FACTORS FOR UNIT CONVERSIONS

Quantity	Equivalent Values
Mass	1 kg = 1000 g =2.20462 lb_m 1 lb_m = 16 oz =453.593 g = 0.453595 kg
Length	1 m = 100 cm = 1000 mm = 10^6 microns (μm) = 39.37 in. = 3.2808 ft = 1.0936 yd = 0.0006214 mile 1 ft = 12 in. = 1/3 yd = 0.3048 m = 30.48 cm
Volume	1 m^3 = 1000 L = 10^6 cm^3 = 10^6 mL = 35.3145 ft^3 = 264.17 gal = 1056.68 qt 1 ft^3 = 1728 $in.^3$ = 7.4805 gal = 0.028317 m^3 = 28.317 L = 28317 cm^3
Force	1 N = 1 $(\text{kg m})/\text{s}^2$ = 10^5 dynes = $10^5(\text{g cm})/\text{s}^2$ = 0.22481 lb_f 1 lb_f = $32.174(\text{lb}_m\text{ft})/\text{s}^2$ = 4.4482 N = 4.4482×10^5 dynes
Pressure	1 atm = 1.01325×10^5 N/m^2 = 1.01325×10^5 Pa =101.325 kPa = 1.01325 bars = 760 mm Hg at 0°C = 760 torr = 10.333 m H_2O at 4°C = 14.696 $lb_f/in.^2$ = 14.696 psi = 33.9 ft H_2O at 4°C = 29.921 in. Hg at 0°C
Energy	1 J = 1 N m = 10^7 ergs = 10^7 dyne cm = 2.778×10^{-7} kW h = 0.23901 cal = 0.7376 ft lb_f = 9.486×10^{-4} Btu
Power	1 W = 1 J/s = 0.23901 cal/s = 0.7376 ft lb_f/s = 9.486×10^{-4} Btu/s = 1.341×10^{-3} hp
Temperature	$(T \text{ in } ^\circ\text{C}) = ((T \text{ in } ^\circ\text{F}) - 32^\circ\text{F})/(1.8\Delta^\circ\text{F}/\Delta^\circ\text{C})$ $(T \text{ in } ^\circ\text{F}) = (T \text{ in } ^\circ\text{C})(1.8\Delta^\circ\text{F}/\Delta^\circ\text{C}) + 32^\circ F$ $(T \text{ in K}) = (T \text{ in } ^\circ\text{C}) + 273.15$ $(T \text{ in R}) = (T \text{ in } ^\circ\text{F}) + 459.67$
Electric Current	(Ampere) 1 A
Frequency	(hertz) 1 Hz = 1 s^{-1}
Electric potential	(volt) 1 V = 1 W/A = 1 J/C
Electric resistance	(ohm) 1 Ω = V/A
Electric charge	(coulomb) 1 C = A s

Example: The factor to convert grams to lb_m is $\left(\frac{2.20462\ \text{lb}_m}{1000\ g}\right)$

Commonly Used SI Prefixes

Factor	Prefix	Symbol
10^{12}	tera	T
10^9	giga	G
10^6	mega	M
10^3	kilo	k
10^{-1}	deci	d
10^{-2}	centi	c
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	pico	p
10^{-15}	femto	f

lbs/day = MGD*mg/L * 8.34

1 ppm = 1 mg/L for aqueous solutions

zero order reaction $C = Co - kt$

Ist order reaction $\ln C = \ln Co - kt$ or $\ln\frac{c}{c0} = -kt$ or $\frac{C}{Co} = e^{-kt}$

Half life for 1st order reactions = 0.693 / k where k is reaction rate

Detention Time $t_d = V/Q$

First Order reactions

a) Batch Reactor $C = C_o e^{-kt}$ or $\ln(C/Co) = -kt$

b) CMFR $C = \frac{C_o}{1 + kt_d}$

c) For n identical (same V and td) CMFR

$$C_n = \frac{C_o}{(1 + kt_d)^n}$$

Tracer Flushing if tracer is mixed in the reactor and is being purged by a clean media $C = C_o e^{-t/td}$

Tracer Flushing if tracer is entering a reactor with clean media and is being purged out $C = C_o(1 - e^{-t/td})$

Area of a circle = $\pi d^2/4$ where d = diameter

7.48 Gallons = $1ft^3$ 3.78 L = 1 Gallon

Hydraulic loading = Q/Surface area of reactor

BOD_t = Ultimate BOD $(1-e^{-kt})$

$k_t = k_{20}\Theta^{T-20}$ Θ = 1.135 for 4-20°C and 1.056 for 20-30°C

Disinfection $N_t = N_o e^{-kt}$ where No initial bacteria concentration; Nt final bacteria concentration

Power $G^2 = P/\mu V$

Molecular Weights

C	12
H	1
O	16
N	14
Cl	35.5
S	32
Fe	56

GAS TRANSFER KINETICS

$\ln(C^*-C_t) = \ln(C^*-C_o) - K_La\ t$ where

C* = saturation concentration of oxygen in water (mass/volume)

C_t = oxygen concentration in water at ant time t (mass/volume)

K_La = gas transfer coefficient ($time^{-1}$)

t= time