A3

Properties of Gases, Vapors, Liquids and Solids

Nitin Goel

Intel Technology India Pvt. Ltd.

TABLE A3.1 Properties of Dry Air at Atmospheric Pressures between 250 and 1000 K

T^a (K)	ρ (kg/m^3)	c_p (kJ/kg K)	μ (kg/m s$\times10^5$)	ν (m^2/s$\times10^6$)	k (W/m K)	α (m^2/s$\times10^4$)	dPr
250	1.4128	1.0053	1.488	9.49	0.02227	0.13161	0.722
300	1.1774	1.0057	1.983	15.68	0.02624	0.22160	0.708
350	0.9980	1.0090	2.075	20.76	0.03003	0.2983	0.697
400	0.8826	1.0140	2.286	25.90	0.03365	0.3760	0.689
450	0.7833	1.0207	2.484	28.86	0.03707	0.4222	0.683
500	0.7048	1.0295	2.671	37.90	0.04038	0.5564	0.680
550	0.6423	1.0392	2.848	44.34	0.04360	0.6532	0.680
600	0.5879	1.0551	3.018	51.34	0.04659	0.7512	0.680
650	0.5430	1.0635	3.177	58.51	0.04953	0.8578	0.682
700	0.5030	1.0752	3.332	66.25	0.05230	0.9672	0.684
750	0.4709	1.0856	3.481	73.91	0.05509	1.0774	0.686
800	0.4405	1.0978	3.625	82.29	0.05779	1.1951	0.689
850	0.4149	1.1095	3.765	90.75	0.06028	1.3097	0.692
900	0.3925	1.1212	3.899	99.3	0.06279	1.4271	0.696
950	0.3716	1.1321	4.023	108.2	0.06525	1.5510	0.699
1000	0.3524	1.1417	4.152	117.8	0.06752	1.6779	0.702

[a] Symbols: K = absolute temperature, degrees Kelvin; $\nu=\mu/\rho$; ρ = density; c_p specific heat capacity; $\alpha=c_p\rho/k$; μ = viscosity; k = thermal conductivity; Pr = Prandtl number, dimensionless. The values of μ, k, c_p, and Pr are not strongly pressure-dependent and may be used over a fairly wide range of pressures.

Source: From Natl. Bureau Standards (U.S.) Circ. 564, 1955.

TABLE A3.2 Properties of Water (Saturated Liquid) between 273 and 533 K

T			c_p (kJ/kg °C)	ρ (kg/m^3)	μ (kg/m s)	k (W/m °C)	Pr	$(g\beta\rho^2 c_p/\mu k)(m^{-3}°C^{-1})$
K	°F	°C						
273	32	0	4.225	999.8	1.79×10^{-3}	0.566	13.25	
277.4	40	4.44	4.208	999.8	1.55	0.575	11.35	1.91×10^{9}
283	50	10	4.195	999.2	1.31	0.585	9.40	6.34×10^{9}
288.6	60	15.56	4.186	998.6	1.12	0.595	7.88	1.08×10^{10}
294.1	70	21.11	4.179	997.4	9.8×10^{-4}	0.604	6.78	1.46×10^{10}
299.7	80	26.67	4.179	995.8	8.6	0.614	5.85	1.91×10^{10}
302.2	90	32.22	4.174	994.9	7.65	0.623	5.12	2.48×10^{10}
310.8	100	37.78	4.174	993.0	6.82	0.630	4.53	3.3×10^{10}
316.3	110	43.33	4.174	990.6	6.16	0.637	4.04	4.19×10^{10}
322.9	120	48.89	4.174	988.8	5.62	0.644	3.64	4.89×10^{10}
327.4	130	54.44	4.179	985.7	5.13	0.649	3.30	5.66×10^{10}
333.0	140	60	4.179	983.3	4.71	0.654	3.01	6.48×10^{10}
338.6	150	65.55	4.183	980.3	4.3	0.659	2.73	7.62×10^{10}
342.1	160	71.11	4.186	977.3	4.01	0.665	2.53	8.84×10^{10}
349.7	170	76.67	4.191	973.7	3.72	0.668	2.33	9.85×10^{10}
355.2	180	82.22	4.195	970.2	3.47	0.673	2.16	1.09×10^{11}
360.8	190	87.78	4.199	966.7	3.27	0.675	2.03	
366.3	200	93.33	4.204	963.2	3.06	0.678	1.90	
377.4	220	104.4	4.216	955.1	2.67	0.684	1.66	
388.6	240	115.6	4.229	946.7	2.44	0.685	1.51	
399.7	260	126.7	4.250	937.2	2.19	0.685	1.36	
410.8	280	137.8	4.271	928.1	1.98	0.685	1.24	
421.9	300	148.9	4.296	918.0	1.86	0.684	1.17	
449.7	350	176.7	4.371	890.4	1.57	0.677	1.02	
477.4	400	204.4	4.467	859.4	1.36	0.665	1.00	
505.2	450	232.2	4.585	825.7	1.20	0.646	0.85	
533.0	500	260	4.731	785.2	1.07	0.616	0.83	

