Molar Diffusion Formulas

List of 17 Molar Diffusion Formulas

Molar Diffusion

1) Convective Mass Transfer Coefficient

Open Calculator

fx $$k_L = \frac{m_a}{\rho_{a1} - \rho_{a2}}$$

ex $$0.45\text{m/s} = \frac{9\text{kg/s/m}^2}{40\text{kg/m}^3 - 20\text{kg/m}^3}$$

2) Logarithmic Mean of Concentration Difference

Open Calculator

fx $$C_{bm} = \frac{C_{b2} - C_{b1}}{\ln\left(\frac{C_{b2}}{C_{b1}}\right)}$$

ex $$12.33152\text{mol/L} = \frac{10\text{mol/L} - 15\text{mol/L}}{\ln\left(\frac{10\text{mol/L}}{15\text{mol/L}}\right)}$$

3) Logarithmic Mean Partial Pressure Difference

Open Calculator

fx $$P_{bm} = \frac{P_{b2} - P_{b1}}{\ln\left(\frac{P_{b2}}{P_{b1}}\right)}$$

ex $$9571.809\text{Pa} = \frac{10500\text{Pa} - 8700\text{Pa}}{\ln\left(\frac{10500\text{Pa}}{8700\text{Pa}}\right)}$$

4) Mass Diffusing Rate through Hollow Cylinder with Solid Boundary

Open Calculator

$$m_r = \frac{2 \cdot \pi \cdot D_{ab} \cdot l \cdot (\rho_{a1} - \rho_{a2})}{\ln\left(\frac{r_2}{r_1}\right)}$$

$$9333.737\text{kg/s} = \frac{2 \cdot \pi \cdot 0.8\text{m}^2/\text{s} \cdot 102\text{m} \cdot (40\text{kg/m}^3 - 20\text{kg/m}^3)}{\ln\left(\frac{7.5\text{m}}{2.5\text{m}}\right)}$$

5) Mass Diffusing Rate through Solid Boundary Plate

Open Calculator

$$m_r = \frac{D_{ab} \cdot (\rho_{a1} - \rho_{a2}) \cdot A}{t_p}$$

$$10666.67\text{kg/s} = \frac{0.8\text{m}^2/\text{s} \cdot (40\text{kg/m}^3 - 20\text{kg/m}^3) \cdot 800\text{m}^2}{1.2\text{m}}$$

6) Mass Diffusing Rate through Solid Boundary Sphere

Open Calculator

$$m_r = \frac{4 \cdot \pi \cdot r_i \cdot r_o \cdot D_{ab} \cdot (\rho_{a1} - \rho_{a2})}{r_o - r_i}$$

$$12666.9\text{kg/s} = \frac{4 \cdot \pi \cdot 6.3\text{m} \cdot 7\text{m} \cdot 0.8\text{m}^2/\text{s} \cdot (40\text{kg/m}^3 - 20\text{kg/m}^3)}{7\text{m} - 6.3\text{m}}$$

7) Molar Flux of Diffusing Component A for Equimolar Diffusion with B based on Mole Fraction of A

Open Calculator

$$N_a = \left(\frac{D \cdot P_t}{[R] \cdot T \cdot \delta}\right) \cdot (y_{a1} - y_{a2})$$

$$56.50379\text{mol/s*m}^2 = \left(\frac{0.007\text{m}^2/\text{s} \cdot 400000\text{Pa}}{[R] \cdot 298\text{K} \cdot 0.005\text{m}}\right) \cdot (0.6 - 0.35)$$

8) Molar Flux of Diffusing Component A for Equimolar Diffusion with B based on Partial Pressure of A

Open Calculator

fx $$N_a = \left(\frac{D}{[R] \cdot T \cdot \delta}\right) \cdot (P_{a1} - P_{a2})$$

ex $$163.0609 \text{mol/s*m}^2 = \left(\frac{0.007 \text{m}^2/\text{s}}{[R] \cdot 298 \text{K} \cdot 0.005 \text{m}}\right) \cdot (300000 \text{Pa} - 11416 \text{Pa})$$

9) Molar Flux of Diffusing Component A through Non-Diffusing B based on Concentration of A

Open Calculator

fx $$N_a = \left(\frac{D \cdot P_t}{\delta}\right) \cdot \left(\frac{C_{a1} - C_{a2}}{P_b}\right)$$

ex $$41.44916 \text{mol/s*m}^2 = \left(\frac{0.007 \text{m}^2/\text{s} \cdot 400000 \text{Pa}}{0.005 \text{m}}\right) \cdot \left(\frac{0.2074978578 \text{mol/L} - 0.2 \text{mol/L}}{101300 \text{Pa}}\right)$$

