

## APPENDIX 1

**Table A1.1: Gas Constants for Common Gases (at 300 K)**

Gas	Chemical Formula	Molar Mass	R, kJ/kg K	C <sub>P</sub> , kJ/kg K	C <sub>V</sub> , kJ/kg K	$\gamma$
Air		28.97	0.287	1.005	0.718	1.400
Argon	Ar	39.95	0.2081	0.5203	0.3122	1.667
Butane	C <sub>4</sub> H <sub>10</sub>	58.12	0.1433	1.7164	1.5734	1.091
Carbon dioxide	CO <sub>2</sub>	44.01	0.1889	0.846	0.657	1.289
Carbin monoxide	CO	28.01	0.2968	1.040	0.744	1.400
Ethane	C <sub>2</sub> H <sub>6</sub>	30.07	0.2765	1.7662	1.4897	1.186
Ethylene	C <sub>2</sub> H <sub>4</sub>	28.05	0.2964	1.5482	1.2518	1.237
Helium	He	4.00	2.0769	5.1926	3.1156	1.667
Hydrogen	H <sub>2</sub>	2.02	4.1240	14.307	10.183	1.405
Methane	CH <sub>4</sub>	16.04	0.5182	2.2537	1.7354	1.299
Neon	Ne	20.18	0.4119	1.0299	0.6179	1.667
Nitrogen	N <sub>2</sub>	28.01	0.2968	1.039	0.743	1.400
Octane	C <sub>8</sub> H <sub>18</sub>	114.23	0.0729	1.7113	1.6385	1.044
Oxygen	O <sub>2</sub>	32.00	0.2598	0.918	0.658	1.395
Propane	C <sub>3</sub> H <sub>8</sub>	44.10	0.1885	1.6794	1.4909	1.126
Steam	H <sub>2</sub> O	18.02	0.4615	1.8723	1.4108	1.327

## APPENDIX 2

**Table A2.1: Properties of SATURATED WATER – Pressure Table**

P kPa	T °C	v <sub>l</sub> m <sup>3</sup> /kg	v <sub>lg</sub> m <sup>3</sup> /kg	v <sub>g</sub> m <sup>3</sup> /kg	u <sub>l</sub> kJ/kg	u <sub>lg</sub> kJ/kg	u <sub>g</sub> kJ/kg	h <sub>l</sub> kJ/kg	h <sub>lg</sub> kJ/kg	h <sub>g</sub> kJ/kg	s <sub>l</sub> kJ/kg.K	s <sub>lg</sub> kJ/kg.K	s <sub>g</sub> kJ/kg.K
1.0	6.9696	0.001	129.19	129.19	29.287	2354.8	2384.1	29.288	2484.0	2513.3	0.1059	8.8678	8.9737
1.5	13.021	0.001001	87.970	87.971	54.634	2337.9	2392.5	54.635	2469.8	2524.4	0.1954	8.6304	8.8258
2.0	17.497	0.001001	66.997	66.998	73.364	2325.2	2398.6	73.366	2459.2	2532.6	0.2603	8.4613	8.7216
2.5	21.080	0.001002	54.248	54.249	88.353	2315.1	2403.5	88.356	2450.7	2539.1	0.3116	8.3295	8.6411
3.0	24.083	0.001003	45.660	45.661	100.92	2306.7	2407.6	100.92	2443.7	2544.6	0.3541	8.2214	8.5755
3.5	26.677	0.001003	39.473	39.474	111.77	2299.4	2411.2	111.77	2437.5	2549.3	0.3904	8.1299	8.5203
4.0	28.966	0.001004	34.797	34.798	121.34	2293.0	2414.3	121.35	2432.2	2553.5	0.4222	8.0503	8.4725
4.5	31.018	0.001005	31.136	31.137	129.93	2287.2	2417.1	129.93	2427.3	2557.2	0.4506	7.9799	8.4305
5.0	32.881	0.001005	28.190	28.191	137.72	2281.9	2419.6	137.72	2422.8	2560.5	0.4761	7.9169	8.3930
5.5	34.589	0.001006	25.767	25.768	144.86	2277.0	2421.9	144.87	2418.7	2563.6	0.4994	7.8598	8.3592
6.0	36.167	0.001006	23.737	23.738	151.46	2272.5	2424.0	151.47	2415.0	2566.5	0.5208	7.8075	8.3283
6.5	37.635	0.001007	22.013	22.014	157.60	2268.4	2426.0	157.61	2411.5	2569.1	0.5406	7.7594	8.3000
7.0	39.008	0.001008	20.528	20.529	163.35	2264.5	2427.9	163.35	2408.3	2571.6	0.5590	7.7148	8.2738
7.5	40.299	0.001008	19.236	19.237	168.75	2260.9	2429.6	168.76	2405.1	2573.9	0.5763	7.6731	8.2494
8.0	41.518	0.001008	18.102	18.103	173.85	2257.5	2431.3	173.85	2402.3	2576.1	0.5925	7.6342	8.2267
8.5	42.673	0.001009	17.098	17.099	178.68	2254.1	2432.8	178.68	2399.4	2578.1	0.6078	7.5975	8.2053
9.0	43.771	0.001009	16.202	16.203	183.27	2251.0	2434.3	183.27	2396.8	2580.1	0.6223	7.5629	8.1852
9.5	44.817	0.001010	15.398	15.399	187.64	2248.1	2435.7	187.65	2394.4	2582.0	0.6361	7.5301	8.1662
10	45.817	0.001010	14.673	14.674	191.82	2245.2	2437.0	191.83	2392.0	2583.8	0.6493	7.4989	8.1482
15	53.983	0.001014	10.022	10.023	225.97	2221.9	2447.9	225.98	2372.2	2598.2	0.7550	7.2516	8.0066
20	60.073	0.001017	7.6489	7.6499	251.44	2204.5	2455.9	251.46	2357.4	2608.9	0.8321	7.0747	7.9068
25	64.980	0.001020	6.2038	6.2048	271.97	2190.3	2462.3	271.99	2345.4	2617.4	0.8933	6.9365	7.8298
30	69.114	0.001022	5.2288	5.2298	289.27	2178.4	2467.7	289.30	2335.3	2624.6	0.9441	6.8231	7.7672
35	72.700	0.001024	4.5252	4.5262	304.28	2168.0	2472.3	304.32	2326.4	2630.7	0.9878	6.7266	7.7144
40	75.877	0.001026	3.9930	3.9940	317.59	2158.8	2476.4	317.64	2318.5	2636.1	1.0261	6.6427	7.6688
45	78.736	0.001028	3.5759	3.5769	329.58	2150.4	2480.0	329.62	2311.3	2640.9	1.0603	6.5684	7.6287
50	81.339	0.001030	3.2398	3.2408	340.49	2142.8	2483.3	340.54	2304.8	2645.3	1.0912	6.5016	7.5928
60	85.949	0.001033	2.7314	2.7324	359.84	2129.2	2489.0	359.90	2293.1	2653.0	1.1454	6.3856	7.5310
70	89.956	0.001036	2.3644	2.3654	376.68	2117.3	2494.0	376.75	2282.9	2659.6	1.1920	6.2869	7.4789
80	93.511	0.001038	2.0866	2.0876	391.63	2106.7	2498.3	391.71	2273.6	2665.3	1.2330	6.2009	7.4339
90	96.713	0.001041	1.8688	1.8698	405.11	2097.1	2502.2	405.20	2265.3	2670.5	1.2696	6.1247	7.3943
100	99.632	0.001043	1.6933	1.6943	417.41	2088.3	2505.7	417.51	2257.6	2675.1	1.3027	6.0562	7.3589
101.32	100.00	0.001043	1.6727	1.6737	418.96	2087.1	2506.1	419.06	2256.6	2675.7	1.3069	6.0476	7.3545
125	105.99	0.001048	1.3742	1.3752	444.25	2068.9	2513.2	444.38	2240.7	2685.1	1.3741	5.9100	7.2841
150	111.38	0.001053	1.1584	1.1595	467.02	2052.4	2519.4	467.18	2226.2	2693.4	1.4338	5.7894	7.2232
175	116.07	0.001057	1.0027	1.0038	486.89	2037.8	2524.7	487.08	2213.3	2700.4	1.4851	5.6866	7.1717
200	120.24	0.001060	0.8848	0.8859	504.59	2024.8	2529.4	504.80	2201.7	2706.5	1.5304	5.5968	7.1272
225	124.01	0.001064	0.7923	0.7934	520.59	2012.9	2533.5	520.83	2191.2	2712.0	1.5708	5.5172	7.0880
250	127.44	0.001067	0.7177	0.7188	535.22	2001.9	2537.1	535.49	2181.3	2716.8	1.6075	5.4454	7.0529
275	130.61	0.001070	0.6563	0.6574	548.73	1991.8	2540.5	549.02	2172.3	2721.3	1.6411	5.3800	7.0211

**TABLE A2.1: Properties of SATURATED WATER – Pressure Table (Continued)**

P kPa	T °C	v <sub>l</sub> m <sup>3</sup> /kg	v <sub>lg</sub> m <sup>3</sup> /kg	v <sub>g</sub> m <sup>3</sup> /kg	u <sub>l</sub> kJ/kg	u <sub>lg</sub> kJ/kg	u <sub>g</sub> kJ/kg	h <sub>l</sub> kJ/kg	h <sub>lg</sub> kJ/kg	h <sub>g</sub> kJ/kg	s <sub>l</sub> kJ/kg.K	s <sub>lg</sub> kJ/kg.K	s <sub>g</sub> kJ/kg.K
300	133.56	0.001073	0.6048	0.6059	561.29	1982.2	2543.5	561.61	2163.7	2725.3	1.6721	5.3200	6.9921
325	136.31	0.001076	0.5609	0.5620	573.04	1973.3	2546.3	573.39	2155.6	2729.0	1.7009	5.2645	6.9654
350	138.89	0.001079	0.5232	0.5243	584.10	1964.8	2548.9	584.48	2147.9	2732.4	1.7278	5.2129	6.9407
375	141.33	0.001081	0.4903	0.4914	594.56	1956.7	2551.3	594.96	2140.6	2735.6	1.7531	5.1646	6.9177
400	143.64	0.001084	0.4614	0.4625	604.47	1949.0	2553.5	604.91	2133.6	2738.5	1.7770	5.1191	6.8961
425	145.84	0.001086	0.4357	0.4368	613.91	1941.7	2555.6	614.37	2126.9	2741.3	1.7996	5.0762	6.8758
450	147.94	0.001088	0.4129	0.4140	622.93	1934.7	2557.6	623.42	2120.5	2743.9	1.8211	5.0356	6.8567
475	149.94	0.001090	0.3923	0.3934	631.56	1927.8	2559.4	632.07	2114.2	2746.3	1.8415	4.9971	6.8386
500	151.87	0.001093	0.3738	0.3749	639.84	1921.4	2561.2	640.38	2108.2	2748.6	1.8610	4.9604	6.8214
550	155.49	0.001097	0.3415	0.3426	655.48	1908.9	2564.4	656.08	2096.8	2752.9	1.8977	4.8917	6.7894
600	158.86	0.001101	0.3145	0.3156	670.05	1897.3	2567.3	670.71	2086.0	2756.7	1.9315	4.8286	6.7601
650	162.02	0.001104	0.2915	0.2926	683.71	1886.2	2569.9	684.42	2075.8	2760.2	1.9631	4.7699	6.7330
700	164.98	0.001108	0.2717	0.2728	696.58	1875.8	2572.4	697.35	2066.0	2763.3	1.9925	4.7154	6.7079
750	167.79	0.001111	0.2544	0.2555	708.76	1865.8	2574.6	709.59	2056.6	2766.2	2.0203	4.6642	6.6845
800	170.44	0.001115	0.2393	0.2404	720.33	1856.3	2576.6	721.23	2047.7	2768.9	2.0464	4.6161	6.6625
850	172.97	0.001118	0.2258	0.2269	731.37	1847.1	2578.5	732.32	2039.1	2771.4	2.0712	4.5706	6.6418
900	175.39	0.001121	0.2138	0.2149	741.92	1838.3	2580.2	742.93	2030.7	2773.6	2.0948	4.5274	6.6222
950	177.70	0.001124	0.2030	0.2041	752.03	1829.8	2581.8	753.10	2022.6	2775.7	2.1173	4.4863	6.6036
1000	179.92	0.001127	0.1933	0.1944	761.75	1821.6	2583.3	762.88	2014.8	2777.7	2.1388	4.4471	6.5859
1100	184.10	0.001133	0.1764	0.1775	780.14	1805.9	2586.0	781.38	1999.8	2781.2	2.1793	4.3736	6.5529
1200	188.00	0.001138	0.1622	0.1633	797.31	1791.1	2588.4	798.68	1985.6	2784.3	2.2167	4.3059	6.5226
1300	191.64	0.001144	0.1501	0.1512	813.44	1777.1	2590.5	814.93	1972.1	2787.0	2.2515	4.2430	6.4945
1400	195.08	0.001149	0.1397	0.1408	828.67	1763.6	2592.3	830.28	1959.1	2789.4	2.2842	4.1841	6.4683
1500	198.33	0.001154	0.1305	0.1317	843.12	1750.8	2593.9	844.85	1946.7	2791.5	2.3150	4.1288	6.4438
1600	201.41	0.001159	0.1225	0.1237	856.88	1738.4	2595.3	858.73	1934.6	2793.3	2.3441	4.0766	6.4207
1700	204.35	0.001163	0.1155	0.1167	870.02	1726.6	2596.6	872.00	1923.0	2795.0	2.3717	4.0272	6.3989
1800	207.15	0.001168	0.1092	0.1104	882.61	1715.1	2597.7	884.71	1911.7	2796.4	2.3980	3.9801	6.3781
1900	209.84	0.001172	0.1035	0.1047	894.70	1704.0	2598.7	896.92	1900.7	2797.6	2.4231	3.9353	6.3584
2000	212.42	0.001177	0.09841	0.09959	906.33	1693.2	2599.5	908.69	1890.0	2798.7	2.4471	3.8925	6.3396
2250	218.45	0.001187	0.08753	0.08872	933.70	1667.5	2601.2	936.37	1864.4	2800.8	2.5032	3.7926	6.2958
2500	223.99	0.001197	0.07875	0.07995	958.98	1643.3	2602.3	961.97	1840.2	2802.2	2.5544	3.7016	6.2560
2750	229.11	0.001207	0.07151	0.07272	982.53	1620.5	2603.0	985.85	1817.2	2803.0	2.6016	3.6178	6.2194
3000	233.89	0.001217	0.06544	0.06666	1004.6	1598.7	2603.3	1008.3	1795.0	2803.3	2.6454	3.5401	6.1855
3250	238.37	0.001226	0.06027	0.06150	1025.5	1577.7	2603.2	1029.5	1773.6	2803.1	2.6865	3.4673	6.1538
3500	242.60	0.001235	0.05582	0.05705	1045.3	1557.6	2602.9	1049.6	1753.0	2802.6	2.7251	3.3989	6.1240
3750	246.59	0.001244	0.05194	0.05318	1064.2	1538.1	2602.3	1068.8	1732.9	2801.7	2.7616	3.3341	6.0957
4000	250.39	0.001252	0.04852	0.04977	1082.2	1519.3	2601.5	1087.2	1713.4	2800.6	2.7962	3.2727	6.0689
5000	263.98	0.001286	0.03815	0.03944	1147.8	1448.7	2596.5	1154.2	1639.5	2793.7	2.9201	3.0524	5.9725
6000	275.62	0.001319	0.03112	0.03244	1205.4	1383.9	2589.3	1213.3	1570.6	2783.9	3.0266	2.8620	5.8886
7000	285.86	0.001352	0.02602	0.02737	1257.5	1322.7	2580.2	1267.0	1504.8	2771.8	3.1211	2.6919	5.8130