Source: Adapted from Brown, A. I. and S. M. Marco. 1958. Introduction to Heat Transfer, 3d Ed., McGraw-Hill Book Company, New York.

TABLE A3.3 Emittances and Absorptances of Materials

Substance	Short-Wave Absorptance	Long-Wave Emittance	*a ε*
Class I substances: Absorptance to emittance ratios less than 0.5			
Magnesium carbonate, $MgCO_3$	0.025–0.04	0.79	0.03–0.05
White plaster	0.07	0.91	0.08
Snow, fine particles, fresh	0.13	0.82	0.16
White paint, 0.017 in. on aluminum	0.20	0.91	0.22
Whitewash on galvanized iron	0.22	0.90	0.24
White paper	0.25–0.28	0.95	0.26–0.29
White enamel on iron	0.25–0.45	0.9	0.28–0.5
Ice, with sparse snow cover	0.31	0.96–0.97	0.32
Snow, ice granules	0.33	0.89	0.37
Aluminum oil base paint	0.45	0.90	0.50
White powdered sand	0.45	0.84	0.54
Class II substances: Absorptance to emittance ratios between 0.5 and 0.9			
Asbestos felt	0.25	0.50	0.50
Green oil base paint	0.5	0.9	0.56
Bricks, red	0.55	0.92	0.60
Asbestos cement board, white	0.59	0.96	0.61
Marble, polished	0.5–0.6	0.9	0.61
Wood, planed oak	–	0.9	–
Rough concrete	0.60	0.97	0.62
Concrete	0.60	0.88	0.68
Grass, green, after rain	0.67	0.98	0.68
Grass, high and dry	0.67–0.69	0.9	0.76
Vegetable fields and shrubs, wilted	0.70	0.9	0.78
Oak leaves	0.71–0.78	0.91–0.95	0.78–0.82
Frozen soil	–	0.93–0.94	–
Desert surface	0.75	0.9	0.83
Common vegetable fields and shrubs	0.72–0.76	0.9	0.82
Ground, dry plowed	0.75–0.80	0.9	0.83–0.89
Oak woodland	0.82	0.9	0.91
Pine forest	0.86	0.9	0.96
Earth surface as a whole (land and sea, no clouds)	0.83	10^{10}	–
Class III substances: Absorptance to emittance ratios between 0.8 and 1.0			
Grey paint	0.75	0.95	0.79
Red oil base paint	0.74	0.90	0.82
Asbestos, slate	0.81	0.96	0.84
Asbestos, paper		0.93–0.96	
Linoleum, red–brown	0.84	0.92	0.91
Dry sand	0.82	0.90	0.91
Green roll roofing	0.88	0.91–0.97	0.93
Slate, dark grey	0.89	–	
Old grey rubber		0.86	–
Hard black rubber	–	0.90–0.95	
Asphalt pavement	0.93	–	–
Black cupric oxide on copper	0.91	0.96	0.95
Bare moist ground	0.9	0.95	0.95
Wet sand	0.91	0.95	0.96
Water	0.94	0.95–0.96	0.98
Black tar paper	0.93	0.93	1.0
Black gloss paint	0.90	0.90	1.0
Small hole in large box, furnace, or enclosure	0.99	0.99	1.0
"Hohlraum," theoretically perfect black body	1.0	1.0	1.0
Class IV substances: Absorptance to emittance ratios greater than 1.0			
Black silk velvet	0.99	0.97	1.02

(continued)

