Table A.1 Properties of metallic solids

	Properties at 20°C				*Thermal Conductivity, k* (W/m·K)									
Metal	ρ (kg/m^3)	c_p (J/kg·K)	k (W/m·K)	α (10^{-5} m^2/s)	−170°C	−100°C	0°C	100°C	200°C	300°C	400°C	600°C	800°C	1000°C
Aluminums														
Pure	2,707	905	237	9.61	302	242	236	240	238	234	228	215	≈95 (liq.)	
99% pure			211		220	206	209							
Duralumin (≈4% Cu, 0.5% Mg)	2,787	883	164	6.66		126	164	182	194					
Alloy 6061-T6	2,700	896	167	6.90			166	172	177	180				
Alloy 7075-T6	2,800	841	130	5.52	76	100	121	137	172	177				
Chromium	7,190	453	90	2.77	158	120	95	88	85	82	77	69	64	62
Cupreous metals														
Pure Copper	8,954	384	398	11.57	483	420	401	391	389	384	378	366	352	336
DS-C15715*	8,900	≈384	365	≈10.7			367	355	345	335	320			
Beryllium copper (2.2% Be)	8,250	420	103	2.97				117						
Brass (30% Zn)	8,522	385	109	3.32	73	89	106	133	143	146	147			
Bronze (25% Sn)§	8,666	343	26	0.86										
Constantan (40% Ni)	8,922	410	22	0.61	17	19	22	26	35					
German silver (15% Ni, 22% Zn)	8,618	394	25	0.73	18	19	24	31	40	45	48			
Gold	19,320	129	318	12.76	327	324	319	313	306	299	293	279	264	249
Ferrous metals														
Pure iron	7,897	447	80	2.26	132	98	84	72	63	56	50	39	30	29.5
Cast iron (4% C)	7,272	420	52	1.70										
Steels (C ≤ 1.5%)‖														
AISI 1010††	7,830	434	64	1.88		70	65	61	55	50	45	36	29	
0.5% carbon	7,833	465	54	1.47			55	52	48	45	42	35	31	29
1.0% carbon	7,801	473	43	1.17			43	43	42	40	36	33	29	28
1.5% carbon	7,753	486	36	0.97			36	36	36	35	33	31	28	28

* Dispersion-strengthened copper (0.3% Al_2O_3 by weight); strength comparable to stainless steel.
§ Conductivity data for this and other bronzes vary by a factor of about two.
‖ k and α for carbon steels can vary greatly, owing to trace elements.
†† 0.1% C, 0.42% Mn, 0.28% Si; hot-rolled.

Table A.1 Properties of metallic solids…*continued.*

	Properties at 20° C				*Thermal Conductivity, k* (W/m·K)									
Metal	ρ (kg/m^3)	c_p (J/kg·K)	k (W/m·K)	α (10^{-5} m^2/s)	−170°C	−100°C	0°C	100°C	200°C	300°C	400°C	600°C	800°C	1000°C
Stainless steels:														
AISI 304	8,000	400	13.8	0.4				15	17$^+$	19$^-$	21	25		
AISI 316	8,000	460	13.5	0.37		12		15	16	17$^+$	19$^-$	21$^+$	24	26$^+$
AISI 347	8,000	420	15	0.44		13		16$^+$	18$^-$	19	20	23	26	28
AISI 410	7,700	460	25	0.7				25$^+$	26	27	27$^+$	28$^+$		
AISI 446	7,500	460						18	19$^-$	19	20	21	22	
Lead	11,373	130	35	2.34	40	37	36	34	33	32	17 (liq.)	20 (liq.)		
Magnesium	1,746	1023	156	8.76	169	160	157	154	152	150	148	145	89 (liq.)	
Mercury†					32	30	7.8 (liq.)							
Molybdenum	10,220	251	138	5.38	175	146	139	135	131	127	123	116	109	103
Nickels														
Pure	8,906	445	91	2.30	156	114	94	83	74	67	64	69	73	78
Alumel§§	8,600	532						30	32	35	38			
Chromel P (10% Cr)	8,730	428						19	21	23	25			
Inconel X-750¶	8,510	442	11.6	0.23	8.8	10.6	11.3	13.0	14.7	16.0	18.3	21.8	25.3	29
Nichrome$^\text{Þ}$	8,250	448		0.34				13	15	16	18$^-$			
Nichrome V**	8,410	466	10	0.26				11	13	15	17	20	24	
Platinum	21,450	133	71	2.50	78	73	72	72	72	73	74	77	80	84
Silicon‡	2,330	705.5	153	9.31	856	342	168	112	82	66	54	38	29	25
Silver														
99.99$^+$% pure	10,524	236	427	17.19	449	431	428	422	417	409	401	386	370	176 (liq.)
99.9% pure	10,524	236	411	16.55		422	405		373	367	364			
Tin†	7,304	228	67	4.17	85	76	68	63	60	32 (liq.)	34 (liq.)	38 (liq.)		
Titanium														
Pure†	4,540	523	22	0.93	31	26	22	21	20	20	19	21	21	22
Ti-6%Al-4%V	4,430	580	7.1	0.28				7.8	8.8	10	12$^-$			
Tungsten	19,350	133	178	6.92	235	223	182	166	153	141	134	125	122	114
Uranium	18,700	116	28	1.29	22	24	27	29	31	33	36	41	46	
Zinc	7,144	388	121	4.37	124	122	122	117	110	106	100	60 (liq.)		

† Polycrystalline form. §§ 2% Al, 2% Mn, 1% Si ¶ 73% Ni, 15% Cr, 6.75% Fe, 2.5% Ti, 0.85% Nb, 0.8% Al, 0.7% Mn, 0.3% Si. Þ 23% Fe, 16% Cr ** 20% Cr, 1.4% Si
‡ Single crystal form.

