

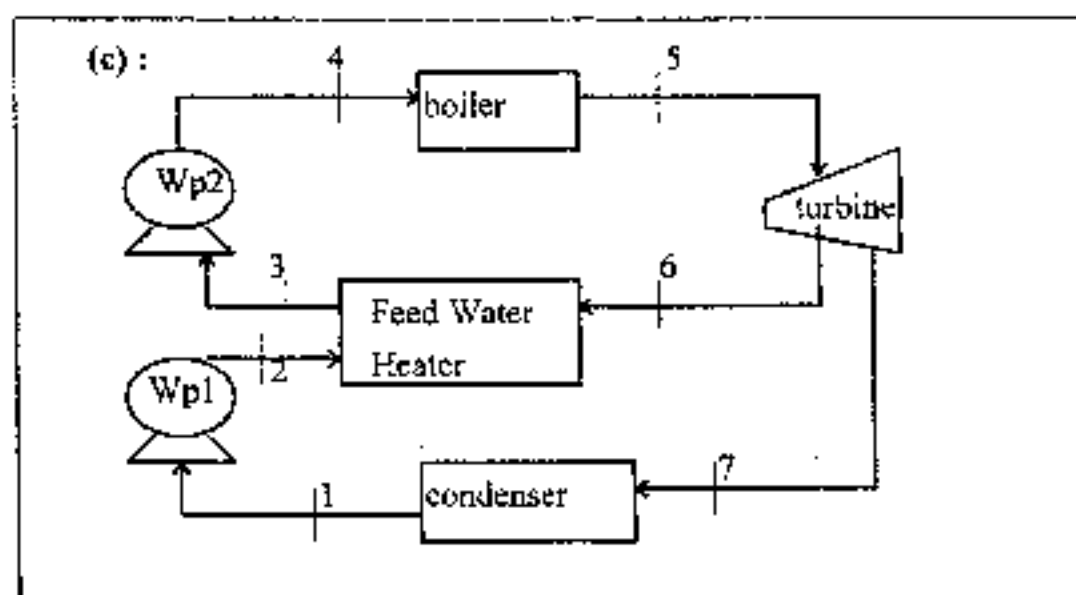
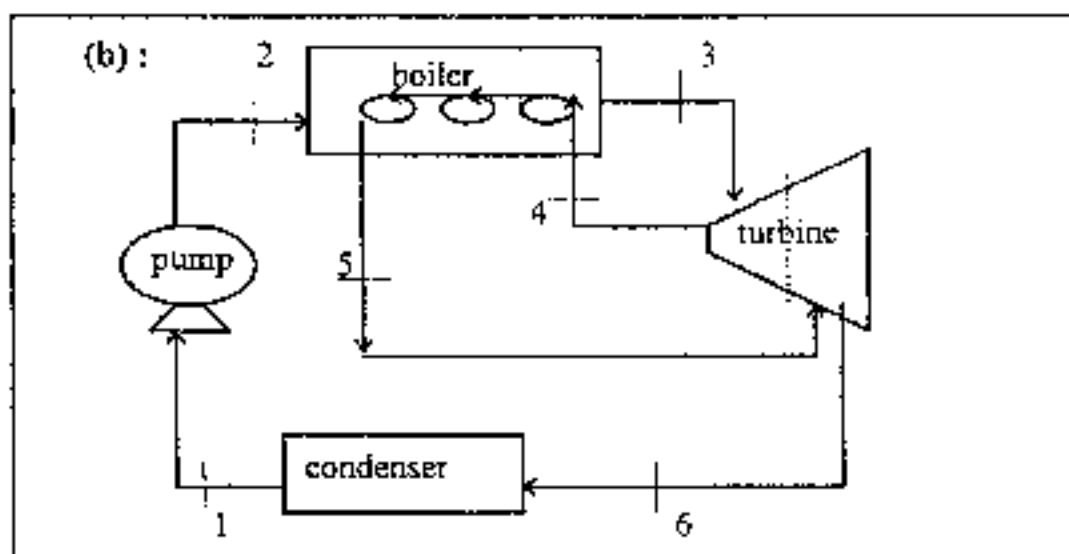
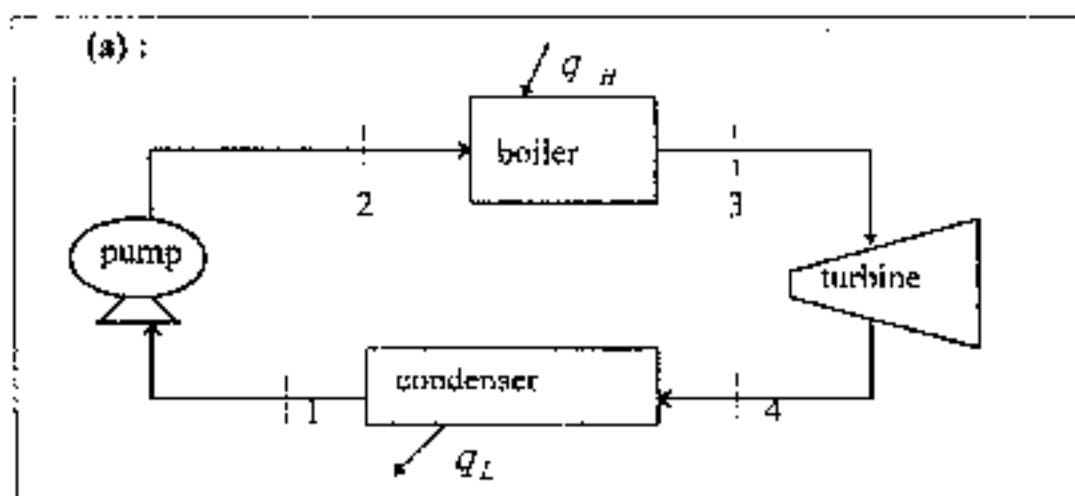
八十五學年度 工程熱力學 系(所) \_\_\_\_\_ 組碩士班研究生入學考試

