

九十一學年度 工程與系統科學 系(所) 乙 組碩士班研究生招生考試

熱力學 科號 3702 共 12 頁第 1 頁 \*請在試卷【答案卷】內作答

Prob. 1

15%

Consider the simple steam power plant, as shown in Fig. A. The following data are for such a power plant.

Location	Pressure	Temperature or Quality
Leaving boiler	2.0 MPa	300°C
Entering turbine	1.9 MPa	290°C
Leaving turbine, entering condenser	15 kPa	90%
Leaving condenser, entering pump	14 kPa	45°C
Pump work = 4 kJ/kg		

Determine the following quantities per kilogram flowing through the unit.

1. Heat transfer in line between boiler and turbine.
2. Turbine work.
3. Heat transfer in condenser.
4. Heat transfer in boiler.

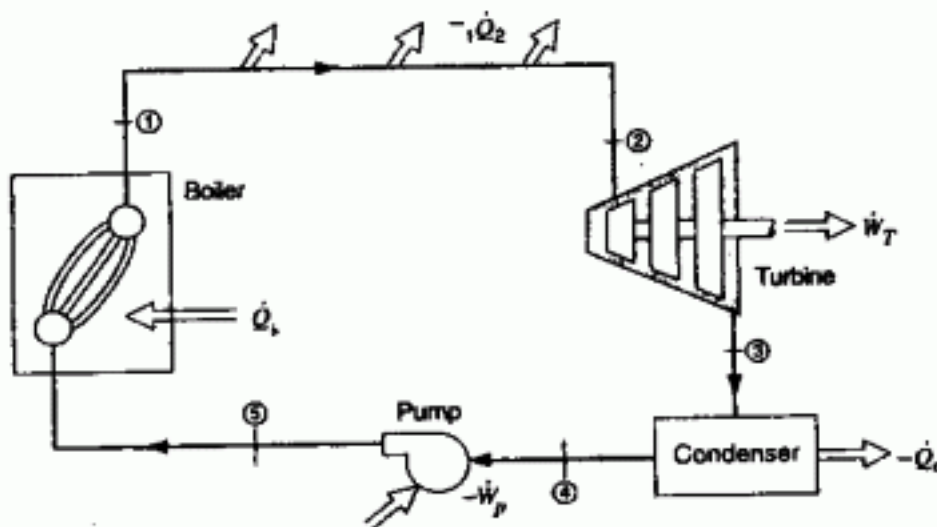


FIGURE A. Simple steam power plant.

<prob. 2>  
25%

Steam at a pressure of 1.4 MPa, 300°C is flowing in a pipe, Fig. B. Connected to this pipe through a valve is an evacuated tank. The valve is opened and the tank fills with steam until the pressure is 1.4 MPa, and then the valve is closed. The process takes place adiabatically and kinetic energies and potential energies are negligible. Determine the final temperature of the steam.

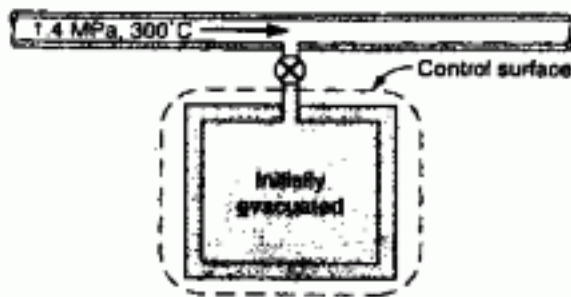


FIGURE B. Flow into an evacuated vessel—control volume analysis.

• 1st Law of of USUF process:

$$Q_{c.v.} + \sum m_i \left( h_i + \frac{V_i^2}{2} + gZ_i \right) = \sum m_e \left( h_e + \frac{V_e^2}{2} + gZ_e \right) + \left[ m_2 \left( u_2 + \frac{V_2^2}{2} + gZ_2 \right) - m_1 \left( u_1 + \frac{V_1^2}{2} + gZ_1 \right) \right]_{c.v.} + W_{c.v.}$$

<prob. 3>  
25%

Consider a regenerative cycle using steam as the working fluid. Steam leaves the boiler and enters the turbine at 4 MPa, 400°C. After expansion to 400 kPa, some of the steam is extracted from the turbine for the purpose of heating the feedwater in an open feedwater heater. The pressure in the feedwater heater is 400 kPa and the water leaving it is saturated liquid at 400 kPa. The steam not extracted expands to 10 kPa. Determine the cycle efficiency.

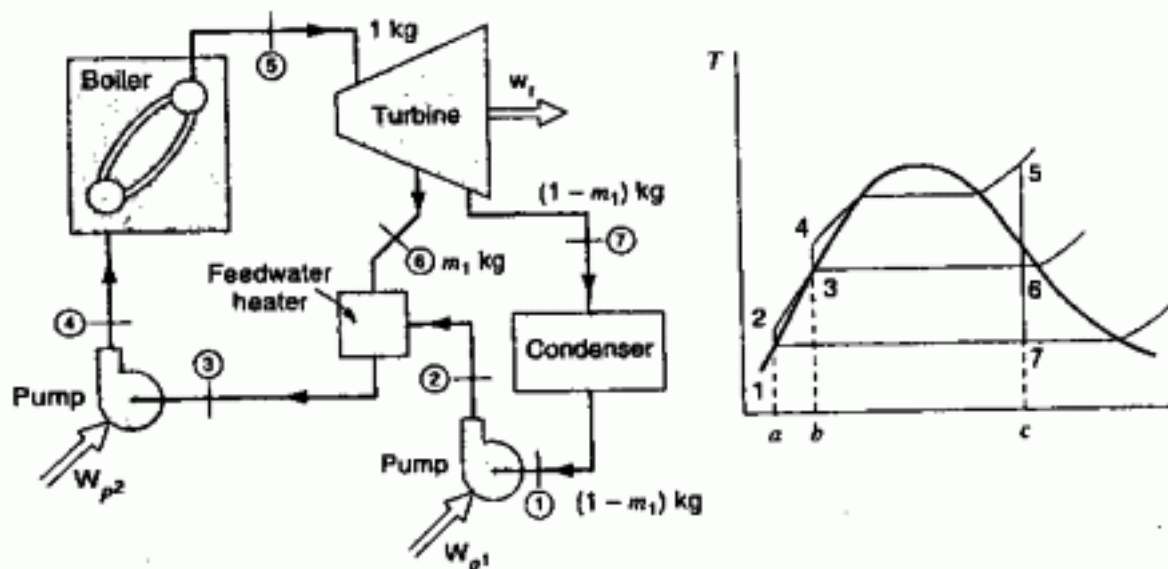


FIGURE C. Regenerative cycle with open feedwater heater.

九十一學年度 工程與系統科學 系(所) 乙 組碩士班研究生招生考試

科目 熱力學 科號 3702 共 12 頁第 3 頁 \*請在試卷【答案卷】內作答

prob. 4) In an air-standard Brayton cycle the air enters the compressor at 0.1 MPa, 15°C. The pressure leaving the compressor is 1.0 MPa, and the maximum temperature in the cycle is 1100°C. Determine

- 25%
1. The pressure and temperature at each point in the cycle
  2. The compressor work, turbine work, and cycle efficiency



熱力學

TABLE B.1.1 SI Thermodynamic Properties of Water

Temp. T	Press. p	Specific Volume, m <sup>3</sup> /kg			Internal Energy, kJ/kg		
		Sat. Liquid v <sub>f</sub>	Evap. v <sub>fg</sub>	Sat. Vapor v <sub>g</sub>	Sat. Liquid u <sub>f</sub>	Evap. u <sub>fg</sub>	Sat. Vapor u <sub>g</sub>
0.01	0.6113	0.001000	206.131	206.132	0	2375.33	2375.33
5	0.8721	0.001000	147.117	147.118	26.07	2361.27	2387.34
10	1.2276	0.001000	106.376	106.377	41.99	2347.16	2389.15
15	1.705	0.001001	77.924	77.925	62.98	2333.06	2390.07
20	2.339	0.001002	57.787	57.787	83.94	2318.98	2400.92
25	3.169	0.001003	43.383	43.383	104.86	2304.90	2409.81
30	4.246	0.001004	32.892	32.892	125.77	2290.81	2416.58
35	5.628	0.001006	25.248	25.248	146.65	2276.71	2422.24
40	7.384	0.001008	19.5219	19.5229	167.53	2262.57	2427.01
45	9.593	0.001010	15.2571	15.2581	188.41	2248.40	2430.11
50	12.350	0.001012	12.0308	12.0318	209.30	2234.17	2432.64
55	15.758	0.001015	9.56734	9.56835	230.19	2219.89	2434.71
60	19.941	0.001017	7.66969	7.67071	251.09	2205.54	2436.33
65	25.03	0.001020	6.19554	6.19656	272.00	2191.12	2437.51
70	31.19	0.001023	5.04114	5.04217	292.91	2176.62	2438.27
75	38.58	0.001026	4.13021	4.13123	313.87	2162.03	2438.61
80	47.39	0.001029	3.40612	3.40715	334.84	2147.36	2438.54
85	57.83	0.001032	2.82654	2.82757	355.82	2132.58	2438.07
90	70.14	0.001036	2.35953	2.36056	376.82	2117.70	2437.21
95	84.55	0.001040	1.98082	1.98186	397.86	2102.70	2435.97
100	101.3	0.001044	1.67185	1.67290	418.91	2087.58	2434.35
105	120.8	0.001047	1.41831	1.41936	440.00	2072.34	2432.35
110	143.3	0.001052	1.20949	1.21054	461.12	2056.96	2430.00
115	169.1	0.001056	1.03552	1.03658	482.28	2041.44	2427.32
120	198.5	0.001060	0.89080	0.89186	503.48	2025.76	2424.34
125	232.1	0.001065	0.76953	0.77059	524.72	2009.91	2421.07
130	270.1	0.001070	0.66744	0.66850	546.00	1993.90	2417.52
135	313.0	0.001075	0.58110	0.58217	567.34	1977.69	2413.70
140	361.3	0.001080	0.50777	0.50884	588.72	1961.30	2409.61
145	415.4	0.001085	0.44524	0.44632	610.16	1944.69	2405.25
150	475.9	0.001090	0.39169	0.39278	631.66	1927.87	2400.64
155	543.1	0.001096	0.34566	0.34676	653.23	1910.82	2395.79
160	617.8	0.001102	0.30596	0.30706	674.85	1893.52	2390.71
165	700.5	0.001108	0.27158	0.27269	696.55	1875.97	2385.41
170	791.7	0.001114	0.24171	0.24283	718.31	1858.14	2379.89
175	892.0	0.001121	0.21586	0.21698	740.16	1840.03	2374.15
180	1002.2	0.001127	0.19292	0.19405	762.08	1821.62	2368.18
185	1122.7	0.001134	0.17295	0.17409	784.08	1802.90	2361.97
190	1254.4	0.001141	0.15539	0.15654	806.17	1783.84	2355.51

