# A

# International Standard Atmosphere (ISA) Table

**Table A.1** International Standard Atmosphere (ISA) (determined as a function of geopotential height, measured in feet)

| ***H*** **(ft)** | ***H*** **(m)** | $\theta$ | ***T*** **(K)** | ***T*** **(°C)** | $\delta$ | ***p*** **(N/m²)** | ***p*** **(lb/ft²)** | $\sigma$ | $\rho$ **(kg/m³)** | $\rho$ **(slug/ft³)** | ***a*** **(m/s)** | ***a*** **(ft/s)** | ***a*** **(kt)** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **−2000** | **−609.6** | **1.0138** | **292.11** | **18.96** | **1.0744** | **108866** | **2273.7** | **1.0598** | **1.2983** | **2.519E-3** | **342.6** | **1124** | **666.0** |
| −1800 | −548.6 | 1.0124 | 291.72 | 18.57 | 1.0668 | 108092 | 2257.5 | 1.0537 | 1.2908 | 2.505E-3 | 342.4 | 1123 | 665.6 |
| −1600 | −487.7 | 1.0110 | 291.32 | 18.17 | 1.0592 | 107322 | 2241.5 | 1.0477 | 1.2834 | 2.490E-3 | 342.2 | 1123 | 665.1 |
| −1400 | −426.7 | 1.0096 | 290.92 | 17.77 | 1.0516 | 106557 | 2225.5 | 1.0416 | 1.2760 | 2.476E-3 | 341.9 | 1122 | 664.7 |
| −1200 | **−365.8** | 1.0083 | 290.53 | 17.38 | 1.0441 | 105797 | 2209.6 | 1.0356 | 1.2686 | 2.461E-3 | 341.7 | 1121 | 664.2 |
| **−1000** | **−304.8** | **1.0069** | **290.13** | **16.98** | **1.0367** | **105041** | **2193.8** | **1.0296** | **1.2612** | **2.447E-3** | **341.5** | **1120** | **663.7** |
| −800 | −243.8 | 1.0055 | 289.73 | 16.58 | 1.0293 | 104289 | 2178.1 | 1.0236 | 1.2539 | 2.433E-3 | 341.2 | 1120 | 663.3 |
| −600 | −182.9 | 1.0041 | 289.34 | 16.19 | 1.0219 | 103541 | 2162.5 | 1.0177 | 1.2467 | 2.419E-3 | 341.0 | 1119 | 662.8 |
| −400 | −121.9 | 1.0028 | 288.94 | 15.79 | 1.0145 | 102798 | 2147.0 | 1.0118 | 1.2394 | 2.405E-3 | 340.8 | 1118 | 662.4 |
| −200 | −61.0 | 1.0014 | 288.55 | 15.40 | 1.0072 | 102059 | 2131.6 | 1.0059 | 1.2322 | 2.391E-3 | 340.5 | 1117 | 661.9 |
| **0** | **0.0** | **1.0000** | **288.15** | **15.00** | **1.0000** | **101325** | **2116.2** | **1.0000** | **1.2250** | **2.377E-3** | **340.3** | **1116** | **661.5** |
| 200 | 61.0 | 0.9986 | 287.75 | 14.60 | 0.9928 | 100595 | 2101.0 | 0.9942 | 1.2178 | 2.363E-3 | 340.1 | 1116 | 661.0 |
| 400 | 121.9 | 0.9972 | 287.36 | 14.21 | 0.9856 | 99869 | 2085.8 | 0.9883 | 1.2107 | 2.349E-3 | 339.8 | 1115 | 660.6 |
| 600 | 182.9 | 0.9959 | 286.96 | 13.81 | 0.9785 | 99147 | 2070.7 | 0.9826 | 1.2036 | 2.335E-3 | 339.6 | 1114 | 660.1 |
| 800 | 243.8 | 0.9945 | 286.57 | 13.42 | 0.9714 | 98430 | 2055.7 | 0.9768 | 1.1966 | 2.322E-3 | 339.4 | 1113 | 659.7 |
| **1000** | **304.8** | **0.9931** | **286.17** | **13.02** | **0.9644** | **97717** | **2040.9** | **0.9711** | **1.1896** | **2.308E-3** | **339.1** | **1113** | **659.2** |
| 1200 | 365.8 | 0.9917 | 285.77 | 12.62 | 0.9574 | 97008 | 2026.0 | 0.9654 | 1.1826 | 2.295E-3 | 338.9 | 1112 | 658.7 |
| 1400 | 426.7 | 0.9904 | 285.38 | 12.23 | 0.9504 | 96303 | 2011.3 | 0.9597 | 1.1756 | 2.281E-3 | 338.7 | 1111 | 658.3 |
| 1600 | 487.7 | 0.9890 | 284.98 | 11.83 | 0.9435 | 95602 | 1996.7 | 0.9540 | 1.1687 | 2.268E-3 | 338.4 | 1110 | 657.8 |
| 1800 | 548.6 | 0.9876 | 284.58 | 11.43 | 0.9366 | 94905 | 1982.1 | 0.9484 | 1.1618 | 2.254E-3 | 338.2 | 1110 | 657.4 |
| **2000** | **609.6** | **0.9862** | **284.19** | **11.04** | **0.9298** | **94213** | **1967.7** | **0.9428** | **1.1549** | **2.241E-3** | **337.9** | **1109** | **656.9** |
| 2200 | 670.6 | 0.9849 | 283.79 | 10.64 | 0.9230 | 93525 | 1953.3 | 0.9372 | 1.1481 | 2.228E-3 | 337.7 | 1108 | 656.5 |
| 2400 | 731.5 | 0.9835 | 283.40 | 10.25 | 0.9163 | 92840 | 1939.0 | 0.9316 | 1.1413 | 2.214E-3 | 337.5 | 1107 | 656.0 |
| 2600 | 792.5 | 0.9821 | 283.00 | 9.85 | 0.9095 | 92160 | 1924.8 | 0.9261 | 1.1345 | 2.201E-3 | 337.2 | 1106 | 655.5 |
| 2800 | 853.4 | 0.9807 | 282.60 | 9.45 | 0.9029 | 91484 | 1910.7 | 0.9206 | 1.1277 | 2.188E-3 | 337.0 | 1106 | 655.1 |
| **3000** | **914.4** | **0.9794** | **282.21** | **9.06** | **0.8962** | **90812** | **1896.6** | **0.9151** | **1.1210** | **2.175E-3** | **336.8** | **1105** | **654.6** |
| 3200 | 975.4 | 0.9780 | 281.81 | 8.66 | 0.8896 | 90144 | 1882.7 | 0.9097 | 1.1143 | 2.162E-3 | 336.5 | 1104 | 654.2 |
| 3400 | 1036.3 | 0.9766 | 281.41 | 8.26 | 0.8831 | 89479 | 1868.8 | 0.9042 | 1.1077 | 2.149E-3 | 336.3 | 1103 | 653.7 |
| 3600 | 1097.3 | 0.9752 | 281.02 | 7.87 | 0.8766 | 88819 | 1855.0 | 0.8988 | 1.1011 | 2.136E-3 | 336.1 | 1103 | 653.2 |
| 3800 | 1158.2 | 0.9739 | 280.62 | 7.47 | 0.8701 | 88163 | 1841.3 | 0.8934 | 1.0945 | 2.124E-3 | 335.8 | 1102 | 652.8 |

(*continued*)

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**Table A.1** (*Continued*)

