

Fact Sheet: Equations, Constants, & Conversions

Equations

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

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|---------------------------------|---------------------------------|-------------------------------|--------------------------------|
| 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 = equivalent 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

$\sigma = 5.67 \times 10^{-8} \text{ W}/(\text{m}^2 \text{ K}^4)$	$\Omega = 7.29 \times 10^{-5} \text{ radians}/\text{sec}$
C of dry air = 0.24 cal/(gram $^{\circ}\text{C}$)	density of air (surface) = 1.22 kg/m ³
$g = 9.8 \text{ m}/\text{sec}^2$	Solar Constant = 1367 W/m ²
$\alpha = 4.0 \times 10^{-5} \text{ K sec}^2/\text{m}^2$	Earth radius = 6378 km

Water Related Constants

latent heat (L) of fusion = 80 cal/gram	latent heat (L) of evaporation = 600 cal/gram
density of liquid water = 1 gram/cm ³	specific heat (C) of pure water = 1 cal/(gram $^{\circ}\text{C}$)
specific heat (C) of ice = 0.50 cal/(gram $^{\circ}\text{C}$)	$\epsilon = \mathcal{R}_d/\mathcal{R}_v = 0.622$

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	1 mi = 1609.3 m