Table A.2 Properties of nonmetallic solids

Material	*Temperature Range* (°C)	*Density* ρ (kg/m^3)	*Specific Heat* c_p (J/kg·K)	*Thermal Conductivity* k (W/m·K)	*Thermal Diffusivity* α (m^2/s)
Aluminum oxide (Al_2O_3)					
plasma sprayed coating	20			≈ 4	
HVOF sprayed coating	20			≈ 14	
polycrystalline (98% dense)	0		725	40	
	27	3900	779	36	1.19×10^{-5}
	127		940	26	
	577		1200	10	
	1077		1270	6.1	
	1577		1350	5.6	
single crystal (sapphire)	0		725	52	
	27	3980	779	46	1.48×10^{-5}
	127		940	32	
	577		1180	13	
Asbestos					
Cement board	20	1920		0.6	
Fiber, densely packed	20	1930		0.8	
Fiber, loosely packed	20	980		0.14	
Asphalt	20–25			0.75	
Beef (lean, fresh)	25	1070	3400	0.48	1.35×10^{-7}
Brick					
B & W, K-28 insulating	300			0.3	
	1000			0.4	
Cement	10	720		0.34	
Common	0–1000			0.7	
Chrome	100			1.9	
Facing	20			1.3	
Firebrick, insulating	300	2000	960	0.1	5.4×10^{-8}
	1000			0.2	
Butter	20	920	2520	0.22	9.5×10^{-6}
Carbon					
Diamond (type IIb)	20	≈3250	510	1350.0	8.1×10^{-4}
Graphites	20	≈1730	≈710	k varies with structure	
AGOT graphite					
⊥ to extrusion axis	0			141	
	27	1700	800	138	
	500		1600	59.1	
∥ to extrusion axis	0			230	
	27	1700	800	220	
	500		1600	93.6	

Table A.2…*continued.*

Material	*Temperature Range* (°C)	*Density* ρ (kg/m^3)	*Specific Heat* c_p (J/kg·K)	*Thermal Conductivity* k (W/m·K)	*Thermal Diffusivity* α (m^2/s)
Pyrolitic graphite					
⊥ to layer planes	0			10.6	
	27	2200	710	9.5	
	227			5.4	
	1027			1.9	
∥ to layer planes	0			2230	
	27	2200	710	2000	
	227			1130	
	1027			400	
Cardboard	0–20	790		0.14	
Cement, Portland	34	2010		0.7	
Clay					
Fireclay	500–750			1.0	
Sandy clay	20	1780		0.9	
Coal					
Anthracite	900	≈1500		≈0.2	
Brown coal	900			≈0.1	
Bituminous in situ		≈1300		0.5–0.7	3 to 4×10^{-7}
Concrete					
Limestone gravel	20	1850		0.6	
Sand : cement (3 : 1)	230			0.1	
Sand and gravel	24	2400		1.4–2.9	
	24	2240	900	1.3–2.6	
	24	2080		1.0–1.9	
Corkboard (medium ρ)	30	170		0.04	
Egg white	20		3400	0.56	1.37×10^{-7}
Glass					
Lead	44	3040		1.2	
Pyrex (borosilicate)	60–100	2210	753	1.3	7.8×10^{-7}
Soda-lime	−73		610	0.9	
	20	2480	750	1.1	
	93		866	1.3	
Glass wool	20	64–160		0.04	
Ice	0	917	2100	2.215	1.15×10^{-6}
Ivory	80			0.5	
Kapok	30			0.035	
Lunar surface dust (high vacuum)	250	1500±300	≈600	≈0.0006	$\approx 7 \times 10^{-10}$

Table A.2…*continued.*

Material	*Temperature Range* (°C)	*Density* ρ (kg/m^3)	*Specific Heat* c_p (J/kg·K)	*Thermal Conductivity* k (W/m·K)	*Thermal Diffusivity* α (m^2/s)
Magnesia, 85% (insulation)	38	≈200		0.067	
	93			0.071	
	150			0.074	
	204			0.08	
Magnesium oxide					
polycrystalline (98% dense)	27	3500	900	48	1.5×10^{-5}
single crystal	27	3580	900	60	1.9×10^{-5}
Polymers					
acetyl (POM, Delrin)	−18–100	1420	1470	0.30–0.37	
acrylic (PMMA, Plexiglas)	25	1180		0.17	
acrylonitrile butadiene styrene (ABS)		1060		0.14–0.31	
epoxy, bisphenol A (EP), cast	24–55	1200		≈ 0.22	
epoxy/glass-cloth laminate (G-10, FR4)		1800	≈1600	0.29	$\approx 1.0 \times 10^{-7}$
polyamide (PA)					
nylon 6,6	0–49	1120	1470	0.25	1.5×10^{-7}
nylon 6,12	0–49	1060	1680	0.22	1.2×10^{-7}
polycarbonate (PC, Lexan)	23	1200	1250	0.29	1.9×10^{-7}
polyethylene (PE)					
HDPE		960	2260	0.33	1.5×10^{-7}
LDPE		920	≈2100	0.33	$\approx 1.7 \times 10^{-7}$
polyimide (PI)		1430	1130	0.35	2.2×10^{-7}
polypropylene (PP)		905	1900	0.17–0.20	
polystyrene (PS)		1040	≈ 1350	0.10–0.16	
expanded (EPS)	4–55	13–30		0.035	
polytetrafluoroethylene (PTFE, Teflon)	20	2200	1050	0.25	$\approx 1.1 \times 10^{-7}$
polyvinylchloride (PVC)	25	1600		0.16	
Rock wool	−5	≈130		0.03	
	93			0.05	
Rubber (hard)	0	1200	2010	0.15	6.2×10^{-8}
Silica aerogel	0	140		0.024	
	120	136		0.022	
Silo-cel (diatomaceous earth)	0	320		0.061	
Silicon dioxide					
Fused silica glass	0		703	1.33	
	27	2200	745	1.38	8.4×10^{-7}
	227		988	1.62	

Table A.2…*continued.*

Material	*Temperature Range* (°C)	*Density* ρ (kg/m^3)	*Specific Heat* c_p (J/kg·K)	*Thermal Conductivity* k (W/m·K)	*Thermal Diffusivity* α (m^2/s)
Single crystal (quartz)					
⊥ to c-axis	0		709	6.84	
	27	2640	743	6.21	
	227		989	3.88	
∥ to c-axis	0		709	11.6	
	27	2640	743	10.8	
	227		989	6.00	
Soil (mineral)					
Dry	15	1500	1840	1.	4×10^{-7}
Wet	15	1930		2.	
Soil (k dry to wet, by type)					
Clays				1.1–1.6	
Loams				0.95–2.2	
Sands				0.78–2.2	
Silts				1.6–2.2	
Stone					
Granite (NTS)	20	≈2640	≈820	1.6	$\approx 7.4 \times 10^{-7}$
Limestone (Indiana)	100	2300	≈900	1.1	$\approx 5.3 \times 10^{-7}$
Sandstone (Berea)	25			≈ 3	
Slate	100			1.5	
Wood (perpendicular to grain)					
Ash	15	740		0.15–0.3	
Balsa	15	100		0.05	
Cedar	15	480		0.11	
Fir	15	600	2720	0.12	7.4×10^{-8}
Mahogany	20	700		0.16	
Oak	20	600	2390	0.1–0.4	
Particle board (medium ρ)	24	800	1300	0.14	1.3×10^{-7}
Pitch pine	20	450		0.14	
Plywood, Douglas fir	24	550	1200	0.12	1.8×10^{-7}
Sawdust (dry)	17	128		0.05	
Sawdust (dry)	17	224		0.07	
Spruce	20	410		0.11	
Wool (sheep)	20	145		0.05	

