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Electrolytes & Ions Formulas

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List of 25 Electrolytes & Ions Formulas

Electrolytes & Ions

1) Cell Potential given Electrochemical Work

Open Calculator

fx $$E_{cell} = \left(\frac{w}{n \cdot [Faraday]} \right)$$

ex $$0.077732V = \left(\frac{30KJ}{4 \cdot [Faraday]} \right)$$

2) Concentration of Hydronium ion using pH

Open Calculator

fx $$C = 10^{-pH}$$

ex $$1E\hat{}\text{-}6mol/L = 10^{-6}$$

3) Concentration of Hydronium Ion using pOH

Open Calculator

fx $$C = 10^{pOH} \cdot k_w$$

ex $$1E\hat{}\text{-}6mol/L = 10^{8} \cdot 1E\hat{}\text{-}14$$

4) Fugacity of Anodic Electrolyte of Concentration Cell without Transference

Open Calculator

$$f_1 = \frac{\frac{c_2 \cdot f_2}{c_1}}{\exp\left(\frac{EMF \cdot [Faraday]}{2 \cdot [R] \cdot T}\right)}$$

ex $$453.6371\text{Pa} = \frac{\frac{2.45\text{mol/L} \cdot 1878000\text{Pa}}{0.6\text{mol/L}}}{\exp\left(\frac{0.5\text{V} \cdot [Faraday]}{2 \cdot [R] \cdot 298\text{K}}\right)}$$

5) Fugacity of Cathodic Electrolyte of Concentration Cell without Transference

Open Calculator

$$f_2 = \left(\exp\left(\frac{EMF \cdot [Faraday]}{2 \cdot [R] \cdot T}\right)\right) \cdot \left(\frac{c_1 \cdot f_1}{c_2}\right)$$

ex $$1.9\text{E}\hat{}6\text{Pa} = \left(\exp\left(\frac{0.5\text{V} \cdot [Faraday]}{2 \cdot [R] \cdot 298\text{K}}\right)\right) \cdot \left(\frac{0.6\text{mol/L} \cdot 453.63\text{Pa}}{2.45\text{mol/L}}\right)$$

6) Fugacity of Electrolyte given Activities

Open Calculator

$$f = \frac{\sqrt{a}}{c}$$

ex $$15.12184\text{Pa} = \frac{\sqrt{0.796\text{mol/kg}}}{0.059\text{mol/L}}$$

7) Ionic Activity given Molality of Solution

Open Calculator

fx $a = (\gamma \cdot m)$

ex $0.795603\text{mol/kg} = (0.1627 \cdot 4.89\text{mol/kg})$

8) Ionic Mobility

Open Calculator

fx $\mu = \frac{V}{x}$

ex $9.166667\text{m}^2/\text{V*s} = \frac{55\text{m/s}}{6\text{V/m}}$

9) Ionic Product of Water

Open Calculator

fx $k_w = k_a \cdot k_b$

ex $1\text{E}\hat{}\text{-}14 = 1\text{E}\hat{}\text{-}4 \cdot 1\text{E}\hat{}\text{-}10$

10) Number of Positive and Negative Ions of Concentration Cell with Transference

Open Calculator

fx $v\pm = \left(\frac{t_- \cdot \nu \cdot [R] \cdot T}{EMF \cdot Z\pm \cdot [Faraday]}\right) \cdot \ln\left(\frac{a_2}{a_1}\right)$

ex $81.35751 = \left(\frac{49 \cdot 110 \cdot [R] \cdot 298\text{K}}{0.5\text{V} \cdot 2 \cdot [Faraday]}\right) \cdot \ln\left(\frac{0.36\text{mol/kg}}{0.2\text{mol/kg}}\right)$

11) pH of Salt of Weak Acid and Strong Base

Open Calculator

$$\text{pH} = \frac{\text{pK}_\text{w} + \text{pk}_\text{a} + \log 10(\text{C}_\text{salt})}{2}$$

$$6.122756 = \frac{14 + 4 + \log 10(1.76\text{E}\hat{}\text{-6mol/L})}{2}$$

12) pH of Salt of Weak Acid and Weak base

Open Calculator

$$\text{pH} = \frac{\text{pK}_\text{w} + \text{pk}_\text{a} - \text{pk}_\text{b}}{2}$$