TABLE A3.3 ***(Continued)***

Substance	Short-Wave Absorptance	Long-Wave Emittance	*a ε*
Alfalfa, dark green	0.97	0.95	1.02
Lampblack	0.98	0.95	1.03
Black paint, 0.017 in. on aluminum	0.94–0.98	0.88	1.07–1.11
Granite	0.55	0.44	1.25
Graphite	0.78	0.41	1.90
High ratios, but absorptances less than 0.80			
Dull brass, copper, lead	0.2–0.4	0.4–0.65	1.63–2.0
Galvanized sheet iron, oxidized	0.8	0.28	2.86
Galvanized iron, clean, new	0.65	0.13	5.0
Aluminum foil	0.15	0.05	3.00
Magnesium	0.3	0.07	4.3
Chromium	0.49	0.08	6.13
Polished zinc	0.46	0.02	23.0
Deposited silver (optical reflector) untarnished	0.07	0.01	
Class V substances: Selective surfaces[a]			
Plated metals:[b]			
Black sulfide on metal	0.92	0.10	9.2
Black cupric oxide on sheet aluminum	0.08–0.93	0.09–0.21	
Copper ($5\times10\sim^{5}$ cm thick) on nickel or silver-plated metal			
Cobalt oxide on platinum			
Cobalt oxide on polished nickel	0.93–0.94	0.24–0.40	3.9
Black nickel oxide on aluminum	0.85–0.93	0.06–0.1	14.5–15.5
Black chrome	0.87	0.09	9.8
Particulate coatings:			
Lampblack on metal			
Black iron oxide, 47 μm grain size, on aluminum			
Geometrically enhanced surfaces:[c]			
Optimally corrugated greys	0.89	0.77	1.2
Optimally corrugated selectives	0.95	0.16	5.9
Stainless-steel wire mesh	0.63–0.86	0.23–0.28	2.7–3.0
Copper, treated with NaClO, and NaOH	0.87	0.13	6.69

[a] Selective surfaces absorb most of the solar radiation between 0.3 and 1.9 μm, and emit very little in the 5–15 μm range–the infrared.

[b] For a discussion of plated selective surfaces, see Daniels, *Direct Use of the Sun's Energy*, especially chapter 12.

[c] For a discussion of how surface selectivity can be enhanced through surface geometry, see K. G. T. Hollands, July 1963. Directional selectivity emittance and absorptance properties of vee corrugated specular surfaces, *J. Sol. Energy Sci. Eng, vol. 3.*

Source: From Anderson, B. 1977. *Solar Energy*, McGraw-Hill Book Company. With permission.

TABLE A3.4 Thermal Properties of Metals and Alloys

Material	k, Btu/(hr)(ft.)(°F)				c, Btu/(lb_m)(°F)	ρ, lb_m/ft.^{3}	α, ft.^{2}/hr
	32°F	212°F	572°F	932°F	32°F	32°F	32°F
Metals							
Aluminum	117	119	133	155	0.208	169	3.33
Bismuth	4.9	3.9	…	…	0.029	612	0.28
Copper, pure	224	218	212	207	0.091	558	4.42
Gold	169	170	…	…	0.030	1,203	4.68
Iron, pure	35.8	36.6	…	…	0.104	491	0.70
Lead	20.1	19	18	…	0.030	705	0.95
Magnesium	91	92	…	…	0.232	109	3.60
Mercury	4.8	…	…	…	0.033	849	0.17
Nickel	34.5	34	32	…	0.103	555	0.60
Silver	242	238	…	…	0.056	655	6.6
Tin	36	34	…	…	0.054	456	1.46
Zinc	65	64	59	…	0.091	446	1.60
Alloys							
Admiralty metal	65	64					
Brass, 70% Cu, 30% Zn	56	60	66	…	0.092	532	1.14
Bronze, 75% Cu, 25% Sn	15	…	…	…	0.082	540	0.34
Cast iron							
Plain	33	31.8	27.7	24.8	0.11	474	0.63
Alloy	30	28.3	27		0.10	455	0.66
Constantan, 60% Cu, 40% Ni	12.4	12.8			0.10	557	0.22
18-8 Stainless steel,							
Type 304	8.0	9.4	10.9	12.4	0.11	488	0.15
Type 347	8.0	9.3	11.0	12.8	0.11	488	0.15
Steel, mild, 1% C	26.5	26	25	22	0.11	490	0.49

Source: From Kreith, F. 1997. *Principles of Heat Transfer*, PWS Publishing Co., Boston.

