ORP (Redox Potential) by the Nernst Equation

Redox potential of a couple from its standard potential, oxidised and reduced activities, pH and temperature, versus hydrogen and Ag/AgCl references.

Method: Nernst equation for a redox couple

Input parameters

Unit system: SI

Parameter	Value	Unit
Standard potential vs SHE	771.00	mV
Electrons transferred	1.0000	
Protons consumed in the reduction	0	
Oxidised species activity	0.001000	
Reduced species activity	1.0000e-04	
pH	2.0000	
Temperature	25.000	°C
Reference electrode potential vs SHE	197.00	mV

Calculated results

Parameter	Value	Unit
Slope per decade	59.159	mV
Potential vs SHE	830.16	mV
Reading vs the reference electrode	633.16	mV

Notes for this case

• For Ox + mH⁺ + ne⁻ ⍰ Red: E_h = E⁰ + (2.303RT/nF)log(a_ox/a_red) − (2.303RT·m/nF)pH. ORP meters read against a reference electrode, usually Ag/AgCl in saturated KCl (+0.197 V vs SHE at 25 °C), so E_meas = E_h − E_ref. Real ORP readings in mixed waters are often not at equilibrium and are best used as trends (for example cyanide destruction, chlorination, chromate reduction).

Formula and method

$$E_h = E^0 + \frac{2.303RT}{nF}\log\frac{a_{ox}}{a_{red}} - \frac{2.303RTm}{nF}pH, \quad E_{meas} = E_h - E_{ref}$$

Variables

E^0	Standard potential vs SHE	V
n	Electrons transferred	-
m	Protons consumed in the reduction	-
a_{ox}	Oxidised species activity	-
a_{red}	Reduced species activity	-
pH	pH	-
T	Temperature	K
E_{ref}	Reference electrode potential vs SHE	V
S	Slope per decade	V
E_h	Potential vs SHE	V
E_{meas}	Reading vs the reference electrode	V

Method and standards

ORP.

Assumptions and limits

- Equilibrium; activities known; reversible couple.

References

Nernst equation for a redox couple

Report details

Report reference	FCC-K43D-9SZ6 (the same inputs always give the same reference)
Generated	23 November 2026, 18:08 UTC
Calculator	ORP (Redox Potential) by the Nernst Equation
Method last reviewed	17 November 2026
Software release	FireCAD Calc, release of 22 November 2026
Release checks	3 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/instrumentation/analysers/orp-redox-potential

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.