**TABLE A2.1: Properties of SATURATED WATER – Pressure Table (Continued)**

P kPa	T °C	v <sub>l</sub> m <sup>3</sup> /kg	v <sub>lg</sub> m <sup>3</sup> /kg	v <sub>g</sub> m <sup>3</sup> /kg	u <sub>l</sub> kJ/kg	u <sub>lg</sub> kJ/kg	u <sub>g</sub> kJ/kg	h <sub>l</sub> kJ/kg	h <sub>lg</sub> kJ/kg	h <sub>g</sub> kJ/kg	s <sub>l</sub> kJ/kg.K	s <sub>lg</sub> kJ/kg.K	s <sub>g</sub> kJ/kg.K
8000	295.04	0.001384	0.02214	0.02352	1305.5	1264.1	2569.6	1316.6	1441.2	2757.8	3.2066	2.5365	5.7431
9000	303.38	0.001418	0.01906	0.02048	1350.3	1207.3	2557.6	1363.1	1378.9	2742.0	3.2855	2.3916	5.6771
10,000	311.03	0.001452	0.01658	0.01803	1392.8	1151.4	2544.2	1407.3	1317.2	2724.5	3.3591	2.2548	5.6139
11,000	318.11	0.001488	0.01450	0.01599	1433.3	1096.2	2529.5	1449.7	1255.7	2705.4	3.4287	2.1238	5.5525
12,000	324.71	0.001526	0.01273	0.01426	1472.4	1041.0	2513.4	1490.7	1193.8	2684.5	3.4953	1.9968	5.4921
13,000	330.89	0.001566	0.01121	0.01278	1510.5	985.20	2495.7	1530.9	1130.9	2661.8	3.5595	1.8723	5.4318
14,000	336.70	0.001610	0.009870	0.01148	1547.9	928.40	2476.3	1570.4	1066.7	2637.1	3.6220	1.7491	5.3711
15,000	342.19	0.001657	0.008683	0.01034	1585.0	870.00	2455.0	1609.8	1000.3	2610.1	3.6837	1.6255	5.3092
16,000	347.39	0.001710	0.007600	0.009310	1622.1	809.20	2431.3	1649.5	930.80	2580.3	3.7452	1.4999	5.2451
17,000	352.34	0.001770	0.006603	0.008373	1659.9	744.90	2404.8	1690.0	857.10	2547.1	3.8073	1.3704	5.1777
18,000	357.04	0.001840	0.005665	0.007505	1698.9	675.70	2374.6	1732.0	777.70	2509.7	3.8714	1.2340	5.1054
19,000	361.52	0.001925	0.004756	0.006681	1740.3	599.00	2339.3	1776.8	689.40	2466.2	3.9393	1.0862	5.0255
20,000	365.80	0.002036	0.003838	0.005874	1786.0	510.10	2296.1	1826.7	586.90	2413.6	4.0146	0.9184	4.9330
21,000	369.88	0.002200	0.002820	0.005020	1841.4	396.00	2237.4	1887.6	455.20	2342.8	4.1062	0.7079	4.8141
22,000	373.77	0.002702	0.000952	0.003654	1953.4	142.80	2096.2	2012.8	163.60	2176.5	4.2866	0.2530	4.5486
22,055	373.98	0.00311	-	0.00311	2017	-	2017	2086	-	2086	4.409	-	4.409

**Table A2.2: Properties of SATURATED WATER – Temperature Table**

T °C	P kPa	v <sub>l</sub> m <sup>3</sup> /kg	v <sub>lg</sub> m <sup>3</sup> /kg	v <sub>g</sub> m <sup>3</sup> /kg	u <sub>l</sub> kJ/kg	u <sub>lg</sub> kJ/kg	u <sub>g</sub> kJ/kg	h <sub>l</sub> kJ/kg	h <sub>lg</sub> kJ/kg	h <sub>g</sub> kJ/kg	s <sub>l</sub> kJ/kg.K	s <sub>lg</sub> kJ/kg.K	s <sub>g</sub> kJ/kg.K
5	0.8726	0.001000	147.02	147.02	21.020	2360.4	2381.4	21.021	2488.7	2509.7	0.07626	8.9473	9.0236
10	1.2281	0.001000	106.32	106.32	41.986	2346.3	2388.3	41.988	2476.9	2518.9	0.1510	8.7476	8.8986
15	1.7056	0.001001	77.896	77.897	62.915	2332.3	2395.2	62.917	2465.1	2528.0	0.2242	8.5550	8.7792
20	2.3388	0.001002	57.777	57.778	83.833	2318.2	2402.0	83.835	2453.4	2537.2	0.2962	8.3689	8.6651
25	3.1690	0.001003	43.356	43.357	104.75	2304.1	2408.9	104.75	2441.6	2546.3	0.3670	8.1888	8.5558
30	4.2455	0.001004	32.895	32.896	125.67	2290.0	2415.7	125.67	2429.6	2555.3	0.4365	8.0148	8.4513
35	5.6267	0.001006	25.219	25.220	146.58	2275.9	2422.5	146.59	2417.8	2564.4	0.5050	7.8461	8.3511
40	7.3814	0.001008	19.527	19.528	167.50	2261.7	2429.2	167.50	2405.9	2573.4	0.5723	7.6827	8.2550
45	9.5898	0.001010	15.262	15.263	188.41	2247.5	2435.9	188.42	2393.9	2582.3	0.6385	7.5244	8.1629
50	12.344	0.001012	12.036	12.037	209.31	2233.3	2442.6	209.33	2381.9	2591.2	0.7037	7.3708	8.0745
55	15.752	0.001015	9.5716	9.5726	230.22	2219.0	2449.2	230.24	2369.8	2600.0	0.7679	7.2217	7.9896
60	19.932	0.001017	7.6733	7.6743	251.13	2204.7	2455.8	251.15	2357.7	2608.8	0.8312	7.0768	7.9080
65	25.022	0.001020	6.1986	6.1996	272.05	2190.3	2462.4	272.08	2345.4	2617.5	0.8935	6.9360	7.8295
70	31.176	0.001023	5.0437	5.0447	292.98	2175.8	2468.8	293.01	2333.1	2626.1	0.9549	6.7991	7.7540
75	38.563	0.001026	4.1323	4.1333	313.92	2161.3	2475.2	313.96	2320.6	2634.6	1.0155	6.6658	7.6813
80	47.373	0.001029	3.4078	3.4088	334.88	2146.7	2481.6	334.93	2308.2	2643.1	1.0753	6.5359	7.6112
85	57.815	0.001032	2.8279	2.8289	355.86	2132.0	2487.9	355.92	2295.5	2651.4	1.1343	6.4093	7.5436
90	70.117	0.001036	2.3607	2.3617	376.86	2117.1	2494.0	376.93	2282.7	2659.6	1.1925	6.2859	7.4784
95	84.529	0.001040	1.9818	1.9828	397.89	2102.2	2500.1	397.98	2269.7	2667.7	1.2501	6.1653	7.4154
100	101.32	0.001043	1.6726	1.6736	418.96	2087.1	2506.1	419.06	2256.6	2675.7	1.3069	6.0476	7.3545
105	120.79	0.001047	1.4190	1.4200	440.05	2072.1	2512.1	440.18	2243.4	2683.6	1.3630	5.9326	7.2956
110	143.24	0.001052	1.2095	1.2106	461.19	2056.7	2517.9	461.34	2230.0	2691.3	1.4186	5.8200	7.2386
115	169.02	0.001056	1.0359	1.0370	482.36	2041.1	2523.5	482.54	2216.3	2698.8	1.4735	5.7098	7.1833
120	198.48	0.001060	0.8911	0.8922	503.57	2025.5	2529.1	503.78	2202.4	2706.2	1.5278	5.6019	7.1297
125	232.01	0.001065	0.7698	0.7709	524.82	2009.7	2534.5	525.07	2188.3	2713.4	1.5815	5.4962	7.0777
130	270.02	0.001070	0.6676	0.6687	546.12	1993.7	2539.8	546.41	2174.0	2720.4	1.6346	5.3926	7.0272
135	312.93	0.001075	0.5813	0.5824	567.46	1977.5	2545.0	567.80	2159.4	2727.2	1.6873	5.2907	6.9780
140	361.19	0.001080	0.5079	0.5090	588.85	1961.2	2550.0	589.24	2144.6	2733.8	1.7394	5.1908	6.9302
145	415.29	0.001085	0.4453	0.4464	610.30	1944.5	2554.8	610.75	2129.4	2740.2	1.7910	5.0926	6.8836
150	475.72	0.001090	0.3918	0.3929	631.80	1927.7	2559.5	632.32	2114.1	2746.4	1.8421	4.9960	6.8381
155	542.99	0.001096	0.3457	0.3468	653.35	1910.7	2564.0	653.95	2098.4	2752.3	1.8927	4.9010	6.7937
160	617.66	0.001102	0.3060	0.3071	674.97	1893.3	2568.3	675.65	2082.3	2758.0	1.9429	4.8074	6.7503
165	700.29	0.001108	0.2716	0.2727	696.65	1875.7	2572.4	697.43	2065.9	2763.3	1.9927	4.7151	6.7078
170	791.47	0.001114	0.2417	0.2428	718.40	1857.9	2576.3	719.28	2049.2	2768.5	2.0421	4.6241	6.6662
175	891.80	0.001121	0.2157	0.2168	740.22	1839.7	2579.9	741.22	2032.1	2773.3	2.0910	4.5344	6.6254
180	1001.9	0.001127	0.1929	0.1940	762.12	1821.3	2583.4	763.25	2014.6	2777.8	2.1397	4.4456	6.5853
185	1122.5	0.001134	0.1730	0.1741	784.10	1802.5	2586.6	785.37	1996.6	2782.0	2.1879	4.3580	6.5459
190	1254.2	0.001141	0.1554	0.1565	806.17	1783.4	2589.6	807.60	1978.2	2785.8	2.2358	4.2713	6.5071
195	1397.6	0.001149	0.1399	0.1410	828.33	1764.0	2592.3	829.93	1959.5	2789.4	2.2834	4.1855	6.4689
200	1553.6	0.001156	0.1261	0.1273	850.58	1744.1	2594.7	852.38	1940.1	2792.5	2.3308	4.1004	6.4312

