

**Prince of Songkla University**  
**Faculty of Engineering**

**Mid-Term Examination**

**31 July 2009**

**216-231 ENGINEERING THERMODYNAMIC I**

**Semester 1/2552**

**Time 9:00-12:00**

**Room: S203**

**Directions**

- A4 paper is allowed and can be written only one side of the A4 paper.
- All types of calculator are permitted.
- Attempt all 5 questions.
- The exam paper has 13 pages.
- Use the following values  
 $R = 0.287 \text{ kJ/kg.K}$   
 $\sigma = 5.67 \times 10^{-8} \text{ W/m}^2.\text{K}^4$

**Juntakan Taweekun**  
**Instructor**

<b>Problem</b>	<b>Marks</b>	
1	15	
2	15	
3	15	
4	20	
5	15	
Total	80	

Name \_\_\_\_\_

ID \_\_\_\_\_

Name \_\_\_\_\_ ID \_\_\_\_\_

**Question 1 (15 points)**

Determine the specific volume of superheated water vapor at 10 MPa and 400 °C, using

- a) The ideal-gas equation
- b) The steam table

Name \_\_\_\_\_ ID \_\_\_\_\_

**Question 2 (15 points)**

A 5 cm-diameter spherical ball whose surface is maintained at a temperature of 80 °C is suspended in the middle of a room at 20 °C. If the convection heat transfer coefficient is 15 W/m<sup>2</sup>. °C and the emissivity of the surface is 0.75, determine the total rate of heat transfer from the ball.

Name \_\_\_\_\_ ID \_\_\_\_\_

**Question 3 (15 points)**

A piston-cylinder device contains  $0.02 \text{ m}^3$  of a gas initially at  $150 \text{ kPa}$ . At this state, a linear spring that has a spring constant of  $125 \text{ kN/m}$  is touching the piston but exerting no force on it. Now heat is transferred to the gas, causing the piston to rise and to compress the spring until the volume inside the cylinder doubles. If the cross-sectional area of the piston is  $0.2 \text{ m}^2$ , determine

- a) The final pressure inside the cylinder and also draw the P-V diagram
- b) The total work done by the gas
- c) The fraction of the work done against the spring to compress it

Name \_\_\_\_\_ ID \_\_\_\_\_

**Question 4 (20 points)**

Compute the following table for H<sub>2</sub>O. Show the method how to obtain the values and fill the answers in the table.

T (°C)	P (kPa)	h (kJ/kg)	X	Phase description
	375		0.8	
150		2,000		
	950		0	
90	500			
	800	3,161.7		

Name \_\_\_\_\_ ID \_\_\_\_\_

**Question 5 (15 points)**

A 80 kg man had two hamburgers, french fries (regular), and ice cream (100 ml, 10% fat). Determine how long it will take for him to burn the lunch calories off.

- a) By watching TV
- b) By fast swimming

TABLE A.1 Thermodynamic Properties of Steam

TABLE A.1.1 Saturated Steam: Temperature Table

Temp. Sat. °C	Press. Sat. kPa	Specific Volume $m^3/kg$		Internal Energy $kJ/kg$			Enthalpy $kJ/kg$			Entropy $kJ/kg K$		
		Sat. Liquid $v_f$	Sat. Vapor $v_g$	Sat. Liquid $u_f$	Evap. $u_{fg}$	Sat. Vapor $u_g$	Sat. Liquid $h_f$	Evap. $h_{fg}$	Sat. Vapor $h_g$	Sat. Liquid $s_f$	Evap. $s_{fg}$	Sat. Vapor $s_g$
0.01	0.6113	0.001000	206.14	.00	2375.3	2375.3	.01	2501.3	2501.4	.0000	9.1562	9.1562
5	0.8721	0.001000	147.12	20.97	2361.3	2382.3	20.98	2489.6	2510.6	.0761	8.9496	9.0257
10	1.2276	0.001000	106.38	42.00	2347.2	2389.2	42.01	2477.7	2519.8	.1510	8.7498	8.9008
15	1.7051	0.001001	77.93	62.99	2333.1	2396.1	62.99	2465.9	2528.9	.2245	8.5569	8.7814
20	2.339	0.001002	57.79	83.95	2319.0	2402.9	83.96	2454.1	2538.1	.2966	8.3706	8.6672
25	3.169	0.001003	43.36	104.88	2304.9	2409.8	104.89	2442.3	2547.2	.3674	8.1905	8.5580
30	4.246	0.001004	32.89	125.78	2290.8	2416.6	125.79	2430.5	2556.3	.4369	8.0164	8.4533
35	5.628	0.001006	25.22	146.67	2276.7	2423.4	146.68	2418.6	2565.3	.5053	7.8478	8.3531
40	7.384	0.001008	19.52	167.56	2262.6	2430.1	167.57	2406.7	2574.3	.5725	7.6845	8.2570
45	9.593	0.001010	15.26	188.44	2248.4	2436.8	188.45	2394.8	2583.2	.6387	7.5261	8.1648
50	12.349	0.001012	12.03	209.32	2234.2	2443.5	209.33	2382.7	2592.1	.7038	7.3725	8.0763
55	15.758	0.001015	9.568	230.21	2219.9	2450.1	230.23	2370.7	2600.9	.7679	7.2234	7.9913
60	19.940	0.001017	7.671	251.11	2205.5	2456.6	251.13	2358.5	2609.6	.8312	7.0784	7.9096
65	25.03	0.001020	6.197	272.02	2191.1	2463.1	272.06	2346.2	2618.3	.8935	6.9375	7.8310
70	31.19	0.001023	5.042	292.95	2176.6	2469.6	292.98	2333.8	2626.8	.9549	6.8004	7.7553
75	38.58	0.001026	4.131	313.90	2162.0	2475.9	313.93	2321.4	2635.3	1.0155	6.6669	7.6824
80	47.39	0.001029	3.407	334.86	2147.4	2482.2	334.91	2308.8	2643.7	1.0753	6.5369	7.6122
85	57.83	0.001033	2.828	355.84	2132.6	2488.4	355.90	2296.0	2651.9	1.1343	6.4102	7.5445
90	70.14	0.001036	2.361	376.85	2117.7	2494.5	376.92	2283.2	2660.1	1.1925	6.2866	7.4791
95	84.55	0.001040	1.982	397.88	2102.7	2500.6	397.96	2270.2	2668.1	1.2500	6.1659	7.4159
100	101.35	0.001044	1.6729	418.94	2087.6	2506.5	419.04	2257.0	2676.1	1.3069	6.0480	7.3549
105	120.82	0.001048	1.4194	440.02	2072.3	2512.4	440.15	2243.7	2683.8	1.3630	5.9328	7.2958
110	143.27	0.001052	1.2102	461.14	2057.0	2518.1	461.30	2230.2	2691.5	1.4185	5.8202	7.2387
115	169.06	0.001056	1.0366	482.30	2041.4	2523.7	482.48	2216.5	2699.0	1.4734	5.7100	7.1833
120	198.53	0.001060	0.8919	503.50	2025.8	2529.3	503.71	2202.6	2706.3	1.5276	5.6020	7.1296
125	232.1	0.001065	0.7706	524.74	2009.9	2534.6	524.99	2188.5	2713.5	1.5813	5.4962	7.0775
130	270.1	0.001070	0.6685	546.02	1993.9	2539.9	546.31	2174.2	2720.5	1.6344	5.3925	7.0269
135	313.0	0.001075	0.5822	567.35	1977.7	2545.0	567.69	2159.6	2727.3	1.6870	5.2907	6.9777

TABLE A.1.1 Saturated Steam: Temperature Table (Cont.)