(Continued)

APPENDIX B.1.1 SI (Continued) Saturated Water

Temp. T	Press. p	Enthalpy, kJ/kg			Entropy, kJ/kg K		
		Sat. Liquid h <sub>f</sub>	Evap. h <sub>fg</sub>	Sat. Vapor h <sub>g</sub>	Sat. Liquid s <sub>f</sub>	Evap. s <sub>fg</sub>	Sat. Vapor s <sub>g</sub>
0.01	0.6113	0.00	2501.35	2501.35	0	9.1562	9.1562
5	0.8721	20.98	2489.57	2510.54	0.0761	8.9496	9.0257
10	1.2276	41.99	2477.75	2519.74	0.1510	8.7498	8.9007
15	1.705	62.98	2465.94	2528.91	0.2245	8.5569	8.7813
20	2.339	83.94	2454.12	2538.06	0.2966	8.3706	8.6672
25	3.169	104.87	2442.30	2547.17	0.3673	8.1905	8.5579
30	4.246	125.77	2430.48	2556.25	0.4369	8.0164	8.4533
35	5.628	146.66	2418.62	2565.28	0.5052	7.8478	8.3530
40	7.384	167.54	2406.72	2574.26	0.5724	7.6845	8.2569
45	9.593	188.42	2394.77	2583.19	0.6386	7.5261	8.1647
50	12.350	209.31	2382.75	2592.06	0.7037	7.3725	8.0762
55	15.758	230.20	2370.66	2600.86	0.7679	7.2234	7.9912
60	19.941	251.11	2358.48	2609.59	0.8311	7.0784	7.9095
65	25.03	272.03	2346.21	2618.24	0.8934	6.9375	7.8309
70	31.19	292.96	2333.85	2626.80	0.9548	6.8004	7.7552
75	38.58	313.91	2321.37	2635.28	1.0154	6.6670	7.6824
80	47.39	334.88	2308.77	2643.66	1.0752	6.5369	7.6121
85	57.83	355.88	2296.05	2651.93	1.1342	6.4102	7.5444
90	70.14	376.90	2283.19	2660.09	1.1924	6.2866	7.4790
95	84.55	397.94	2270.19	2668.13	1.2500	6.1659	7.4158
100	101.3	419.02	2257.03	2676.05	1.3068	6.0480	7.3548
105	120.8	440.13	2243.70	2683.83	1.3629	5.9328	7.2958
110	143.3	461.27	2230.20	2691.47	1.4184	5.8202	7.2386
115	169.1	482.46	2216.50	2698.96	1.4733	5.7100	7.1832
120	198.5	503.69	2202.61	2706.30	1.5275	5.6020	7.1295
125	232.1	524.96	2188.50	2713.46	1.5812	5.4962	7.0774
130	270.1	546.29	2174.16	2720.46	1.6343	5.3925	7.0269
135	313.0	567.67	2159.59	2727.26	1.6869	5.2907	6.9777
140	361.3	589.11	2144.75	2733.87	1.7390	5.1908	6.9298
145	415.4	610.61	2129.65	2740.26	1.7906	5.0926	6.8832
150	475.9	632.18	2114.26	2746.44	1.8417	4.9960	6.8378
155	543.1	653.82	2098.56	2752.39	1.8924	4.9010	6.7934
160	617.8	675.53	2082.55	2758.09	1.9426	4.8075	6.7501
165	700.5	697.32	2066.20	2763.53	1.9924	4.7153	6.7078
170	791.7	719.20	2049.50	2768.70	2.0418	4.6244	6.6663
175	892.0	741.16	2032.42	2773.58	2.0909	4.5347	6.6256
180	1002.2	763.21	2014.96	2778.16	2.1395	4.4461	6.5857
185	1122.7	785.36	1997.07	2782.43	2.1878	4.3586	6.5464
190	1254.4	807.61	1978.76	2786.37	2.2358	4.2720	6.5078

(Continued)



APPENDIX B SI UNITS THERMODYNAMIC TABLES

TABLE B.1.1 SI (Continued) Saturated Water

Temp. T	Press. p	Specific Volume, m <sup>3</sup> /kg			Internal Energy, kJ/kg		
		Sat. Liquid v <sub>f</sub>	Exp. v <sub>g</sub>	Sat. Vapor v <sub>g</sub>	Sat. Liquid u <sub>f</sub>	Exp. u <sub>g</sub>	Sat. Vapor u <sub>g</sub>
195	1397.8	0.001149	0.13990	0.14105	828.36	1764.63	2592.79
200	1553.8	0.001156	0.12620	0.12736	850.64	1744.66	2595.29
205	1723.0	0.001164	0.11405	0.11521	873.02	1724.49	2597.52
210	1906.3	0.001173	0.10324	0.10441	895.51	1703.93	2599.47
215	2104.2	0.001181	0.09361	0.09479	918.12	1682.94	2601.06
220	2317.8	0.001190	0.08500	0.08619	940.85	1661.49	2602.35
225	2547.7	0.001199	0.07729	0.07849	963.72	1639.58	2603.30
230	2794.9	0.001209	0.07037	0.07158	986.72	1617.17	2603.89
235	3060.1	0.001219	0.06415	0.06536	1009.88	1594.24	2604.11
240	3344.2	0.001229	0.05853	0.05976	1033.19	1570.75	2603.93
245	3648.2	0.001240	0.05346	0.05470	1056.69	1546.68	2603.37
250	3973.0	0.001251	0.04887	0.05013	1080.37	1522.00	2602.37
255	4319.5	0.001263	0.04471	0.04598	1104.26	1496.66	2600.93
260	4688.6	0.001276	0.04093	0.04220	1128.37	1470.64	2599.01
265	5081.3	0.001289	0.03748	0.03877	1152.72	1443.87	2596.69
270	5498.7	0.001302	0.03434	0.03564	1177.33	1416.33	2593.66
275	5941.8	0.001317	0.03147	0.03279	1202.23	1387.94	2590.11
280	6411.7	0.001332	0.02884	0.03017	1227.43	1358.66	2586.07
285	6909.4	0.001348	0.02642	0.02777	1252.98	1328.41	2581.38
290	7436.0	0.001366	0.02420	0.02557	1278.89	1297.11	2575.99
295	7992.8	0.001384	0.02216	0.02354	1305.21	1264.67	2569.87
300	8581.0	0.001404	0.02027	0.02167	1331.97	1230.99	2562.96
305	9201.8	0.001425	0.01852	0.01995	1359.22	1195.94	2555.10
310	9856.6	0.001447	0.01690	0.01835	1387.03	1159.37	2546.40
315	10547	0.001472	0.01539	0.01687	1415.44	1121.11	2536.55
320	11274	0.001499	0.01399	0.01549	1444.55	1081.93	2525.48
325	12040	0.001528	0.01267	0.01420	1474.44	1038.57	2513.01
330	12845	0.001561	0.01144	0.01300	1505.24	993.66	2498.91
335	13694	0.001597	0.01027	0.01186	1537.11	945.77	2482.88
340	14586	0.001638	0.00916	0.01080	1570.26	894.26	2464.53
345	15525	0.001685	0.00810	0.00978	1605.01	838.29	2443.30
350	16514	0.001740	0.00707	0.00881	1641.81	778.58	2418.39
355	17554	0.001807	0.00607	0.00787	1681.41	707.11	2388.52
360	18651	0.001882	0.00505	0.00694	1723.19	626.29	2351.47
365	19807	0.002013	0.00398	0.00599	1776.13	526.54	2302.62
370	21028	0.002215	0.00271	0.00493	1843.84	384.69	2228.53
374.1	22089	0.002355	0	0.00375	2029.58	0	2029.58