**Table A2.2: Properties of SATURATED WATER – Temperature Table (Continued)**

T °C	P kPa	v <sub>l</sub> m <sup>3</sup> /kg	v <sub>lg</sub> m <sup>3</sup> /kg	v <sub>g</sub> m <sup>3</sup> /kg	u <sub>l</sub> kJ/kg	u <sub>lg</sub> kJ/kg	u <sub>g</sub> kJ/kg	h <sub>l</sub> kJ/kg	h <sub>lg</sub> kJ/kg	h <sub>g</sub> kJ/kg	s <sub>l</sub> kJ/kg.K	s <sub>lg</sub> kJ/kg.K	s <sub>g</sub> kJ/kg.K
205	1722.9	0.001164	0.1140	0.1152	872.95	1723.9	2596.9	874.95	1920.4	2795.3	2.3778	4.0162	6.3940
210	1906.2	0.001173	0.1032	0.1044	895.43	1703.3	2598.7	897.66	1900.0	2797.7	2.4246	3.9326	6.3572
215	2104.2	0.001181	0.09357	0.09475	918.02	1682.3	2600.3	920.51	1879.2	2799.7	2.4712	3.8496	6.3208
220	2317.8	0.001190	0.08497	0.08616	940.75	1660.9	2601.6	943.51	1857.8	2801.3	2.5175	3.7672	6.2847
225	2547.9	0.001199	0.07726	0.07846	963.61	1638.9	2602.5	966.67	1835.7	2802.4	2.5637	3.6851	6.2488
230	2795.1	0.001209	0.07034	0.07155	986.62	1616.5	2603.1	990.00	1813.1	2803.1	2.6097	3.6034	6.2131
235	3060.4	0.001219	0.06412	0.06534	1009.8	1593.5	2603.3	1013.5	1789.8	2803.3	2.6556	3.5221	6.1777
240	3344.7	0.001229	0.05851	0.05974	1033.1	1570.0	2603.1	1037.2	1765.8	2803.0	2.7013	3.4410	6.1423
245	3648.8	0.001240	0.05345	0.05469	1056.6	1546.0	2602.6	1061.2	1740.9	2802.1	2.7470	3.3600	6.1070
250	3973.6	0.001251	0.04886	0.05011	1080.3	1521.3	2601.6	1085.3	1715.4	2800.7	2.7926	3.2791	6.0717
255	4320.2	0.001263	0.04470	0.04596	1104.3	1495.9	2600.2	1109.7	1689.1	2798.8	2.8382	3.1981	6.0363
260	4689.4	0.001276	0.04091	0.04219	1128.4	1470.0	2598.4	1134.4	1661.8	2796.2	2.8838	3.1171	6.0009
265	5082.3	0.001289	0.03747	0.03876	1152.8	1443.2	2596.0	1159.3	1633.7	2793.0	2.9294	3.0358	5.9652
270	5499.9	0.001303	0.03434	0.03564	1177.4	1415.8	2593.2	1184.6	1604.5	2789.1	2.9751	2.9542	5.9293
275	5943.1	0.001317	0.03146	0.03278	1202.3	1387.4	2589.7	1210.1	1574.4	2784.5	3.0209	2.8722	5.8931
280	6413.2	0.001332	0.02883	0.03016	1227.5	1358.2	2585.7	1236.1	1543.1	2779.2	3.0669	2.7896	5.8565
285	6911.1	0.001349	0.02642	0.02777	1253.1	1328.0	2581.1	1262.4	1510.6	2773.0	3.1131	2.7064	5.8195
290	7438.0	0.001366	0.02419	0.02556	1279.0	1296.7	2575.7	1289.1	1476.8	2765.9	3.1595	2.6223	5.7818
295	7995.2	0.001384	0.02216	0.02354	1305.3	1264.4	2569.7	1316.3	1441.5	2757.8	3.2062	2.5372	5.7454
300	8583.8	0.001404	0.02027	0.02167	1332.0	1230.8	2562.8	1344.1	1404.6	2748.7	3.2534	2.4569	5.7042
305	9205.1	0.001425	0.01852	0.01994	1359.2	1195.8	2555.0	1372.3	1366.2	2738.5	3.3010	2.3630	5.6640
310	9860.5	0.001447	0.01689	0.01834	1387.0	1159.2	2546.2	1401.2	1325.8	2727.0	3.3491	2.2735	5.6226
315	10,550	0.001472	0.01539	0.01686	1415.3	1121.0	2536.3	1430.8	1283.4	2714.2	3.3979	2.1820	5.5799
320	11,280	0.001498	0.01398	0.01548	1444.4	1080.8	2525.2	1461.3	1238.4	2699.7	3.4476	2.0880	5.5356
325	12,050	0.001528	0.01266	0.01419	1474.2	1038.4	2512.6	1492.6	1190.9	2683.5	3.4983	1.9910	5.4893
330	12,850	0.001560	0.01142	0.01298	1504.9	993.50	2498.4	1525.0	1140.3	2665.3	3.5501	1.8906	5.4407
335	13,700	0.001596	0.01025	0.01185	1536.8	945.50	2482.3	1558.6	1086.1	2644.7	3.6035	1.7854	5.3894
340	14,590	0.001637	0.009153	0.01079	1569.9	894.00	2463.9	1593.8	1027.5	2621.3	3.6587	1.6758	5.3345
345	15,530	0.001684	0.008094	0.009778	1604.7	838.00	2442.7	1630.9	963.60	2594.5	3.7164	1.5589	5.2753
350	16,520	0.001740	0.007072	0.008812	1641.7	776.20	2417.9	1670.4	893.10	2563.5	3.7774	1.4331	5.2105
355	17,560	0.001808	0.006071	0.007879	1681.5	706.90	2388.4	1713.3	813.40	2526.7	3.8429	1.2950	5.1379
360	18,660	0.001894	0.005068	0.006962	1725.6	626.60	2352.2	1761.0	721.00	2482.0	3.9153	1.1389	5.0542
365	19,810	0.002012	0.004017	0.006029	1776.8	528.40	2305.2	1816.7	607.90	2424.6	3.9994	0.9526	4.9520
370	21,030	0.002207	0.002786	0.004993	1843.3	391.90	2235.2	1889.7	450.50	2340.2	4.1094	0.7004	4.8098
373	22,055	0.00311	-	0.00311	2017	-	2017	2086	-	2086	4.409	-	4.409

**Table A2.3: Properties of WATER in Compressed Liquid State**

P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
5,000	10	0.000998	41.860	46.850	0.1505
	30	0.001002	125.21	130.22	0.4350
	50	0.001010	208.58	213.63	0.7014
	70	0.001020	291.97	297.07	0.9520
	90	0.001034	375.59	380.75	1.1890
	110	0.001049	459.63	464.88	1.4145
	130	0.001067	544.28	549.61	1.6301
	150	0.001087	629.68	635.12	1.8371
	170	0.001111	716.04	721.59	2.0367
	190	0.001138	803.64	809.33	2.2304
	210	0.001169	892.89	898.74	2.4193
	230	0.001206	984.40	990.43	2.6053
	250	0.001250	1079.0	1085.3	2.7901

P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
10,000	10	0.000996	41.729	51.685	0.1500
	30	0.001000	124.75	134.75	0.4334
	50	0.001008	207.85	217.93	0.6991
	70	0.001018	290.98	301.16	0.9491
	90	0.001031	374.32	384.63	1.1855
	110	0.001046	458.07	468.53	1.4104
	130	0.001064	542.38	553.02	1.6253
	150	0.001084	627.41	638.25	1.8316
	170	0.001107	713.31	724.39	2.0305
	190	0.001133	800.37	811.70	2.2232
	210	0.001164	888.94	900.57	2.4111
	230	0.001199	979.55	991.54	2.5955
	250	0.001241	1073.0	1085.4	2.7784
	270	0.001292	1170.3	1183.2	2.9619
	290	0.001357	1273.5	1287.1	3.1497

P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
15,000	10	0.000993	41.593	56.493	0.1494
	30	0.000998	124.30	139.27	0.4319
	50	0.001006	207.13	222.22	0.6968
	70	0.001016	290.01	305.25	0.9461
	90	0.001029	373.08	388.51	1.1820
	110	0.001044	456.54	472.20	1.4063
	130	0.001061	540.53	556.45	1.6206
	150	0.001081	625.19	641.41	1.8263
	170	0.001104	710.67	727.22	2.0244
	190	0.001129	797.20	814.14	2.2163
	210	0.001159	885.13	902.51	2.4030
	230	0.001193	974.91	992.80	2.5862
	250	0.001233	1067.2	1085.7	2.7672
	270	0.001281	1163.0	1182.2	2.9481
	290	0.001341	1263.7	1283.8	3.1319
	310	0.001421	1372.1	1393.5	3.3231
	330	0.001539	1494.7	1517.8	3.5327

P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
20,000	10	0.000991	41.453	61.274	0.1488
	30	0.000996	123.86	143.77	0.4303
	50	0.001003	206.43	226.50	0.6946
	70	0.001014	289.05	309.33	0.9432
	90	0.001026	371.86	392.39	1.1785
	110	0.001041	455.04	475.87	1.4023
	130	0.001058	538.73	559.90	1.6160
	150	0.001078	623.03	644.59	1.8211
	170	0.001100	708.10	730.10	2.0185
	190	0.001125	794.14	816.64	2.2095
	210	0.001154	881.46	904.53	2.3953
	230	0.001187	970.48	994.21	2.5771
	250	0.001225	1061.8	1086.3	2.7565
	270	0.001271	1156.1	1181.5	2.9352
	290	0.001327	1254.7	1281.3	3.1155
	310	0.001399	1359.7	1387.7	3.3011
	330	0.001499	1475.0	1505.0	3.4988
	350	0.001665	1612.1	1645.4	3.7277

**Table A2.3: Properties of WATER in Compressed Liquid State (Continued)**

P kPa	T °C	v m <sup>3</sup> /kg	u kJ/kg	h kJ/kg	s kJ/kg.K	P kPa	T °C	v m <sup>3</sup> /kg	u kJ/kg	h kJ/kg	s kJ/kg.K
30,000	10	0.000987	41.158	70.757	0.1473	50,000	10	0.000978	40.519	89.428	0.1439
	30	0.000992	122.99	152.73	0.4271		30	0.000984	121.31	170.48	0.4205
	50	0.000999	205.07	235.05	0.6900		50	0.000991	202.46	252.03	0.6810
	70	0.001010	287.20	317.49	0.9375		70	0.001001	283.69	333.76	0.9264
	90	0.001022	369.51	400.16	1.1717		90	0.001013	365.06	415.73	1.1585
	110	0.001036	452.15	483.24	1.3944		110	0.001027	446.70	498.06	1.3792
	130	0.001053	535.24	566.83	1.6070		130	0.001043	528.70	580.85	1.5898
	150	0.001072	618.87	651.03	1.8109		150	0.001061	611.12	664.16	1.7915
	170	0.001093	703.17	735.96	2.0070		170	0.001081	694.04	748.07	1.9853
	190	0.001117	788.29	821.81	2.1965		190	0.001103	777.56	832.70	2.1720
	210	0.001144	874.50	908.83	2.3804		210	0.001128	861.87	918.25	2.3529
	230	0.001175	962.13	997.39	2.5600		230	0.001155	947.19	1005.0	2.5287
	250	0.001211	1051.6	1088.0	2.7365		250	0.001187	1033.8	1093.2	2.7006
	270	0.001253	1143.6	1181.2	2.9113		270	0.001223	1122.1	1183.3	2.8696
	290	0.001303	1238.8	1277.9	3.0862		290	0.001264	1212.5	1275.8	3.0368
	310	0.001364	1338.6	1379.5	3.2635		310	0.001313	1305.6	1371.3	3.2035
	330	0.001443	1444.9	1488.1	3.4466		330	0.001371	1402.2	1470.7	3.3712
	350	0.001552	1561.5	1608.1	3.6421		350	0.001442	1503.2	1575.3	3.5417
	370	0.001726	1697.8	1749.6	3.8656		370	0.001533	1610.2	1686.9	3.7179