TABLE A3.5 Thermal Properties of Some Insulating and Building Materials

Material	Average, Temperature, °F	k, Btu/(hr)(ft.)(°F)	c, Btu/(lb_m)(°F)	ρ, $lb_m/ft.^3$	a, $ft.^2$/hr
		Insulating Materials			
Asbestos	32	0.087	0.25	36	−0.01
	392	0.12		36	−0.01
Cork	86	0.025	0.04	10	−0.006
Cotton, fabric	200	0.046			
Diatomaceous earth, powdered	100	0.030	0.21	14	−0.01
	300	0.036	…		
	600	0.046	…		
Molded pipe covering	400	0.051	…	26	
	1600	0.088	…		
		Glass Wool			
Fine	20	0.022	…		
	100	0.031	…	1.5	
	200	0.043	…		
Packed	20	0.016	…		
	100	0.022	…	6.0	
	200	0.029	…		
Hair felt	100	0.027	…	8.2	
Kaolin insulating brick	932	0.15	…	27	
	2102	0.26	…		
Kaolin insulating firebrick	392	0.05	…	19	
	1400	0.11	…		
85% magnesia	32	0.032	…	17	
	200	0.037	…	17	
Rock wool	20	0.017	…	8	
	200	0.030	…		
Rubber	32	0.087	0.48	75	0.0024
Brick		Building Materials			
Fire-clay	392	0.58	0.20	144	0.02
	1832	0.95			
Masonry	70	0.38	0.20	106	0.018
Zirconia	392	0.84	…	304	
	1832	1.13	…		
Chrome brick	392	0.82	…	246	
	1832	0.96	…		
		Concrete			
Stone	−70	0.54	0.20	144	0.019
10% Moisture	−70	0.70	…	140	−0.025
Glass, window	−70	−0.45	0.2	170	0.013
Limestone, dry	70	0.40	0.22	105	0.017
		Sand			
Dry	68	0.20	…	95	
10% H_2O	68	0.60		100	
		Soil			
Dry	70	−0.20	0.44	…	−0.01
Wet	70	−1.5	…		−0.03
		Wood			
Oak ⊥ to grain	70	0.12	0.57	51	0.0041
‖ to grain	70	0.20	0.57	51	0.0069
Pine ⊥ to grain	70	0.06	0.67	31	0.0029
‖ to grain	70	0.14	0.67	31	0.0067
Ice	32	1.28	0.46	57	0.048

Source: From Kreith, R. 1997. *Principles of Heat Transfer*, PWS Publishing Co.

