

Apêndice

Propriedades Gerais

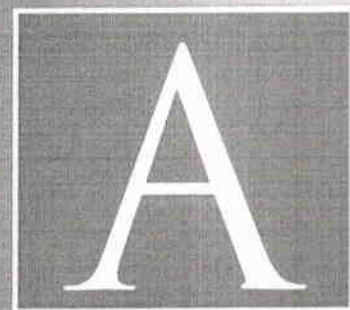


Tabela A.1
Fatores de Conversão

Aceleração da gravidade

$$g = 9,806\,65 \text{ m/s}^2$$

$$g = 32,174\,05 \text{ ft/s}^2$$

Área (A)

$$1 \text{ mm}^2 = 1,0 \times 10^{-6} \text{ m}^2$$

$$1 \text{ ft}^2 = 144 \text{ in}^2$$

$$1 \text{ cm}^2 = 1,0 \times 10^{-4} \text{ m}^2 = 0,1550 \text{ in}^2$$

$$1 \text{ in}^2 = 6,4516 \text{ cm}^2 = 6,4516 \times 10^{-4} \text{ m}^2$$

$$1 \text{ m}^2 = 10,7639 \text{ ft}^2$$

$$1 \text{ ft}^2 = 0,092\,903 \text{ m}^2$$

Calor específico (C_p , C_v , C), entropia específica(s)

$$1 \text{ kJ/(kg-K)} = 0,238\,846 \text{ Btu/lbm-}^\circ\text{R}$$

$$1 \text{ Btu/lbm-}^\circ\text{R} = 4,1868 \text{ kJ/kg-K}$$

Coefficiente de transferência de calor

$$1 \text{ W/m}^2\text{-K} = 0,176\,11 \text{ Btu/h-ft}^2\text{-}^\circ\text{R}$$

$$1 \text{ Btu/h-ft}^2\text{-}^\circ\text{R} = 5,678\,26 \text{ W/m}^2\text{-K}$$

Comprimento

$$1 \text{ mm} = 0,001 \text{ m} = 0,1 \text{ cm}$$

$$1 \text{ ft} = 12 \text{ in}$$

$$1 \text{ cm} = 0,01 = 10 \text{ mm} = 0,3937 \text{ in}$$

$$1 \text{ in} = 2,54 \text{ cm} = 0,0254 \text{ m}$$

$$1 \text{ m} = 3,280\,84 \text{ ft} = 39,370 \text{ in}$$

$$1 \text{ ft} = 0,3048 \text{ m}$$

$$1 \text{ km} = 0,621\,371 \text{ mi}$$

$$1 \text{ mi} = 1,609\,344 \text{ km}$$

$$1 \text{ mi} = 1609,3 \text{ m (US statute)}$$

$$1 \text{ yd} = 0,9144 \text{ m}$$

Condutividade térmica

$$1 \text{ W/m-K} = 1 \text{ J/s-m-K} = 0,577\,789 \text{ Btu/h-ft-}^\circ\text{R}$$

$$1 \text{ Btu/h-ft-R} = 1,730\,735 \text{ W/m-K}$$

Constante universal dos gases

$$\bar{R} = N_A k = 8,314\,51 \text{ kJ/kmol-K}$$

$$\bar{R} = 1,985\,89 \text{ Btu/lbmol-R}$$

$$= 1,985\,89 \text{ kcal/kmol-K}$$

$$= 1545,36 \text{ lbg-ft/lbmol-R}$$

$$= 82,0578 \text{ atm-L/kmol-K}$$

$$= 0,730\,24 \text{ atm-ft}^3\text{/lbmol-R}$$

$$= 10,7317 \text{ (lbg/in}^2\text{)-ft}^3\text{/lbmol-R}$$

Energia

$$1 \text{ J} = 1 \text{ N}\cdot\text{m} = 1 \text{ kg}\cdot\text{m}^2/\text{s}^2$$

$$1 \text{ J} = 0,737\,562 \text{ lbf}\cdot\text{ft}$$

$$1 \text{ cal (Int.)} = 4,186\,81 \text{ J}$$

$$1 \text{ erg} = 1,0 \times 10^{-7} \text{ J}$$

$$1 \text{ eV} = 1,602\,177\,33 \times 10^{-19} \text{ J}$$

$$1 \text{ lbf}\cdot\text{ft} = 1,355\,818$$

$$\text{J} = 1,285\,07 \times 10^{-3} \text{ Btu}$$

$$1 \text{ Btu (Int.)} = 1,055\,056 \text{ kJ}$$

$$= 778,1693 \text{ lbf}\cdot\text{ft}$$

Energia específica (e , u)