科目 工程熱力學 科號 3803 共 10 頁第 1 頁 \*請在試卷【答案卷】內作答

1. Giving the following three schematic diagrams of the ideal cycle for a simple power plant please draw the T-S diagram for each one, and also remark the stage number 1, 2, 3 ... etc. on your T-S diagram. (15%)

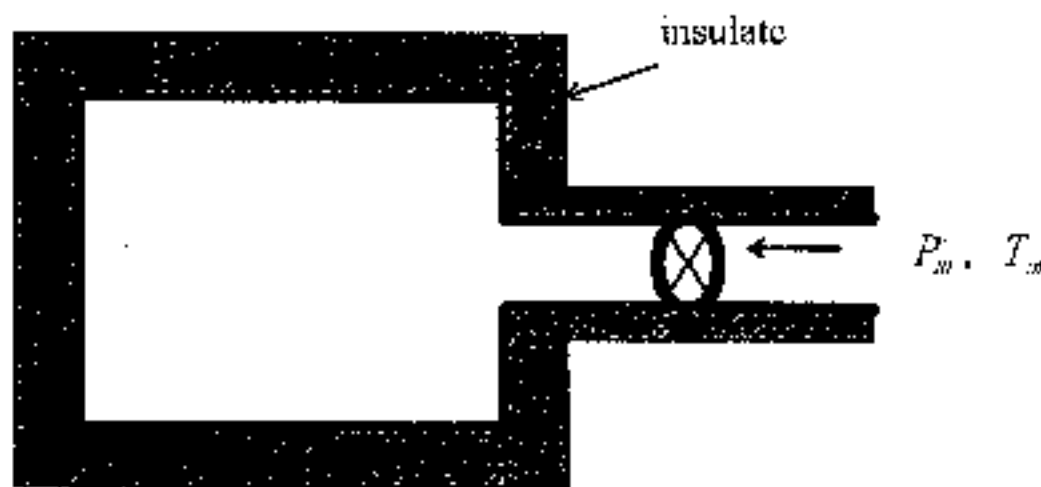
the ideal cycle here is defined:

- (i) Reversible adiabatic pumping process in the pump, and reversible adiabatic expansion in the turbine.
- (ii) Constant pressure transfer of heat in the boiler and in the condenser.
- (iii) All the fluid comes from the boiler is superheated, and comes from the turbine is two phase mixture.



八十五學年度 核子工程及核物理系(所) 組碩士班研究生入學考試  
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2. A tank of volume  $V$  is to be filled with an ideal gas. Initially the tank is at  $P_1$  and  $T_1$ . The port is regulated with a valve, and the port properties are constant at  $T_{in}$ ,  $P_{in}$ . The process is adiabatic. If the final pressure of the tank is  $P_2$ , determine the final temperature of the tank  $T_2$  as function of  $P_2$ ,  $P_1$ ,  $k$ ,  $T_{in}$ ,  $T_1$ , for ideal gas  $k=C_p/C_v$ . (15%)