$$6 = \frac{14 + 4 - 6}{2}$$

13) pH of Salt of Weak Base and Strong Base

Open Calculator

$$\text{pH} = \frac{\text{pK}_\text{w} - \text{pk}_\text{b} - \log 10(\text{C}_\text{salt})}{2}$$

$$5.377244 = \frac{14 - 6 - \log 10(1.76\text{E}\hat{}\text{-6mol/L})}{2}$$

14) pH of Water using Concentration

Open Calculator

$$\text{pH} = -\log 10(\text{C})$$

$$6 = -\log 10(1\text{E}\hat{}\text{-6mol/L})$$

15) pH Value of Ionic Product of Water

Open Calculator

fx $$\mathrm{pH_{water}} = \mathrm{pk_a} + \mathrm{pk_b}$$

ex $$10 = 4 + 6$$

16) pOH of Salt of Strong Base and Weak Acid

Open Calculator

fx $$\mathrm{pOH} = 14 - \frac{\mathrm{pk_a} + \mathrm{pK_w} + \log 10(\mathrm{C_{salt}})}{2}$$

ex $$7.877244 = 14 - \frac{4 + 14 + \log 10(1.76\mathrm{E\hat{}\text{-}6mol/L})}{2}$$

17) pOH of Salt of Weak Acid and Weak Base

Open Calculator

fx $$\mathrm{pOH} = 14 - \frac{\mathrm{pK_w} + \mathrm{pk_a} - \mathrm{pk_b}}{2}$$

ex $$8 = 14 - \frac{14 + 4 - 6}{2}$$

18) pOH of Salt of Weak Base and Strong Base

Open Calculator

fx $$\mathrm{pOH} = 14 - \frac{\mathrm{pK_w} - \mathrm{pk_b} - \log 10(\mathrm{C_{salt}})}{2}$$

ex $$8.622756 = 14 - \frac{14 - 6 - \log 10(1.76\mathrm{E\hat{}\text{-}6mol/L})}{2}$$

19) pOH of Strong acid and Strong base

Open Calculator

fx $$\mathrm{pOH} = \frac{\mathrm{pK_w}}{2}$$

ex $$7 = \frac{14}{2}$$

20) pOH using Concentration of Hydroxide ion

Open Calculator

fx $$\mathrm{pOH} = 14 + \log 10(\mathrm{C})$$

ex $$8 = 14 + \log 10(1\mathrm{E\hat{}\text{-}6mol/L})$$

21) Quantity of Charges given Mass of Substance

Open Calculator

fx $$\mathrm{q} = \frac{\mathrm{m_{ion}}}{\mathrm{Z}}$$

ex $$0.254545\mathrm{C} = \frac{5.6\mathrm{g}}{22\mathrm{g/C}}$$

22) Relation between pH and pOH

Open Calculator

fx $$\mathrm{pH} = 14 - \mathrm{pOH}$$

ex $$6 = 14 - 8$$

23) Time required for Flowing of Charge given Mass and Time

Open Calculator

$$t_{tot} = \frac{m_{ion}}{Z \cdot i_p}$$

$$0.115702\text{s} = \frac{5.6\text{g}}{22\text{g/C} \cdot 2.2\text{A}}$$

24) Total Number of Ions of Concentration Cell with Transference given Valencies

Open Calculator

$$\nu = \frac{\frac{EMF \cdot \nu\pm \cdot Z\pm \cdot [Faraday]}{t_- \cdot T \cdot [R]}}{\ln\left(\frac{a_2}{a_1}\right)}$$

$$109.9898 = \frac{\frac{0.5\text{V} \cdot 81.35 \cdot 2 \cdot [Faraday]}{49 \cdot 298\text{K} \cdot [R]}}{\ln\left(\frac{0.36\text{mol/kg}}{0.2\text{mol/kg}}\right)}$$

25) Valencies of Positive and Negative Ions of Concentration Cell with Transference

Open Calculator

$$Z\pm = \left(\frac{t_- \cdot \nu \cdot [R] \cdot T}{EMF \cdot \nu\pm \cdot [Faraday]}\right) \cdot \ln\left(\frac{a_2}{a_1}\right)$$

$$2.000185 = \left(\frac{49 \cdot 110 \cdot [R] \cdot 298\text{K}}{0.5\text{V} \cdot 81.35 \cdot [Faraday]}\right) \cdot \ln\left(\frac{0.36\text{mol/kg}}{0.2\text{mol/kg}}\right)$$