**Table A2.4: Properties of Superheated Steam**

P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
10	(45.82)	(14.674)	(2437.0)	(2583.8)	(8.1482)
	50	14.869	2443.1	2591.8	8.1731
	100	17.196	2515.0	2687.0	8.4471
	150	19.513	2587.4	2782.5	8.6873
	200	21.826	2660.8	2879.0	8.9030
	250	24.136	2735.5	2976.9	9.0995
	300	26.446	2811.7	3076.2	9.2808
	350	28.755	2889.5	3177.0	9.4494
	400	31.063	2968.8	3279.4	9.6075
	450	33.372	3049.7	3383.4	9.7565
	500	35.680	3132.4	3489.2	9.8979
	550	37.988	3216.7	3596.6	10.032
	600	40.296	3302.8	3705.7	10.161
	650	42.604	3390.6	3816.7	10.285
	700	44.912	3480.2	3929.4	10.404
	750	47.220	3571.6	4043.8	10.518
	800	49.527	3664.8	4160.1	10.629
	850	51.835	3759.7	4278.1	10.737

P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
50	(81.33)	(3.2408)	(2483.3)	(2645.3)	(7.5928)
	100	3.4188	2511.2	2682.1	7.6941
	150	3.8895	2585.2	2779.7	7.9394
	200	4.3560	2659.4	2877.2	8.1572
	250	4.8205	2734.5	2975.6	8.3548
	300	5.2840	2811.0	3075.2	8.5367
	350	5.7469	2888.9	3176.2	8.7057
	400	6.2094	2968.3	3278.8	8.8640
	450	6.6717	3049.3	3382.9	9.0132
	500	7.1338	3132.0	3488.7	9.1547
	550	7.5958	3216.4	3596.2	9.2894
	600	8.0577	3302.5	3705.4	9.4182
	650	8.5195	3390.4	3816.4	9.5417
	700	8.9813	3480.1	3929.1	9.6606
	750	9.4430	3571.5	4043.6	9.7754
	800	9.9047	3664.7	4159.9	9.8863
	850	10.366	3759.6	4277.9	9.9938

P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
100	(99.63)	(1.6943)	(2505.7)	(2675.1)	(7.3589)
	100	1.6961	2506.3	2675.9	7.3609
	150	1.9364	2582.4	2776.1	7.6129
	200	2.1723	2657.6	2874.8	7.8335
	250	2.4061	2733.3	2973.9	8.0325
	300	2.6388	2810.1	3073.9	8.2152
	350	2.8709	2888.2	3175.3	8.3846
	400	3.1027	2967.7	3278.0	8.5432
	450	3.3342	3048.9	3382.3	8.6927
	500	3.5655	3131.6	3488.2	8.8342
	550	3.7968	3216.1	3595.8	8.9690
	600	4.0279	3302.3	3705.0	9.0979
	650	4.2590	3390.2	3816.1	9.2216
	700	4.4900	3479.8	3928.8	9.3405
	750	4.7210	3571.3	4043.4	9.4553
	800	4.9519	3664.5	4159.7	9.5662
	850	5.1828	3759.4	4277.7	9.6738

P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
101.33	(100.00)	(1.6737)	(2506.1)	(2675.7)	(7.3545)
	150	1.9108	2582.3	2776.0	7.6066
	200	2.1436	2657.5	2874.8	7.8273
	250	2.3744	2733.3	2973.8	8.0264
	300	2.6041	2810.0	3073.9	8.2090
	350	2.8332	2888.1	3175.2	8.3785
	400	3.0619	2967.7	3278.0	8.5371
	450	3.2904	3048.9	3382.3	8.6865
	500	3.5187	3131.6	3488.2	8.8281
	550	3.7469	3216.1	3595.8	8.9629
	600	3.9750	3302.2	3705.0	9.0918
	650	4.2030	3390.2	3816.1	9.2154
	700	4.4310	3479.8	3928.8	9.3344
	750	4.6590	3571.3	4043.4	9.4492
	800	4.8869	3664.5	4159.7	9.5601
	850	5.1148	3759.4	4277.7	9.6677

**Table A2.4: Properties of Superheated Steam (Continued)**

P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
200	(120.24)	(0.8859)	(2529.4)	(2706.5)	(7.1272)
150	0.9597	2576.7	2768.6	7.2793	
200	1.0803	2653.9	2870.0	7.5059	
250	1.1988	2730.8	2970.5	7.7078	
300	1.3162	2808.2	3071.4	7.8920	
350	1.4329	2886.7	3173.3	8.0624	
400	1.5493	2966.6	3276.4	8.2216	
450	1.6655	3047.9	3381.0	8.3714	
500	1.7814	3130.8	3487.1	8.5133	
550	1.8973	3215.4	3594.9	8.6483	
600	2.0130	3301.7	3704.3	8.7773	
650	2.1287	3389.7	3815.4	8.9011	
700	2.2443	3479.4	3928.3	9.0201	
750	2.3599	3570.9	4042.9	9.1350	
800	2.4755	3664.1	4159.2	9.2460	
850	2.5910	3759.1	4277.3	9.3536	

P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
300	(133.56)	(0.6059)	(2543.5)	(2725.3)	(6.9921)
150	0.6339	2570.7	2760.9	7.0779	
200	0.7163	2650.2	2865.1	7.3108	
250	0.7963	2728.2	2967.1	7.5157	
300	0.8753	2806.3	3068.9	7.7015	
350	0.9536	2885.3	3171.3	7.8729	
400	1.0315	2965.4	3274.9	8.0327	
450	1.1092	3047.0	3379.7	8.1830	
500	1.1867	3130.1	3486.1	8.3252	
550	1.2641	3214.7	3594.0	8.4604	
600	1.3414	3301.1	3703.5	8.5895	
650	1.4186	3389.1	3814.7	8.7134	
700	1.4958	3478.9	3927.7	8.8325	
750	1.5729	3570.5	4042.3	8.9475	
800	1.6500	3663.8	4158.8	9.0585	
850	1.7271	3758.8	4276.9	9.1661	

P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
400	(143.64)	(0.4625)	(2553.5)	(2738.5)	(6.8961)
150	0.4708	2564.4	2752.8	6.9300	
200	0.5342	2646.4	2860.1	7.1699	
250	0.5951	2725.6	2963.6	7.3779	
300	0.6548	2804.4	3066.3	7.5654	
350	0.7139	2883.8	3169.4	7.7378	
400	0.7726	2964.3	3273.3	7.8982	
450	0.8311	3046.0	3378.5	8.0489	
500	0.8894	3129.3	3485.0	8.1914	
550	0.9475	3214.1	3593.1	8.3268	
600	1.0056	3300.5	3702.7	8.4561	
650	1.0636	3388.6	3814.1	8.5801	
700	1.1215	3478.5	3927.1	8.6993	
750	1.1794	3570.1	4041.8	8.8143	
800	1.2373	3663.4	4158.3	8.9254	
850	1.2951	3758.4	4276.5	9.0331	

P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
600	(158.86)	(0.3156)	(2567.3)	(2756.7)	(6.7601)
200	0.3520	2638.5	2849.7	6.9658	
250	0.3938	2720.3	2956.6	7.1806	
300	0.4344	2800.5	3061.2	7.3716	
350	0.4742	2880.9	3165.4	7.5459	
400	0.5137	2961.9	3270.2	7.7076	
450	0.5529	3044.1	3375.9	7.8591	
500	0.5920	3127.7	3482.9	8.0022	
550	0.6309	3212.7	3591.2	8.1380	
600	0.6697	3299.3	3701.2	8.2676	
650	0.7085	3387.6	3812.7	8.3918	
700	0.7472	3477.6	3925.9	8.5112	
750	0.7859	3569.2	4040.8	8.6264	
800	0.8246	3662.7	4157.4	8.7376	
850	0.8632	3757.8	4275.7	8.8453	

**Table A2.4: Properties of Superheated Steam (Continued)**

P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
800	(170.44)	(0.2404)	(2576.6)	(2768.9)	(6.6625)
	200	0.2607	2630.2	2838.8	6.8151
	250	0.2931	2714.8	2949.3	7.0373
	300	0.3241	2796.6	3055.9	7.2319
	350	0.3544	2877.9	3161.4	7.4084
	400	0.3843	2959.6	3267.0	7.5713
	450	0.4139	3042.2	3373.3	7.7237
	500	0.4433	3126.1	3480.7	7.8673
	550	0.4726	3211.3	3589.4	8.0036
	600	0.5018	3298.1	3699.6	8.1335
	650	0.5310	3386.6	3811.4	8.2579
	700	0.5601	3476.7	3924.7	8.3775
	750	0.5892	3568.4	4039.8	8.4928
	800	0.6182	3661.9	4156.5	8.6041
	850	0.6472	3757.1	4274.9	8.7120

P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
1000	(179.92)	(0.1944)	(2583.3)	(2781.2)	(6.5529)
	200	0.2059	2621.5	2827.4	6.6932
	250	0.2326	2709.2	2941.9	6.9235
	300	0.2579	2792.7	3050.6	7.1219
	350	0.2825	2874.9	3157.3	7.3005
	400	0.3066	2957.2	3263.8	7.4648
	450	0.3304	3040.3	3370.7	7.6180
	500	0.3541	3124.5	3478.6	7.7622
	550	0.3776	3210.0	3587.6	7.8989
	600	0.4011	3297.0	3698.1	8.0292
	650	0.4245	3385.5	3810.0	8.1538
	700	0.4478	3475.7	3923.6	8.2736
	750	0.4711	3567.6	4038.7	8.3890
	800	0.4944	3661.2	4155.5	8.5005
	850	0.5176	3756.4	4274.0	8.6084

P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
1500	(198.33)	(0.1317)	(2593.9)	(2791.5)	(6.4438)
	200	0.1324	2597.5	2796.1	6.4536
	250	0.1519	2694.6	2922.4	6.7077
	300	0.1696	2782.5	3036.9	6.9168
	350	0.1866	2867.2	3147.1	7.1011
	400	0.2030	2951.2	3255.7	7.2687
	450	0.2192	3035.4	3364.2	7.4242
	500	0.2351	3120.4	3473.1	7.5699
	550	0.2510	3206.5	3583.0	7.7076
	600	0.2668	3294.0	3694.2	7.8386
	650	0.2825	3382.9	3806.6	7.9639
	700	0.2981	3473.4	3920.6	8.0841
	750	0.3137	3565.6	4036.1	8.1999
	800	0.3293	3659.3	4153.2	8.3116
	850	0.3448	3754.8	4272.0	8.4198

P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
2000	(212.42)	(0.09959)	(2599.5)	(2798.7)	(6.3396)
	250	0.1114	2678.8	2901.6	6.5438
	300	0.1254	2771.8	3022.7	6.7651
	350	0.1386	2859.4	3136.6	6.9556
	400	0.1512	2945.1	3247.5	7.1269
	450	0.1635	3030.5	3357.5	7.2845
	500	0.1757	3116.3	3467.7	7.4318
	550	0.1877	3203.1	3578.4	7.5706
	600	0.1996	3291.0	3690.2	7.7024
	650	0.2114	3380.3	3803.2	7.8283
	700	0.2232	3471.1	3917.6	7.9490
	750	0.2350	3563.5	4033.5	8.0651
	800	0.2467	3657.5	4150.9	8.1771
	850	0.2584	3753.1	4269.9	8.2855

**Table A2.4: Properties of Superheated Steam (Continued)**

P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
2500	(223.99)	(0.07995)	(2602.3)	(2802.2)	(6.2560)
250	0.08698	2661.7	2879.1	6.4069	
300	0.09888	2760.8	3008.0	6.6424	
350	0.1097	2851.4	3125.8	6.8395	
400	0.1201	2938.9	3239.2	7.0146	
450	0.1301	3025.5	3350.9	7.1746	
500	0.1400	3112.2	3462.2	7.3235	
550	0.1497	3199.6	3573.8	7.4634	
600	0.1593	3288.0	3686.3	7.5960	
650	0.1688	3377.7	3799.8	7.7225	
700	0.1783	3468.8	3914.7	7.8436	
750	0.1878	3561.4	4030.9	7.9601	
800	0.1972	3655.6	4148.6	8.0724	
850	0.2066	3751.4	4267.9	8.1810	

