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Thermodynamics Factor Formulas

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List of 12 Thermodynamics Factor Formulas

Thermodynamics Factor

1) Entropy Change for Isochoric Process given Pressures

$$\text{fx } \Delta S_{CV} = m_{\text{gas}} \cdot C_v \cdot \ln\left(\frac{P_f}{P_i}\right)$$

[Open Calculator !\[\]\(a870788d6ed9b8fd294b7654a8c8526b_img.jpg\)](#)

$$\text{ex } 130.1023\text{J/kg}\cdot\text{K} = 2\text{kg} \cdot 530\text{J/K}\cdot\text{mol} \cdot \ln\left(\frac{96100\text{Pa}}{85000\text{Pa}}\right)$$

2) Entropy Change for Isochoric Process given Temperature

$$\text{fx } \Delta S_{CV} = m_{\text{gas}} \cdot C_v \cdot \ln\left(\frac{T_f}{T_i}\right)$$

[Open Calculator !\[\]\(c50c8b7b2cc2cf9ff925edec0ee94c0d_img.jpg\)](#)

$$\text{ex } 130.6266\text{J/kg}\cdot\text{K} = 2\text{kg} \cdot 530\text{J/K}\cdot\text{mol} \cdot \ln\left(\frac{345\text{K}}{305\text{K}}\right)$$

3) Entropy Change for Isothermal Process given Volumes

$$\text{fx } \Delta S = m_{\text{gas}} \cdot [R] \cdot \ln\left(\frac{V_f}{V_i}\right)$$

[Open Calculator !\[\]\(f60b7a900783ac3fd531bfd9c111be6d_img.jpg\)](#)

$$\text{ex } 2.77793\text{J/kg}\cdot\text{K} = 2\text{kg} \cdot [R] \cdot \ln\left(\frac{13\text{m}^3}{11.0\text{m}^3}\right)$$



4) Entropy Change in Isobaric Process given Temperature

$$fx \quad \Delta S_{CP} = m_{\text{gas}} \cdot C_{pm} \cdot \ln\left(\frac{T_f}{T_i}\right)$$

[Open Calculator !\[\]\(cbe80b694ebd74fcfe136a095b608235_img.jpg\)](#)

$$ex \quad 30.06876\text{J/kg}\cdot\text{K} = 2\text{kg} \cdot 122\text{J/K}\cdot\text{mol} \cdot \ln\left(\frac{345\text{K}}{305\text{K}}\right)$$

5) Entropy Change in Isobaric Process in Terms of Volume

$$fx \quad \Delta S_{CP} = m_{\text{gas}} \cdot C_{pm} \cdot \ln\left(\frac{V_f}{V_i}\right)$$

[Open Calculator !\[\]\(3e2231b1ad3ca8da8658228c00dd08e0_img.jpg\)](#)

$$ex \quad 40.7612\text{J/kg}\cdot\text{K} = 2\text{kg} \cdot 122\text{J/K}\cdot\text{mol} \cdot \ln\left(\frac{13\text{m}^3}{11.0\text{m}^3}\right)$$

6) Heat Transfer at Constant Pressure

$$fx \quad Q_p = m_{\text{gas}} \cdot C_{pm} \cdot (T_f - T_i)$$

[Open Calculator !\[\]\(0d5ec72f61334709c3fc9450209b754f_img.jpg\)](#)

$$ex \quad 9.76\text{kJ/kg} = 2\text{kg} \cdot 122\text{J/K}\cdot\text{mol} \cdot (345\text{K} - 305\text{K})$$

7) Isobaric Work for given Mass and Temperatures

$$fx \quad W_b = N \cdot [R] \cdot (T_f - T_i)$$

[Open Calculator !\[\]\(b64b40baaee5acddc1eab8538ba84754_img.jpg\)](#)

$$ex \quad 16628.93\text{J} = 50\text{mol} \cdot [R] \cdot (345\text{K} - 305\text{K})$$



8) Isobaric Work for given Pressure and Volumes

$$fx \quad W_b = P_{abs} \cdot (V_f - V_i)$$

[Open Calculator !\[\]\(e78f798d4ea5c530c9db49e7d26e6b95_img.jpg\)](#)

$$ex \quad 200000J = 100000Pa \cdot (13m^3 - 11.0m^3)$$

9) Mass Flow Rate in Steady Flow

$$fx \quad m = A \cdot \frac{u_f}{v}$$

[Open Calculator !\[\]\(05be7c7a8995decd503647c99211f7c2_img.jpg\)](#)

$$ex \quad 19.63636kg/s = 24m^2 \cdot \frac{9m/s}{11m^3/kg}$$

10) Specific Heat Capacity at Constant Pressure

$$fx \quad C_{pm} = [R] + C_v$$

[Open Calculator !\[\]\(fe3aebe81acea8d45108cd2768939da7_img.jpg\)](#)