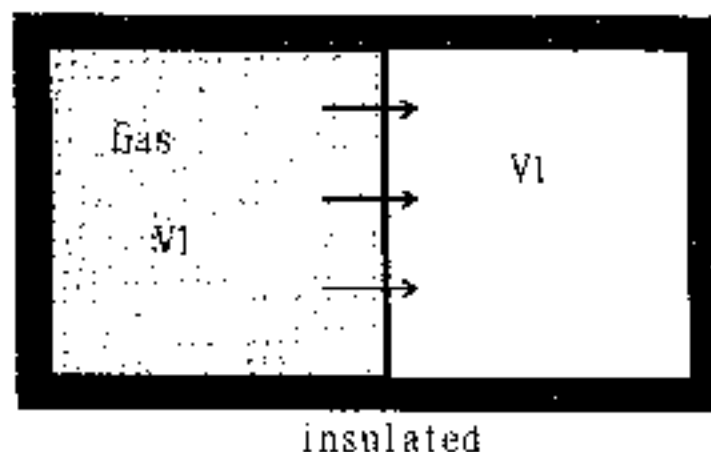


3. A well insulated vessel is divided into two equal compartments by a partition. The volume of each compartment is  $V_1$ , one of the compartment is fill with gas at  $T_1$ , and the other compartment is initially evacuated. The partition is then removed until the volume is  $2V_1$ , and the gas is allowed to equilibrate. Assume Argon is Vander Waals gas behavior.

$$\text{The equation of state : } \left( P + \frac{a}{v^2} \right) (v - b) = RT$$

where  $a$ ,  $b$  are constant, and the heat capacity at constant volume of Argon gas is Constant,  $C_v$ .

- (i) How do you calculate the final temperature  $T_2$  from the known data? (5%)  
 (ii) What is the entropy change during this process? (5%)



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4. A house of constant volume  $V_1$  is warmed, the air pressure being kept constant at  $P_1$  atm, during the heating process, some of the air must be expelled through keyholes. Assume that  $C_v$  and  $C_p$  are constant for air and  $R$  is gas constant, derive an expression for the amount of heat that must be supplied to warm the air in the house from  $T_1$  to  $T_2$ , taking into account the continuous ejection of air, the air can be assumed as an ideal gas. hint: It is a flow system (open system) and S.S.S.F (10%)
5. Give the brief description of the Kelvin-Planck Statement (3%) ; Clausius Statement (3%) and explain what is the inequality of Clausius (or write down the equation)(4%)
6. Giving a power plant, the system schematic shown as following; the primary loop flow rate is 17,500 kg/s, the state condition are shown in table 1, the component efficiency are shown in table 2,

where:

$$\eta_{s(pump)} = \frac{Ws(pump)}{Wa(pump)}$$

$Wa(pump)$  : the actual work input the pump

$Ws(pump)$  : the work of liquid flow through the pump for isentropic process

$$\eta_{s(turbine)} = \frac{Wa(turbine)}{Ws(turbine)}$$

$Wa(turbine)$  : the actual work done of steam flow through the turbine

$Ws(turbine)$  : the work that would have been done in an isentropic process between the turbine inlet state and the turbine outlet state.

Table 1

State	T(°C)	P(MPa)
1	290	15
2	320	14.3
3		13.6
4		6.5
5	300	6.0
6		0.0096
7	40	0.0096

