milliliters
- A kitchen scale

WORDS TO USE

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

kilogram (kg): 1,000 grams: a big bag of rice

milliliter (mL): a tiny amount of liquid, a few drops; 1,000 make a liter

ASK

- What does kilo mean?
- Which is more, 2 kg or 2,300 g? How do you know?
- Would you measure a spoon of medicine in milliliters or liters?

WATCH FOR

Says 8 L is less than 7,500 mL because 8 is less than 7,500. Write both in milliliters first: 8,000 mL and 7,500 mL.

Writes 5 kg 400 g as 5,040 g or 405 g. Change the kilograms first (5,000 g), then add the 400.

Mixes up mass and liquid units. Ask: are we weighing it or pouring it?

ON ANIMAL MATH

- PRINTABLE **Measurement Conversions**: sheet 4, kilograms and grams
- PRINTABLE **Measurement Conversion Word Problems**: sheet 2, problems 11, 14, 17 and 20; sheet 3 for early finishers
- PRINTABLE **Grams and Kilograms**: sheet 2, for review
- QUIZ **Measurement Conversions Quiz**: the Grams and Liters level
- EXIT TICKET **4th Grade Measurement and Conversions Exit Tickets**: Exit Ticket 11.2

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Measurement

Lesson 11.3: Customary length

GOAL Students learn how inches, feet, yards and miles compare (1 ft = 12 in, 1 yd = 3 ft = 36 in, 1 mi = 1,760 yd = 5,280 ft), fill in conversion tables, and change a larger unit to a smaller one by multiplying.

I can convert miles, yards, feet and inches.

About 45 minutes

THE LESSON

1. **Warm up** (5 min) Hold a ruler next to a yardstick. Ask how many rulers fit along the yardstick, and how many inches that is.
2. **Teach** (10 min) Lay 3 rulers along the yardstick: 1 yd = 3 ft. Each ruler is 12 in, so 1 yd = 3 × 12 = 36 in. Fill in a table of feet and inches: 1 ft is 12 in, so 12 ft is 144 in and 20 ft is 240 in. Then yards and feet: 6 yd = 18 ft and 20 yd = 60 ft. Last, 3 ft 8 in is 36 + 8 = 44 in. A mile is 1,760 yards, so long trips and races are in miles.

   > **Say:** "I find how many of the small unit fit in one of the big unit. Then I multiply."

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. Then they fill in a yards and inches table for 1, 13 and 20 yards together.
4. **Practice** (15 min) Students fill in the length tables and compare on sheet 2 of Measurement Conversions, then do the customary problems on sheet 1 of Measurement Conversion Word Problems (problems 2 to 4, 10, 14 and 15). Early finishers find how many inches are in a mile.
5. **Exit ticket** (5 min) Students do **Exit Ticket 11.3** and circle a face beside the "I can" line. On question 1, look for 252 and 288 inches; 21 and 24 means the yards were changed to feet, not inches. On question 2, look for 5,280 feet; 1,760 is the yards in a mile, and 12 or 36 means the mile fact is not known yet.

Need help? Lay rulers along a yardstick and count the inches by 12s.

Ready for more? A soccer field is 120 yards long. How many feet is that? How many inches?

GET READY

- Rulers, yardsticks and a tape measure
- Two-column table templates
- A map with a 1 mile walk from school marked

WORDS TO USE

foot (ft): 12 inches; about as long as a sheet of paper

yard (yd): 3 feet, or 36 inches: a yardstick

mile (mi): 5,280 feet; about a 20 minute walk

ASK

- How many inches are in a yard? How did you work it out?
- Is 40 inches more or less than 1 yard?
- What would you measure in miles?

WATCH FOR

Uses 10 inches in a foot, as with centimeters. Customary units do not go by 10s. Count the inches on a ruler: 12 make a foot.

Multiplies by 3 to change yards to inches. Yards to feet is times 3, feet to inches times 12. Go one step at a time, or use 36.

Writes 3 ft 8 in as 38 in. Change the feet first (36 in), then add the 8.

ON ANIMAL MATH

- PRINTABLE **Measurement Conversions**: sheet 2
- PRINTABLE **Measurement Conversion Word Problems**: sheet 1, problems 2-4, 10, 14 and 15
- TOOL **Measuring Tool**: Measure With Yardstick, then Tape Measure (Feet)
- QUIZ **Measurement Conversions Quiz**: the Customary Length level
- EXIT TICKET **4th Grade Measurement and Conversions Exit Tickets**: Exit Ticket 11.3

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Measurement

Lesson 11.4: Customary weight and capacity

GOAL Students change pounds to ounces (1 lb = 16 oz) and gallons to quarts, pints and cups (1 gal = 4 qt, 1 qt = 2 pt, 1 pt = 2 c), fill in tables, and compare by writing both amounts in the smaller unit.

