

Unit Conversion

SI Prefixes

Think of the table of SI prefixes as conversion codes.

SI prefix	Symbol	Value
giga	G	10^9
mega	M	10^6
kilo	k	10^3
deci	d	10^{-1}
centi	c	10^{-2}
milli	m	10^{-3}
micro	μ	10^{-6}
nano	n	10^{-9}
pico	p	10^{-12}

Worth remembering: $10^{-3} = \frac{1}{10^3} = \frac{1}{10 \times 10 \times 10} = \frac{1}{1000}$

The symbol can be replaced with multiplication by the value.

Examples: 15 mL = 15×10^{-3} L (the same as 1.5×10^{-2} L)

$$2.3 \text{ kg} = 2.3 \times 10^3 \text{ g}$$

Mass and Moles

M is the "molar mass" calculated by adding the atomic masses of the elements in the number given in the formula. It is measured in g mol^{-1} (grams per mole).

Example: $M_{\text{CO}_2} = 12.01 + (16.00 \times 2) = 44.01 \text{ g mol}^{-1}$

Use the formula $n = \frac{m}{M}$ to convert from mass to moles, and $m = n \times M$ to convert from moles to mass.

Converting between g L^{-1} and mol L^{-1}

Think of M as a bridge, with g L^{-1} at one end and mol L^{-1} at the other.

To get from mass concentration to mol L^{-1} , you need to get to g L^{-1} first.

To convert from g L^{-1} to mol L^{-1} , divide by M

To convert from mol L^{-1} to g L^{-1} , multiply by M

If you're having trouble remembering which way is divide and which way is multiply, you can check by multiplying or dividing the units and seeing which one gets you the right units.

e.g. $\text{g L}^{-1} \div \text{g mol}^{-1} = \text{mol L}^{-1}$ {g cancels out}

Same Unit Conversion

To convert a value to a different prefix but the same base unit, complete this equation:

$$1 \text{ old unit} = ? \text{ new units}$$

If you're converting the first part of the unit (for example the g in g L^{-1} or the mg in mg mol^{-1})

Multiply the original value by the number found above to get the value in the new units.

Example: Convert 5 kg L^{-1} into g L^{-1}

$$1 \text{ kg} = 1000 \text{ g}$$

$$\therefore 5 \times 1000 = 5000 \text{ g L}^{-1}$$

Or, if you're converting the second part (the 'per' part, for example the L in g L^{-1} or the mol in mg mol^{-1})

Divide the original value by the number found above to get the value in the new units.

Example: Convert 5 g L^{-1} into g (mL)^{-1} (from grams per litre into grams per millilitre)

$$1 \text{ L} = 1000 \text{ mL}$$

$$\therefore 5 \div 1000 = 0.005 \text{ g (mL)}^{-1}$$

Other things to Remember

%w/v is the same as g (100mL)^{-1} (grams per hundred millilitres)

%w/w is the same as g (100g)^{-1} (grams per hundred grams)

ppm is the same as mg L^{-1} or mg kg^{-1} , depending on whether the sample is dissolved or solid.

ppb is the same as $\mu\text{g L}^{-1}$ or $\mu\text{g kg}^{-1}$, depending on whether the sample is dissolved or solid.

Given a mass and a volume, the concentration can be calculated with $C = \frac{\text{mass}}{\text{volume}}$ and the units will be in mass per volume, whatever units were used in the calculation.

Example: 5 g in 1 L is 5 g L^{-1}

Given a number of moles and a volume, the same rule applies except with $C = \frac{\text{moles}}{\text{volume}}$ and units of moles instead of units of mass.

You can also rearrange these formulas to convert from a concentration into a volume, number of moles, or mass.