

CRC Handbook of Chemistry and Physics

A Ready-Reference Book of Chemical and Physical Data



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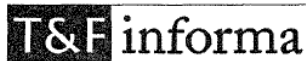
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STANDARD DENSITY OF WATER

This table gives the density ρ of water in the temperature range from 0°C to 100°C at a pressure of 101325 Pa (one standard atmosphere). From 0°C to 40°C the values are taken from the IUPAC publication in Reference 1 and refer to standard mean ocean water (SMOW), free from dissolved salts and gases. SMOW is a standard water sample of high purity and known isotopic composition. Methods of correcting for different isotopic compositions are discussed in Reference 1. The remaining values are taken from the NIST Chemistry WebBook, Reference 2.

Note that the IUPAC values refer to the IPTS-68 temperature scale, while the NIST values are based on the ITS-90 scale (where the normal boiling point is 99.974°C). The conversion between these scales can be found in Sec. 1. The difference between the scales leads to a difference in the density of water of about 20 ppm in the neighborhood of 100°C and much less at lower temperatures.

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| $t/^\circ\text{C}$ | $\rho/\text{g cm}^{-3}$ | $t/^\circ\text{C}$ | $\rho/\text{g cm}^{-3}$ | $t/^\circ\text{C}$ | $\rho/\text{g cm}^{-3}$ | $t/^\circ\text{C}$ | $\rho/\text{g cm}^{-3}$ | $t/^\circ\text{C}$ | $\rho/\text{g cm}^{-3}$ |
|--------------------|-------------------------|--------------------|-------------------------|--------------------|-------------------------|--------------------|-------------------------|--------------------|-------------------------|
| 0.1 | 0.9998493 | 4.3 | 0.9999742 | 8.5 | 0.9998189 | 12.7 | 0.9994167 | 16.9 | 0.9987942 |
| 0.2 | 0.9998558 | 4.4 | 0.9999736 | 8.6 | 0.9998121 | 12.8 | 0.9994043 | 17.0 | 0.9987769 |
| 0.3 | 0.9998622 | 4.5 | 0.9999728 | 8.7 | 0.9998051 | 12.9 | 0.9993918 | 17.1 | 0.9987595 |
| 0.4 | 0.9998683 | 4.6 | 0.9999719 | 8.8 | 0.9997980 | 13.0 | 0.9993792 | 17.2 | 0.9987419 |
| 0.5 | 0.9998743 | 4.7 | 0.9999709 | 8.9 | 0.9997908 | 13.1 | 0.9993665 | 17.3 | 0.9987243 |
| 0.6 | 0.9998801 | 4.8 | 0.9999696 | 9.0 | 0.9997834 | 13.2 | 0.9993536 | 17.4 | 0.9987065 |
| 0.7 | 0.9998857 | 4.9 | 0.9999683 | 9.1 | 0.9997759 | 13.3 | 0.9993407 | 17.5 | 0.9986886 |
| 0.8 | 0.9998912 | 5.0 | 0.9999668 | 9.2 | 0.9997682 | 13.4 | 0.9993276 | 17.6 | 0.9986706 |
| 0.9 | 0.9998964 | 5.1 | 0.9999651 | 9.3 | 0.9997604 | 13.5 | 0.9993143 | 17.7 | 0.9986525 |
| 1.0 | 0.9999015 | 5.2 | 0.9999632 | 9.4 | 0.9997525 | 13.6 | 0.9993010 | 17.8 | 0.9986343 |
| 1.1 | 0.9999065 | 5.3 | 0.9999612 | 9.5 | 0.9997444 | 13.7 | 0.9992875 | 17.9 | 0.9986160 |
| 1.2 | 0.9999112 | 5.4 | 0.9999591 | 9.6 | 0.9997362 | 13.8 | 0.9992740 | 18.0 | 0.9985976 |