P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
3000	(233.89)	(0.06666)	(2603.3)	(2803.3)	(6.1855)
250	0.07056	2643.1	2854.8	6.2857	
300	0.08113	2749.2	2992.6	6.5375	
350	0.09052	2843.2	3114.8	6.7420	
400	0.09935	2932.7	3230.7	6.9210	
450	0.1079	3020.5	3344.1	7.0835	
500	0.1162	3108.1	3456.6	7.2339	
550	0.1244	3196.1	3569.1	7.3750	
600	0.1324	3285.0	3682.3	7.5084	
650	0.1404	3375.1	3796.4	7.6355	
700	0.1484	3466.5	3911.7	7.7571	
750	0.1563	3559.4	4028.3	7.8739	
800	0.1642	3653.8	4146.3	7.9865	
850	0.1720	3749.7	4265.8	8.0954	

P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
4000	(250.39)	(0.04977)	(2601.5)	(2800.6)	(6.0689)
300	0.05882	2724.4	2959.7	6.3598	
350	0.06644	2826.1	3091.8	6.5811	
400	0.07340	2919.8	3213.4	6.7688	
450	0.08002	3010.3	3330.4	6.9364	
500	0.08642	3099.7	3445.4	7.0902	
550	0.09268	3189.0	3559.7	7.2335	
600	0.09884	3278.9	3674.3	7.3687	
650	0.1049	3369.8	3789.5	7.4970	
700	0.1110	3461.8	3905.7	7.6195	
750	0.1170	3555.2	4023.0	7.7371	
800	0.1229	3650.0	4141.7	7.8503	
850	0.1288	3746.3	4261.7	7.9596	

P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
5000	(263.98)	(0.03944)	(2596.5)	(2793.7)	(5.9725)
300	0.04530	2697.0	2923.5	6.2067	
350	0.05193	2808.0	3067.7	6.4482	
400	0.05781	2906.5	3195.5	6.6456	
450	0.06330	2999.8	3316.3	6.8187	
500	0.06856	3091.1	3433.9	6.9760	
550	0.07367	3181.8	3550.2	7.1218	
600	0.07869	3272.8	3666.2	7.2586	
650	0.08362	3364.5	3782.6	7.3882	
700	0.08850	3457.1	3899.7	7.5117	
750	0.09334	3551.0	4017.7	7.6300	
800	0.09815	3646.3	4137.0	7.7438	
850	0.1029	3742.9	4257.5	7.8536	

**Table A2.4: Properties of Superheated Steam (Continued)**

P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
6000	(275.62)	(0.03244)	(2589.3)	(2783.9)	(5.8886)
300	0.03615	2666.3	2883.2	6.0659	
350	0.04222	2788.9	3042.2	6.3322	
400	0.04739	2892.7	3177.0	6.5404	
450	0.05214	2989.1	3301.9	6.7195	
500	0.05665	3082.4	3422.3	6.8805	
550	0.06100	3174.6	3540.6	7.0287	
600	0.06525	3266.6	3658.1	7.1673	
650	0.06942	3359.1	3775.6	7.2982	
700	0.07353	3452.4	3893.6	7.4227	
750	0.07760	3546.8	4012.4	7.5418	
800	0.08164	3642.5	4132.3	7.6561	
850	0.08565	3739.5	4253.4	7.7664	

P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
7000	(285.86)	(0.02737)	(2580.2)	(2771.8)	(5.8130)
300	0.02946	2631.4	2837.6	5.9293	
350	0.03523	2768.5	3015.1	6.2269	
400	0.03993	2878.4	3157.9	6.4474	
450	0.04416	2978.1	3287.3	6.6329	
500	0.04813	3073.6	3410.5	6.7978	
550	0.05194	3167.2	3530.8	6.9486	
600	0.05565	3260.3	3649.8	7.0889	
650	0.05927	3353.6	3768.5	7.2211	
700	0.06284	3447.6	3887.5	7.3466	
750	0.06636	3542.6	4007.1	7.4665	
800	0.06985	3638.7	4127.6	7.5815	
850	0.07331	3736.1	4249.2	7.6922	

P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
8000	(295.04)	(0.02352)	(2569.6)	(2757.8)	(5.7431)
300	0.02426	2590.5	2784.6	5.7901	
350	0.02995	2746.7	2986.3	6.1286	
400	0.03431	2863.5	3138.0	6.3630	
450	0.03816	2966.9	3272.2	6.5554	
500	0.04174	3064.6	3398.5	6.7243	
550	0.04515	3159.8	3521.0	6.8778	
600	0.04845	3254.0	3641.5	7.0200	
650	0.05166	3348.1	3761.4	7.1535	
700	0.05482	3442.8	3881.4	7.2800	
750	0.05793	3538.3	4001.7	7.4007	
800	0.06101	3634.9	4122.9	7.5163	
850	0.06406	3732.6	4245.1	7.6275	

P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
10,000	(311.03)	(0.01803)	(2544.2)	(2724.5)	(5.6139)
350	0.02242	2698.1	2922.2	5.9425	
400	0.02641	2832.0	3096.1	6.2114	
450	0.02975	2943.6	3241.1	6.4194	
500	0.03278	3046.2	3374.0	6.5971	
550	0.03563	3144.6	3500.9	6.7561	
600	0.03836	3241.1	3624.7	6.9022	
650	0.04101	3337.1	3747.1	7.0385	
700	0.04359	3433.1	3869.0	7.1671	
750	0.04613	3529.7	3991.0	7.2893	
800	0.04863	3627.2	4113.5	7.4062	
850	0.05110	3725.7	4236.7	7.5184	

**Table A2.4: Properties of Superheated Steam (Continued)**

P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
15,000 (342.19)	(0.01034)	(2455.0)	(2610.1)	(5.3092)	
350	0.01147	2519.3	2691.3	5.4404	
400	0.01565	2739.9	2974.7	5.8799	
450	0.01845	2879.9	3156.6	6.1410	
500	0.02080	2997.3	3309.3	6.3452	
550	0.02292	3104.9	3448.8	6.5201	
600	0.02490	3207.9	3581.5	6.6767	
650	0.02679	3308.6	3710.5	6.8204	
700	0.02862	3408.3	3837.6	6.9544	
750	0.03039	3507.8	3963.7	7.0808	
800	0.03213	3607.6	4089.6	7.2009	
850	0.03384	3708.1	4215.6	7.3158	

P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
20,000	(365.80)	(0.005874)	(2296.1)	(2413.6)	(4.9330)
400	0.009946	2617.9	2816.9	5.5521	
450	0.01270	2806.8	3060.8	5.9026	
500	0.01477	2944.1	3239.4	6.1417	
550	0.01655	3063.0	3393.9	6.3355	
600	0.01817	3173.3	3536.7	6.5039	
650	0.01969	3279.2	3672.9	6.6557	
700	0.02113	3382.8	3805.5	6.7955	
750	0.02253	3485.4	3936.0	6.9263	
800	0.02388	3587.8	4065.4	7.0498	
850	0.02521	3690.3	4194.4	7.1673	

P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
25,000	500	0.01112	2886.1	3164.2	5.9616
550	0.01272	3018.6	3336.5	6.1778	
600	0.01413	3137.3	3490.4	6.3593	
650	0.01542	3249.0	3634.5	6.5198	
700	0.01664	3356.8	3773.0	6.6659	
750	0.01781	3462.7	3908.0	6.8012	
800	0.01894	3567.6	4041.1	6.9282	
850	0.02003	3672.3	4173.1	7.0485	

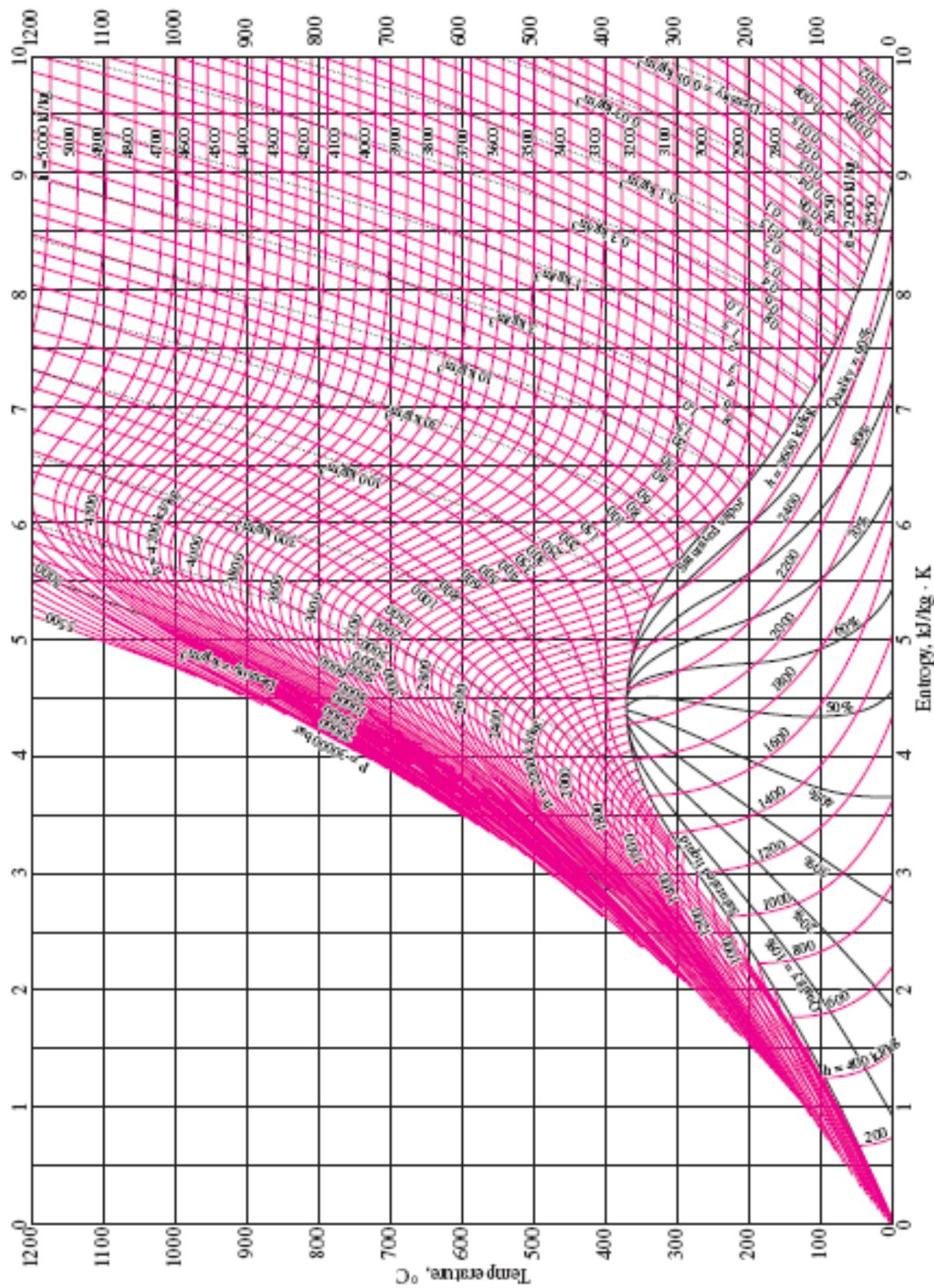
P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
30,000	500	0.008676	2823.2	3083.5	5.7936
550	0.01016	2972.0	3276.8	6.0362	
600	0.01143	3100.1	3443.1	6.2324	
650	0.01258	3218.0	3595.5	6.4022	
700	0.01365	3330.4	3740.1	6.5547	
750	0.01467	3439.7	3879.8	6.6948	
800	0.01564	3547.3	4016.7	6.8254	
850	0.01659	3654.2	4151.8	6.9484	

P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
35,000	600	0.009511	3061.9	3394.7	6.1174
650	0.01056	3186.5	3556.0	6.2971	
700	0.01152	3303.6	3706.9	6.4563	
750	0.01243	3416.5	3851.6	6.6012	
800	0.01330	3526.9	3992.2	6.7355	
850	0.01413	3636.0	4130.4	6.8614	