6

(Continued)

APPENDIX B SI UNITS THERMODYNAMIC TABLES

TABLE B.1.1 SI (Continued) Saturated Water

Temp. T	Press. p	Enthalpy, kJ/kg			Entropy, kJ/kg K		
		Sat. Liquid h <sub>f</sub>	Exp. h <sub>g</sub>	Sat. Vapor h <sub>g</sub>	Sat. Liquid s <sub>f</sub>	Exp. s <sub>g</sub>	Sat. Vapor s <sub>g</sub>
195	1397.8	829.96	1929.99	2789.96	2.2835	4.1863	6.4693
200	1553.8	852.41	1940.75	2793.18	2.3108	4.1014	6.4122
205	1723.0	875.03	1921.00	2796.03	2.3799	4.0172	6.3951
210	1906.3	897.75	1900.73	2798.48	2.4207	3.9337	6.3584
215	2104.2	920.61	1879.91	2800.51	2.4713	3.8507	6.3221
220	2317.8	943.61	1858.51	2802.12	2.5177	3.7683	6.2860
225	2547.7	966.77	1836.50	2803.27	2.5639	3.6863	6.2502
230	2794.9	990.10	1813.85	2803.95	2.6099	3.6047	6.2146
235	3060.1	1013.61	1790.53	2804.11	2.6557	3.5233	6.1791
240	3344.2	1037.31	1766.50	2803.81	2.7015	3.4422	6.1436
245	3648.2	1061.23	1741.73	2802.95	2.7471	3.3612	6.1083
250	3973.0	1085.34	1716.18	2801.52	2.7927	3.2802	6.0729
255	4319.5	1109.72	1689.80	2799.51	2.8382	3.1992	6.0374
260	4688.6	1134.35	1662.54	2796.89	2.8837	3.1181	6.0018
265	5081.3	1159.27	1634.34	2793.61	2.9291	3.0368	5.9661
270	5498.7	1184.49	1605.16	2789.65	2.9750	2.9551	5.9301
275	5941.8	1210.05	1574.92	2784.97	3.0208	2.8730	5.8937
280	6411.7	1235.97	1543.55	2779.53	3.0667	2.7903	5.8570
285	6909.4	1262.29	1510.97	2773.27	3.1129	2.7069	5.8198
290	7436.0	1289.04	1477.06	2766.13	3.1593	2.6227	5.7821
295	7992.8	1316.27	1441.78	2758.05	3.2061	2.5374	5.7436
300	8581.0	1344.01	1404.93	2748.94	3.2533	2.4511	5.7044
305	9201.8	1372.33	1366.38	2738.72	3.3009	2.3633	5.6647
310	9856.6	1401.29	1325.97	2727.27	3.3492	2.2737	5.6229
315	10547	1430.97	1283.48	2714.44	3.3981	2.1821	5.5803
320	11274	1461.45	1238.64	2700.08	3.4479	2.0882	5.5361
325	12040	1492.84	1191.13	2683.97	3.4987	1.9917	5.4900
330	12845	1525.29	1140.56	2665.85	3.5506	1.8909	5.4416
335	13694	1558.98	1086.37	2645.35	3.6040	1.7863	5.3903
340	14586	1594.15	1027.86	2622.01	3.6593	1.6763	5.3356
345	15525	1631.17	964.02	2595.19	3.7169	1.5594	5.2763
350	16514	1670.54	893.38	2563.92	3.7776	1.4336	5.2111
355	17554	1712.13	813.59	2526.72	3.8427	1.2951	5.1378
360	18651	1760.48	720.52	2481.00	3.9146	1.1379	5.0525
365	19807	1815.96	605.44	2421.40	3.9983	0.9687	4.9470
370	21028	1890.37	441.75	2332.12	4.1104	0.6868	4.7972
374.1	22089	2099.26	0	2099.26	4.8297	0	4.8297

7

九十一學年度 工程與系統科學系(所) 乙 組碩士班研究生招生考試

科目 熱力學 科號 3702 共 12 頁第 6 頁 \*請在試卷【答案卷】內作答

APPENDIX B SI UNITS: THERMODYNAMIC TABLES

TABLE B.1.1 SI Saturated Water Pressure Entry

Press. $P$	Temp. $T$	Specific Volume, $m^3/kg$			Internal Energy, $kJ/kg$		
		Sat. Liquid $v_f$	Evap. $v_{fg}$	Sat. Vapor $v_g$	Sat. Liquid $u_f$	Evap. $u_{fg}$	Sat. Vapor $u_g$
0.6113	0.01	0.001000	206.131	206.132	0	2375.3	2375.3
1	6.98	0.001000	129.20702	129.20802	29.29	2355.69	2384.98
1.5	13.03	0.001001	87.97913	87.98013	54.30	2338.63	2393.32
2	17.50	0.001001	67.00285	67.00385	73.47	2326.02	2399.48
2.5	21.08	0.001002	54.25285	54.25385	88.47	2315.93	2404.40
3	24.08	0.001003	45.64402	45.64502	101.03	2307.48	2408.51
4	26.96	0.001004	39.79915	39.80015	121.44	2293.73	2415.17
5	28.96	0.001005	34.79150	34.79251	137.79	2282.70	2420.49
7.5	32.88	0.001008	28.19150	28.19251	173.79	2261.74	2430.50
10	36.98	0.001010	19.23674	19.23775	188.76	2246.10	2437.80
15	45.81	0.001014	14.67254	14.67355	191.79	2222.83	2448.73
20	53.97	0.001017	10.02117	10.02218	225.90	2205.36	2456.71
25	60.96	0.001017	7.64835	7.64937	251.35	2191.21	2463.08
30	64.97	0.001026	6.20322	6.20424	271.88	2179.22	2468.40
40	69.10	0.001026	5.22816	5.22918	289.18	2159.49	2477.00
50	71.83	0.001030	3.99243	3.99345	317.51	2139.43	2483.85
75	81.77	0.001037	2.21607	2.21711	384.29	2112.29	2496.67
100	91.77	0.001043	1.69296	1.69400	417.33	2088.72	2506.06
125	99.62	0.001048	1.37385	1.37490	444.16	2069.32	2513.48
150	105.99	0.001053	1.15828	1.15933	466.92	2052.72	2519.64
175	111.37	0.001057	1.00257	1.00363	486.78	2038.12	2524.90
200	116.06	0.001061	0.88867	0.88973	504.47	2025.02	2529.40
225	120.23	0.001064	0.79219	0.79325	520.45	2013.10	2533.56
250	124.00	0.001067	0.71365	0.71471	535.08	2002.34	2537.21
275	127.43	0.001070	0.65624	0.65731	548.57	1991.95	2540.53
300	130.60	0.001073	0.61475	0.61582	561.13	1982.43	2543.55
325	136.30	0.001076	0.56201	0.56308	572.88	1973.46	2546.34
350	138.88	0.001079	0.52317	0.52425	583.93	1964.98	2548.92
375	141.32	0.001081	0.49029	0.49137	594.38	1956.93	2551.31
400	143.63	0.001084	0.46138	0.46246	604.29	1949.26	2553.55
450	147.93	0.001088	0.41289	0.41398	622.75	1934.87	2557.62
500	151.86	0.001093	0.37380	0.37489	639.66	1921.57	2561.23
550	155.48	0.001097	0.34159	0.34268	655.30	1909.17	2564.47
600	158.85	0.001101	0.31457	0.31567	669.88	1897.52	2567.40
650	162.01	0.001104	0.29158	0.29268	683.55	1886.51	2570.08
700	164.97	0.001108	0.27136	0.27246	696.43	1876.07	2572.49
750	167.77	0.001111	0.25449	0.25560	708.62	1866.11	2574.71
800	170.43	0.001115	0.23971	0.24083	720.20	1856.58	2576.79

8

(Continued)

