2.51 Intermediate Heat and Mass Transfer

Fall 2008

Table 2: Selected Conversion Factors

Dimension	SI	=	multiplier	×	Other Unit
Density	kg/m^3	=	16.018	×	lbm/ft^3
	kg/m^3	=	10^3	×	g/cm^3
Diffusivity (α, ν, $\mathcal{D}$)	m^2/s	=	0.092903	×	ft^2/s
	m^2/s	=	10^{-6}	×	centistokes
Energy	J	=	1055.04	×	Btu[a]
	J	=	4.1868	×	cal[b]
Flow rate	m^3/s	=	6.3090×10^{-5}	×	gal/min (gpm)
	m^3/s	=	4.7195×10^{-4}	×	ft^3/min (cfm)
Heat flux	W/m^2	=	3.154	×	$Btu/hr\cdot ft^2$
Heat transfer coefficient	W/m^2K	=	5.6786	×	$Btu/hr\cdot ft^2\cdot°F$
Length	m	=	0.0254	×	inches
	m	=	0.3048	×	feet
Power	W	=	0.022597	×	ft·lbf/min
	W	=	0.29307	×	Btu/hr
	W	=	745.700	×	hp
Pressure	Pa	=	248.8	×	inH_2O (@60°F)
	Pa	=	6894.8	×	psi
	Pa	=	101325	×	atm
Specific heat capacity	$J/kg\cdot K$	=	4186.9	×	$Btu/lbm\cdot°F$
	$J/kg\cdot K$	=	4186.8	×	$cal/g\cdot°C$
Temperature	K	=	5/9	×	°R
	K	=	°C + 273.15		
	K	=	(°F + 459.67)/1.8		
Thermal conductivity	$W/m\cdot K$	=	1.7307	×	$Btu/hr\cdot ft°F$
	$W/m\cdot K$	=	418.68	×	$cal/s\cdot cm°C$
Viscosity (dynamic)	$Pa\cdot s$	=	10^{-3}	×	centipoise
	$Pa\cdot s$	=	1.4881	×	$lbm/ft\cdot s$
	$Pa\cdot s$	=	47.8803	×	$lbf\cdot s/ft^2$

[a] The British thermal unit, originally defined as the heat that raises 1 lbm of water 1°F, has several values that depend mainly on the initial temperature of the water warmed. The above is the International Table (*i.e.*, steam table) Btu. A "mean" Btu of 1055.87 J is also common. Related quantities are: 1 therm = 10^5 Btu; 1 quad = 10^{15} Btu ≈ 1 EJ; 1 ton of refrigeration = 12,000 Btu/hr absorbed.

[b] The calorie represents the heat that raises 1 g of water 1°C. The above is the International Table calorie, or IT calorie. A "thermochemical" calorie of 4.184 J has also been common. The dietitian's "Calorie" is actually 1 kilocalorie.