$$ex \quad 538.3145J/K \cdot mol = [R] + 530J/K \cdot mol$$

11) Specific Heat Capacity at Constant Pressure using Adiabatic Index

$$fx \quad C_p = \frac{\gamma \cdot [R]}{\gamma - 1}$$

[Open Calculator !\[\]\(899d8b7697d64725bf017d3296cfcf1b_img.jpg\)](#)

$$ex \quad 0.029101kJ/kg \cdot K = \frac{1.4 \cdot [R]}{1.4 - 1}$$



12) Work Done in Adiabatic Process given Adiabatic Index [Open Calculator](#) 

$$\text{fx } W = \frac{m_{\text{gas}} \cdot [R] \cdot (T_i - T_f)}{\gamma - 1}$$

$$\text{ex } -1662.892524\text{J} = \frac{2\text{kg} \cdot [R] \cdot (305\text{K} - 345\text{K})}{1.4 - 1}$$



Variables Used










- **A** Cross Sectional Area (Square Meter)
- **C_p** Specific Heat Capacity at Constant Pressure (Kilojoule per Kilogram per K)
- **C_{pm}** Molar Specific Heat Capacity at Constant Pressure (Joule Per Kelvin Per Mole)
- **C_v** Molar Specific Heat Capacity at Constant Volume (Joule Per Kelvin Per Mole)
- **m** Mass Flow Rate (Kilogram per Second)
- **m_{gas}** Mass of Gas (Kilogram)
- **N** Amount of Gaseous Substance in Moles (Mole)
- **P_{abs}** Absolute Pressure (Pascal)
- **P_f** Final Pressure of System (Pascal)
- **P_i** Initial Pressure of System (Pascal)
- **Q_p** Heat Transfer (Kilojoule per Kilogram)
- **T_f** Final Temperature (Kelvin)
- **T_i** Initial Temperature (Kelvin)
- **u_f** Fluid Velocity (Meter per Second)
- **v** Specific Volume (Cubic Meter per Kilogram)
- **V_f** Final Volume of System (Cubic Meter)
- **V_i** Initial Volume of System (Cubic Meter)
- **W** Work (Joule)
- **W_b** Isobaric Work (Joule)



- γ Heat Capacity Ratio
- ΔS Change in Entropy (Joule per Kilogram K)
- ΔS_{CP} Entropy Change Constant Pressure (Joule per Kilogram K)
- ΔS_{CV} Entropy Change Constant Volume (Joule per Kilogram K)



Constants, Functions, Measurements used

- **Constant:** **[R]**, 8.31446261815324
Universal gas constant
- **Function:** **ln**, ln(Number)
The natural logarithm, also known as the logarithm to the base e, is the inverse function of the natural exponential function.
- **Measurement:** **Weight** in Kilogram (kg)
Weight Unit Conversion 
- **Measurement:** **Temperature** in Kelvin (K)
Temperature Unit Conversion 
- **Measurement:** **Amount of Substance** in Mole (mol)
Amount of Substance Unit Conversion 
- **Measurement:** **Volume** in Cubic Meter (m³)
Volume Unit Conversion 
- **Measurement:** **Area** in Square Meter (m²)
Area Unit Conversion 
- **Measurement:** **Pressure** in Pascal (Pa)
Pressure Unit Conversion 
- **Measurement:** **Speed** in Meter per Second (m/s)
Speed Unit Conversion 
- **Measurement:** **Energy** in Joule (J)
Energy Unit Conversion 
- **Measurement:** **Heat of Combustion (per Mass)** in Kilojoule per Kilogram (kJ/kg)
Heat of Combustion (per Mass) Unit Conversion 
- **Measurement:** **Specific Heat Capacity** in Kilojoule per Kilogram per K (kJ/kg*K)



Specific Heat Capacity Unit Conversion

- **Measurement: Mass Flow Rate** in Kilogram per Second (kg/s)

Mass Flow Rate Unit Conversion 


- **Measurement: Specific Volume** in Cubic Meter per Kilogram (m^3/kg)

Specific Volume Unit Conversion 


- **Measurement: Specific Entropy** in Joule per Kilogram K ($\text{J}/\text{kg}\cdot\text{K}$)

Specific Entropy Unit Conversion 

- **Measurement: Molar Specific Heat Capacity at Constant Pressure** in Joule Per Kelvin Per Mole ($\text{J}/\text{K}\cdot\text{mol}$)

Molar Specific Heat Capacity at Constant Pressure Unit Conversion 

- **Measurement: Molar Specific Heat Capacity at Constant Volume** in Joule Per Kelvin Per Mole ($\text{J}/\text{K}\cdot\text{mol}$)

Molar Specific Heat Capacity at Constant Volume Unit Conversion 



Check other formula lists

- **Ducts Formulas** 

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