Important Thermal Parameters Formulas PDF

Formulas
Examples
with Units

List of 17
Important Thermal Parameters Formulas

1) Change in Kinetic Energy Formula

Evaluate Formula

Formula

$$\Delta KE = \frac{1}{2} \cdot m \cdot \left({v_{02}}^2 - {v_{01}}^2 \right)$$

Example with Units

$$12956.975\,\text{J} = \frac{1}{2} \cdot 35.45\,\text{kg} \cdot \left(30\,\text{m/s}^2 - 13\,\text{m/s}^2 \right)$$

2) Change in Potential Energy Formula

Evaluate Formula

Formula

$$\Delta PE = m \cdot [g] \cdot \left(z_2 - z_1 \right)$$

Example with Units

$$32678.6998\,\text{J} = 35.45\,\text{kg} \cdot 9.8066\,\text{m/s}^2 \cdot \left(111\,\text{m} - 17\,\text{m} \right)$$

3) Heat Transfer at Constant Pressure Formula

Evaluate Formula

Formula

$$Q_p = m_{gas} \cdot C_{pm} \cdot \left(T_f - T_i \right)$$

Example with Units

$$9.76\,\text{kJ/kg} = 2\,\text{kg} \cdot 122\,\text{J/K*mol} \cdot \left(345\,\text{K} - 305\,\text{K} \right)$$

4) Latent Heat Formula

Evaluate Formula

Formula

$$LH = \frac{Q}{m}$$

Example with Units

$$16.079\,\text{J} = \frac{570\,\text{J}}{35.45\,\text{kg}}$$

5) Ratio of Specific Heat Formula

Evaluate Formula

Formula

$$Y = \frac{C_{p\,molar}}{C_{v\,molar}}$$

Example with Units

$$1.1845 = \frac{122\,\text{J/K*mol}}{103\,\text{J/K*mol}}$$

6) Saturated Mixture Specific Enthalpy Formula

Evaluate Formula

Formula

$$h = h_f + \chi \cdot h_{fg}$$

Example with Units

$$645\,\text{kJ/kg} = 419\,\text{kJ/kg} + 0.1 \cdot 2260\,\text{kJ/kg}$$

7) Sensible Heat Factor Formula

Evaluate Formula

Formula

$$SHF = \frac{SH}{SH + LH}$$

Example with Units

$$0.0089 = \frac{9\,J}{9\,J + 1000\,J}$$

8) Specific Heat Formula

Evaluate Formula

Formula

$$c = Q \cdot m \cdot \Delta T$$

Example with Units

$$424336.5\,J/(kg*K) = 570\,J \cdot 35.45\,kg \cdot 21\,K$$

9) Specific Heat at Constant Volume Formula

Evaluate Formula

Formula

$$C_{v\,molar} = \frac{\Delta Q}{N_{moles} \cdot \Delta T}$$

Example with Units

$$2.5476\,J/K*mol = \frac{107\,J}{2 \cdot 21\,K}$$

10) Specific Heat Capacity at Constant Pressure Formula

Evaluate Formula

Formula

$$C_{pm} = [R] + C_v$$

Example with Units

$$538.3145\,J/K*mol = 8.3145 + 530\,J/K*mol$$

11) Specific Heat of Gas Mixture Formula

Evaluate Formula

Formula

$$C_{gas\ mixture} = \frac{n_1 \cdot C_{v1} + n_2 \cdot C_{v2}}{n_1 + n_2}$$

Example with Units

$$112\,J/(kg*K) = \frac{6\,mol \cdot 113\,J/(kg*K) + 3\,mol \cdot 110\,J/(kg*K)}{6\,mol + 3\,mol}$$

