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Entropy Generation Formulas

Calculators! Examples! Conversions!

List of 16 Entropy Generation Formulas

Entropy Generation

1) Entropy Balance Equation

Open Calculator

fx $\delta s = Gsys - Gsurr + TEG$

ex $105 J/kg*K = 85 J/kg*K - 130.0 J/kg*K + 150 J/kg*K$

2) Entropy Change at Constant Pressure

Open Calculator

fx $\delta s_{pres} = C_p \cdot \ln\left(\frac{T_2}{T_1}\right) - [R] \cdot \ln\left(\frac{P_2}{P_1}\right)$

ex $396.4722 J/kg*K = 1001 J/(kg*K) \cdot \ln\left(\frac{151K}{101K}\right) - [R] \cdot \ln\left(\frac{5.2Bar}{2.5Bar}\right)$

3) Entropy Change at Constant Volume

Open Calculator

fx $\delta s_{vol} = C_v \cdot \ln\left(\frac{T_2}{T_1}\right) + [R] \cdot \ln\left(\frac{v_2}{v_1}\right)$

ex $344.494 J/kg*K = 718 J/(kg*K) \cdot \ln\left(\frac{151K}{101K}\right) + [R] \cdot \ln\left(\frac{0.816 m^3/kg}{0.001 m^3/kg}\right)$

4) Entropy Change for Isochoric Process given Pressures

Open Calculator

$$\delta s_{vol} = m_{gas} \cdot C_{vs} \cdot \ln\left(\frac{P_f}{P_i}\right)$$

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

5) Entropy Change for Isochoric Process given Temperature

Open Calculator

$$\delta s_{vol} = m_{gas} \cdot C_{vs} \cdot \ln\left(\frac{T_f}{T_i}\right)$$

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

6) Entropy Change for Isothermal Process given Volumes

Open Calculator

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

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

7) Entropy Change in Isobaric Process given Temperature

Open Calculator

$$\delta s_{pres} = m_{gas} \cdot C_{pm} \cdot \ln\left(\frac{T_f}{T_i}\right)$$

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

8) Entropy Change in Isobaric Processin Terms of Volume

Open Calculator

fx $$\delta s_{pres} = m_{gas} \cdot C_{pm} \cdot \ln\left(\frac{V_f}{V_i}\right)$$

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

9) Entropy Change Variable Specific Heat

Open Calculator

fx $$\delta s = s2^{\circ} - s1^{\circ} - [R] \cdot \ln\left(\frac{P_2}{P_1}\right)$$

ex $$157.5108 \text{J/kg*K} = 188.8 \text{J/kg*K} - 25.2 \text{J/kg*K} - [R] \cdot \ln\left(\frac{5.2\text{Bar}}{2.5\text{Bar}}\right)$$

10) Entropy using Helmholtz Free Energy

Open Calculator

fx $$S = \frac{U - A}{T}$$

ex $$0.369128 \text{J/K} = \frac{1.21\text{KJ} - 1.1\text{KJ}}{298\text{K}}$$

11) Gibbs Free Energy

Open Calculator

fx $$G = H - T \cdot S$$

ex $$-19.648\text{KJ} = 1.51\text{KJ} - 298\text{K} \cdot 71 \text{J/K}$$

12) Helmholtz Free Energy

Open Calculator

fx $$A = U - T \cdot S$$

ex $$-19.948\text{KJ} = 1.21\text{KJ} - 298\text{K} \cdot 71 \text{J/K}$$

13) Internal Energy using Helmholtz Free Energy

Open Calculator

fx $$U = A + T \cdot S$$

ex $$22.258\text{KJ} = 1.1\text{KJ} + 298\text{K} \cdot 71\text{J/K}$$

14) Irreversibility

Open Calculator

fx $$I_{12} = \left(T \cdot (S_2 - S_1) - \frac{Q_{in}}{T_{in}} + \frac{Q_{out}}{T_{out}} \right)$$

ex $$28311.55\text{J/kg} = \left(298\text{K} \cdot (145\text{J/kg*K} - 50\text{J/kg*K}) - \frac{200\text{J/kg}}{210\text{K}} + \frac{300\text{J/kg}}{120\text{K}} \right)$$

