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Density of Gas Formulas

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List of 13 Density of Gas Formulas

Density of Gas

1) Density given Relative Size of Fluctuations in Particle Density

Open Calculator

fx $$\rho_{fluctuation} = \sqrt{\frac{\left(\frac{\Delta N^2}{V_T}\right)}{[BoltZ] \cdot K_T \cdot T}}$$

ex $$1.6E\hat{}10kg/m^3 = \sqrt{\frac{\left(\frac{15}{0.63m^3}\right)}{[BoltZ] \cdot 75m^2/N \cdot 85K}}$$

2) Density given Thermal Pressure Coefficient, Compressibility Factors and Cp

Open Calculator

fx $$\rho_{TPC} = \frac{\left(\Lambda^2\right) \cdot T}{\left(\left(\frac{1}{K_S}\right) - \left(\frac{1}{K_T}\right)\right) \cdot (C_p - [R])}$$

ex $$0.078506kg/m^3 = \frac{\left((0.01Pa/K)^2\right) \cdot 85K}{\left(\left(\frac{1}{70m^2/N}\right) - \left(\frac{1}{75m^2/N}\right)\right) \cdot (122J/K*mol - [R])}$$

3) Density given Thermal Pressure Coefficient, Compressibility Factors and Cv

Open Calculator

fx $$\rho_{TPC} = \frac{\left(\Lambda^2\right) \cdot T}{\left(\left(\frac{1}{K_S}\right) - \left(\frac{1}{K_T}\right)\right) \cdot C_v}$$

ex $$0.08665\text{kg/m}^3 = \frac{\left((0.01\text{Pa/K})^2\right) \cdot 85\text{K}}{\left(\left(\frac{1}{70\text{m}^2/\text{N}}\right) - \left(\frac{1}{75\text{m}^2/\text{N}}\right)\right) \cdot 103\text{J/K*mol}}$$

4) Density given Volumetric Coefficient of Thermal Expansion, Compressibility Factors and Cp

Open Calculator

fx $$\rho_{vC} = \frac{\left(\alpha^2\right) \cdot T}{(K_T - K_S) \cdot C_p}$$

ex $$87.09016\text{kg/m}^3 = \frac{\left((25\text{K}^{-1})^2\right) \cdot 85\text{K}}{(75\text{m}^2/\text{N} - 70\text{m}^2/\text{N}) \cdot 122\text{J/K*mol}}$$

5) Density given Volumetric Coefficient of Thermal Expansion, Compressibility Factors and Cv

Open Calculator

fx $$\rho_{vC} = \frac{\left(\alpha^2\right) \cdot T}{(K_T - K_S) \cdot (C_v + [R])}$$

ex $$95.45031\text{kg/m}^3 = \frac{\left((25\text{K}^{-1})^2\right) \cdot 85\text{K}}{(75\text{m}^2/\text{N} - 70\text{m}^2/\text{N}) \cdot (103\text{J/K*mol} + [R])}$$

6) Density of Gas given Average Velocity and Pressure

Open Calculator

fx $$\rho_{AV\_P} = \frac{8 \cdot P_{gas}}{\pi \cdot \left((C_{av})^2 \right)}$$

ex $$0.0219 kg/m^3 = \frac{8 \cdot 0.215 Pa}{\pi \cdot \left((5 m/s)^2 \right)}$$

7) Density of Gas given Average Velocity and Pressure in 2D

Open Calculator

fx $$\rho_{AV\_P} = \frac{\pi \cdot P_{gas}}{2 \cdot \left((C_{av})^2 \right)}$$

ex $$0.013509 kg/m^3 = \frac{\pi \cdot 0.215 Pa}{2 \cdot \left((5 m/s)^2 \right)}$$