| $H$ (ft) | $H$ (m) | $\theta$ | $T$ (K) | $T$ (°C) | $\delta$ | $p$ (N/m$^2$) | $p$ (lb/ft$^2$) | $\sigma$ | $\rho$ (kg/m$^3$) | $\rho$ (slug/ft$^3$) | $a$ (m/s) | $a$ (ft/s) | $a$ (kt) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **4000** | **1219.2** | **0.9725** | **280.23** | **7.08** | **0.8637** | **87511** | **1827.7** | **0.8881** | **1.0879** | **2.111E-3** | **335.6** | **1101** | **652.3** |
| 4200 | 1280.2 | 0.9711 | 279.83 | 6.68 | 0.8573 | 86862 | 1814.2 | 0.8828 | 1.0814 | 2.098E-3 | 335.3 | 1100 | 651.9 |
| 4400 | 1341.1 | 0.9697 | 279.43 | 6.28 | 0.8509 | 86218 | 1800.7 | 0.8774 | 1.0749 | 2.086E-3 | 335.1 | 1099 | 651.4 |
| 4600 | 1402.1 | 0.9684 | 279.04 | 5.89 | 0.8446 | 85577 | 1787.3 | 0.8722 | 1.0684 | 2.073E-3 | 334.9 | 1099 | 650.9 |
| 4800 | 1463.0 | 0.9670 | 278.64 | 5.49 | 0.8383 | 84940 | 1774.0 | 0.8669 | 1.0620 | 2.061E-3 | 334.6 | 1098 | 650.5 |
| **5000** | **1524.0** | **0.9656** | **278.24** | **5.09** | **0.8320** | **84307** | **1760.8** | **0.8617** | **1.0555** | **2.048E-3** | **334.4** | **1097** | **650.0** |
| 5200 | 1585.0 | 0.9642 | 277.85 | 4.70 | 0.8258 | 83678 | 1747.7 | 0.8565 | 1.0492 | 2.036E-3 | 334.2 | 1096 | 649.5 |
| 5400 | 1645.9 | 0.9629 | 277.45 | 4.30 | 0.8197 | 83053 | 1734.6 | 0.8513 | 1.0428 | 2.023E-3 | 333.9 | 1096 | 649.1 |
| 5600 | 1706.9 | 0.9615 | 277.06 | 3.91 | 0.8135 | 82431 | 1721.6 | 0.8461 | 1.0365 | 2.011E-3 | 333.7 | 1095 | 648.6 |
| 5800 | 1767.8 | 0.9601 | 276.66 | 3.51 | 0.8074 | 81814 | 1708.7 | 0.8410 | 1.0302 | 1.999E-3 | 333.4 | 1094 | 648.2 |
| **6000** | **1828.8** | **0.9587** | **276.26** | **3.11** | **0.8014** | **81200** | **1695.9** | **0.8359** | **1.0239** | **1.987E-3** | **333.2** | **1093** | **647.7** |
| 6200 | 1889.8 | 0.9574 | 275.87 | 2.72 | 0.7954 | 80589 | 1683.1 | 0.8308 | 1.0177 | 1.975E-3 | 333.0 | 1092 | 647.2 |
| 6400 | 1950.7 | 0.9560 | 275.47 | 2.32 | 0.7894 | 79983 | 1670.5 | 0.8257 | 1.0115 | 1.963E-3 | 332.7 | 1092 | 646.8 |
| 6600 | 2011.7 | 0.9546 | 275.07 | 1.92 | 0.7834 | 79380 | 1657.9 | 0.8207 | 1.0053 | 1.951E-3 | 332.5 | 1091 | 646.3 |
| 6800 | 2072.6 | 0.9532 | 274.68 | 1.53 | 0.7775 | 78781 | 1645.4 | 0.8156 | 0.9992 | 1.939E-3 | 332.2 | 1090 | 645.8 |
| **7000** | **2133.6** | **0.9519** | **274.28** | **1.13** | **0.7716** | **78185** | **1632.9** | **0.8106** | **0.9930** | **1.927E-3** | **332.0** | **1089** | **645.4** |
| 7200 | 2194.6 | 0.9505 | 273.89 | 0.74 | 0.7658 | 77594 | 1620.6 | 0.8057 | 0.9869 | 1.915E-3 | 331.8 | 1088 | 644.9 |
| 7400 | 2255.5 | 0.9491 | 273.49 | 0.34 | 0.7600 | 77005 | 1608.3 | 0.8007 | 0.9809 | 1.903E-3 | 331.5 | 1088 | 644.4 |
| 7600 | 2316.5 | 0.9477 | 273.09 | −0.06 | 0.7542 | 76421 | 1596.1 | 0.7958 | 0.9749 | 1.892E-3 | 331.3 | 1087 | 644.0 |
| 7800 | 2377.4 | 0.9464 | 272.70 | −0.45 | 0.7485 | 75840 | 1583.9 | 0.7909 | 0.9688 | 1.880E-3 | 331.0 | 1086 | 643.5 |
| **8000** | **2438.4** | **0.9450** | **272.30** | **−0.85** | **0.7428** | **75262** | **1571.9** | **0.7860** | **0.9629** | **1.868E-3** | **330.8** | **1085** | **643.0** |
| 8200 | 2499.4 | 0.9436 | 271.90 | −1.25 | 0.7371 | 74689 | 1559.9 | 0.7812 | 0.9569 | 1.857E-3 | 330.6 | 1085 | 642.6 |
| 8400 | 2560.3 | 0.9422 | 271.51 | −1.64 | 0.7315 | 74118 | 1548.0 | 0.7763 | 0.9510 | 1.845E-3 | 330.3 | 1084 | 642.1 |
| 8600 | 2621.3 | 0.9409 | 271.11 | −2.04 | 0.7259 | 73551 | 1536.2 | 0.7715 | 0.9451 | 1.834E-3 | 330.1 | 1083 | 641.6 |
| 8800 | 2682.2 | 0.9395 | 270.72 | −2.43 | 0.7203 | 72988 | 1524.4 | 0.7667 | 0.9392 | 1.822E-3 | 329.8 | 1082 | 641.2 |
| **9000** | **2743.2** | **0.9381** | **270.32** | **−2.83** | **0.7148** | **72428** | **1512.7** | **0.7620** | **0.9334** | **1.811E-3** | **329.6** | **1081** | **640.7** |
| 9200 | 2804.2 | 0.9367 | 269.92 | −3.23 | 0.7093 | 71872 | 1501.1 | 0.7572 | 0.9276 | 1.800E-3 | 329.4 | 1081 | 640.2 |
| 9400 | 2865.1 | 0.9354 | 269.53 | −3.62 | 0.7039 | 71319 | 1489.5 | 0.7525 | 0.9218 | 1.789E-3 | 329.1 | 1080 | 639.7 |
| 9600 | 2926.1 | 0.9340 | 269.13 | −4.02 | 0.6984 | 70770 | 1478.1 | 0.7478 | 0.9161 | 1.777E-3 | 328.9 | 1079 | 639.3 |
| 9800 | 2987.0 | 0.9326 | 268.73 | −4.42 | 0.6931 | 70224 | 1466.7 | 0.7431 | 0.9103 | 1.766E-3 | 328.6 | 1078 | 638.8 |
| **10000** | **3048.0** | **0.9312** | **268.34** | **−4.81** | **0.6877** | **69682** | **1455.3** | **0.7385** | **0.9046** | **1.755E-3** | **328.4** | **1077** | **638.3** |
| 10200 | 3109.0 | 0.9299 | 267.94 | −5.21 | 0.6824 | 69143 | 1444.1 | 0.7338 | 0.8990 | 1.744E-3 | 328.1 | 1077 | 637.9 |
| 10400 | 3169.9 | 0.9285 | 267.55 | −5.60 | 0.6771 | 68607 | 1432.9 | 0.7292 | 0.8933 | 1.733E-3 | 327.9 | 1076 | 637.4 |
| 10600 | 3230.9 | 0.9271 | 267.15 | −6.00 | 0.6718 | 68074 | 1421.8 | 0.7247 | 0.8877 | 1.722E-3 | 327.7 | 1075 | 636.9 |
| 10800 | 3291.8 | 0.9257 | 266.75 | −6.40 | 0.6666 | 67545 | 1410.7 | 0.7201 | 0.8821 | 1.712E-3 | 327.4 | 1074 | 636.4 |
| **11000** | **3352.8** | **0.9244** | **266.36** | **−6.79** | **0.6614** | **67020** | **1399.7** | **0.7156** | **0.8766** | **1.701E-3** | **327.2** | **1073** | **636.0** |
| 11200 | 3413.8 | 0.9230 | 265.96 | −7.19 | 0.6563 | 66497 | 1388.8 | 0.7110 | 0.8710 | 1.690E-3 | 326.9 | 1073 | 635.5 |
| 11400 | 3474.7 | 0.9216 | 265.56 | −7.59 | 0.6512 | 65978 | 1378.0 | 0.7065 | 0.8655 | 1.679E-3 | 326.7 | 1072 | 635.0 |
| 11600 | 3535.7 | 0.9202 | 265.17 | −7.98 | 0.6461 | 65463 | 1367.2 | 0.7021 | 0.8600 | 1.669E-3 | 326.4 | 1071 | 634.6 |
| 11800 | 3596.6 | 0.9189 | 264.77 | −8.38 | 0.6410 | 64950 | 1356.5 | 0.6976 | 0.8546 | 1.658E-3 | 326.2 | 1070 | 634.1 |

