

Measurement – Metric System

In the world of science and medicine, the metric system of measurement is used. Also, many European countries use the metric system rather than the customary measurement system. We will study metric units of length based on the meter, metric units of weight based on gram, and metric units of capacity based on the liter.

We will begin with how the metric units are named and the meaning of their prefixes.

The metric units of length that we will study are kilometer, meter, centimeter, millimeter. We will measure length using a ruler that shows centimeter and millimeter divisions.

Sometimes, we will need to convert from one metric unit to a different metric unit. First, we'll look at expressing a large unit into a smaller unit and vice versa, look at expressing a small unit into a larger unit.

Metric System Conversion Tables

Metric System Prefixes

Metric Units of Length

Measuring with Metric Units of Length

Converting Metric Units of Length Using Multiplication

Converting Metric Units of Length Using Division

Metric System Conversion Tables

Length	
kilometer (km)	1000 meters
1 meter (m)	100 centimeters
1 centimeter (cm)	10 millimeters (mm)

Weight	
kilogram (kg)	1000 grams
1 gram (g)	1000 milligrams (mg)

Capacity	
liter (l)	1000 milliliters (ml)

Metric System Prefixes

Metric prefixes have meaning.

kilo means 1000 times the base unit.

kilo + meter means 1000 meters.
Thus a kilometer = 1000 meters.

kilo + gram means 1000 grams.
Thus a kilogram = 1000 grams.

deci means $\frac{1}{10}$ th of the base.

deci + meter means $\frac{1}{10}$ of a meter.

Thus, a decimeter is $\frac{1}{10}$ of a meter *or* 1 meter = 10 decimeters.

centi means $\frac{1}{100}$ th of the base.

centi + meter means $\frac{1}{100}$ of a meter.

Thus, a centimeter is $\frac{1}{100}$ of a meter *or* 1 meter = 100 centimeters.

milli means $\frac{1}{1000}$ th of the base.

milli + meter means $\frac{1}{1000}$ of a meter.

Thus, a millimeter is $\frac{1}{1000}$ of a meter *or* 1 meter = 1000 millimeters.

milli + gram means $\frac{1}{1000}$ of a gram
1 gram = 1000 milligrams

milli + liter means $\frac{1}{1000}$ of a liter
1 liter = 1000 milliliters

Metric Units of Length

The metric system of measurement is used by scientists, doctors, and people of many other countries.

Kilometer (km)

A kilometer is a distance that is about 7 blocks long. Kilometers are used to measure long distances.



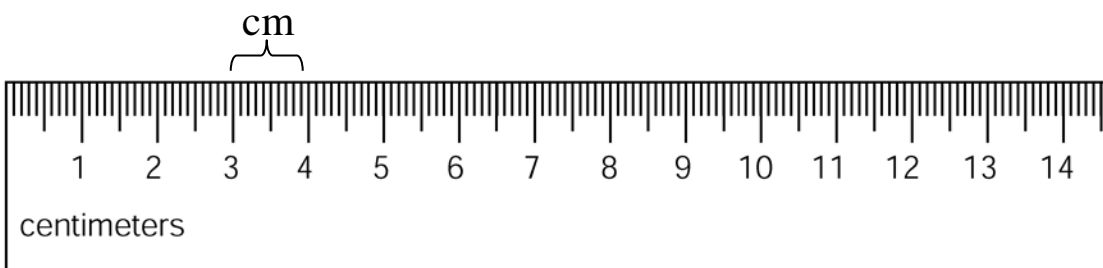
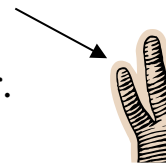
Meter (m)



A meter is about as long as a baseball bat. A meter stick could be used to measure the length of a room.

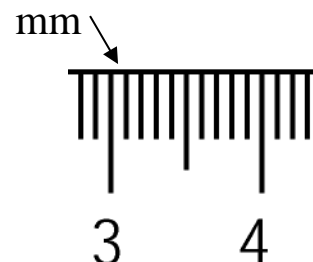
Centimeter (cm)

A centimeter is about the width of the pinky finger. A centimeter is a little less than half an inch long.



Millimeter (mm)

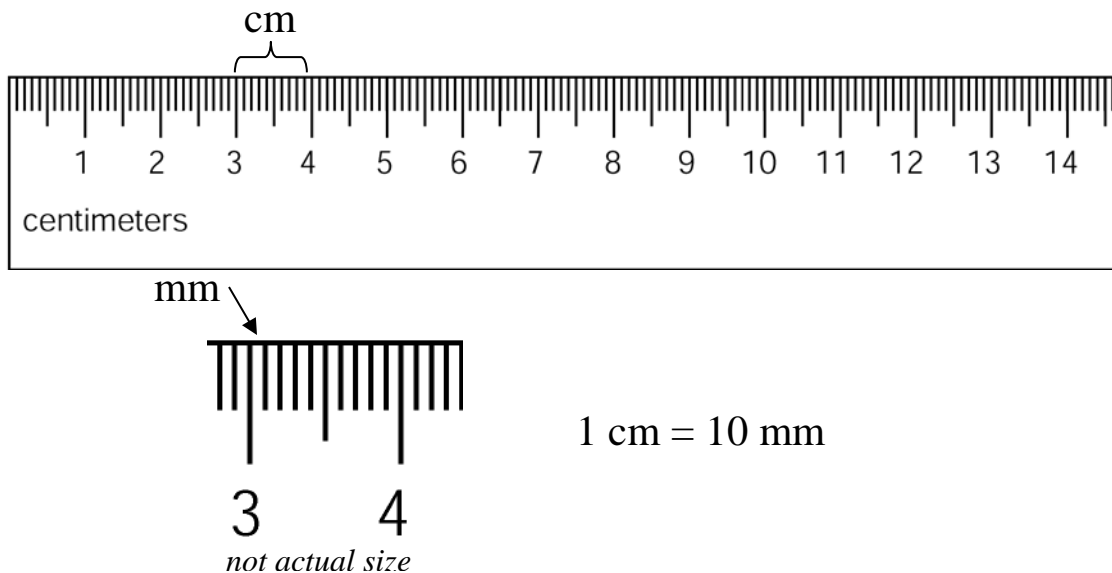
A millimeter is about as long as the thickness of the wire in a paper clip. The thickness of a dime is about 2 millimeters.



