

TABLE A-3

Properties of saturated water

| Temp. <i>T</i> , °C | Saturation Pressure <i>P</i> _{sat} , kPa | Density <i>ρ</i> , kg/m ³ | | Enthalpy of Vaporization <i>h</i> _{fg} , kJ/kg | Specific Heat <i>c</i> _p , J/kg · K | | Thermal Conductivity <i>k</i> , W/m · K | | Dynamic Viscosity <i>μ</i> , kg/m · s | | Prandtl Number Pr | | Volume Expansion Coefficient <i>β</i> , 1/K Liquid |
|------------------------|---|---|--------|--|--|--------|---|--------|--|--------------------------|-------------------------|-------|--|
| | | Liquid | Vapor | | Liquid | Vapor | Liquid | Vapor | Liquid | Vapor | Liquid | Vapor | |
| 0.01 | 0.6113 | 999.8 | 0.0048 | 2501 | 4217 | 1854 | 0.561 | 0.0171 | 1.792 × 10 ⁻³ | 0.922 × 10 ⁻⁵ | 13.5 | 1.00 | -0.068 × 10 ⁻³ |
| 5 | 0.8721 | 999.9 | 0.0068 | 2490 | 4205 | 1857 | 0.571 | 0.0173 | 1.519 × 10 ⁻³ | 0.934 × 10 ⁻⁵ | 11.2 | 1.00 | 0.015 × 10 ⁻³ |
| 10 | 1.2276 | 999.7 | 0.0094 | 2478 | 4194 | 1862 | 0.580 | 0.0176 | 1.307 × 10 ⁻³ | 0.946 × 10 ⁻⁵ | 9.45 | 1.00 | 0.733 × 10 ⁻³ |
| 15 | 1.7051 | 999.1 | 0.0128 | 2466 | 4186 | 1863 | 0.589 | 0.0179 | 1.138 × 10 ⁻³ | 0.959 × 10 ⁻⁵ | 8.09 | 1.00 | 0.138 × 10 ⁻³ |
| 20 | 2.339 | 998.0 | 0.0173 | 2454 | 4182 | 1867 | 0.598 | 0.0182 | 1.002 × 10 ⁻³ | 0.973 × 10 ⁻⁵ | 7.01 | 1.00 | 0.195 × 10 ⁻³ |
| 25 | 3.169 | 997.0 | 0.0231 | 2442 | 4180 | 1870 | 0.607 | 0.0186 | 0.891 × 10 ⁻³ | 0.987 × 10 ⁻⁵ | 6.14 | 1.00 | 0.247 × 10 ⁻³ |
| 30 | 4.246 | 996.0 | 0.0304 | 2431 | 4178 | 1875 | 0.615 | 0.0189 | 0.798 × 10 ⁻³ | 1.001 × 10 ⁻⁵ | 5.42 | 1.00 | 0.294 × 10 ⁻³ |
| 35 | 5.628 | 994.0 | 0.0397 | 2419 | 4178 | 1880 | 0.623 | 0.0192 | 0.720 × 10 ⁻³ | 1.016 × 10 ⁻⁵ | 4.83 | 1.00 | 0.337 × 10 ⁻³ |
| 40 | 7.384 | 992.1 | 0.0512 | 2407 | 4179 | 1885 | 0.631 | 0.0196 | 0.653 × 10 ⁻³ | 1.031 × 10 ⁻⁵ | 4.32 | 1.00 | 0.377 × 10 ⁻³ |
| 45 | 9.593 | 990.1 | 0.0655 | 2395 | 4180 | 1892 | 0.637 | 0.0200 | 0.596 × 10 ⁻³ | 1.046 × 10 ⁻⁵ | 3.91 | 1.00 | 0.415 × 10 ⁻³ |
| 50 | 12.35 | 988.1 | 0.0831 | 2383 | 4181 | 1900 | 0.644 | 0.0204 | 0.547 × 10 ⁻³ | 1.062 × 10 ⁻⁵ | 3.55 | 1.00 | 0.451 × 10 ⁻³ |
| 55 | 15.76 | 985.2 | 0.1045 | 2371 | 4183 | 1908 | 0.649 | 0.0208 | 0.504 × 10 ⁻³ | 1.077 × 10 ⁻⁵ | 3.25 | 1.00 | 0.484 × 10 ⁻³ |
