



calculatoratoz.com



unitsconverters.com

Basics 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 17 Basics of Heat Transfer Formulas

Basics of Heat Transfer

1) Colburn Factor using Chilton Colburn Analogy

$$\text{fx } j_H = \frac{\text{Nu}}{(\text{Re}) \cdot (\text{Pr})^{\frac{1}{3}}}$$

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

$$\text{ex } 0.004541 = \frac{12.6}{(3125) \cdot (0.7)^{\frac{1}{3}}}$$

2) Colburn J-Factor given Fanning Friction Factor

$$\text{fx } j_H = \frac{f}{2}$$

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

$$\text{ex } 0.0045 = \frac{0.009}{2}$$

3) Equivalent Diameter of Non-Circular Duct

$$\text{fx } D_e = \frac{4 \cdot A_{cs}}{P}$$

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

$$\text{ex } 1.25\text{m} = \frac{4 \cdot 25\text{m}^2}{80\text{m}}$$



4) Equivalent Diameter when Flow in Rectangular Duct

$$fx \quad D_e = \frac{4 \cdot L \cdot B}{2 \cdot (L + B)}$$

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

$$ex \quad 1.221429m = \frac{4 \cdot 1.9m \cdot 0.9m}{2 \cdot (1.9m + 0.9m)}$$

5) Fanning Friction Factor given Colburn J-Factor

$$fx \quad f = 2 \cdot j_H$$

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

$$ex \quad 0.0092 = 2 \cdot 0.0046$$

6) Heat Transfer Coefficient based on Temperature Difference

$$fx \quad h_{ht} = \frac{q}{\Delta T_{Overall}}$$

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

$$ex \quad 0.312727W/m^2 \cdot K = \frac{17.2W/m^2}{55K}$$

7) Heat Transfer Coefficient given Local Heat Transfer Resistance of Air Film

$$fx \quad h_{ht} = \frac{1}{(A) \cdot HT_{Resistance}}$$

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

$$ex \quad 1.500375W/m^2 \cdot K = \frac{1}{(0.05m^2) \cdot 13.33K/W}$$



8) Heat Transfer from Stream of Gas flowing in Turbulent Motion

$$\text{fx } h_{ht} = \frac{16.6 \cdot c_p \cdot (G)^{0.8}}{D^{0.2}}$$

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

$$\text{ex } 2.930745 \text{ W/m}^2 \cdot \text{K} = \frac{16.6 \cdot 0.0002 \text{ kcal(IT)/kg}^{\circ} \text{C} \cdot (0.1 \text{ kg/s/m}^2)^{0.8}}{(0.24 \text{ m})^{0.2}}$$

9) Hydraulic Radius

$$\text{fx } r_H = \frac{A_{cs}}{P}$$

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

$$\text{ex } 0.3125 \text{ m} = \frac{25 \text{ m}^2}{80 \text{ m}}$$


10) Internal Diameter of Pipe given Heat Transfer Coefficient for Gas in Turbulent Motion

$$\text{fx } D = \left(\frac{16.6 \cdot c_p \cdot (G)^{0.8}}{h} \right)^{\frac{1}{0.2}}$$

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

$$\text{ex } 0.249748 \text{ m} = \left(\frac{16.6 \cdot 0.0002 \text{ kcal(IT)/kg}^{\circ} \text{C} \cdot (0.1 \text{ kg/s/m}^2)^{0.8}}{2.5 \text{ kcal(IT)/h}^{\circ} \text{m}^2 \cdot \text{C}} \right)^{\frac{1}{0.2}}$$



11) J-Factor for Pipe Flow 

$$fx \quad j_H = 0.023 \cdot (Re)^{-0.2}$$

[Open Calculator !\[\]\(e2376d476d06eb31946dc01a69a4403a_img.jpg\)](#)

$$ex \quad 0.0046 = 0.023 \cdot (3125)^{-0.2}$$

12) Local Heat Transfer Resistance of Air-Film 

$$fx \quad HT_{Resistance} = \frac{1}{h_{ht} \cdot A}$$

[Open Calculator !\[\]\(0b5e7e25e8775f7e7e80906ada4f0021_img.jpg\)](#)

$$ex \quad 13.33333K/W = \frac{1}{1.5W/m^2 \cdot K \cdot 0.05m^2}$$

13) Log Mean Temperature Difference for CoCurrent Flow 

$$fx \quad LMTD = \frac{(T_{ho} - T_{co}) - (T_{hi} - T_{ci})}{\ln\left(\frac{T_{ho} - T_{co}}{T_{hi} - T_{ci}}\right)}$$

[Open Calculator !\[\]\(bd3b31712ad9bab5a241210fa6925cdd_img.jpg\)](#)

$$ex \quad 18.20478K = \frac{(20K - 10K) - (35K - 5K)}{\ln\left(\frac{20K - 10K}{35K - 5K}\right)}$$


14) Log Mean Temperature Difference for Counter Current Flow 

$$fx \quad LMTD = \frac{(T_{ho} - T_{ci}) - (T_{hi} - T_{co})}{\ln\left(\frac{T_{ho} - T_{ci}}{T_{hi} - T_{co}}\right)}$$