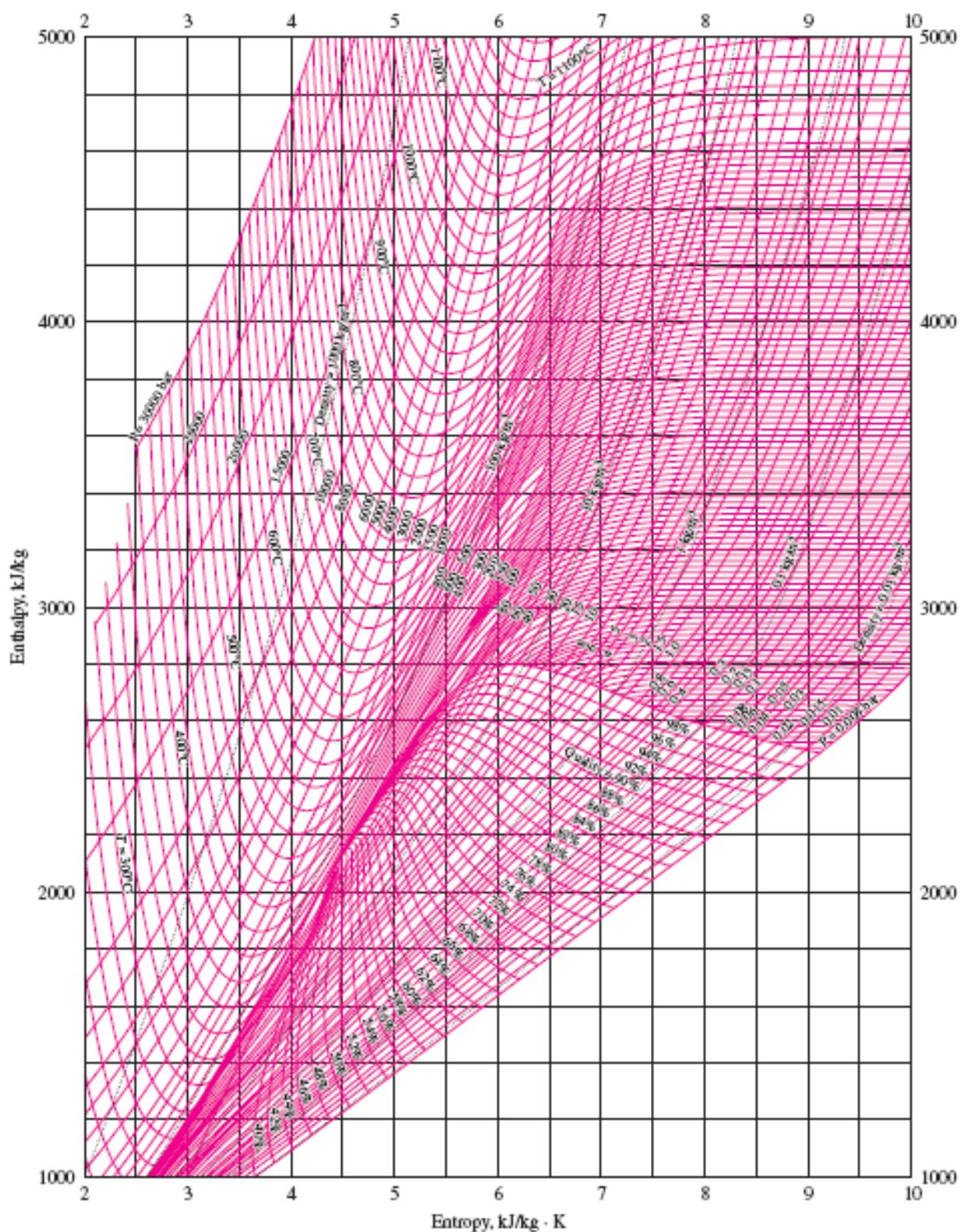
P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
40,000	650	0.009046	3154.5	3516.3	6.2012
700	0.009930	3276.6	3673.8	6.3673	
750	0.01075	3393.1	3823.3	6.5171	
800	0.01154	3506.4	3967.8	6.6551	
850	0.01229	3617.7	4109.2	6.7838	

## APPENDIX 3

**Figure A3.1: Temperature - Entropy Diagram for Water**



**Figure A3.2: Enthalpy - Entropy Diagram for Water**



## APPENDIX 4

**Table A4.1: Properties of Saturated Ammonia – Pressure Table**

P kPa	T °C	v <sub>l</sub> m <sup>3</sup> /kg	v <sub>lg</sub> m <sup>3</sup> /kg	v <sub>g</sub> m <sup>3</sup> /kg	u <sub>l</sub> kJ/kg	u <sub>lg</sub> kJ/kg	u <sub>g</sub> kJ/kg	h <sub>l</sub> kJ/kg	h <sub>lg</sub> kJ/kg	h <sub>g</sub> kJ/kg	s <sub>l</sub> kJ/kg.K	s <sub>lg</sub> kJ/kg.K	s <sub>g</sub> kJ/kg.K
40.0	-50.3	0.001424	2.6792	2.6806	-35.13	1319.7	1284.5	-35.1	1426.8	1391.8	0.0498	6.4025	6.4523
45.0	-48.3	0.001429	2.3997	2.4012	-24.97	1312.0	1287.0	-24.9	1420.0	1395.1	0.0952	6.3153	6.4105
50.0	-46.5	0.001433	2.1745	2.1759	-15.85	1305.1	1289.3	-15.8	1413.9	1398.1	0.1356	6.2376	6.3732
55.0	-44.8	0.001437	1.9892	1.9906	-7.59	1298.9	1291.3	-7.5	1408.3	1400.8	0.172	6.1676	6.3396
60.0	-43.2	0.001441	1.8336	1.8351	-0.00	1293.2	1293.2	0.1	1403.3	1403.3	0.2051	6.1037	6.3088
65.0	-41.8	0.001445	1.7014	1.7028	7.01	1288.0	1295.0	7.1	1398.6	1405.7	0.2355	6.0451	6.2806
70.0	-40.4	0.001448	1.5871	1.5886	13.80	1282.8	1296.6	13.9	1393.9	1407.8	0.2648	5.9897	6.2544
75.0	-39.1	0.001451	1.4879	1.4893	19.93	1278.2	1298.1	20.0	1389.8	1409.8	0.2910	5.9391	6.2301
80.0	-37.9	0.001455	1.4007	1.4021	25.69	1273.9	1299.6	25.8	1385.9	1411.7	0.3156	5.8919	6.2075
85.0	-36.8	0.001458	1.3235	1.3249	31.14	1269.8	1300.9	31.3	1382.3	1413.5	0.3387	5.8475	6.1862
90.0	-35.7	0.001460	1.2545	1.2560	36.30	1265.9	1302.2	36.4	1378.8	1415.2	0.3605	5.8057	6.1661
95.0	-34.6	0.001463	1.1925	1.1940	41.22	1262.2	1303.4	41.4	1375.5	1416.8	0.3812	5.7660	6.1471
100.0	-33.6	0.001466	1.1367	1.1381	45.92	1258.6	1304.6	46.1	1372.3	1418.4	0.4008	5.7284	6.1292
120.0	-29.9	0.001476	0.9582	0.9596	62.87	1245.8	1308.7	63.0	1360.8	1423.8	0.4710	5.5943	6.0654
140.0	-26.7	0.001485	0.8292	0.8307	77.55	1234.6	1312.2	77.8	1350.7	1428.5	0.5310	5.4805	6.0115
160.0	-23.8	0.001493	0.7315	0.7330	90.59	1224.6	1315.2	90.8	1341.7	1432.5	0.5836	5.3813	5.9649
180.0	-21.2	0.001500	0.6549	0.6564	102.36	1215.6	1317.9	102.6	1333.5	1436.1	0.6306	5.2932	5.9237
200.0	-18.9	0.001507	0.5931	0.5946	113.12	1207.2	1320.4	113.4	1325.9	1439.3	0.6731	5.2139	5.8870
220.0	-16.7	0.001513	0.5422	0.5437	123.05	1199.5	1322.5	123.4	1318.8	1442.2	0.7120	5.1418	5.8538
240.0	-14.6	0.001519	0.4995	0.5010	132.30	1192.2	1324.5	132.7	1312.1	1444.8	0.7479	5.0755	5.8230
260.0	-12.7	0.001525	0.4631	0.4646	140.97	1185.4	1326.4	141.4	1305.8	1447.2	0.7813	5.0142	5.7955
280.0	-10.9	0.001531	0.4318	0.4333	149.14	1178.9	1328.1	149.6	1299.8	1449.4	0.8126	4.9571	5.7697
300.0	-9.2	0.001536	0.4045	0.4061	156.87	1172.8	1329.6	157.3	1294.1	1451.5	0.8420	4.9036	5.7451
320.0	-7.6	0.001541	0.3805	0.3821	164.21	1166.9	1331.1	164.7	1288.7	1453.4	0.8697	4.8534	5.7231
340.0	-6.1	0.001546	0.3593	0.3608	171.23	1161.2	1332.5	171.8	1283.4	1455.2	0.8961	4.8058	5.7019
360.0	-4.6	0.001551	0.3403	0.3419	177.93	1155.8	1333.8	178.5	1278.3	1456.8	0.9211	4.7608	5.6819
380.0	-3.2	0.001555	0.3233	0.3248	184.36	1150.6	1335.0	184.9	1273.5	1458.4	0.9450	4.7181	5.6631
400.0	-1.9	0.001560	0.3078	0.3094	190.55	1145.6	1336.1	191.2	1268.7	1459.9	0.9679	4.6772	5.6451
450.0	1.2	0.001570	0.2751	0.2767	205.05	1133.7	1338.7	205.8	1257.5	1463.3	1.0210	4.5828	5.6031
500.0	4.1	0.001580	0.2488	0.2503	218.40	1122.6	1341.0	219.2	1247.0	1466.2	1.0694	4.4974	5.5668
550.0	6.8	0.001589	0.2270	0.2286	230.80	1112.3	1343.1	231.7	1237.1	1468.8	1.1140	4.4193	5.5333
600.0	9.3	0.001598	0.2088	0.2104	242.39	1102.5	1344.9	243.3	1227.8	1471.1	1.1552	4.3474	5.5026
650.0	11.6	0.001607	0.1933	0.1949	253.28	1093.3	1346.6	254.3	1218.9	1473.2	1.1937	4.2806	5.4742
700.0	13.8	0.001615	0.1799	0.1815	263.59	1084.5	1348.1	264.7	1210.4	1475.1	1.2297	4.2182	5.4475
750.0	15.9	0.001622	0.1682	0.1698	273.36	1076.1	1349.4	274.6	1202.2	1476.8	1.2637	4.1597	5.4233
800.0	17.8	0.001630	0.1579	0.1596	282.67	1068.0	1350.7	284.0	1194.4	1478.3	1.2958	4.1045	5.4003
850.0	19.7	0.001637	0.1489	0.1505	291.55	1060.3	1351.8	292.9	1186.8	1479.7	1.3263	4.0523	5.3785
900.0	21.5	0.001645	0.1407	0.1424	300.07	1052.8	1352.9	301.5	1179.5	1481.0	1.3553	4.0027	5.3575
950.0	23.2	0.001651	0.1335	0.1351	308.24	1045.6	1353.8	309.8	1172.4	1482.2	1.3829	3.9555	5.3384
1000.0	24.9	0.001658	0.1269	0.1285	316.10	1038.6	1354.7	317.8	1165.5	1483.2	1.4094	3.9104	5.3198

**TABLE A4.1: Properties of Saturated Ammonia – Pressure Table (Continued)**

P kPa	T °C	v <sub>l</sub> m <sup>3</sup> /kg	v <sub>lg</sub> m <sup>3</sup> /kg	v <sub>g</sub> m <sup>3</sup> /kg	u <sub>l</sub> kJ/kg	u <sub>lg</sub> kJ/kg	u <sub>g</sub> kJ/kg	h <sub>l</sub> kJ/kg	h <sub>lg</sub> kJ/kg	h <sub>g</sub> kJ/kg	s <sub>l</sub> kJ/kg.K	s <sub>lg</sub> kJ/kg.K	s <sub>g</sub> kJ/kg.K
1050.0	26.5	0.001665	0.1209	0.1225	323.69	1031.8	1355.5	325.4	1158.7	1484.2	1.4348	3.8672	5.3020
1100.0	28.0	0.001671	0.1154	0.1171	331.02	1025.2	1356.3	332.9	1152.2	1485.1	1.4592	3.8257	5.2850
1150.0	29.5	0.001678	0.1104	0.1121	338.12	1018.8	1356.9	340.0	1145.8	1485.9	1.4828	3.7858	5.2686
1200.0	30.9	0.001684	0.1058	0.1075	344.98	1012.6	1357.6	347.0	1139.6	1486.6	1.5054	3.7475	5.2530
1250.0	32.3	0.001690	0.1016	0.1033	351.65	1006.5	1358.2	353.8	1133.5	1487.2	1.5273	3.7105	5.2378
1300.0	33.7	0.001696	0.0977	0.0993	358.13	1000.6	1358.7	360.3	1127.5	1487.8	1.5485	3.6747	5.2232
1350.0	35.0	0.001702	0.0940	0.0957	364.42	994.7	1359.2	366.7	1121.7	1488.4	1.5690	3.6401	5.2091
1400.0	36.3	0.001708	0.0906	0.0923	370.57	989.0	1359.6	373.0	1115.9	1488.9	1.5889	3.6065	5.1955
1410.0	37.5	0.001714	0.0874	0.0891	376.55	983.5	1360.0	379.0	1110.2	1489.3	1.6083	3.5739	5.1822
1500.0	38.7	0.001719	0.0845	0.0862	382.39	978.0	1360.4	385.0	1104.7	1489.7	1.6271	3.5423	5.1694
1600.0	41.0	0.001730	0.0791	0.0808	393.65	967.4	1361.0	396.4	1093.9	1490.3	1.6631	3.4817	5.1447
1700.0	43.3	0.001741	0.0743	0.0760	404.44	957.1	1361.5	407.4	1083.4	1490.8	1.6974	3.4240	5.1214
1800.0	45.4	0.001752	0.0700	0.0718	414.79	947.2	1361.9	417.9	1073.1	1491.1	1.7300	3.3691	5.0991
1900.0	47.4	0.001763	0.0662	0.0679	424.75	937.5	1362.2	428.1	1063.2	1491.3	1.7613	3.3166	5.0779
2000.0	49.41	0.001773	0.0627	0.0645	434.37	928.1	1362.4	437.9	1053.4	1491.3	1.7913	3.2662	5.0575