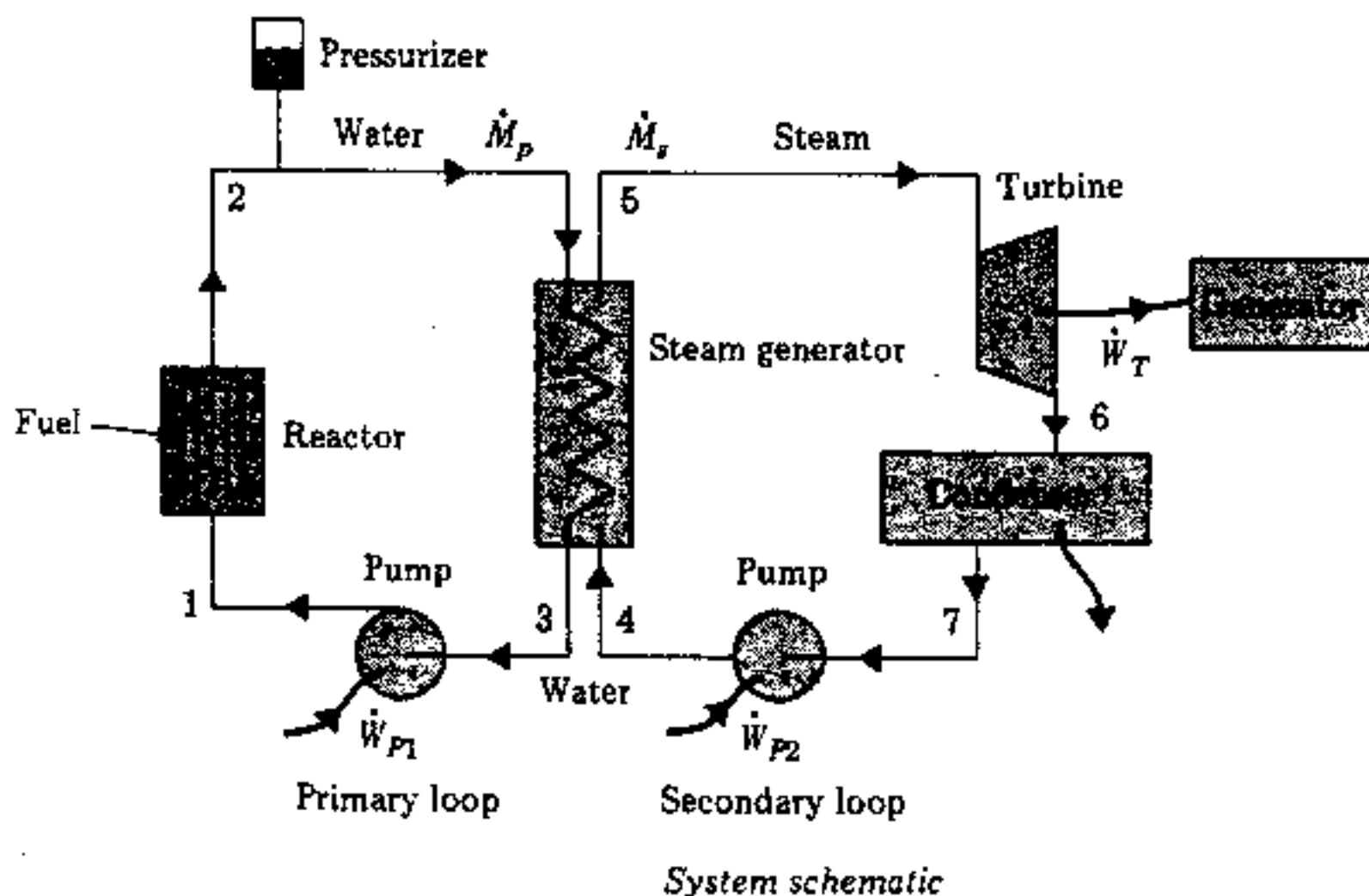
Table 2

component	$\eta_s$
primary loop pump	0.80
secondary loop pump	0.75
turbine	0.85

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科目 工程熱力學 科號 3803 共 10 頁第 4 頁 \*請在試卷【答案卷】內作答

- (i) Please draw the T-S diagram for the system, and also remark state 1, state 2, state 3, state 4, state 5, state 6, state 7, state 1s (the outlet of the primary loop pump for the isentropic process), state 6s (the outlet of the secondary loop turbine for the isentropic process), and state 4s (the outlet of the secondary loop pump for the isentropic process) (10%)
- (ii) Calculate the enthalpy value for state 1,2,3,4,5,6,7 (7%)
- (iii) Please calculate the actual work of  $\dot{W}_{P1}$  in the unit of MW (mega watt). (3%)
- (iv) Calculate the reactor power in the unit of MW. (2%)
- (v) Calculate the flow rate (kg/s) of the secondary loop (2%)  
the actual turbine work  $\dot{W}_T$  (MW) (3%)  
and the actual pump work  $\dot{W}_{P2}$  (MW) (3%)
- (vi) What is the state 6 condition, is it in superheated? Saturated vapor? or saturated two phase mixture? also calculate the quality if it is in two phase mixture (5%)
- (vii) Calculate the plant thermal efficiency (5%)



八十五學年度 校務委員會 物理系(所)

