Important Calculator of Compressibility Formulas PDF

Formulas
Examples
with Units

List of 13
Important Calculator of Compressibility Formulas

1) Compressibility Factor given Molar Volume of Gases Formula

Evaluate Formula

Formula

$$Z_{ktog} = \frac{V_m}{V_{m\,(ideal)}}$$

Example with Units

$$1.9643 = \frac{22\,\mathrm{L}}{11.2\,\mathrm{L}}$$

2) Molar Volume of Real Gas given Compressibility Factor Formula

Evaluate Formula

Formula

$$V_{molar} = z \cdot V_{m\,(ideal)}$$

Example with Units

$$126.7812\,\mathrm{L} = 11.31975 \cdot 11.2\,\mathrm{L}$$

3) Relative Size of Fluctuations in Particle Density Formula

Evaluate Formula

Formula

$$\Delta Nr^2 = K_T \cdot [BoltZ] \cdot T \cdot \left(\rho^2\right) \cdot V$$

Example with Units

$$2E\text{-}15 = 75\,\mathrm{m^2/N} \cdot 1.4E\text{-}23\,\mathrm{J/K} \cdot 85\,\mathrm{K} \cdot \left(997\,\mathrm{kg/m^3}^{\,2}\right) \cdot 22.4\,\mathrm{L}$$

4) Temperature given Coefficient of Thermal Expansion, Compressibility Factors and Cp Formula

Evaluate Formula

Formula

$$T_{TE} = \frac{\left(K_T - K_S\right) \cdot \rho \cdot C_p}{\alpha^2}$$

Example with Units

$$973.072\,\mathrm{K} = \frac{\left(75\,\mathrm{m^2/N} - 70\,\mathrm{m^2/N}\right) \cdot 997\,\mathrm{kg/m^3} \cdot 122\,\mathrm{J/K{*}mol}}{25\,\mathrm{K^{-1}}^{\,2}}$$

5) Temperature given Coefficient of Thermal Expansion, Compressibility Factors and Cv Formula

Evaluate Formula

Formula

$$T_{TE} = \frac{\left(K_T - K_S\right) \cdot \rho \cdot \left(C_v + [R]\right)}{\alpha^2}$$

Example with Units

$$887.8442\,\mathrm{K} = \frac{\left(75\,\mathrm{m^2/N} - 70\,\mathrm{m^2/N}\right) \cdot 997\,\mathrm{kg/m^3} \cdot \left(103\,\mathrm{J/K^*mol} + 8.3145\right)}{25\,\mathrm{K^{-1}}^2}$$

6) Temperature given Relative Size of Fluctuations in Particle Density Formula

Evaluate Formula

Formula

$$T_f = \frac{\left(\frac{\Delta N^2}{V}\right)}{[BoltZ] \cdot K_T \cdot \left(\rho^2\right)}$$

Example with Units

$$6.5E+17\,\mathrm{K} = \frac{\left(\frac{15}{22.4\,\mathrm{L}}\right)}{1.4E-23\,\mathrm{J/K} \cdot 75\,\mathrm{m^2/N} \cdot \left(997\,\mathrm{kg/m^3}^2\right)}$$

7) Temperature given Thermal Pressure Coefficient, Compressibility Factors and Cp Formula

Evaluate Formula

Formula

$$T_{Cp} = \frac{\left(\left(\frac{1}{K_S}\right) - \left(\frac{1}{K_T}\right)\right) \cdot \rho \cdot \left(C_p - [R]\right)}{\Lambda^2}$$

Example with Units

$$1.1E+6\,\mathrm{K} = \frac{\left(\left(\frac{1}{70\,\mathrm{m^2/N}}\right) - \left(\frac{1}{75\,\mathrm{m^2/N}}\right)\right) \cdot 997\,\mathrm{kg/m^3} \cdot \left(122\,\mathrm{J/K^*mol} - 8.3145\right)}{0.01\,\mathrm{Pa/K}^2}$$

8) Temperature given Thermal Pressure Coefficient, Compressibility Factors and Cv Formula

Evaluate Formula

Formula

$$T_{Cv} = \frac{\left(\left(\frac{1}{K_S}\right) - \left(\frac{1}{K_T}\right)\right) \cdot \rho \cdot C_v}{\Lambda^2}$$

Example with Units

$$978009.5238\,\mathrm{K} = \frac{\left(\left(\frac{1}{70\,\mathrm{m^2/N}}\right) - \left(\frac{1}{75\,\mathrm{m^2/N}}\right)\right) \cdot 997\,\mathrm{kg/m^3} \cdot 103\,\mathrm{J/K^*mol}}{0.01\,\mathrm{Pa/K}^2}$$

9) Thermal Pressure Coefficient given Compressibility Factors and Cp Formula

Evaluate Formula

Formula

$$\Lambda_{coeff} = \sqrt{\frac{\left(\left(\frac{1}{K_S}\right) - \left(\frac{1}{K_T}\right)\right) \cdot \rho \cdot \left(C_p - [R]\right)}{T}}$$

Example with Units

$$1.1269 \, \text{Pa/K} = \sqrt{\frac{\left(\left(\frac{1}{70 \, \text{m}^2/\text{N}}\right) - \left(\frac{1}{75 \, \text{m}^2/\text{N}}\right)\right) \cdot 997 \, \text{kg/m}^3 \cdot \left(122 \, \text{J/K*mol} - 8.3145\right)}{85 \, \text{K}}}$$

