Important Ideal Gas Formulas PDF

Formulas
Examples
with Units

List of 8
Important Ideal Gas Formulas

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

Evaluate Formula

Formula

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

Example with Units

$$0.0243 = 2 \cdot \frac{121\,\text{J}}{4 \cdot 8.3145 \cdot 300\,\text{K}}$$

2) Ideal Gas Law for Calculating Pressure Formula

Evaluate Formula

Formula

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

Example with Units

$$39.5927\,\text{Pa} = 8.3145 \cdot \frac{300\,\text{K}}{63\,\text{m}^3}$$

3) Ideal Gas Law for Calculating Volume Formula

Evaluate Formula

Formula

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

Example with Units

$$2.7715\,\text{m}^3 = 8.3145 \cdot \frac{300\,\text{K}}{900\,\text{Pa}}$$

4) Isothermal Compression of Ideal Gas Formula

Evaluate Formula

Formula

$$W_{Iso\,T} = N_{moles} \cdot [R] \cdot T_g \cdot 2.303 \cdot \log10\left(\frac{V_f}{V_i}\right)$$

Example with Units

$$1667.0583\,\text{J} = 4 \cdot 8.3145 \cdot 300\,\text{K} \cdot 2.303 \cdot \log10\left(\frac{13\,\text{m}^3}{11\,\text{m}^3}\right)$$

5) Molar Internal Energy of Ideal Gas Formula

Evaluate Formula

Formula

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

Example with Units

$$3741.5082\,\text{J} = \frac{3 \cdot 8.3145 \cdot 300\,\text{K}}{2}$$

6) Molar Internal Energy of Ideal Gas given Boltzmann Constant Formula

Evaluate Formula

Formula

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

Example with Units

$$2.5E\text{-}20\,J = \frac{3 \cdot 4 \cdot 1.4E\text{-}23\,J/K \cdot 300\,K}{2}$$

7) Number of Moles given Internal Energy of Ideal Gas Formula

Evaluate Formula

Formula

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

Example with Units

$$1.9E+22 = 2 \cdot \frac{121\,J}{3 \cdot 1.4E\text{-}23\,J/K \cdot 300\,K}$$

8) Temperature of Ideal Gas given its Internal Energy Formula

Evaluate Formula

Formula

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

Example with Units

$$1.5E+24\,K = 2 \cdot \frac{121\,J}{3 \cdot 4 \cdot 1.4E\text{-}23\,J/K}$$

Variables used in list of Ideal Gas Formulas above

- **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 in list of Ideal Gas Formulas above

- constant(s): **[BoltZ]**, 1.38064852E-23
  Boltzmann constant
- constant(s): **[R]**, 8.31446261815324
  Universal gas constant
- Functions: **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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