Temp. Sat. °C	Press. Sat. MPa	Specific Volume $m^3/kg$		Internal Energy $kJ/kg$			Enthalpy $kJ/kg$			Entropy $kJ/kg K$		
		Sat. Liquid $v_f$	Sat. Vapor $v_g$	Sat. Liquid $u_f$	Evap. $u_{fg}$	Sat. Vapor $u_g$	Sat. Liquid $h_f$	Evap. $h_{fg}$	Sat. Vapor $h_g$	Sat. Liquid $s_f$	Evap. $s_{fg}$	Sat. Vapor $s_g$
140	0.3613	0.001080	0.5089	588.74	1961.3	2550.0	589.13	2144.7	2733.9	1.7391	5.1908	6.9299
145	0.4154	0.001085	0.4463	610.18	1944.7	2554.9	610.63	2129.6	2740.3	1.7907	5.0926	6.8833
150	0.4758	0.001091	0.3928	631.68	1927.9	2559.5	632.20	2114.3	2746.5	1.8418	4.9960	6.8379
155	0.5431	0.001096	0.3468	653.24	1910.8	2564.1	653.84	2098.6	2752.4	1.8925	4.9010	6.7935
160	0.6178	0.001102	0.3071	674.87	1893.5	2568.4	675.55	2082.6	2758.1	1.9427	4.8075	6.7502
165	0.7005	0.001108	0.2727	696.56	1876.0	2572.5	697.34	2066.2	2763.5	1.9925	4.7153	6.7078
170	0.7917	0.001114	0.2428	718.33	1858.1	2576.5	719.21	2049.5	2768.7	2.0419	4.6244	6.6663
175	0.8920	0.001121	0.2168	740.17	1840.0	2580.2	741.17	2032.4	2773.6	2.0909	4.5347	6.6256
180	1.0021	0.001127	0.19405	762.09	1821.6	2583.7	763.22	2015.0	2778.2	2.1396	4.4461	6.5857
185	1.1227	0.001134	0.17409	784.10	1802.9	2587.0	785.37	1997.1	2782.4	2.1879	4.3586	6.5465
190	1.2544	0.001141	0.15654	806.19	1783.8	2590.0	807.62	1978.8	2786.4	2.2359	4.2720	6.5079
195	1.3978	0.001149	0.14105	828.37	1764.4	2592.8	829.98	1960.0	2790.0	2.2835	4.1863	6.4698
200	1.5538	0.001157	0.12736	850.65	1744.7	2595.3	852.45	1940.7	2793.2	2.3309	4.1014	6.4323
205	1.7230	0.001164	0.11521	873.04	1724.5	2597.5	875.04	1921.0	2796.0	2.3780	4.0172	6.3952
210	1.9062	0.001173	0.10441	895.53	1703.9	2599.5	897.76	1900.7	2798.5	2.4248	3.9337	6.3585
215	2.104	0.001181	0.09479	918.14	1682.9	2601.1	920.62	1879.9	2800.5	2.4714	3.8507	6.3221
220	2.318	0.001190	0.08619	940.87	1661.5	2602.4	943.62	1858.5	2802.1	2.5178	3.7683	6.2861
225	2.548	0.001199	0.07849	963.73	1639.6	2603.3	966.78	1836.5	2803.3	2.5639	3.6863	6.2503
230	2.795	0.001209	0.07158	986.74	1617.2	2603.9	990.12	1813.8	2804.0	2.6099	3.6047	6.2146
235	3.060	0.001219	0.06537	1009.89	1594.2	2604.1	1013.62	1790.5	2804.2	2.6558	3.5233	6.1791
240	3.344	0.001229	0.05976	1033.21	1570.8	2604.0	1037.32	1766.5	2803.8	2.7015	3.4422	6.1437
245	3.648	0.001240	0.05471	1056.71	1546.7	2603.4	1061.23	1741.7	2803.0	2.7472	3.3612	6.1083
250	3.973	0.001251	0.05013	1080.39	1522.0	2602.4	1085.36	1716.2	2801.5	2.7927	3.2802	6.0730
255	4.319	0.001263	0.04598	1104.28	1496.7	2600.9	1109.73	1689.8	2799.5	2.8383	3.1992	6.0375
260	4.688	0.001276	0.04221	1128.39	1470.6	2599.0	1134.37	1662.5	2796.9	2.8838	3.1181	6.0019
265	5.081	0.001289	0.03877	1152.74	1443.9	2596.6	1159.28	1634.4	2793.6	2.9294	3.0368	5.9662
270	5.499	0.001302	0.03564	1177.36	1416.3	2593.7	1184.51	1605.2	2789.7	2.9751	2.9551	5.9301
275	5.942	0.001317	0.03279	1202.25	1387.9	2590.2	1210.07	1574.9	2785.0	3.0208	2.8730	5.8938
280	6.412	0.001332	0.03017	1227.46	1358.7	2586.1	1235.99	1543.6	2779.6	3.0668	2.7903	5.8577
285	6.909	0.001348	0.02777	1253.00	1328.4	2581.4	1262.31	1511.1	2773.3	3.1130	2.7077	5.8209
290	7.434	0.001365	0.02557	1278.92	1297.1	2576.1	1288.77	1477.1	2766.2	3.1594	2.6257	5.7837

