USEFUL CONVERSIONS OF UNITS

Physical quantity	Given in ⟶ Gives ⟵	Multiplied by ⟶ Divided by ⟵	Gives Given in	Approximate or useful relationship
Length	ft	0.3048	m	$3\frac{1}{4}$ ft ≈ 1 m
	in	25.4 (exact)	mm	1 in ≈ 25 mm
	mil	0.0254	mm	
	yard	0.9144	m	
	mile (mi)	1609.3	m	1 mi ≈ 1.6 km
	km	0.621388	mi	
Area	ft^2	0.092903	m^2	100 ft^2 ≈ 9 m^2
	in^2	645.16	mm^2	1 in^2 ≈ 650 mm^2
	acre	4047.0	m^2	
Volume	ft^3	0.028317	m^3	35 ft^3 ≈ 1 m^3
	U.S. gal	0.003785	m^3	260 gal ≈ 1 m^3
	U.S. gal	3.785	liter (L)	1 gal ≈ $3\frac{3}{4}$ L
	L (liter)	0.2642	U.S. gal	1 L ≈ 0.26 gal
	Brit. gal	0.004546	m^3	
	U.S. gal	0.13368	ft^3	
	barrel (U.S. pet.)	0.15898	m^3	
	barrel (U.S. pet.)	42	U.S. gal	
Velocity	ft/s[a]	0.3048	m/s	10 ft/s ≈ 3 m/s
	m/s	3.2808	ft/s	
	ft/min	0.00508	m/s	100 ft/min ≈ 0.5 m/s
	mi/h	1.6093	km/h	30 mi/h ≈ 48 km/h
	km/h	0.6214	mi/h	50 km/h ≈ 31 mi/h
	knots	1.852	km/h	
Mass	lb_m	0.45359	kg	1 lb_m ≈ .45 kg
	kg	2.2046	lb_m	1 kg ≈ 2.2 lb_m
	metric ton	2204.6	lb_m	metric ton = 10^3 kg
	ton (2000 lb_m)	907.18	kg	

Reprinted from International System of Units (SI), J. Taborek, in Heat Exchanger Design Handbook, pp. xxvii–xxix, Hemisphere, Washington, D.C., 1984.

Physical quantity	Given in ⟶ Gives ⟵	Multiplied by ⟶ Divided by ⟵	Gives Given in	Approximate or useful relationship
Force	lb_f	4.44822	N = kg m/s^2	
	lb_f	0.45359	kg_f	1 N ≈ 0.1 kg_f
	kg_f	2.2046	lb_f	≈ 0.22 lb_f
	kg_f	9.80665	N	
	dyne	0.00001 (exact)	N	
Amount of substance	lb_m-mol	453.6	kmol	
	g-mol	1.000	mol	
	kg-mol	1.000	kmol	
	mol	1000	kmol	
Mass flow rate	lb_m/h	0.0001260	kg/s	10^3 lb/h ≈ .13kg/s
	kg/s	7936.51	lb_m/h	
	lb_m/s	0.4536	kg/s	
	lb_m/min	0.00756	kg/s	
Volume flow rate	U.S. gal/min	6.309×10^{-5}	m^3/s	
	U.S. bbl/day	0.15899	m^3/day	
	U.S. bbl/day	1.84×10^{-6}	m^3/s	
	ft^3/s	0.02832	m^3/s	
	ft^3/min	0.000472	m^3/s	
Mass velocity (mass flux)	lb_m/h ft^2	1.356×10^{-3}	kg/s m^2	
	kg/s m^2	737.5	lb_m/h ft^2	
Energy (work)	Btu[b]	1055.056	J = N m = W s	1 Btu ≈ 1000 J
(heat)	Btu	0.2520	kcal	1 kcal ≈ 4 Btu
	Btu	778.28	ft lb_f	
	kcal	4186.8	J	1 kcal ≈ 4000 J
	ft lb_f	1.3558	J	
	W h	3600	J	
Power	Btu/h	0.2931	W = J/s	10^6 Btu/h ≈ 300 kW
	W	3.4118	Btu/h	
	kcal/h	1.163	W	
	ft lb_f/s	1.3558	W	1000 kW ≈ 3.5×10^6 Btu/h
	hp (metric)	735.5	W	
	Btu/h	0.2520	kcal/h	
	tons refrig.	3516.9	W	
Heat flux	Btu/h ft^2 ^{o}F	3.1546	W/m^2	1000 Btu/h ft^2 ≈ 3.2 kW/m^2
	W/m^2	0.317	Btu/h ft^2	
	kcal/cm^2 s ^{o}C	41.868	W/m^2	
Heat transfer coefficient	Btu/h ft^2 ^{o}F	5.6784	W/m^2 K	1000 Btu/h ft^2 ^{o}F ≈ 5600 W/m^2 K
	W/m^2 K	0.1761	Btu/h ft^2 ^{o}F	
	kcal/cm^2 s ^{o}C	41.868	W/m^2 K	
Heat transfer resistance	(Btu/h ft^2 ^{o}F)$^{-1}$	0.1761	(W/m^2 K)$^{-1}$	0.001 (Btu/h ft^2 ^{o}F)$^{-1}$ ≈ 0.00018 (W/m^2 K)$^{-1}$
	(W/m^2 K)$^{-1}$	0.6784	(Btu/h ft^2 ^{o}F)$^{-1}$	

