Important Formulas of Conductance PDF

Formulas
Examples
with Units

List of 17
Important Formulas of Conductance

1) Charge Number of Ion Species using Debey-Huckel Limiting Law Formula

Evaluate Formula

Formula

$$Z_i = \left(-\frac{\ln(\gamma_{\pm})}{A \cdot \sqrt{I}} \right)^{\frac{1}{2}}$$

Example with Units

$$2.941 = \left(-\frac{\ln(0.05)}{0.509\,\text{kg\^{}(1/2)/mol\^{}(1/2)} \cdot \sqrt{0.463\,\text{mol/kg}}} \right)^{\frac{1}{2}}$$

2) Conductance Formula

Evaluate Formula

Formula

$$G = \frac{1}{R}$$

Example with Units

$$9900.9901\,\mho = \frac{1}{0.000101\,\Omega}$$

3) Conductivity given Cell Constant Formula

Evaluate Formula

Formula

$$K = (G \cdot b)$$

Example with Units

$$4960.0252\,\text{S/m} = (9900.25\,\mho \cdot 0.501\,\text{1/m})$$

4) Conductivity given Conductance Formula

Evaluate Formula

Formula

$$K = (G) \cdot \left(\frac{l}{a} \right)$$

Example with Units

$$4714.4048\,\text{S/m} = (9900.25\,\mho) \cdot \left(\frac{5\,\text{m}}{10.5\,\text{m}^2} \right)$$

5) Conductivity given Molar Volume of Solution Formula

Evaluate Formula

Formula

$$K = \left(\frac{\Lambda_{m(solution)}}{V_m} \right)$$

Example with Units

$$4464.2857\,\text{S/m} = \left(\frac{100\,\text{S*m}^2\text{/mol}}{0.0224\,\text{m}^3\text{/mol}} \right)$$

6) Debey-Huckel Limiting Law Constant Formula

Evaluate Formula

Formula

$$A = -\frac{\ln(\gamma_{\pm})}{Z_i^2} \cdot \sqrt{I}$$

Example with Units

$$0.5096\,\text{kg\^{}(1/2)/mol\^{}(1/2)} = -\frac{\ln(0.05)}{2^2} \cdot \sqrt{0.463\,\text{mol/kg}}$$

7) Degree of Dissociation Formula

Evaluate Formula

Formula

$$\alpha = \frac{\Lambda_m}{\Lambda°_m}$$

Example with Units

$$0.3529 = \frac{150\,\mathrm{S{*}m^2/mol}}{425\,\mathrm{S{*}m^2/mol}}$$

8) Degree of Dissociation given Concentration and Dissociation Constant of Weak Electrolyte Formula

Evaluate Formula

Formula

$$\alpha = \sqrt{\frac{K_a}{C}}$$

Example with Units

$$0.3508 = \sqrt{\frac{1.6E\text{-}4}{0.0013\,\mathrm{mol/L}}}$$

9) Dissociation Constant given Degree of Dissociation of Weak Electrolyte Formula

Evaluate Formula

Formula

$$K_a = C \cdot \left((\alpha)^2 \right)$$

Example with Units

$$0.0002 = 0.0013\,\mathrm{mol/L} \cdot \left((0.35)^2 \right)$$

10) Dissociation Constant of Acid 1 given Degree of Dissociation of Both Acids Formula

Evaluate Formula

Formula

$$K_{a1} = (K_{a2}) \cdot \left(\left(\frac{\alpha_1}{\alpha_2} \right)^2 \right)$$

Example

$$0.0002 = (1.1E\text{-}4) \cdot \left(\left(\frac{0.5}{0.34} \right)^2 \right)$$

11) Dissociation Constant of Base 1 given Degree of Dissociation of Both Bases Formula

Evaluate Formula

Formula

$$K_{b1} = (K_{b2}) \cdot \left(\left(\frac{\alpha_1}{\alpha_2} \right)^2 \right)$$

Example

$$0.0011 = (0.0005) \cdot \left(\left(\frac{0.5}{0.34} \right)^2 \right)$$

12) Distance between Electrode given Conductance and Conductivity Formula

Evaluate Formula

Formula

$$l = \frac{K \cdot a}{G}$$

Example with Units

$$5.1968\,\mathrm{m} = \frac{4900\,\mathrm{S/m} \cdot 10.5\,\mathrm{m^2}}{9900.25\,\mho}$$

