SCI-123 Spring 2020

Fact Sheet: Equations, Constants, & Conversions

Equations

$^\circ\text{C} = \frac{5}{9}(^\circ\text{F} - 32)$	$\text{K} = {}^\circ\text{C} + 273$	$T = \alpha m_W \bar{v}^2$	$T(z) = T_s - \frac{6.5}{1000}z$
$\text{PE} = mgz$	$\text{KE} = \frac{1}{2}mv^2$	$E = \sigma T^4$	$\rho(z) = \rho_s e^{-z/8000}$
$\lambda_{max} = \frac{2897}{T}$	$\Delta Q = Cm\Delta T$	$\Delta Q = mL$	$P(z) = P_s e^{-z/8000}$
$P = 2.87\rho T$	$\frac{\Delta P}{\Delta z} = -\rho g$	$MR = \frac{m \text{ of } \text{H}_2\text{O}}{m \text{ of air}}$	$\theta = T\left(\frac{1000}{P}\right)^{0.2859}$
${}^*F_{pg} = \frac{1}{\rho}\frac{\Delta p}{\Delta d}$	${}^*F_{co} = 2\Omega v \sin\phi$	${}^*F_{cf} = \frac{v^2}{r}$	$T_e = T + \frac{L_v}{C_p}MR$
$D = \frac{\Delta u}{\Delta x} + \frac{\Delta v}{\Delta y}$	$\zeta_r = \frac{\Delta v}{\Delta x} - \frac{\Delta u}{\Delta y}$	$T_v = \frac{T}{1 - \frac{e}{P}(1-\epsilon)}$	$\theta_e = T_e\left(\frac{1000}{P}\right)^{0.2859}$

m = mass	g = gravitational accel.	z = height	v = velocity
T = temperature	λ = wavelength	ΔQ = change in energy	C = specific heat
P = pressure	ρ = density	F = force	α = thermal constant
Δd = change in location	L = latent heat	ϕ = latitude angle	r = radius of curvature
m_W = molecular weight	T_s = surface temperature	$\bar{v}$ = average velocity	ρ_s = surface density
P_s = surface pressure	ΔP = change in pressure	Δz = change in height	E = irradiance
θ = potential temp.	MR = mixing ratio	D = divergence	ζ_r = relative vorticity
PE = potential energy	KE = kinetic energy	T_e = eqivalent temp.	θ_e = equiv. pot. temp.
		T_v = virtual temp.	e = vapor pressure

* - The forces F_{pg}, F_{co}, and F_{cf} are per one unit of mass.

General Constants

$\sigma = 5.67 \times 10^{-8}$ W/(m^2 K^4)

C of dry air = 0.24 cal/(gram °C)

$g = 9.8$ m/sec^2

$\alpha = 4.0 \times 10^{-5}$ K sec^2/m^2

$\Omega = 7.29 \times 10^{-5}$ radians/sec

density of air (surface) = 1.22 kg/m^3

Solar Constant = 1367 W/m^2

Earth radius = 6378 km

Water Related Constants

latent heat (L) of fusion = 80 cal/gram

density of liquid water = 1 gram/cm^3

specific heat (C) of ice = 0.50 cal/(gram °C)

latent heat (L) of evaporation = 600 cal/gram

specific heat (C) of pure water = 1 cal/(gram °C)

$\epsilon = \mathcal{R}_d/\mathcal{R}_v = 0.622$

Conversions

1 m/sec	=	2.22 mi/hr	1 N	=	1 kg · m/sec^2	1 knot	=	1.15 mi/hr
1 kg	=	2.2 lb	1 mb	=	100 N/m^2	1 J	=	1 N·m
1 cal	=	4.186 J	1 W	=	1 J/sec	1 Pa	=	1 N/m^2
1 m	=	3.28 ft	1 in	=	2.54 cm			