



Engineering ToolBox - Resources, Tools and Basic Information for Engineering and Design of Technical Applications!

## U.S. Standard Atmosphere vs. Altitude

### Properties of the US standard atmosphere ranging -5000 to 250000 ft altitude.

A "Standard Atmosphere" can be regarded as an average pressure, temperature and air density for various altitudes.

The "*U.S. Standard Atmosphere 1976*" is an atmospheric model of how the pressure, temperature, density, and viscosity of the Earth's atmosphere changes with altitude. It is defined as having a temperature of 288.15 K (15 °C, 59 °F) at the sea level 0 km geo-potential height and 101325 Pa (1013.25 hPa, 1013.25 mbar, 760 mm Hg, 29.92 in Hg).

The atmosphere are divided in

- the **Troposphere** - ranging 0 to 11 km (36.000 ft) altitude
- the **Stratosphere** - ranging 11 to 51 km (167.000 ft) altitude
- the **Mesosphere** - ranging 51 to 71 km (232.000 ft) altitude
- the **Ionosphere** - ranging above 71 km (above 232.000 ft) altitude

### U.S. Standard Atmosphere Air Properties - Imperial (BG) Units

Geo-potential Altitude above Sea Level - <i>h</i> - (ft)	Temperature - <i>t</i> - (°F)	Acceleration of Gravity - <i>g</i> - (ft/s <sup>2</sup> )	Absolute Pressure - <i>p</i> - (lb/in <sup>2</sup> )	Density - <i>ρ</i> - (10 <sup>-4</sup> <b>slugs</b> /ft <sup>3</sup> ) (lbs/ft <sup>3</sup> )	Dynamic Viscosity - <i>μ</i> - (10 <sup>-7</sup> lb s/ft <sup>2</sup> ) (10 <sup>-7</sup> slug /(ft s))
-5000	76.84	32.189	17.554	27.45	3.836
0	59	32.174	14.696	23.77	3.737
5000	41.17	32.159	12.228	20.48	3.637
10000	23.36	32.143	10.108	17.56	3.534
15000	5.55	32.128	8.297	14.96	3.430
20000	-12.26	32.112	6.759	12.67	3.324
25000	-30.05	32.097	5.461	10.66	3.217
30000	-47.83	32.082	4.373	8.91	3.107
35000	-65.61	32.066	3.468	7.38	2.995
40000	-69.70	32.051	2.730	5.87	2.969
45000	-69.70	32.036	2.149	4.62	2.969
50000	-69.70	32.020	1.692	3.64	2.969
60000	-69.70	31.990	1.049	2.26	2.969
70000	-67.42	31.959	0.651	1.39	2.984
80000	-61.98	31.929	0.406	0.86	3.018
90000	-56.54	31.897	0.255	0.56	3.052
100000	-51.10	31.868	0.162	0.33	3.087
150000	19.40	31.717	0.020	0.037	3.511

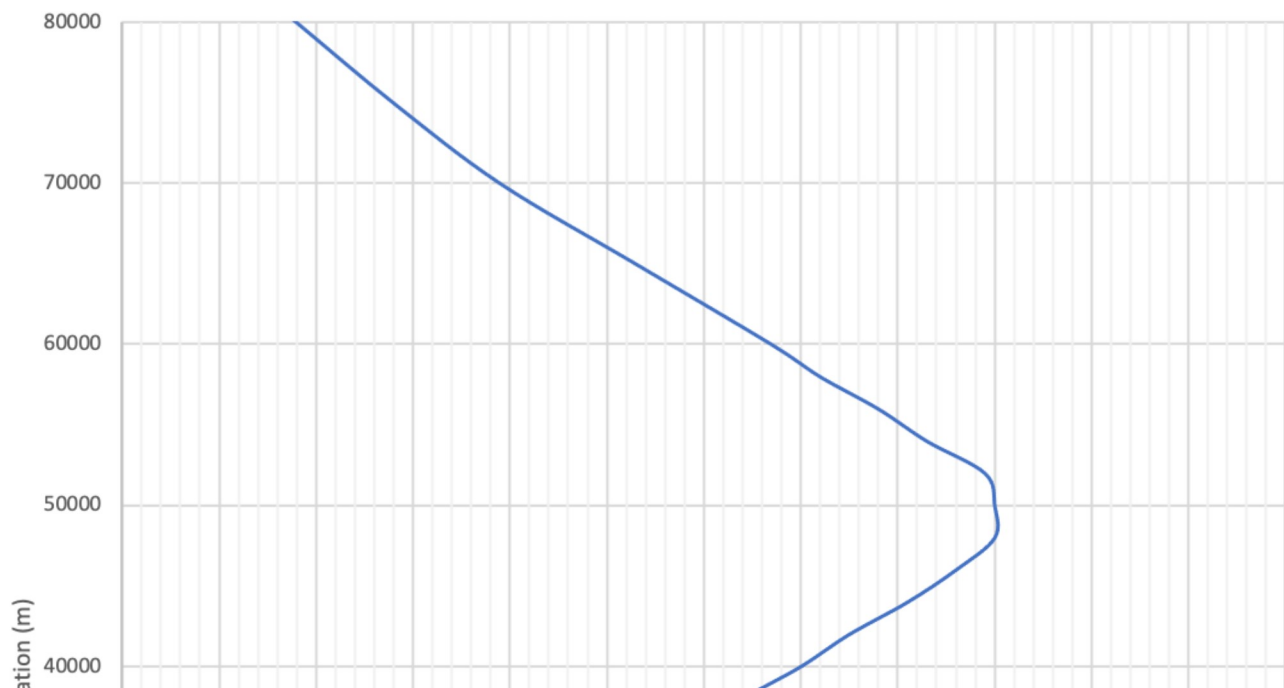
Geo-potential Altitude above Sea Level - <i>h</i> - (ft)	Temperature - <i>t</i> - (°F)	Acceleration of Gravity - <i>g</i> - (ft/s <sup>2</sup> )	Absolute Pressure - <i>p</i> - (lb/in <sup>2</sup> )	Density - <i>ρ</i> - (10 <sup>-4</sup> <b>slugs</b> /ft <sup>3</sup> ) (lbs/ft <sup>3</sup> )	Dynamic Viscosity - <i>μ</i> - (10 <sup>-7</sup> lb s/ft <sup>2</sup> ) (10 <sup>-7</sup> slug /(ft s))
200000	-19.78	31.566	0.003	0.0053	3.279
250000	-88.77	31.415	0.000	0.00065	2.846