I can convert customary weights and capacities.

About 45 minutes

THE LESSON

1. **Warm up** (5 min) Show the gallon jug and a cup. Students guess how many cups fill the gallon and write their guesses.
2. **Teach** (10 min) Pour cups into a quart (4 cups) and quarts into the gallon (4 quarts): 1 gal = 4 qt = 8 pt = 16 c. Draw it as a big G holding 4 Qs, each Q holding 2 Ps, each P holding 2 Cs. Fill in a table of gallons and quarts: 7 gal = 28 qt. Then weight: 1 lb = 16 oz, so 12 lb = 12 × 16 = 192 oz. Compare 2 qt and 7 c: 2 qt is 8 c, so 2 qt > 7 c.

   > **Say:** "I write both amounts in the smaller unit before I compare. Then the numbers tell me which is more."

3. **Try it together** (10 min) Pairs pour water or rice to check that 1 qt = 2 pt = 4 c. Then they fill in a pounds and ounces table (1, 4, 20) and compare 3 gal and 13 qt, and 2 lb and 34 oz.
4. **Practice** (15 min) Students change cups, pints, quarts and gallons on sheet 3 and pounds and ounces on sheet 4 of Measurement Conversions, then use the kitchen chart on sheet 3 of Cooking Measurements. Early finishers fill in 1 gal = 4 qt = 8 pt = 16 c from memory.
5. **Exit ticket** (5 min) Students do **Exit Ticket 11.4** and circle a face beside the "I can" line. On question 1, look for 160 oz and 24 c; 12 c means the quarts were changed to pints, not cups. On question 2, look for 3 lb < 50 oz, with 3 pounds changed to 48 ounces; > means the bigger unit was taken to be more, and a bare < may be 3 compared with 50, so ask how they know.

Need help? Draw the gallon picture (G, Q, P, C) and count the cups in it.

Ready for more? A recipe needs 3 pints of milk. Is a half gallon enough? How do you know?

GET READY

- A kitchen scale in ounces and a 1 pound bag
- A gallon jug, quart, pint and cup containers, and water or rice to pour
- Two-column table templates

WORDS TO USE

ounce (oz): a small unit of weight; 16 make a pound

quart (qt): 2 pints, or 4 cups

pint (pt): 2 cups

ASK

- How many cups are in a quart? In a gallon?
- Why do you change both amounts to the same unit?
- Is 20 ounces more or less than a pound?

WATCH FOR

Uses 12 ounces in a pound, as with inches in a foot. Each kind of unit has its own fact: 16 ounces make a pound.

Changes gallons to cups with 4, because 4 quarts make a gallon. Go step by step, gallons to quarts to pints to cups, or use 16 cups in a gallon.

Compares 2 qt and 7 c by the numbers: 7 is more. Change 2 qt to cups first: 8 c.

ON ANIMAL MATH

PRINTABLE **Measurement Conversions**: sheets 3-4

PRINTABLE **Cooking Measurements**: sheet 3

QUIZ **Measurement Conversions Quiz**: the Pounds and Gallons level

EXIT TICKET **4th Grade Measurement and Conversions Exit Tickets**: Exit Ticket 11.4

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Measurement

Lesson 11.5: Units of time

GOAL Students use the time facts (1 min = 60 s, 1 h = 60 min, 1 day = 24 h, 1 week = 7 days) to fill in conversion tables, change a larger unit to a smaller one, and write a time like 2 h 15 min in minutes.

I can convert units of time.

About 45 minutes

THE LESSON

1. **Warm up** (5 min) Students sit quietly for what they think is one minute, then stand. Compare with the second hand.
2. **Teach** (10 min) Watch the second hand go once around: 60 seconds. The minute hand goes once around in 60 minutes, an hour, and the hour hand goes twice around in a day: 24 hours. Fill in a table of hours and minutes: 1 h = 60 min, 3 h = 180 min and 14 h = 840 min. Then 13 min = 13 × 60 = 780 s. Last, 2 h 15 min is 120 + 15 = 135 min.

   > **Say:** "Time units do not go by 10s. I use 60 for minutes and seconds, 24 for hours in a day and 7 for days in a week."

