calculatoratoz.com

unitsconverters.com

# Basics of Modes of Heat Transfer Formulas

Calculators! Examples! Conversions!

Bookmark **calculatoratoz.com**, **unitsconverters.com**

Widest Coverage of Calculators and Growing - **30,000+ Calculators!**
Calculate With a Different Unit for Each Variable - **In built Unit Conversion!**
Widest Collection of Measurements and Units - **250+ Measurements!**

Feel free to SHARE this document with your friends!

*Please leave your feedback here...*



# List of 13 Basics of Modes of Heat Transfer Formulas

## Basics of Modes of Heat Transfer

### 1) Heat Transfer through Plane Wall or Surface

Open Calculator

fx $$q = -k \cdot A_c \cdot \frac{t_o - t_i}{w}$$

ex $$799.8571\text{W} = -10.18\text{W/(m*K)} \cdot 11\text{m}^2 \cdot \frac{321\text{K} - 371\text{K}}{7\text{m}}$$

### 2) Ohm's Law

Open Calculator

fx $$V = I \cdot R$$

ex $$31.5\text{V} = 2.1\text{A} \cdot 15\Omega$$

### 3) Overall Heat Transfer based on Thermal Resistance

Open Calculator

fx $$q_{overall} = \frac{\Delta T_{Overall}}{\Sigma R_{Thermal}}$$

ex $$2.794715\text{W} = \frac{55\text{K}}{19.68\text{K/W}}$$

### 4) Radial Heat Flowing through Cylinder

Open Calculator

fx $$Q = k \cdot 2 \cdot \pi \cdot \Delta T \cdot \frac{l}{\ln\left(\frac{r_{outer}}{r_{inner}}\right)}$$

ex $$2731.399\text{J} = 10.18\text{W/(m*K)} \cdot 2 \cdot \pi \cdot 5.25\text{K} \cdot \frac{6.21\text{m}}{\ln\left(\frac{7.51\text{m}}{3.5\text{m}}\right)}$$

## 5) Radiation Thermal Resistance

Open Calculator

$$R_{th} = \frac{1}{\varepsilon \cdot [Stefan\text{-}BoltZ] \cdot A_{base} \cdot (T_1 + T_2) \cdot \left(\left((T_1)^2\right) + \left((T_2)^2\right)\right)}$$

ex

$$0.007647 K/W = \frac{1}{0.95 \cdot [Stefan\text{-}BoltZ] \cdot 9 m^2 \cdot (503K + 293K) \cdot \left(\left((503K)^2\right) + \left((293K)^2\right)\right)}$$

## 6) Radiative Heat Transfer

Open Calculator

$$Q = [Stefan\text{-}BoltZ] \cdot SA_{Body} \cdot F \cdot \left(T_1^4 - T_2^4\right)$$

ex

$$2730.11J = [Stefan\text{-}BoltZ] \cdot 8.5 m^2 \cdot 0.1 \cdot \left((503K)^4 - (293K)^4\right)$$

## 7) Radiosity

Open Calculator

$$J = \frac{E_{Leaving}}{SA_{Body} \cdot t_{sec}}$$

ex

$$0.058824 W/m^2 = \frac{19J}{8.5 m^2 \cdot 38s}$$

## 8) Rate of Convective Heat Transfer

Open Calculator

$$q = h_{transfer} \cdot A_{Exposed} \cdot (T_w - T_a)$$

ex

$$732.6W = 13.2 W/m^2*K \cdot 11.1 m^2 \cdot (305K - 300K)$$

## 9) Temperature Difference using Thermal Analogy to Ohm's Law

Open Calculator

$$\Delta T = q \cdot R_{th}$$

ex

$$7.5K = 750W \cdot 0.01K/W$$

### 10) Thermal Diffusivity

Open Calculator

fx $$\alpha = \frac{k}{\rho \cdot C_o}$$

ex $$0.461887\text{m}^2/\text{s} = \frac{10.18\text{W/(m*K)}}{5.51\text{kg/m}^3 \cdot 4\text{J/(kg*K)}}$$

### 11) Thermal Resistance in Convection Heat Transfer

Open Calculator

fx $$R_{th} = \frac{1}{A_{expo} \cdot h_{conv}}$$

ex $$0.004505\text{K/W} = \frac{1}{11.1\text{m}^2 \cdot 20\text{W/m}^2\text{*K}}$$

### 12) Thermal Resistance of Spherical Wall

Open Calculator

fx $$r_{th} = \frac{r_2 - r_1}{4 \cdot \pi \cdot k \cdot r_1 \cdot r_2}$$

ex $$0.001326\text{K/W} = \frac{6\text{m} - 5\text{m}}{4 \cdot \pi \cdot 2\text{W/(m*K)} \cdot 5\text{m} \cdot 6\text{m}}$$

### 13) Total Emissive Power of Radiating Body

Open Calculator

fx $$E_b = \left(\varepsilon \cdot (T_e)^4\right) \cdot [\text{Stefan-BoltZ}]$$

ex $$2.811969\text{W} = \left(0.95 \cdot (85\text{K})^4\right) \cdot [\text{Stefan-BoltZ}]$$