**Table A.1** (*Continued*)

| $H$ (ft) | $H$ (m) | $\theta$ | $T$ (K) | $T$ (°C) | $\delta$ | $p$ (N/m$^2$) | $p$ (lb/ft$^2$) | $\sigma$ | $\rho$ (kg/m$^3$) | $\rho$ (slug/ft$^3$) | $a$ (m/s) | $a$ (ft/s) | $a$ (kt) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **12000** | **3657.6** | **0.9175** | **264.38** | **−8.77** | **0.6360** | **64441** | **1345.9** | **0.6932** | **0.8491** | **1.648E-3** | **326.0** | **1069** | **633.6** |
| 12200 | 3718.6 | 0.9161 | 263.98 | −9.17 | 0.6310 | 63935 | 1335.3 | 0.6888 | 0.8437 | 1.637E-3 | 325.7 | 1069 | 633.1 |
| 12400 | 3779.5 | 0.9147 | 263.58 | −9.57 | 0.6260 | 63432 | 1324.8 | 0.6844 | 0.8384 | 1.627E-3 | 325.5 | 1068 | 632.7 |
| 12600 | 3840.5 | 0.9134 | 263.19 | −9.96 | 0.6211 | 62932 | 1314.4 | 0.6800 | 0.8330 | 1.616E-3 | 325.2 | 1067 | 632.2 |
| 12800 | 3901.4 | 0.9120 | 262.79 | −10.36 | 0.6162 | 62436 | 1304.0 | 0.6757 | 0.8277 | 1.606E-3 | 325.0 | 1066 | 631.7 |
| **13000** | **3962.4** | **0.9106** | **262.39** | **−10.76** | **0.6113** | **61943** | **1293.7** | **0.6713** | **0.8224** | **1.596E-3** | **324.7** | **1065** | **631.2** |
| 13200 | 4023.4 | 0.9092 | 262.00 | −11.15 | 0.6065 | 61453 | 1283.5 | 0.6670 | 0.8171 | 1.585E-3 | 324.5 | 1065 | 630.7 |
| 13400 | 4084.3 | 0.9079 | 261.60 | −11.55 | 0.6017 | 60966 | 1273.3 | 0.6627 | 0.8119 | 1.575E-3 | 324.2 | 1064 | 630.3 |
| 13600 | 4145.3 | 0.9065 | 261.21 | −11.94 | 0.5969 | 60482 | 1263.2 | 0.6585 | 0.8066 | 1.565E-3 | 324.0 | 1063 | 629.8 |
| 13800 | 4206.2 | 0.9051 | 260.81 | −12.34 | 0.5922 | 60001 | 1253.2 | 0.6542 | 0.8014 | 1.555E-3 | 323.7 | 1062 | 629.3 |
| **14000** | **4267.2** | **0.9037** | **260.41** | **−12.74** | **0.5875** | **59524** | **1243.2** | **0.6500** | **0.7963** | **1.545E-3** | **323.5** | **1061** | **628.8** |
| 14200 | 4328.2 | 0.9024 | 260.02 | −13.13 | 0.5828 | 59049 | 1233.3 | 0.6458 | 0.7911 | 1.535E-3 | 323.3 | 1061 | 628.4 |
| 14400 | 4389.1 | 0.9010 | 259.62 | −13.53 | 0.5781 | 58578 | 1223.4 | 0.6416 | 0.7860 | 1.525E-3 | 323.0 | 1060 | 627.9 |
| 14600 | 4450.1 | 0.8996 | 259.22 | −13.93 | 0.5735 | 58110 | 1213.6 | 0.6375 | 0.7809 | 1.515E-3 | 322.8 | 1059 | 627.4 |
| 14800 | 4511.0 | 0.8982 | 258.83 | −14.32 | 0.5689 | 57644 | 1203.9 | 0.6334 | 0.7759 | 1.505E-3 | 322.5 | 1058 | 626.9 |
| **15000** | **4572.0** | **0.8969** | **258.43** | **−14.72** | **0.5643** | **57182** | **1194.3** | **0.6292** | **0.7708** | **1.496E-3** | **322.3** | **1057** | **626.4** |
| 15200 | 4633.0 | 0.8955 | 258.04 | −15.11 | 0.5598 | 56723 | 1184.7 | 0.6251 | 0.7658 | 1.486E-3 | 322.0 | 1057 | 626.0 |
| 15400 | 4693.9 | 0.8941 | 257.64 | −15.51 | 0.5553 | 56266 | 1175.1 | 0.6211 | 0.7608 | 1.476E-3 | 321.8 | 1056 | 625.5 |
| 15600 | 4754.9 | 0.8927 | 257.24 | −15.91 | 0.5508 | 55813 | 1165.7 | 0.6170 | 0.7558 | 1.467E-3 | 321.5 | 1055 | 625.0 |
| 15800 | 4815.8 | 0.8914 | 256.85 | −16.30 | 0.5464 | 55363 | 1156.3 | 0.6130 | 0.7509 | 1.457E-3 | 321.3 | 1054 | 624.5 |
| **16000** | **4876.8** | **0.8900** | **256.45** | **−16.70** | **0.5420** | **54915** | **1146.9** | **0.6090** | **0.7460** | **1.447E-3** | **321.0** | **1053** | **624.0** |
| 16200 | 4937.8 | 0.8886 | 256.05 | −17.10 | 0.5376 | 54471 | 1137.6 | 0.6050 | 0.7411 | 1.438E-3 | 320.8 | 1052 | 623.6 |
| 16400 | 4998.7 | 0.8872 | 255.66 | −17.49 | 0.5332 | 54029 | 1128.4 | 0.6010 | 0.7362 | 1.428E-3 | 320.5 | 1052 | 623.1 |
| 16600 | 5059.7 | 0.8859 | 255.26 | −17.89 | 0.5289 | 53590 | 1119.3 | 0.5970 | 0.7314 | 1.419E-3 | 320.3 | 1051 | 622.6 |
| 16800 | 5120.6 | 0.8845 | 254.87 | −18.28 | 0.5246 | 53155 | 1110.2 | 0.5931 | 0.7266 | 1.410E-3 | 320.0 | 1050 | 622.1 |
| **17000** | **5181.6** | **0.8831** | **254.47** | **−18.68** | **0.5203** | **52722** | **1101.1** | **0.5892** | **0.7218** | **1.400E-3** | **319.8** | **1049** | **621.6** |
| 17200 | 5242.6 | 0.8817 | 254.07 | −19.08 | 0.5161 | 52292 | 1092.1 | 0.5853 | 0.7170 | 1.391E-3 | 319.5 | 1048 | 621.1 |
| 17400 | 5303.5 | 0.8804 | 253.68 | −19.47 | 0.5119 | 51865 | 1083.2 | 0.5814 | 0.7122 | 1.382E-3 | 319.3 | 1048 | 620.7 |
| 17600 | 5364.5 | 0.8790 | 253.28 | −19.87 | 0.5077 | 51440 | 1074.3 | 0.5776 | 0.7075 | 1.373E-3 | 319.0 | 1047 | 620.2 |
| 17800 | 5425.4 | 0.8776 | 252.88 | −20.27 | 0.5035 | 51019 | 1065.5 | 0.5737 | 0.7028 | 1.364E-3 | 318.8 | 1046 | 619.7 |
| **18000** | **5486.4** | **0.8762** | **252.49** | **−20.66** | **0.4994** | **50600** | **1056.8** | **0.5699** | **0.6981** | **1.355E-3** | **318.5** | **1045** | **619.2** |
| 18200 | 5547.4 | 0.8749 | 252.09 | −21.06 | 0.4953 | 50184 | 1048.1 | 0.5661 | 0.6935 | 1.346E-3 | 318.3 | 1044 | 618.7 |
| 18400 | 5608.3 | 0.8735 | 251.70 | −21.45 | 0.4912 | 49771 | 1039.5 | 0.5623 | 0.6889 | 1.337E-3 | 318.0 | 1043 | 618.2 |
| 18600 | 5669.3 | 0.8721 | 251.30 | −21.85 | 0.4871 | 49360 | 1030.9 | 0.5586 | 0.6843 | 1.328E-3 | 317.8 | 1043 | 617.7 |
| 18800 | 5730.2 | 0.8707 | 250.90 | −22.25 | 0.4831 | 48953 | 1022.4 | 0.5548 | 0.6797 | 1.319E-3 | 317.5 | 1042 | 617.2 |
| **19000** | **5791.2** | **0.8694** | **250.51** | **−22.64** | **0.4791** | **48548** | **1013.9** | **0.5511** | **0.6751** | **1.310E-3** | **317.3** | **1041** | **616.8** |
| 19200 | 5852.2 | 0.8680 | 250.11 | −23.04 | 0.4752 | 48145 | 1005.5 | 0.5474 | 0.6706 | 1.301E-3 | 317.0 | 1040 | 616.3 |
| 19400 | 5913.1 | 0.8666 | 249.71 | −23.44 | 0.4712 | 47746 | 997.2 | 0.5437 | 0.6661 | 1.292E-3 | 316.8 | 1039 | 615.8 |
| 19600 | 5974.1 | 0.8652 | 249.32 | −23.83 | 0.4673 | 47349 | 988.9 | 0.5401 | 0.6616 | 1.284E-3 | 316.5 | 1039 | 615.3 |
| 19800 | 6035.0 | 0.8639 | 248.92 | −24.23 | 0.4634 | 46955 | 980.7 | 0.5364 | 0.6571 | 1.275E-3 | 316.3 | 1038 | 614.8 |

(*continued*)