| 60 | 19.94 | 983.3 | 0.1304 | 2359 | 4185 | 1916 | 0.654 | 0.0212 | 0.467 × 10 ⁻³ | 1.093 × 10 ⁻⁵ | 2.99 | 1.00 | 0.517 × 10 ⁻³ |
| 65 | 25.03 | 980.4 | 0.1614 | 2346 | 4187 | 1926 | 0.659 | 0.0216 | 0.433 × 10 ⁻³ | 1.110 × 10 ⁻⁵ | 2.75 | 1.00 | 0.548 × 10 ⁻³ |
| 70 | 31.19 | 977.5 | 0.1983 | 2334 | 4190 | 1936 | 0.663 | 0.0221 | 0.404 × 10 ⁻³ | 1.126 × 10 ⁻⁵ | 2.55 | 1.00 | 0.578 × 10 ⁻³ |
| 75 | 38.58 | 974.7 | 0.2421 | 2321 | 4193 | 1948 | 0.667 | 0.0225 | 0.378 × 10 ⁻³ | 1.142 × 10 ⁻⁵ | 2.38 | 1.00 | 0.607 × 10 ⁻³ |
| 80 | 47.39 | 971.8 | 0.2935 | 2309 | 4197 | 1962 | 0.670 | 0.0230 | 0.355 × 10 ⁻³ | 1.159 × 10 ⁻⁵ | 2.22 | 1.00 | 0.653 × 10 ⁻³ |
| 85 | 57.83 | 968.1 | 0.3536 | 2296 | 4201 | 1977 | 0.673 | 0.0235 | 0.333 × 10 ⁻³ | 1.176 × 10 ⁻⁵ | 2.08 | 1.00 | 0.670 × 10 ⁻³ |
| 90 | 70.14 | 965.3 | 0.4235 | 2283 | 4206 | 1993 | 0.675 | 0.0240 | 0.315 × 10 ⁻³ | 1.193 × 10 ⁻⁵ | 1.96 | 1.00 | 0.702 × 10 ⁻³ |
| 95 | 84.55 | 961.5 | 0.5045 | 2270 | 4212 | 2010 | 0.677 | 0.0246 | 0.297 × 10 ⁻³ | 1.210 × 10 ⁻⁵ | 1.85 | 1.00 | 0.716 × 10 ⁻³ |
| 100 | 101.33 | 957.9 | 0.5978 | 2257 | 4217 | 2029 | 0.679 | 0.0251 | 0.282 × 10 ⁻³ | 1.227 × 10 ⁻⁵ | 1.75 | 1.00 | 0.750 × 10 ⁻³ |
| 110 | 143.27 | 950.6 | 0.8263 | 2230 | 4229 | 2071 | 0.682 | 0.0262 | 0.255 × 10 ⁻³ | 1.261 × 10 ⁻⁵ | 1.58 | 1.00 | 0.798 × 10 ⁻³ |
| 120 | 198.53 | 943.4 | 1.121 | 2203 | 4244 | 2120 | 0.683 | 0.0275 | 0.232 × 10 ⁻³ | 1.296 × 10 ⁻⁵ | 1.44 | 1.00 | 0.858 × 10 ⁻³ |
| 130 | 270.1 | 934.6 | 1.496 | 2174 | 4263 | 2177 | 0.684 | 0.0288 | 0.213 × 10 ⁻³ | 1.330 × 10 ⁻⁵ | 1.33 | 1.01 | 0.913 × 10 ⁻³ |
| 140 | 361.3 | 921.7 | 1.965 | 2145 | 4286 | 2244 | 0.683 | 0.0301 | 0.197 × 10 ⁻³ | 1.365 × 10 ⁻⁵ | 1.24 | 1.02 | 0.970 × 10 ⁻³ |
| 150 | 475.8 | 916.6 | 2.546 | 2114 | 4311 | 2314 | 0.682 | 0.0316 | 0.183 × 10 ⁻³ | 1.399 × 10 ⁻⁵ | 1.16 | 1.02 | 1.025 × 10 ⁻³ |
| 160 | 617.8 | 907.4 | 3.256 | 2083 | 4340 | 2420 | 0.680 | 0.0331 | 0.170 × 10 ⁻³ | 1.434 × 10 ⁻⁵ | 1.09 | 1.05 | 1.145 × 10 ⁻³ |
| 170 | 791.7 | 897.7 | 4.119 | 2050 | 4370 | 2490 | 0.677 | 0.0347 | 0.160 × 10 ⁻³ | 1.468 × 10 ⁻⁵ | 1.03 | 1.05 | 1.178 × 10 ⁻³ |
| 180 | 1,002.1 | 887.3 | 5.153 | 2015 | 4410 | 2590 | 0.673 | 0.0364 | 0.150 × 10 ⁻³ | 1.502 × 10 ⁻⁵ | 0.983 | 1.07 | 1.210 × 10 ⁻³ |