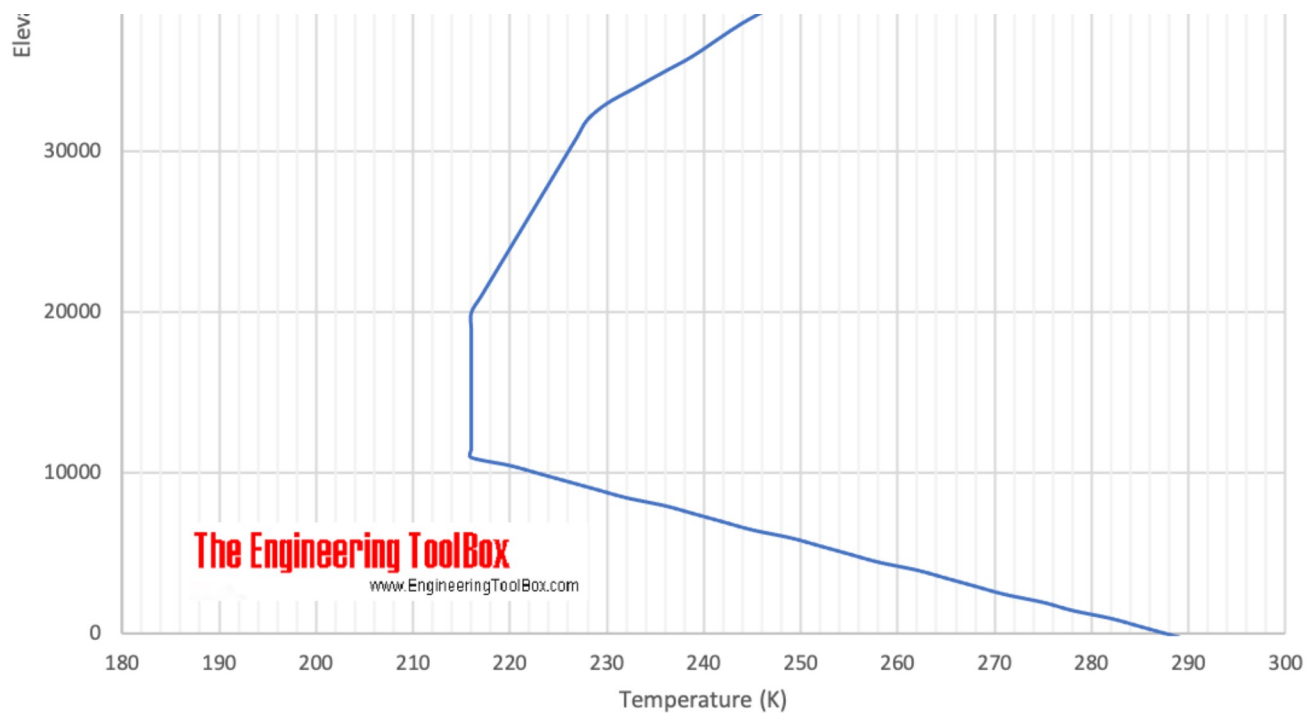
## U.S. Standard Atmosphere Air Properties - SI Units