組碩士班研究生入學考試

科目 工程熱力學

科號 3803

共 10 頁第 5 頁 \*請在試卷【答案卷】內作答

TABLE A-4  
Saturated water-Temperature table

Temp. °C T	Sat. press. kPa P <sub>sat</sub>	Specific volume m <sup>3</sup> /kg		Internal energy kJ/kg			Enthalpy kJ/kg			Entropy kJ/(kg · K)		
		Sat. liquid v <sub>f</sub>	Sat. vapor v <sub>g</sub>	Sat. liquid u <sub>f</sub>	Evap. u <sub>fg</sub>	Sat. vapor u <sub>g</sub>	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	0.6113	0.001000	206.14	0.0	2375.3	2375.3	0.01	2501.3	2501.4	0.000	9.1562	9.1562
5	0.6721	0.001000	147.12	20.97	2381.3	2382.3	20.96	2489.6	2510.6	0.0761	8.9496	9.0257
10	1.2276	0.001000	106.38	42.00	2347.2	2389.2	42.01	2477.7	2519.8	0.1510	8.7498	8.9008
15	1.7051	0.001001	77.83	62.99	2333.1	2396.1	62.99	2465.9	2528.9	0.2245	8.5569	8.7814
20	2.339	0.001002	57.79	93.95	2319.0	2402.9	93.96	2454.1	2538.1	0.2986	8.3736	8.6672
25	3.169	0.001003	43.36	104.88	2304.9	2409.8	104.89	2442.3	2547.2	0.3674	8.1905	8.5580
30	4.246	0.001004	32.89	125.78	2290.8	2416.6	125.79	2430.5	2556.3	0.4369	8.0164	8.4533
35	5.628	0.001006	25.22	146.67	2276.7	2423.4	146.66	2418.6	2565.3	0.5052	7.8478	8.3531
40	7.384	0.001008	19.52	167.56	2262.6	2430.1	167.57	2406.7	2574.3	0.5725	7.6845	8.2570
45	9.593	0.001010	15.26	188.44	2248.4	2436.8	188.45	2394.8	2583.2	0.6387	7.5261	8.1648
50	12.349	0.001012	12.03	209.32	2234.2	2443.5	209.33	2382.7	2592.1	0.7038	7.3725	8.0763
55	15.758	0.001015	9.566	230.21	2219.9	2450.1	230.23	2370.7	2600.9	0.7679	7.2234	7.9913
60	19.940	0.001017	7.671	251.11	2205.5	2456.6	251.13	2358.5	2609.6	0.8312	7.0784	7.9096
65	25.03	0.001020	6.197	272.02	2191.1	2463.1	272.06	2346.2	2618.3	0.8935	6.9375	7.8310
70	31.19	0.001023	5.042	292.95	2176.6	2469.5	292.96	2333.9	2626.8	0.9549	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
<b>Sat. press. MPa</b>												
100	0.10135	0.001044	1.6729	418.94	2087.6	2506.5	419.04	2257.0	2676.1	1.3069	6.0460	7.3549
105	0.12082	0.001048	1.4194	440.02	2072.3	2512.4	440.15	2243.7	2683.8	1.3630	5.9328	7.2956
110	0.14327	0.001052	1.2102	461.14	2057.0	2518.1	461.30	2230.2	2691.5	1.4185	5.8202	7.2387
115	0.16906	0.001056	1.0366	482.30	2041.4	2523.7	482.48	2216.5	2699.0	1.4734	5.7100	7.1833
120	0.19853	0.001060	0.8919	503.50	2025.8	2529.3	503.71	2202.6	2706.3	1.5276	5.6020	7.1296
125	0.2321	0.001065	0.7706	524.74	2009.9	2534.6	524.99	2188.5	2713.5	1.5813	5.4962	7.0775
130	0.2701	0.001070	0.6685	546.02	1993.9	2539.9	546.31	2174.2	2720.5	1.6344	5.3925	7.0269
135	0.3130	0.001075	0.5822	567.35	1977.7	2545.0	567.69	2159.6	2727.3	1.6870	5.2907	6.9777
140	0.3612	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	0.14165	828.37	1764.4	2592.8	829.98	1960.0	2790.0	2.2835	4.1863	6.4698

八十五學年度 校 = 院 = 系 (所)

組碩士班研究生入學考試

科目 工程熱力學

科號 3812

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\*請在試卷【答案卷】內作答

TABLE A-4  
Saturated water—Temperature table

TABLE A-4  
(Continued)

Temp. °C T	Sat. press. MPa P <sub>sat</sub>	Specific volume m <sup>3</sup> /kg		Internal energy kJ/kg			Enthalpy kJ/kg			Entropy kJ/(kg·K)		
		Sat. liquid v <sub>f</sub>	Sat. vapor v <sub>g</sub>	Sat. liquid u <sub>f</sub>	Evap. u <sub>fg</sub>	Sat. vapor u <sub>g</sub>	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>
200	1.5538	0.001157	0.12736	850.85	1744.7	2595.3	852.45	1940.7	2793.2	2.3309	4.1014	6.4329
205	1.7230	0.001164	0.11521	873.04	1724.5	2697.5	875.04	1921.0	2798.0	2.3760	4.0172	6.3952
210	1.9062	0.001173	0.10441	895.53	1703.9	2599.5	897.78	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	0.001198	0.07849	963.73	1639.8	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	2599.3	1134.37	1662.5	2796.9	2.8838	3.1181	6.0019
266	5.081	0.001289	0.03877	1152.74	1443.9	2598.6	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	2788.7	2.9751	2.9551	5.9301
275	5.942	0.001317	0.03279	1202.25	1387.8	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	2779.8	3.0668	2.7903	5.8571
285	6.909	0.001348	0.02777	1253.00	1329.4	2581.4	1262.31	1511.0	2773.3	3.1130	2.7070	5.8199
290	7.436	0.001365	0.02557	1278.92	1299.1	2576.0	1289.07	1477.1	2766.2	3.1594	2.6227	5.7821
296	7.983	0.001384	0.02354	1305.2	1267.7	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	18.851	0.001893	0.006945	1725.2	626.3	2351.5	1760.5	720.3	2481.0	3.9147	1.1379	5.0526
370	21.03	0.002213	0.004325	1844.0	384.5	2228.5	1890.5	441.6	2332.1	4.1106	0.6865	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

