

Metric System Review

Mass: 1 kg = 1000 g

Length: 1 m = 100 cm = 10^{-3} km

Force: 1 dyne = $1 \frac{\text{g cm}}{\text{s}^2} = 10^{-5}$ N

1 Newton (N) = $1 \frac{\text{kg m}}{\text{s}^2} = 10^5$ dynes

Energy: 1 Joule (J) = 1 N m = 10^7 erg = 0.239 cal

(1 cal = 4.186 J)

Pressure: 1 bar = $10^6 \frac{\text{dynes}}{\text{cm}^2} = 10^6 \frac{\text{g}}{\text{cm sec}^2} = 1000 \text{ mb} = 10^5 \text{ Pa}$

1 millibar (mb) = $10^{-3} \text{ bar} = 10^3 \frac{\text{dynes}}{\text{cm}^2} = 10^3 \frac{\text{g}}{\text{cm s}^2} = 100 \text{ Pa} = 1 \text{ hectoPascal (hPa)}$

1 Pascal (Pa) = $1 \frac{\text{N}}{\text{m}^2} = 1 \frac{\text{kg}}{\text{m s}^2} = 10 \frac{\text{dynes}}{\text{cm}^2} = 10^{-5} \text{ bar} = 10^{-2} \text{ mb} = 10^{-2} \text{ hPa}$

Density: $1 \frac{\text{kg}}{\text{m}^3} = 10^{-3} \frac{\text{g}}{\text{cm}^3}$

Power: 1 Watt (W) = $1 \frac{\text{J}}{\text{s}}$

Useful Conversions

1° latitude = 60 nautical miles (n.mi.) = 69.1 statute miles (mi.) = 111.1 km 1 knot = 1 n.mi./hr

1 atmosphere (atm) = 1013.25 mb = 101325 Pa = 76 cm Hg = 29.92 in Hg

$T(^{\circ}\text{F}) = 1.8 T(^{\circ}\text{C}) + 32$

$T(^{\circ}\text{C}) = 5/9 (T(^{\circ}\text{F}) - 32)$

$T(\text{K}) = T(^{\circ}\text{C}) + 273.15$

Useful Equations

Gas law

$$p = \rho RT$$

$$R_d = 287.0 \frac{\text{J}}{\text{kg K}}$$

$$p = \rho R_d T_v$$

$$R_v = 461.5 \frac{\text{J}}{\text{kg K}}$$

Virtual temperature

$$T_v = T (1 + 0.608 w)$$

Hydrostatic equation

$$\frac{dp}{dz} = -\rho g$$

$$g_0 = 9.81 \text{ m s}^{-2}$$

Hypsometric equation

$$Z_2 - Z_1 = \frac{R_d \bar{T}_v}{g} \ln \left(\frac{p_1}{p_2} \right)$$

Poisson's equation

$$\theta = T \left(\frac{p_0}{p} \right)^{\frac{R}{c_p}}$$

$$c_p = 1004 \frac{\text{J}}{\text{kg K}}$$

$$p_0 = 1000 \text{ mb}$$