10) Thermal Pressure Coefficient given Compressibility Factors and Cv Formula

Evaluate Formula

Formula

$$\Lambda_{coeff} = \sqrt{\frac{\left(\left(\frac{1}{K_S}\right) - \left(\frac{1}{K_T}\right)\right) \cdot \rho \cdot C_v}{T}}$$

Example with Units

$$1.0727 \, \text{Pa/K} = \sqrt{\frac{\left(\left(\frac{1}{70 \, \text{m}^2/\text{N}}\right) - \left(\frac{1}{75 \, \text{m}^2/\text{N}}\right)\right) \cdot 997 \, \text{kg/m}^3 \cdot 103 \, \text{J/K*mol}}{85 \, \text{K}}}$$

11) Volume given Relative Size of Fluctuations in Particle Density Formula

Evaluate Formula

Formula

$$V_f = \frac{\Delta N^2}{K_T \cdot [BoltZ] \cdot T \cdot \left(\rho^2\right)}$$

Example with Units

$$1.7E{+}17 \, \text{L} = \frac{15}{75 \, \text{m}^2/\text{N} \cdot 1.4E{-}23 \, \text{J/K} \cdot 85 \, \text{K} \cdot \left(997 \, \text{kg/m}^3\right)^2}$$

12) Volumetric Coefficient of Thermal Expansion given Compressibility Factors and Cp Formula

Evaluate Formula

Formula

$$\alpha_{comp} = \sqrt{\frac{\left(K_T - K_S\right) \cdot \rho \cdot C_p}{T}}$$

Example with Units

$$84.5869 \, \text{K}^{-1} = \sqrt{\frac{\left(75 \, \text{m}^2/\text{N} - 70 \, \text{m}^2/\text{N}\right) \cdot 997 \, \text{kg/m}^3 \cdot 122 \, \text{J/K*mol}}{85 \, \text{K}}}$$

13) Volumetric Coefficient of Thermal Expansion given Compressibility Factors and Cv Formula

Evaluate Formula

Formula

$$\alpha_{comp} = \sqrt{\frac{(K_T - K_S) \cdot \rho \cdot (C_v + [R])}{T}}$$

Example with Units

$$80.7977\,\text{K}^{-1} = \sqrt{\frac{(75\,\text{m}^2/\text{N} - 70\,\text{m}^2/\text{N}) \cdot 997\,\text{kg/m}^3 \cdot (103\,\text{J/K*mol} + 8.3145)}{85\,\text{K}}}$$

Variables used in list of Important Calculator of Compressibility Formulas above

- C_p Molar Specific Heat Capacity at Constant Pressure *(Joule Per Kelvin Per Mole)*
- C_v Molar Specific Heat Capacity at Constant Volume *(Joule Per Kelvin Per Mole)*
- K_S Isentropic Compressibility *(Square Meter per Newton)*
- K_T Isothermal Compressibility *(Square Meter per Newton)*
- **T** Temperature *(Kelvin)*
- T_{Cp} Temperature given Cp *(Kelvin)*
- T_{Cv} Temperature given Cv *(Kelvin)*
- T_f Temperature given fluctuations *(Kelvin)*
- T_{TE} Temperature given Coefficient of Thermal Expansion *(Kelvin)*
- **V** Volume of Gas *(Liter)*
- V_f Volume of Gas given fluctuation size *(Liter)*
- $V_{m\ (ideal)}$ Molar Volume of Ideal Gas *(Liter)*
- V_m Molar Volume of Real Gas *(Liter)*
- V_{molar} Molar Volume of Gas *(Liter)*
- **z** Compressibility Factor
- Z_{ktog} Compressibility Factor for KTOG
- **α** Volumetric Coefficient of Thermal Expansion *(1 Per Kelvin)*
- α_{comp} Volumetric Coefficient of Compressibility *(1 Per Kelvin)*
- ΔN^2 Relative Size of Fluctuations
- ΔNr^2 Relative Size of Fluctuation
- **Λ** Thermal Pressure Coefficient *(Pascal per Kelvin)*
- Λ_{coeff} Coefficient of Thermal Pressure *(Pascal per Kelvin)*
- **ρ** Density *(Kilogram per Cubic Meter)*

Constants, Functions, Measurements used in list of Important Calculator of Compressibility Formulas above

- constant(s): **[BoltZ]**, 1.38064852E-23
  Boltzmann constant
- constant(s): **[R]**, 8.31446261815324
  Universal gas constant
- 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: **Temperature** in Kelvin (K)
  Temperature Unit Conversion
- Measurement: **Volume** in Liter (L)
  Volume Unit Conversion
- Measurement: **Density** in Kilogram per Cubic Meter (kg/m³)
  Density Unit Conversion
- Measurement: **Compressibility** in Square Meter per Newton (m²/N)
  Compressibility Unit Conversion
- Measurement: **Slope of Coexistence Curve** in Pascal per Kelvin (Pa/K)
  Slope of Coexistence Curve Unit Conversion
- Measurement: **Thermal Expansion** in 1 Per Kelvin (K^{-1})
  Thermal Expansion Unit Conversion
- Measurement: **Molar Specific Heat Capacity at Constant Pressure** in Joule Per Kelvin Per Mole (J/K*mol)
  Molar Specific Heat Capacity at Constant Pressure Unit Conversion
- Measurement: **Molar Specific Heat Capacity at Constant Volume** in Joule Per Kelvin Per Mole (J/K*mol)
  Molar Specific Heat Capacity at Constant Volume Unit Conversion

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