295	7.993	0.001384	0.02354	1305.2	1264.7	2569.9	1316.3	1441.8	2758.1	3.2062	2.5375	5.7437
300	8.581	0.001404	0.02167	1332.0	1231.0	2563.0	1344.0	1404.9	2749.0	3.2534	2.4511	5.7045
305	9.202	0.001425	0.019948	1359.3	1195.9	2555.2	1372.4	1366.4	2738.7	3.3010	2.3633	5.6643
310	9.856	0.001447	0.018350	1387.1	1159.4	2546.4	1401.3	1326.0	2727.3	3.3493	2.2737	5.6230
315	10.547	0.001472	0.016867	1415.5	1121.1	2536.6	1431.0	1283.5	2714.5	3.3982	2.1821	5.5804
320	11.274	0.001499	0.015488	1444.6	1080.9	2525.5	1461.5	1238.6	2700.1	3.4480	2.0882	5.5362
330	12.845	0.001561	0.012996	1505.3	993.7	2498.9	1525.3	1140.6	2665.9	3.5507	1.8909	5.4417
340	14.586	0.001638	0.010797	1570.3	894.3	2464.6	1594.2	1027.9	2622.0	3.6594	1.6763	5.3357
350	16.513	0.001740	0.008813	1641.9	776.6	2418.4	1670.6	893.4	2563.9	3.7777	1.4335	5.2112
360	18.651	0.001893	0.006945	1725.2	626.3	2351.5	1760.5	720.5	2481.0	3.9147	1.1379	5.0526
370	21.03	0.002213	0.004925	1844.0	384.5	2228.5	1890.5	441.6	2332.1	4.1106	.6865	4.7971
374.14	22.09	0.003155	0.003155	2029.6	0	2029.6	2099.3	0	2099.3	4.4298	0	4.4298

TABLE A.1.2 Saturated Steam: Pressure Table

Press. Sat. kPa	Temp. Sat. °C	Specific Volume $m^3/kg$		Internal Energy $kJ/kg$			Enthalpy $kJ/kg$			Entropy $kJ/kg K$		
		Sat. Liquid $v_f$	Sat. Vapor $v_g$	Sat. Liquid $u_f$	Evap. $u_{fg}$	Sat. Vapor $u_g$	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	0.001000	206.14	.00	2375.3	2375.3	.01	2501.3	2501.4	.0000	9.1562	9.1562
1.0	6.98	0.001000	129.21	29.30	2355.7	2385.0	29.30	2484.9	2514.2	.1059	8.8697	8.9756
1.5	13.03	0.001001	87.98	54.71	2338.6	2393.3	54.71	2470.6	2525.3	.1957	8.6322	8.8279
2.0	17.50	0.001001	67.00	73.48	2326.0	2399.5	73.48	2460.0	2533.5	.2607	8.4629	8.7237
2.5	21.08	0.001002	54.25	88.48	2315.9	2404.4	88.49	2451.6	2540.0	.3120	8.3311	8.6432
3.0	24.08	0.001003	45.67	101.04	2307.5	2408.5	101.05	2444.5	2545.5	.3545	8.2231	8.5776
4.0	28.96	0.001004	34.80	121.45	2293.7	2415.2	121.46	2432.9	2554.4	.4226	8.0520	8.4746
5.0	32.88	0.001005	28.19	137.81	2282.7	2420.5	137.82	2423.7	2561.5	.4764	7.9187	8.3951
7.5	40.29	0.001008	19.24	168.78	2261.7	2430.5	168.79	2406.0	2574.8	.5764	7.6750	8.2515
10	45.81	0.001010	14.67	191.82	2246.1	2437.9	191.83	2392.8	2584.7	.6493	7.5009	8.1502
15	53.97	0.001014	10.02	225.92	2222.8	2448.7	225.94	2373.1	2599.1	.7549	7.2536	8.0085
20	60.06	0.001017	7.649	251.38	2205.4	2456.7	251.40	2358.3	2609.7	.8320	7.0766	7.9085
25	64.97	0.001020	6.204	271.90	2191.2	2463.1	271.93	2346.3	2618.2	.8931	6.9383	7.8314
30	69.10	0.001022	5.229	289.20	2179.2	2468.4	289.23	2336.1	2625.3	.9439	6.8247	7.7686
40	75.87	0.001027	3.993	317.53	2159.5	2477.0	317.58	2319.2	2636.8	1.0259	6.6441	7.6700
50	81.33	0.001030	3.240	340.44	2143.4	2483.9	340.49	2305.4	2645.9	1.0910	6.5029	7.5939
75	91.78	0.001037	2.217	384.31	2112.4	2496.7	384.39	2278.6	2663.0	1.2130	6.2434	7.4564



TABLE A.1.2 Saturated Steam: Pressure Table (Cont.)