**Table A4.2: Properties of Saturated Ammonia – Temperature Table**

T °C	P kPa	v <sub>l</sub> m <sup>3</sup> /kg	v <sub>lg</sub> m <sup>3</sup> /kg	v <sub>g</sub> m <sup>3</sup> /kg	u <sub>l</sub> kJ/kg	u <sub>lg</sub> kJ/kg	u <sub>g</sub> kJ/kg	h <sub>l</sub> kJ/kg	h <sub>lg</sub> kJ/kg	h <sub>g</sub> kJ/kg	s <sub>l</sub> kJ/kg.K	s <sub>lg</sub> kJ/kg.K	s <sub>g</sub> kJ/kg.K
50	40.7	0.001424	2.6357	2.6371	-33.62	1318.5	1284.9	-33.6	1425.8	1392.3	0.0566	6.3895	6.4461
-48	45.8	0.001429	2.3606	2.3621	-23.45	1310.9	1287.4	-23.4	1419.0	1395.6	0.1020	6.3023	6.4043
-46	51.4	0.001434	2.1192	2.1206	-13.47	1303.3	1289.9	-13.4	1412.3	1398.9	0.1461	6.2173	6.3635
-44	57.5	0.001439	1.9067	1.9081	-3.65	1296.0	1292.3	-3.6	1405.7	1402.1	0.1892	6.1344	6.3236
-42	64.3	0.001444	1.7192	1.7207	6.03	1288.7	1294.7	6.1	1399.2	1405.3	0.2312	6.0533	6.2845
-40	71.6	0.001449	1.5530	1.5545	15.86	1281.3	1297.1	16.0	1392.5	1408.5	0.2736	5.9727	6.2463
-38	79.7	0.001454	1.4060	1.4075	25.33	1274.1	1299.5	25.4	1386.2	1411.6	0.3140	5.8948	6.2089
-36	88.4	0.001460	1.2753	1.2768	34.71	1267.1	1301.8	34.8	1379.9	1414.7	0.3538	5.8185	6.1723
-34	97.9	0.001465	1.1590	1.1604	44.01	1260.1	1304.1	44.2	1373.6	1417.7	0.3928	5.7436	6.1365
-32	108.3	0.001470	1.0551	1.0566	53.25	1253.1	1306.3	53.4	1367.3	1420.7	0.4313	5.6701	6.1014
-30	119.5	0.001476	0.9623	0.9637	62.44	1246.1	1308.6	62.6	1361.1	1423.7	0.4692	5.5977	6.0670
-28	131.6	0.001481	0.8790	0.8805	71.58	1239.2	1310.8	71.8	1354.8	1426.6	0.5067	5.5265	6.0332
-26	144.6	0.001487	0.8043	0.8058	80.70	1232.2	1312.9	80.9	1348.5	1429.5	0.5437	5.4564	6.0001
-24	158.7	0.001492	0.7371	0.7386	89.79	1225.3	1315.0	90.0	1342.2	1432.3	0.5804	5.3873	5.9677
-22	173.9	0.001498	0.6765	0.6780	98.87	1218.3	1317.1	99.1	1335.9	1435.0	0.6167	5.3192	5.9358
-20	190.2	0.001504	0.6219	0.6234	107.94	1211.3	1319.2	108.2	1329.5	1437.7	0.6527	5.2519	5.9046
-18	207.7	0.001509	0.5724	0.5739	117.02	1204.2	1321.2	117.3	1323.1	1440.4	0.6884	5.1855	5.8739
-16	226.4	0.001515	0.5277	0.5292	126.09	1197.1	1323.2	126.4	1316.6	1443.0	0.7238	5.1199	5.8437
-14	246.5	0.001521	0.4870	0.4885	135.18	1190.0	1325.1	135.6	1310.0	1445.6	0.7590	5.0551	5.8141
-12	268.0	0.001527	0.4501	0.4516	144.28	1182.8	1327.1	144.7	1303.4	1448.1	0.7940	4.9910	5.7850
-10	290.9	0.001534	0.4165	0.4180	153.39	1175.5	1328.9	153.8	1296.7	1450.5	0.8288	4.9276	5.7564
-8	315.3	0.001540	0.3859	0.3874	162.53	1168.2	1330.8	163.0	1289.9	1452.9	0.8634	4.8649	5.7282
-6	341.3	0.001546	0.3579	0.3595	171.68	1160.9	1332.6	172.2	1283.1	1455.3	0.8978	4.8028	5.7005
-4	369.0	0.001553	0.3324	0.3340	180.86	1153.5	1334.3	181.4	1276.1	1457.6	0.9320	4.7413	5.6733
-2	398.4	0.001559	0.3090	0.3106	190.06	1146.0	1336.0	190.7	1269.1	1459.8	0.9661	4.6804	5.6465
0	429.6	0.001566	0.2876	0.2892	199.29	1138.4	1337.7	200.0	1262.0	1461.9	1.0000	4.6201	5.6201
2	462.7	0.001573	0.2679	0.2695	208.54	1130.8	1339.3	209.3	1254.8	1464.0	1.0337	4.5603	5.5941
4	497.7	0.001579	0.2498	0.2514	217.81	1123.1	1340.9	218.6	1247.5	1466.1	1.0673	4.5011	5.5684
6	534.8	0.001586	0.2332	0.23481	227.11	1115.4	1342.5	228.0	1240.1	1468.1	1.1008	4.4424	5.5432
8	573.9	0.001594	0.2179	0.2195	236.44	1107.5	1344.0	237.4	1232.6	1470.0	1.1341	4.3842	5.5183
10	615.3	0.001601	0.2038	0.2054	245.79	1099.6	1345.4	246.8	1225.0	1471.8	1.1672	4.3264	5.4937
12	658.9	0.001608	0.1907	0.1923	255.16	1091.7	1346.8	256.2	1217.4	1473.6	1.2002	4.2692	5.4694
14	704.9	0.001615	0.1787	0.1803	264.55	1083.7	1348.2	265.7	1209.6	1475.3	1.2331	4.2124	5.4455
16	753.2	0.001623	0.1675	0.1691	273.97	1075.5	1349.5	275.2	1201.7	1476.9	1.2658	4.1560	5.4218
18	804.1	0.001631	0.1572	0.1588	283.41	1067.4	1350.8	284.7	1193.7	1478.5	1.2984	4.1001	5.3984
20	857.6	0.001638	0.1476	0.1492	292.87	1059.1	1352.0	294.3	1185.7	1479.9	1.3308	4.0446	5.3753
22	913.8	0.001646	0.1387	0.1403	302.35	1050.8	1353.1	303.9	1177.5	1481.3	1.3630	3.9894	5.3524
24	972.7	0.001655	0.1304	0.1320	311.86	1042.4	1354.2	313.5	1169.2	1482.7	1.3951	3.9347	5.3298
26	1034.5	0.001663	0.1227	0.1243	321.38	1033.9	1355.3	323.1	1160.8	1483.9	1.4271	3.8803	5.3074
28	1099.3	0.001671	0.1155	0.1172	330.92	1025.3	1356.2	332.8	1152.3	1485.0	1.4589	3.8263	5.2852

**Table A4.2: Properties of Saturated Ammonia – Temperature Table (Continued)**

T °C	P kPa	v <sub>l</sub> m <sup>3</sup> /kg	v <sub>lg</sub> m <sup>3</sup> /kg	v <sub>g</sub> m <sup>3</sup> /kg	u <sub>l</sub> kJ/kg	u <sub>lg</sub> kJ/kg	u <sub>g</sub> kJ/kg	h <sub>l</sub> kJ/kg	h <sub>lg</sub> kJ/kg	h <sub>g</sub> kJ/kg	s <sub>l</sub> kJ/kg.K	s <sub>lg</sub> kJ/kg.K	s <sub>g</sub> kJ/kg.K
34	1312.2	0.001698	0.0967	0.0984	359.67	999.1	1358.8	361.9	1126.1	1488.0	1.5536	3.6662	5.2198
36	1389.6	0.001707	0.0913	0.0930	369.30	990.2	1359.5	371.7	1117.1	1488.8	1.5849	3.6134	5.1983
38	1470.5	0.001716	0.0862	0.0879	378.96	981.2	1360.2	381.5	1108.0	1489.4	1.6160	3.5609	5.1769
40	1554.9	0.001725	0.0814	0.0831	388.64	972.1	1360.8	391.3	1098.7	1490.0	1.6471	3.5086	5.1557
42	1642.9	0.001735	0.0769	0.0787	398.34	962.9	1361.3	401.2	1089.3	1490.5	1.6780	3.4565	5.1346
44	1734.7	0.001745	0.0727	0.0745	408.08	953.6	1361.7	411.1	1079.8	1490.9	1.7089	3.4047	5.1135
46	1830.2	0.001755	0.0688	0.0706	417.84	944.2	1362.0	421.1	1070.1	1491.2	1.7396	3.3530	5.0926
48	1929.6	0.001766	0.0651	0.0669	427.64	934.7	1362.3	431.0	1060.3	1491.3	1.7703	3.3015	5.0717
50	2033.1	0.001776	0.0616	0.0634	437.47	925.0	1362.5	441.1	1050.3	1491.3	1.8009	3.2501	5.0509

**Table A4.3: Properties of Superheated Ammonia**

P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
50	(-46.5)	(2.1759)	(1289.3)	(1398.1)	(6.3732)
	-40	2.2427	1299.7	1411.9	6.4332
	-30	2.3450	1315.9	1433.1	6.5223
	-20	2.4464	1332.0	1454.3	6.6077
	-10	2.5471	1348.1	1475.5	6.6898
	0	2.6474	1364.3	1496.6	6.7687
	10	2.7472	1380.5	1517.8	6.8449
	20	2.8466	1396.7	1539.1	6.9187
	30	2.9458	1413.1	1560.4	6.9902
	40	3.0447	1429.6	1581.8	7.0596
	50	3.1435	1446.1	1603.3	7.1273
	60	3.2417	1462.8	1624.9	7.1931
	70	3.3406	1479.7	1646.7	7.2576
	80	3.4389	1496.7	1668.6	7.3205
	90	3.5373	1513.8	1690.7	7.3821
	100	3.6355	1531.1	1712.9	7.4425

P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
75	(-39.1)	(1.4893)	(1298.1)	(1409.8)	(6.2301)
	-30	1.5534	1313.3	1429.8	6.3137
	-20	1.6223	1329.8	1451.4	6.4011
	-10	1.6906	1346.2	1473.0	6.4846
	0	1.7583	1362.6	1494.5	6.5648
	10	1.8255	1379.1	1516.0	6.6420
	20	1.8924	1395.5	1537.5	6.7166
	30	1.9591	1412.0	1559.0	6.7887
	40	2.0255	1428.6	1580.5	6.8587
	50	2.0917	1445.3	1602.2	6.9267
	60	2.1574	1462.1	1623.9	6.9929
	70	2.2237	1479.0	1645.8	7.0576
	80	2.2895	1496.0	1667.8	7.1208
	90	2.3553	1513.3	1689.9	7.1826
	100	2.4210	1530.6	1712.2	7.2431

P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
100	(-33.6)	(1.1381)	(1304.6)	(1418.4)	(6.1292)
	-30	1.1573	1310.7	1426.4	6.1424
	-20	1.2102	1327.5	1448.6	6.2518
	-10	1.2622	1344.3	1470.5	6.3369
	0	1.3137	1361.0	1492.4	6.4184
	10	1.3647	1377.7	1514.1	6.4966
	20	1.4153	1394.3	1535.8	6.5719
	30	1.4657	1411.0	1557.5	6.6447
	40	1.5158	1427.7	1579.3	6.7152
	50	1.5658	1444.5	1601.0	6.7837
	60	1.6153	1461.3	1622.9	6.8502
	70	1.6652	1478.3	1644.8	6.9152
	80	1.7148	1495.4	1666.9	6.9786
	90	1.7643	1512.7	1689.1	7.0406
	100	1.8137	1530.1	1711.5	7.1013

