Chemistry 20

Unit C: Solutions and acid-base chemistry

Concentration of solutions

Three tags on salty water

- A clinic bag, a lab bottle, and a river report can all describe salty water with different numbers.
- Each number is a ratio, and the ratio is useful only when its unit is named beside it.

Concentration ratios

- $c = n/V$. Here n is moles and V is litres.
- Percent by mass and parts per million, ppm, both compare solute mass with solution mass.
- The unit $mol \cdot L^{-1}$ means moles of solute in one litre of solution.

Key terms

molar concentration

The amount of solute in moles divided by the volume of solution in litres. The unit $mol \cdot L^{-1}$ means moles of solute in one litre of solution. ($c = n/V$)

percent by mass

The mass of solute divided by the mass of solution, multiplied by 100. (% (m/m))

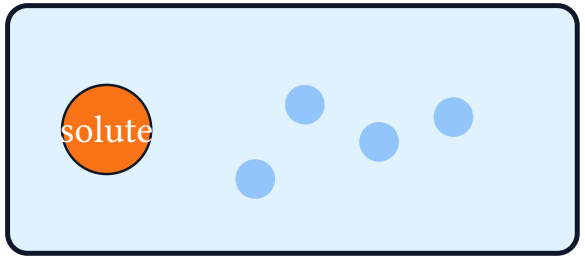
parts per million

The mass of solute divided by the mass of solution, multiplied by one million. The symbol is ppm. (ppm)

The denominator is the whole solution

- Percent by mass divides by the mass of solute plus the mass of solvent.
- A ppm value uses the same solution mass, then scales the ratio by one million.

Denominator = whole solution



mass solute + mass solvent

ppm = same ratio × 10^6

From 2.922 g of salt to mol·L^{-1}

- Convert the measured mass to moles with the molar mass, and convert millilitres to litres.
- Divide the moles by the litres to get c in mol·L^{-1}.

From mol·L^{-1} back to grams

- Multiply c by V, with V in litres, to get the amount of solute in moles.
- Multiply that amount by the molar mass to get the mass to measure.

Concentration units

- Find the percent by mass for 12.0 g of solute dissolved in 108.0 g of water.
- Find c for 1.461 g of NaCl made up to 100.0 mL, and find ppm for 7.5 mg of solute in 1.50 kg of solution.