Press. Sat. MPa	Temp. Sat. °C	Specific Volume $m^3/kg$		Internal Energy $kJ/kg$			Enthalpy $kJ/kg$			Entropy $kJ/kg K$		
		Sat. Liquid $v_f$	Sat. Vapor $v_g$	Sat. Liquid $u_f$	Evap. $u_{fg}$	Sat. Vapor $u_g$	Sat. Liquid $h_f$	Evap. $h_{fg}$	Sat. Vapor $h_g$	Sat. Liquid $s_f$	Evap. $s_{fg}$	Sat. Vapor $s_g$
0.100	99.63	0.001043	1.6940	417.36	2088.7	2506.1	417.46	2258.0	2675.5	1.3026	6.0568	7.3594
0.125	105.99	0.001048	1.3749	444.19	2069.3	2513.5	444.32	2241.0	2685.4	1.3740	5.9104	7.2844
0.150	111.37	0.001053	1.1593	466.94	2052.7	2519.7	467.11	2226.5	2693.6	1.4336	5.7897	7.2233
0.175	116.06	0.001057	1.0036	486.80	2038.1	2524.9	486.99	2213.6	2700.6	1.4849	5.6868	7.1717
0.200	120.23	0.001061	0.8857	504.49	2025.0	2529.5	504.70	2201.9	2706.7	1.5301	5.5970	7.1271
0.225	124.00	0.001064	0.7933	520.47	2013.1	2533.6	520.72	2191.3	2712.1	1.5706	5.5173	7.0878
0.250	127.44	0.001067	0.7187	535.10	2002.1	2537.2	535.37	2181.5	2716.9	1.6072	5.4455	7.0527
0.275	130.60	0.001070	0.6573	548.59	1991.9	2540.5	548.89	2172.4	2721.3	1.6408	5.3801	7.0209
0.300	133.55	0.001073	0.6058	561.15	1982.4	2543.6	561.47	2163.8	2725.3	1.6718	5.3201	6.9919
0.325	136.30	0.001076	0.5620	572.90	1973.5	2546.4	573.25	2155.8	2729.0	1.7006	5.2646	6.9652
0.350	138.88	0.001079	0.5243	583.95	1965.0	2548.9	584.33	2148.1	2732.4	1.7275	5.2130	6.9405
0.375	141.32	0.001081	0.4914	594.40	1956.9	2551.3	594.81	2140.8	2735.6	1.7528	5.1647	6.9175
0.40	143.63	0.001084	0.4625	604.31	1949.3	2553.6	604.74	2133.8	2738.6	1.7766	5.1193	6.8959
0.45	147.93	0.001088	0.4140	622.77	1934.9	2557.6	623.25	2120.7	2743.9	1.8207	5.0359	6.8565
0.50	151.86	0.001093	0.3749	639.68	1921.6	2561.2	640.23	2108.5	2748.7	1.8607	4.9606	6.8213
0.55	155.48	0.001097	0.3427	655.32	1909.2	2564.5	655.93	2097.0	2753.0	1.8973	4.8920	6.7893
0.60	158.85	0.001101	0.3157	669.90	1897.5	2567.4	670.56	2086.3	2756.8	1.9312	4.8288	6.7600
0.65	162.01	0.001104	0.2927	683.56	1886.5	2570.1	684.28	2076.0	2760.3	1.9627	4.7703	6.7331
0.70	164.97	0.001108	0.2729	696.44	1876.1	2572.5	697.22	2066.3	2763.5	1.9922	4.7158	6.7080
0.75	167.78	0.001112	0.2556	708.64	1866.1	2574.7	709.47	2057.0	2766.4	2.0200	4.6647	6.6847
0.80	170.43	0.001115	0.2404	720.22	1856.6	2576.8	721.11	2048.0	2769.1	2.0462	4.6166	6.6628
0.85	172.96	0.001118	0.2270	731.27	1847.4	2578.7	732.22	2039.4	2771.6	2.0710	4.5711	6.6421
0.90	175.38	0.001121	0.2150	741.83	1838.6	2580.5	742.83	2031.1	2773.9	2.0946	4.5280	6.6226
0.95	177.69	0.001124	0.2042	751.95	1830.2	2582.1	753.02	2023.1	2776.1	2.1172	4.4869	6.6041
1.00	179.91	0.001127	0.19444	761.68	1822.0	2583.6	762.81	2015.3	2778.1	2.1387	4.4478	6.5865
1.10	184.09	0.001133	0.17753	780.09	1806.3	2586.4	781.34	2000.4	2781.7	2.1792	4.3744	6.5536
1.20	187.99	0.001139	0.16333	797.29	1791.5	2588.8	798.65	1986.2	2784.8	2.2166	4.3067	6.5233
1.30	191.64	0.001144	0.15125	813.44	1777.5	2591.0	814.93	1972.7	2787.6	2.2515	4.2438	6.4953
1.40	195.07	0.001149	0.14084	828.70	1764.1	2592.8	830.30	1959.7	2790.0	2.2842	4.1850	6.4693
1.50	198.32	0.001154	0.13177	843.16	1751.3	2594.5	844.89	1947.3	2792.2	2.3150	4.1298	6.4448
1.60	201.37	0.001159	0.12389	856.46	1738.4	2597.8	858.50	1935.9	2796.4	2.3851	4.0044	6.3896

2.00	212.42	0.001177	0.09963	906.44	1693.8	2600.3	908.79	1890.7	2799.5	2.4474	3.8935	6.3409
2.25	218.45	0.001187	0.08875	933.83	1668.2	2602.0	936.49	1865.2	2801.7	2.5035	3.7937	6.2972
2.5	223.99	0.001197	0.07998	959.11	1644.0	2603.1	962.11	1841.0	2803.1	2.5547	3.7028	6.2575
3.0	233.90	0.001217	0.06668	1004.78	1599.3	2604.1	1008.42	1795.7	2804.2	2.6457	3.5412	6.1869
3.5	242.60	0.001235	0.05707	1045.43	1558.3	2603.7	1049.75	1753.7	2803.4	2.7253	3.4000	6.1253
4	250.40	0.001252	0.04978	1082.31	1520.0	2602.3	1087.31	1714.1	2801.4	2.7964	3.2737	6.0701
5	263.99	0.001286	0.03944	1147.81	1449.3	2597.1	1154.23	1640.1	2794.3	2.9202	3.0532	5.9734
6	275.64	0.001319	0.03244	1205.44	1384.3	2589.7	1213.35	1571.0	2784.3	3.0267	2.8625	5.8892
7	285.88	0.001351	0.02737	1257.55	1323.0	2580.5	1267.00	1505.1	2772.1	3.1211	2.6922	5.8133
8	295.06	0.001384	0.02352	1305.57	1264.2	2569.8	1316.64	1441.3	2758.0	3.2068	2.5364	5.7432
9	303.40	0.001418	0.02048	1350.51	1207.3	2557.8	1363.26	1378.9	2742.1	3.2858	2.3915	5.6772
10	311.06	0.001452	0.018026	1393.04	1151.4	2544.4	1407.56	1317.1	2724.7	3.3596	2.2544	5.6141
11	318.15	0.001489	0.015987	1433.7	1096.0	2529.8	1450.1	1255.5	2705.6	3.4295	2.1233	5.5527
12	324.75	0.001527	0.014263	1473.0	1040.7	2513.7	1491.3	1193.6	2684.9	3.4962	1.9962	5.4924
13	330.93	0.001567	0.012780	1511.1	985.0	2496.1	1531.5	1130.7	2662.2	3.5606	1.8718	5.4323
14	336.75	0.001611	0.011485	1548.6	928.2	2476.8	1571.1	1066.5	2637.6	3.6232	1.7485	5.3717
15	342.24	0.001658	0.010337	1585.6	869.8	2455.5	1610.5	1000.0	2610.5	3.6848	1.6249	5.3098
16	347.44	0.001711	0.009306	1622.7	809.0	2431.7	1650.1	930.6	2580.6	3.7451	1.4994	5.2455
17	352.37	0.001770	0.008364	1660.2	744.8	2405.0	1690.3	856.9	2547.2	3.8079	1.3698	5.1777
18	357.06	0.001840	0.007489	1698.9	675.4	2374.3	1732.0	777.1	2509.1	3.8715	1.2329	5.1044
19	361.54	0.001924	0.006657	1739.9	598.1	2338.1	1776.5	688.0	2464.5	3.9388	1.0839	5.0228
20	365.81	0.002036	0.005834	1785.6	507.5	2293.0	1826.3	583.4	2409.7	4.0139	0.9130	4.9269
21	369.89	0.002207	0.004952	1842.1	388.5	2230.6	1888.4	446.2	2334.6	4.1075	0.6938	4.8013
22	373.80	0.002742	0.003568	1961.9	125.2	2087.1	2022.2	143.4	2165.6	4.3110	0.2216	4.5327
22.09	374.14	0.003155	0.003155	2029.6	0	2029.6	2099.3	0	2099.3	4.4298	0	4.4298