Table A.3 Thermophysical properties of saturated liquids

Temperature								
K	°C	ρ (kg/m^3)	c_p (J/kg·K)	k (W/m·K)	α (m^2/s)	ν (m^2/s)	Pr	β (K^{-1})
				Ammonia				
200	−73	728	4227	0.803	2.61×10^{-7}	6.967×10^{-7}	2.67	0.00147
220	−53	706	4342	0.733	2.39	4.912	2.05	0.00165
240	−33	682	4488	0.665	2.19	3.738	1.70	0.00182
260	−13	656	4548	0.600	2.01	3.007	1.50	0.00201
280	7	629	4656	0.539	1.84	2.514	1.37	0.00225
300	27	600	4800	0.480	1.67	2.156	1.29	0.00258
320	47	568	5018	0.425	1.49	1.882	1.26	0.00306
340	67	532	5385	0.372	1.30	1.663	1.28	0.00387
360	87	490	6082	0.319	1.07	1.485	1.39	0.00542
380	107	436	7818	0.267	0.782	1.337	1.71	0.00952
400	127	345	22728	0.216	0.276	1.214	4.40	0.04862
				Carbon dioxide				
220	−53	1166	1962	0.176	7.70×10^{-8}	2.075×10^{-7}	2.70	0.00318
230	−43	1129	1997	0.163	7.24	1.809	2.50	0.00350
240	−33	1089	2051	0.151	6.75	1.588	2.35	0.00392
250	−23	1046	2132	0.139	6.21	1.402	2.26	0.00451
260	−13	999	2255	0.127	5.61	1.245	2.22	0.00538
270	−3	946	2453	0.115	4.92	1.110	2.26	0.00677
280	7	884	2814	0.102	4.10	0.993	2.42	0.00934
290	17	805	3676	0.0895	3.03	0.887	2.93	0.0157
300	27	679	8698	0.0806	1.36	0.782	5.73	0.0570
302	29	634	15787	0.0845	0.844	0.756	8.96	0.119
				Freon 12 (dichlorodifluoromethane)				
180	−93	1661	823	0.113	8.27×10^{-8}	5.27×10^{-7}	6.37	
200	−73	1608	837	0.104	7.73	3.82	4.94	
220	−53	1553	858	0.0959	7.20	2.97	4.12	0.00263
240	−33	1496	882	0.0880	6.67	2.40	3.60	
260	−13	1437	912	0.0806	6.15	1.99	3.24	
280	7	1373	948	0.0734	5.63	1.68	2.99	
300	27	1304	994	0.0665	5.13	1.43	2.80	
320	47	1226	1059	0.0597	4.97	1.32	2.67	
340	67	1134	1170	0.0530	3.99	1.04	2.61	

Table A.3: saturated liquids...*continued*

Temperature								
K	°C	ρ (kg/m^3)	c_p (J/kg·K)	k (W/m·K)	α (m^2/s)	ν (m^2/s)	Pr	β (K^{-1})
				Glycerin (or glycerol)				
273	0	1276	2200	0.282	1.00×10^{-7}	0.0083	83,000	
293	20	1261	2350	0.285	0.962	0.001120	11,630	0.00048
303	30	1255	2400	0.285	0.946	0.000488	5,161	0.00049
313	40	1249	2460	0.285	0.928	0.000227	2,451	0.00049
323	50	1243	2520	0.285	0.910	0.000114	1,254	0.00050
				20% glycerin, 80% water				
293	20	1047	3860	0.519	1.28×10^{-7}	1.681×10^{-6}	13.1	0.00031
303	30	1043	3860	0.532	1.32	1.294	9.8	0.00036
313	40	1039	3915	0.540	1.33	1.030	7.7	0.00041
323	50	1035	3970	0.553	1.35	0.849	6.3	0.00046
				40% glycerin, 60% water				
293	20	1099	3480	0.448	1.20×10^{-7}	3.385×10^{-6}	28.9	0.00041
303	30	1095	3480	0.452	1.22	2.484	20.4	0.00045
313	40	1090	3570	0.461	1.18	1.900	16.1	0.00048
323	50	1085	3620	0.469	1.19	1.493	12.5	0.00051
				60% glycerin, 40% water				
293	20	1154	3180	0.381	1.04×10^{-7}	9.36×10^{-6}	90.0	0.00048
303	30	1148	3180	0.381	1.04	6.89	66.3	0.00050
313	40	1143	3240	0.385	1.04	4.44	42.7	0.00052
323	50	1137	3300	0.389	1.04	3.31	31.8	0.00053
				80% glycerin, 20% water				
293	20	1209	2730	0.327	0.99×10^{-7}	4.97×10^{-5}	502	0.00051
303	30	1203	2750	0.327	0.99	2.82	282	0.00052
313	40	1197	2800	0.327	0.98	1.74	178	0.00053
323	50	1191	2860	0.331	0.97	1.14	118	0.00053
				Helium I and Helium II				

- k for He I is about 0.020 W/m·K near the λ-transition ($\approx$ 2.17 K).
- k for He II below the λ-transition is hard to measure. It appears to be about 80,000 W/m·K between 1.4 and 1.75 K and it might go as high as 340,000 W/m·K at 1.92 K. These are the highest conductivities known (cf. copper, silver, and diamond).

Table A.3: saturated liquids...*continued*

Temperature								
K	°C	ρ (kg/m^3)	c_p (J/kg·K)	k (W/m·K)	α (m^2/s)	ν (m^2/s)	Pr	β (K^{-1})
				HCFC-22 (R22)				
160	−113	1605	1061	0.1504	8.82×10^{-8}	7.10×10^{-7}	8.05	0.00163
180	−93	1553	1061	0.1395	8.46	4.77	5.63	0.00170
200	−73	1499	1064	0.1291	8.09	3.55	4.38	0.00181
220	−53	1444	1076	0.1193	7.67	2.79	3.64	0.00196
240	−33	1386	1100	0.1099	7.21	2.28	3.16	0.00216
260	−13	1324	1136	0.1008	6.69	1.90	2.84	0.00245
280	7	1257	1189	0.0918	6.14	1.61	2.62	0.00286
300	27	1183	1265	0.0828	5.53	1.37	2.48	0.00351
320	47	1097	1390	0.0737	4.83	1.17	2.42	0.00469
340	67	990.1	1665	0.0644	3.91	0.981	2.51	0.00756
360	87	823.4	3001	0.0575	2.33	0.786	3.38	0.02388
				Heavy water (D_2O)				
589	316	740	2034	0.0509	0.978×10^{-7}	1.23×10^{-7}	1.257	
				HFC-134a (R134a)				
180	−93	1564	1187	0.1391	7.49×10^{-8}	9.45×10^{-7}	12.62	0.00170
200	−73	1510	1205	0.1277	7.01	5.74	8.18	0.00180
220	−53	1455	1233	0.1172	6.53	4.03	6.17	0.00193
240	−33	1397	1266	0.1073	6.06	3.05	5.03	0.00211
260	−13	1337	1308	0.0979	5.60	2.41	4.30	0.00236
280	7	1271	1360	0.0890	5.14	1.95	3.80	0.00273
300	27	1199	1432	0.0803	4.67	1.61	3.45	0.00330
320	47	1116	1542	0.0718	4.17	1.34	3.21	0.00433
340	67	1015	1750	0.0631	3.55	1.10	3.11	0.00657
360	87	870.1	2436	0.0541	2.55	0.883	3.46	0.0154
				Lead				
644	371	10,540	159	16.1	1.084×10^{-5}	2.276×10^{-7}	0.024	
755	482	10,442	155	15.6	1.223	1.85	0.017	
811	538	10,348	145	15.3	1.02	1.68	0.017	