APPENDIX B SI UNITS: THERMODYNAMIC TABLES

TABLE B.1.2 SI (Continued) Saturated Water Pressure Entry

Press. $P$	Temp. $T$	Enthalpy, $kJ/kg$			Entropy, $kJ/kg \cdot K$		
		Sat. Liquid $h_f$	Evap. $h_{fg}$	Sat. Vapor $h_g$	Sat. Liquid $s_f$	Evap. $s_{fg}$	Sat. Vapor $s_g$
0.6113	0.01	0.00	2501.3	2501.3	0	9.1562	9.1562
1.0	6.98	29.29	2484.89	2514.18	0.1059	8.8697	8.9756
1.5	13.03	54.30	2470.59	2525.30	0.1956	8.6322	8.8278
2.0	17.50	73.47	2460.02	2533.49	0.2607	8.4629	8.7236
2.5	21.08	88.47	2451.56	2540.03	0.3120	8.3311	8.6431
3.0	24.08	101.03	2444.47	2545.50	0.3545	8.2231	8.5775
4.0	26.96	121.44	2432.93	2554.37	0.4226	8.0520	8.4746
5.0	28.96	137.79	2423.66	2561.45	0.4763	7.9187	8.3950
7.5	32.88	168.77	2406.02	2574.79	0.5763	7.6751	8.2514
10	36.98	191.81	2392.82	2584.63	0.6402	7.5010	8.1501
15	45.81	225.91	2373.14	2599.06	0.7548	7.2536	8.0084
20	53.97	251.38	2358.33	2609.70	0.8319	7.0085	7.9085
25	60.96	271.90	2346.29	2618.19	0.8930	6.9183	7.8313
30	64.97	289.21	2336.07	2625.28	0.9439	6.8247	7.7686
40	71.83	317.51	2319.19	2636.74	1.0258	6.6441	7.6700
50	81.77	340.47	2305.40	2645.85	1.0910	6.5029	7.5979
75	91.77	384.36	2278.59	2662.96	1.2129	6.2434	7.4583
100	99.62	417.44	2258.02	2675.46	1.3025	6.0568	7.3593
125	105.99	444.30	2241.05	2685.35	1.3739	5.9104	7.2843
150	111.37	467.08	2226.46	2693.54	1.4335	5.7997	7.2232
175	116.06	486.97	2213.57	2700.53	1.4848	5.6868	7.1717
200	120.23	504.68	2201.96	2706.63	1.5300	5.5970	7.1271
225	124.00	520.69	2191.35	2712.04	1.5705	5.5173	7.0878
250	127.43	535.34	2181.55	2716.89	1.6072	5.4455	7.0526
275	130.60	548.87	2172.42	2721.29	1.6407	5.3801	7.0208
300	133.55	561.43	2163.85	2725.30	1.6717	5.3101	6.9918
325	136.30	573.23	2155.76	2728.99	1.7005	5.2466	6.9651
350	138.88	584.31	2148.10	2732.40	1.7274	5.1880	6.9404
375	141.32	594.79	2140.79	2735.58	1.7527	5.1347	6.9174
400	143.63	604.73	2133.81	2738.53	1.7766	5.1193	6.8958
450	147.93	623.24	2120.67	2743.91	1.8206	5.0359	6.8565
500	151.86	640.21	2108.47	2748.67	1.8606	4.9606	6.8212
550	155.48	655.91	2097.04	2752.94	1.8972	4.8920	6.7892
600	158.85	670.54	2086.26	2756.80	1.9311	4.8289	6.7600
650	162.01	684.26	2076.04	2760.30	1.9627	4.7704	6.7330
700	164.97	697.20	2066.30	2763.50	1.9922	4.7156	6.7080
750	167.77	709.45	2056.98	2766.43	2.0199	4.6647	6.6846
800	170.43	721.10	2048.04	2769.13	2.0461	4.6166	6.6627

9

(Continued)



APPENDIX B SI UNITS: THERMODYNAMIC TABLES

TABLE B.1.2 SI (Continued) Saturated Water Pressure Entry

Press. kPa P	Temp. °C T	Specific Volume, m <sup>3</sup> /kg			Internal Energy, kJ/kg		
		Sat. Liquid v <sub>f</sub>	Evap. v <sub>fg</sub>	Sat. Vapor v <sub>g</sub>	Sat. Liquid u <sub>f</sub>	Evap. u <sub>fg</sub>	Sat. Vapor u <sub>g</sub>
850	172.96	0.001118	0.22386	0.22698	731.23	1847.45	2578.69
900	175.38	0.001121	0.21385	0.21497	741.81	1838.65	2580.46
950	177.69	0.001124	0.20306	0.20419	751.94	1830.17	2582.11
1000	179.91	0.001127	0.19332	0.19444	761.67	1821.97	2583.64
1100	184.09	0.001133	0.17639	0.17753	780.08	1806.32	2586.40
1200	187.99	0.001139	0.16220	0.16335	797.27	1791.55	2588.82
1300	191.64	0.001144	0.15011	0.15125	813.42	1777.33	2590.95
1400	195.07	0.001149	0.13969	0.14084	828.68	1764.15	2592.83
1500	198.32	0.001154	0.13062	0.13177	843.16	1751.3	2594.5
1750	200.76	0.001166	0.11232	0.11349	876.44	1721.39	2597.83
2000	212.42	0.001177	0.09845	0.09963	906.42	1693.84	2600.26
2250	218.45	0.001187	0.08756	0.08875	931.81	1668.18	2601.98
2500	223.99	0.001197	0.07878	0.07998	959.09	1644.04	2603.13
2750	229.12	0.001207	0.07154	0.07275	982.65	1621.16	2603.81
3000	233.90	0.001216	0.06546	0.06668	1004.76	1599.34	2604.10
3250	238.38	0.001226	0.06029	0.06152	1025.62	1578.43	2604.04
3500	242.60	0.001235	0.05583	0.05707	1045.41	1558.29	2603.70
4000	250.40	0.001252	0.04853	0.04978	1087.28	1519.99	2602.27
5000	263.99	0.001286	0.03815	0.03944	1147.78	1449.34	2597.12
6000	275.64	0.001319	0.03112	0.03244	1205.41	1384.27	2589.69
7000	285.88	0.001351	0.02602	0.02737	1257.51	1322.97	2580.48
8000	295.06	0.001384	0.02213	0.02352	1305.54	1264.25	2569.79
9000	303.40	0.001418	0.01907	0.02048	1350.47	1207.28	2557.75
10000	311.06	0.001452	0.01637	0.01803	1393.00	1151.40	2544.41
11000	318.15	0.001489	0.01430	0.01599	1433.68	1096.06	2529.74
12000	324.75	0.001527	0.01274	0.01426	1472.92	1040.76	2513.67
13000	330.93	0.001567	0.01121	0.01278	1511.09	984.99	2496.08
14000	336.75	0.001611	0.00987	0.01149	1548.53	928.23	2476.76
15000	342.24	0.001658	0.00868	0.01034	1585.58	869.85	2455.43
16000	347.43	0.001711	0.00760	0.00931	1622.63	809.07	2431.70
17000	352.37	0.001770	0.00659	0.00836	1660.16	744.80	2404.96
18000	357.06	0.001840	0.00565	0.00749	1698.86	675.42	2374.28
19000	361.54	0.001924	0.00473	0.00666	1739.87	599.18	2338.05
20000	365.81	0.002025	0.00380	0.00583	1783.47	507.58	2293.05
21000	369.89	0.002106	0.00287	0.00495	1841.97	388.74	2230.71
22000	373.80	0.002208	0.00192	0.00403	1915.16	238.24	2081.39
22089	374.14	0.002155	0	0.00315	2029.58	0	2029.58

(Continued)

APPENDIX B SI UNITS: THERMODYNAMIC TABLES

TABLE B.1.2 SI (Continued) Saturated Water Pressure Entry

Press. kPa P	Temp. °C T	Enthalpy, kJ/kg			Entropy, kJ/kg·K		
		Sat. Liquid h <sub>f</sub>	Evap. h <sub>fg</sub>	Sat. Vapor h <sub>g</sub>	Sat. Liquid s <sub>f</sub>	Evap. s <sub>fg</sub>	Sat. Vapor s <sub>g</sub>
850	172.96	732.20	2039.43	2771.63	2.0709	4.5711	6.6421
900	175.38	742.82	2031.12	2773.94	2.0946	4.5260	6.6225
950	177.69	753.00	2023.08	2776.08	2.1171	4.4869	6.6040
1000	179.91	762.79	2015.29	2778.08	2.1386	4.4478	6.5864
1100	184.09	781.32	2000.36	2781.68	2.1791	4.3744	6.5535
1200	187.99	798.64	1986.19	2784.82	2.2165	4.3067	6.5233
1300	191.64	814.91	1972.67	2787.58	2.2514	4.2438	6.4953
1400	195.07	830.29	1959.72	2790.00	2.2842	4.1850	6.4692
1500	198.32	844.87	1947.28	2792.15	2.3150	4.1298	6.4448
1750	200.76	878.48	1917.95	2796.43	2.3851	4.0044	6.3895
2000	212.42	908.77	1890.74	2799.51	2.4473	3.8935	6.3408
2250	218.45	936.48	1865.19	2801.67	2.5034	3.7938	6.2971
2500	223.99	962.09	1840.98	2803.07	2.5546	3.7028	6.2574
2750	229.12	985.97	1817.89	2803.86	2.6018	3.6190	6.2208
3000	233.90	1008.41	1795.73	2804.14	2.6456	3.5412	6.1869
3250	238.38	1029.60	1774.37	2803.97	2.6866	3.4685	6.1551
3500	242.60	1049.73	1753.70	2803.43	2.7252	3.4000	6.1252
4000	250.40	1087.29	1714.09	2801.38	2.7963	3.2737	6.0700
5000	263.99	1154.21	1640.12	2794.33	2.9201	3.0532	5.9733
6000	275.64	1213.32	1571.00	2784.33	3.0266	2.8625	5.8891
7000	285.88	1266.97	1505.10	2772.07	3.1210	2.6922	5.8132
8000	295.06	1316.61	1441.33	2757.94	3.2067	2.5365	5.7431
9000	303.40	1363.23	1378.88	2742.11	3.2857	2.3915	5.6771
10000	311.06	1407.53	1317.14	2724.67	3.3595	2.2545	5.6140
11000	318.15	1450.05	1255.55	2705.60	3.4294	2.1233	5.5527
12000	324.75	1491.24	1193.59	2684.83	3.4961	1.9962	5.4923
13000	330.93	1531.46	1130.76	2662.22	3.5604	1.8718	5.4323
14000	336.75	1571.08	1066.47	2637.55	3.6231	1.7485	5.3716
15000	342.24	1610.45	1000.04	2610.49	3.6847	1.6250	5.3097
16000	347.43	1650.00	930.59	2580.59	3.7460	1.4995	5.2454
17000	352.37	1690.25	856.90	2547.15	3.8078	1.3698	5.1776
18000	357.06	1731.97	777.13	2509.09	3.8713	1.2310	5.1044
19000	361.54	1776.43	688.11	2464.54	3.9387	1.0841	5.0227
20000	365.81	1826.18	583.56	2409.74	4.0137	0.9132	4.9289
21000	369.89	1883.30	466.42	2334.72	4.1073	0.6942	4.8015
22000	373.80	2034.92	134.04	2138.97	4.3307	0.1917	4.5224
22089	374.14	2099.26	0	2099.26	4.4297	0	4.4297