3. **Try it together** (10 min) Pairs fill in a table of days and hours (1, 2, 10) and one of weeks and days (1, 4, 9). Then they work out how many minutes long the school day is, from the first bell to the last.
4. **Practice** (15 min) Students finish the time facts on sheet 1, compare times on sheet 3 and count by the time facts on sheet 4 of Units of Time. Early finishers find how many seconds are in an hour.
5. **Exit ticket** (5 min) Students do **Exit Ticket 11.5** and circle a face beside the "I can" line. On question 1, look for 120 and 168 hours; 300 and 420 means 60 was used, so ask how many hours are in a day. On question 2, look for 480 seconds; 800 means a minute was taken as 100 seconds.

Need help? Count by 60s on a number line (60, 120, 180) to change hours to minutes.

Ready for more? How many minutes are in a whole day? Show how you worked it out.

GET READY

- A classroom clock with a second hand, and the Teaching Clock
- A calendar
- Two-column table templates

WORDS TO USE

second (s): a very short time, about one clap; 60 make a minute

hour (h): 60 minutes

day: 24 hours, from one midnight to the next

ASK

- How many seconds are in 3 minutes? How do you know?
- Why can we not just write a zero to change hours to minutes?
- What is 2 hours 15 minutes in minutes?

WATCH FOR

Uses 100 minutes in an hour, as with centimeters. Show the clock: the minute hand goes around once, 60 minutes, each hour.

Uses 12 for the hours in a day. The hour hand goes around twice a day, from midnight to noon and from noon to midnight: 24 hours.

Writes 2 h 15 min as 215 min. Change the hours first (120 min), then add the 15.

ON ANIMAL MATH

PRINTABLE **Units of Time**: sheets 1, 3 and 4

TOOL **Teaching Clock**: Minute Hand Moves By 1 Minute

QUIZ **Measurement Conversions Quiz**: the Time level

EXIT TICKET **4th Grade Measurement and Conversions Exit Tickets**: Exit Ticket 11.5

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Measurement

Lesson 11.6: Elapsed time

GOAL Students find elapsed time across the hour, and across noon, on an open time line: a jump to the next hour, then whole hours, then the minutes left. They find an end time or a start time from a time span.

I can find elapsed time and end times.

About 45 minutes

THE LESSON

1. **Warm up** (5 min) Show 10:40 on the Teaching Clock. Ask how many minutes it is until 11:00, and until 11:30.
2. **Teach** (10 min) Find the time from 10:40 a.m. to 1:15 p.m. on a time line: jump 20 minutes to 11:00, then 2 hours to 1:00, then 15 minutes to 1:15. Add the jumps: 2 hours 35 minutes. Then an end time: start at 7:45 a.m. and go 2 hours 25 minutes. Jump the hours (9:45), then 15 minutes to 10:00 and 10 more: 10:10 a.m. Last, a start time: a game ended at 6:20 p.m. after 1 hour 55 minutes. Jump back 1 hour (5:20), then 20 minutes (5:00), then 35 more: 4:25 p.m.

   > **Say:** "I make friendly jumps: to the next hour, then whole hours, then the minutes left. Then I add the jumps."

3. **Try it together** (10 min) Pairs use the class schedule: how long is lunch, and how long from the first bell to lunch? Then: a field trip starts at 9:40 a.m. and lasts 1 hour 20 minutes. When does it end? They check each answer on the Teaching Clock.
4. **Practice** (15 min) Students draw jumps on the time lines of sheet 3, find end and start times in the tables of sheet 4, and solve the stories of sheet 5 of Elapsed Time. Early finishers plan a 3 hour field day with four events and write each start and end time.
5. **Exit ticket** (5 min) Students do **Exit Ticket 11.6** and circle a face beside the "I can" line. On question 1, look for 1 hr 30 min; 1 hr 70 min means the times were subtracted as if an hour had 100 minutes. On question 2, look for 11:15 a.m.; 10:75 means the minutes went past 60 without making a new hour.

Ready for more? A movie starts at 7:25 p.m. and is 2 hours 48 minutes long. Does it end before 10:00 p.m.?

GET READY

- The Teaching Clock and paper clocks
- Blank open time lines
- The class schedule with start and end times

WORDS TO USE

elapsed time: how much time passes from the start to the end

start time: when something begins

end time: when something is over

ASK

- Where is a good first jump?
- How many minutes are in your jumps altogether? Is that more than an hour?
- Did the time pass noon? Is it a.m. or p.m.?