**Table A.1** (*Continued*)

| $H$ (ft) | $H$ (m) | $\theta$ | $T$ (K) | $T$ (°C) | $\delta$ | $p$ (N/m$^2$) | $p$ (lb/ft$^2$) | $\sigma$ | $\rho$ (kg/m$^3$) | $\rho$ (slug/ft$^3$) | $a$ (m/s) | $a$ (ft/s) | $a$ (kt) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **20000** | **6096.0** | **0.8625** | **248.53** | **−24.62** | **0.4595** | **46563** | **972.5** | **0.5328** | **0.6527** | **1.266E-3** | **316.0** | **1037** | **614.3** |
| 20200 | 6157.0 | 0.8611 | 248.13 | −25.02 | 0.4557 | 46174 | 964.4 | 0.5292 | 0.6483 | 1.258E-3 | 315.8 | 1036 | 613.8 |
| 20400 | 6217.9 | 0.8597 | 247.73 | −25.42 | 0.4519 | 45788 | 956.3 | 0.5256 | 0.6439 | 1.249E-3 | 315.5 | 1035 | 613.3 |
| 20600 | 6278.9 | 0.8584 | 247.34 | −25.81 | 0.4481 | 45405 | 948.3 | 0.5220 | 0.6395 | 1.241E-3 | 315.3 | 1034 | 612.8 |
| 20800 | 6339.8 | 0.8570 | 246.94 | −26.21 | 0.4443 | 45024 | 940.3 | 0.5185 | 0.6352 | 1.232E-3 | 315.0 | 1034 | 612.4 |
| **21000** | **6400.8** | **0.8556** | **246.54** | **−26.61** | **0.4406** | **44645** | **932.4** | **0.5150** | **0.6308** | **1.224E-3** | **314.8** | **1033** | **611.9** |
| 21200 | 6461.8 | 0.8542 | 246.15 | −27.00 | 0.4369 | 44269 | 924.6 | 0.5115 | 0.6265 | 1.216E-3 | 314.5 | 1032 | 611.4 |
| 21400 | 6522.7 | 0.8529 | 245.75 | −27.40 | 0.4332 | 43896 | 916.8 | 0.5080 | 0.6223 | 1.207E-3 | 314.3 | 1031 | 610.9 |
| 21600 | 6583.7 | 0.8515 | 245.36 | −27.79 | 0.4296 | 43525 | 909.0 | 0.5045 | 0.6180 | 1.199E-3 | 314.0 | 1030 | 610.4 |
| 21800 | 6644.6 | 0.8501 | 244.96 | −28.19 | 0.4259 | 43157 | 901.4 | 0.5010 | 0.6138 | 1.191E-3 | 313.8 | 1029 | 609.9 |
| **22000** | **6705.6** | **0.8487** | **244.56** | **−28.59** | **0.4223** | **42791** | **893.7** | **0.4976** | **0.6095** | **1.183E-3** | **313.5** | **1029** | **609.4** |
| 22200 | 6766.6 | 0.8474 | 244.17 | −28.98 | 0.4187 | 42428 | 886.1 | 0.4942 | 0.6053 | 1.175E-3 | 313.2 | 1028 | 608.9 |
| 22400 | 6827.5 | 0.8460 | 243.77 | −29.38 | 0.4152 | 42068 | 878.6 | 0.4908 | 0.6012 | 1.166E-3 | 313.0 | 1027 | 608.4 |
| 22600 | 6888.5 | 0.8446 | 243.37 | −29.78 | 0.4116 | 41710 | 871.1 | 0.4874 | 0.5970 | 1.158E-3 | 312.7 | 1026 | 607.9 |
| 22800 | 6949.4 | 0.8432 | 242.98 | −30.17 | 0.4081 | 41354 | 863.7 | 0.4840 | 0.5929 | 1.150E-3 | 312.5 | 1025 | 607.4 |
| **23000** | **7010.4** | **0.8419** | **242.58** | **−30.57** | **0.4046** | **41001** | **856.3** | **0.4807** | **0.5888** | **1.142E-3** | **312.2** | **1024** | **606.9** |
| 23200 | 7071.4 | 0.8405 | 242.19 | −30.96 | 0.4012 | 40650 | 849.0 | 0.4773 | 0.5847 | 1.135E-3 | 312.0 | 1024 | 606.4 |
| 23400 | 7132.3 | 0.8391 | 241.79 | −31.36 | 0.3977 | 40302 | 841.7 | 0.4740 | 0.5807 | 1.127E-3 | 311.7 | 1023 | 605.9 |
| 23600 | 7193.3 | 0.8377 | 241.39 | −31.76 | 0.3943 | 39956 | 834.5 | 0.4707 | 0.5766 | 1.119E-3 | 311.5 | 1022 | 605.4 |
| 23800 | 7254.2 | 0.8364 | 241.00 | −32.15 | 0.3909 | 39612 | 827.3 | 0.4674 | 0.5726 | 1.111E-3 | 311.2 | 1021 | 604.9 |
| **24000** | **7315.2** | **0.8350** | **240.60** | **−32.55** | **0.3876** | **39271** | **820.2** | **0.4642** | **0.5686** | **1.103E-3** | **311.0** | **1020** | **604.4** |
| 24200 | 7376.2 | 0.8336 | 240.20 | −32.95 | 0.3842 | 38932 | 813.1 | 0.4609 | 0.5646 | 1.096E-3 | 310.7 | 1019 | 603.9 |
| 24400 | 7437.1 | 0.8322 | 239.81 | −33.34 | 0.3809 | 38596 | 806.1 | 0.4577 | 0.5607 | 1.088E-3 | 310.4 | 1019 | 603.4 |
| 24600 | 7498.1 | 0.8309 | 239.41 | −33.74 | 0.3776 | 38262 | 799.1 | 0.4545 | 0.5567 | 1.080E-3 | 310.2 | 1018 | 602.9 |
| 24800 | 7559.0 | 0.8295 | 239.02 | −34.13 | 0.3743 | 37930 | 792.2 | 0.4513 | 0.5528 | 1.073E-3 | 309.9 | 1017 | 602.4 |
| **25000** | **7620.0** | **0.8281** | **238.62** | **−34.53** | **0.3711** | **37601** | **785.3** | **0.4481** | **0.5489** | **1.065E-3** | **309.7** | **1016** | **601.9** |
| 25200 | 7681.0 | 0.8267 | 238.22 | −34.93 | 0.3679 | 37274 | 778.5 | 0.4450 | 0.5451 | 1.058E-3 | 309.4 | 1015 | 601.4 |
| 25400 | 7741.9 | 0.8254 | 237.83 | −35.32 | 0.3647 | 36949 | 771.7 | 0.4418 | 0.5412 | 1.050E-3 | 309.2 | 1014 | 600.9 |
| 25600 | 7802.9 | 0.8240 | 237.43 | −35.72 | 0.3615 | 36627 | 765.0 | 0.4387 | 0.5374 | 1.043E-3 | 308.9 | 1013 | 600.4 |
| 25800 | 7863.8 | 0.8226 | 237.04 | −36.11 | 0.3583 | 36307 | 758.3 | 0.4356 | 0.5336 | 1.035E-3 | 308.6 | 1013 | 599.9 |
| **26000** | **7924.8** | **0.8212** | **236.64** | **−36.51** | **0.3552** | **35989** | **751.6** | **0.4325** | **0.5298** | **1.028E-3** | **308.4** | **1012** | **599.4** |
| 26200 | 7985.8 | 0.8199 | 236.24 | −36.91 | 0.3521 | 35673 | 745.0 | 0.4294 | 0.5260 | 1.021E-3 | 308.1 | 1011 | 598.9 |
| 26400 | 8046.7 | 0.8185 | 235.85 | −37.30 | 0.3490 | 35360 | 738.5 | 0.4264 | 0.5223 | 1.013E-3 | 307.9 | 1010 | 598.4 |
| 26600 | 8107.7 | 0.8171 | 235.45 | −37.70 | 0.3459 | 35049 | 732.0 | 0.4233 | 0.5186 | 1.006E-3 | 307.6 | 1009 | 597.9 |
| 26800 | 8168.6 | 0.8157 | 235.05 | −38.10 | 0.3429 | 34740 | 725.6 | 0.4203 | 0.5149 | 9.990E-4 | 307.3 | 1008 | 597.4 |
| **27000** | **8229.6** | **0.8144** | **234.66** | **−38.49** | **0.3398** | **34433** | **719.2** | **0.4173** | **0.5112** | **9.919E-4** | **307.1** | **1008** | **596.9** |
| 27200 | 8290.6 | 0.8130 | 234.26 | −38.89 | 0.3368 | 34129 | 712.8 | 0.4143 | 0.5075 | 9.848E-4 | 306.8 | 1007 | 596.4 |
| 27400 | 8351.5 | 0.8116 | 233.87 | −39.28 | 0.3338 | 33826 | 706.5 | 0.4113 | 0.5039 | 9.777E-4 | 306.6 | 1006 | 595.9 |
| 27600 | 8412.5 | 0.8102 | 233.47 | −39.68 | 0.3309 | 33526 | 700.2 | 0.4084 | 0.5003 | 9.707E-4 | 306.3 | 1005 | 595.4 |
| 27800 | 8473.4 | 0.8089 | 233.07 | −40.08 | 0.3279 | 33228 | 694.0 | 0.4054 | 0.4967 | 9.637E-4 | 306.0 | 1004 | 594.9 |