12) Specific Heat Ratio Formula

Evaluate Formula

Formula

$$\kappa = \frac{C_p}{C_v}$$

Example with Units

$$1.3942 = \frac{1001\,J/(kg*K)}{718\,J/(kg*K)}$$

13) Stefan Boltzmann Law Formula

Evaluate Formula

Formula

$$e_b = [Stefan\text{-}BoltZ] \cdot T^4$$

Example with Units

$$2.96\,W/m^2 = 5.7E\text{-}8 \cdot 85\,K^4$$

14) Thermal Capacity Formula

Evaluate Formula

Formula

$$H = m \cdot c$$

Example with Units

$$4254\,J/(kg*K) = 35.45\,kg \cdot 120\,J/(kg*K)$$

15) Thermal Expansion Formula

Evaluate Formula

Formula

$$\alpha = \frac{\Delta l}{l_0 \cdot \Delta T}$$

Example with Units

$$1.7\text{E-}5\,°C^{-1} = \frac{0.0025\,m}{7\,m \cdot 21\,K}$$

16) Thermal Stress of Material Formula

Evaluate Formula

Formula

$$\sigma = \frac{\alpha \cdot E \cdot \Delta T}{l_0}$$

Example with Units

$$4.5\text{E-}8\,MPa = \frac{0.001\,°C^{-1} \cdot 15\,N/m \cdot 21\,K}{7\,m}$$

17) Total Energy of System Formula

Evaluate Formula

Formula

$$E_{system} = PE + KE + U$$

Example with Units

$$200\,J = 4\,J + 75\,J + 121\,J$$

Variables used in list of Thermal Parameters Formulas above

- **c** Specific Heat *(Joule per Kilogram per K)*
- **$C_{gas\ mixture}$** Specific Heat of Gas Mixture *(Joule per Kilogram per K)*
- **$C_{p\ molar}$** Molar Specific Heat Capacity at Constant Pressure *(Joule Per Kelvin Per Mole)*
- **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)*
- **$C_{v\ molar}$** Molar Specific Heat Capacity at Constant Volume *(Joule Per Kelvin Per Mole)*
- **C_v** Molar Specific Heat Capacity at Constant Volume *(Joule Per Kelvin Per Mole)*
- **C_v** Heat Capacity Constant Volume *(Joule per Kilogram per K)*
- **C_{v1}** Specific Heat Capacity of Gas 1 at Constant Volume *(Joule per Kilogram per K)*
- **C_{v2}** Specific Heat Capacity of Gas 2 at Constant Volume *(Joule per Kilogram per K)*
- **E** Young's Modulus *(Newton per Meter)*
- **e_b** Black-Body Radiant Emittance *(Watt per Square Meter)*
- **E_{system}** Total Energy of System *(Joule)*
- **h** Saturated Mixture Specific Enthalpy *(Kilojoule per Kilogram)*
- **h_f** Fluid Specific Enthalpy *(Kilojoule per Kilogram)*
- **h_{fg}** Latent Heat of Vaporization *(Kilojoule per Kilogram)*
- **KE** Kinetic Energy *(Joule)*
- **l_0** Initial Length *(Meter)*
- **LH** Latent Heat *(Joule)*
- **m** Mass *(Kilogram)*
- **m_{gas}** Mass of Gas *(Kilogram)*
- **n_1** Number of Moles of Gas 1 *(Mole)*
- **n_2** Number of Moles of Gas 2 *(Mole)*

Constants, Functions, Measurements used in list of Thermal Parameters Formulas above

- constant(s): **[g]**, 9.80665
  Gravitational acceleration on Earth
- constant(s): **[Stefan-BoltZ]**, 5.670367E-8
  Stefan-Boltzmann Constant
- constant(s): **[R]**, 8.31446261815324
  Universal gas constant
- 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: **Amount of Substance** in Mole (mol)
  Amount of Substance 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 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: **Latent Heat** in Kilojoule per Kilogram (kJ/kg)
  Latent Heat Unit Conversion
- Measurement: **Temperature Coefficient of Resistance** in Per Degree Celsius ($°C^{-1}$)
  Temperature Coefficient of Resistance Unit Conversion
- Measurement: **Molar Specific Heat Capacity at Constant Pressure** in Joule Per Kelvin Per Mole (J/K*mol)

- N_{moles} Number of Moles
- **PE** Potential Energy *(Joule)*
- **Q** Heat *(Joule)*
- Q_p Heat Transfer *(Kilojoule per Kilogram)*
- **SH** Sensible Heat *(Joule)*
- **SHF** Sensible Heat Factor
- **T** Temperature *(Kelvin)*
- T_f Final Temperature *(Kelvin)*
- T_i Initial Temperature *(Kelvin)*
- **U** Internal Energy *(Joule)*
- v_{01} Final Velocity at Point 1 *(Meter per Second)*
- v_{02} Final Velocity at Point 2 *(Meter per Second)*
- **Y** Specific Heat Ratio
- z_1 Height of Object at Point 1 *(Meter)*
- z_2 Height of Object at Point 2 *(Meter)*
- **α** Coefficient of Linear Thermal Expansion *(Per Degree Celsius)*
- **ΔKE** Change in Kinetic Energy *(Joule)*
- **ΔI** Change in Length *(Meter)*
- **ΔPE** Change in Potential Energy *(Joule)*
- **ΔQ** Heat Change *(Joule)*
- **ΔT** Temperature Change *(Kelvin)*
- **H** Thermal Capacity *(Joule per Kilogram per K)*
- **κ** Specific Heat Ratio Dynamic
- **σ** Thermal Stress *(Megapascal)*
- **χ** Vapour Quality

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
- Measurement: **Stiffness Constant** in Newton per Meter (N/m)
  Stiffness Constant Unit Conversion
- Measurement: **Stress** in Megapascal (MPa)
  Stress Unit Conversion

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