| 1.3 | 0.9999158 | 5.5 | 0.9999568 | 9.7 | 0.9997279 | 13.9 | 0.9992602 | 18.1 | 0.9985790 |
| 1.4 | 0.9999202 | 5.6 | 0.9999544 | 9.8 | 0.9997194 | 14.0 | 0.9992464 | 18.2 | 0.9985604 |
| 1.5 | 0.9999244 | 5.7 | 0.9999518 | 9.9 | 0.9997108 | 14.1 | 0.9992325 | 18.3 | 0.9985416 |
| 1.6 | 0.9999284 | 5.8 | 0.9999490 | 10.0 | 0.9997021 | 14.2 | 0.9992184 | 18.4 | 0.9985228 |
| 1.7 | 0.9999323 | 5.9 | 0.9999461 | 10.1 | 0.9996932 | 14.3 | 0.9992042 | 18.5 | 0.9985038 |
| 1.8 | 0.9999360 | 6.0 | 0.9999430 | 10.2 | 0.9996842 | 14.4 | 0.9991899 | 18.6 | 0.9984847 |
| 1.9 | 0.9999395 | 6.1 | 0.9999398 | 10.3 | 0.9996751 | 14.5 | 0.9991755 | 18.7 | 0.9984655 |
| 2.0 | 0.9999429 | 6.2 | 0.9999365 | 10.4 | 0.9996658 | 14.6 | 0.9991609 | 18.8 | 0.9984462 |
| 2.1 | 0.9999461 | 6.3 | 0.9999330 | 10.5 | 0.9996564 | 14.7 | 0.9991463 | 18.9 | 0.9984268 |
| 2.2 | 0.9999491 | 6.4 | 0.9999293 | 10.6 | 0.9996468 | 14.8 | 0.9991315 | 19.0 | 0.9984073 |
| 2.3 | 0.9999519 | 6.5 | 0.9999255 | 10.7 | 0.9996372 | 14.9 | 0.9991166 | 19.1 | 0.9983877 |
| 2.4 | 0.9999546 | 6.6 | 0.9999216 | 10.8 | 0.9996274 | 15.0 | 0.9991016 | 19.2 | 0.9983680 |
| 2.5 | 0.9999571 | 6.7 | 0.9999175 | 10.9 | 0.9996174 | 15.1 | 0.9990864 | 19.3 | 0.9983481 |
| 2.6 | 0.9999595 | 6.8 | 0.9999132 | 11.0 | 0.9996074 | 15.2 | 0.9990712 | 19.4 | 0.9983282 |
| 2.7 | 0.9999616 | 6.9 | 0.9999088 | 11.1 | 0.9995972 | 15.3 | 0.9990558 | 19.5 | 0.9983081 |
| 2.8 | 0.9999636 | 7.0 | 0.9999043 | 11.2 | 0.9995869 | 15.4 | 0.9990403 | 19.6 | 0.9982880 |
| 2.9 | 0.9999655 | 7.1 | 0.9998996 | 11.3 | 0.9995764 | 15.5 | 0.9990247 | 19.7 | 0.9982677 |
| 3.0 | 0.9999672 | 7.2 | 0.9998948 | 11.4 | 0.9995658 | 15.6 | 0.9990090 | 19.8 | 0.9982474 |
| 3.1 | 0.9999687 | 7.3 | 0.9998898 | 11.5 | 0.9995551 | 15.7 | 0.9989932 | 19.9 | 0.9982269 |
| 3.2 | 0.9999700 | 7.4 | 0.9998847 | 11.6 | 0.9995443 | 15.8 | 0.9989772 | 20.0 | 0.9982063 |
| 3.3 | 0.9999712 | 7.5 | 0.9998794 | 11.7 | 0.9995333 | 15.9 | 0.9989612 | 20.1 | 0.9981856 |
| 3.4 | 0.9999722 | 7.6 | 0.9998740 | 11.8 | 0.9995222 | 16.0 | 0.9989450 | 20.2 | 0.9981649 |
| 3.5 | 0.9999731 | 7.7 | 0.9998684 | 11.9 | 0.9995110 | 16.1 | 0.9989287 | 20.3 | 0.9981440 |
| 3.6 | 0.9999738 | 7.8 | 0.9998627 | 12.0 | 0.9994996 | 16.2 | 0.9989123 | 20.4 | 0.9981230 |
| 3.7 | 0.9999743 | 7.9 | 0.9998569 | 12.1 | 0.9994882 | 16.3 | 0.9988957 | 20.5 | 0.9981019 |
| 3.8 | 0.9999747 | 8.0 | 0.9998509 | 12.2 | 0.9994766 | 16.4 | 0.9988791 | 20.6 | 0.9980807 |
| 3.9 | 0.9999749 | 8.1 | 0.9998448 | 12.3 | 0.9994648 | 16.5 | 0.9988623 | 20.7 | 0.9980594 |
| 4.0 | 0.9999750 | 8.2 | 0.9998385 | 12.4 | 0.9994530 | 16.6 | 0.9988455 | 20.8 | 0.9980380 |
| 4.1 | 0.9999748 | 8.3 | 0.9998321 | 12.5 | 0.9994410 | 16.7 | 0.9988285 | 20.9 | 0.9980164 |
| 4.2 | 0.9999746 | 8.4 | 0.9998256 | 12.6 | 0.9994289 | 16.8 | 0.9988114 | 21.0 | 0.9979948 |