WATCH FOR

Subtracts the times like whole numbers. Use the time line: jump to the hour, then whole hours, then minutes.

Writes 75 minutes instead of 1 hour 15 minutes. 60 minutes make an hour. Trade them.

Forgets to change a.m. to p.m. after noon. Mark 12:00 noon on the time line before jumping.

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

ON ANIMAL MATH

PRINTABLE **Elapsed Time**: sheets 3–5

TOOL **Teaching Clock**: Elapsed Time and Start From Here, in Advanced Options

QUIZ **Telling Time Quiz**: the Elapsed Time level

EXIT TICKET **4th Grade Measurement and Conversions Exit Tickets**: Exit Ticket 11.6

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Measurement

Lesson 11.7: Measurement stories

GOAL Students solve measurement stories with all four operations. When a story mixes units, they change to the smaller unit first; they draw a number line or a bar diagram to show the story, and write the answer with its unit.

I can solve measurement stories.

About 45 minutes

THE LESSON

1. **Warm up** (5 min) Quick facts on whiteboards: 6 yd = ? ft, 4 h = ? min, 3 m = ? cm.
2. **Teach** (10 min) Read: A board is 3 meters long. It is cut into pieces 25 centimeters long. How many pieces? Change to one unit: 300 cm. Draw a number line from 0 to 300 cm and jump by 25s: 12 jumps, so 12 pieces. Then: A hose is 6 yards long. 3 feet are cut off. How many feet are left? 6 yd = 18 ft, and 18 – 3 = 15 feet. Draw a bar of 18 with a piece of 3 cut off.

   > **Say:** "If the story has two units, I change to the smaller unit first. Then I draw it and choose the operation."

3. **Try it together** (10 min) Pairs solve two stories with diagrams. Ty walks 1 km 400 m to school, then 900 m more to the park: how many meters? Each of 12 steps is 55 centimeters: how far is that in meters and centimeters? Pairs share which diagram helped.
4. **Practice** (15 min) Students write each step on sheet 4 of Measurement Conversion Word Problems, then solve the stories on sheet 6 of Measurement Conversions. Early finishers try the three-step stories on sheet 5 of the first pack.
5. **Exit ticket** (5 min) Students do **Exit Ticket 11.7** and circle a face beside the "I can" line. On question 1, look for 165 centimeters; 33 means the meters were not changed to centimeters first. On question 2, look for 3,000 mL and 3 L; if the numbers were added, ask what "4 bottles" means and draw 4 bars.

Ready for more? Write a story that needs kilograms changed to grams, and trade with a partner.

GET READY

- Meter sticks and string to act out the stories
- Blank number lines and bar diagrams
- The wall chart of conversion facts

WORDS TO USE

diagram: a drawing that shows the story: a number line or a bar

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

ASK

- Are both amounts in the same unit?
- What does your diagram show?
- Does your answer make sense? Is it more or less than you started with?

WATCH FOR

Uses the numbers as they are when the units differ (6 yards and 3 feet). Change to the smaller unit first, then add or subtract.

Writes the answer without a unit. Ask: 15 what? Write the unit every time.

Picks the operation from one word, such as "left", without reading the whole story. Act it out or draw it before choosing.

Need help? Act the story out with a meter stick or string, then draw what happened.

ON ANIMAL MATH

- PRINTABLE **Measurement Conversion Word Problems**: sheet 4, then 5 for early finishers
- PRINTABLE **Measurement Conversions**: sheet 6
- QUIZ **Measurement Conversions Quiz**: the Metric Length level
- EXIT TICKET **4th Grade Measurement and Conversions Exit Tickets**: Exit Ticket 11.7

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Measurement

Lesson 11.8: Stories with fractions and decimals

GOAL Students solve measurement stories with fractions and decimals: a whole number times a fraction of a unit (4 × 2/5 L), and tenths plus hundredths of a unit (0.7 m + 0.18 m). They name each answer as a mixed number or a decimal, with its unit.

I can solve stories with fractions and decimals.

About 45 minutes

THE LESSON

1. **Warm up** (5 min) Students write 8/5 and 11/4 as mixed numbers on whiteboards.
2. **Teach** (10 min) Read: Each glass holds 2/5 liter. How much do 4 glasses hold? Draw 4 bars of 2/5: 4 × 2/5 = 8/5 = 1 3/5 liters. Then: A paper chain is 0.7 meter long. Students add 0.18 meter. How long is it now? Write the tenths as hundredths: 0.70 + 0.18 = 0.88 meter, or 70/100 + 18/100 = 88/100. Write each answer with its unit.

