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Tafel Slope Formulas

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List of 16 Tafel Slope Formulas

Tafel Slope

1) Charge Transfer Coefficient given Tafel Slope

Open Calculator

fx $$\alpha = \frac{\ln(10) \cdot [\text{BoltZ}] \cdot \text{T}}{\text{A}_{\text{slope}} \cdot \text{e}}$$

ex $$0.603429 = \frac{\ln(10) \cdot [\text{BoltZ}] \cdot 298\text{K}}{0.098\text{V} \cdot 1.602\text{E}\hat{}\text{-}19\text{C}}$$

2) Charge Transfer Coefficient given Thermal Voltage

Open Calculator

fx $$\alpha = \frac{\ln(10) \cdot \text{V}_\text{t}}{\text{A}_{\text{slope}}}$$

ex $$0.603841 = \frac{\ln(10) \cdot 0.0257\text{V}}{0.098\text{V}}$$

3) Current Density for Anodic Reaction from Tafel Equation

Open Calculator

fx $$\text{i} = \left(10^{\frac{\eta}{\text{A}_{\text{slope}}}}\right) \cdot \text{i}_0$$

ex $$0.404718\text{A/m}^2 = \left(10^{\frac{0.03\text{V}}{0.098\text{V}}}\right) \cdot 0.2\text{A/m}^2$$

4) Current Density for Cathodic Reaction from Tafel Equation

Open Calculator

fx $$i = \left(10^{\frac{\eta}{-A_{slope}}}\right) \cdot i_0$$

ex $$0.098834A/m^2 = \left(10^{\frac{0.03V}{-0.098V}}\right) \cdot 0.2A/m^2$$

5) Electric Elementary Charge given Tafel Slope

Open Calculator

fx $$e = \frac{\ln(10) \cdot [BoltZ] \cdot T}{A_{slope} \cdot \alpha}$$

ex $$1.6E\hat{}\text{-}19C = \frac{\ln(10) \cdot [BoltZ] \cdot 298K}{0.098V \cdot 0.6}$$

6) Electric Elementary Charge given Thermal Voltage

Open Calculator

fx $$e = \frac{[BoltZ] \cdot T}{V_t}$$

ex $$1.6E\hat{}\text{-}19C = \frac{[BoltZ] \cdot 298K}{0.0257V}$$

7) Exchange Current Density for Anodic Reaction from Tafel Equation

Open Calculator

fx $$i_0 = \frac{i}{10^{\frac{\eta}{+}A_{slope}}}$$

ex $$0.200139A/m^2 = \frac{0.405A/m^2}{10^{\frac{0.03V}{+}0.098V}}$$

8) Exchange Current Density for Cathodic Reaction from Tafel Equation

Open Calculator

fx $$i_0 = \frac{i}{10^{\frac{\eta}{-A_{slope}}}}$$

ex $$0.819554\text{A/m}^2 = \frac{0.405\text{A/m}^2}{10^{\frac{0.03\text{V}}{-0.098\text{V}}}}$$

9) Overpotential for Anodic Reaction from Tafel Equation

Open Calculator

fx $$\eta = +(A_{slope}) \cdot \left(\log 10\left(\frac{i}{i_0}\right)\right)$$

ex $$0.03003\text{V} = +(0.098\text{V}) \cdot \left(\log 10\left(\frac{0.405\text{A/m}^2}{0.2\text{A/m}^2}\right)\right)$$

10) Overpotential for Cathodic Reaction from Tafel Equation

Open Calculator

fx $$\eta = -(A_{slope}) \cdot \left(\log 10\left(\frac{i}{i_0}\right)\right)$$

ex $$-0.03003\text{V} = -(0.098\text{V}) \cdot \left(\log 10\left(\frac{0.405\text{A/m}^2}{0.2\text{A/m}^2}\right)\right)$$

11) Tafel Slope for Anodic Reaction from Tafel Equation

Open Calculator

fx $$A_{slope} = +\frac{\eta}{\log 10\left(\frac{i}{i_0}\right)}$$

ex $$0.097903V = +\frac{0.03V}{\log 10\left(\frac{0.405A/m^2}{0.2A/m^2}\right)}$$

