

US Standard Atmosphere, 1976

As published by NOAA, NASA, and USAF

The standard atmosphere is mathematically defined in six layers from sea level to 71 km.

Layer	Name	Lower Altitude (km)	Upper Altitude (km)	Upper Altitude (ft)
1	Troposphere	0	11	36,089
2	Stratosphere	11	20	65,618
3	-	20	32	104,987
4	-	32	47	154,199
5	-	47	51	167,323
6	Mesosphere	51	71	232,940

h = altitude above sea level in feet or meters.

T_0 = Absolute temperature at sea level = 288.15 K = 518.67 R (or 15° C = 59° F)

ρ_0 = Density of air at sea level = 1.225 kg/m³ = 0.07648 lb/ft³ = 0.0023769 slug/ft³

P_0 = Standard air pressure at sea level = 1 Atm = 101325 N/m² = 2116.2 lb/ft² = 14.696 lb/in² = 29.921 in of Hg

#	Altitudes	English Units	Metric Units
		Temperature (R)	(K)
		Density (slug/ft ³)	(kg/m ³)

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		Pressure (lb/ft ²)	(N/m ²)
	h is measured in:	feet	meters
1	11 km	$T = T_0 (1 - h / 145442 \text{ ft})$ $r = r_0 (1 - h / 145442 \text{ ft})^{4.255876}$ $P = P_0 (1 - h / 145442 \text{ ft})^{5.255876}$	$T = T_0 (1 - h / 44329 \text{ m})$ $r = r_0 (1 - h / 44329 \text{ m})^{4.255876}$ $P = P_0 (1 - h / 44329 \text{ m})^{5.255876}$
2	20 km	$T = T_0 (0.751865)$ $r = r_0 (0.297076)e^{((36089-h)/20806)}$ $P = P_0 (0.223361)e^{((36089-h)/20806)}$	$T = T_0 (0.751865)$ $r = r_0 (0.297076)e^{((10999-h)/6341.4)}$ $P = P_0 (0.223361)e^{((10999-h)/6341.4)}$
3	32 km	$T = T_0 (0.682457 + h/945374)$ $r = r_0 (0.978261 + h/659515)^{-35.16319}$ $P = P_0 (0.988626 + h/652600)^{-34.16319}$	$T = T_0 (0.682457 + h/288136)$ $r = r_0 (0.978261 + h/201010)^{-35.16319}$ $P = P_0 (0.988626 + h/198903)^{-34.16319}$
4	47 km	$T = T_0 (0.482561 + h/337634)$ $r = r_0 (0.857003 + h/190115)^{-13.20114}$ $P = P_0 (0.898309 + h/181373)^{-12.20114}$	$T = T_0 (0.482561 + h/102906)$ $r = r_0 (0.857003 + h/57944)^{-13.20114}$ $P = P_0 (0.898309 + h/55280)^{-12.20114}$

5	51 km	$T = T_0 (0.939268)$ $r = r_0 (0.00116533)e^{((154200-h)/25992)}$ $P = P_0 (0.00109456)e^{((154200-h)/25992)}$	$T = T_0 (0.939268)$ $r = r_0 (0.00116533)e^{((46998-h)/7922)}$ $P = P_0 (0.00109456)e^{((46998-h)/7922)}$
6	71 km	$T = T_0 (1.434843 - h/337634)$ $r = r_0 (0.79899 - h/606330)^{11.20114}$ $P = P_0 (0.838263 - h/577922)^{12.20114}$	$T = T_0 (1.434843 - h/102906)$ $r = r_0 (0.79899 - h/184800)^{11.20114}$ $P = P_0 (0.838263 - h/176142)^{12.20114}$

Conversion factors:

Length: 1 m = 3.281 ft

Temperature: R = 1.8 K K = °C + 273.16 R = °F + 491.69 °F = 1.8 °C + 32

Density: 1 slug/ft³ = 515.38 kg/m³

Pressure: 1 lb/ft² = 47.88 N/m²