Source: Tables A-4 through A-8 are adapted from Gordon J. Van Wylen and Richard E. Sonntag, *Fundamentals of Classical Thermodynamics*, English/SI Version, 3d ed., Wiley, New York, 1986, pp. 635-651. Originally published in Joseph H. Keenan, Frederick G. Keyes, Philip G. Hill, and Joan G. Moore, *Steam Tables*, SI Units, Wiley, New York, 1978.

八十五學年度 核子工程學系 (所)

組碩士班研究生入學考試

科目 工程熱力學

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\*請在試卷【答案卷】內作答

TABLE A-5  
Saturated water—Pressure table

Press. kPa <i>P</i>	Sat. temp. °C <i>T<sub>sat</sub></i>	Specific volume m <sup>3</sup> /kg		Internal energy kJ/kg			Enthalpy kJ/kg			Entropy kJ/(kg · K)		
		Sat. liquid <i>v<sub>f</sub></i>	Sat. vapor <i>v<sub>g</sub></i>	Sat. liquid <i>u<sub>f</sub></i>	Evap. <i>u<sub>fg</sub></i>	Sat. vapor <i>u<sub>g</sub></i>	Sat. liquid <i>h<sub>f</sub></i>	Evap. <i>h<sub>fg</sub></i>	Sat. vapor <i>h<sub>g</sub></i>	Sat. liquid <i>s<sub>f</sub></i>	Evap. <i>s<sub>fg</sub></i>	Sat. vapor <i>s<sub>g</sub></i>
0.6113	0.01	0.001 000	206.14	0.00	2375.3	2375.3	0.01	2501.3	2501.4	0.0000	9.1562	9.1562
1.0	6.98	0.001 000	129.21	29.30	2355.7	2385.0	29.30	2484.9	2514.2	0.1069	8.8697	8.9756
1.5	13.03	0.001 001	87.98	54.71	2338.8	2393.3	54.71	2470.6	2525.3	0.1957	8.6322	8.8279
2.0	17.50	0.001 001	67.30	73.48	2326.9	2399.5	73.48	2460.0	2533.5	0.2607	8.4629	8.7237
2.5	21.08	0.001 002	54.25	88.48	2316.9	2404.4	88.49	2451.6	2540.0	0.3120	8.3311	8.6432
3.0	24.08	0.001 003	45.67	101.04	2307.5	2408.5	101.05	2444.5	2545.5	0.3545	8.2231	8.5776
4.0	28.96	0.001 004	34.80	121.45	2293.7	2415.2	121.46	2432.9	2554.4	0.4226	8.0520	8.4746
5.0	32.88	0.001 005	28.19	137.81	2282.7	2420.5	137.82	2423.7	2561.5	0.4764	7.9187	8.3951
7.5	40.29	0.001 008	19.24	168.76	2261.7	2430.5	168.79	2408.0	2574.9	0.5764	7.6750	8.2515
10	45.81	0.001 010	14.87	197.92	2246.1	2437.9	197.83	2392.6	2584.7	0.6493	7.5009	8.1502
15	53.97	0.001 014	10.02	225.92	2222.8	2446.7	225.94	2373.1	2599.1	0.7549	7.2536	8.0085
20	60.06	0.001 017	7.649	251.38	2205.4	2456.7	251.40	2359.3	2609.7	0.8320	7.0766	7.9085
25	64.97	0.001 020	6.204	271.90	2191.2	2463.1	271.93	2348.3	2618.2	0.8931	6.9383	7.8314
30	69.10	0.001 022	5.229	289.20	2179.2	2468.4	289.23	2336.1	2625.3	0.9439	6.8247	7.7686
40	75.87	0.001 027	3.993	317.53	2159.5	2477.0	317.58	2319.2	2638.8	1.0259	6.6441	7.6700
50	81.33	0.001 030	3.240	340.44	2143.4	2483.9	340.49	2305.4	2645.9	1.0910	6.5029	7.5939
75	91.78	0.001 037	2.217	384.31	2112.4	2496.7	384.39	2273.6	2663.9	1.2130	6.2434	7.4564
100	99.63	0.001 043	1.6940	417.36	2088.7	2506.1	417.46	2258.0	2675.5	1.3026	6.0568	7.3594