**Table A.1** (*Continued*)

| $H$ (ft) | $H$ (m) | $\theta$ | $T$ (K) | $T$ (°C) | $\delta$ | $p$ (N/m$^2$) | $p$ (lb/ft$^2$) | $\sigma$ | $\rho$ (kg/m$^3$) | $\rho$ (slug/ft$^3$) | $a$ (m/s) | $a$ (ft/s) | $a$ (kt) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **28000** | **8534.4** | **0.8075** | **232.68** | **−40.47** | **0.3250** | **32932** | **687.8** | **0.4025** | **0.4931** | **9.567E-4** | **305.8** | **1003** | **594.4** |
| 28200 | 8595.4 | 0.8061 | 232.28 | −40.87 | 0.3221 | 32639 | 681.7 | 0.3996 | 0.4895 | 9.498E-4 | 305.5 | 1002 | 593.9 |
| 28400 | 8656.3 | 0.8047 | 231.88 | −41.27 | 0.3192 | 32347 | 675.6 | 0.3967 | 0.4860 | 9.429E-4 | 305.3 | 1002 | 593.4 |
| 28600 | 8717.3 | 0.8034 | 231.49 | −41.66 | 0.3164 | 32058 | 669.5 | 0.3938 | 0.4824 | 9.361E-4 | 305.0 | 1001 | 592.9 |
| 28800 | 8778.2 | 0.8020 | 231.09 | −42.06 | 0.3135 | 31770 | 663.5 | 0.3910 | 0.4789 | 9.293E-4 | 304.7 | 1000 | 592.4 |
| **29000** | **8839.2** | **0.8006** | **230.70** | **−42.45** | **0.3107** | **31485** | **657.6** | **0.3881** | **0.4754** | **9.225E-4** | **304.5** | 999.0 | **591.9** |
| 29200 | 8900.2 | 0.7992 | 230.30 | −42.85 | 0.3079 | 31202 | 651.7 | 0.3853 | 0.4720 | 9.158E-4 | 304.2 | 998.1 | 591.4 |
| 29400 | 8961.1 | 0.7979 | 229.90 | −43.25 | 0.3052 | 30921 | 645.8 | 0.3825 | 0.4685 | 9.091E-4 | 304.0 | 997.2 | 590.9 |
| 29600 | 9022.1 | 0.7965 | 229.51 | −43.64 | 0.3024 | 30642 | 640.0 | 0.3797 | 0.4651 | 9.025E-4 | 303.7 | 996.4 | 590.3 |
| 29800 | 9083.0 | 0.7951 | 229.11 | −44.04 | 0.2997 | 30365 | 634.2 | 0.3769 | 0.4617 | 8.958E-4 | 303.4 | 995.5 | 589.8 |
| **30000** | **9144.0** | **0.7937** | **228.71** | **−44.44** | **0.2970** | **30090** | **628.4** | **0.3741** | **0.4583** | **8.893E-4** | **303.2** | 994.7 | **589.3** |
| 30200 | 9205.0 | 0.7924 | 228.32 | −44.83 | 0.2943 | 29817 | 622.7 | 0.3714 | 0.4549 | 8.827E-4 | 302.9 | 993.8 | 588.8 |
| 30400 | 9265.9 | 0.7910 | 227.92 | −45.23 | 0.2916 | 29546 | 617.1 | 0.3686 | 0.4516 | 8.762E-4 | 302.6 | 992.9 | 588.3 |
| 30600 | 9326.9 | 0.7896 | 227.53 | −45.62 | 0.2889 | 29277 | 611.5 | 0.3659 | 0.4483 | 8.698E-4 | 302.4 | 992.1 | 587.8 |
| 30800 | 9387.8 | 0.7882 | 227.13 | −46.02 | 0.2863 | 29010 | 605.9 | 0.3632 | 0.4449 | 8.633E-4 | 302.1 | 991.2 | 587.3 |
| **31000** | **9448.8** | **0.7869** | **226.73** | **−46.42** | **0.2837** | **28745** | **600.3** | **0.3605** | **0.4417** | **8.569E-4** | **301.9** | 990.3 | **586.8** |
| 31200 | 9509.8 | 0.7855 | 226.34 | −46.81 | 0.2811 | 28482 | 594.9 | 0.3579 | 0.4384 | 8.506E-4 | 301.6 | 989.5 | 586.3 |
| 31400 | 9570.7 | 0.7841 | 225.94 | −47.21 | 0.2785 | 28221 | 589.4 | 0.3552 | 0.4351 | 8.443E-4 | 301.3 | 988.6 | 585.7 |
| 31600 | 9631.7 | 0.7827 | 225.54 | −47.61 | 0.2760 | 27961 | 584.0 | 0.3526 | 0.4319 | 8.380E-4 | 301.1 | 987.7 | 585.2 |
| 31800 | 9692.6 | 0.7814 | 225.15 | −48.00 | 0.2734 | 27704 | 578.6 | 0.3499 | 0.4287 | 8.317E-4 | 300.8 | 986.9 | 584.7 |
| **32000** | **9753.6** | **0.7800** | **224.75** | **−48.40** | **0.2709** | **27449** | **573.3** | **0.3473** | **0.4255** | **8.255E-4** | **300.5** | 986.0 | **584.2** |
| 32200 | 9814.6 | 0.7786 | 224.36 | −48.79 | 0.2684 | 27195 | 568.0 | 0.3447 | 0.4223 | 8.194E-4 | 300.3 | 985.1 | 583.7 |
| 32400 | 9875.5 | 0.7772 | 223.96 | −49.19 | 0.2659 | 26944 | 562.7 | 0.3421 | 0.4191 | 8.132E-4 | 300.0 | 984.3 | 583.2 |
| 32600 | 9936.5 | 0.7759 | 223.56 | −49.59 | 0.2635 | 26694 | 557.5 | 0.3396 | 0.4160 | 8.071E-4 | 299.7 | 983.4 | 582.6 |
| 32800 | 9997.4 | 0.7745 | 223.17 | −49.98 | 0.2610 | 26447 | 552.3 | 0.3370 | 0.4128 | 8.010E-4 | 299.5 | 982.5 | 582.1 |
| **33000** | **10058.4** | **0.7731** | **222.77** | **−50.38** | **0.2586** | **26201** | **547.2** | **0.3345** | **0.4097** | **7.950E-4** | **299.2** | **981.7** | **581.6** |
| 33200 | 10119.4 | 0.7717 | 222.37 | −50.78 | 0.2562 | 25957 | 542.1 | 0.3319 | 0.4066 | 7.890E-4 | 298.9 | 980.8 | 581.1 |
| 33400 | 10180.3 | 0.7704 | 221.98 | −51.17 | 0.2538 | 25715 | 537.1 | 0.3294 | 0.4036 | 7.830E-4 | 298.7 | 979.9 | 580.6 |
| 33600 | 10241.3 | 0.7690 | 221.58 | −51.57 | 0.2514 | 25474 | 532.0 | 0.3269 | 0.4005 | 7.771E-4 | 298.4 | 979.0 | 580.1 |
| 33800 | 10302.2 | 0.7676 | 221.19 | −51.96 | 0.2491 | 25236 | 527.1 | 0.3245 | 0.3975 | 7.712E-4 | 298.1 | 978.2 | 579.5 |
| **34000** | **10363.2** | **0.7662** | **220.79** | **−52.36** | **0.2467** | **24999** | **522.1** | **0.3220** | **0.3944** | **7.653E-4** | **297.9** | **977.3** | **579.0** |
| 34200 | 10424.2 | 0.7649 | 220.39 | −52.76 | 0.2444 | 24764 | 517.2 | 0.3195 | 0.3914 | 7.595E-4 | 297.6 | 976.4 | 578.5 |
| 34400 | 10485.1 | 0.7635 | 220.00 | −53.15 | 0.2421 | 24531 | 512.3 | 0.3171 | 0.3885 | 7.537E-4 | 297.3 | 975.5 | 578.0 |
| 34600 | 10546.1 | 0.7621 | 219.60 | −53.55 | 0.2398 | 24300 | 507.5 | 0.3147 | 0.3855 | 7.480E-4 | 297.1 | 974.6 | 577.5 |
| 34800 | 10607.0 | 0.7607 | 219.20 | −53.95 | 0.2376 | 24070 | 502.7 | 0.3123 | 0.3825 | 7.422E-4 | 296.8 | 973.8 | 576.9 |
| **35000** | **10668.0** | **0.7594** | **218.81** | **−54.34** | **0.2353** | **23842** | **498.0** | **0.3099** | **0.3796** | **7.365E-4** | **296.5** | **972.9** | **576.4** |
| 35200 | 10729.0 | 0.7580 | 218.41 | −54.74 | 0.2331 | 23616 | 493.2 | 0.3075 | 0.3767 | 7.309E-4 | 296.3 | 972.0 | 575.9 |
| 35400 | 10789.9 | 0.7566 | 218.02 | −55.13 | 0.2309 | 23392 | 488.5 | 0.3051 | 0.3738 | 7.253E-4 | 296.0 | 971.1 | 575.4 |
| 35600 | 10850.9 | 0.7552 | 217.62 | −55.53 | 0.2287 | 23169 | 483.9 | 0.3028 | 0.3709 | 7.197E-4 | 295.7 | 970.2 | 574.9 |
| 35800 | 10911.8 | 0.7539 | 217.22 | −55.93 | 0.2265 | 22948 | 479.3 | 0.3004 | 0.3680 | 7.141E-4 | 295.5 | 969.4 | 574.3 |

(*continued*)