Table A.3: saturated liquids...*continued*

Temperature								
K	°C	ρ (kg/m^3)	c_p (J/kg·K)	k (W/m·K)	α (m^2/s)	ν (m^2/s)	Pr	β (K^{-1})
				Mercury				
234	−39		141.5	6.97	3.62×10^{-6}	1.5×10^{-7}	0.041	
250	−23		140.5	7.32	3.83	1.4	0.037	
300	27	13,529	139.3	8.34	4.43	1.12	0.0253	0.000181
350	77	13,407	137.7	9.15	4.96	0.974	0.0196	0.000181
400	127	13,286	136.6	9.84	5.42	0.88	0.016	0.000181
500	227	13,048	135.3	11.0	6.23	0.73	0.012	0.000183
600	327	12,809	135.5	12.0	6.91	0.71	0.010	0.000187
700	427	12,567	136.9	12.7	7.38	0.67	0.0091	0.000195
800	527	12,318	139.8	12.8	7.43	0.64	0.0086	0.000207
				Methyl alcohol (methanol)				
260	−13	823	2336	0.2164	1.126×10^{-7}	1.21×10^{-6}	10.8	0.00113
280	7	804	2423	0.2078	1.021	0.883	8.65	0.00119
300	27	785	2534	0.2022	1.016	0.675	6.65	0.00120
320	47	767	2672	0.1965	0.959	0.537	5.60	0.00123
340	67	748	2856	0.1908	0.893	0.442	4.94	0.00135
360	87	729	3036	0.1851	0.836	0.36	4.3	0.00144
380	107	710	3265	0.1794	0.774	0.30	3.9	0.00164
				NaK (eutectic mixture of sodium and potassium)				
366	93	849	946	24.4	3.05×10^{-5}	5.8×10^{-7}	0.019	
672	399	775	879	26.7	3.92	2.67	0.0068	
811	538	743	872	27.7	4.27	2.24	0.0053	
1033	760	690	883			2.12		
				Nitrogen				
70	−203	838.5	2014	0.162	9.58×10^{-8}	2.62×10^{-7}	2.74	0.00513
77	−196	807.7	2040	0.147	8.90	2.02	2.27	0.00564
80	−193	793.9	2055	0.140	8.59	1.83	2.13	0.00591
90	−183	745.0	2140	0.120	7.52	1.38	1.83	0.00711
100	−173	689.4	2318	0.101	6.29	1.09	1.74	0.00927
110	−163	621.5	2743	0.0818	4.80	0.894	1.86	0.0142
120	−153	523.4	4507	0.0633	2.68	0.730	2.72	0.0359

Table A.3: saturated liquids…*continued*

Temperature								
K	°C	ρ (kg/m^3)	c_p (J/kg·K)	k (W/m·K)	α (m^2/s)	ν (m^2/s)	Pr	β (K^{-1})
				Oils (some approximate viscosities)				
273	0			MS-20		0.0076	100,000	
339	66			California crude (heavy)		0.00008		
289	16			California crude (light)		0.00005		
339	66			California crude (light)		0.000010		
289	16			Light machine oil (ρ = 907)		0.00016		
339	66			Light machine oil (ρ = 907)		0.000013		
289	16			SAE 30		0.00044	$\approx 5,000$	
339	66			SAE 30		0.00003		
289	16			SAE 30 (Eastern)		0.00011		
339	66			SAE 30 (Eastern)		0.00001		
289	16			Spindle oil (ρ = 885)		0.00005		
339	66			Spindle oil (ρ = 885)		0.000007		
				Olive Oil (1 atm, not saturated)				
283	10	920				14.9×10^{-5}		
293	20	913	1800	0.24	1.46×10^{-7}	9.02	620	0.000728
303	30	906				5.76		
313	40	900				3.84		
323	50	893				2.67		
333	60	886				1.91		
343	70	880				1.41		
				Oxygen				
60	−213	1282	1673	0.195	9.09×10^{-8}	4.50×10^{-7}	4.94	0.00343
70	−203	1237	1678	0.181	8.72	2.84	3.26	0.00370
80	−193	1190	1682	0.167	8.33	2.08	2.49	0.00398
90	−183	1142	1699	0.153	7.88	1.63	2.07	0.00436
100	−173	1091	1738	0.139	7.33	1.34	1.83	0.00492
110	−163	1036	1807	0.125	6.67	1.13	1.70	0.00575
120	−153	973.9	1927	0.111	5.89	0.974	1.65	0.00708
130	−143	902.5	2153	0.0960	4.94	0.848	1.72	0.00953
140	−133	813.2	2691	0.0806	3.67	0.741	2.01	0.0155
150	−123	675.5	5464	0.0643	1.74	0.639	3.67	0.0495