   > **Say:** "I draw the story, then use what I know about fractions and decimals. The unit stays the same, so I write it with the answer."

3. **Try it together** (10 min) Pairs solve two stories with drawings. A path is 5/6 mile long, and Ana walks it 4 times: how far does she walk? Rosa has $4.00 and spends $2.65 on stamps: how much is left? Each pair explains one answer to another pair.
4. **Practice** (15 min) Students change units with decimals and fractions on sheet 3 of Measurement Conversion Word Problems, then solve the recipe stories on sheet 5 of Cooking Measurements or the money stories on sheet 5 of Mail and Postage. Early finishers write a fraction story for a partner.
5. **Exit ticket** (5 min) Students do **Exit Ticket 11.8** and circle a face beside the "I can" line. On question 1, look for 3 3/4 yards (15/4 is right too); 15/20 means the denominators were multiplied too. On question 2, look for 0.95 liter; 0.23 means 0.8 was read as 8 hundredths, so write it as 0.80 first.

Ready for more? A recipe uses 5/8 cup of oats for one batch. How much do 5 batches use?

GET READY

- Fraction strips or number lines
- Hundred grids
- Measuring cups and a meter stick

WORDS TO USE

mixed number: a whole number and a fraction: 1 3/5

decimal: tenths and hundredths: 0.18 m is 18 hundredths of a meter

ASK

- How many fifths is 4 × 2/5?
- Why write 0.7 as 0.70 before adding 0.18?
- Is the answer more or less than 1 liter? How do you know?

WATCH FOR

Multiplies the top and the bottom: 4 × 2/5 = 8/20. Draw 4 bars of 2/5: the pieces are still fifths.

Adds 0.7 + 0.18 as 0.25. Write both to hundredths: 0.70 + 0.18.

Leaves 8/5 liters without seeing it is more than 1. Write it as a mixed number: 1 3/5 liters.

Need help? Use a number line in fifths, or a hundred grid, to act out each story.

ON ANIMAL MATH

- PRINTABLE **Measurement Conversion Word Problems**: sheet 3
- PRINTABLE **Cooking Measurements**: sheet 5
- PRINTABLE **Mail and Postage**: sheet 5
- QUIZ **Fraction Operations Quiz**: the Times a Whole Number level
- EXIT TICKET **4th Grade Measurement and Conversions Exit Tickets**: Exit Ticket 11.8

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Measurement

Lesson 11.9: Measure to the eighth inch and millimeter

GOAL Students measure to the nearest eighth inch (each inch cut into 8 equal parts) and to the nearest millimeter on a centimeter ruler, and read scales to the nearest unit.

I can measure to the nearest eighth inch and millimeter.

About 45 minutes

★ Taught in 4th grade in some states

THE LESSON

1. **Warm up** (5 min) Draw a 1 inch line on the board. Cut it in half, then in fourths, then in eighths. Students count the eighths.
2. **Teach** (10 min) Show a ruler on the document camera. The longest marks are inches, then halves, then fourths, and the shortest are eighths. Line a crayon up with 0: it ends 5 eighth marks past 3, so it is 3 5/8 inches. Turn the ruler to centimeters and measure a pencil cap: 3 centimeters and 7 small marks, 37 millimeters. Last, on a dial scale, read the mark nearest the pointer.

   > **Say:** "I line up the end with 0, find the mark closest to the other end, and count the small parts after the last whole number."

3. **Try it together** (10 min) Pairs measure a marker, a glue stick and a spoon to the nearest eighth inch and to the nearest millimeter, and compare with another pair. Then each student draws a line 1 1/8 inches long.
4. **Practice** (15 min) No Animal Math sheet covers all of this lesson, so it is mostly hands-on. Students measure eighth inches on sheet 3 of Line Plots with Fractions and in problems 1 and 2 of sheet 3 of Estimating and Measuring, millimeters on its sheet 2, and read scales on sheets 1 and 2 of Pounds and Ounces. Print at actual size.
5. **Exit ticket** (5 min) Students do **Exit Ticket 11.9** and circle a face beside the "I can" line. On question 1, look for 1 3/8 inches; 1 3/4 means each small mark was counted as a fourth. On question 2, look for 52 millimeters; 5 or 6 means centimeters were read instead.