Variables Used

- **a** Ionic Activity *(Mole per Kilogram)*
- a_1 Anodic Ionic Activity *(Mole per Kilogram)*
- a_2 Cathodic Ionic Activity *(Mole per Kilogram)*
- **c** Actual Concentration *(Mole per Liter)*
- **C** Hydronium Ion Concentration *(Mole per Liter)*
- c_1 Anodic Concentration *(Mole per Liter)*
- c_2 Cathodic Concentration *(Mole per Liter)*
- C_{salt} Concentration of Salt *(Mole per Liter)*
- E_{cell} Cell Potential *(Volt)*
- **EMF** EMF of Cell *(Volt)*
- **f** Fugacity *(Pascal)*
- f_1 Anodic Fugacity *(Pascal)*
- f_2 Cathodic Fugacity *(Pascal)*
- i_p Electric Current *(Ampere)*
- k_a Constant of Ionization of Acids
- k_b Constant Of Ionization Of Bases
- k_w Ionic Product of Water
- **m** Molality *(Mole per Kilogram)*
- m_{ion} Mass of Ions *(Gram)*
- **n** Moles of Electron Transferred
- **pH** Negative Log of Hydronium Concentration
- pH_{water} Negative Log of H+ Conc. for Ionic Pdt. of H_2O

- **pk_a** Negative Log of Acid Ionization Constant
- **pk_b** Negative Log of Base Ionization Constant
- **pK_w** Negative Log of Ionic Product of Water
- **pOH** Negative Log of Hydroxyl Concentration
- **q** Charge *(Coulomb)*
- **T** Temperature *(Kelvin)*
- **t_-** Transport Number of Anion
- **t_{tot}** Total Time Taken *(Second)*
- **V** Speed of Ions *(Meter per Second)*
- **v±** Number of Positive and Negative Ions
- **w** Work Done *(Kilojoule)*
- **x** Potential Gradient *(Volt per Meter)*
- **Z** Electrochemical Equivalent of Element *(Gram Per Coulomb)*
- **Z±** Valencies of Positive and Negative Ions
- **γ** Activity Coefficient
- **μ** Ionic Mobility *(Square Meter per Volt per Second)*
- **ν** Total number of Ions

Constants, Functions, Measurements used

- Constant: **[Faraday]**, 96485.33212 Coulomb / Mole
  Faraday constant
- Constant: **[R]**, 8.31446261815324 Joule / Kelvin * Mole
  Universal gas constant
- Function: **exp**, exp(Number)
  Exponential function
- Function: **ln**, ln(Number)
  Natural logarithm function (base e)
- Function: **log10**, log10(Number)
  Common logarithm function (base 10)
- Function: **sqrt**, sqrt(Number)
  Square root function
- Measurement: **Weight** in Gram (g)
  Weight Unit Conversion
- Measurement: **Time** in Second (s)
  Time Unit Conversion
- Measurement: **Electric Current** in Ampere (A)
  Electric Current Unit Conversion
- Measurement: **Temperature** in Kelvin (K)
  Temperature Unit Conversion
- Measurement: **Pressure** in Pascal (Pa)
  Pressure Unit Conversion
- Measurement: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion
- Measurement: **Energy** in Kilojoule (KJ)
  Energy Unit Conversion

- Measurement: **Electric Charge** in Coulomb (C)
  Electric Charge Unit Conversion
- Measurement: **Electric Field Strength** in Volt per Meter (V/m)
  Electric Field Strength Unit Conversion
- Measurement: **Electric Potential** in Volt (V)
  Electric Potential Unit Conversion
- Measurement: **Molar Concentration** in Mole per Liter (mol/L)
  Molar Concentration Unit Conversion
- Measurement: **Molality** in Mole per Kilogram (mol/kg)
  Molality Unit Conversion
- Measurement: **Mobility** in Square Meter per Volt per Second (m²/V*s)
  Mobility Unit Conversion
- Measurement: **Electrochemical Equivalent** in Gram Per Coulomb (g/C)
  Electrochemical Equivalent Unit Conversion

Check other formula lists

- Activity of Electrolytes Formulas
- Concentration of Electrolyte Formulas
- Conductance and Conductivity Formulas
- Electrochemical Cell Formulas
- Electrolytes & Ions Formulas
- EMF of Concentration Cell Formulas
- Equivalent Weight Formulas
- Important Formulas of Activity and Concentration of Electrolytes
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