$$1 \text{ kJ/kg} = 0,429\,92 \text{ Btu/lbm}$$

$$= 334,55 \text{ lbf}\cdot\text{ft/lbm}$$

$$1 \text{ Btu/lbm} = 2,326 \text{ kJ/kg}$$

$$1 \text{ lbf}\cdot\text{ft/lbm} = 2,989\,07 \times 10^{-3} \text{ kJ/kg}$$

$$= 1,285\,07 \times 10^{-3} \text{ Btu/lbm}$$

Energia cinética específica ($1/2 V^2$)

$$1 \text{ m}^2/\text{s}^2 = 0,001 \text{ kJ/kg}$$

$$1 \text{ kJ/kg} = 1000 \text{ m}^2/\text{s}^2$$

$$1 \text{ ft}^2/\text{s}^2 = 3,9941 \times 10^{-5} \text{ Btu/lbm}$$

$$1 \text{ Btu/lbm} = 250\,37 \text{ ft}^2/\text{s}^2$$

Energia potencial específica (Zg)

$$1 \text{ m} - \text{gstd} = 9,806\,65 \times 10^{-3} \text{ kJ/kg}$$

$$= 4,216\,07 \times 10^{-3} \text{ Btu/lbm}$$

$$1 \text{ ft} - \text{gstd} = 1,0 \text{ lbf}\cdot\text{ft/lbm}$$

$$= 0,001\,285 \text{ Btu/lbm}$$

$$= 0,002\,989 \text{ kJ/kg}$$

Fluxo de calor

$$1 \text{ W/m}^2 = 0,316\,998 \text{ Btu/h}\cdot\text{ft}^2$$

$$1 \text{ Btu/h}\cdot\text{ft}^2 = 3,154\,59 \text{ W/m}^2$$

Força (F)

$$1 \text{ N} = 0,224\,809 \text{ lbf}$$

$$1 \text{ kgf} = 9,806\,65 \text{ N (1 kgf)}$$

$$1 \text{ lbf} = 4,448\,222 \text{ N}$$

Massa

$$1 \text{ kg} = 2,204\,623 \text{ lbm}$$

$$1 \text{ ton} = 1000 \text{ kg}$$

$$1 \text{ grain} = 6,479\,89 \times 10^{-5} \text{ kg}$$

$$1 \text{ lbm} = 0,453\,592 \text{ kg}$$

$$1 \text{ slug} = 14,5939 \text{ kg}$$

$$1 \text{ ton} = 2000 \text{ lbm}$$

Massa específica

$$1 \text{ kg/m}^3 = 0,062\,427\,97 \text{ lbm/ft}^3$$

$$1 \text{ g/cm}^3 = 1000 \text{ kg/m}^3$$

$$1 \text{ g/cm}^3 = 1 \text{ kg/L}$$

$$1 \text{ lbm/ft}^3 = 16,018\,46 \text{ kg/m}^3$$

Momento (Torque, T)

$$1 \text{ N}\cdot\text{m} = 0,737\,562 \text{ lbf}\cdot\text{ft}$$

$$1 \text{ lbf}\cdot\text{ft} = 1,355\,818 \text{ N}\cdot\text{m}$$

Potência ($\dot{Q}$, $\dot{W}$)

$$1 \text{ W} = 1 \text{ J/s} = 1 \text{ N}\cdot\text{m/s}$$

$$= 0,737\,562 \text{ lbf}\cdot\text{ft/s}$$

$$1 \text{ kW} = 3412,14 \text{ Btu/h}$$

$$1 \text{ hp (métrico)} = 0,735\,499 \text{ kW}$$

$$1 \text{ ton de refrigeração} = 3,516\,85 \text{ kW}$$

$$1 \text{ lbf}\cdot\text{ft/s} = 1,355\,818 \text{ W}$$

$$= 4,626\,24 \text{ Btu/h}$$

$$1 \text{ Btu/s} = 1,055\,056 \text{ kW}$$

$$1 \text{ hp (UK)} = 0,7457 \text{ kW}$$

$$= 550 \text{ lbf}\cdot\text{ft/s}$$

$$= 2544,43 \text{ Btu/h}$$

$$1 \text{ ton de refrigeração} = 12\,000 \text{ Btu/h}$$

Pressão (*P*)