TABLE A3.6 Saturated Steam and Water–SI Units

Temperature (K)	Pressure (MN/m^2)	Specific Volume (m^3/kg)		Specific Energy Internal (kJ/kg)		Specific Enthalpy (kJ/kg)			Specific Entropy (kJ/kg.K)	
		v_f	v_g	u_f	u_g	h_f	h_{fg}	h_g	s_f	s_g
273.15	0.0006109	0.0010002	206.278	−0.03	2375.3	−0.02	2501.4	2501.3	−0.0001	9.1565
273.16	0.0006113	0.0010002	206.136	0	2375.3	+0.01	2501.3	2501.4	0	9.1562
278.15	0.0008721	0.0010001	147.120	+20.97	2382.3	20.98	2489.6	2510.6	+0.0761	9.0257
280.13	0.0010000	0.0010002	129.208	29.30	2385.0	29.30	2484.9	2514.2	0.1059	8.975
283.15	0.0012276	0.0010004	106.379	42.00	2389.2	42.01	2477.7	2519.8	0.1510	8.9008
286.18	0.0015000	0.0010007	87.980	54.71	2393.3	54.71	2470.6	2525.3	0.1957	8.8279
288.15	0.0017051	0.0010009	77.926	62.99	2396.1	62.99	2465.9	2528.9	0.2245	8.7814
290.65	0.0020000	0.0010013	67.004	73.48	2399.5	73.48	2460.0	2533.5	0.2607	8.7237
293.15	0.002339	0.0010018	57.791	83.95	2402.9	83.96	2454.1	2538.1	0.2966	8.6672
297.23	0.0030000	0.0010027	45.665	101.04	2408.5	101.05	2444.5	2545.5	0.3545	8.5776
298.15	0.003169	0.0010029	43.360	104.88	2409.8	104.89	2442.3	2547.2	0.3674	8.5580
302.11	0.004000	0.0010040	34.800	121.45	2415.2	121.46	2432.9	2554.4	0.4226	8.4746
303.15	0.004246	0.0010043	32.894	125.78	2416.6	125.79	2430.5	2556.3	0.4369	8.4533
306.03	0.005000	0.0010053	28.192	137.81	2420.5	137.82	2423.7	2561.5	0.4764	8.3951
308.15	0.005628	0.0010060	25.216	146.67	2423.4	146.68	2418.6	2565.3	0.5053	8.3531
309.31	0.006000	0.0010064	23.739	151.53	2425.0	151.53	2415.9	2567.4	0.5210	8.3304
312.15	0.007000	0.0010074	20.530	163.39	2428.8	163.40	2409.1	2572.5	0.5592	8.2758
313.15	0.007384	0.0010078	19.523	167.56	2430.1	167.57	2406.7	2574.3	0.5725	8.2570
314.66	0.008000	0.0010084	18.103	173.87	2432.2	173.88	2403.1	2577.0	0.5926	8.2287
316.91	0.009000	0.0010094	16.203	183.27	2435.2	183.29	2397.7	2581.0	0.6224	8.1872
318.15	0.009593	0.0010099	15.258	188.44	2436.8	188.45	2394.8	2583.2	0.6387	8.1648
318.96	0.010000	0.0010102	14.674	191.82	2437.9	191.83	2392.8	2584.7	0.6493	8.1502
323.15	0.012349	0.0010121	12.032	209.32	2443.5	209.33	2382.7	2592.1	0.7038	8.0763
327.12	0.015000	0.0010141	10.022	225.92	2448.7	225.94	2373.1	2599.1	0.7549	8.0085
328.15	0.015758	0.0010146	9.568	230.21	2450.1	230.23	2370.7	2600.9	0.7679	7.9913
333.15	0.019940	0.0010172	7.671	251.11	2456.6	251.13	2358.5	2609.6	0.8312	7.9096
333.21	0.020000	0.0010172	7.649	251.38	2456.7	251.40	2358.3	2609.7	0.8320	7.9085
338.15	0.025030	0.0010199	6.197	272.02	2463.1	272.06	2346.2	2618.3	0.8935	7.8310
342.25	0.030000	0.0010223	5.229	289.20	2468.4	289.23	2336.1	2625.3	0.9439	7.7686
343.15	0.031190	0.0010228	5.042	292.95	2469.6	292.98	2333.8	2626.8	0.9549	7.7553
348.15	0.038580	0.0010259	4.131	313.90	2475.9	313.93	2221.4	2635.3	1.0155	7.6824
349.02	0.040000	0.0010265	3.993	317.53	2477.0	317.58	2319.2	2636.8	1.0259	7.6700
353.15	0.047390	0.0010291	3.407	334.86	2482.2	334.91	2308.8	2643.7	1.0753	7.6122
354.48	0.050000	0.0010300	3.240	340.44	2483.9	340.49	2305.4	2645.9	1.0910	7.5939

358.15	0.057830	0.0010325	2.828	355.84	2488.4	355.90	2296.0	2651.9	1.1343	7.5445
359.09	0.060000	0.0010331	2.732	359.79	2489.6	359.86	2293.6	2653.5	1.1453	7.5320
363.10	0.070000	0.0010360	2.365	376.63	2494.5	376.70	2283.3	2660.0	1.1919	7.4797
363.15	0.070140	0.0010360	2.361	376.85	2494.5	376.92	2283.2	2660.1	1.1925	7.4791
366.65	0.080000	0.0010386	2.087	391.58	2498.8	391.66	2274.1	2665.8	1.2329	7.4346
368.15	0.084550	0.0010397	1.9819	397.88	2500.6	397.96	2270.2	2668.1	1.2500	7.4159

Subscripts: *f* refers to a property of liquid in equilibrium with vapor; *g* refers to a property of vapor in equilibrium with liquid; *fg* refers to a change by evaporation. Table from Bolz, R. E. and G. L. Tuve, eds. 1973. *CRC Handbook of Tables for Applied Engineering Science*, 2nd Ed., Chemical Rubber Co., Cleveland, Ohio.