Standard Density of Water

| t/°C | ρ/g cm ⁻³ | t/°C | ρ/g cm ⁻³ | t/°C | ρ/g cm ⁻³ | t/°C | ρ/g cm ⁻³ | t/°C | ρ/g cm ⁻³ |
|------|----------------------|------|----------------------|------|----------------------|------|----------------------|--------|----------------------|
| 21.1 | 0.9979731 | 26.1 | 0.9967604 | 31.1 | 0.9953139 | 36.1 | 0.9936531 | 51.0 | 0.98758 |
| 21.2 | 0.9979513 | 26.2 | 0.9967337 | 31.2 | 0.9952827 | 36.2 | 0.9936178 | 52.0 | 0.98712 |
| 21.3 | 0.9979294 | 26.3 | 0.9967069 | 31.3 | 0.9952514 | 36.3 | 0.9935825 | 53.0 | 0.98665 |
| 21.4 | 0.9979073 | 26.4 | 0.9966800 | 31.4 | 0.9952201 | 36.4 | 0.9935470 | 54.0 | 0.98617 |
| 21.5 | 0.9978852 | 26.5 | 0.9966530 | 31.5 | 0.9951887 | 36.5 | 0.9935115 | 55.0 | 0.98569 |
| 21.6 | 0.9978630 | 26.6 | 0.9966259 | 31.6 | 0.9951572 | 36.6 | 0.9934759 | 56.0 | 0.98521 |
| 21.7 | 0.9978406 | 26.7 | 0.9965987 | 31.7 | 0.9951255 | 36.7 | 0.9934403 | 57.0 | 0.98471 |
| 21.8 | 0.9978182 | 26.8 | 0.9965714 | 31.8 | 0.9950939 | 36.8 | 0.9934045 | 58.0 | 0.98421 |
| 21.9 | 0.9977957 | 26.9 | 0.9965441 | 31.9 | 0.9950621 | 36.9 | 0.9933687 | 59.0 | 0.98371 |
| 22.0 | 0.9977730 | 27.0 | 0.9965166 | 32.0 | 0.9950302 | 37.0 | 0.9933328 | 60.0 | 0.98320 |
| 22.1 | 0.9977503 | 27.1 | 0.9964891 | 32.1 | 0.9949983 | 37.1 | 0.9932968 | 61.0 | 0.98268 |
| 22.2 | 0.9977275 | 27.2 | 0.9964615 | 32.2 | 0.9949663 | 37.2 | 0.9932607 | 62.0 | 0.98216 |
| 22.3 | 0.9977045 | 27.3 | 0.9964337 | 32.3 | 0.9949342 | 37.3 | 0.9932246 | 63.0 | 0.98163 |
| 22.4 | 0.9976815 | 27.4 | 0.9964059 | 32.4 | 0.9949020 | 37.4 | 0.9931884 | 64.0 | 0.98109 |
| 22.5 | 0.9976584 | 27.5 | 0.9963780 | 32.5 | 0.9948697 | 37.5 | 0.9931521 | 65.0 | 0.98055 |
| 22.6 | 0.9976351 | 27.6 | 0.9963500 | 32.6 | 0.9948373 | 37.6 | 0.9931157 | 66.0 | 0.98000 |
| 22.7 | 0.9976118 | 27.7 | 0.9963219 | 32.7 | 0.9948049 | 37.7 | 0.9930793 | 67.0 | 0.97945 |
| 22.8 | 0.9975883 | 27.8 | 0.9962938 | 32.8 | 0.9947724 | 37.8 | 0.9930428 | 68.0 | 0.97890 |
| 22.9 | 0.9975648 | 27.9 | 0.9962655 | 32.9 | 0.9947397 | 37.9 | 0.9930062 | 69.0 | 0.97833 |
| 23.0 | 0.9975412 | 28.0 | 0.9962371 | 33.0 | 0.9947071 | 38.0 | 0.9929695 | 70.0 | 0.97776 |
| 23.1 | 0.9975174 | 28.1 | 0.9962087 | 33.1 | 0.9946743 | 38.1 | 0.9929328 | 71.0 | 0.97719 |
| 23.2 | 0.9974936 | 28.2 | 0.9961801 | 33.2 | 0.9946414 | 38.2 | 0.9928960 | 72.0 | 0.97661 |
| 23.3 | 0.9974697 | 28.3 | 0.9961515 | 33.3 | 0.9946085 | 38.3 | 0.9928591 | 73.0 | 0.97603 |
| 23.4 | 0.9974456 | 28.4 | 0.9961228 | 33.4 | 0.9945755 | 38.4 | 0.9928221 | 74.0 | 0.97544 |