$1 \text{ Pa} = 1 \text{ N/m}^2 = 1 \text{ kg/m-s}^2$	$1 \text{ lbf/in}^2 = 6,894\,757 \text{ kPa}$
$1 \text{ bar} = 1,0 \times 10^5 \text{ Pa} = 100 \text{ kPa}$	
$1 \text{ atm} = 101,325 \text{ kPa}$	$1 \text{ atm} = 14,695\,94 \text{ lbf/in}^2$
$= 1,013\,25 \text{ bar}$	$= 29\,921 \text{ in Hg } [32 \text{ }^\circ\text{F}]$
$= 760 \text{ mm Hg } [0 \text{ }^\circ\text{C}]$	$= 33,8995 \text{ ft H}_2\text{O } [4 \text{ }^\circ\text{C}]$
$= 10,332\,56 \text{ m H}_2\text{O } [4 \text{ }^\circ\text{C}]$	
$1 \text{ torr} = 1 \text{ mm Hg } [0 \text{ }^\circ\text{C}]$	
$1 \text{ mm Hg } [0 \text{ }^\circ\text{C}] = 0,133\,322 \text{ kPa}$	$1 \text{ in Hg } [0 \text{ }^\circ\text{C}] = 0,491\,15 \text{ lbf/in}^2$
$1 \text{ m H}_2\text{O } [4 \text{ }^\circ\text{C}] = 9,806\,38 \text{ kPa}$	$1 \text{ in H}_2\text{O } [4 \text{ }^\circ\text{C}] = 0,0361\,26 \text{ lbf/in}^2$

Quantidade de movimento (*mV*)

$1 \text{ kg-m/s} = 7,232\,94 \text{ lbm-ft/s}$	$1 \text{ lbm-ft/s} = 0,138\,256 \text{ kg-m/s}$
$= 0,224\,809 \text{ lbf-s}$	

Temperatura (*T*)

$1 \text{ K} = 1 \text{ }^\circ\text{C} = 1,8 \text{ R} = 1,8 \text{ F}$	$1 \text{ R} = (5/9) \text{ K}$
$\text{TC} = \text{TK} - 273,15$	$\text{TF} = \text{TR} - 459,67$
$= (\text{TF} - 32)/1,8$	$= 1,8 \text{ TC} + 32$
$\text{TK} = \text{TR}/1,8$	$\text{TR} = 1,8 \text{ TK}$

Velocidade (*V*)

$1 \text{ m/s} = 3,6 \text{ km/h}$	$1 \text{ ft/s} = 0,681\,818 \text{ mi/h}$
$= 3,280\,84 \text{ ft/s}$	$= 0,3048 \text{ m/s}$
$= 2,236\,94 \text{ mi/h}$	$= 1,097\,28 \text{ km/h}$
$1 \text{ km/h} = 0,277\,78 \text{ m/s}$	$1 \text{ mi/h} = 1,466\,67 \text{ ft/s}$
$= 0,911\,34 \text{ ft/s}$	$= 0,447\,04 \text{ m/s}$
$= 0,621\,37 \text{ mi/h}$	$= 1,609\,344 \text{ km/h}$

Volume específico (*V*)

$1 \text{ cm}^3/\text{g} = 0,001 \text{ m}^3/\text{kg}$	
$1 \text{ cm}^3/\text{g} = 1 \text{ L/kg}$	
$1 \text{ m}^3/\text{kg} = 161\,846 \text{ ft}^3/\text{lbm}$	$1 \text{ ft}^3/\text{lbm} = 0,062\,428 \text{ m}^3/\text{kg}$

Volume (*V*)

$1 \text{ m}^3 = 35,3147 \text{ ft}^3$	$1 \text{ ft}^3 = 2,831\,685 \times 10^{-2} \text{ m}^3$
$1 \text{ L} = 1 \text{ dm}^3 = 0,001 \text{ m}^3$	$1 \text{ in.}^3 = 1,6387 \times 10^{-5} \text{ m}^3$
$1 \text{ Gal (US)} = 3,785\,412 \text{ L}$	$1 \text{ Gal (UK)} = 4,546\,090 \text{ L}$
$= 3,785\,412 \times 10^{-3} \text{ m}^3$	$1 \text{ Gal (US)} = 231,00 \text{ in.}^3$