125	105.99	0.001 048	1.3749	444.19	2069.3	2513.5	444.32	2241.0	2685.4	1.3740	5.9104	7.2844
150	111.37	0.001 053	1.1593	466.94	2052.7	2519.7	467.11	2228.5	2693.8	1.4336	5.7897	7.2233
175	116.06	0.001 057	1.0036	486.90	2038.1	2524.9	486.99	2213.6	2700.6	1.4849	5.6868	7.1717
200	120.23	0.001 061	0.8667	504.49	2025.0	2529.5	504.70	2201.9	2706.7	1.5301	5.5970	7.1271
225	124.00	0.001 064	0.7593	520.47	2013.1	2533.6	520.72	2191.3	2712.1	1.5706	5.5173	7.0878
250	127.44	0.001 067	0.6787	535.10	2002.1	2537.2	535.37	2181.5	2716.9	1.6072	5.4455	7.0527
275	130.60	0.001 070	0.6173	548.59	1991.9	2540.5	548.89	2172.4	2721.3	1.6408	5.3801	7.0209
300	133.55	0.001 073	0.5658	561.15	1982.4	2543.6	561.47	2163.8	2725.3	1.6718	5.3201	6.9919
325	136.30	0.001 076	0.5220	572.90	1973.5	2546.4	573.25	2155.8	2729.0	1.7006	5.2646	6.9652
350	138.88	0.001 079	0.4843	583.95	1965.3	2548.9	584.33	2148.1	2732.4	1.7275	5.2130	6.9405
375	141.32	0.001 081	0.4514	594.40	1956.9	2551.3	594.81	2140.8	2735.6	1.7529	5.1647	6.9175
400	143.63	0.001 084	0.4225	604.31	1949.3	2553.6	604.74	2133.8	2738.6	1.7766	5.1193	6.8959
450	147.93	0.001 088	0.3740	622.77	1934.9	2557.6	623.25	2120.7	2743.9	1.8207	5.0359	6.8565
500	151.86	0.001 093	0.3249	639.68	1921.5	2561.2	640.23	2108.5	2748.7	1.8607	4.9606	6.8213
550	155.48	0.001 097	0.2827	655.32	1909.2	2564.5	665.93	2097.0	2753.3	1.8973	4.8920	6.7893
600	158.85	0.001 101	0.2457	669.90	1897.5	2567.4	670.56	2086.3	2758.8	1.9312	4.8288	6.7600
650	162.01	0.001 104	0.2127	683.56	1886.5	2570.1	684.26	2076.0	2760.3	1.9627	4.7703	6.7331
700	164.97	0.001 108	0.1829	696.44	1876.1	2572.5	697.22	2066.3	2763.5	1.9922	4.7158	6.7080
750	167.78	0.001 112	0.1556	708.64	1866.1	2574.7	709.47	2057.0	2766.4	2.0200	4.6647	6.6847
800	170.43	0.001 115	0.1304	720.22	1856.8	2576.8	721.11	2048.0	2769.1	2.0462	4.6166	6.6628
850	172.96	0.001 118	0.1070	731.27	1847.4	2578.7	732.22	2039.4	2771.6	2.0710	4.5711	6.6421
900	175.38	0.001 121	0.0850	741.83	1838.6	2580.5	742.83	2031.1	2773.9	2.0946	4.5280	6.6226
950	177.69	0.001 124	0.0642	751.95	1830.2	2582.1	753.02	2023.1	2776.1	2.1172	4.4869	6.6041
1.00	179.91	0.001 127	0.0454	761.66	1822.0	2583.6	762.81	2015.3	2778.1	2.1387	4.4478	6.5865
1.10	184.09	0.001 133	0.0353	780.09	1806.3	2588.4	781.34	2000.4	2781.7	2.1792	4.3744	6.5536
1.20	187.99	0.001 139	0.0263	797.29	1791.5	2588.8	798.65	1986.2	2784.8	2.2166	4.3087	6.5233
1.30	191.64	0.001 144	0.0181	813.44	1777.5	2591.0	814.93	1972.7	2787.6	2.2515	4.2438	6.4953

八十五學年度 機械工程學系(所) 組碩士班研究生入學考試

科目 工程熱力學 科號 3812 共 10 頁第 8 頁 \*請在試卷【答案卷】內作答

TABLE A-5  
Saturated water—Pressure table

TABLE A-5  
(Continued)