10) Molar Flux of Diffusing Component A through Non-Diffusing B based on Log Mean Partial Pressure

Open Calculator

fx $$N_a = \left(\frac{D \cdot P_t}{[R] \cdot T \cdot \delta}\right) \cdot \left(\frac{P_{a1} - P_{a2}}{P_b}\right)$$

ex $$643.8732 \text{mol/s*m}^2 = \left(\frac{0.007 \text{m}^2/\text{s} \cdot 400000 \text{Pa}}{[R] \cdot 298 \text{K} \cdot 0.005 \text{m}}\right) \cdot \left(\frac{300000 \text{Pa} - 11416 \text{Pa}}{101300 \text{Pa}}\right)$$

11) Molar Flux of Diffusing Component A through Non-Diffusing B based on Mole Fractions of A

Open Calculator

fx $$N_a = \left(\frac{D \cdot P_t}{\delta}\right) \cdot \ln\left(\frac{1 - y_{a2}}{1 - y_{a1}}\right)$$

ex $$271884.4 \text{mol/s*m}^2 = \left(\frac{0.007 \text{m}^2/\text{s} \cdot 400000 \text{Pa}}{0.005 \text{m}}\right) \cdot \ln\left(\frac{1 - 0.35}{1 - 0.6}\right)$$

12) Molar Flux of Diffusing Component A through Non-Diffusing B based on Mole Fractions of A and LMMF

Open Calculator

fx $$N_a = \left(\frac{D \cdot P_t}{\delta}\right) \cdot \left(\frac{y_{a1} - y_{a2}}{y_b}\right)$$

ex $$215384.6\text{mol/s*m}^2 = \left(\frac{0.007\text{m}^2\text{/s} \cdot 400000\text{Pa}}{0.005\text{m}}\right) \cdot \left(\frac{0.6 - 0.35}{0.65}\right)$$

13) Molar Flux of Diffusing Component A through Non-Diffusing B based on Mole Fractions of A and LMPP

Open Calculator

fx $$N_a = \left(\frac{D \cdot \left(P_t^2\right)}{\delta}\right) \cdot \left(\frac{y_{a1} - y_{a2}}{P_b}\right)$$

ex $$552813.4\text{mol/s*m}^2 = \left(\frac{0.007\text{m}^2\text{/s} \cdot \left((400000\text{Pa})^2\right)}{0.005\text{m}}\right) \cdot \left(\frac{0.6 - 0.35}{101300\text{Pa}}\right)$$

14) Molar Flux of Diffusing Component A through Non-Diffusing B based on Mole Fractions of B

Open Calculator

fx $$N_a = \left(\frac{D \cdot P_t}{\delta}\right) \cdot \ln\left(\frac{y_{b2}}{y_{b1}}\right)$$

ex $$776324.8\text{mol/s*m}^2 = \left(\frac{0.007\text{m}^2\text{/s} \cdot 400000\text{Pa}}{0.005\text{m}}\right) \cdot \ln\left(\frac{0.4}{0.1}\right)$$

15) Molar Flux of Diffusing Component A through Non-Diffusing B based on Partial Pressure of A

Open Calculator

fx $$N_a = \left(\frac{D \cdot P_t}{[R] \cdot T \cdot \delta}\right) \cdot \ln\left(\frac{P_t - P_{a2}}{P_t - P_{a1}}\right)$$

ex $$306.7792\text{mol/s*m}^2 = \left(\frac{0.007\text{m}^2\text{/s} \cdot 400000\text{Pa}}{[R] \cdot 298\text{K} \cdot 0.005\text{m}}\right) \cdot \ln\left(\frac{400000\text{Pa} - 11416\text{Pa}}{400000\text{Pa} - 300000\text{Pa}}\right)$$

16) Molar Flux of Diffusing Component A through Non-Diffusing B based on Partial Pressure of B

Open Calculator

fx $$N_a = \left(\frac{D \cdot P_t}{[R] \cdot T \cdot \delta}\right) \cdot \ln\left(\frac{P_{b2}}{P_{b1}}\right)$$

ex $$42.50266\text{mol/s*m}^2 = \left(\frac{0.007\text{m}^2/\text{s} \cdot 400000\text{Pa}}{[R] \cdot 298\text{K} \cdot 0.005\text{m}}\right) \cdot \ln\left(\frac{10500\text{Pa}}{8700\text{Pa}}\right)$$