TABLE A3.7 Superheated Steam–SI Units

Pressure (MN/m^2) (Saturation Temperature)[a]		Temperature									
		50°C 323.15 K	100°C 373.15 K	150°C 423.15 K	200°C 473.15 K	300°C 573.15 K	400°C 673.15 K	500°C 773.15 K	700°C 973.15 K	1000°C 1273.15 K	1300°C 1573.15 K
0.001	*v*	149.093	172.187	195.272	218.352	264.508	310.661	356.814	449.117	587.571	726.025
(6.98°C)	*u*	2445.4	2516.4	2588.4	2661.6	2812.2	2969.0	3132.4	3479.6	4053.0	4683.7
(280.13 K)	*h*	2594.5	2688.6	2783.6	2880.0	3076.8	3279.7	3489.2	3928.7	4640.6	5409.7
	s	9.2423	9.5129	9.7520	9.9671	10.3443	10.6705	10.9605	11.4655	12.1019	12.6438
0.002	*v*	74.524	86.081	97.628	109.170	132.251	155.329	178.405	224.558	293.785	363.012
(17.50°C)	*u*	2445.2	2516.3	2588.3	2661.6	2812.2	2969.0	3132.4	3479.6	4053.0	4683.7
(290.65 K)	*h*	2594.3	2688.4	2793.6	2879.9	3076.7	3279.7	3489.2	3928.7	4640.6	5409.7
	s	8.9219	9.1928	9.4320	9.6471	10.0243	10.3506	10.6406	11.1456	11.7820	12.3239
0.004	*v*	37.240	43.028	48.806	54.580	66.122	77.662	89.201	112.278	146.892	181.506
(28.%°C)	*u*	2444.9	2516.1	2588.2	2661.5	2812.2	2969.0	3132.3	3479.6	4053.0	4683.7
(302.11 K)	*h*	2593.9	2688.2	2783.4	2879.8	3076.7	3279.6	3489.2	3928.7	4640.6	5409.7
	s	8.6009	8.8724	9.1118	9.3271	9.7044	10.0307	10.3207	10.8257	11.4621	12.0040
0.006	*v*	24.812	28.676	32.532	36.383	44.079	51.774	59.467	74.852	97.928	121.004
(36.16°C)	*u*	2444.6	2515.9	2588.1	2661.4	2812.2	2969.0	31323	3479.6	4053.0	4683.7
(309.31 K)	*h*	2593.4	2688.0	2783.3	2879.7	3076.6	3279.6	3489.1	3928.7	4640.6	5409.7
	s	8.4128	8.6847	8.9244	9.1398	9.5172	9.8435	10.1336	10.6386	11.2750	11.8168
0.008	*v*	18.598	21.501	24.395	27.284	33.058	38.829	44.599	56.138	73.446	90.753
(41.51°C)	*u*	2444.2	2515.7	2588.0	2661.4	2812.1	2969.0	3132.3	3479.6	4053.0	4683.7
(314.66 K)	*h*	2593.0	2687.7	2783.1	2879.6	3076.6	3279.6	3489.1	3928.7	4640.6	5409.7
	s	8.2790	8.5514	8.7914	9.0069	9.3844	9.7107	10.0008	10.5058	11.1422	11.6841
0.010	*v*	14.869	17.196	19.512	21.825	26.445	31.063	35.679	44.911	58.757	72.602
(45.81°C)	*u*	2443.9	2515.5	2587.9	2661.3	2812.1	2968.9	3132.3	3479.6	4053.0	4683.7
(318.96 K)	*h*	2592.6	2687.5	2783.0	2879.5	3076.5	3279.6	3489.1	3928.7	4640.6	5409.7
	s	8.1749	8.4479	8.6882	8.9038	9.2813	9.6077	9.8978	10.4028	11.0393	11.5811
0.020	*v*	7.412	8.585	9.748	10.907	13.219	15.529	17.838	22.455	29.378	36.301
(60.06°C)	*u*	2442.2	2514.6	2587.3	2660.9	2811.9	2968.8	3132.2	3479.5	4053.0	4683.7
(333.21 K)	*h*	2590.4	2686.2	2782.3	2879.1	3076.3	3279.4	3489.0	3928.6	4640.6	5409.7
	s	7.8498	8.1255	8.3669	8.5831	8.9611	9.2876	9.5778	10.0829	10.7193	11.2612
0.040	*v*	3.683	4.279	4.866	5.448	6.606	7.763	8.918	11.227	14.689	18.151
(75.87°C)	*u*	2438.8	2512.6	2586.2	2660.2	2811.5	2968.6	3132.1	3479.4	4052.9	4683.6
(349.02 K)	*h*	2586.1	2683.8	2780.8	2878.1	3075.8	3279.1	3488.8	3928.5	4640.5	5409.6
	s	7.5192	7.8003	8.0444	8.2617	8.6406	8.9674	9.2577	9.7629	10.3994	10.9412
0.060	*v*	2.440	2.844	3.238	3.628	4.402	5.174	5.944	7.484	9.792	12.100
(85.94°C)	*u*	2435.3	2510.6	2585.1	2659.5	2811.2	2968.4	3131.9	3479.4	4052.9	4683.6
(359.09 K)	*h*	2581.7	2681.3	2779.4	2877.2	3075.3	3278.8	3488.6	3928.4	4640.4	5409.6
	s	7.3212	7.6079	7.8546	8.0731	8.4528	8.7799	9.0704	9.5757	10.2122	10.7541
0.080	*v*	1.8183	2.127	2.425	2.718	3.300	3.879	4.458	5.613	7.344	9.075
(93.50°C)	*u*	2431.7	2508.7	2583.9	2658.8	2810.8	2968.1	3131.7	3479.3	4052.8	4683.5
(366.65 K)	*h*	2577.2	2678.8	2777.9	2876.2	3074.8	3278.5	3488.3	3928.3	4640.4	5409.5
	s	7.1775	7.4698	7.7191	7.9388	8.3194	8.6468	8.9374	9.4428	10.0794	10.6213
0.100	*v*	1.4450	1.6958	1.9364	2.172	2.639	3.103	3.565	4.490	5.875	7.260