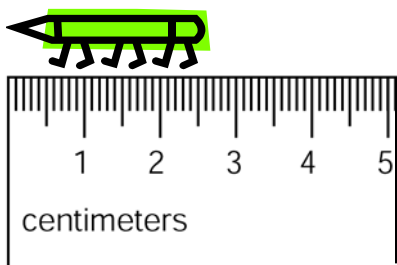
not actual size

Measuring with Metric Units of Length

Look closely at the rulers below to view centimeters and millimeters. A centimeter is the length from one number's notch to the next number's notch. One section of the ruler is enlarged to show millimeters. Count the spaces between the 3 notch and the 4 notch and note that there are 10 millimeters in a centimeter.

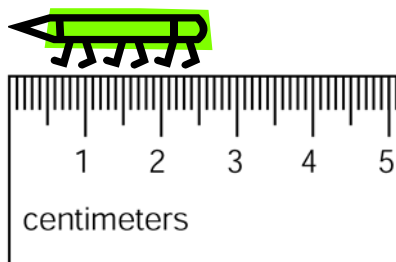


Using the ruler, determine approximately how long the pencil is in **centimeters**.



Since the major unit shown is centimeters, read the closest whole number. The pencil measures approximately **3 cm (centimeters)**.

Using the ruler, determine approximately how long the pencil is in **millimeters**.



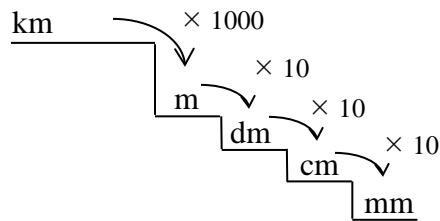
Since 1 centimeter equals 10 millimeters, count 10, 20 up to 2 centimeters, then count in ones. The pencil is approximately **27 mm (millimeters)** long. Zoom in to view a more precise measurement.

Converting Metric Units of Length Using Multiplication

Large Units to Small Units

To express a **larger unit** as a **smaller unit**, *multiply* by the conversion factor.

The metric units are arranged on the steps in order from largest to smallest. The conversion factor is beside the arrow.



Solve: 7 km = _____ m

Using the steps, multiply 7×1000 .

$$7 \text{ km} = 7000 \text{ m}$$

Solve: 5 cm = _____ mm

Using the steps, multiply 5×10 .

$$5 \text{ cm} = 50 \text{ mm}$$

Solve: 4 m = _____ cm

Using the steps,
multiply $4 \times 10 \times 10$.
(two steps down)

or
multiply 4×100

$$4 \text{ m} = 400 \text{ cm}$$

Solve:

9.3 m = _____ mm

Using the steps,
multiply $9.3 \times 10 \times 10 \times 10$.
(three steps down)

or
multiply 9.3×1000

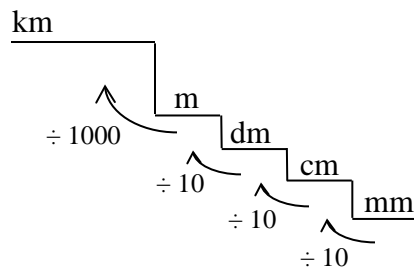
$$9.3 \text{ m} = 9300 \text{ mm}$$

Converting Metric Units of Length Using Division

Small Units to Large Units

To express a **smaller unit as a larger unit**, *divide* by the conversion factor.

The metric units are arranged on the steps in order from smallest unit to largest. The conversion factor is beside the arrow.



Solve: $9000 \text{ m} = \underline{\hspace{2cm}}$ km

Using the steps, divide 9000 by 1000.

$$9000 \text{ m} = 9 \text{ km}$$

Solve: $80 \text{ mm} = \underline{\hspace{2cm}}$ cm

Using the steps, divide 80 by 10.

$$80 \text{ mm} = 8 \text{ cm}$$

Solve: $700 \text{ cm} = \underline{\hspace{2cm}}$ m

Using the steps,
compute $700 \div 10 \div 10$
(two steps up)

or
compute $700 \div 100$

$$700 \text{ cm} = 7 \text{ m}$$

Solve: $4500 \text{ mm} = \underline{\hspace{2cm}}$ m

Using the steps,
Compute $4500 \div 10 \div 10 \div 10$.
(three steps up)

or
compute $4500 \div 1000$

$$4500 \text{ mm} = 4.5 \text{ m}$$