TABLE A.1.3 Superheated Vapor

T	v	u	h	s	v	u	h	s	v	u	h	s
	P = 0.010 MPa (45.81)				P = 0.050 MPa (81.33)				P = 0.10 MPa (99.63)			
Sat.	14.674	2437.9	2584.7	8.1502	3.240	2483.9	2645.9	7.5939	1.6940	2506.1	2675.5	7.3594
50	14.869	2443.9	2592.6	8.1749					1.6958	2506.7	2676.2	7.3614
100	17.196	2515.5	2687.5	8.4479	3.418	2511.6	2682.5	7.6947	1.9364	2582.8	2776.4	7.6134
150	19.512	2587.9	2783.0	8.6882	3.889	2585.6	2780.1	7.9401	2.172	2658.1	2875.3	7.8343
200	21.825	2661.3	2879.5	8.9038	4.356	2659.9	2877.7	8.1580	2.406	2733.7	2974.3	8.0333
250	24.136	2736.0	2977.3	9.1002	4.820	2735.0	2976.0	8.3556	2.639	2810.4	3074.3	8.2158
300	26.445	2812.1	3076.5	9.2813	5.284	2811.3	3075.5	8.5373	3.103	2967.9	3278.2	8.5435
400	31.063	2968.9	3279.6	9.6077	6.209	2968.5	3278.9	8.8642	3.565	3131.6	3488.1	8.8342
500	35.679	3132.3	3489.1	9.8978	7.134	3132.0	3488.7	9.1546	4.028	3301.9	3704.7	9.0976
600	40.295	3302.5	3705.4	10.1608	8.057	3302.2	3705.1	9.4178	4.490	3479.2	3928.2	9.3398
700	44.911	3479.6	3928.7	10.4028	8.981	3479.4	3928.5	9.6599	4.952	3663.5	4158.6	9.5652
800	49.526	3663.8	4159.0	10.6281	9.904	3663.6	4158.9	9.8852	5.414	3854.8	4396.1	9.7767
900	54.141	3855.0	4396.4	10.8396	10.828	3854.9	4396.3	10.0967	5.875	4052.8	4640.3	9.9764
1000	58.757	4053.0	4640.6	11.0393	11.751	4052.9	4640.5	10.2964	6.337	4257.3	4891.0	10.1659
1100	63.372	4257.5	4891.2	11.2287	12.674	4257.4	4891.1	10.4859	6.799	4467.7	5147.6	10.3463
1200	67.987	4467.9	5147.8	11.4091	13.597	4467.8	5147.7	10.6662	7.260	4683.5	5409.5	10.5183
1300	72.602	4683.7	5409.7	11.5811	14.521	4683.6	5409.6	10.8382				
	P = 0.20 MPa (120.23)				P = 0.30 MPa (133.55)				P = 0.40 MPa (143.63)			
Sat.	.8857	2529.5	2706.7	7.1272	.6058	2543.6	2725.3	6.9919	.4625	2553.6	2738.6	6.8959
150	.9596	2576.9	2768.8	7.2795	.6339	2570.8	2761.0	7.0778	.4708	2564.5	2752.8	6.9299
200	1.0803	2654.4	2870.5	7.5066	.7163	2650.7	2865.6	7.3115	.5342	2646.8	2860.5	7.1706
250	1.1988	2731.2	2971.0	7.7086	.7964	2728.7	2967.6	7.5166	.5951	2726.1	2964.2	7.3789
300	1.3162	2808.6	3071.8	7.8926	.8753	2806.7	3069.3	7.7022	.6548	2804.8	3066.8	7.5662
400	1.5493	2966.7	3276.6	8.2218	1.0315	2965.6	3275.0	8.0330	.7726	2964.4	3273.4	7.8985
500	1.7814	3130.8	3487.1	8.5133	1.1867	3130.0	3486.0	8.3251	.8893	3129.2	3484.9	8.1913
600	2.013	3301.4	3704.0	8.7770	1.3414	3300.8	3703.2	8.5892	1.0055	3300.2	3702.4	8.4558
700	2.244	3478.8	3927.6	9.0194	1.4957	3478.4	3927.1	8.8319	1.1215	3477.9	3926.5	8.6987
800	2.475	3663.1	4158.2	9.2449	1.6499	3662.9	4157.8	9.0576	1.2372	3662.4	4157.3	8.9244
900	2.706	3854.5	4395.8	9.4566	1.8041	3854.2	4395.4	9.2692	1.3529	3853.9	4395.1	9.1362
1000	2.937	4052.5	4640.0	9.6563	1.9581	4052.3	4639.7	9.4690	1.4685	4052.0	4639.4	9.3360
1100	3.168	4257.0	4890.7	9.8458	2.1121	4256.8	4890.4	9.6585	1.5840	4256.5	4890.2	9.5256
1200	3.399	4467.5	5147.3	10.0262	2.2661	4467.2	5147.1	9.8389	1.6996	4467.0	5146.8	9.7060
1300	3.630	4683.2	5409.3	10.1982	2.4201	4683.0	5409.0	10.0110	1.8151	4682.8	5408.8	9.8780