**Table A.1** (*Continued*)

| $H$ (ft) | $H$ (m) | $\theta$ | $T$ (K) | $T$ (°C) | $\delta$ | $p$ (N/m$^2$) | $p$ (lb/ft$^2$) | $\sigma$ | $\rho$ (kg/m$^3$) | $\rho$ (slug/ft$^3$) | $a$ (m/s) | $a$ (ft/s) | $a$ (kt) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **36000** | **10972.8** | **0.7525** | **216.83** | **−56.32** | **0.2243** | **22729** | **474.7** | **0.2981** | **0.3652** | **7.086E-4** | **295.2** | **968.5** | **573.8** |
| 36200 | 11033.8 | 0.7519 | 216.65 | −56.50 | 0.2222 | 22512 | 470.2 | 0.2955 | 0.3620 | 7.024E-4 | 295.1 | 968.1 | 573.6 |
| 36400 | 11094.7 | 0.7519 | 216.65 | −56.50 | 0.2200 | 22297 | 465.7 | 0.2927 | 0.3585 | 6.956E-4 | 295.1 | 968.1 | 573.6 |
| 36600 | 11155.7 | 0.7519 | 216.65 | −56.50 | 0.2179 | 22083 | 461.2 | 0.2899 | 0.3551 | 6.890E-4 | 295.1 | 968.1 | 573.6 |
| 36800 | 11216.6 | 0.7519 | 216.65 | −56.50 | 0.2159 | 21872 | 456.8 | 0.2871 | 0.3517 | 6.824E-4 | 295.1 | 968.1 | 573.6 |
| **37000** | **11277.6** | **0.7519** | **216.65** | **−56.50** | **0.2138** | **21663** | **452.4** | **0.2844** | **0.3483** | **6.759E-4** | **295.1** | **968.1** | **573.6** |
| 37200 | 11338.6 | 0.7519 | 216.65 | −56.50 | 0.2117 | 21455 | 448.1 | 0.2816 | 0.3450 | 6.694E-4 | 295.1 | 968.1 | 573.6 |
| 37400 | 11399.5 | 0.7519 | 216.65 | −56.50 | 0.2097 | 21250 | 443.8 | 0.2789 | 0.3417 | 6.630E-4 | 295.1 | 968.1 | 573.6 |
| 37600 | 11460.5 | 0.7519 | 216.65 | −56.50 | 0.2077 | 21047 | 439.6 | 0.2763 | 0.3384 | 6.567E-4 | 295.1 | 968.1 | 573.6 |
| 37800 | 11521.4 | 0.7519 | 216.65 | −56.50 | 0.2057 | 20846 | 435.4 | 0.2736 | 0.3352 | 6.504E-4 | 295.1 | 968.1 | 573.6 |
| **38000** | **11582.4** | **0.7519** | **216.65** | **−56.50** | **0.2038** | **20646** | **431.2** | **0.2710** | **0.3320** | **6.442E-4** | **295.1** | **968.1** | **573.6** |
| 38200 | 11643.4 | 0.7519 | 216.65 | −56.50 | 0.2018 | 20449 | 427.1 | 0.2684 | 0.3288 | 6.380E-4 | 295.1 | 968.1 | 573.6 |
| 38400 | 11704.3 | 0.7519 | 216.65 | −56.50 | 0.1999 | 20253 | 423.0 | 0.2658 | 0.3257 | 6.319E-4 | 295.1 | 968.1 | 573.6 |
| 38600 | 11765.3 | 0.7519 | 216.65 | −56.50 | 0.1980 | 20059 | 418.9 | 0.2633 | 0.3225 | 6.258E-4 | 295.1 | 968.1 | 573.6 |
| 38800 | 11826.2 | 0.7519 | 216.65 | −56.50 | 0.1961 | 19867 | 414.9 | 0.2608 | 0.3195 | 6.199E-4 | 295.1 | 968.1 | 573.6 |
| **39000** | **11887.2** | **0.7519** | **216.65** | **−56.50** | **0.1942** | **19677** | **411.0** | **0.2583** | **0.3164** | **6.139E-4** | **295.1** | **968.1** | **573.6** |
| 39200 | 11948.2 | 0.7519 | 216.65 | −56.50 | 0.1923 | 19489 | 407.0 | 0.2558 | 0.3134 | 6.081E-4 | 295.1 | 968.1 | 573.6 |
| 39400 | 12009.1 | 0.7519 | 216.65 | −56.50 | 0.1905 | 19303 | 403.1 | 0.2534 | 0.3104 | 6.022E-4 | 295.1 | 968.1 | 573.6 |
| 39600 | 12070.1 | 0.7519 | 216.65 | −56.50 | 0.1887 | 19118 | 399.3 | 0.2509 | 0.3074 | 5.965E-4 | 295.1 | 968.1 | 573.6 |
| 39800 | 12131.0 | 0.7519 | 216.65 | −56.50 | 0.1869 | 18935 | 395.5 | 0.2485 | 0.3045 | 5.908E-4 | 295.1 | 968.1 | 573.6 |
| **40000** | **12192.0** | **0.7519** | **216.65** | **−56.50** | **0.1851** | **18754** | **391.7** | **0.2462** | **0.3016** | **5.851E-4** | **295.1** | **968.1** | **573.6** |
| 40200 | 12253.0 | 0.7519 | 216.65 | −56.50 | 0.1833 | 18574 | 387.9 | 0.2438 | 0.2987 | 5.795E-4 | 295.1 | 968.1 | 573.6 |
| 40400 | 12313.9 | 0.7519 | 216.65 | −56.50 | 0.1816 | 18397 | 384.2 | 0.2415 | 0.2958 | 5.740E-4 | 295.1 | 968.1 | 573.6 |
| 40600 | 12374.9 | 0.7519 | 216.65 | −56.50 | 0.1798 | 18221 | 380.5 | 0.2392 | 0.2930 | 5.685E-4 | 295.1 | 968.1 | 573.6 |
| 40800 | 12435.8 | 0.7519 | 216.65 | −56.50 | 0.1781 | 18046 | 376.9 | 0.2369 | 0.2902 | 5.630E-4 | 295.1 | 968.1 | 573.6 |
| **41000** | **12496.8** | **0.7519** | **216.65** | **−56.50** | **0.1764** | **17874** | **373.3** | **0.2346** | **0.2874** | **5.577E-4** | **295.1** | **968.1** | **573.6** |
| 41200 | 12557.8 | 0.7519 | 216.65 | −56.50 | 0.1747 | 17703 | 369.7 | 0.2324 | 0.2847 | 5.523E-4 | 295.1 | 968.1 | 573.6 |
| 41400 | 12618.7 | 0.7519 | 216.65 | −56.50 | 0.1730 | 17533 | 366.2 | 0.2302 | 0.2819 | 5.470E-4 | 295.1 | 968.1 | 573.6 |
| 41600 | 12679.7 | 0.7519 | 216.65 | −56.50 | 0.1714 | 17366 | 362.7 | 0.2279 | 0.2792 | 5.418E-4 | 295.1 | 968.1 | 573.6 |
| 41800 | 12740.6 | 0.7519 | 216.65 | −56.50 | 0.1697 | 17200 | 359.2 | 0.2258 | 0.2766 | 5.366E-4 | 295.1 | 968.1 | 573.6 |
| **42000** | **12801.6** | **0.7519** | **216.65** | **−56.50** | **0.1681** | **17035** | **355.8** | **0.2236** | **0.2739** | **5.315E-4** | **295.1** | **968.1** | **573.6** |
| 42200 | 12862.6 | 0.7519 | 216.65 | −56.50 | 0.1665 | 16872 | 352.4 | 0.2215 | 0.2713 | 5.264E-4 | 295.1 | 968.1 | 573.6 |
| 42400 | 12923.5 | 0.7519 | 216.65 | −56.50 | 0.1649 | 16711 | 349.0 | 0.2194 | 0.2687 | 5.214E-4 | 295.1 | 968.1 | 573.6 |
| 42600 | 12984.5 | 0.7519 | 216.65 | −56.50 | 0.1633 | 16551 | 345.7 | 0.2173 | 0.2661 | 5.164E-4 | 295.1 | 968.1 | 573.6 |
| 42800 | 13045.4 | 0.7519 | 216.65 | −56.50 | 0.1618 | 16393 | 342.4 | 0.2152 | 0.2636 | 5.114E-4 | 295.1 | 968.1 | 573.6 |
| **43000** | **13106.4** | **0.7519** | **216.65** | **−56.50** | **0.1602** | **16236** | **339.1** | **0.2131** | **0.2611** | **5.066E-4** | **295.1** | **968.1** | **573.6** |
| 43200 | 13167.4 | 0.7519 | 216.65 | −56.50 | 0.1587 | 16080 | 335.8 | 0.2111 | 0.2586 | 5.017E-4 | 295.1 | 968.1 | 573.6 |
| 43400 | 13228.3 | 0.7519 | 216.65 | −56.50 | 0.1572 | 15927 | 332.6 | 0.2091 | 0.2561 | 4.969E-4 | 295.1 | 968.1 | 573.6 |
| 43600 | 13289.3 | 0.7519 | 216.65 | −56.50 | 0.1557 | 15774 | 329.5 | 0.2071 | 0.2536 | 4.922E-4 | 295.1 | 968.1 | 573.6 |
| 43800 | 13350.2 | 0.7519 | 216.65 | −56.50 | 0.1542 | 15623 | 326.3 | 0.2051 | 0.2512 | 4.874E-4 | 295.1 | 968.1 | 573.6 |

