pH of a Strong or Weak Acid or Base Solution

pH, pOH, hydrogen ion concentration and degree of dissociation of a strong or weak acid or base in water at 25 °C, solved exactly with the water equilibrium.

Method: Acid–base equilibrium with the charge balance (Harris, Quantitative Chemical Analysis)

Input parameters

Unit system: SI

Parameter	Value	Unit
Solute	Weak acid (pKa)	
Concentration	0.010000	mol/L
pKa of the weak acid or pKb of the weak base	4.7600	
H^+ or OH^- released per molecule (strong only) Only for strong acids and bases, all of whose protons or hydroxides dissociate fully. Sulphuric acid's second proton is weak (pKa_2 about 2), so n = 2 overstates its acidity except in very dilute solutions.	1.0000	

Calculated results

Parameter	Value	Unit
pH	3.3891	
pOH	10.611	
Hydrogen ion concentration	4.0827e-04	mol/L
Degree of dissociation	4.0827	%

Notes for this case

- Ideal dilute solution at 25 °C (activities taken as concentrations); above about 0.1 mol/L the real pH differs.
- Weak acids and bases are treated as monoprotic: a second dissociation step is ignored.

Formula and method

$$\text{strong}: \quad x = \frac{nC + \sqrt{(nC)^2 + 4K_w}}{2}$$

$$\text{weak}: \quad x = \frac{KC}{x + K} + \frac{K_w}{x}, \quad K = 10^{-pK}$$

$$pH = -\log_{10}[H^+], \quad pOH = 14 - pH, \quad \alpha = \frac{K}{x + K}$$

Variables

solute	Solute	-
C	Concentration	mol/m³
pK	pKa of the weak acid or pKb of the weak base	-
n	H^+ or OH^- released per molecule (strong only)	-
pH	pH	-
pOH	pOH	-
$[H^+]$	Hydrogen ion concentration	mol/m³
α	Degree of dissociation	-
x	$[H^+]$ for an acid, $[OH^-]$ for a base	mol/L
K_w	Ionic product of water at 25 °C	(mol/L)²
K	Ka or Kb	mol/L

Method and standards

The charge balance of the solution, including water's own dissociation (Kw = 10^{-14} at 25 °C), is solved exactly; x is $[H^+]$ for acids and $[OH^-]$ for bases.

Assumptions and limits

- Ideal dilute solution at 25 °C.
- One acid or base at a time.
- n applies to strong electrolytes only, taken as fully dissociated. Sulphuric acid's second proton is weak (pKa_2 about 2), so n = 2 overstates its acidity except when dilute.
- Weak acids and bases are monoprotic here: the second dissociation of a diprotic weak acid is ignored.

References

• Acid–base equilibrium with the charge balance (Harris, Quantitative Chemical Analysis)

Report details

Report reference	FCC-HKCT-9W9N (the same inputs always give the same reference)
Generated	17 November 2026, 19:49 UTC
Calculator	pH of a Strong or Weak Acid or Base Solution
Method last reviewed	12 November 2026
Software release	FireCAD Calc, release of 17 November 2026
Release checks	5 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/ph-strong-weak-acid-base

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.