P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
125	(-29.1)	(0.9237)	(1309.6)	(1425.1)	(6.0511)
	-20	0.96270	1325.3	1445.6	6.1337
	-10	1.0052	1342.4	1468.0	6.2206
	0	1.0469	1359.4	1490.2	6.3034
	10	1.0881	1376.2	1512.3	6.3826
	20	1.1290	1393.1	1534.2	6.4588
	30	1.1696	1409.9	1556.1	6.5322
	40	1.2100	1426.7	1578.0	6.6032
	50	1.2502	1443.6	1599.9	6.6721
	60	1.2903	1460.6	1621.9	6.7390
	70	1.3302	1477.6	1643.9	6.8042
	80	1.3700	1494.8	1666.0	6.8679
	90	1.4097	1512.1	1688.3	6.9300
	100	1.4494	1529.6	1710.7	6.9909

**Table A4.3: Properties of Superheated Ammonia (Continued)**

P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
<b>150</b>	(-25.2)	(0.7787)	(1313.8)	(1430.6)	(5.9874)
	-20	0.79774	1323.0	1442.6	6.0355
	-10	0.83380	1340.4	1465.5	6.1241
	0	0.86901	1357.7	1488.0	6.2082
	10	0.90377	1374.8	1510.4	6.2885
	20	0.93817	1391.8	1532.6	6.3655
	30	0.97227	1408.8	1554.6	6.4396
	40	1.0062	1425.8	1576.7	6.5111
	50	1.0398	1442.8	1598.7	6.5804
	60	1.0734	1459.8	1620.8	6.6477
	70	1.1068	1476.9	1643.0	6.7132
	80	1.1401	1494.2	1665.2	6.7771
	90	1.1733	1511.5	1687.5	6.8394
	100	1.2065	1529.0	1710.0	6.9005

P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
<b>200</b>	(-18.9)	(0.5946)	(1320.4)	(1439.3)	(5.8870)
	-10	0.6192	1336.4	1460.3	5.9683
	0	0.6466	1354.3	1483.6	6.0553
	10	0.6733	1371.9	1506.5	6.1377
	20	0.6995	1389.3	1529.2	6.2164
	30	0.7255	1406.6	1551.7	6.2919
	40	0.7513	1423.8	1574.1	6.3645
	50	0.7768	1441.0	1596.4	6.4347
	60	0.8023	1458.3	1618.7	6.5027
	70	0.8275	1475.6	1641.1	6.5687
	80	0.8527	1492.9	1663.5	6.6330
	90	0.8778	1510.4	1685.9	6.6958
	100	0.9028	1528.0	1708.5	6.7572

P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
<b>250</b>	( - 13.7)	-0.4821	(1325.5)	(1446.0)	(5.8092)
	-10	0.4905	1332.4	1455.0	5.8436
	0	0.5129	1350.8	1479.1	5.9334
	10	0.5349	1368.9	1502.7	6.0182
	20	0.5563	1386.8	1525.8	6.0987
	30	0.5775	1404.4	1548.8	6.1755
	40.	0.5983	1421.9	1571.5	6.2493
	50	0.6190	1439.3	1594.1	6.3203
	60	0.6396	1456.7	1616.6	6.3891
	70	0.6600	1474.2	1639.2	6.4557
	80	0.6803	1491.6	1661.7	6.5205
	90	0.7005	1509.2	1684.3	6.5837
	100	0.7206	1526.9	1707.0	6.6453

P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
<b>300</b>	(-9.2)	(0.4061)	(1329.6)	(1451.5)	(5.7456)
	0	0.4238	1347.3	1474.4	5.8312
	10	0.4425	1365.9	1498.7	5.9183
	20	0.4608	1384.2	1522.4	6.0008
	30	0.4787	1402.1	1545.7	6.0790
	40	0.4964	1419.9	1568.8	6.1539
	50	0.5138	1437.6	1591.7	6.2259
	60	0.5311	1455.2	1614.5	6.2953
	70	0.5483	1472.8	1637.2	6.3626
	80	0.5653	1490.4	1660.0	6.4279
	90	0.5823	1508.0	1682.7	6.4914
	100	0.5992	1525.8	1705.6	6.5534

**Table A4.3: Properties of Superheated Ammonia (Continued)**

P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
<b>350</b>	(-5.4)	(0.3511)	(1333.1)	(1456.0)	(5.6918)
	0	0.3601	1343.7	1469.7	5.7424
	10	0.3765	1362.8	1494.6	5.8320
	20	0.3926	1381.5	1518.9	5.9164
	30	0.4082	1399.9	1542.7	5.9962
	40	0.4235	1417.9	1566.1	6.0722
	50	0.4386	1435.8	1589.3	6.1451
	60	0.4536	1453.6	1612.4	6.2153
	70	0.4685	1471.3	1635.3	6.2832
	80	0.4832	1489.1	1658.2	6.3490
	90	0.4978	1506.9	1681.1	6.4129
	100	0.5124	1524.7	1704.1	6.4753

P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
<b>400</b>	(-1.9)	(0.3094)	(1336.1)	(1459.9)	(5.6451)
	0	0.3123	1340.0	1464.9	5.6634
	10	0.3270	1359.7	1490.5	5.7556
	20	0.3413	1378.8	1515.4	5.8418
	30	0.3552	1397.5	1539.6	5.9233
	40	0.3688	1415.9	1563.4	6.0005
	50	0.3823	1434.0	1586.9	6.0744
	60	0.3954	1452.0	1610.2	6.1452
	70	0.4086	1469.9	1633.4	6.2138
	80	0.4216	1487.8	1656.4	6.2801
	90	0.4345	1505.7	1679.5	6.3445
	100	0.4473	1523.6	1702.6	6.4072

P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
<b>450</b>	(1.3)	(0.2767)	(1338.7)	(1463.3)	(5.6038)
	10	0.2885	1356.5	1486.3	5.6865
	20	0.3014	1376.1	1511.8	5.7749
	30	0.3141	1395.2	1536.5	5.8579
	40	0.3263	1413.9	1560.7	5.9364
	50	0.3384	1432.2	1584.5	6.0113
	60	0.3502	1450.4	1608.0	6.0829
	70	0.3620	1468.5	1631.4	6.1521
	80	0.3737	1486.5	1654.7	6.2189
	90	0.3852	1504.5	1677.9	6.2837
	100	0.3967	1522.5	1701.1	6.3467

P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
<b>500</b>	(4.1)	(0.2503)	(1341.0)	(1466.2)	(5.6668)
	20	0.2695	1373.3	1508.1	5.7138
	40	0.2923	1411.8	1557.9	5.8783
	60	0.3141	1448.8	1605.9	6.0267
	80	0.3354	1485.2	1652.9	6.1637
	100	0.3562	1521.5	1699.6	6.2923
	120	0.3768	1557.9	1746.3	6.4144
	140	0.3973	1594.8	1793.4	6.5313
	160	0.4176	1632.2	1841.0	6.6437
	180	0.4377	1670.3	1889.2	6.7524

P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
<b>600</b>	(9.3)	(0.2104)	(1344.9)	(1471.1)	(5.5026)
	10	0.2112	1346.5	1473.2	5.5098
	20	0.2215	1367.7	1500.6	5.6049
	40	0.2412	1407.6	1552.3	5.7756
	60	0.2598	1445.5	1601.4	5.9277
	80	0.2778	1482.6	1649.3	6.0672
	100	0.2955	1519.2	1696.5	6.1974
	120	0.3129	1556.0	1743.7	6.3206
	140	0.3300	1593.1	1791.1	6.4382
	160	0.3470	1630.8	1839.0	6.5513
	180	0.3639	1669.0	1887.4	6.6605

P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
<b>700</b>	(13.8)	(0.1815)	(1348.1)	(1475.1)	(5.4479)
	20	0.1872	1361.8	1492.8	5.5090
	40	0.2047	1403.3	1546.5	5.6863
	60	0.2210	1442.2	1596.9	5.8423
	80	0.2367	1479.9	1645.6	5.9842
	100	0.2521	1517.0	1693.5	6.1161
	120	0.2671	1554.1	1741.1	6.2405
	140	0.2820	1591.5	1788.9	6.3589
	160	0.2967	1629.3	1837.0	6.4726
	180	0.3113	1667.7	1885.6	6.5824

**Table A4.3: Properties of Superheated Ammonia (Continued)**

P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
800	(-17.8)	(0.1596)	(1350.7)	(1478.3)	(5.4003)
	20	0.1614	1355.6	1484.7	5.4222
	40	0.1772	1398.8	1540.6	5.6065
	60	0.1919	1438.8	1592.3	5.7668
	80	0.2059	1477.2	1641.9	5.9113
	100	0.2196	1514.8	1690.4	6.0449
	120	0.2328	1552.2	1738.5	6.1704
	140	0.2459	1589.8	1786.5	6.2897
	160	0.2589	1627.8	1834.9	6.4040
	180	0.2717	1666.4	1883.8	6.5142

P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
1000	(24.9)	(0.1285)	(1354.7)	(1483.2)	(5.3198)
	40	0.1387	1389.6	1528.3	5.4672
	60	0.1511	1431.8	1582.9	5.6365
	80	0.1627	1471.6	1634.3	5.7864
	100	0.1739	1510.2	1684.1	5.9236
	120	0.1848	1548.3	1733.1	6.0515
	140	0.1955	1586.4	1781.9	6.1725
	160	0.2060	1624.8	1830.8	6.2881
	180	0.2164	1663.7	1880.1	6.3994

P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
1200	(Tsat=30.9°C)	(0.1075)	(1357.6)	(1486.6)	(5.2530)
	40	0.1129	1379.8	1515.2	5.3458
	60	0.1238	1424.6	1573.1	5.5251
	80	0.1339	1465.9	1626.6	5.6810
	100	0.1435	1505.5	1677.7	5.8219
	120	0.1528	1544.4	1727.7	5.9523
	140	0.1618	1583.0	1777.2	6.0751
	160	0.1707	1621.8	1826.7	6.1921
	180	0.1795	1661.0	1876.5	6.3044

P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
1400	(Tsat=36.3°C)	(0.0923)	(1359.6)	(1488.9)	(5.1955)
	40	0.0943	1369.3	1501.4	5.2357
	60	0.1042	1417.0	1563.0	5.4265
	80	0.1132	1460.1	1618.6	5.5888
	100	0.1217	1500.8	1671.2	5.7337
	120	0.1299	1540.4	1722.2	5.8667
	140	0.1378	1579.5	1772.4	5.9914
	160	0.1455	1618.8	1822.5	6.1098
	180	0.1532	1658.3	1872.8	6.2232

P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
1600	(Tsat=41.0°C)	(0.0808)	(1361.0)	(1490.3)	(5.1447)
	60	0.0895	1409.1	1552.3	5.3366
	80	0.0977	1454.0	1610.4	5.5060
	100	0.1054	1495.9	1664.6	5.6552
	120	0.1127	1536.3	1716.6	5.7911
	140	0.1198	1576.0	1767.7	5.9177
	160	0.1266	1615.7	1818.3	6.0375
	180	0.1334	1655.6	1869.1	6.1520

P kPa	T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
1800	(Tsat=45.4°C)	(0.0718)	(1361.9)	(1491.1)	(5.0991)
	60	0.0780	1400.8	1541.2	5.2531
	80	0.0857	1447.8	1602.0	5.4303
	100	0.0927	1491.0	1657.8	5.5841
	120	0.0993	1532.2	1711.0	5.7229
	140	0.1057	1572.5	1762.8	5.8515
	160	0.1119	1612.6	1814.1	5.9728
	180	0.1180	1652.9	1865.3	6.0884

**Table A4.3: Properties of Superheated Ammonia (Continued)**

P kPa	T °C	v m <sup>3</sup> /kg	u kJ/kg	h kJ/kg	s kJ/kg.K
<b>2000</b>	(49.4)	(0.0645)	(1362.4)	(1491.3)	(5.0575)
	60	0.0687	1392.1	1529.6	5.1742
	80	0.0760	1441.4	1593.3	5.3600
	100	0.0825	1485.9	1650.9	5.5187
	120	0.0886	1528.0	1705.2	5.6606
	140	0.0945	1568.9	1757.9	5.7913
	160	0.1002	1609.5	1809.9	5.9141
	180	0.1057	1650.1	1861.6	6.0308