	P = 0.50 MPa (151.86)				P = 0.60 MPa (158.85)				P = 0.80 MPa (170.43)			
Sat.	.3749	2561.2	2748.7	6.8213	.3157	2567.4	2756.8	6.7600	.2404	2576.8	2769.1	6.6628
200	.4249	2642.9	2855.4	7.0592	.3520	2638.9	2850.1	6.9665	.2608	2630.6	2839.3	6.8158
250	.4744	2723.5	2960.7	7.2709	.3938	2720.9	2957.2	7.1816	.2931	2715.5	2950.0	7.0384
300	.5226	2802.9	3064.2	7.4599	.4344	2801.0	3061.6	7.3724	.3241	2797.2	3056.5	7.2328
350	.5701	2882.6	3167.7	7.6329	.4742	2881.2	3165.7	7.5464	.3544	2878.2	3161.7	7.4089
400	.6173	2963.2	3271.9	7.7938	.5137	2962.1	3270.3	7.7079	.3843	2959.7	3267.1	7.5716
500	.7109	3128.4	3483.9	8.0873	.5920	3127.6	3482.8	8.0021	.4433	3126.0	3480.6	7.8673
600	.8041	3299.6	3701.7	8.3522	.6697	3299.1	3700.9	8.2674	.5018	3297.9	3699.4	8.1333
700	.8969	3477.5	3925.9	8.5952	.7472	3477.0	3925.3	8.5107	.5601	3476.2	3924.2	8.3770
800	.9896	3662.1	4156.9	8.8211	.8245	3661.8	4156.5	8.7367	.6181	3661.1	4155.6	8.6033
900	1.0822	3853.6	4394.7	9.0329	.9017	3853.4	4394.4	8.9486	.6761	3852.8	4393.7	8.8153
1000	1.1747	4051.8	4639.1	9.2328	.9788	4051.5	4638.8	9.1485	.7340	4051.0	4638.2	9.0153
1100	1.2672	4256.3	4889.9	9.4224	1.0559	4256.1	4889.6	9.3381	.7919	4255.6	4889.1	9.2050
1200	1.3596	4466.8	5146.6	9.6029	1.1330	4466.5	5146.3	9.5185	.8497	4466.1	5145.9	9.3855
1300	1.4521	4682.5	5408.6	9.7749	1.2101	4682.3	5408.3	9.6906	.9076	4681.8	5407.9	9.5575
	P = 1.00 MPa (179.91)				P = 1.20 MPa (187.99)				P = 1.40 MPa (195.07)			
Sat.	.19444	2583.6	2778.1	6.5865	.16333	2588.8	2784.8	6.5233	.14084	2592.8	2790.0	6.4693
200	.2060	2621.9	2827.9	6.6940	.16930	2612.8	2815.9	6.5898	.14302	2603.1	2803.3	6.4975
250	.2327	2709.9	2942.6	6.9247	.19234	2704.2	2935.0	6.8294	.16350	2698.3	2927.2	6.7467
300	.2579	2793.2	3051.2	7.1229	.2138	2789.2	3045.8	7.0317	.18228	2785.2	3040.4	6.9534
350	.2825	2875.2	3157.7	7.3011	.2345	2872.2	3153.6	7.2121	.2003	2869.2	3149.5	7.1360
400	.3066	2957.3	3263.9	7.4651	.2548	2954.9	3260.7	7.3774	.2178	2952.5	3257.5	7.3026
500	.3541	3124.4	3478.5	7.7622	.2946	3122.8	3476.3	7.6759	.2521	3121.1	3474.1	7.6027
600	.4011	3296.8	3697.9	8.0290	.3339	3295.6	3696.3	7.9435	.2860	3294.4	3694.8	7.8710
700	.4478	3475.3	3923.1	8.2731	.3729	3474.4	3922.0	8.1881	.3195	3473.6	3920.8	8.1160
800	.4943	3660.4	4154.7	8.4996	.4118	3659.7	4153.8	8.4148	.3528	3659.0	4153.0	8.3431
900	.5407	3852.2	4392.9	8.7118	.4505	3851.6	4392.2	8.6272	.3861	3851.1	4391.5	8.5556
1000	.5871	4050.5	4637.6	8.9119	.4892	4050.0	4637.0	8.8274	.4192	4049.5	4636.4	8.7559
1100	.6335	4255.1	4888.6	9.1017	.5278	4254.6	4888.0	9.0172	.4524	4254.1	4887.5	8.9457
1200	.6798	4465.6	5145.4	9.2822	.5665	4465.1	5144.9	9.1977	.4855	4464.7	5144.4	9.1262
1300	.7261	4681.3	5407.4	9.4543	.6051	4680.9	5407.0	9.3698	.5186	4680.4	5406.5	9.2984

TABLE A.1.3 Superheated Vapor (Cont.)

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T	v	u	h	s	v	u	h	s	v	u	h	s
<b>P = 9.0 MPa (303.40)</b>				<b>P = 10.0 MPa (311.06)</b>				<b>P = 12.5 MPa (327.89)</b>				
Sat.	.020 48	2557.8	2742.1	5.6772	.018 026	2544.4	2724.7	5.6141	.013 495	2505.1	2673.8	5.4624
325	.023 27	2646.6	2856.0	5.8712	.019 861	2610.4	2809.1	5.7568				
350	.02580	2724.4	2956.6	6.0361	.02242	2699.2	2923.4	5.9443	.016126	26246	2826.2	5.7118
400	.02993	2848.4	3117.8	6.2854	.02641	2832.4	3096.5	6.2120	.02000	2789.3	3039.3	6.0417
450	.033 50	2955.2	3256.6	6.4844	.029 75	2947.4	3240.9	6.4190	.022 99	2912.5	3199.8	6.2719
500	.036 77	3055.2	3386.1	6.6576	.032 79	3045.8	3373.7	6.5966	.025 60	3021.7	3341.8	6.4618
550	.039 87	3152.2	3511.0	6.8142	.035 64	3144.6	3500.9	6.7561	.028 01	3125.0	3475.2	6.6290
600	.04285	3248.1	3633.7	6.9589	.03837	3241.7	3625.3	6.9029	.03029	3225.4	3604.0	6.7810
650	.045 74	3343.6	3755.3	7.0943	.04101	3338.2	3748.2	7.0398	.032 48	3324.4	3730.4	6.9218
700	.048 57	3439.3	3876.5	7.2221	.043 58	3434.7	3870.5	7.1687	.034 60	3422.9	3855.3	7.0536
800	.054 09	3632.5	4119.3	7.4596	.048 59	3628.9	4114.8	7.4077	.038 69	3620.0	4103.6	7.2965
900	.059 50	3829.2	4364.8	7.6783	.053 49	3826.3	4361.2	7.6272	.042 67	3819.1	4352.5	7.5182
1000	.06485	4030.3	4614.0	7.8821	.05832	4027.8	4611.0	7.8315	.04658	4021.6	4603.8	7.7237
1100	.070 16	4236.3	4867.7	8.0740	.063 12	4234.0	4865.1	8.0237	.05045	4228.2	4858.8	7.9165
1200	.07544	4447.2	5126.2	8.2556	.06789	4444.9	5123.8	8.2055	.05430	4439.3	5118.0	8.0987
1300	.080 72	4662.7	5389.2	8.4284	.072 65	4460.5	5387.0	8.3783	.058 13	4654.8	5381.4	8.2717
<b>P = 15.0 MPa (342.24)</b>				<b>P = 17.5 MPa (354.75)</b>				<b>P = 20.0 MPa (365.81)</b>				
Sat.	.010 337	2455.5	2610.5	5.3098	.007 920	2390.2	2528.8	5.1419	.005 834	2293.0	2409.7	4.9269
350	.011470	2520.4	2692.4	5.4421								
400	.015649	2740.7	2975.5	5.8811	.012447	2685.0	2902.9	5.7213	.009942	2619.3	2818.1	5.5540
450	.018 445	2879.5	3156.2	6.1404	.015 174	2844.2	3109.7	6.0184	.012 695	2806.2	3060.1	5.9017
500	.020 80	2996.6	3308.6	6.3443	.017 358	2970.3	3274.1	6.2383	.014 768	2942.9	3238.2	6.1401
550	.022 93	3104.7	3448.6	6.5199	.019 288	3083.9	3421.4	6.4230	.016 555	3062.4	3393.5	6.3348
600	.02491	3208.6	3582.3	6.6776	.02106	3191.5	3560.1	6.5866	.018 178	3174.0	3537.6	6.5048
650	.026 80	3310.3	3712.3	6.8224	.022 74	3296.0	3693.9	6.7357	.019 693	3281.4	3675.3	6.6582
700	.02861	3410.9	3840.1	6.9572	.02434	3398.7	3824.6	6.8736	.021 13	3386.4	3809.0	6.7993
800	.032 10	3610.9	4092.4	7.2040	.027 38	3601.8	4081.1	7.1244	.023 85	3592.7	4069.7	7.0544
900	.03546	3811.9	4343.8	7.4279	.03031	3804.7	4335.1	7.3507	.02645	3797.5	4326.4	7.2830
1000	.038 75	4015.4	4596.6	7.6348	.033 16	4009.3	4589.5	7.5589	.028 97	4003.1	4582.5	7.4925
1100	.04200	4222.6	4852.6	7.8283	.03597	4216.9	4846.4	7.7531	.03145	4211.3	4840.2	7.6874
1200	.045 23	4433.8	5112.3	8.0108	.038 76	4428.3	5106.6	7.9360	.033 91	4422.8	5101.0	7.8707
1300	.04845	4649.1	5376.0	8.1840	.04154	4643.5	5370.5	8.1093	.03636	4638.0	5365.1	8.0442