Need help? Color the eighth marks on a paper ruler in one color and the fourth marks in another. Start with quarter inches.

Ready for more? Measure your hand span to the nearest eighth inch and to the nearest millimeter. Which measurement is more exact?

GET READY

- Inch rulers (eighths) and centimeter rulers (millimeters)
- A crayon, a marker, a glue stick, a spoon, a pencil cap
- A kitchen scale

WORDS TO USE

eighth inch: one of 8 equal parts of an inch

millimeter (mm): the small marks on a centimeter ruler

nearest: the mark closest to the end

ASK

- What is the shortest mark worth?
- Where did you line up the ruler?
- Is the end closer to this mark or the next?

WATCH FOR

Starts at the end of the ruler instead of at 0. Find the 0 mark first and line the end of the thing up with it.

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

Reads 37 mm as 37 cm. Ask which marks were counted: the tiny ones are millimeters.

ON ANIMAL MATH

- PRINTABLE — **Line Plots with Fractions**: sheet 3
- PRINTABLE — **Estimating and Measuring: Length, Mass and Liquid Volume**: sheet 2, and sheet 3, problems 1-2; 5th grade
- PRINTABLE — **Pounds and Ounces**: sheets 1-2
- TOOL — **Measuring Tool**: Measure With Centimeter Ruler, Ruler Marks Every Mark (millimeters)
- EXIT TICKET — **4th Grade Measurement and Conversions Exit Tickets**: Exit Ticket 11.9

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Measurement

Lesson 11.10: Choose a unit and a tool

GOAL Students choose a sensible unit and the right tool for a job (a ruler, meter stick, scale, measuring cup, thermometer or clock), estimate with a benchmark first, then measure and compare.

I can choose a sensible unit and tool.

About 45 minutes

★ Taught in 4th grade in some states

THE LESSON

1. **Warm up** (5 min) Hold up a backpack. Students write an estimate of its mass, then say what tool and what unit they would use.
2. **Teach** (10 min) Model four jobs. The hallway: long, so meters and a meter stick or tape measure; estimate first, about 30 meter sticks. The backpack: a scale and kilograms; estimate, then weigh. The water a vase holds: a measuring cup, in milliliters or cups. The temperature outside: a thermometer. Compare each measurement with its estimate.

   > **Say:** "First I ask what I am measuring: length, mass, liquid, time or temperature. That gives the tool. The size gives the unit."

3. **Try it together** (10 min) Pairs take job cards, name the tool and the unit, estimate, measure where they can, and record how close they were. Then the class orders the length units: mm, cm, m, km.
4. **Practice** (15 min) Students choose metric units on sheet 1 of Estimating and Measuring, estimate and read scales in problems 1 to 3 of its sheet 4, and choose units on sheet 5 of Estimate or Exact? Early finishers read sheet 1 of Reading Thermometers.
5. **Exit ticket** (5 min) Students do **Exit Ticket 11.10** and circle a face beside the "I can" line. On question 1, look for meters for the tree and grams for the key; kilometers or kilograms means the size of the thing was not thought about. On question 2, look for the measuring cup; a scale means "how much water" was read as how heavy.

Need help? Match each tool to a picture of what it measures before choosing a unit.

Ready for more? Estimate, then measure, the hallway in meters and in feet. Which number is larger, and why?

GET READY

- Rulers, a meter stick, a scale, measuring cups, a thermometer
- Benchmark cards (a paper clip is about 1 gram)
- A backpack, a vase and job cards

WORDS TO USE

estimate: a careful guess

benchmark: a thing we know the size of

tool: what you measure with

ASK

- What are you measuring: length, mass, liquid, time or temperature?
- Which benchmark helps you estimate?
- How close was your estimate?

WATCH FOR

Picks a ruler for every job. Ask: is it how long, how heavy or how much liquid?

Picks a unit far too big, such as kilometers for the hallway. Hold up the benchmark: kilometers or meters?

Changes the estimate after measuring. Write the estimate first and keep it.

ON ANIMAL MATH

PRINTABLE **Estimating and Measuring: Length, Mass and Liquid Volume**: sheet 1, and sheet 4, problems 1-3; 5th grade

PRINTABLE **Estimate or Exact?** sheet 5

PRINTABLE **Reading Thermometers**: sheet 1, for early finishers

TOOL **Measuring Tool**: Measure With Inch and Centimeter Rulers

EXIT TICKET **4th Grade Measurement and Conversions Exit Tickets**: Exit Ticket 11.10

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