Table A.3: saturated liquids...*continued*

Temperature								
K	°C	ρ (kg/m^3)	c_p (J/kg·K)	k (W/m·K)	α (m^2/s)	ν (m^2/s)	Pr	β (K^{-1})
				Water				
273.16	0.01	999.8	4220	0.5610	1.330×10^{-7}	17.91×10^{-7}	13.47	-6.80×10^{-5}
275	2	999.9	4214	0.5645	1.340	16.82	12.55	-3.55×10^{-5}
280	7	999.9	4201	0.5740	1.366	14.34	10.63	4.36×10^{-5}
285	12	999.5	4193	0.5835	1.392	12.40	8.91	0.000112
290	17	998.8	4187	0.5927	1.417	10.85	7.66	0.000172
295	22	997.8	4183	0.6017	1.442	9.600	6.66	0.000226
300	27	996.5	4181	0.6103	1.465	8.568	5.85	0.000275
305	32	995.0	4180	0.6184	1.487	7.708	5.18	0.000319
310	37	993.3	4179	0.6260	1.508	6.982	4.63	0.000361
320	47	989.3	4181	0.6396	1.546	5.832	3.77	0.000436
340	67	979.5	4189	0.6605	1.610	4.308	2.68	0.000565
360	87	967.4	4202	0.6737	1.657	3.371	2.03	0.000679
373.15	100.0	958.3	4216	0.6791	1.681	2.940	1.75	0.000751
400	127	937.5	4256	0.6836	1.713	2.332	1.36	0.000895
420	147	919.9	4299	0.6825	1.726	2.030	1.18	0.001008
440	167	900.5	4357	0.6780	1.728	1.808	1.05	0.001132
460	187	879.5	4433	0.6702	1.719	1.641	0.955	0.001273
480	207	856.5	4533	0.6590	1.697	1.514	0.892	0.001440
500	227	831.3	4664	0.6439	1.660	1.416	0.853	0.001645
520	247	803.6	4838	0.6246	1.607	1.339	0.833	0.001909
540	267	772.8	5077	0.6001	1.530	1.278	0.835	0.002266
560	287	738.0	5423	0.5701	1.425	1.231	0.864	0.002783
580	307	697.6	5969	0.5346	1.284	1.195	0.931	0.003607
600	327	649.4	6953	0.4953	1.097	1.166	1.06	0.005141
620	347	586.9	9354	0.4541	0.8272	1.146	1.39	0.009092
640	367	481.5	25,940	0.4149	0.3322	1.148	3.46	0.03971
642	369	463.7	34,930	0.4180	0.2581	1.151	4.46	0.05679
644	371	440.7	58,910	0.4357	0.1678	1.156	6.89	0.1030
646	373	403.0	204,600	0.5280	0.06404	1.192	18.6	0.3952
647.0	374	357.3	3,905,000	1.323	0.00948	1.313	138.	7.735

Table A.4 Some latent heats of vaporization, h_{fg} (kJ/kg), with temperatures at triple point, T_{tp} (K), and critical point, T_c (K).

T(K)	Water	Ammonia	CO_2	HCFC-22	HFC-134a	Mercury	Methanol	Nitrogen	Oxygen
60									238.4
70								208.1	230.5
80								195.7	222.3
90								180.5	213.2
100								161.0	202.6
110								134.3	189.7
120				300.4				92.0	173.7
130				294.0					153.1
140				287.9					125.2
150				281.8					79.2
160				275.9					
180				264.3	257.4				
200		1474		252.9	245.7		1310		
220		1424	344.9	241.3	233.9		1269		
230		1397	328.0	235.2	227.8		1258		
240		1369	309.6	228.9	221.5		1247		
250		1339	289.3	222.2	215.0		1235		
260		1307	266.5	215.1	208.2		1222		
270		1273	240.1	207.5	201.0		1209		
273	2501	1263	230.9	205.0	198.6	306.8	1205		
280	2485	1237	208.6	199.4	193.3	306.6	1196		
290	2462	1199	168.1	190.5	185.0	306.2	1181		
300	2438	1158	103.7	180.9	176.1	305.8	1166		
310	2414	1114		170.2	166.3	305.5	1168		
320	2390	1066		158.3	155.5	305.1	1150		
330	2365	1015		144.7	143.3	304.8	1116		
340	2341	957.9		128.7	129.3	304.4	1096		
350	2315	895.2		109.0	112.5	304.1	1078		
360	2290	824.8		81.8	91.0	303.8	1054		
373	2257	717.0				303.3	1022		
400	2183	346.9				302.4	945		
500	1828					299.2	391		
600	1173					295.9			
700						292.3			
T_{tp}	273.16	195.5	216.6	115.7	169.9	234.2	175.5	63.2	54.3
T_c	647.1	405.4	304.3	369.3	374.2		512.5	126.2	154.6

Table A.5 Thermophysical properties of saturated vapors ($p \neq 1$ atm).

T (K)	p (MPa)	ρ (kg/m^3)	c_p (J/kg·K)	k (W/m·K)	μ (kg/m·s)	Pr	β (K^{-1})
			Ammonia				
200	0.008651	0.08908	2076	0.0197	6.952×10^{-6}	0.733	0.005141
220	0.03379	0.3188	2160	0.0201	7.485	0.803	0.004847
240	0.1022	0.8969	2298	0.0210	8.059	0.883	0.004724
260	0.2553	2.115	2503	0.0223	8.656	0.973	0.004781
280	0.5509	4.382	2788	0.0240	9.266	1.08	0.005042
300	1.062	8.251	3177	0.0264	9.894	1.19	0.005560
320	1.873	14.51	3718	0.0296	10.56	1.33	0.006462
340	3.080	24.40	4530	0.0339	11.33	1.51	0.008053
360	4.793	40.19	5955	0.0408	12.35	1.80	0.01121
380	7.140	67.37	9395	0.0546	14.02	2.42	0.01957
400	10.30	131.1	34924	0.114	18.53	5.70	0.08664
			Carbon dioxide				
220	0.5991	15.82	930.3	0.0113	1.114×10^{-5}	0.917	0.006223
230	0.8929	23.27	1005.	0.0122	1.169	0.962	0.006615
240	1.283	33.30	1103.	0.0133	1.227	1.02	0.007223
250	1.785	46.64	1237.	0.0146	1.290	1.09	0.008154
260	2.419	64.42	1430.	0.0163	1.361	1.19	0.009611
270	3.203	88.37	1731.	0.0187	1.447	1.34	0.01203
280	4.161	121.7	2277.	0.0225	1.560	1.58	0.01662
290	5.318	172.0	3614.	0.0298	1.736	2.10	0.02811
300	6.713	268.6	11921.	0.0537	2.131	4.73	0.09949
302	7.027	308.2	23800.	0.0710	2.321	7.78	0.2010
			HCFC-22 (R22)				
160	0.0005236	0.03406	479.2	0.00398	6.69×10^{-6}	0.807	0.006266
180	0.003701	0.2145	507.1	0.00472	7.54	0.810	0.005622
200	0.01667	0.8752	539.1	0.00554	8.39	0.816	0.005185
220	0.05473	2.649	577.8	0.00644	9.23	0.828	0.004947
240	0.1432	6.501	626.2	0.00744	10.1	0.847	0.004919
260	0.3169	13.76	688.0	0.00858	10.9	0.877	0.005131
280	0.6186	26.23	769.8	0.00990	11.8	0.918	0.005661
300	1.097	46.54	885.1	0.0116	12.8	0.977	0.006704
320	1.806	79.19	1071.	0.0140	14.0	1.07	0.008801
340	2.808	133.9	1470.	0.0181	15.7	1.27	0.01402
360	4.184	246.7	3469.	0.0298	19.3	2.24	0.04233