Physical quantity	Given in ⟶ / Gives ⟵	Multiplied by ⟶ / Divided by ⟵	Gives / Given in	Approximate or useful relationship
Pressure	lb_f/in^2 (psi)	6.8948	kN/m^2 = kPa	1 psi ≈ 7 kPa
	kPa	0.1450	psi	14.5 psi ≈ 100 kPa
	bar	100	kPa	
	lb_f/ft^2	0.0479	kPa	
	mm Hg (torr)	0.1333	kPa	1000 kPa = 1 MPa ≈
	in Hg	3.3866	kPa	150 psi
	mm H_2O	9.8067	Pa	
	in H_2O	249.09	Pa	1 in H_2O ≈ .25 kPa
	at (kg_f/cm^2)	98.0665	kPa	
	atm (normal)	101.325	kPa	atm = 760 mm Hg
Mass flux	lb_m/ft^2 s	4.8824	kg/m^2 s	
	lb_m/ft^2 h	0.001356	kg/m^2 s	
Physical and Transport Properties				
Thermal conductivity	Btu/ft h°F	1.7308	W/m K	steel ≈ 50 W/m K
	W/m K	0.5778	Btu/ft h°F	water (20°C) ≈ 0.6 W/m K
	kcal/m h°C	1.163	W/m K	air (STP) ≈ 24 mW/m K
Density	lb_m/ft^3	16.0185	kg/m^3	62.4 lb_m/ft^3 ≈ 1000 kg/m^3
	kg/m^3	0.06243	lb_m/ft^3	
	lb_m/U.S. gal	119.7	kg/m^3	
Specific heat capacity	Btu/lb_m °F	4186.8	J/kg K	1 Btu/lb_m °F ≈ 4.2
	kcal/kg °C	4186.8	J/kg K	kJ/kg K
Enthalpy	Btu/lb_m	2326	J/kg	
	kcal/kg_m	4186.8	J/kg	
Dynamic (absolute) viscosity	centipoise (cP)	0.001	kg/m s	kg/m s = N s/m^2 = Pa s
	poise (P)	0.1	Pa s	
	cP	1.000	mPa s	
	cP	1000	μPa s	water (1000°C), 0.31 cP
	lb_m/ft h	0.0004134	Pa s	
	lb_m/ft h	0.4134	cP	
	cP	2.4189	lb_m/ft h	air (100°C), 0.021 cP
	lb_m/ft s	1.4482	Pa s	
Kinematic viscosity	stoke (St), cm^2 s	0.0001	m^2/s	
	centistoke (cSt)	10^{-6}	m^2/s	
	ft^2/s	0.092903	m^2/s	
Diffusivity	ft^2/s	0.092903	m^2/s	
Thermal diffusiivity	m^2/h	0.0002778	m^2/s	
	ft^2/s	0.092903	m^2/s	
	ft^2/h	25.81×10^{-6}	m^2/s	
Surface tension	dyne/cm	0.001	N/m	
	dyne/cm	$6.852\ 10^{-5}$	lb_f/ft	
	lb_f/ft	14.954	N/m	

Temperature relations:	$^{o}C = \frac{5}{9}[^{o}F - 32]$	$^{o}C = (^{o}F + 40)\frac{5}{9} - 40$	$\Delta T(^{o}C) = \frac{9}{5}\Delta T(^{o}F)$	$mK = {}^{o}C + 273.15$
	$^{o}F = \frac{9}{5}(^{o}C) + 32$	$^{o}F = (^{o}C + 40)\frac{9}{5} - 40$	$\Delta T(^{o}F) = \frac{5}{9}\Delta t(^{o}C)$	$R = {}^{o}F + 459.67$

Miscellaneous:	Acceleration of gravity (standard):	$g = 9.80665\ m/s^2$
	Gas constant:	$R = 8314.3\ m\ N/K\ kmol$
	Stefan–Boltzmann constant:	$5.6697 \times 10^{-8}\ W/m^2\ K^4$
		$1.714 \times 10^{-9}\ Btu/ft^2\ h\ R^4$

[a]Even though the abbreviations s and h were introduced only with the SI, they are used here throughout for consistency.

[b]The calorie and Btu are based on the International Standard Table values. The thermochemical calorie equals 4.184 J (exact) and is used in some older texts.