Concentration Conversions (Rev. B, 2/4/2025, WEV)

- Grams per liter to percent by mass

g	mL	1 L	100 percent	% m/m
L	density, g	1000 mL	1.0 decimal	Result

g/L / density / 1000 * 100 = % m/m

Example: convert 58.44 g/L aqueous NaCl to % m/m if solution density 1.03 g/mL.

What we know: g solute per L solution, density (g/mL), 1.0 g/g decimal = 100 %.

58.44/1.03/1000*100 = 5.67 % m/m aqueous NaCl

- Percent by mass to grams per liter

% m/m	1.0 decimal	density, g	1000 mL	g/L
	100 percent	mL	L	Result

% m/m / 100 * density * 1000 = g/L

Example: convert 11.03 % m/m aqueous NaCl to g/L if solution density 1.06 g/mL.

What we know: 100 % = 1.0 g/g (decimal), density (g/mL), 1000 mL per L solution,

11.03/100*1.06*1000 = 117 g/L aqueous NaCl.

- Grams per liter to molarity

g	1 mole	M
L	molar mass, g	Result

g/L / molar mass = M

Example: convert 58.44 g/L aqueous NaCl to molarity.

What we know: g solute per L solution, molar mass (g per mole solute),

58.44/58.44 = 1.000 M aqueous NaCl.

- Molarity to grams per liter

moles	molar mass, g	g/L
L	1 mol	Result

M * molar mass = g/L

Example: convert 2.000 M aqueous NaCl to g/L.

What we know: moles solute per L solution, molar mass (g per mole solute),

2.000*58.44 = 116.9 g/L.

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1. Molarity to molality, step 1

moles	molar mass, g	L	g/kg solution
L	1 mol	density, kg	Result

2. Molarity to molality, step 2

kg solution – g solute/1000 = kg solvent

3. Molarity to molality, step 3

g solute	1 mol	m
kg solvent	molar mass, g	Result

1. M * molar mass / density = g/kg solution
2. 1 kg solution – g solute/1000 = kg solvent
3. g solute / kg solvent / molar mass = m

Example: convert 2.000 M aqueous NaCl to molality if the density is 1.06 kg/L.

What we know: M (moles solute per L solution), molar mass (g/mol), density (kg/L).

2.000*58.44/1.06 = 110.3 g NaCl per 1.000 kg aqueous NaCl (solution).

1.000 – 110.3/1000 = 0.8897 kg water (solvent)

110.3/0.8897/58.44 = 2.123 m aqueous NaCl (moles solute per kg solvent)

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1. Molality to molarity, step 1

moles solute	solute molar mass, g	g/kg solvent
kg solvent	1 mol	Result

2. Molality to molarity, step 2

kg solvent + g solute/1000 = kg solution

3. Molality to molarity, step 3

g solute	1 mol	density, kg	M
kg solution	solute molar mass, g	L	Result

1. m * solute molar mass = g solute/kg solvent
2. 1 kg solvent + g solute/1000 = kg solution

3. g solvent/kg solution / solute molar mass * density = M

Example: convert 2.000 m aqueous NaCl to molarity if the density is 1.05 kg/L.

What we know: m (moles solute per kg solvent), molar mass (g/mol), density (kg/L)..

Step 1: 2.000*58.44 = 116.9 g NaCl per 1.000 kg water (solvent).

Step 2: 1.000 + 116.9/1000 = 1.117 kg aqueous NaCl (solution).

Step 3: 116.9/1.117/58.44*1.05 = 1.880 M aqueous NaCl (mol solute per L solution).