Table A.5: saturated vapors ($p \neq 1$ atm)...*continued.*

T (K)	p (MPa)	ρ (kg/m^3)	c_p (J/kg·K)	k (W/m·K)	μ (kg/m·s)	Pr	β (K^{-1})
			HFC-134a (R134a)				
180	0.001128	0.07702	609.7	0.00389	6.90×10^{-6}	1.08	0.005617
200	0.006313	0.3898	658.6	0.00550	7.75	0.929	0.005150
220	0.02443	1.385	710.9	0.00711	8.59	0.859	0.004870
240	0.07248	3.837	770.5	0.00873	9.40	0.829	0.004796
260	0.1768	8.905	841.8	0.0104	10.2	0.826	0.004959
280	0.3727	18.23	929.6	0.0121	11.0	0.845	0.005421
300	0.7028	34.19	1044.	0.0140	11.9	0.886	0.006335
320	1.217	60.71	1211.	0.0163	12.9	0.961	0.008126
340	1.972	105.7	1524.	0.0197	14.4	1.11	0.01227
360	3.040	193.6	2606.	0.0274	17.0	1.62	0.02863
			Nitrogen				
70	0.03854	1.896	1082.	0.00680	4.88×10^{-6}	0.776	0.01525
77	0.09715	4.437	1121.	0.00747	5.41	0.812	0.01475
80	0.1369	6.089	1145.	0.00778	5.64	0.830	0.01472
90	0.3605	15.08	1266.	0.00902	6.46	0.906	0.01553
100	0.7783	31.96	1503.	0.0109	7.39	1.02	0.01842
110	1.466	62.58	2062.	0.0144	8.58	1.23	0.02646
120	2.511	125.1	4631.	0.0235	10.6	2.09	0.06454
			Oxygen				
60	0.0007258	0.04659	947.5	0.00486	3.89×10^{-6}	0.757	0.01688
70	0.006262	0.3457	978.0	0.00598	4.78	0.781	0.01471
80	0.03012	1.468	974.3	0.00711	5.66	0.776	0.01314
90	0.09935	4.387	970.5	0.00826	6.54	0.769	0.01223
100	0.2540	10.42	1006.	0.00949	7.44	0.789	0.01207
110	0.5434	21.28	1101.	0.0109	8.36	0.847	0.01277
120	1.022	39.31	1276.	0.0126	9.35	0.951	0.01462
130	1.749	68.37	1600.	0.0149	10.5	1.13	0.01868
140	2.788	116.8	2370.	0.0190	12.1	1.51	0.02919
150	4.219	214.9	6625.	0.0318	15.2	3.17	0.08865

Table A.5: saturated vapors ($p \neq 1$ atm)...*continued.*

T (K)	p (MPa)	ρ (kg/m^3)	c_p (J/kg·K)	k (W/m·K)	μ (kg/m·s)	Pr	β (K^{-1})
			Water vapor				
273.16	0.0006177	0.004855	1884	0.01707	0.9216×10^{-5}	1.02	0.003681
275.0	0.0006985	0.005507	1886	0.01717	0.9260	1.02	0.003657
280.0	0.0009918	0.007681	1891	0.01744	0.9382	1.02	0.003596
285.0	0.001389	0.01057	1897	0.01773	0.9509	1.02	0.003538
290.0	0.001920	0.01436	1902	0.01803	0.9641	1.02	0.003481
295.0	0.002621	0.01928	1908	0.01835	0.9778	1.02	0.003428
300.0	0.003537	0.02559	1914	0.01867	0.9920	1.02	0.003376
305.0	0.004719	0.03360	1920	0.01901	1.006	1.02	0.003328
310.0	0.006231	0.04366	1927	0.01937	1.021	1.02	0.003281
320.0	0.01055	0.07166	1942	0.02012	1.052	1.02	0.003195
340.0	0.02719	0.1744	1979	0.02178	1.116	1.01	0.003052
360.0	0.06219	0.3786	2033	0.02369	1.182	1.01	0.002948
373.15	0.1014	0.5982	2080	0.02510	1.227	1.02	0.002902
380.0	0.1289	0.7483	2110	0.02587	1.250	1.02	0.002887
400.0	0.2458	1.369	2218	0.02835	1.319	1.03	0.002874
420.0	0.4373	2.352	2367	0.03113	1.388	1.06	0.002914
440.0	0.7337	3.833	2560	0.03423	1.457	1.09	0.003014
460.0	1.171	5.983	2801	0.03766	1.526	1.13	0.003181
480.0	1.790	9.014	3098	0.04145	1.595	1.19	0.003428
500.0	2.639	13.20	3463	0.04567	1.665	1.26	0.003778
520.0	3.769	18.90	3926	0.05044	1.738	1.35	0.004274
540.0	5.237	26.63	4540	0.05610	1.815	1.47	0.004994
560.0	7.106	37.15	5410	0.06334	1.901	1.62	0.006091
580.0	9.448	51.74	6760	0.07372	2.002	1.84	0.007904
600.0	12.34	72.84	9181	0.09105	2.135	2.15	0.01135
620.0	15.90	106.3	14,940	0.1267	2.337	2.76	0.02000
640.0	20.27	177.1	52,590	0.2500	2.794	5.88	0.07995
642.0	20.76	191.5	737,900	0.2897	2.894	7.37	0.1144
644.0	21.26	211.0	1,253,000	0.3596	3.034	10.6	0.1988
646.0	21.77	243.5	3,852,000	0.5561	3.325	23.0	0.6329
647.0	22.04	286.5	53,340,000	1.573	3.972	135.	9.274

Table A.6 Thermophysical properties of gases at atmospheric pressure (101325 Pa)

T (K)	ρ (kg/m^3)	c_p (J/kg·K)	μ (kg/m·s)	ν (m^2/s)	k (W/m·K)	α (m^2/s)	Pr
			Air				
100	3.605	1039	0.711×10^{-5}	0.197×10^{-5}	0.00941	0.251×10^{-5}	0.784
150	2.368	1012	1.035	0.437	0.01406	0.587	0.745
200	1.769	1007	1.333	0.754	0.01836	1.031	0.731
250	1.412	1006	1.606	1.137	0.02241	1.578	0.721
260	1.358	1006	1.649	1.214	0.02329	1.705	0.712
270	1.308	1006	1.699	1.299	0.02400	1.824	0.712
280	1.261	1006	1.747	1.385	0.02473	1.879	0.711
290	1.217	1006	1.795	1.475	0.02544	2.078	0.710
300	1.177	1007	1.857	1.578	0.02623	2.213	0.713
310	1.139	1007	1.889	1.659	0.02684	2.340	0.709
320	1.103	1008	1.935	1.754	0.02753	2.476	0.708
330	1.070	1008	1.981	1.851	0.02821	2.616	0.708
340	1.038	1009	2.025	1.951	0.02888	2.821	0.707
350	1.008	1009	2.090	2.073	0.02984	2.931	0.707
400	0.8821	1014	2.310	2.619	0.03328	3.721	0.704
450	0.7840	1021	2.517	3.210	0.03656	4.567	0.703
500	0.7056	1030	2.713	3.845	0.03971	5.464	0.704
550	0.6414	1040	2.902	4.524	0.04277	6.412	0.706
600	0.5880	1051	3.082	5.242	0.04573	7.400	0.708
650	0.5427	1063	3.257	6.001	0.04863	8.430	0.712
700	0.5040	1075	3.425	6.796	0.05146	9.498	0.715
750	0.4704	1087	3.588	7.623	0.05425	10.61	0.719
800	0.4410	1099	3.747	8.497	0.05699	11.76	0.723
850	0.4150	1110	3.901	9.400	0.05969	12.96	0.725
900	0.3920	1121	4.052	10.34	0.06237	14.19	0.728
950	0.3716	1131	4.199	11.30	0.06501	15.47	0.731
1000	0.3528	1142	4.343	12.31	0.06763	16.79	0.733
1100	0.3207	1159	4.622	14.41	0.07281	19.59	0.736
1200	0.2940	1175	4.891	16.64	0.07792	22.56	0.738
1300	0.2714	1189	5.151	18.98	0.08297	25.71	0.738
1400	0.2520	1201	5.403	21.44	0.08798	29.05	0.738
1500	0.2352	1211	5.648	23.99	0.09296	32.64	0.735