**Table A.1** (*Continued*)

| $H$ (ft) | $H$ (m) | $\theta$ | $T$ (K) | $T$ (°C) | $\delta$ | $p$ (N/m$^2$) | $p$ (lb/ft$^2$) | $\sigma$ | $\rho$ (kg/m$^3$) | $\rho$ (slug/ft$^3$) | $a$ (m/s) | $a$ (ft/s) | $a$ (kt) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **44000** | **13411.2** | **0.7519** | **216.65** | **−56.50** | **0.1527** | **15474** | **323.2** | **0.2031** | **0.2488** | **4.828E-4** | **295.1** | **968.1** | **573.6** |
| 44200 | 13472.2 | 0.7519 | 216.65 | −56.50 | 0.1513 | 15326 | 320.1 | 0.2012 | 0.2464 | 4.782E-4 | 295.1 | 968.1 | 573.6 |
| 44400 | 13533.1 | 0.7519 | 216.65 | −56.50 | 0.1498 | 15179 | 317.0 | 0.1992 | 0.2441 | 4.736E-4 | 295.1 | 968.1 | 573.6 |
| 44600 | 13594.1 | 0.7519 | 216.65 | −56.50 | 0.1484 | 15034 | 314.0 | 0.1973 | 0.2417 | 4.691E-4 | 295.1 | 968.1 | 573.6 |
| 44800 | 13655.0 | 0.7519 | 216.65 | −56.50 | 0.1470 | 14890 | 311.0 | 0.1955 | 0.2394 | 4.646E-4 | 295.1 | 968.1 | 573.6 |
| **45000** | **13716.0** | **0.7519** | **216.65** | **−56.50** | **0.1455** | **14748** | **308.0** | **0.1936** | **0.2371** | **4.601E-4** | **295.1** | **968.1** | **573.6** |
| 45200 | 13777.0 | 0.7519 | 216.65 | −56.50 | 0.1442 | 14607 | 305.1 | 0.1917 | 0.2349 | 4.557E-4 | 295.1 | 968.1 | 573.6 |
| 45400 | 13837.9 | 0.7519 | 216.65 | −56.50 | 0.1428 | 14467 | 302.1 | 0.1899 | 0.2326 | 4.514E-4 | 295.1 | 968.1 | 573.6 |
| 45600 | 13898.9 | 0.7519 | 216.65 | −56.50 | 0.1414 | 14328 | 299.3 | 0.1881 | 0.2304 | 4.470E-4 | 295.1 | 968.1 | 573.6 |
| 45800 | 13959.8 | 0.7519 | 216.65 | −56.50 | 0.1401 | 14191 | 296.4 | 0.1863 | 0.2282 | 4.428E-4 | 295.1 | 968.1 | 573.6 |
| **46000** | **14020.8** | **0.7519** | **216.65** | **−56.50** | **0.1387** | **14056** | **293.6** | **0.1845** | **0.2260** | **4.385E-4** | **295.1** | **968.1** | **573.6** |
| 46200 | 14081.8 | 0.7519 | 216.65 | −56.50 | 0.1374 | 13921 | 290.7 | 0.1827 | 0.2238 | 4.343E-4 | 295.1 | 968.1 | 573.6 |
| 46400 | 14142.7 | 0.7519 | 216.65 | −56.50 | 0.1361 | 13788 | 288.0 | 0.1810 | 0.2217 | 4.302E-4 | 295.1 | 968.1 | 573.6 |
| 46600 | 14203.7 | 0.7519 | 216.65 | −56.50 | 0.1348 | 13656 | 285.2 | 0.1793 | 0.2196 | 4.261E-4 | 295.1 | 968.1 | 573.6 |
| 46800 | 14264.6 | 0.7519 | 216.65 | −56.50 | 0.1335 | 13525 | 282.5 | 0.1775 | 0.2175 | 4.220E-4 | 295.1 | 968.1 | 573.6 |
| **47000** | **14325.6** | **0.7519** | **216.65** | **−56.50** | **0.1322** | **13396** | **279.8** | **0.1758** | **0.2154** | **4.180E-4** | **295.1** | **968.1** | **573.6** |
| 47200 | 14386.6 | 0.7519 | 216.65 | −56.50 | 0.1309 | 13268 | 277.1 | 0.1742 | 0.2133 | 4.140E-4 | 295.1 | 968.1 | 573.6 |
| 47400 | 14447.5 | 0.7519 | 216.65 | −56.50 | 0.1297 | 13141 | 274.5 | 0.1725 | 0.2113 | 4.100E-4 | 295.1 | 968.1 | 573.6 |
| 47600 | 14508.5 | 0.7519 | 216.65 | −56.50 | 0.1285 | 13015 | 271.8 | 0.1708 | 0.2093 | 4.061E-4 | 295.1 | 968.1 | 573.6 |
| 47800 | 14569.4 | 0.7519 | 216.65 | −56.50 | 0.1272 | 12891 | 269.2 | 0.1692 | 0.2073 | 4.022E-4 | 295.1 | 968.1 | 573.6 |
| **48000** | **14630.4** | **0.7519** | **216.65** | **−56.50** | **0.1260** | **12767** | **266.7** | **0.1676** | **0.2053** | **3.983E-4** | **295.1** | **968.1** | **573.6** |
| 48200 | 14691.4 | 0.7519 | 216.65 | −56.50 | 0.1248 | 12645 | 264.1 | 0.1660 | 0.2033 | 3.945E-4 | 295.1 | 968.1 | 573.6 |
| 48400 | 14752.3 | 0.7519 | 216.65 | −56.50 | 0.1236 | 12524 | 261.6 | 0.1644 | 0.2014 | 3.908E-4 | 295.1 | 968.1 | 573.6 |
| 48600 | 14813.3 | 0.7519 | 216.65 | −56.50 | 0.1224 | 12404 | 259.1 | 0.1628 | 0.1995 | 3.870E-4 | 295.1 | 968.1 | 573.6 |
| 48800 | 14874.2 | 0.7519 | 216.65 | −56.50 | 0.1213 | 12286 | 256.6 | 0.1613 | 0.1976 | 3.833E-4 | 295.1 | 968.1 | 573.6 |
| **49000** | **14935.2** | **0.7519** | **216.65** | **−56.50** | **0.1201** | **12168** | **254.1** | **0.1597** | **0.1957** | **3.796E-4** | **295.1** | **968.1** | **573.6** |
| 49200 | 14996.2 | 0.7519 | 216.65 | −56.50 | 0.1189 | 12052 | 251.7 | 0.1582 | 0.1938 | 3.760E-4 | 295.1 | 968.1 | 573.6 |
| 49400 | 15057.1 | 0.7519 | 216.65 | −56.50 | 0.1178 | 11937 | 249.3 | 0.1567 | 0.1919 | 3.724E-4 | 295.1 | 968.1 | 573.6 |
| 49600 | 15118.1 | 0.7519 | 216.65 | −56.50 | 0.1167 | 11822 | 246.9 | 0.1552 | 0.1901 | 3.689E-4 | 295.1 | 968.1 | 573.6 |
| 49800 | 15179.0 | 0.7519 | 216.65 | −56.50 | 0.1156 | 11709 | 244.6 | 0.1537 | 0.1883 | 3.653E-4 | 295.1 | 968.1 | 573.6 |
| **50000** | **15240.0** | **0.7519** | **216.65** | **−56.50** | **0.1145** | **11597** | **242.2** | **0.1522** | **0.1865** | **3.618E-4** | **295.1** | **968.1** | **573.6** |
| 50200 | 15301.0 | 0.7519 | 216.65 | −56.50 | 0.1134 | 11486 | 239.9 | 0.1508 | 0.1847 | 3.584E-4 | 295.1 | 968.1 | 573.6 |
| 50400 | 15361.9 | 0.7519 | 216.65 | −56.50 | 0.1123 | 11376 | 237.6 | 0.1493 | 0.1829 | 3.549E-4 | 295.1 | 968.1 | 573.6 |
| 50600 | 15422.9 | 0.7519 | 216.65 | −56.50 | 0.1112 | 11268 | 235.3 | 0.1479 | 0.1812 | 3.515E-4 | 295.1 | 968.1 | 573.6 |
| 50800 | 15483.8 | 0.7519 | 216.65 | −56.50 | 0.1101 | 11160 | 233.1 | 0.1465 | 0.1794 | 3.482E-4 | 295.1 | 968.1 | 573.6 |
| **51000** | **15544.8** | **0.7519** | **216.65** | **−56.50** | **0.1091** | **11053** | **230.8** | **0.1451** | **0.1777** | **3.449E-4** | **295.1** | **968.1** | **573.6** |
| 51200 | 15605.8 | 0.7519 | 216.65 | −56.50 | 0.1080 | 10947 | 228.6 | 0.1437 | 0.1760 | 3.416E-4 | 295.1 | 968.1 | 573.6 |
| 51400 | 15666.7 | 0.7519 | 216.65 | −56.50 | 0.1070 | 10843 | 226.5 | 0.1423 | 0.1743 | 3.383E-4 | 295.1 | 968.1 | 573.6 |
| 51600 | 15727.7 | 0.7519 | 216.65 | −56.50 | 0.1060 | 10739 | 224.3 | 0.1410 | 0.1727 | 3.350E-4 | 295.1 | 968.1 | 573.6 |
| 51800 | 15788.6 | 0.7519 | 216.65 | −56.50 | 0.1050 | 10636 | 222.1 | 0.1396 | 0.1710 | 3.318E-4 | 295.1 | 968.1 | 573.6 |

(*continued*)

