# Gas Solubility in Water by Henry's Law

Equilibrium mole fraction and concentration of a dissolved gas in water from its partial pressure and Henry's law constant, in mg/L.

**Method:** Henry's law p_i = H x_i (dilute solutions)

## Input parameters

Unit system: SI

| Parameter | Value | Unit |
|---|---|---|
| Partial pressure of the gas | 21.228 | kPa |
| Henry's constant (pressure per mole fraction)<br>From a table for the gas at the water temperature; units of pressure per mole fraction. | 4,260.0 | MPa |
| Molar mass of the gas | 31.999 | kg/kmol |

## Calculated results

| Parameter | Value | Unit |
|---|---|---|
| Mole fraction in water | 4.9830e-04 | % |
| Concentration | 8.8509 | mg/L |

**Notes for this case**

- Dilute solutions only; concentration taken per m³ of water at 1000 kg/m³.

## Formula and method

$$x_i = \frac{p_i}{H}, \quad c = \frac{x_i}{1 - x_i} \cdot \frac{M}{M_w} \rho_w$$

### Variables

| | | |
|---|---|---|
| $p_i$ | Partial pressure of the gas | Pa |
| $H$ | Henry's constant (pressure per mole fraction) | Pa |
| $M$ | Molar mass of the gas | kg/kmol |
| $x_i$ | Mole fraction in water | - |
| $C$ | Concentration | kg/m³ |
| $M_w$ | Molar mass of water, 18.015 | kg/kmol |
| $\rho_w$ | Density of water, taken as 1000 | kg/m³ |

### Method and standards

Henry's law.

### Assumptions and limits

- Dilute, non-reacting gas.
- ρ_w = 1000 kg/m³ and M_w = 18.015 kg/kmol are fixed: the concentration is per m³ of water at 1000 kg/m³ (at 60 °C real water is about 1.7 % less dense).
- Henry's constant must be at the water temperature. For $O_2$, $N_2$, $CO_2$ and other common gases the dissolved gas saturation calculator takes it from IAPWS G7-04 directly.

### References

- Henry's law p_i = H x_i (dilute solutions)

## Report details

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|---|---|
| Report reference | FCC-48KE-ZY3Y (the same inputs always give the same reference) |
| Generated | 17 November 2026, 19:49 UTC |
| Calculator | Gas Solubility in Water by Henry's Law |
| Method last reviewed | 12 November 2026 |
| Software release | FireCAD Calc, release of 17 November 2026 |
| Release checks | 2 reference cases of this calculator, computed independently, are checked on every release |

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

### This calculator online

https://calc.firecad.com/chemical/solutions/henrys-law-solubility

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.