

Measure, Compare and Convert

Choose units, estimate first and measure real objects.

GRADE 4 • 4.MG.1

4.MG.1 "The student will reason mathematically to solve problems, including those in context, that involve length, weight/mass, and liquid volume using U.S. Customary and metric units. Determine an appropriate unit of measure to use when measuring: length in both U.S. Customary (inch, foot, yard, mile) and metric units (millimeter, centimeter, meter); weight/mass in both U.S. Customary (ounce, pound) and metric units (gram, kilogram); and liquid volume in both U.S. Customary (cup, pint, quart, gallon) and metric units (milliliter, liter). Estimate and measure: length of an object to the nearest U.S. Customary unit (12 inch, 14 inch, 18 inch, foot, yard) and nearest metric unit (millimeter, centimeter, or meter); weight/mass of an object to the nearest U.S. Customary unit (ounce, pound) and nearest metric unit (gram, kilogram); and liquid volume to the nearest U.S. Customary unit (cup, pint, quart, gallon) and nearest metric unit (milliliter, liter). Compare estimates of length, weight/mass, or liquid volume with the actual measurements. Given the equivalent measure of one unit, solve problems, including those in context, by determining the equivalent measures within the U.S. Customary system for: length (inches and feet, feet and yards, inches and yards); weight/mass (ounces and pounds); and liquid volume (cups, pints, quarts, and gallons)."

NAME _____ DATE _____

Write each estimate before measuring; keep both numbers and units. Reuse the object where a row says same. An adult handles heavy objects and large pours.

Materials and setup

Pencil, desk, room space, light object, backpack; eighth-inch ruler, metric ruler/tape; scales for ounces, pounds, grams and kilograms.

Water jug, small vial, tray; liquid measures for cups, pints, quarts, gallons, milliliters and liters. Adult: demonstrate tools and assist pouring.

Match the tool and unit

Measure from zero. Fractional-inch units are $\frac{1}{2}$, $\frac{1}{4}$ and $\frac{1}{8}$ inch; the source quotation above omits their slashes. Round to the requested unit.

Try it together

A ribbon estimate is 10 cm. Compare it with the measurement.

Ribbon record

Item	Record
Estimate	10 cm
Measured	12 cm

Both use centimeters. $12 - 10 = 2$ cm. The estimate was 2 cm too short.

1. Choose useful units

Name a reasonable unit for each situation. Use the system named. Be ready to explain your choices.

Unit choices

Item / unit	Unit and reason
Pencil: customary	
Road distance: customary	
Desk length: metric	
Paperclip mass: metric	
Backpack weight: customary	
Jug volume: metric	

2. Measure lengths

Measure the pencil and room. For each row, record an estimate and the measurement rounded to the named unit.

Length records

Item / unit	Estimate → measurement
Pencil: nearest 1/2 inch	
Same pencil: nearest 1/4 inch	
Same pencil: nearest 1/8 inch	
Same pencil: nearest mm	
Room length: nearest foot	
Same room: nearest yard	

3. Metric lengths and weight/mass

Estimate, then measure. Keep both records with units. Use the same backpack for pounds and kilograms.

Tool records

Item / unit	Estimate → measurement
Desk length: nearest cm	
Room length: nearest m	
Light object: nearest ounce	
Backpack: nearest pound	
Light object: nearest gram	
Backpack: nearest kilogram	

4. Measure liquid volume

Estimate and measure the jug water in each customary unit and liters. Use the small vial for milliliters. Round to the nearest whole named unit.

Liquid records

Item / unit	Estimate → measurement
Jug: cups	
Same jug: pints	
Same jug: quarts	
Same jug: gallons	
Small vial: milliliters	
Same jug: liters	

5. Convert length and weight

Use $12\text{ in} = 1\text{ ft}$, $3\text{ ft} = 1\text{ yd}$, $36\text{ in} = 1\text{ yd}$ and $16\text{ oz} = 1\text{ lb}$. Write one equation per line: 5 yd ribbon to feet; 72 in cord to feet; 2 yd trim to inches; 48 oz supplies to pounds.

6. Convert liquid units

A club packs drinks. Use $2\text{ cups} = 1\text{ pint}$, $2\text{ pints} = 1\text{ quart}$, $4\text{ quarts} = 1\text{ gallon}$ and $16\text{ cups} = 1\text{ gallon}$. Write one equation per line: 8 cups to pints; 6 pints to quarts; 2 gallons to quarts; 32 cups to gallons.

7. Compare your estimates

Choose one length, one weight/mass and one liquid record. For each, say whether your estimate was high, low or equal and by how much. Keep the same unit in each comparison.

Three comparisons

Item / unit	Estimate comparison
Length record	
Weight/mass record	
Liquid record	

Teacher notes

Demonstrate zero alignment, scales and eye-level liquid readings. Discuss benchmarks: inch, foot, yard, mile; millimeter, centimeter, meter; ounce, pound; gram, kilogram; cup, pint, quart, gallon; milliliter, liter. Use U.S. customary units where customary units are requested. Require real estimates and measurements, judged against each object/tool; conversions have fixed answers. Round exact midpoints up.

Task 1

Examples: pencil inches; road miles; desk centimeters or meters; paperclip grams; backpack pounds; jug liters. Accept other sensible choices supported by the object and desired precision.

Task 2

Answers vary. Check an estimate recorded before measurement and the correct rounding increment for every row. Same pencil measurements should agree within rounding precision.

Task 3

Answers vary. Desk length is recorded in whole centimeters and room length in whole meters. Weights/masses use whole ounces, pounds, grams and kilograms as directed; do not compare numbers without their units.

Task 4

Answers vary. Require actual estimates and tool readings in cups, pints, quarts, gallons, milliliters and liters. The same jug has equivalent volume, though whole-unit rounding changes the reported precision.

Task 5

Ribbon: $5 \times 3 = 15$ feet. Cord: $72 \div 12 = 6$ feet. Trim: $2 \times 36 = 72$ inches. Supplies: $48 \div 16 = 3$ pounds. Choose multiplication or division using the stated unit equivalence.

Task 6

8 cups = 4 pints; 6 pints = 3 quarts; 2 gallons = 8 quarts; 32 cups = 2 gallons.
Use the unit facts; keep units beside each answer.

Task 7

Answers vary. Subtract estimate and measurement in the same unit, give the absolute difference (zero if equal) and correctly identify high/low/equal for all three quantities.