Table A.6: gases at 1 atm...*continued.*

T(K)	ρ (kg/m^3)	c_p (J/kg·K)	μ (kg/m·s)	ν (m^2/s)	k (W/m·K)	α (m^2/s)	Pr
			Argon				
100	4.982	547.4	0.799×10^{-5}	0.160×10^{-5}	0.00632	0.232×10^{-5}	0.692
150	3.269	527.7	1.20	0.366	0.00939	0.544	0.673
200	2.441	523.7	1.59	0.652	0.01245	0.974	0.669
250	1.950	522.2	1.95	1.00	0.01527	1.50	0.668
300	1.624	521.5	2.29	1.41	0.01787	2.11	0.667
350	1.391	521.2	2.59	1.86	0.02029	2.80	0.666
400	1.217	520.9	2.88	2.37	0.02256	3.56	0.666
450	1.082	520.8	3.16	2.92	0.02470	4.39	0.666
500	0.9735	520.7	3.42	3.51	0.02675	5.28	0.666
550	0.8850	520.6	3.67	4.14	0.02870	6.23	0.665
600	0.8112	520.6	3.91	4.82	0.03057	7.24	0.665
650	0.7488	520.5	4.14	5.52	0.03238	8.31	0.665
700	0.6953	520.5	4.36	6.27	0.03412	9.43	0.665
			Ammonia				
240	0.8888	2296	8.06×10^{-6}	0.907×10^{-5}	0.0210	0.1028×10^{-4}	0.882
273	0.7719	2180	9.19	1.19	0.0229	0.1361	0.874
323	0.6475	2176	11.01	1.70	0.0274	0.1943	0.876
373	0.5589	2238	12.92	2.31	0.0334	0.2671	0.866
423	0.4920	2326	14.87	3.01	0.0407	0.3554	0.850
473	0.4396	2425	16.82	3.82	0.0487	0.4565	0.838
			Carbon dioxide				
220	2.4733	783	11.06×10^{-6}	4.472×10^{-6}	0.01090	0.05628×10^{-4}	0.795
250	2.1657	804	12.57	5.804	0.01295	0.07437	0.780
300	1.7973	853	15.02	8.357	0.01677	0.1094	0.764
350	1.5362	900	17.40	11.33	0.02092	0.1513	0.749
400	1.3424	942	19.70	14.68	0.02515	0.1989	0.738
450	1.1918	980	21.88	18.36	0.02938	0.2516	0.730
500	1.0732	1013	24.02	22.38	0.03354	0.3085	0.725
550	0.9739	1047	26.05	26.75	0.03761	0.3688	0.725
600	0.8938	1076	28.00	31.33	0.04159	0.4325	0.724

Table A.6: gases at 1 atm...*continued.*

T(K)	ρ (kg/m^3)	c_p (J/kg·K)	μ (kg/m·s)	ν (m^2/s)	k (W/m·K)	α (m^2/s)	Pr
			Carbon monoxide				
250	1.367	1042	1.54×10^{-5}	1.13×10^{-5}	0.02306	1.62×10^{-5}	0.697
300	1.138	1040	1.77	1.56	0.02656	2.24	0.694
350	0.975	1040	1.99	2.04	0.02981	2.94	0.693
400	0.853	1039	2.19	2.56	0.03285	3.70	0.692
450	0.758	1039	2.38	3.13	0.03571	4.53	0.691
500	0.682	1040	2.55	3.74	0.03844	5.42	0.691
600	0.5687	1041	2.89	5.08	0.04357	7.36	0.690
700	0.4874	1043	3.20	6.56	0.04838	9.52	0.689
800	0.4265	1046	3.49	8.18	0.05297	11.9	0.689
900	0.3791	1049	3.77	9.94	0.05738	14.4	0.689
1000	0.3412	1052	4.04	11.8	0.06164	17.2	0.689
			Helium				
50	0.9732	5201	0.607×10^{-5}	0.0624×10^{-4}	0.0476	0.0940×10^{-4}	0.663
100	0.4871	5194	0.953	0.196	0.0746	0.295	0.664
150	0.3249	5193	1.25	0.385	0.0976	0.578	0.665
200	0.2437	5193	1.51	0.621	0.118	0.932	0.667
250	0.1950	5193	1.76	0.903	0.138	1.36	0.665
300	0.1625	5193	1.99	1.23	0.156	1.85	0.664
350	0.1393	5193	2.22	1.59	0.174	2.40	0.663
400	0.1219	5193	2.43	1.99	0.190	3.01	0.663
450	0.1084	5193	2.64	2.43	0.207	3.67	0.663
500	0.09753	5193	2.84	2.91	0.222	4.39	0.663
600	0.08128	5193	3.22	3.96	0.252	5.98	0.663
700	0.06967	5193	3.59	5.15	0.281	7.77	0.663
800	0.06096	5193	3.94	6.47	0.309	9.75	0.664
900	0.05419	5193	4.28	7.91	0.335	11.9	0.664
1000	0.04877	5193	4.62	9.46	0.361	14.2	0.665
1100	0.04434	5193	4.95	11.2	0.387	16.8	0.664
1200	0.04065	5193	5.27	13.0	0.412	19.5	0.664
1300	0.03752	5193	5.59	14.9	0.437	22.4	0.664
1400	0.03484	5193	5.90	16.9	0.461	25.5	0.665
1500	0.03252	5193	6.21	19.1	0.485	28.7	0.665

