

DIMENSIONAL ANALYSIS (FACTOR LABEL METHOD)

Name _____

Using this method, it is possible to solve many problems by using the relationship of one unit to another. For example, 12 inches = one foot. Since these two numbers represent the same value, the fractions 12 in/1 ft and 1 ft/12 in are both equal to one. When you multiply another number by the number one, you do not change its value. However, you may change its unit.

Example 1: Convert 2 miles to inches.

$$2 \text{ miles} \times \frac{5,280 \text{ ft}}{1 \text{ mile}} \times \frac{12 \text{ inches}}{1 \text{ ft}} = 126,720 \text{ in}$$

(Using significant figures,
2 mi = 100,000 in.)

Example 2: How many seconds are in 4 days?

$$4 \text{ days} \times \frac{24 \text{ hrs}}{1 \text{ day}} \times \frac{60 \text{ min}}{1 \text{ hr}} \times \frac{60 \text{ sec}}{1 \text{ min}} = 345,600 \text{ sec}$$

(Using significant figures,
4 days = 300,000 sec.)

Solve the following problems. Write the answers in significant figures.

- 3 hrs = _____ sec
- 0.035 mg = _____ cg
- 5.5 kg = _____ lbs
- 2.5 yds = _____ in
- 1.3 yrs = _____ hr (1 yr = 365 days)
- 3 moles = _____ molecules (1 mole = 6.02×10^{23} molecules)
- 2.5×10^{24} molecules = _____ moles
- 5 moles = _____ liters (1 mole = 22.4 liters)
100. liters = _____ moles
50. liters = _____ molecules
- 5.0×10^{24} molecules = _____ liters
- 7.5×10^3 mL = _____ liters

METRICS AND MEASUREMENT

Name _____

In the chemistry classroom and lab, the metric system of measurement is used, so it is important to be able to convert from one unit to another.

mega	kilo	hecto	deca	Basic Unit	deci	centi	milli	micro
(M)	(k)	(h)	(da)	gram (g)	(d)	(c)	(m)	(μ)
1,000,000	1000	100	10	liter (L)	.1	.01	.001	.000001
10^6	10^3	10^2	10^1	meter (m)	10^{-1}	10^{-2}	10^{-3}	10^{-6}

Factor Label Method

- Write the given number and unit.
- Set up a conversion factor (fraction used to convert one unit to another).
 - Place the given unit as denominator of conversion factor.
 - Place desired unit as numerator.
 - Place a "1" in front of the larger unit.
 - Determine the number of smaller units needed to make "1" of the larger unit.
- Cancel units. Solve the problem.

Example 1: 55 mm = _____ m

$$\frac{55 \cancel{\text{mm}}}{1000 \cancel{\text{mm}}} \times \frac{1 \text{ m}}{1} = 0.055 \text{ m}$$

Example 2: 88 km = _____ m

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

Example 3: 7000 cm = _____ hm

$$\frac{7000 \cancel{\text{cm}}}{100 \cancel{\text{cm}}} \times \frac{1 \cancel{\text{m}}}{100 \cancel{\text{m}}} \times \frac{1 \text{ hm}}{1} = 0.7 \text{ hm}$$

Example 4: 8 daL = _____ dL

$$\frac{8 \cancel{\text{daL}}}{1 \cancel{\text{daL}}} \times \frac{10 \cancel{\text{L}}}{1 \cancel{\text{L}}} \times \frac{10 \text{ dL}}{1} = 800 \text{ dL}$$

The factor label method can be used to solve virtually any problem including changes in units. It is especially useful in making complex conversions dealing with concentrations and derived units.

Convert the following.

- 35 mL = _____ dL
- 950 g = _____ kg
- 275 mm = _____ cm
- 1,000 L = _____ kL
- 1,000 mL = _____ L
- 4,500 mg = _____ g
- 25 cm = _____ mm
- 0.005 kg = _____ dag
- 0.075 m = _____ cm
- 15 g = _____ mg