Gas Mixture Molar Mass, Density and Specific Gravity

Molar mass, specific gas constant, normal density and specific gravity of a gas mixture from its mole (volume) percentages, as an ideal gas.

Method: IUPAC 2013 atomic masses; ideal gas

Input parameters

Unit system: SI

Parameter	Value	Unit
CH_4 methane, mole %	90.000	%
C_2H_6 ethane, mole %	5.0000	%
C_3H_8 propane, mole %	2.0000	%
C_4H_{10} butane, mole %	0.50000	%
H_2 hydrogen, mole %	0	%
CO carbon monoxide, mole %	0	%
CO_2 carbon dioxide, mole %	1.0000	%
N_2 nitrogen, mole %	1.5000	%
O_2 oxygen, mole %	0	%
H_2O water vapour, mole %	0	%

Calculated results

Parameter	Value	Unit
Molar mass of the mixture	17.975	kg/kmol
Density at 0 °C and 1.01325 bar	0.80196	kg/m³
Specific gravity (air = 1)	0.62056	
Specific gas constant	0.46256	kJ/(kg·K)
Sum of the entered percentages	100.00	%

Formula and method

$$M = \frac{\sum y_i M_i}{\sum y_i} \qquad \rho_n = \frac{M}{V_{m,n}} \qquad SG = \frac{M}{M_{air}} \qquad R_s = \frac{R_u}{M}$$

Variables

$y_{CH_4}, y_{C_2H_6}, y_{C_3H_8}, y_{C_4H_{10}}, y_{H_2}, y_{CO}, y_{CO_2}, y_{N_2}, y_{O_2}, y_{H_2O}$	mole fractions of each gas	–
M	mixture molar mass	kg/kmol
ρ_n	density at 0 °C, 1.01325 bar	kg/m³
SG	specific gravity (air = 1)	–
R_s	specific gas constant	J/(kg·K)
Σy	sum entered	–
M_i	molar mass of each gas	kg/kmol
$V_{m,n}$	molar volume at normal conditions	m³/kmol
R_u	universal gas constant	J/(kmol·K)

Method and standards

Mole-fraction weighting of IUPAC 2013 molar masses; ideal-gas molar volume at 0 °C and 1 atm.

Assumptions and limits

- Ideal gas; real-gas compressibility not included. Natural gas at normal conditions has Z of about 0.997–0.998, so its real normal density (ISO 6976) is about 0.2–0.3 % higher than shown.

References

• IUPAC 2013 atomic masses; ideal gas

Report details

Report reference	FCC-3TWG-H3VA (the same inputs always give the same reference)
Generated	17 November 2026, 19:37 UTC
Calculator	Gas Mixture Molar Mass, Density and Specific Gravity
Method last reviewed	12 November 2026
Software release	FireCAD Calc, release of 17 November 2026
Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

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Reopens the calculator with the inputs of this report.