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Factors of Thermodynamics Formulas

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List of 13 Factors of Thermodynamics Formulas

Factors of Thermodynamics

1) Absolute Humidity

Open Calculator

fx $$AH = \frac{W}{V}$$

ex $$2200 = \frac{55kg}{25L}$$

2) Average Speed of Gases

Open Calculator

fx $$V_{avg} = \sqrt{\frac{8 \cdot [R] \cdot T_{ga}}{\pi \cdot M_{molar}}}$$

ex $$147.1356m/s = \sqrt{\frac{8 \cdot [R] \cdot 45K}{\pi \cdot 44.01g/mol}}$$

3) Change in Momentum

Open Calculator

fx $$\Delta U = M \cdot (u_{02} - u_{01})$$

ex $$1260kg*m/s = 12.6kg \cdot (250m/s - 150m/s)$$

4) Degree of Freedom given Equipartition Energy

Open Calculator

$$F = 2 \cdot \frac{K}{[BoltZ] \cdot T_{gb}}$$

$$1.7E\hat{}23 = 2 \cdot \frac{107J}{[BoltZ] \cdot 90K}$$

5) Input Power to Turbine or Power given to Turbine

Open Calculator

$$P = \rho \cdot g \cdot Q \cdot H_w$$

$$37372.54W = 997kg/m^3 \cdot 9.8m/s^2 \cdot 1.5m^3/s \cdot 2.55m$$

6) Molar Mass of Gas given Average Speed of Gas

Open Calculator

$$M_{molar} = \frac{8 \cdot [R] \cdot T_{ga}}{\pi \cdot V_{avg}^2}$$

$$44.00999g/mol = \frac{8 \cdot [R] \cdot 45K}{\pi \cdot (147.1356m/s)^2}$$

7) Molar Mass of Gas given Most Probable Speed of Gas

Open Calculator

$$M_{molar} = \frac{2 \cdot [R] \cdot T_{ga}}{V_p^2}$$

$$44.01001g/mol = \frac{2 \cdot [R] \cdot 45K}{(130.3955m/s)^2}$$

8) Molar Mass of Gas given RMS Velocity of Gas

Open Calculator

fx $$M_{molar} = \frac{3 \cdot [R] \cdot T_{ga}}{V_{rms}^2}$$

ex $$43.91241\text{g/mol} = \frac{3 \cdot [R] \cdot 45\text{K}}{(159.8786\text{m/s})^2}$$

9) Most Probable Speed

Open Calculator

fx $$V_p = \sqrt{\frac{2 \cdot [R] \cdot T_{ga}}{M_{molar}}}$$

ex $$130.3955\text{m/s} = \sqrt{\frac{2 \cdot [R] \cdot 45\text{K}}{44.01\text{g/mol}}}$$

10) Newton's Law of Cooling

Open Calculator

fx $$q = h_t \cdot (T_w - T_f)$$

ex $$77.7\text{W/m}^2 = 13.2\text{W/m}^2\text{*K} \cdot (305\text{K} - 299.113636\text{K})$$

11) RMS Speed

Open Calculator

fx $$V_{rms} = \sqrt{\frac{3 \cdot [R] \cdot T_g}{M_{molar}}}$$

ex $$159.8786\text{m/s} = \sqrt{\frac{3 \cdot [R] \cdot 45.1\text{K}}{44.01\text{g/mol}}}$$

12) Specific Gas Constant

Open Calculator

fx $$R = \frac{[R]}{M_{molar}}$$

ex $$188.9221\text{J/(kg*K)} = \frac{[R]}{44.01\text{g/mol}}$$

13) Van der Waals Equation

Open Calculator

fx $$p = [R] \cdot \frac{T}{V_m - b} - \frac{R_a}{V_m^2}$$

ex $$22.08478\text{Pa} = [R] \cdot \frac{85\text{K}}{32\text{m}^3\text{/mol} - 30.52\text{e-}6\text{m}^3\text{/mol}} - \frac{5.47\text{e-}1\text{J/kg*K}}{(32\text{m}^3\text{/mol})^2}$$