8) Density of Gas given Most Probable Speed Pressure

Open Calculator

fx $$\rho_{MPS} = \frac{2 \cdot P_{gas}}{(C_{mp})^2}$$

ex $$0.001075 kg/m^3 = \frac{2 \cdot 0.215 Pa}{(20 m/s)^2}$$

9) Density of Gas given Most Probable Speed Pressure in 2D

Open Calculator

$$\rho_{MPS} = \frac{P_{gas}}{(C_{mp})^2}$$

$$0.000538\text{kg/m}^3 = \frac{0.215\text{Pa}}{(20\text{m/s})^2}$$

10) Density of Gas given Root Mean Square Speed and Pressure

Open Calculator

$$\rho_{RMS\_P} = \frac{3 \cdot P_{gas}}{(C_{RMS})^2}$$

$$0.00645\text{kg/m}^3 = \frac{3 \cdot 0.215\text{Pa}}{(10\text{m/s})^2}$$

11) Density of Gas given Root Mean Square Speed and Pressure in 1D

Open Calculator

$$\rho_{RMS\_P} = \frac{P_{gas}}{(C_{RMS})^2}$$

$$0.00215\text{kg/m}^3 = \frac{0.215\text{Pa}}{(10\text{m/s})^2}$$

12) Density of Gas given Root Mean Square Speed and Pressure in 2D

Open Calculator

fx $$\rho_{RMS\_P} = \frac{2 \cdot P_{gas}}{(C_{RMS})^2}$$

ex $$0.0043\text{kg/m}^3 = \frac{2 \cdot 0.215\text{Pa}}{(10\text{m/s})^2}$$

13) Density of Material given Isentropic Compressibility

Open Calculator

fx $$\rho_{IC} = \frac{1}{K_S \cdot (c^2)}$$

ex $$1.2\text{E}\hat{}\text{-}7\text{kg/m}^3 = \frac{1}{70\text{m}^2\text{/N} \cdot \left((343\text{m/s})^2\right)}$$

Variables Used

- **c** Speed of Sound *(Meter per Second)*
- C_{av} Average Velocity of Gas *(Meter per Second)*
- C_{mp} Most Probable Velocity *(Meter per Second)*
- C_p Molar Specific Heat Capacity at Constant Pressure *(Joule Per Kelvin Per Mole)*
- C_{RMS} Root Mean Square Speed *(Meter per Second)*
- 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)*
- P_{gas} Pressure of Gas *(Pascal)*
- **T** Temperature *(Kelvin)*
- V_T Volume *(Cubic Meter)*
- **α** Volumetric Coefficient of Thermal Expansion *(1 Per Kelvin)*
- ΔN^2 Relative Size of Fluctuations
- **Λ** Thermal Pressure Coefficient *(Pascal per Kelvin)*
- ρ_{AV_P} Density of Gas given AV and P *(Kilogram per Cubic Meter)*
- $\rho_{fluctuation}$ Density given fluctuations *(Kilogram per Cubic Meter)*
- ρ_{IC} Density given IC *(Kilogram per Cubic Meter)*
- ρ_{MPS} Density of Gas given MPS *(Kilogram per Cubic Meter)*
- ρ_{RMS_P} Density of Gas given RMS and P *(Kilogram per Cubic Meter)*

- ρ_{TPC} Density given TPC *(Kilogram per Cubic Meter)*
- ρ_{VC} Density given VC *(Kilogram per Cubic Meter)*

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Constant: **[BoltZ]**, 1.38064852E-23 Joule/Kelvin
  Boltzmann constant
- Constant: **[R]**, 8.31446261815324 Joule / Kelvin * Mole
  Universal gas constant
- Function: **sqrt**, sqrt(Number)
  Square root function
- Measurement: **Temperature** in Kelvin (K)
  Temperature Unit Conversion
- Measurement: **Volume** in Cubic Meter (m^3)
  Volume Unit Conversion
- Measurement: **Pressure** in Pascal (Pa)
  Pressure Unit Conversion
- Measurement: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion
- Measurement: **Density** in Kilogram per Cubic Meter (kg/m^3)
  Density Unit Conversion
- Measurement: **Compressibility** in Square Meter per Newton (m^2/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

Check other formula lists

- Acentric Factor Formulas
- Average Velocity of Gas Formulas
- Average velocity of gas and Acentric factor Formulas
- Compressibility Formulas
- Density of Gas Formulas
- Equipartition Principle and Heat Capacity Formulas
- Inversion Temperature Formulas
- Kinetic Energy of Gas Formulas
- Mean Square Speed of Gas Formulas
- Molar Mass of Gas Formulas
- Most Probable Velocity of Gas Formulas
- PIB Formulas
- Pressure of Gas Formulas
- RMS Velocity Formulas
- Temperature of Gas Formulas
- Van der Waals Constant Formulas
- Volume of Gas Formulas

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