[Open Calculator !\[\]\(7bc43b319a082987e20f7bf78f4bab80_img.jpg\)](#)

$$ex \quad 19.57615K = \frac{(20K - 5K) - (35K - 10K)}{\ln\left(\frac{20K - 5K}{35K - 10K}\right)}$$




15) Logarithmic Mean Area of Cylinder 

$$\text{fx } A_{\text{mean}} = \frac{A_o - A_i}{\ln\left(\frac{A_o}{A_i}\right)}$$

Open Calculator 

$$\text{ex } 9.865214\text{m}^2 = \frac{12\text{m}^2 - 8\text{m}^2}{\ln\left(\frac{12\text{m}^2}{8\text{m}^2}\right)}$$

16) Reynolds Number given Colburn Factor 

$$\text{fx } \text{Re} = \left(\frac{j_H}{0.023}\right)^{\frac{-1}{0.2}}$$

Open Calculator 

$$\text{ex } 3125 = \left(\frac{0.0046}{0.023}\right)^{\frac{-1}{0.2}}$$

17) Wetted Perimeter given Hydraulic Radius 

$$\text{fx } P = \frac{A_{\text{cs}}}{r_H}$$

Open Calculator 

$$\text{ex } 80.64516\text{m} = \frac{25\text{m}^2}{0.31\text{m}}$$



Variables Used









- **A** Area (Square Meter)
- **A_{cs}** Cross Sectional Area of Flow (Square Meter)
- **A_i** Inner Area of Cylinder (Square Meter)
- **A_{mean}** Logarithmic Mean Area (Square Meter)
- **A_o** Outer Area of Cylinder (Square Meter)
- **B** Breadth of Rectangle (Meter)
- **c_p** Specific Heat Capacity (Kilocalorie (IT) per Kilogram per Celcius)
- **D** Internal Diameter of Pipe (Meter)
- **D_e** Equivalent Diameter (Meter)
- **f** Fanning Friction Factor
- **G** Mass Velocity (Kilogram per Second per Square Meter)
- **h** Heat Transfer Coefficient for Gas (Kilocalorie (IT) per Hour per Square Meter per Celcius)
- **h_{ht}** Heat Transfer Coefficient (Watt per Square Meter per Kelvin)
- **HT_{Resistance}** Local Heat Transfer Resistance (Kelvin per Watt)
- **j_H** Colburn's j-factor
- **L** Length of Rectangular Section (Meter)
- **LMTD** Log Mean Temperature Difference (Kelvin)
- **Nu** Nusselt Number
- **P** Wetted Perimeter (Meter)
- **Pr** Prandtl Number
- **q** Heat Transfer (Watt per Square Meter)



- r_H Hydraulic Radius (Meter)
- Re Reynolds Number
- T_{ci} Inlet Temperature of Cold Fluid (Kelvin)
- T_{co} Outlet Temperature of Cold Fluid (Kelvin)
- T_{hi} Inlet Temperature of Hot Fluid (Kelvin)
- T_{ho} Outlet Temperature of Hot Fluid (Kelvin)
- $\Delta T_{Overall}$ Overall Temperature Difference (Kelvin)









Constants, Functions, Measurements used

- **Function:** **In**, $\ln(\text{Number})$
Natural logarithm function (base e)
- **Measurement:** **Length** in Meter (m)
Length Unit Conversion 
- **Measurement:** **Temperature** in Kelvin (K)
Temperature Unit Conversion 
- **Measurement:** **Area** in Square Meter (m^2)
Area Unit Conversion 
- **Measurement:** **Thermal Resistance** in Kelvin per Watt (K/W)
Thermal Resistance Unit Conversion 
- **Measurement:** **Specific Heat Capacity** in Kilocalorie (IT) per Kilogram per Celcius ($\text{kcal(IT)/kg}^{\circ}\text{C}$)
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 ($\text{W/m}^2\text{K}$), Kilocalorie (IT) per Hour per Square Meter per Celcius ($\text{kcal(IT)/h}^{\circ}\text{m}^2\text{C}$)
Heat Transfer Coefficient Unit Conversion 
- **Measurement:** **Mass Velocity** in Kilogram per Second per Square Meter (kg/s/m^2)
Mass Velocity Unit Conversion 



Check other formula lists

- **Basics of Heat Transfer Formulas** 
- **Co-Relation of Dimensionless Numbers Formulas** 
- **Critical Thickness of Insulation Formulas** 
- **Effectiveness of Heat Exchanger Formulas** 
- **Heat Exchanger Formulas** 
- **Heat Exchanger and its Effectiveness Formulas** 
- **Heat Transfer from Extended Surfaces (Fins) Formulas** 
- **Heat Transfer from Extended Surfaces (Fins), Critical Thickness of Insulation and Thermal Resistance Formulas** 
- **Thermal Resistance Formulas** 
- **Unsteady State Heat Conduction Formulas** 

Feel free to SHARE this document with your friends!

PDF Available in

[English](#) [Spanish](#) [French](#) [German](#) [Russian](#) [Italian](#) [Portuguese](#) [Polish](#) [Dutch](#)

8/21/2023 | 2:45:13 PM UTC

[Please leave your feedback here...](#)