	<b>P = 25.0 MPa</b>				<b>P = 30.0 MPa</b>				<b>P = 35.0 MPa</b>			
375	.0019731	1798.7	1848.0	4.0320	.0017892	1737.8	1791.5	3.9305	.0017003	1702.9	1762.4	3.8722
400	.006004	2430.1	2580.2	5.1418	.002790	2067.4	2151.1	4.4728	.002100	1914.1	1987.6	4.2126
425	.007881	2609.2	2806.3	5.4723	.005303	2455.1	2614.2	5.1504	.003428	2253.4	2373.4	4.7747
450	.009162	2720.7	2949.7	5.6744	.006735	2619.3	2821.4	5.4424	.004961	2498.7	2672.4	5.1962
500	.011123	2884.3	3162.4	5.9592	.008678	2820.7	3081.1	5.7905	.006927	2751.9	2994.4	5.6282
550	.012724	3017.5	3335.6	6.1765	.010168	2970.3	3275.4	6.0342	.008345	2921.0	3213.0	5.9026
600	.014137	3137.9	3491.4	6.3602	.011446	3100.5	3443.9	6.2331	.009527	3062.0	3395.5	6.1179
650	.015433	3251.6	3637.4	6.5229	.012596	3221.0	3598.9	6.4058	.010575	3189.8	3559.9	6.3010
700	.016646	3361.3	3777.5	6.6707	.013661	3335.8	3745.6	6.5606	.011533	3309.8	3713.5	6.4631
800	.018912	3574.3	4047.1	6.9345	.015623	3555.5	4024.2	6.8332	.013278	3536.7	4001.5	6.7450
900	.021045	3783.0	4309.1	7.1680	.017448	3768.5	4291.9	7.0718	.014883	3754.0	4274.9	6.9886
1000	.02310	3990.9	4568.5	7.3802	.019196	3978.8	4554.7	7.2867	.016410	3966.7	4541.1	7.2064
1100	.02512	4200.2	4828.2	7.5765	.020903	4189.2	4816.3	7.4845	.017895	4178.3	4804.6	7.4057
1200	.02711	4412.0	5089.9	7.7605	.022589	4401.3	5079.0	7.6692	.019360	4390.7	5068.3	7.5910
1300	.02910	4626.9	5354.4	7.9342	.024266	4616.0	5344.0	7.8432	.020815	4605.1	5333.6	7.7653
	<b>P=40.0 MPa</b>				<b>P=50.0 MPa</b>				<b>P=60.0 MPa</b>			
375	.0016407	1677.1	1742.8	3.8290	.0015594	1638.6	1716.6	3.7639	.0015028	1609.4	1699.5	3.7141
400	.0019077	1854.6	1930.9	4.1135	.0017309	1788.1	1874.6	4.0031	.0016335	1745.4	1843.4	3.9318
425	.002532	2096.9	2198.1	4.5029	.002007	1959.7	2060.0	4.2734	.0018165	1892.7	2001.7	4.1626
450	.003693	2365.1	2512.8	4.9459	.002486	2159.6	2284.0	4.5884	.002085	2053.9	2179.0	4.4121
500	.005622	2678.4	2903.3	5.4700	.003892	2525.5	2720.1	5.1726	.002956	2390.6	2567.9	4.9321
550	.006984	2869.7	3149.1	5.7785	.005118	2763.6	3019.5	5.5485	.003956	2658.8	2896.2	5.3441
600	.008094	3022.6	3346.4	6.0114	.006112	2942.0	3247.6	5.8178	.004834	2861.1	3151.2	5.6452
650	.009063	3158.0	3520.6	6.2054	.006966	3093.5	3441.8	6.0342	.005595	3028.8	3364.5	5.8829
700	.009941	3283.6	3681.2	6.3750	.007727	3230.5	3616.8	6.2189	.006272	3177.2	3553.5	6.0824
800	.011523	3517.8	3978.7	6.6662	.009076	3479.8	3933.6	6.5290	.007459	3441.5	3889.1	6.4109
900	.012962	3739.4	4257.9	6.9150	.010283	3710.3	4224.4	6.7882	.008508	3681.0	4191.5	6.6805
1000	.014324	3954.6	4527.6	7.1356	.011411	3930.5	4501.1	7.0146	.009480	3906.4	4475.2	6.9127
1100	.015642	4167.4	4793.1	7.3364	.012496	4145.7	4770.5	7.2184	.010409	4124.1	4748.6	7.1195
1200	.016940	4380.1	5057.7	7.5224	.013561	4359.1	5037.2	7.4058	.011317	4338.2	5017.2	7.3083
1300	.018229	4594.3	5323.5	7.6969	.014616	4572.8	5303.6	7.5808	.012215	4551.4	5284.3	7.4837

