Electrolyte Conductivity by Kohlrausch's Law and Onsager

Limiting molar conductivity from ionic conductivities, the Kohlrausch slope by the Onsager limiting law, and the conductivity of a dilute 1:1 electrolyte solution.

Method: Kohlrausch's law and the Debye–Hückel–Onsager limiting law

Input parameters

Unit system: SI

Parameter	Value	Unit
Cation limiting ionic conductivity (S·cm²/mol)	50.100	
Anion limiting ionic conductivity (S·cm²/mol)	76.350	
Concentration	1.0000	mmol/L

Calculated results

Parameter	Value	Unit
Limiting molar conductivity (S·cm²/mol)	126.45	
Kohlrausch slope, Onsager (S·cm²/mol per (mol/L)^½)	89.157	
Molar conductivity at c (S·cm²/mol)	123.63	
Solution conductivity	123.63	µS/cm
Conductivity ignoring interionic effects	126.45	µS/cm

Notes for this case

• Kohlrausch: ions migrate independently at infinite dilution, Λ° = λ°₊ + λ°₋, and Λ_m = Λ° − □√c for strong electrolytes. Onsager's limiting law for a 1:1 electrolyte in water at 25 °C gives □ = A + BΛ° with A = 60.20 S·cm²/mol·(mol/L)^−½ and B = 0.229 (mol/L)^−½. κ = Λ_mc. Reliable below about 1 mmol/L; above about 10 mmol/L it overestimates the fall. 25 °C values; conductivity rises about 2 %/K.

Formula and method

$$\Lambda_m^0 = \lambda_+^0 + \lambda_-^0, \quad \Lambda_m = \Lambda_m^0 - (A + B\Lambda_m^0)\sqrt{c}, \quad \kappa = \Lambda_m c$$

Variables

λ_+^0	Cation limiting ionic conductivity (S·cm²/mol)	-
λ_-^0	Anion limiting ionic conductivity (S·cm²/mol)	-
c	Concentration	mol/m³
Λ_m^0	Limiting molar conductivity (S·cm²/mol)	-
$\mathcal{K}$	Kohlrausch slope, Onsager (S·cm²/mol per (mol/L)^½)	-
Λ_m	Molar conductivity at c (S·cm²/mol)	-
κ	Solution conductivity	S/m
κ^0	Conductivity ignoring interionic effects	S/m

Method and standards

Kohlrausch.

Assumptions and limits

- 1:1 strong electrolyte; water at 25 °C; dilute solutions.

References

Kohlrausch's law and the Debye–Hückel–Onsager limiting law

Report details

Report reference	FCC-H07V-DAXV (the same inputs always give the same reference)
Generated	23 November 2026, 18:00 UTC
Calculator	Electrolyte Conductivity by Kohlrausch's Law and Onsager
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/kohlrausch-conductivity

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.