pH Electrode Nernst Slope and Temperature Compensation

Theoretical slope of a pH electrode at a temperature from the Nernst equation, the electrode voltage at a pH, and the pH from a measured voltage.

Method: Nernst equation; slope = ln(10) R T / F (CODATA 2018 R and F)

Input parameters

Unit system: SI

Parameter	Value	Unit
Temperature of the solution	25.000	°C
pH (to find the voltage)	4.0000	
Measured electrode voltage (to find the pH)	-100.00	mV
Isopotential (zero-voltage) pH	7.0000	
Electrode slope efficiency	100.00	%

Calculated results

Parameter	Value	Unit
Slope at this temperature (mV per pH)	59.159	mV
Voltage at the pH entered	177.48	mV
pH at the voltage entered	8.6903	

Notes for this case

- Automatic temperature compensation corrects the electrode slope only; the sample's own pH also changes with temperature.

Formula and method

$$S = \eta_s \frac{\ln 10\, R T}{F}, \quad E = -S\,(pH - pH_0)$$

Variables

T	Temperature of the solution	K
pH	pH (to find the voltage)	-
E	Measured electrode voltage (to find the pH)	V
pH_0	Isopotential (zero-voltage) pH	-
η_s	Electrode slope efficiency	-
S	Slope at this temperature (mV per pH)	V
E_{pH}	Voltage at the pH entered	V
pH_E	pH at the voltage entered	-

Method and standards

Nernst equation for a glass electrode.

Assumptions and limits

- Ideal glass electrode.

References

- Nernst equation
- slope = ln(10) R T / F (CODATA 2018 R and F)

Report details

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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/ph-nernst-temperature

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.