(Continued)



APPENDIX B SI UNITS, THERMODYNAMIC TABLES

TABLE B.1.3 SI Superheated Vapor Water

Temp. C	P = 10 MPa (145.81)					P = 50 MPa (51.33)						
	m <sup>3</sup> /kg	h/kJ/kg	h/kJ/kg	s/kJ/kg K	m <sup>3</sup> /kg	h/kJ/kg	h/kJ/kg	s/kJ/kg K	m <sup>3</sup> /kg	h/kJ/kg	h/kJ/kg	s/kJ/kg K
Sat.	14.67355	2437.89	2584.63	8.1501	3.24034	2487.85	2645.87	7.5939				
50	14.66820	2443.87	2592.56	8.1749								
100	17.19561	2515.50	2687.46	8.4479	3.41833	2511.61	2682.52	7.6947				
150	19.51251	2587.86	2782.99	8.6983	3.88937	2585.61	2780.08	7.9400				
200	21.82507	2661.27	2879.52	8.9037	4.15595	2659.85	2877.64	8.1579				
250	24.13559	2735.95	2977.31	9.1002	4.82045	2734.97	2975.99	8.3555				
300	26.44508	2812.06	3076.51	9.2812	5.28391	2811.33	3075.52	8.5372				
400	31.06252	2968.99	3279.51	9.6076	6.20929	2968.43	3278.89	8.8641				
500	35.67896	3132.26	3489.05	9.8977	7.13364	3131.94	3488.62	9.1545				
600	40.29488	3302.45	3705.40	10.1608	8.05748	3302.22	3705.10	9.4177				
700	44.91052	3479.63	3928.73	10.4078	8.98104	3479.49 <sup>a</sup>	3928.51	9.6599				
800	49.52599	3663.84	4159.10	10.6381	9.90444	3663.70	4158.92	9.8852				
900	54.14137	3855.03	4396.44	10.8395	10.82773	3854.91	4396.30	10.0967				
1000	58.75669	4053.01	4640.58	11.0292	11.75097	4052.91	4640.46	10.2964				
1100	63.37198	4257.47	4891.19	11.2287	12.67418	4257.37	4891.68	10.4858				
1200	67.98724	4467.91	5143.78	11.4090	13.59737	4467.82	5147.69	10.6662				
1300	72.60259	4683.68	5409.70	11.5810	14.52054	4683.58	5409.61	10.8382				

Temp. C	100 kPa (0.9813)					200 kPa (1.2023)						
	m <sup>3</sup> /kg	h/kJ/kg	h/kJ/kg	s/kJ/kg K	m <sup>3</sup> /kg	h/kJ/kg	h/kJ/kg	s/kJ/kg K	m <sup>3</sup> /kg	h/kJ/kg	h/kJ/kg	s/kJ/kg K
Sat.	1.69400	2506.06	2675.46	7.5933	0.88573	2529.49	2706.63	7.1271				
150	1.93636	2582.75	2776.38	7.6133	0.95964	2576.87	2768.80	7.2792				
200	2.17226	2658.05	2875.27	7.8362	1.08834	2654.39	2870.46	7.5060				
250	2.40864	2733.73	2974.33	8.0332	1.19880	2731.22	2970.98	7.7085				
300	2.63876	2810.41	3074.28	8.2157	1.31616	2808.55	3071.79	7.8926				
400	3.10263	2967.85	3278.11	8.5434	1.54936	2966.69	3276.55	8.2217				
500	3.56547	3131.54	3488.09	8.8341	1.78139	3130.75	3487.03	8.5132				
600	4.02781	3301.94	3704.72	9.0975	2.01297	3301.36	3703.96	8.7769				
700	4.48986	3479.24	3928.23	9.3398	2.24426	3478.81	3927.66	9.0194				
800	4.95174	3663.53	4158.71	9.5652	2.47579	3663.19	4158.27	9.2450				
900	5.41353	3854.77	4390.12	9.7767	2.70645	3854.49	4395.77	9.4565				
1000	5.87526	4052.78	4640.31	9.9764	2.93740	4052.53	4640.03	9.6583				
1100	6.33696	4257.25	4890.95	10.1658	3.16834	4257.01	4890.68	9.8458				
1200	6.79863	4467.70	5147.56	10.3462	3.39927	4467.46	5147.32	10.0202				
1300	7.26030	4683.47	5409.49	10.5182	3.63018	4683.23	5409.26	10.1982				

12

(Continued)

APPENDIX B SI UNITS, THERMODYNAMIC TABLES

TABLE B.1.3 SI (Continued) Superheated Vapor Water

Temp. C	300 kPa (133.55)					400 kPa (143.63)						
	m <sup>3</sup> /kg	h/kJ/kg	h/kJ/kg	s/kJ/kg K	m <sup>3</sup> /kg	h/kJ/kg	h/kJ/kg	s/kJ/kg K	m <sup>3</sup> /kg	h/kJ/kg	h/kJ/kg	s/kJ/kg K
500	1.18669	3129.95	3485.96	8.3250	0.88934	3129.15	3484.89	8.1912				
600	1.34136	3300.79	3703.20	8.5892	1.00555	3300.22	3702.44	8.4557				
700	1.49573	3478.38	3927.10	8.8319	1.12147	3477.95	3926.53	8.6987				
800	1.64994	3662.85	4157.83	9.0575	1.23722	3662.51	4157.40	8.9244				
900	1.80406	3854.20	4395.42	9.2691	1.35288	3853.91	4395.06	9.1461				
1000	1.95812	4052.27	4639.71	9.4689	1.46847	4052.02	4639.41	9.3360				
1100	2.11214	4256.77	4890.41	9.6585	1.58404	4256.53	4890.15	9.5255				
1200	2.26614	4467.23	5147.07	9.8389	1.69958	4466.99	5146.83	9.7059				
1300	2.42013	4682.99	5409.03	10.0109	1.81511	4682.75	5408.80	9.8780				

Temp. C	500 kPa (151.86)					600 kPa (158.85)						
	m <sup>3</sup> /kg	h/kJ/kg	h/kJ/kg	s/kJ/kg K	m <sup>3</sup> /kg	h/kJ/kg	h/kJ/kg	s/kJ/kg K	m <sup>3</sup> /kg	h/kJ/kg	h/kJ/kg	s/kJ/kg K
500	0.37480	2561.23	2738.67	6.8212	0.31567	2567.40	2756.80	6.7600				
200	0.42492	2642.91	2835.77	7.0592	0.35202	2638.41	2830.12	6.9665				
250	0.47436	2723.50	2940.68	7.2708	0.39383	2720.86	2937.16	7.1816				
300	0.52356	2802.91	3044.20	7.4598	0.43437	2801.00	3041.63	7.3723				
350	0.57012	2882.59	3167.65	7.6328	0.47424	2881.12	3165.66	7.5463				
400	0.61728	2963.19	3271.83	7.7937	0.51372	2962.62	3270.25	7.7078				
500	0.71093	3128.35	3483.82	8.0872	0.59199	3127.55	3482.75	8.0020				
600	0.80406	3290.64	3701.67	8.3521	0.66978	3290.07	3700.91	8.2673				
700	0.89691	3477.52	3925.97	8.5952	0.74720	3477.08	3925.41	8.5107				
800	0.98959	3662.17	4156.96	8.8211	0.82450	3661.83	4156.52	8.7567				
900	1.08217	3853.63	4394.71	9.0329	0.90160	3853.34	4394.36	8.9485				
1000	1.17469	4051.76	4639.11	9.2328	0.97883	4051.51	4638.81	9.1484				
1100	1.26718	4256.29	4889.88	9.4224	1.05594	4256.05	4889.61	9.3381				
1200	1.35964	4466.76	5146.58	9.6028	1.13302	4466.52	5146.34	9.5185				
1300	1.45210	4682.52	5408.57	9.7749	1.21009	4682.28	5408.34	9.6906				

13

(Continued)