Variables Used

- **AH** Absolute Humidity
- **b** Gas Constant b *(Cubic Meter per Mole)*
- **F** Degree of Freedom
- **g** Acceleration due to Gravity *(Meter per Square Second)*
- h_t Heat Transfer Coefficient *(Watt per Square Meter per Kelvin)*
- H_w Head *(Meter)*
- **K** Equipartition Energy *(Joule)*
- **M** Mass of Body *(Kilogram)*
- M_{molar} Molar Mass *(Gram Per Mole)*
- **p** Van der Waals Equation *(Pascal)*
- **P** Power *(Watt)*
- **q** Heat Flux *(Watt per Square Meter)*
- **Q** Discharge *(Cubic Meter per Second)*
- **R** Specific Gas Constant *(Joule per Kilogram per K)*
- R_a Gas Constant a *(Joule per Kilogram K)*
- **T** Temperature *(Kelvin)*
- T_f Temperature of Characteristic Fluid *(Kelvin)*
- T_g Temperature of Gas *(Kelvin)*
- T_{ga} Temperature of Gas A *(Kelvin)*
- T_{gb} Temperature of Gas B *(Kelvin)*
- T_w Surface Temperature *(Kelvin)*
- u_{01} Initial Velocity at Point 1 *(Meter per Second)*

- u_{02} Initial Velocity at Point 2 *(Meter per Second)*
- V Volume of Gas *(Liter)*
- V_{avg} Average Speed of Gas *(Meter per Second)*
- V_m Molar Volume *(Cubic Meter per Mole)*
- V_p Most Probable Speed *(Meter per Second)*
- V_{rms} Root Mean Square Velocity *(Meter per Second)*
- W Weight *(Kilogram)*
- ΔU Change in Momentum *(Kilogram Meter per Second)*
- ρ Density *(Kilogram per Cubic Meter)*

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Constant: **[BoltZ]**, 1.38064852E-23
  Boltzmann constant
- Constant: **[R]**, 8.31446261815324
  Universal gas constant
- Function: **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: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Weight** in Kilogram (kg)
  Weight Unit Conversion
- Measurement: **Temperature** in Kelvin (K)
  Temperature Unit Conversion
- Measurement: **Volume** in Liter (L)
  Volume Unit Conversion
- Measurement: **Pressure** in Pascal (Pa)
  Pressure Unit Conversion
- Measurement: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion
- Measurement: **Acceleration** in Meter per Square Second (m/s²)
  Acceleration Unit Conversion
- Measurement: **Energy** in Joule (J)
  Energy Unit Conversion

- Measurement: **Power** in Watt (W)
  Power Unit Conversion
- Measurement: **Volumetric Flow Rate** in Cubic Meter per Second (m^3/s)
  Volumetric Flow Rate Unit Conversion
- Measurement: **Specific Heat Capacity** in Joule per Kilogram per K (J/(kg*K))
  Specific Heat Capacity Unit Conversion
- Measurement: **Heat Flux Density** in Watt per Square Meter (W/m^2)
  Heat Flux Density Unit Conversion
- Measurement: **Heat Transfer Coefficient** in Watt per Square Meter per Kelvin (W/m^2*K)
  Heat Transfer Coefficient Unit Conversion
- Measurement: **Density** in Kilogram per Cubic Meter (kg/m^3)
  Density Unit Conversion
- Measurement: **Specific Entropy** in Joule per Kilogram K (J/kg*K)
  Specific Entropy Unit Conversion
- Measurement: **Molar Mass** in Gram Per Mole (g/mol)
  Molar Mass Unit Conversion
- Measurement: **Molar Magnetic Susceptibility** in Cubic Meter per Mole (m^3/mol)
  Molar Magnetic Susceptibility Unit Conversion
- Measurement: **Momentum** in Kilogram Meter per Second (kg*m/s)
  Momentum Unit Conversion

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- Factors of Thermodynamics Formulas
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