| 23.5 | 0.9974215 | 28.5 | 0.9960940 | 33.5 | 0.9945423 | 38.5 | 0.9927850 | 75.0 | 0.97484 |
| 23.6 | 0.9973973 | 28.6 | 0.9960651 | 33.6 | 0.9945092 | 38.6 | 0.9927479 | 76.0 | 0.97424 |
| 23.7 | 0.9973730 | 28.7 | 0.9960361 | 33.7 | 0.9944759 | 38.7 | 0.9927107 | 77.0 | 0.97364 |
| 23.8 | 0.9973485 | 28.8 | 0.9960070 | 33.8 | 0.9944425 | 38.8 | 0.9926735 | 78.0 | 0.97303 |
| 23.9 | 0.9973240 | 28.9 | 0.9959778 | 33.9 | 0.9944091 | 38.9 | 0.9926361 | 79.0 | 0.97241 |
| 24.0 | 0.9972994 | 29.0 | 0.9959486 | 34.0 | 0.9943756 | 39.0 | 0.9925987 | 80.0 | 0.97179 |
| 24.1 | 0.9972747 | 29.1 | 0.9959192 | 34.1 | 0.9943420 | 39.1 | 0.9925612 | 81.0 | 0.97116 |
| 24.2 | 0.9972499 | 29.2 | 0.9958898 | 34.2 | 0.9943083 | 39.2 | 0.9925236 | 82.0 | 0.97053 |
| 24.3 | 0.9972250 | 29.3 | 0.9958603 | 34.3 | 0.9942745 | 39.3 | 0.9924860 | 83.0 | 0.96990 |
| 24.4 | 0.9972000 | 29.4 | 0.9958306 | 34.4 | 0.9942407 | 39.4 | 0.9924483 | 84.0 | 0.96926 |
| 24.5 | 0.9971749 | 29.5 | 0.9958009 | 34.5 | 0.9942068 | 39.5 | 0.9924105 | 85.0 | 0.96861 |
| 24.6 | 0.9971497 | 29.6 | 0.9957712 | 34.6 | 0.9941728 | 39.6 | 0.9923726 | 86.0 | 0.96796 |
| 24.7 | 0.9971244 | 29.7 | 0.9957413 | 34.7 | 0.9941387 | 39.7 | 0.9923347 | 87.0 | 0.96731 |
| 24.8 | 0.9970990 | 29.8 | 0.9957113 | 34.8 | 0.9941045 | 39.8 | 0.9922966 | 88.0 | 0.96664 |
| 24.9 | 0.9970735 | 29.9 | 0.9956813 | 34.9 | 0.9940703 | 39.9 | 0.9922586 | 89.0 | 0.96598 |
| 25.0 | 0.9970480 | 30.0 | 0.9956511 | 35.0 | 0.9940359 | 40.0 | 0.9922204 | 90.0 | 0.96531 |
| 25.1 | 0.9970223 | 30.1 | 0.9956209 | 35.1 | 0.9940015 | 41.0 | 0.99183 | 91.0 | 0.96463 |
| 25.2 | 0.9969965 | 30.2 | 0.9955906 | 35.2 | 0.9939671 | 42.0 | 0.99144 | 92.0 | 0.96396 |
| 25.3 | 0.9969707 | 30.3 | 0.9955602 | 35.3 | 0.9939325 | 43.0 | 0.99104 | 93.0 | 0.96327 |
| 25.4 | 0.9969447 | 30.4 | 0.9955297 | 35.4 | 0.9938978 | 44.0 | 0.99063 | 94.0 | 0.96258 |
| 25.5 | 0.9969186 | 30.5 | 0.9954991 | 35.5 | 0.9938631 | 45.0 | 0.99021 | 95.0 | 0.96189 |
| 25.6 | 0.9968925 | 30.6 | 0.9954685 | 35.6 | 0.9938283 | 46.0 | 0.98979 | 96.0 | 0.96119 |
| 25.7 | 0.9968663 | 30.7 | 0.9954377 | 35.7 | 0.9937934 | 47.0 | 0.98936 | 97.0 | 0.96049 |
| 25.8 | 0.9968399 | 30.8 | 0.9954069 | 35.8 | 0.9937585 | 48.0 | 0.98893 | 98.0 | 0.95978 |
| 25.9 | 0.9968135 | 30.9 | 0.9953760 | 35.9 | 0.9937234 | 49.0 | 0.98848 | 99.0 | 0.95907 |
| 26.0 | 0.9967870 | 31.0 | 0.9953450 | 36.0 | 0.9936883 | 50.0 | 0.98804 | 99.974 | 0.95837 |

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