APPENDIX B SI UNITS: THERMODYNAMIC TABLES

TABLE B.1.3 SI (Continued) Superheated Vapor Water

Temp. C	1200 kPa (1.187 991)					1400 kPa (1.05.07)										
	m <sup>3</sup> /kg	h	s	h	s	m <sup>3</sup> /kg	h	s	h	s						
Sum.	0.16333	2588.82	2784.82	6.5233	0.14094	2592.83	2790.80	6.4692	0.16333	2612.74	2815.90	6.5898	0.14302	2603.09	2803.32	6.4975
250	0.16920	2612.74	2815.90	6.5898	0.14302	2603.09	2803.32	6.4975	0.16920	2704.20	2935.01	6.8293	0.16350	2698.32	2927.22	6.7467
300	0.19235	2704.20	2935.01	6.8293	0.16350	2698.32	2927.22	6.7467	0.19235	2789.22	3045.80	7.0316	0.18228	2785.16	3040.35	6.9333
350	0.23452	2872.16	3133.59	7.2120	0.20006	2869.12	3149.49	7.1359	0.23452	2954.90	3260.66	7.3773	0.21780	2952.50	3257.42	7.2025
400	0.25480	2954.90	3260.66	7.3773	0.21780	2952.50	3257.42	7.2025	0.25480	3122.72	3476.28	7.6758	0.23215	3121.10	3474.11	7.6026
500	0.29463	3122.72	3476.28	7.6758	0.23215	3121.10	3474.11	7.6026	0.29463	3295.60	3696.32	7.9434	0.26396	3294.44	3694.78	7.8710
600	0.33393	3295.60	3696.32	7.9434	0.26396	3294.44	3694.78	7.8710	0.33393	3474.48	3922.01	8.1881	0.281947	3473.61	3920.87	8.1160
700	0.37294	3474.48	3922.01	8.1881	0.281947	3473.61	3920.87	8.1160	0.37294	3659.77	4153.90	8.4149	0.30281	3659.09	4153.03	8.3431
800	0.41177	3659.77	4153.90	8.4149	0.30281	3659.09	4153.03	8.3431	0.41177	3851.62	4392.33	8.6272	0.31806	3851.05	4391.53	8.5555
900	0.45051	3851.62	4392.33	8.6272	0.31806	3851.05	4391.53	8.5555	0.45051	4049.98	4637.00	8.8274	0.41924	4049.47	4636.41	8.7558
1000	0.48919	4049.98	4637.00	8.8274	0.41924	4049.47	4636.41	8.7558	0.48919	4254.61	4888.02	9.0171	0.45239	4254.14	4887.49	8.9456
1100	0.52783	4254.61	4888.02	9.0171	0.45239	4254.14	4887.49	8.9456	0.52783	4465.12	5144.87	9.1977	0.48552	4464.65	5144.38	9.1262
1200	0.56646	4465.12	5144.87	9.1977	0.48552	4464.65	5144.38	9.1262	0.56646	4680.86	5406.95	9.3698	0.51864	4680.39	5406.49	9.2983
1300	0.60507	4680.86	5406.95	9.3698	0.51864	4680.39	5406.49	9.2983								

14

(Continued)

APPENDIX B SI UNITS: THERMODYNAMIC TABLES

TABLE B.1.3 SI (Continued) Superheated Vapor Water

Temp. C	2000 kPa (2.12 42)					2500 kPa (2.23 99)										
	m <sup>3</sup> /kg	h	s	h	s	m <sup>3</sup> /kg	h	s	h	s						
Sum.	0.09963	2694.10	2894.14	6.1869	0.07907	2603.13	2803.07	6.2574	0.09963	2694.10	2894.14	6.1869	0.07907	2603.13	2803.07	6.2574
250	0.11144	2679.58	2902.46	6.5452	0.08700	2662.55	2808.06	6.4084	0.11144	2772.56	3023.50	6.7663	0.09690	2761.56	3008.61	6.6437
300	0.12547	2772.56	3023.50	6.7663	0.09690	2761.56	3008.61	6.6437	0.12547	2859.81	3136.96	6.9562	0.10976	2851.84	3126.24	6.8402
350	0.13857	2859.81	3136.96	6.9562	0.10976	2851.84	3126.24	6.8402	0.13857	2945.21	3247.60	7.1270	0.12010	2939.03	3239.28	7.0147
400	0.15120	2945.21	3247.60	7.1270	0.12010	2939.03	3239.28	7.0147	0.15120	3030.41	3357.48	7.2844	0.13014	3025.43	3230.77	7.1745
450	0.16353	3030.41	3357.48	7.2844	0.13014	3025.43	3230.77	7.1745	0.16353	3116.20	3467.55	7.4316	0.13998	3112.08	3462.04	7.3233
500	0.17568	3116.20	3467.55	7.4316	0.13998	3112.08	3462.04	7.3233	0.17568	3200.93	3690.14	7.5723	0.14970	3287.99	3686.25	7.5960
600	0.19960	3200.93	3690.14	7.5723	0.14970	3287.99	3686.25	7.5960	0.19960	3470.99	3917.45	7.9487	0.17832	3468.80	3914.59	7.8435
700	0.22222	3470.99	3917.45	7.9487	0.17832	3468.80	3914.59	7.8435	0.22222	3657.03	4150.40	8.1766	0.19716	3655.30	4148.20	8.0720
800	0.24468	3657.03	4150.40	8.1766	0.19716	3655.30	4148.20	8.0720	0.24468	3849.33	4389.40	8.3895	0.21590	3847.89	4387.64	8.2853
900	0.27004	3849.33	4389.40	8.3895	0.21590	3847.89	4387.64	8.2853	0.27004	4047.94	4634.61	8.5900	0.23458	4046.67	4633.12	8.4860
1000	0.29333	4047.94	4634.61	8.5900	0.23458	4046.67	4633.12	8.4860	0.29333	4252.74	4885.89	8.7800	0.25322	4251.52	4884.57	8.4860
1100	0.31659	4252.74	4885.89	8.7800	0.25322	4251.52	4884.57	8.4860	0.31659	4463.25	5142.92	8.9606	0.27185	4462.08	5141.70	8.5769
1200	0.33984	4463.25	5142.92	8.9606	0.27185	4462.08	5141.70	8.5769	0.33984	4678.97	5405.10	9.1328	0.29046	4677.80	5403.95	9.0291
1300	0.36306	4678.97	5405.10	9.1328	0.29046	4677.80	5403.95	9.0291								

15

(Continued)

九十一學年度 工程與系統科學系(所) 乙 組碩士班研究生招生考試

科目 熱力學 科號 3702 共 12 頁第 10 頁 \*請在試卷【答案卷】內作答

APPENDIX B SI UNITS, THERMODYNAMIC TABLES

TABLE B.1.3 SI (Continued) Saturated Vapor Water

Temp. C	4000 kPa (230.40)					4500 kPa (237.48)				
	v m <sup>3</sup> /kg	u kJ/kg	h kJ/kg	s kJ/kg K	g	v m <sup>3</sup> /kg	u kJ/kg	h kJ/kg	s kJ/kg K	g
Sat	0.04978	2602.27	2801.38	6.0700	0.04406	2600.03	2798.29	6.0198		
300	0.05884	2723.33	2960.68	6.3614	0.05135	2712.00	2943.07	6.2827		
350	0.06645	2826.65	3092.43	6.5820	0.05840	2817.78	3080.57	6.5120		
400	0.07341	2919.88	3213.51	6.7689	0.06475	2913.29	3204.65	6.7046		
450	0.08003	3010.13	3330.23	6.9362	0.07074	3004.91	3323.23	6.8745		
500	0.08643	3099.49	3445.21	7.0900	0.07651	3095.23	3439.51	7.0200		
600	0.09885	3279.06	3674.44	7.3688	0.08765	3276.04	3670.47	7.3109		
700	0.11095	3462.15	3905.94	7.6198	0.09847	3459.91	3903.04	7.5631		
800	0.12287	3650.11	4141.59	7.8502	0.10911	3648.37	4139.38	7.7942		
900	0.13465	3843.59	4382.34	8.0647	0.11965	3842.19	4380.58	8.0091		
1000	0.14645	4042.87	4628.65	8.2641	0.13013	4041.61	4627.17	8.2108		
1100	0.15817	4247.96	4880.63	8.4566	0.14056	4246.78	4879.32	8.4014		
1200	0.16987	4458.60	5138.07	8.6376	0.15098	4457.45	5136.87	8.5824		
1300	0.18156	4674.29	5400.52	8.8099	0.16139	4673.12	5399.38	8.7548		

Sat	5000 kPa (263.99)					6000 kPa (275.64)				
	v m <sup>3</sup> /kg	u kJ/kg	h kJ/kg	s kJ/kg K	g	v m <sup>3</sup> /kg	u kJ/kg	h kJ/kg	s kJ/kg K	g
0.07944	2597.12	2794.33	5.9733	0.07344	2589.69	2784.33	5.8901			
0.044532	2697.94	2924.53	6.2083	0.07616	2667.22	2884.19	6.0673			
0.05194	2808.67	3068.39	6.4492	0.04223	2789.61	3042.97	6.334			
0.05781	2906.58	3195.64	6.6458	0.04739	2892.81	3177.17	6.5407			
0.06330	2999.64	3316.15	6.8185	0.05214	2988.90	3301.76	6.7102			
0.06857	3090.92	3433.76	6.9758	0.05665	3082.20	3422.12	6.8502			
0.07368	3181.82	3550.23	7.1217	0.06101	3174.57	3540.62	7.0287			
0.07869	3273.01	3666.47	7.2588	0.06525	3266.89	3658.40	7.1876			
0.08349	3357.67	3780.33	7.3922	0.07352	3453.15	3804.28	7.4234			
0.09811	3646.62	4137.17	7.7440	0.08160	3643.12	4132.74	7.6566			
0.10762	3840.71	4378.82	7.9993	0.08958	3837.84	4375.29	7.8727			
0.11707	4040.35	4623.69	8.1612	0.09749	4037.83	4622.74	8.0731			
0.12648	4243.61	4878.02	8.3319	0.10536	4233.26	4875.42	8.2661			
0.13587	4456.30	5135.87	8.5300	0.11323	4434.00	5133.28	8.4473			
0.14526	4671.96	5398.24	8.7055	0.12106	4640.64	5395.97	8.6199			

