

Appendix A3

Table A3.1 Temperature dependence of thermodynamic properties at 100 kPa.

	T	ρ_a	L_v	L_f	γ^\dagger		s^\dagger
(°C)	(K)	(kg m ⁻³)	(MJ kg ⁻¹)		(g m ⁻³ K ⁻¹)	(Pa K ⁻¹)	(g m ⁻³ K ⁻¹)
-30	243.2	1.433	2.575	0.264	0.562	63.1	0.04
-25	248.2	1.404	2.562	0.277	0.553	63.4	0.06
-20	253.2	1.376	2.549	0.289	0.545	63.7	0.09
-15	258.2	1.349	2.537	0.301	0.537	64.0	0.13
-10	263.2	1.324	2.525	0.312	0.530	64.3	0.18
-5	268.2	1.299	2.513	0.323	0.522	64.6	0.25
0	273.2	1.275	2.501	0.334	0.515	64.9	0.33
5	278.2	1.252	2.488		0.508	65.3	0.45
10	283.2	1.230	2.476		0.502	65.6	0.60
15	288.2	1.209	2.464		0.496	65.9	0.78
20	293.2	1.188	2.453		0.489	66.2	1.01
25	298.2	1.168	2.442		0.483	66.5	1.30
30	303.2	1.149	2.432		0.477	66.8	1.65
35	308.2	1.131	2.422		0.472	67.0	2.07
40	313.2	1.113	2.413		0.466	67.3	2.57
45	318.2	1.095	2.404		0.460	67.6	3.17

[†] Values with respect to water not ice surface.

Sources: List, 1966; Monteith, 1973. L_v above 0°C and all values of s are based on the equations of Henderson-Sellers, 1984, and Lowe, 1977, respectively.

Symbols: ρ_a , ρ_w – densities of air and water; L_v , L_f – latent heats of vaporization and fusion; γ – psychrometric constant; s – slope of saturation humidity vs temperature curve; k_a – thermal conductivity of air; κ_{Ha} , κ_{Ma} , κ_{Va} – molecular diffusion coefficients in air of heat, momentum and water vapour.

Temperature-dependent properties

(Pa K ⁻¹)	$\frac{\sigma}{s+\gamma}^\dagger$	ρ_w (kg m ⁻³)	k_a (W m ⁻¹) K ⁻¹ × 10 ⁻³	κ_{Ha} (mm ² s ⁻¹ × 10 ⁻⁴)	κ_{Ma}	κ_{Va}
4.79	0.07		22.8	16.5	11.7	18.7
7.27	0.10	997.9	23.6	17.7	12.6	20.0
10.81	0.15	999.2	24.0	18.3	12.9	20.5
15.78	0.20	999.9	24.3	18.9	13.3	21.2
22.63	0.26	999.9	24.6	19.5	13.7	22.0
31.94	0.32	999.7	25.0	20.2	14.2	22.7
44.38	0.39	999.1	25.3	20.8	14.6	23.4
60.81	0.47	998.2	25.7	21.5	15.1	24.2
82.21	0.54	997.1	26.0	22.2	15.5	24.9
109.75	0.61	995.7	26.4	22.8	16.0	25.7
144.76	0.67	994.1	26.7	23.5	16.4	26.4
188.78	0.73	992.3	27.0	24.2	16.9	27.2
243.55	0.77	990.2	27.4	24.9	17.4	28.0
311.00	0.81					
393.31	0.84					
492.86	0.87					

Table A3.2 Temperature dependence of saturation humidity (p , e^*) and the emittance of a full radiator (σT^4)

T (°C)	ρ_v^* (g m ⁻³) Water	(Ice)	e^* (Pa) Water	(Ice)	σT^4 (W m ⁻²)	T (°C)	ρ_v^* (g m ⁻³)	e^* (Pa)	σT^4 (W m ⁻²)	T (°C)	ρ_v^* (g m ⁻³)	e^* (Pa)	σT^4 (W m ⁻²)
-50		(0.04)		(4)	141	0	4.85	611	316	26	24.38	3361	454
-45		(0.07)		(7)	154	1	5.19	657	320	27	25.78	3565	460
-40		(0.12)		(13)	165	2	5.56	705	325	28	27.24	3779	466
-35		(0.20)		(22)	183	3	5.95	757	330	29	28.78	4005	473
-30		(0.34)		(38)	198	4	6.36	813	335	30	30.38	4243	479
-25	0.70	(0.55)	81	(63)	215	5	6.80	872	339	31	32.07	4493	485
-20	1.07	(0.88)	125	(103)	233	6	7.26	935	344	32	33.83	4755	492
-19	1.17	(0.97)	137	(114)	237	7	7.75	1001	349	33	35.68	5031	498
-18	1.26	(1.06)	149	(125)	240	8	8.27	1072	354	34	37.61	5320	505
-17	1.37	(1.16)	162	(137)	244	9	8.82	1147	359	35	39.63	5623	511
-16	1.48	(1.27)	176	(151)	248	10	9.40	1227	364	36	41.75	5942	518
-15	1.61	(1.39)	191	(165)	252	11	10.01	1312	370	37	43.96	6276	525
-14	1.74	(1.52)	208	(181)	256	12	10.66	1402	375	38	46.26	6626	531
-13	1.88	(1.65)	225	(198)	260	13	11.35	1497	380	39	48.67	6993	538
-12	2.03	(1.80)	244	(217)	264	14	12.07	1597	385	40	51.19	7378	545
-11	2.19	(1.96)	265	(238)	268	15	12.83	1704	391	41	53.82	7780	552
-10	2.36	(2.14)	286	(260)	272	16	13.63	1817	396	42	56.56	8201	559
-9	2.54	(2.33)	310	(284)	276	17	14.48	1937	402	43	59.41	8642	566
-8	2.74	(2.53)	335	(310)	280	18	15.37	2063	407	44	62.39	9103	574
-7	2.95	(2.75)	362	(338)	285	19	16.31	2196	413	45	65.50	9585	581
-6	3.17	(2.99)	391	(368)	289	20	17.30	2337	419	50	83.06	12341	619
-5	3.41	(3.25)	422	(401)	293	21	18.34	2486	424	60			699
-4	3.66	(3.52)	455	(437)	298	22	19.43	2643	430	70			787
-3	3.93	(3.82)	490	(476)	302	23	20.58	2808	436				
-2	4.22	(4.14)	528	(517)	306	24	21.78	2983	442				
-1	4.52	(4.48)	568	(562)	311	25	23.05	3167	448				

Sources: List, 1966, and calculations using the equation of Lowe, 1977.