**Table A.1** (*Continued*)

| $H$ (ft) | $H$ (m) | $\theta$ | $T$ (K) | $T$ (°C) | $\delta$ | $p$ (N/m$^2$) | $p$ (lb/ft$^2$) | $\sigma$ | $\rho$ (kg/m$^3$) | $\rho$ (slug/ft$^3$) | $a$ (m/s) | $a$ (ft/s) | $a$ (kt) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **52000** | **15849.6** | **0.7519** | **216.65** | **−56.50** | **0.1040** | **10534** | **220.0** | **0.1383** | **0.1694** | **3.287E-4** | **295.1** | **968.1** | **573.6** |
| 52200 | 15910.6 | 0.7519 | 216.65 | −56.50 | 0.1030 | 10434 | 217.9 | 0.1370 | 0.1678 | 3.255E-4 | 295.1 | 968.1 | 573.6 |
| 52400 | 15971.5 | 0.7519 | 216.65 | −56.50 | 0.1020 | 10334 | 215.8 | 0.1356 | 0.1662 | 3.224E-4 | 295.1 | 968.1 | 573.6 |
| 52600 | 16032.5 | 0.7519 | 216.65 | −56.50 | 0.1010 | 10235 | 213.8 | 0.1343 | 0.1646 | 3.193E-4 | 295.1 | 968.1 | 573.6 |
| 52800 | 16093.4 | 0.7519 | 216.65 | −56.50 | 0.1000 | 10137 | 211.7 | 0.1331 | 0.1630 | 3.163E-4 | 295.1 | 968.1 | 573.6 |
| **53000** | **16154.4** | **0.7519** | **216.65** | **−56.50** | **0.0991** | **10040** | **209.7** | **0.1318** | **0.1614** | **3.132E-4** | **295.1** | **968.1** | **573.6** |
| 53200 | 16215.4 | 0.7519 | 216.65 | −56.50 | 0.0981 | 9944 | 207.7 | 0.1305 | 0.1599 | 3.102E-4 | 295.1 | 968.1 | 573.6 |
| 53400 | 16276.3 | 0.7519 | 216.65 | −56.50 | 0.0972 | 9849 | 205.7 | 0.1293 | 0.1584 | 3.073E-4 | 295.1 | 968.1 | 573.6 |
| 53600 | 16337.3 | 0.7519 | 216.65 | −56.50 | 0.0963 | 9755 | 203.7 | 0.1280 | 0.1569 | 3.043E-4 | 295.1 | 968.1 | 573.6 |
| 53800 | 16398.2 | 0.7519 | 216.65 | −56.50 | 0.0953 | 9661 | 201.8 | 0.1268 | 0.1554 | 3.014E-4 | 295.1 | 968.1 | 573.6 |
| **54000** | **16459.2** | **0.7519** | **216.65** | **−56.50** | **0.0944** | **9569** | **199.8** | **0.1256** | **0.1539** | **2.985E-4** | **295.1** | **968.1** | **573.6** |
| 54200 | 16520.2 | 0.7519 | 216.65 | −56.50 | 0.0935 | 9477 | 197.9 | 0.1244 | 0.1524 | 2.957E-4 | 295.1 | 968.1 | 573.6 |
| 54400 | 16581.1 | 0.7519 | 216.65 | −56.50 | 0.0926 | 9387 | 196.0 | 0.1232 | 0.1509 | 2.929E-4 | 295.1 | 968.1 | 573.6 |
| 54600 | 16642.1 | 0.7519 | 216.65 | −56.50 | 0.0918 | 9297 | 194.2 | 0.1220 | 0.1495 | 2.901E-4 | 295.1 | 968.1 | 573.6 |
| 54800 | 16703.0 | 0.7519 | 216.65 | −56.50 | 0.0909 | 9208 | 192.3 | 0.1209 | 0.1481 | 2.873E-4 | 295.1 | 968.1 | 573.6 |
| **55000** | **16764.0** | **0.7519** | **216.65** | **−56.50** | **0.0900** | **9120** | **190.5** | **0.1197** | **0.1466** | **2.845E-4** | **295.1** | **968.1** | **573.6** |
| 55200 | 16825.0 | 0.7519 | 216.65 | −56.50 | 0.0891 | 9033 | 188.6 | 0.1186 | 0.1452 | 2.818E-4 | 295.1 | 968.1 | 573.6 |
| 55400 | 16885.9 | 0.7519 | 216.65 | −56.50 | 0.0883 | 8946 | 186.8 | 0.1174 | 0.1439 | 2.791E-4 | 295.1 | 968.1 | 573.6 |
| 55600 | 16946.9 | 0.7519 | 216.65 | −56.50 | 0.0874 | 8861 | 185.1 | 0.1163 | 0.1425 | 2.764E-4 | 295.1 | 968.1 | 573.6 |
| 55800 | 17007.8 | 0.7519 | 216.65 | −56.50 | 0.0866 | 8776 | 183.3 | 0.1152 | 0.1411 | 2.738E-4 | 295.1 | 968.1 | 573.6 |
| **56000** | **17068.8** | **0.7519** | **216.65** | **−56.50** | **0.0858** | **8692** | **181.5** | **0.1141** | **0.1398** | **2.712E-4** | **295.1** | **968.1** | **573.6** |
| 56200 | 17129.8 | 0.7519 | 216.65 | −56.50 | 0.0850 | 8609 | 179.8 | 0.1130 | 0.1384 | 2.686E-4 | 295.1 | 968.1 | 573.6 |
| 56400 | 17190.7 | 0.7519 | 216.65 | −56.50 | 0.0841 | 8526 | 178.1 | 0.1119 | 0.1371 | 2.660E-4 | 295.1 | 968.1 | 573.6 |
| 56600 | 17251.7 | 0.7519 | 216.65 | −56.50 | 0.0833 | 8445 | 176.4 | 0.1108 | 0.1358 | 2.635E-4 | 295.1 | 968.1 | 573.6 |
| 56800 | 17312.6 | 0.7519 | 216.65 | −56.50 | 0.0825 | 8364 | 174.7 | 0.1098 | 0.1345 | 2.610E-4 | 295.1 | 968.1 | 573.6 |
| **57000** | **17373.6** | **0.7519** | **216.65** | **−56.50** | **0.0818** | **8284** | **173.0** | **0.1087** | **0.1332** | **2.585E-4** | **295.1** | **968.1** | **573.6** |
| 57200 | 17434.6 | 0.7519 | 216.65 | −56.50 | 0.0810 | 8205 | 171.4 | 0.1077 | 0.1319 | 2.560E-4 | 295.1 | 968.1 | 573.6 |
| 57400 | 17495.5 | 0.7519 | 216.65 | −56.50 | 0.0802 | 8126 | 169.7 | 0.1067 | 0.1307 | 2.535E-4 | 295.1 | 968.1 | 573.6 |
| 57600 | 17556.5 | 0.7519 | 216.65 | −56.50 | 0.0794 | 8048 | 168.1 | 0.1056 | 0.1294 | 2.511E-4 | 295.1 | 968.1 | 573.6 |
| 57800 | 17617.4 | 0.7519 | 216.65 | −56.50 | 0.0787 | 7971 | 166.5 | 0.1046 | 0.1282 | 2.487E-4 | 295.1 | 968.1 | 573.6 |
| **58000** | **17678.4** | **0.7519** | **216.65** | **−56.50** | **0.0779** | **7895** | **164.9** | **0.1036** | **0.1270** | **2.463E-4** | **295.1** | **968.1** | **573.6** |
| 58200 | 17739.4 | 0.7519 | 216.65 | −56.50 | 0.0772 | 7820 | 163.3 | 0.1026 | 0.1257 | 2.440E-4 | 295.1 | 968.1 | 573.6 |
| 58400 | 17800.3 | 0.7519 | 216.65 | −56.50 | 0.0764 | 7745 | 161.8 | 0.1017 | 0.1245 | 2.416E-4 | 295.1 | 968.1 | 573.6 |
| 58600 | 17861.3 | 0.7519 | 216.65 | −56.50 | 0.0757 | 7671 | 160.2 | 0.1007 | 0.1233 | 2.393E-4 | 295.1 | 968.1 | 573.6 |
| 58800 | 17922.2 | 0.7519 | 216.65 | −56.50 | 0.0750 | 7597 | 158.7 | 0.0997 | 0.1222 | 2.370E-4 | 295.1 | 968.1 | 573.6 |
| **59000** | **17983.2** | **0.7519** | **216.65** | **−56.50** | **0.0743** | **7525** | **157.2** | **0.0988** | **0.1210** | **2.348E-4** | **295.1** | **968.1** | **573.6** |
| 59200 | 18044.2 | 0.7519 | 216.65 | −56.50 | 0.0736 | 7453 | 155.7 | 0.0978 | 0.1198 | 2.325E-4 | 295.1 | 968.1 | 573.6 |
| 59400 | 18105.1 | 0.7519 | 216.65 | −56.50 | 0.0728 | 7381 | 154.2 | 0.0969 | 0.1187 | 2.303E-4 | 295.1 | 968.1 | 573.6 |
| 59600 | 18166.1 | 0.7519 | 216.65 | −56.50 | 0.0722 | 7311 | 152.7 | 0.0960 | 0.1176 | 2.281E-4 | 295.1 | 968.1 | 573.6 |
| 59800 | 18227.0 | 0.7519 | 216.65 | −56.50 | 0.0715 | 7241 | 151.2 | 0.0950 | 0.1164 | 2.259E-4 | 295.1 | 968.1 | 573.6 |
| **60000** | **18288.0** | **0.7519** | **216.65** | **−56.50** | **0.0708** | **7172** | **149.8** | **0.0941** | **0.1153** | **2.238E-4** | **295.1** | **968.1** | **573.6** |