16

(Continued)

APPENDIX B SI UNITS, THERMODYNAMIC TABLES

TABLE B.1.3 SI (Continued) Saturated Vapor Water

Temp. C	7000 kPa (285.82)					8000 kPa (295.06)				
	v m <sup>3</sup> /kg	u kJ/kg	h kJ/kg	s kJ/kg K	g	v m <sup>3</sup> /kg	u kJ/kg	h kJ/kg	s kJ/kg K	g
Sat	0.07277	2580.48	2772.07	5.8132	0.07352	2567.79	2757.94	5.7431		
300	0.07947	2632.13	2838.60	5.9304	0.07426	2590.93	2784.98	5.7905		
350	0.08524	2709.34	3016.02	6.2282	0.08095	2747.67	2987.30	6.1300		
400	0.09093	2878.55	3158.07	6.4477	0.08432	2863.75	3138.28	6.3633		
450	0.04416	2977.91	3287.04	6.6326	0.08817	2966.66	3271.99	6.5550		
500	0.04814	3073.33	3410.29	6.7974	0.04175	3064.30	3398.27	6.7239		
550	0.05195	3167.21	3530.87	6.9486	0.04516	3159.76	3521.01	6.8778		
600	0.05565	3260.09	3650.26	7.0894	0.04845	3254.43	3642.03	7.0205		
700	0.06283	3448.68	3888.39	7.3476	0.05481	3444.00	3882.47	7.2812		
800	0.06981	3639.61	4128.30	7.5822	0.06097	3636.08	4123.84	7.5173		
900	0.07660	3834.96	4371.77	7.7991	0.06702	3832.08	4368.26	7.7380		
1000	0.08350	4035.31	4619.80	8.0020	0.07301	4033.81	4616.87	7.9384		
1100	0.09027	4240.92	4872.83	8.1933	0.07896	4238.60	4870.25	8.1299		
1200	0.09703	4451.72	5130.90	8.3747	0.08489	4440.45	5128.54	8.3115		
1300	0.10377	4667.33	5393.21	8.5472	0.09080	4645.02	5391.46	8.4842		

Sat	9000 kPa (303.80)					10000 kPa (311.06)				
	v m <sup>3</sup> /kg	u kJ/kg	h kJ/kg	s kJ/kg K	g	v m <sup>3</sup> /kg	u kJ/kg	h kJ/kg	s kJ/kg K	g
0.07048	2577.73	2742.11	5.6771	0.07303	2544.41	2754.67	5.6140			
0.02580	2724.38	2956.55	6.0361	0.07242	2690.16	2927.39	5.9442			
0.02993	2848.38	3117.76	6.2853	0.07041	2832.38	3096.46	6.2119			
0.03350	2955.13	3256.39	6.4843	0.02975	2943.32	3240.83	6.4189			
0.03677	3055.12	3386.09	6.6575	0.03279	3045.77	3373.63	6.5965			
0.03987	3152.20	3511.02	6.8141	0.03564	3144.54	3500.92	6.7561			
0.04285	3248.09	3633.73	6.9588	0.03837	3241.68	3625.34	6.9028			
0.04574	3343.65	3755.32	7.0943	0.04101	3338.22	3748.27	7.0397			
0.04857	3439.38	3876.54	7.2231	0.04358	3434.72	3870.52	7.1687			
0.05140	3532.53	4019.38	7.3497	0.04609	3528.97	4014.91	7.3077			
0.05409	3629.20	4164.74	7.4782	0.05349	3626.32	4161.24	7.4272			
0.05685	4030.30	4613.95	7.8821	0.05832	4027.81	4611.04	7.8115			
0.05950	4236.28	4867.69	8.0739	0.06312	4231.97	4865.14	8.0236			
0.06216	4447.18	5126.18	8.2556	0.06789	4444.95	5123.84	8.2054			
0.06482	4662.73	5389.22	8.4283	0.07265	4660.44	5386.99	8.3783			

17

(Continued)



九十一學年度 工程與系統科學 系(所) 乙 組碩士班研究生招生考試

科目 熱力學 科號 3702 共 12 頁第 11 頁 \*請在試卷【答案卷】內作答

APPENDIX B SI UNITS: THERMODYNAMIC TABLES

TABLE B.1.3 SI (Continued) Saturated Vapor Water

Temp. C	$v$ m <sup>3</sup> /kg	$u$ kJ/kg	$h$ kJ/kg	$s$ kJ/kg K	$v$ m <sup>3</sup> /kg	$u$ kJ/kg	$h$ kJ/kg	$s$ kJ/kg K
12500 kPa (327.89)								
Sat.	0.01350	2505.08	2673.97	5.4623	0.01034	2455.49	2610.49	5.3997
350	0.01613	2624.57	2826.15	5.7117	0.01147	2520.26	2692.41	5.4420
400	0.02000	2789.25	3039.30	6.0416	0.01565	2740.70	2975.44	5.8810
450	0.02599	2912.44	3199.78	6.2718	0.01845	2879.47	3156.15	6.1403
500	0.03460	3021.68	3341.72	6.4617	0.02080	2996.52	3308.53	6.3442
550	0.04601	3124.94	3475.13	6.6289	0.02293	3104.71	3448.61	6.5198
600	0.06029	3223.37	3604.05	6.7810	0.02491	3208.64	3582.30	6.6775
650	0.07848	3324.43	3730.44	6.9218	0.02680	3310.37	3712.32	6.8223
700	0.10140	3422.93	3855.41	7.0536	0.02861	3410.94	3840.12	6.9572
800	0.15869	3620.02	4103.69	7.2965	0.03210	3610.99	4092.43	7.2040
900	0.24267	3819.11	4352.48	7.5181	0.03546	3811.89	4343.75	7.4279
1000	0.36658	4021.59	4603.81	7.7237	0.03875	4013.41	4596.63	7.6347
1100	0.53045	4228.23	4858.82	7.9165	0.04200	4222.55	4852.56	7.8282
1200	0.74530	4439.33	5118.02	8.0987	0.04523	4433.78	5112.27	8.0108
1300	1.02813	4654.76	5381.44	8.2717	0.04845	4649.12	5375.94	8.1839
17500 kPa (354.75)								
Sat.	0.00792	2390.19	2528.79	5.1418	0.00583	2293.05	2409.74	4.9269
400	0.01245	2584.98	2902.82	5.7212	0.00994	2519.22	2818.07	5.5539
450	0.01517	2844.15	3109.69	6.0182	0.01270	2806.16	3060.06	5.9016
500	0.01736	2979.25	3274.02	6.2382	0.01477	2942.82	3238.18	6.1400
550	0.01929	3083.84	3421.37	6.4229	0.01656	3082.54	3393.45	6.3347
600	0.02106	3191.51	3560.13	6.5806	0.01818	3174.00	3537.57	6.5048
650	0.02274	3298.04	3693.94	6.7356	0.01969	3281.46	3675.52	6.6582
700	0.02424	3398.78	3824.67	6.8776	0.02112	3386.46	3809.09	6.7993
750	0.02588	3500.56	3953.48	7.0026	0.02251	3490.01	3940.27	6.9308
800	0.02738	3601.89	4081.13	7.1245	0.02385	3592.73	4069.80	7.0544
900	0.03071	3804.67	4335.05	7.3507	0.02645	3797.44	4328.37	7.2830
1000	0.03316	4009.25	4589.52	7.5588	0.02897	4003.12	4587.45	7.4925
1100	0.03597	4216.90	4846.37	7.7510	0.03145	4211.20	4840.24	7.6874
1200	0.03876	4428.28	5106.59	7.9359	0.03391	4422.81	5100.96	7.8706
1300	0.04154	4643.52	5370.50	8.1093	0.03636	4637.95	5365.10	8.0441
25000 kPa								
375	0.001973	1798.60	1847.93	4.0319	0.001789	1737.75	1791.43	3.9303
400	0.006004	2430.05	2580.16	5.1418	0.002790	2067.34	2151.04	4.4728
425	0.007882	2609.21	2886.25	5.4722	0.003705	2455.06	2614.17	5.1503
450	0.009162	2720.65	2949.70	5.6743	0.004639	2619.30	2831.35	5.4423
500	0.011124	2884.29	3162.39	5.9592	0.006679	2820.67	3081.03	5.7904
550	0.012724	3017.51	3335.62	6.1764	0.010168	2970.31	3275.36	6.0342
600	0.014138	3137.92	3491.36	6.3602	0.011446	3100.53	3443.91	6.2330
650	0.015433	3251.64	3637.46	6.5229	0.012396	3221.04	3598.93	6.4057
700	0.016647	3361.39	3777.56	6.6707	0.013641	3335.84	3745.67	6.5606

18

(Continued)

