

## How to solve unit conversions using Dimensional Analysis (Factor Label Method)

The Problem: 55mm = \_\_\_\_?\_\_ km **(How to do each step is written in bold)**

1. Write the number with unit that is given in the problem **55mm**
2. Write a multiplication symbol and a fraction line **55mm x -----**
3. Write the same unit as the number given in the denominator spot **55mm x -----**  
**mm**
4. Using the table on the next page, fill in the number for the denominator and write what it is equal to in the numerator

$$55\text{mm} \times \frac{\mathbf{1 \text{ meter}}}{\mathbf{1000\text{mm}}}$$

5. The mm would cross out and if the question asked for the answer in meters, you could stop there and just multiply (55 x 1)/ 1000 and you would be done. But the question asked for km... you need to keep going.

6. You can cross out units that are diagonal from each other... keep going until the unit you want is in the last numerator spot.

$$55\text{mm} \times \frac{\mathbf{1 \text{ m}}}{\mathbf{1000\text{mm}}} \times \frac{\mathbf{1 \text{ km}}}{\mathbf{1000 \text{ m}}} = 55 / (1000 \times 1000) = 0.000055 \text{ or } 5.5 \times 10^{-5} \text{ km}$$

6. Make sure your answer has the same number of sig figs as the number you started with and that your answer has a unit.

Example one:

$$88\text{km} = \text{____} \text{m}$$

$$88\text{km} \times \frac{1000\text{m}}{1\text{km}} = 88,000\text{m}$$

Example two: When you are changing 2 units, it doesn't matter which one you change first, as long as the units that need to cancel each other are diagonal from each other

$$\frac{25\text{km}}{\text{hr}} = \text{____} \frac{\text{m}}{\text{s}}$$

$$\frac{25\text{km}}{1\text{h}} \times \frac{1000\text{m}}{1\text{km}} \times \frac{1\text{h}}{60\text{min}} \times \frac{1\text{min}}{60\text{s}} = \frac{6.9\text{m}}{\text{s}}$$

OR

$$\frac{25\text{km}}{1\text{h}} \times \frac{1\text{h}}{60 \text{ min}} \times \frac{1\text{min}}{60 \text{ sec}} \times \frac{1000\text{m}}{1\text{km}} = \frac{6.9\text{m}}{\text{s}}$$

Prefix	Symbol	Conversion factor examples using meter
kilo	<u>k</u>	<u>1km = 1000m</u>
hecto	<u>h</u>	<u>1hm = 100m</u>
deka	<u>da or D</u>	<u>1 Dm = 10 m</u>
(meter, liter, gram...)		
deci	<u>d</u>	<u>10dm = 1m</u>
centi	<u>c</u>	<u>100cm = 1m</u>
milli	<u>m</u>	<u>1000mm = 1m</u>
micro	<u>μ</u>	<u>1,000,000 μm = 1m</u>
nano	<u>n</u>	<u>1,000,000,000 = 1nm</u>

Make the following conversions using dimensional analysis, show all your work for full credit. Make sure all your answers are rounded off to the correct number of significant figures. This goes for all the problems on these worksheets

1) 10 m = \_\_\_\_\_ km

7) 42.3 hm = \_\_\_\_\_ cm

2) 2 km = \_\_\_\_\_ cm

8) 234.3 dg = \_\_\_\_\_ dkg (Dg)

3) 250 mL = \_\_\_\_\_ L

9) 56.82 kL = \_\_\_\_\_ dL

4) 2,000 g = \_\_\_\_\_ kg

10) 4.2 cm = \_\_\_\_\_ dm

5) 10 kg = \_\_\_\_\_ mg

11) 23.2 m = \_\_\_\_\_ Hm

6) 1,500cm<sup>3</sup> = \_\_\_\_\_ L (hint 1 mL = 1cm<sup>3</sup>)

12) 2.6 mm = \_\_\_\_\_ km

If you are having a hard time, here is a short video to help [Dimensional Analysis/Factor Label Method: UPDATED - Chemsitry Tutorial - YouTube](#)

1 pound = 454 g  
16 oz = 1 pound

2.54 cm = 1 inch  
12 inches = 1 foot  
3 feet = 1 yard  
5,280 feet = 1 mile  
1 mile = 1.61 km

1.06 quarts = 1 Liter  
4 quarts = 1 gallon  
2 pints = 1 quart  
2 cups = 1 pint

Problems to Solve: (refer to the equivalencies)

1. Suppose a bug is 5 inches long. What is its length in feet?
2. Express a length of 320 feet in miles.
3. Express 76.874 cm in miles.
4. How many seconds are there in 7.2 years?
5. How many miles in 1600 meters?
6. How many pints in 22.4 quarts?
7. How many milligrams are there in 62.4 ounces?
8. How many years in 635976 hours?

9. If the price of gasoline is \$0.400 per liter, what is its price per gallon?
  
10. If a plane is traveling 300 miles per hour, how long will it take to travel 1800 miles?
  
11. If you are traveling at 60km/hr, how many centimeters per second is that equivalent to?
  
12. If you are running at a pace of 7.0 miles per hour, how many meters per minute is that equivalent to?
  
13. Convert the speed of light,  $3.0 \times 10^8$  m/s, into mi/hr. (1610 m = 1 mi)
  
14. Convert the density of aluminum, 2.70 g/mL into kg/cm<sup>3</sup>. (1 mL = 1 cm<sup>3</sup>)
  
15. Convert 22.4 kg/L to kg/mL
  
16. What is 10095 m/s in miles/s?
  
17. Change 8.41 g/mL to Kg/L