(99.63°C)	*u*	2428.2	2506.7	2582.8	2658.1	2810.4	2967.9	3131.6	3479.2	4052.8	4683.5
(372.78 K)	*h*	2572.7	2676.2	2776.4	2875.3	3074.3	3278.2	3488.1	3928.2	4640.3	5409.5
	s	7.0633	7.3614	7.6134	7.8343	8.2158	8.5435	8.8342	9.3398	9.9764	10.5183
0.200	*v*	0.6969	0.8340	0.9596	1.0803	1.3162	1.5493	1.7814	2.244	2.937	3.630
(120.23°C)	*u*	2409.5	2496.3	2576.9	2654.4	2808.6	2966.7	3130.8	3478.8	4052.5	4683.2
(393.38 K)	*h*	2548.9	2663.1	2768.8	2870.5	3071.8	3276.6	3487.1	3927.6	4640.0	5409.3
	s	6.6844	7.0135	7.2795	7.5066	7.8926	8.2218	8.5133	9.0194	9.6563	10.1982
0.300	*v*	0.4455	0.5461	0.6339	0.7163	0.8753	1.0315	1.1867	1.4957	1.9581	2.4201
(133.55°C)	*u*	2389.1	2485.4	2570.8	2650.7	2806.7	2965.6	3130.0	3478.4	4052.3	4683.0
(406.70 K)	*h*	2522.7	2649.2	2761.0	2865.6	3069.3	3275.0	3486.0	3927.1	4639.7	5409.0
	s	6.4319	6.7965	7.0778	7.3115	7.7022	8.0330	8.3251	8.8319	9.4690	10.0110
0.400	*v*	0.3177	0.4017	0.4708	0.5342	0.6548	0.7726	0.8893	1.1215	1.4685	1.8151
(143.63°C)	*u*	2366.3	2473.8	2564.5	2646.8	2804.8	2964.4	3129.2	3477.9	4052.0	4682.8
(416.78 K)	*h*	2493.4	2634.5	2752.8	2860.5	3066.8	3273.4	3484.9	3926.5	4639.4	5408.8
	s	6.2248	6.6319	6.9299	7.1706	7.5662	7.8985	8.1913	8.6987	9.3360	9.8780
0.500	*v*		0.3146	0.3729	0.4249	0.5226	0.6173	0.7109	0.8969	1.1747	1.4521
(151.86°C)	*u*		2461.5	2557.9	2642.9	2802.9	2963.2	328.4	3477.5	4051.8	4682.5
(425.01 K)	*h*		2618.7	2744.4	2855.4	3064.2	3271.9	3483.9	3925.9	4639.1	5408.6
	s		6.4945	6.8111	7.0592	7.4599	7.7938	8.0873	8.5952	9.2328	9.7749

[a] Symbols: v = specific volume, m^3/kg; u = specific internal energy, U/kg; h = specific enthalpy, kJ/kg; s = specific entropy, kJ/K kg.
Source: From Bolz, R. E. and G. L. Tuve, Eds. 1973. *CRC Handbook of Tables for Applied Engineering Science*, 2nd Ed., Chemical Rubber Co., Cleveland, Ohio.