Geo potential Altitude above Sea Level - <i>h</i> - (m)	Temperature - <i>t</i> - (°C)	Acceleration of Gravity - <i>g</i> - (m/s <sup>2</sup> )	Absolute Pressure - <i>p</i> - (10 <sup>4</sup> N/m <sup>2</sup> )	Density - <i>ρ</i> - (kg/m <sup>3</sup> )	Dynamic Viscosity - <i>μ</i> - (10 <sup>-5</sup> N s/m <sup>2</sup> )
-1000	21.50	9.810	11.39	1.347	1.821
0	15.00	9.807	10.13	1.225	1.789
1000	8.50	9.804	8.988	1.112	1.758
2000	2.00	9.801	7.950	1.007	1.726
3000	-4.49	9.797	7.012	0.9093	1.694
4000	-10.98	9.794	6.166	0.8194	1.661
5000	-17.47	9.791	5.405	0.7364	1.628
6000	-23.96	9.788	4.722	0.6601	1.595
7000	-30.45	9.785	4.111	0.5900	1.561
8000	-36.94	9.782	3.565	0.5258	1.527
9000	-43.42	9.779	3.080	0.4671	1.493
10000	-49.90	9.776	2.650	0.4135	1.458
15000	-56.50	9.761	1.211	0.1948	1.422
20000	-56.50	9.745	0.5529	0.08891	1.422
25000	-51.60	9.730	0.2549	0.04008	1.448
30000	-46.64	9.715	0.1197	0.01841	1.475
40000	-22.80	9.684	0.0287	0.003996	1.601
50000	-2.5	9.654	0.007978	0.001027	1.704
60000	-26.13	9.624	0.002196	0.0003097	1.584
70000	-53.57	9.594	0.00052	0.00008283	1.438
80000	-74.51	9.564	0.00011	0.00001846	1.321

## US Atmosphere - Temperature vs. Elevation

US. Standard Atmosphere  
Temperature vs. Elevation





## Related Topics

- [Material Properties](#)

Material properties of gases, fluids and solids - densities, specific heats, viscosities and more.

## Related Documents

- [Air - Composition and Molecular Weight](#)

Dry air is a mechanical mixture of nitrogen, oxygen, argon and several other gases in minor amounts.

- [Air - Density and Specific Volume vs. Altitude](#)

Density and specific volume of air varies with elevation above sea level.

- [Air - Density, Specific Weight and Thermal Expansion Coefficient vs. Temperature and Pressure](#)

Online calculator, figures and tables showing density, specific weight and thermal expansion coefficients of air at temperatures ranging -100 to 1600 °C (-140 to 2900 °F) at atmospheric and higher pressure - Imperial and SI Units.

- [Air - Specific Heat vs. Pressure at Constant Temperature](#)

Figures and tables with isobaric ( $C_p$ ) and isochoric ( $C_v$ ) specific heat of air at constant temperature and pressure ranging 0.01 to 10000 bara.

- [Air - Speed of Sound vs. Temperature](#)

Speed of sound in air at standard atmospheric pressure with temperatures ranging -40 to 1000°C (-40 to 1500°F) - Imperial and SI Units.

- [Air - Thermal Conductivity vs. Temperature and Pressure](#)

Online calculator with figures and tables showing air thermal conductivity vs. temperature and pressure. SI and imperial units.

- [Air Temperature, Pressure and Density vs. Altitude](#)

Elevation above sea level and air temperature, pressure and density.

- [Atmospheric Pressure vs. Elevation above Sea Level](#)

Elevation above sea level - in feet and meter - with barometric and atmospheric pressure - *inches mercury, psia, kg/cm<sup>2</sup> and kPa*.

- **Barometer - Altitude Compensation**

Elevation compensating manometer.

- **Barometric Pressure - Pressure in psi, psf and kPa**

Convert between barometric pressure inches Hg, psi and psf.

- **Dry Air and Water Vapor - Density and Specific Volume vs. Temperature - Imperial Units**

Density and specific volume of dry air and water vapor at temperatures ranging 225 to 900 degF (107 to 482 degC).

- **Elevation - Temperature, Pressure and Speed of Sound**

Altitude and speed of sound, temperature and pressure.

- **International Standard Atmosphere**

International standard atmosphere in elevation -2000 to 30000 metre - pressure, temperature, density, viscosity, thermal conductivity and velocity of sound.

- **Pressure**

Introduction to pressure - online pressure units converter.

- **STP - Standard Temperature and Pressure and NTP - Normal Temperature and Pressure**

The definition of STP - Standard Temperature and Pressure and NTP - Normal Temperature and Pressure.

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