TABLE A.1.4 Compressed Liquid

T	v	u	h	s	v	u	h	s	v	u	h	s
	P = 5 MPa (263.99)				P = 10 MPa (311.06)				P = 15 MPa (342.24)			
Sat.	.0012859	1147.8	1154.2	2.9202	.0014524	1393.0	1407.6	3.3596	.0016581	1585.6	1610.5	3.6848
0	.0009977	.04	5.04	.0001	.0009952	.09	10.04	.0002	.0009928	.15	15.05	.0004
20	.0009995	83.65	88.65	.2956	.0009972	83.36	93.33	.2945	.0009950	83.06	97.99	.2934
40	.0010056	166.95	171.97	.5705	.0010034	166.35	176.38	.5686	.0010013	165.76	180.78	.5666
60	.0010149	250.23	255.30	.8285	.0010127	249.36	259.49	.8258	.0010105	248.51	263.67	.8232
80	.0010268	333.72	338.85	1.0720	.0010245	332.59	342.83	1.0688	.0010222	331.48	346.81	1.0656
100	.0010410	417.52	422.72	1.3030	.0010385	416.12	426.50	1.2992	.0010361	414.74	430.28	1.2955
120	.0010576	501.80	507.09	1.5233	.0010549	500.08	510.64	1.5189	.0010522	498.40	514.19	1.5145
140	.0010768	586.76	592.15	1.7343	.0010737	584.68	595.42	1.7292	.0010707	582.66	598.72	1.7242
160	.0010988	672.62	678.12	1.9375	.0010953	670.13	681.08	1.9317	.0010918	667.71	684.09	1.9260
180	.0011240	759.63	765.25	2.1341	.0011199	756.65	767.84	2.1275	.0011159	753.76	770.50	2.1210
200	.0011530	848.1	853.9	2.3255	.0011480	844.5	856.0	2.3178	.0011433	841.0	858.2	2.3104
220	.0011866	938.4	944.4	2.5128	.0011805	934.1	945.9	2.5039	.0011748	929.9	947.5	2.4953
240	.0012264	1031.4	1037.5	2.6979	.0012187	1026.0	1038.1	2.6872	.0012114	1020.8	1039.0	2.6771
260	.0012749	1127.9	1134.3	2.8830	.0012645	1121.1	1133.7	2.8699	.0012550	1114.6	1133.4	2.8576
280					.0013216	1220.9	1234.1	3.0548	.0013084	1212.5	1232.1	3.0393
300					.0013972	1328.4	1342.3	3.2469	.0013770	1316.6	1337.3	3.2260
320									.0014724	1431.1	1453.2	3.4247
340									.0016311	1567.5	1591.9	3.6546

	P=20 MPa(365.81)				P=30 MPa				P=50 MPa			
Sat.	.002036	1785.6	1826.3	4.0139	.0009856	.25	29.82	.0001	.0009766	.20	49.03	-.0014
0	.0009904	.19	20.01	.0004	.0009886	82.17	111.84	.2899	.0009804	81.00	130.02	.2848
20	.0009928	82.77	102.62	.2923	.0009886	82.17	111.84	.2899	.0009804	81.00	130.02	.2848
40	.0009992	165.17	185.16	.5646	.0009951	164.04	193.89	.5607	.0009872	161.86	211.21	.5527
60	.0010084	247.68	267.85	.8206	.0010042	246.06	276.19	.8154	.0009962	242.98	292.79	.8052
80	.0010199	330.40	350.80	1.0624	.0010156	328.30	358.77	1.0561	.0010073	324.34	374.70	1.0440
100	.0010337	413.39	434.06	1.2917	.0010290	410.78	441.66	1.2844	.0010201	405.88	456.89	1.2703
120	.0010496	496.76	517.76	1.5102	.0010445	493.59	524.93	1.5018	.0010348	487.65	539.39	1.4857
140	.0010678	580.69	602.04	1.7193	.0010621	576.88	608.75	1.7098	.0010515	569.77	622.35	1.6915
160	.0010885	665.35	687.12	1.9204	.0010821	660.82	693.28	1.9096	.0010703	652.41	705.92	1.8891
180	.0011120	750.95	773.20	2.1147	.0011047	745.59	778.73	2.1024	.0010912	735.69	790.25	2.0794
200	.0011388	837.7	860.5	2.3031	.0011302	831.4	865.3	2.2893	.0011146	819.7	875.5	2.2634
220	.0011693	925.9	949.3	2.4870	.0011590	918.3	953.1	2.4711	.0011408	904.7	961.7	2.4419
240	.0012046	1016.0	1040.0	2.6674	.0011920	1006.9	1042.6	2.6490	.0011702	990.7	1049.2	2.6158
260	.0012462	1108.6	1133.5	2.8459	.0012303	1097.4	1134.3	2.8243	.0012034	1078.1	1138.2	2.7860
280	.0012965	1204.7	1230.6	3.0248	.0012755	1190.7	1229.0	2.9986	.0012415	1167.2	1229.3	2.9537
300	.0013596	1306.1	1333.3	3.2071	.0013304	1287.9	1327.8	3.1741	.0012860	1258.7	1323.0	3.1200
320	.0014437	1415.7	1444.6	3.3979	.0013997	1390.7	1432.7	3.3539	.0013388	1353.3	1420.2	3.2868
340	.0015684	1539.7	1571.0	3.6075	.0014920	1501.7	1546.5	3.5426	.0014032	1452.0	1522.1	3.4557
360	.0018226	1702.8	1739.3	3.8772	.0016265	1626.6	1675.4	3.7494	.0014838	1556.0	1630.2	3.6291
380					.0018691	1781.4	1837.5	4.0012	.0015884	1667.2	1746.6	3.8101

**TABLE 1-3**

Approximate metabolizable energy content of some common foods  
(1 Calorie = 4.1868 kJ = 3.968 Btu)

Food	Calories
Apple (one, medium)	70
Baked potato (plain)	250
Baked potato with cheese	550
Bread (white, one slice)	70
Butter (one teaspoon)	35
Cheeseburger	325
Chocolate candy bar (20 g)	105
Cola (200 ml)	87
Egg (one)	80
Fish sandwich	450
French fries (regular)	250
Hamburger	275
Hot dog	300
Ice cream (100 ml, 10% fat)	110
Lettuce salad with French dressing	150
Milk (skim, 200 ml)	76
Milk (whole, 200 ml)	136
Peach (one, medium)	65
Pie (one $\frac{1}{8}$ slice, 23 cm diameter)	300
Pizza (large, cheese, one $\frac{1}{8}$ slice)	350

**TABLE 1-4**

Approximate energy consumption of a 68-kg adult during some activities  
(1 Calorie = 4.1868 kJ = 3.968 Btu)

Activity	Calories/h
Basal metabolism	72
Basketball	550
Bicycling (21 km/h)	639
Cross-country skiing (13 km/h)	936
Driving a car	180
Eating	99
Fast dancing	600
Fast running (13 km/h)	936
Jogging (8 km/h)	540
Swimming (fast)	860
Swimming (slow)	288
Tennis (advanced)	480
Tennis (beginner)	288
Walking (7.2 km/h)	432
Watching TV	72