APPENDIX B SI UNITS: THERMODYNAMIC TABLES

TABLE B.1.3 SI (Continued) Saturated Vapor Water

Temp. C	$v$ m <sup>3</sup> /kg	$u$ kJ/kg	$h$ kJ/kg	$s$ kJ/kg K	$v$ m <sup>3</sup> /kg	$u$ kJ/kg	$h$ kJ/kg	$s$ kJ/kg K
25000 kPa								
800	0.018913	3574.26	4047.08	6.9345	0.015623	3555.60	4024.31	6.8332
900	0.021045	3782.97	4309.09	7.1479	0.017448	3768.48	4291.93	7.0717
1000	0.023102	3990.92	4568.47	7.3301	0.019196	3978.79	4554.68	7.2867
1100	0.025119	4200.18	4828.15	7.5765	0.020903	4189.18	4816.28	7.4845
1200	0.027115	4412.00	5089.86	7.7604	0.022589	4401.29	5078.97	7.6691
1300	0.029101	4626.91	5354.44	7.9242	0.024266	4615.96	5363.95	7.8432
35000 kPa								
375	0.001700	1702.86	1762.37	3.8721	0.001641	1677.09	1742.71	3.8280
400	0.002100	1914.02	1987.52	4.2124	0.001908	1854.52	1930.83	4.1134
425	0.003428	2125.42	2373.41	4.7747	0.002532	2096.83	2198.11	4.9028
450	0.004962	2498.71	2672.36	5.1962	0.003493	2365.07	2512.79	4.9459
500	0.006902	2751.88	2994.34	5.6281	0.004623	2678.36	2903.26	5.4699
550	0.008545	2920.94	3213.01	5.9025	0.005984	2869.69	3149.05	5.7784
600	0.009927	3062.03	3395.49	6.1178	0.007294	3022.61	3346.38	6.0113
650	0.010975	3189.79	3559.91	6.3010	0.008604	3158.04	3520.58	6.2034
700	0.011533	3309.89	3713.54	6.4651	0.009944	3283.63	3681.29	6.3750
800	0.013278	3536.83	4001.54	6.7450	0.011523	3517.89	3978.80	6.6662
900	0.014883	3753.95	4274.87	6.9886	0.012963	3739.42	4257.93	6.9150
1000	0.016440	3968.70	4541.05	7.2063	0.014324	3954.64	4527.59	7.1356
1100	0.017995	4178.23	4804.99	7.4056	0.015643	4167.38	4793.08	7.3364
1200	0.019360	4390.67	5068.26	7.5910	0.016940	4380.11	5057.72	7.5224
1300	0.020815	4605.69	5333.62	7.7632	0.018229	4594.28	5323.45	7.6969
50000 kPa								
375	0.001459	1638.55	1716.52	3.7638	0.001503	1609.34	1699.51	3.7140
400	0.001731	1788.04	1874.38	4.0030	0.001613	1745.34	1843.35	3.9317
425	0.002007	1959.63	2059.98	4.2733	0.001817	1897.66	2001.65	4.1625
450	0.002486	2159.60	2283.91	4.5883	0.002085	2051.86	2178.96	4.4119
500	0.003892	2525.45	2720.07	5.1725	0.002956	2390.73	2567.88	4.9320
550	0.005118	2763.61	3019.51	5.5485	0.004035	2658.50	2896.16	5.3440
600	0.006112	2941.98	3247.59	5.8177	0.005387	2861.14	3151.21	5.6451
650	0.006966	3093.56	3441.84	6.0342	0.006995	3028.83	3364.55	5.8829
700	0.007727	3230.54	3616.91	6.2189	0.008627	3177.25	3553.56	6.0824
800	0.009076	3479.82	3933.62	6.5290	0.010349	3441.60	3889.12	6.4110
900	0.010283	3710.26	4224.41	6.7882	0.012208	3680.97	4191.47	6.6805
1000	0.011247	3930.53	4501.09	7.0146	0.014109	3906.36	4475.16	6.9126
1100	0.012497	4145.72	4770.35	7.2183	0.016040	4124.07	4748.61	7.1194
1200	0.013564	4359.12	5037.15	7.4018	0.018117	4338.18	5017.19	7.3082
1300	0.014616	4572.77	5303.56	7.5697	0.020215	4551.35	5284.28	7.4837

19

(Continued)



九十一學年度 工程與系統科學系(所) 2 組碩士班研究生招生考試

科目 熱力學 科號 3702 共 12 頁第 12 頁 \*請在試卷【答案卷】內作答

APPENDIX B SI UNITS THERMODYNAMIC TABLES

TABLE B.1.4 SI Compressed Liquid Water

Temp. C	5000 kPa (263.99)			10000 kPa (311.06)		
	m <sup>3</sup> /kg	kJ/kg	kJ/kg K	m <sup>3</sup> /kg	kJ/kg	kJ/kg K
Sat.	0.001286	1147.78	1194.21	0.001452	1393.00	1407.53
0	0.000998	0.03	5.02	0.000995	0.10	10.05
20	0.001000	83.64	88.64	0.000997	83.35	93.32
40	0.001006	166.93	171.95	0.001003	166.33	176.36
60	0.001015	250.21	255.28	0.001013	249.34	259.47
80	0.001027	333.69	338.83	0.001025	332.56	342.81
100	0.001041	417.50	422.71	0.001039	416.09	426.48
120	0.001058	501.79	507.07	0.001055	500.07	510.61
140	0.001077	586.74	592.13	0.001074	584.67	595.40
160	0.001099	672.61	678.10	0.001095	670.11	681.07
180	0.001124	759.62	765.24	0.001120	756.63	767.83
200	0.001153	848.08	853.85	0.001148	844.49	855.97
220	0.001187	938.43	944.36	0.001181	934.07	945.88
240	0.001226	1031.34	1037.47	0.001219	1025.94	1036.13
260	0.001273	1127.92	1134.30	0.001265	1121.03	1133.08
280				0.001322	1220.90	1234.11
300				0.001397	1328.34	1342.31

Temp. C	15000 kPa (342.24)			20000 kPa (365.81)		
	m <sup>3</sup> /kg	kJ/kg	kJ/kg K	m <sup>3</sup> /kg	kJ/kg	kJ/kg K
Sat.	0.001658	1585.58	1610.45	0.002035	1785.47	1826.18
0	0.000993	0.15	15.04	0.000990	0.20	20.00
20	0.000995	83.05	97.97	0.000993	82.75	102.61
40	0.001001	165.73	180.75	0.000999	165.15	185.14
60	0.001011	248.49	263.65	0.001008	247.66	267.82
80	0.001022	331.46	346.79	0.001020	330.38	350.78
100	0.001036	414.72	430.26	0.001034	413.37	434.04
120	0.001052	498.39	514.17	0.001050	496.75	517.74
140	0.001071	582.64	598.70	0.001068	590.67	602.03
160	0.001092	667.69	684.07	0.001089	665.34	687.11
180	0.001116	753.74	770.48	0.001112	750.94	775.18
200	0.001143	841.04	858.18	0.001139	837.70	860.47
220	0.001175	929.89	947.52	0.001169	925.89	949.27
240	0.001211	1020.82	1038.99	0.001205	1015.94	1040.04
260	0.001253	1114.59	1133.41	0.001246	1108.53	1133.45
280	0.001308	1212.47	1232.09	0.001297	1204.69	1230.62
300	0.001377	1314.58	1337.23	0.001360	1306.10	1332.89
320	0.001472	1431.05	1451.13	0.001444	1415.66	1444.51
340	0.001631	1567.42	1591.88	0.001568	1539.64	1571.01
360				0.001823	1702.78	1739.23

20

(Continued)

APPENDIX B SI UNITS THERMODYNAMIC TABLES

TABLE B.1.4 SI (Continued) Compressed Liquid Water

Temp. C	30000 kPa			50000 kPa		
	m <sup>3</sup> /kg	kJ/kg	kJ/kg K	m <sup>3</sup> /kg	kJ/kg	kJ/kg K
0	0.000986	0.25	29.82	0.000977	0.30	49.03
20	0.000989	82.16	111.82	0.000980	80.08	130.00
40	0.000995	164.61	193.87	0.000987	161.84	211.20
60	0.001004	246.05	276.16	0.000996	242.96	292.77
80	0.001016	328.28	358.75	0.001007	324.12	374.68
100	0.001029	410.76	441.63	0.001020	405.86	456.87
120	0.001044	493.58	524.91	0.001035	487.63	539.37
140	0.001062	576.86	608.73	0.001052	569.76	622.33
160	0.001082	660.81	693.27	0.001070	652.39	705.91
180	0.001105	745.57	778.71	0.001091	735.68	790.24
200	0.001130	831.34	865.24	0.001115	819.73	875.46
220	0.001159	918.32	953.09	0.001141	904.67	961.71
240	0.001192	1006.84	1042.60	0.001170	990.69	1049.20
260	0.001230	1097.38	1134.29	0.001203	1078.06	1138.23
280	0.001275	1190.69	1228.96	0.001242	1167.19	1229.26
300	0.001330	1287.89	1327.80	0.001286	1258.66	1322.95
320	0.001400	1390.64	1432.63	0.001339	1353.23	1420.17
340	0.001492	1501.72	1546.47	0.001403	1451.91	1522.07
360	0.001627	1626.57	1675.36	0.001484	1555.97	1630.16
380	0.001809	1783.35	1837.43	0.001588	1667.13	1746.54

21

(Continued)