Table A.6: gases at 1 atm...*continued.*

T(K)	ρ (kg/m^3)	c_p (J/kg·K)	μ (kg/m·s)	ν (m^2/s)	k (W/m·K)	α (m^2/s)	Pr
			Hydrogen				
30	0.8472	10840	1.606×10^{-6}	1.805×10^{-6}	0.0228	0.0249×10^{-4}	0.759
50	0.5096	10501	2.516	4.880	0.0362	0.0676	0.721
100	0.2457	11229	4.212	17.14	0.0665	0.2408	0.712
150	0.1637	12602	5.595	34.18	0.0981	0.475	0.718
200	0.1227	13540	6.813	55.53	0.1282	0.772	0.719
250	0.09819	14059	7.919	80.64	0.1561	1.130	0.713
300	0.08185	14314	8.963	109.5	0.182	1.554	0.706
350	0.07016	14436	9.954	141.9	0.206	2.031	0.697
400	0.06135	14491	10.86	177.1	0.228	2.568	0.690
450	0.05462	14499	11.78	215.6	0.251	3.164	0.682
500	0.04918	14507	12.64	257.0	0.272	3.817	0.675
600	0.04085	14537	14.29	349.7	0.315	5.306	0.664
700	0.03492	14574	15.89	455.1	0.351	6.903	0.659
800	0.03060	14675	17.40	569	0.384	8.563	0.664
900	0.02723	14821	18.78	690	0.412	10.21	0.675
1000	0.02451	14968	20.16	822	0.445	12.13	0.678
1100	0.02227	15165	21.46	965	0.488	14.45	0.668
1200	0.02050	15366	22.75	1107	0.528	16.76	0.661
1300	0.01890	15575	24.08	1273	0.568	19.3	0.660
			Nitrogen				
100	3.484	1072	6.80×10^{-6}	1.95×10^{-6}	0.00988	0.0265×10^{-4}	0.738
200	1.711	1043	12.9	7.54	0.0187	0.105	0.720
300	1.138	1041	18.0	15.8	0.0260	0.219	0.721
400	0.8533	1044	22.2	26.0	0.0326	0.366	0.711
500	0.6826	1055	26.1	38.2	0.0388	0.539	0.709
600	0.5688	1074	29.5	51.9	0.0448	0.733	0.708
700	0.4876	1096	32.8	67.3	0.0508	0.951	0.708
800	0.4266	1120	35.8	83.9	0.0567	1.19	0.707
900	0.3792	1143	38.7	102.	0.0624	1.44	0.709
1000	0.3413	1165	41.5	122.	0.0680	1.71	0.711
1100	0.3103	1184	44.2	142.	0.0735	2.00	0.712
1200	0.2844	1201	46.7	164.	0.0788	2.31	0.712
1400	0.2438	1229	51.7	212.	0.0889	2.97	0.715
1600	0.2133	1250	56.3	264.	0.0984	3.69	0.715

Table A.6: gases at 1 atm...*continued.*

T(K)	ρ (kg/m^3)	c_p (J/kg·K)	μ (kg/m·s)	ν (m^2/s)	k (W/m·K)	α (m^2/s)	Pr
			Oxygen				
100	3.995	935.6	0.738×10^{-5}	0.185×10^{-5}	0.00930	0.249×10^{-5}	0.743
150	2.619	919.8	1.13	0.431	0.01415	0.587	0.733
200	1.956	914.6	1.47	0.754	0.01848	1.03	0.730
250	1.562	915.0	1.79	1.145	0.02244	1.57	0.729
300	1.301	919.9	2.07	1.595	0.02615	2.19	0.730
350	1.114	929.1	2.34	2.101	0.02974	2.87	0.731
400	0.9749	941.7	2.59	2.657	0.03324	3.62	0.734
450	0.8665	956.4	2.83	3.261	0.03670	4.43	0.737
500	0.7798	972.2	3.05	3.911	0.04010	5.29	0.739
600	0.6498	1003	3.47	5.340	0.04673	7.17	0.745
700	0.5569	1031	3.86	6.930	0.05309	9.24	0.750
800	0.4873	1054	4.23	8.673	0.05915	11.5	0.753
900	0.4332	1073	4.57	10.56	0.06493	14.0	0.757
1000	0.3899	1089	4.91	12.59	0.07046	16.6	0.759
			Steam (H_2O vapor)				
373.15	0.5976	2080	12.28×10^{-6}	20.55×10^{-6}	0.02509	2.019×10^{-5}	1.018
393.15	0.5652	2021	13.04	23.07	0.02650	2.320	0.994
413.15	0.5365	1994	13.81	25.74	0.02805	2.622	0.982
433.15	0.5108	1980	14.59	28.56	0.02970	2.937	0.973
453.15	0.4875	1976	15.38	31.55	0.03145	3.265	0.966
473.15	0.4665	1976	16.18	34.68	0.03328	3.610	0.961
493.15	0.4472	1980	17.00	38.01	0.03519	3.974	0.956
513.15	0.4295	1986	17.81	41.47	0.03716	4.357	0.952
533.15	0.4131	1994	18.63	45.10	0.03919	4.758	0.948
553.15	0.3980	2003	19.46	48.89	0.04128	5.178	0.944
573.15	0.3840	2013	20.29	52.84	0.04341	5.616	0.941
593.15	0.3709	2023	21.12	56.94	0.04560	6.077	0.937
613.15	0.3587	2034	21.95	61.19	0.04784	6.554	0.934
673.15	0.3266	2070	24.45	74.86	0.05476	8.100	0.924
773.15	0.2842	2134	28.57	100.5	0.06698	11.04	0.910
873.15	0.2516	2203	32.62	129.7	0.07990	14.42	0.899
973.15	0.2257	2273	36.55	161.9	0.09338	18.20	0.890
1073.15	0.2046	2343	40.38	197.4	0.1073	22.38	0.882

Table A.7 Physical constants from 2002 CODATA. The one standard deviation uncertainty of the last two digits is stated in parentheses.

Avogadro's number, N_A	$6.0221415\ (10) \times 10^{26}$	molecules/kmol
Boltzmann's constant, k_B	$1.3806505\ (24) \times 10^{-23}$	J/K
Universal gas constant, R°	8314.472 (15)	J/kmol·K
Speed of light in vacuum, c	299,792,458 (0)	m/s
Standard acceleration of gravity, g	9.80665 (0)	m/s^2
Stefan-Boltzmann constant, σ	$5.670400\ (40) \times 10^{-8}$	W/m^2K^4

Table A.8 Additional physical property data in the text

Page no.	*Data*
28	Electromagnetic wave spectrum
52, 53	Additional thermal conductivities of metals, liquids, and gases
467, 468	Surface tension
530	Total emittances
618	Lennard-Jones constants and molecular weights
620	Collision integrals
624	Molal specific volumes and latent heats