| 190 | 1,254.4 | 876.4 | 6.388 | 1979 | 4460 | 2710 | 0.669 | 0.0382 | 0.142 × 10 ⁻³ | 1.537 × 10 ⁻⁵ | 0.947 | 1.09 | 1.280 × 10 ⁻³ |
| 200 | 1,553.8 | 864.3 | 7.852 | 1941 | 4500 | 2840 | 0.663 | 0.0401 | 0.134 × 10 ⁻³ | 1.571 × 10 ⁻⁵ | 0.910 | 1.11 | 1.350 × 10 ⁻³ |
| 220 | 2,318 | 840.3 | 11.60 | 1859 | 4610 | 3110 | 0.650 | 0.0442 | 0.122 × 10 ⁻³ | 1.641 × 10 ⁻⁵ | 0.865 | 1.15 | 1.520 × 10 ⁻³ |
| 240 | 3,344 | 813.7 | 16.73 | 1767 | 4760 | 3520 | 0.632 | 0.0487 | 0.111 × 10 ⁻³ | 1.712 × 10 ⁻⁵ | 0.836 | 1.24 | 1.720 × 10 ⁻³ |
| 260 | 4,688 | 783.7 | 23.69 | 1663 | 4970 | 4070 | 0.609 | 0.0540 | 0.102 × 10 ⁻³ | 1.788 × 10 ⁻⁵ | 0.832 | 1.35 | 2.000 × 10 ⁻³ |
| 280 | 6,412 | 750.8 | 33.15 | 1544 | 5280 | 4835 | 0.581 | 0.0605 | 0.094 × 10 ⁻³ | 1.870 × 10 ⁻⁵ | 0.854 | 1.49 | 2.380 × 10 ⁻³ |
| 300 | 8,581 | 713.8 | 46.15 | 1405 | 5750 | 5980 | 0.548 | 0.0695 | 0.086 × 10 ⁻³ | 1.965 × 10 ⁻⁵ | 0.902 | 1.69 | 2.950 × 10 ⁻³ |
| 320 | 11,274 | 667.1 | 64.57 | 1239 | 6540 | 7900 | 0.509 | 0.0836 | 0.078 × 10 ⁻³ | 2.084 × 10 ⁻⁵ | 1.00 | 1.97 | |
| 340 | 14,586 | 610.5 | 92.62 | 1028 | 8240 | 11,870 | 0.469 | 0.110 | 0.070 × 10 ⁻³ | 2.255 × 10 ⁻⁵ | 1.23 | 2.43 | |
| 360 | 18,651 | 528.3 | 144.0 | 720 | 14,690 | 25,800 | 0.427 | 0.178 | 0.060 × 10 ⁻³ | 2.571 × 10 ⁻⁵ | 2.06 | 3.73 | |
| 374.14 | 22,090 | 317.0 | 317.0 | 0 | — | — | — | — | 0.043 × 10 ⁻³ | 4.313 × 10 ⁻⁵ | | | |

Note 1: Kinematic viscosity ν and thermal diffusivity α can be calculated from their definitions, $\nu = \mu/\rho$ and $\alpha = k/\rho c_p = \nu/Pr$. The temperatures 0.01°C, 100°C, and 374.14°C are the triple-, boiling-, and critical-point temperatures of water, respectively. The properties listed above (except the vapor density) can be used at any pressure with negligible error except at temperatures near the critical-point value.

Note 2: The unit kJ/kg · °C for specific heat is equivalent to kJ/kg · K, and the unit W/m · °C for thermal conductivity is equivalent to W/m · K.

Source: Viscosity and thermal conductivity data are from J. V. Sengers and J. T. R. Watson, *Journal of Physical and Chemical Reference Data* 15 (1986), pp. 1291–1322. Other data are obtained from various sources or calculated.