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Ideal Gas Formulas

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List of 8 Ideal Gas Formulas

Ideal Gas

1) Degree of Freedom given Molar Internal Energy of Ideal Gas

Open Calculator

fx $$F = 2 \cdot \frac{U}{N_{moles} \cdot [R] \cdot T_g}$$

ex $$0.024255 = 2 \cdot \frac{121J}{4 \cdot [R] \cdot 300K}$$

2) Ideal Gas Law for Calculating Pressure

Open Calculator

fx $$P_{ideal} = [R] \cdot \frac{T_g}{V_{Total}}$$

ex $$39.59268Pa = [R] \cdot \frac{300K}{63m^3}$$

3) Ideal Gas Law for Calculating Volume

Open Calculator

fx $$V_{ideal} = [R] \cdot \frac{T_g}{P}$$

ex $$2.771488m^3 = [R] \cdot \frac{300K}{900Pa}$$

4) Isothermal Compression of Ideal Gas

Open Calculator

$$W_{\text{Iso T}} = N_{\text{moles}} \cdot [R] \cdot T_g \cdot 2.303 \cdot \log 10\left(\frac{V_f}{V_i}\right)$$

ex $$1667.058\text{J} = 4 \cdot [R] \cdot 300\text{K} \cdot 2.303 \cdot \log 10\left(\frac{13\text{m}^3}{11\text{m}^3}\right)$$

5) Molar Internal Energy of Ideal Gas

Open Calculator

$$U_{\text{molar}} = \frac{F \cdot [R] \cdot T_g}{2}$$

ex $$3741.508\text{J} = \frac{3 \cdot [R] \cdot 300\text{K}}{2}$$

6) Molar Internal Energy of Ideal Gas given Boltzmann Constant

Open Calculator

$$U = \frac{F \cdot N_{\text{moles}} \cdot [\text{BoltZ}] \cdot T_g}{2}$$

ex $$2.5\text{E}\hat{}\text{-}20\text{J} = \frac{3 \cdot 4 \cdot [\text{BoltZ}] \cdot 300\text{K}}{2}$$

7) Number of Moles given Internal Energy of Ideal Gas

Open Calculator

fx $$N_{moles} = 2 \cdot \frac{U}{F \cdot [BoltZ] \cdot T_g}$$

ex $$1.9E\hat{}22 = 2 \cdot \frac{121J}{3 \cdot [BoltZ] \cdot 300K}$$

8) Temperature of Ideal Gas given its Internal Energy

Open Calculator

fx $$T_g = 2 \cdot \frac{U}{F \cdot N_{moles} \cdot [BoltZ]}$$

ex $$1.5E\hat{}24K = 2 \cdot \frac{121J}{3 \cdot 4 \cdot [BoltZ]}$$

Variables Used

- **F** Degree of Freedom
- N_{moles} Number of Moles
- **P** Total Pressure of Ideal Gas *(Pascal)*
- P_{ideal} Ideal Gas Law for Calculating Pressure *(Pascal)*
- T_g Temperature of Gas *(Kelvin)*
- T_g Temperature of Gas *(Kelvin)*
- **U** Internal Energy *(Joule)*
- U_{molar} Molar Internal Energy of Ideal gas *(Joule)*
- V_f Final Volume of System *(Cubic Meter)*
- V_i Initial Volume of System *(Cubic Meter)*
- V_{ideal} Ideal Gas Law for Calculating Volume *(Cubic Meter)*
- V_{Total} Total Volume of System *(Cubic Meter)*
- $W_{Iso\ T}$ Isothermal Work *(Joule)*

Constants, Functions, Measurements used

- Constant: **[BoltZ]**, 1.38064852E-23
  Boltzmann constant
- Constant: **[R]**, 8.31446261815324
  Universal gas constant
- Function: **log10**, log10(Number)
  The common logarithm, also known as the base-10 logarithm or the decimal logarithm, is a mathematical function that is the inverse of the exponential 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: **Energy** in Joule (J)
  Energy Unit Conversion

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