## Variables Used

- $A_{base}$ Base Area *(Square Meter)*
- $A_c$ Cross Sectional Area *(Square Meter)*
- $A_{expo}$ Exposed Surface Area *(Square Meter)*
- $A_{Exposed}$ Exposed Surface Area *(Square Meter)*
- $C_o$ Specific Heat Capacity *(Joule per Kilogram per K)*
- $E_b$ Emissive Power per Unit Area *(Watt)*
- $E_{Leaving}$ Energy Leaving Surface *(Joule)*
- **F** Geometric View Factor
- $h_{conv}$ Co-efficient of Convective Heat Transfer *(Watt per Square Meter per Kelvin)*
- $h_{transfer}$ Heat Transfer Coefficient *(Watt per Square Meter per Kelvin)*
- **I** Electric Current *(Ampere)*
- **J** Radiosity *(Watt per Square Meter)*
- **k** Thermal Conductivity *(Watt per Meter per K)*
- **k** Thermal Conductivity *(Watt per Meter per K)*
- **k** Thermal Conductivity *(Watt per Meter per K)*
- **l** Length of Cylinder *(Meter)*
- **q** Heat Flow Rate *(Watt)*
- **Q** Heat *(Joule)*
- $q_{overall}$ Overall Heat Transfer *(Watt)*
- **R** Resistance *(Ohm)*
- $r_1$ Radius of 1st Concentric Sphere *(Meter)*
- $r_2$ Radius of 2nd Concentric Sphere *(Meter)*
- $r_{inner}$ Inner Radius of Cylinder *(Meter)*
- $r_{outer}$ Outer Radius of Cylinder *(Meter)*
- $r_{th}$ Thermal Resistance of Sphere Without Convection *(Kelvin per Watt)*
- $R_{th}$ Thermal Resistance *(Kelvin per Watt)*
- $SA_{Body}$ Body Surface Area *(Square Meter)*
- $T_1$ Temperature of Surface 1 *(Kelvin)*

- $T_2$ Temperature of Surface 2 *(Kelvin)*
- $T_a$ Ambient Air Temperature *(Kelvin)*
- $T_e$ Effective Radiating Temperature *(Kelvin)*
- $t_i$ Inside Temperature *(Kelvin)*
- $t_o$ Outside Temperature *(Kelvin)*
- $t_{sec}$ Time in seconds *(Second)*
- $T_w$ Surface Temperature *(Kelvin)*
- **V** Voltage *(Volt)*
- **w** Width of Plane Surface *(Meter)*
- **α** Thermal Diffusivity *(Square Meter Per Second)*
- **ΔT** Temperature Difference *(Kelvin)*
- $\Delta T_{Overall}$ Overall Temperature Difference *(Kelvin)*
- **ε** Emissivity
- **ρ** Density *(Kilogram per Cubic Meter)*
- $\Sigma R_{Thermal}$ Total Thermal Resistance *(Kelvin per Watt)*

## Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  *Archimedes' constant*
- Constant: **[Stefan-BoltZ]**, 5.670367E-8
  *Stefan-Boltzmann 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: **Length** in Meter (m)
  *Length Unit Conversion*
- Measurement: **Time** in Second (s)
  *Time Unit Conversion*
- Measurement: **Electric Current** in Ampere (A)
  *Electric Current Unit Conversion*
- Measurement: **Temperature** in Kelvin (K)
  *Temperature Unit Conversion*
- Measurement: **Area** in Square Meter (m²)
  *Area Unit Conversion*
- Measurement: **Energy** in Joule (J)
  *Energy Unit Conversion*
- Measurement: **Power** in Watt (W)
  *Power Unit Conversion*
- Measurement: **Electric Resistance** in Ohm (Ω)
  *Electric Resistance Unit Conversion*
- Measurement: **Temperature Difference** in Kelvin (K)
  *Temperature Difference Unit Conversion*
- Measurement: **Thermal Resistance** in Kelvin per Watt (K/W)
  *Thermal Resistance Unit Conversion*
- Measurement: **Thermal Conductivity** in Watt per Meter per K (W/(m*K))
  *Thermal Conductivity Unit Conversion*
- Measurement: **Electric Potential** in Volt (V)
  *Electric Potential 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/m²)
  *Heat Flux Density Unit Conversion*
- Measurement: **Heat Transfer Coefficient** in Watt per Square Meter per Kelvin (W/m²*K)
  *Heat Transfer Coefficient Unit Conversion*
- Measurement: **Density** in Kilogram per Cubic Meter (kg/m³)
  *Density Unit Conversion*
- Measurement: **Diffusivity** in Square Meter Per Second (m²/s)
  *Diffusivity Unit Conversion*

## Check other formula lists

- **Basics of Modes of Heat Transfer Formulas**
- **Convection Heat Transfer Formulas**

Feel free to SHARE this document with your friends!

## PDF Available in

English Spanish French German Russian Italian Portuguese Polish Dutch

*3/28/2024 | 5:30:30 AM UTC*

*Please leave your feedback here...*