13) Equilibrium Constant given Degree of Dissociation Formula

Evaluate Formula

Formula

$$k_C = C_0 \cdot \frac{\alpha^2}{1 - \alpha}$$

Example with Units

$$0.0565\,\mathrm{mol/L} = 0.3\,\mathrm{mol/L} \cdot \frac{0.35^2}{1 - 0.35}$$

14) Equivalent Conductance Formula

Evaluate Formula

Formula

$$E = K \cdot V$$

Example with Units

$$784\,℧ = 4900\,\text{S/m} \cdot 160\,\text{L}$$

15) Molar Conductance Formula

Evaluate Formula

Formula

$$\lambda = \frac{K}{M}$$

Example with Units

$$0.0883\,℧ = \frac{4900\,\text{S/m}}{55.5\,\text{mol/L}}$$

16) Molar Conductivity at Infinite Dilution Formula

Evaluate Formula

Formula

$$\Lambda_{AB} = \left(u_A + u_B\right) \cdot [\text{Faraday}]$$

Example with Units

$$21226.7731\,\text{S/m} = \left(0.1\,\text{m}^2/\text{V*s} + 0.12\,\text{m}^2/\text{V*s}\right) \cdot 96485.3321$$

17) Specific Conductance Formula

Evaluate Formula

Formula

$$K = \frac{1}{\rho}$$

Example with Units

$$4545.4545\,\text{S/m} = \frac{1}{0.00022\,\Omega\text{*m}}$$

Variables used in list of Important Formulas of Conductance above

- **a** Electrode Cross-sectional Area *(Square Meter)*
- **A** Debye Huckel limiting Law Constant *(sqrt(Kilogram) per sqrt(Mole))*
- **b** Cell Constant *(1 per Meter)*
- **C** Ionic Concentration *(Mole per Liter)*
- C_0 Initial Concentration *(Mole per Liter)*
- **E** Equivalent Conductance *(Mho)*
- **G** Conductance *(Mho)*
- **I** Ionic Strength *(Mole per Kilogram)*
- **K** Specific Conductance *(Siemens per Meter)*
- K_a Dissociation Constant of Weak Acid
- K_{a1} Dissociation Constant of Acid 1
- K_{a2} Dissociation Constant of Acid 2
- K_{b1} Dissociation Constant of Base 1
- K_{b2} Dissociation Constant of Base 2
- k_C Equilibrium Constant *(Mole per Liter)*
- **l** Distance between Electrodes *(Meter)*
- **M** Molarity *(Mole per Liter)*
- **R** Resistance *(Ohm)*
- u_A Mobility of Cation *(Square Meter per Volt per Second)*
- u_B Mobility of Anion *(Square Meter per Volt per Second)*
- **V** Volume of Solution *(Liter)*
- V_m Molar Volume *(Cubic Meter per Mole)*
- Z_i Charge Number of Ion Species
- $\gamma_{\pm}$ Mean Activity Coefficient
- **λ** Molar Conductance *(Mho)*
- Λ_{AB} Molar Conductivity at Infinite Dilution *(Siemens per Meter)*
- Λ_m Molar Conductivity *(Siemens Square Meter per Mole)*
- $\Lambda_{m(solution)}$ Solution Molar Conductivity *(Siemens Square Meter per Mole)*

Constants, Functions, Measurements used in list of Important Formulas of Conductance above

- constant(s): **[Faraday]**, 96485.33212
  Faraday constant
- Functions: **ln**, ln(Number)
  The natural logarithm, also known as the logarithm to the base e, is the inverse function of the natural exponential function.
- Functions: **sqrt**, sqrt(Number)
  A square root function is a function that takes a non-negative number as an input and returns the square root of the given input number.
- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Volume** in Liter (L)
  Volume Unit Conversion
- Measurement: **Area** in Square Meter (m²)
  Area Unit Conversion
- Measurement: **Electric Resistance** in Ohm (Ω)
  Electric Resistance Unit Conversion
- Measurement: **Electric Conductance** in Mho (℧)
  Electric Conductance Unit Conversion
- Measurement: **Electric Resistivity** in Ohm Meter (Ω*m)
  Electric Resistivity Unit Conversion
- Measurement: **Electric Conductivity** in Siemens per Meter (S/m)
  Electric Conductivity Unit Conversion
- Measurement: **Molar Concentration** in Mole per Liter (mol/L)
  Molar Concentration Unit Conversion
- Measurement: **Molar Magnetic Susceptibility** in Cubic Meter per Mole (m³/mol)
  Molar Magnetic Susceptibility Unit Conversion
- Measurement: **Molality** in Mole per Kilogram (mol/kg)
  Molality Unit Conversion
- Measurement: **Wave Number** in 1 per Meter (1/m)
  Wave Number Unit Conversion

- Λ°_m Limiting Molar Conductivity *(Siemens Square Meter per Mole)*
- ρ Resistivity *(Ohm Meter)*
- α Degree of Dissociation
- α_1 Degree of Dissociation 1
- α_2 Degree of Dissociation 2

- Measurement: **Mobility** in Square Meter per Volt per Second (m²/V*s)
  Mobility Unit Conversion
- Measurement: **Molar Conductivity** in Siemens Square Meter per Mole (S*m²/mol)
  Molar Conductivity Unit Conversion
- Measurement: **Debye–Hückel limiting law constant** in sqrt(Kilogram) per sqrt(Mole) (kg^(1/2)/mol^(1/2))
  Debye–Hückel limiting law constant Unit Conversion

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