17) Total Concentration

Open Calculator

fx $$C = C_a + C_b$$

ex $$26\text{mol/L} = 12\text{mol/L} + 14\text{mol/L}$$

Variables Used

- **A** Area of Solid Boundary Plate *(Square Meter)*
- **C** Total Concentration *(Mole per Liter)*
- **C_a** Concentration of A *(Mole per Liter)*
- **C_{a1}** Concentration of Component A in 1 *(Mole per Liter)*
- **C_{a2}** Concentration of Component A in 2 *(Mole per Liter)*
- **C_b** Concentration of B *(Mole per Liter)*
- **C_{b1}** Concentration of Component B in Mixture 1 *(Mole per Liter)*
- **C_{b2}** Concentration of Component B in Mixture 2 *(Mole per Liter)*
- **C_{bm}** Logarithmic Mean of Concentration Difference *(Mole per Liter)*
- **D** Diffusion Coefficient (DAB) *(Square Meter Per Second)*
- **D_{ab}** Diffusion Coefficient When A Diffuse with B *(Square Meter Per Second)*
- **k_L** Convective Mass Transfer Coefficient *(Meter per Second)*
- **l** Length of Cylinder *(Meter)*
- **m_a** Mass Flux of Diffusion Component A *(Kilogram per Second per Square Meter)*
- **m_r** Mass Diffusing Rate *(Kilogram per Second)*
- **N_a** Molar Flux of Diffusing Component A *(Mole per Second Square Meter)*
- **P_{a1}** Partial Pressure of Component A in 1 *(Pascal)*
- **P_{a2}** Partial Pressure of Component A in 2 *(Pascal)*
- **P_b** Log Mean Partial Pressure of B *(Pascal)*
- **P_{b1}** Partial Pressure of Component B in 1 *(Pascal)*
- **P_{b2}** Partial Pressure of Component B in 2 *(Pascal)*
- **P_{bm}** Logarithmic Mean Partial Pressure Difference *(Pascal)*
- **P_t** Total Pressure of Gas *(Pascal)*
- **r_1** Inner Radius of Cylinder *(Meter)*
- **r_2** Outer Radius of Cylinder *(Meter)*
- **r_i** Inner Radius *(Meter)*

- r_o Outer Radius *(Meter)*
- T Temperature of Gas *(Kelvin)*
- t_p Thickness of Solid Plate *(Meter)*
- y_{a1} Mole Fraction of Component A in 1
- y_{a2} Mole Fraction of Component A in 2
- y_b Log Mean Mole Fraction of B
- y_{b1} Mole Fraction of Component B in 1
- y_{b2} Mole Fraction of Component B in 2
- δ Film Thickness *(Meter)*
- ρ_{a1} Mass Concentration of Component A in Mixture 1 *(Kilogram per Cubic Meter)*
- ρ_{a2} Mass Concentration of Component A in Mixture 2 *(Kilogram per Cubic Meter)*

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Constant: **[R]**, 8.31446261815324
  Universal gas constant
- Function: **ln**, ln(Number)
  The natural logarithm, also known as the logarithm to the base e, is the inverse function of the natural exponential function.
- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Temperature** in Kelvin (K)
  Temperature Unit Conversion
- Measurement: **Area** in Square Meter (m²)
  Area Unit Conversion
- Measurement: **Pressure** in Pascal (Pa)
  Pressure Unit Conversion
- Measurement: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion
- Measurement: **Mass Flow Rate** in Kilogram per Second (kg/s)
  Mass Flow Rate Unit Conversion
- Measurement: **Molar Concentration** in Mole per Liter (mol/L)
  Molar Concentration Unit Conversion
- Measurement: **Mass Flux** in Kilogram per Second per Square Meter (kg/s/m²)
  Mass Flux Unit Conversion
- Measurement: **Density** in Kilogram per Cubic Meter (kg/m³)
  Density Unit Conversion
- Measurement: **Diffusivity** in Square Meter Per Second (m²/s)
  Diffusivity Unit Conversion
- Measurement: **Molar Flux of Diffusing Component** in Mole per Second Square Meter (mol/s*m²)
  Molar Flux of Diffusing Component Unit Conversion

Check other formula lists

- **Convective Mass Transfer Formulas**
- **Humidification Formulas**
- **Internal Flow Formulas**
- **Molar Diffusion Formulas**

Feel free to SHARE this document with your friends!

PDF Available in

English Spanish French German Russian Italian Portuguese Polish Dutch

8/14/2024 | 5:16:18 AM UTC *Please leave your feedback here...*