15) Specific Entropy

Open Calculator

fx $$G_s = \frac{S}{m}$$

ex $$2.151515 = \frac{71\text{J/K}}{33\text{kg}}$$

16) Temperature using Helmholtz Free Energy

Open Calculator

fx $$T = \frac{U - A}{S}$$

ex $$1.549296\text{K} = \frac{1.21\text{KJ} - 1.1\text{KJ}}{71\text{J/K}}$$

Variables Used

- **A** Helmholtz Free Energy *(Kilojoule)*
- **C_p** Heat Capacity Constant Pressure *(Joule per Kilogram per K)*
- **C_{pm}** Molar Specific Heat Capacity at Constant Pressure *(Joule Per Kelvin Per Mole)*
- **C_v** Heat Capacity Constant Volume *(Joule per Kilogram per K)*
- **C_{vs}** Specific Molar Heat Capacity at Constant Volume *(Joule Per Kelvin Per Mole)*
- **G** Gibbs Free Energy *(Kilojoule)*
- **G_s** Specific Entropy
- **Gsurr** Entropy of Surrounding *(Joule per Kilogram K)*
- **Gsys** Entropy of System *(Joule per Kilogram K)*
- **H** Enthalpy *(Kilojoule)*
- **I_{12}** Irreversibility *(Joule per Kilogram)*
- **m** Mass *(Kilogram)*
- **m_{gas}** Mass of Gas *(Kilogram)*
- **P_1** Pressure 1 *(Bar)*
- **P_2** Pressure 2 *(Bar)*
- **P_f** Final Pressure of System *(Pascal)*
- **P_i** Initial Pressure of System *(Pascal)*
- **Q_{in}** Heat input *(Joule per Kilogram)*
- **Q_{out}** Heat output *(Joule per Kilogram)*
- **S** Entropy *(Joule per Kelvin)*
- **S_1** Entropy at point 1 *(Joule per Kilogram K)*
- **S_2** Entropy at point 2 *(Joule per Kilogram K)*
- **$s1^{\circ}$** Standard molar entropy at point 1 *(Joule per Kilogram K)*

- **$s2^{\circ}$** Standard molar entropy at point 2 *(Joule per Kilogram K)*
- **T** Temperature *(Kelvin)*
- **T_1** Temperature of Surface 1 *(Kelvin)*
- **T_2** Temperature of Surface 2 *(Kelvin)*
- **T_f** Final Temperature *(Kelvin)*
- **T_i** Initial Temperature *(Kelvin)*
- **T_{in}** Input Temperature *(Kelvin)*
- **T_{out}** Output Temperature *(Kelvin)*
- **TEG** Total Entropy Generation *(Joule per Kilogram K)*
- **U** Internal Energy *(Kilojoule)*
- **V_f** Final Volume of System *(Cubic Meter)*
- **V_i** Initial Volume of System *(Cubic Meter)*
- **δs** Entropy Change Variable Specific Heat *(Joule per Kilogram K)*
- **ΔS** Change in Entropy *(Joule per Kilogram K)*
- **δs_{pres}** Entropy Change Constant Pressure *(Joule per Kilogram K)*
- **δs_{vol}** Entropy Change Constant Volume *(Joule per Kilogram K)*
- **v_1** Specific Volume at Point 1 *(Cubic Meter per Kilogram)*
- **v_2** Specific Volume at Point 2 *(Cubic Meter per Kilogram)*

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: **Volume** in Cubic Meter (m^3)
  Volume Unit Conversion
- Measurement: **Pressure** in Bar (Bar), Pascal (Pa)
  Pressure Unit Conversion
- Measurement: **Energy** in Kilojoule (KJ)
  Energy Unit Conversion
- Measurement: **Heat of Combustion (per Mass)** in Joule per Kilogram (J/kg)
  Heat of Combustion (per Mass) Unit Conversion
- Measurement: **Specific Heat Capacity** in Joule per Kilogram per K (J/(kg*K))
  Specific Heat Capacity 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 (J/kg*K)
  Specific Entropy Unit Conversion
- Measurement: **Entropy** in Joule per Kelvin (J/K)
  Entropy Unit Conversion
- Measurement: **Molar Specific Heat Capacity at Constant Pressure** in Joule Per Kelvin Per Mole (J/K*mol)
  Molar Specific Heat Capacity at Constant Pressure Unit Conversion

- Measurement: **Molar Specific Heat Capacity at Constant Volume** in Joule Per Kelvin Per Mole (J/K*mol)
  Molar Specific Heat Capacity at Constant Volume Unit Conversion

Check other formula lists

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- **Heat Engine and Heat Pump Formulas**
- **Ideal Gas Formulas**
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