12) Tafel Slope for Cathodic Reaction from Tafel Equation

Open Calculator

fx $$A_{slope} = -\frac{\eta}{\log 10\left(\frac{i}{i_0}\right)}$$

ex $$-0.097903V = -\frac{0.03V}{\log 10\left(\frac{0.405A/m^2}{0.2A/m^2}\right)}$$

13) Tafel Slope given Temperature and Charge Transfer Coefficient

Open Calculator

fx $$A_{slope} = \frac{\ln(10)\cdot[BoltZ]\cdot T}{e\cdot\alpha}$$

ex $$0.09856V = \frac{\ln(10)\cdot[BoltZ]\cdot 298K}{1.602E\text{^}\text{-}19C\cdot 0.6}$$

14) Tafel Slope given Thermal Voltage

Open Calculator

fx $$A_{slope} = \frac{\ln(10) \cdot V_t}{\alpha}$$

ex $$0.098627V = \frac{\ln(10) \cdot 0.0257V}{0.6}$$

15) Thermal Voltage given Tafel Slope

Open Calculator

fx $$V_t = \frac{A_{slope} \cdot \alpha}{\ln(10)}$$

ex $$0.025537V = \frac{0.098V \cdot 0.6}{\ln(10)}$$

16) Thermal Voltage given Temperature and Electric Elementary Charge

Open Calculator

fx $$V_t = \frac{[BoltZ] \cdot T}{e}$$

ex $$0.025682V = \frac{[BoltZ] \cdot 298K}{1.602E\hat{}\text{-}19C}$$

Variables Used

- A_{slope} Tafel Slope *(Volt)*
- **e** Elementary Charge *(Coulomb)*
- **i** Electric Current Density *(Ampere per Square Meter)*
- i_0 Exchange Current Density *(Ampere per Square Meter)*
- **T** Temperature *(Kelvin)*
- V_t Thermal Voltage *(Volt)*
- **α** Charge Transfer Coefficient
- **η** Overpotential *(Volt)*

Constants, Functions, Measurements used

- Constant: **[BoltZ]**, 1.38064852E-23 Joule/Kelvin
  Boltzmann constant
- Function: **ln**, ln(Number)
  Natural logarithm function (base e)
- Function: **log10**, log10(Number)
  Common logarithm function (base 10)
- Measurement: **Temperature** in Kelvin (K)
  Temperature Unit Conversion
- Measurement: **Electric Charge** in Coulomb (C)
  Electric Charge Unit Conversion
- Measurement: **Surface Current Density** in Ampere per Square Meter (A/m²)
  Surface Current Density Unit Conversion
- Measurement: **Electric Potential** in Volt (V)
  Electric Potential Unit Conversion

Check other formula lists

- Activity of Electrolytes Formulas
- Concentration of Electrolyte Formulas
- Conductance and Conductivity Formulas
- Debey Huckel Limiting Law Formulas
- Degree of Dissociation Formulas
- Dissociation Constant Formulas
- Electrochemical Cell Formulas
- Electrolytes & Ions Formulas
- EMF of Concentration Cell Formulas
- Equivalent Weight Formulas
- Gibbs Free Energy Formulas
- Gibbs Free Entropy Formulas
- Helmholtz Free Energy Formulas
- Helmholtz Free Entropy Formulas
- Important Formulas of Activity and Concentration of Electrolytes
- Important Formulas of Conductance
- Important Formulas of Current Efficiency and Resistance
- Important Formulas of Gibbs Free Energy and Entropy and Helmholtz Free Energy and Entropy
- Important Formulas of Ionic Activity
- Ionic Strength Formulas
- Mean Activity Coefficient Formulas
- Mean Ionic Activity Formulas
- Normality of Solution Formulas
- Osmotic Coefficient & Current Efficiency Formulas
- Resistance and Resistivity Formulas
- Tafel Slope Formulas
- Temperature of Concentration Cell Formulas
- Transport Number Formulas

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