Press. MPa <i>P</i>	Sat. temp. °C <i>T<sub>sat</sub></i>	Specific volume m <sup>3</sup> /kg		Internal energy kJ/kg			Enthalpy kJ/kg			Entropy kJ/(kg·K)		
		Sat. liquid <i>v<sub>f</sub></i>	Sat. vapor <i>v<sub>g</sub></i>	Sat. liquid <i>u<sub>f</sub></i>	Evap. <i>u<sub>fg</sub></i>	Sat. vapor <i>u<sub>g</sub></i>	Sat. liquid <i>h<sub>f</sub></i>	Evap. <i>h<sub>fg</sub></i>	Sat. vapor <i>h<sub>g</sub></i>	Sat. liquid <i>s<sub>f</sub></i>	Evap. <i>s<sub>fg</sub></i>	Sat. vapor <i>s<sub>g</sub></i>
1.40	195.07	0.001749	0.14084	828.70	1764.1	2592.8	830.30	1959.7	2790.0	2.2942	4.1850	6.4893
1.50	198.32	0.001154	0.13177	843.16	1757.3	2594.5	844.89	1947.3	2792.2	2.3150	4.1298	6.4448
1.75	205.76	0.001166	0.11349	876.46	1727.4	2597.8	878.50	1917.9	2796.4	2.3651	4.0044	6.3896
2.00	212.42	0.001177	0.09863	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	2.5095	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	1046.43	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	6.0731
5	258.99	0.001286	0.03944	1147.81	1449.3	2597.1	1154.23	1640.1	2794.3	2.9202	3.0532	5.9734
6	267.64	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	5.6722
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	1098.0	2529.8	1450.1	1255.5	2705.6	3.4295	2.1233	5.5627
12	324.75	0.001527	0.014263	1473.0	1040.7	2513.7	1491.3	1193.3	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	2478.8	1571.1	1068.5	2637.8	3.6232	1.7495	5.3717
15	342.24	0.001658	0.010337	1585.6	869.8	2455.6	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	3.7461	1.4994	5.2455
17	352.37	0.001770	0.008364	1660.2	744.8	2405.0	1690.3	858.9	2547.2	3.8079	1.3698	5.1777
18	357.08	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	386.5	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	2097.1	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



八十五學年度 核子工程學系(所)

組碩士班研究生入學考試

科目 工程熱力學 科號 3803 共 10 頁第 9 頁 \*請在試卷【答案卷】內作答

TABLE A-6  
Superheated water

T °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)	v m <sup>3</sup> /kg	u kJ/kg	h kJ/kg	s kJ/(kg·K)
<b>P = 4.0 MPa (250.40°C)</b>				<b>P = 4.5 MPa (267.49°C)</b>				<b>P = 5.0 MPa (283.89°C)</b>				
300	0.05854	2775.3	2980.7	6.3615	0.05135	2712.0	2943.1	6.2828	0.04532	2698.0	2924.5	6.2084
350	0.06645	2826.7	3092.5	6.5821	0.05840	2817.8	3080.6	6.5131	0.05194	2808.7	3068.4	6.4493
400	0.07341	2818.9	3213.6	6.7690	0.06475	2913.3	3204.7	6.7047	0.05781	2906.6	3195.7	6.6459
450	0.08002	3010.2	3390.3	6.9363	0.07074	3005.0	3323.3	6.8746	0.06330	2992.7	3316.2	6.8186
500	0.08543	3098.6	3445.3	7.0901	0.07651	3095.3	3439.6	7.0301	0.06857	3081.0	3433.8	6.9759
600	0.09585	3279.1	3674.4	7.3888	0.08765	3276.0	3670.6	7.3110	0.07869	3273.0	3686.5	7.2589
700	0.11095	3462.1	3905.9	7.6198	0.09847	3459.9	3903.0	7.5631	0.08849	3457.6	3900.1	7.5122
800	0.12287	3650.0	4141.5	7.8502	0.10911	3648.3	4139.3	7.7942	0.09811	3646.6	4137.1	7.7440
900	0.13469	3843.6	4382.3	8.0847	0.11965	3842.2	4380.6	8.0091	0.10762	3840.7	4378.6	7.9593
1000	0.14845	4042.9	4628.7	8.2622	0.13013	4041.6	4627.2	8.2108	0.11707	4040.4	4625.7	8.1812
1100	0.15817	4248.0	4880.6	8.4557	0.14056	4246.8	4679.3	8.4015	0.12648	4245.6	4678.0	8.3520
1200	0.16987	4458.6	5138.1	8.6376	0.15098	4457.5	5136.9	8.5825	0.13587	4456.3	5135.7	8.5331
1300	0.18156	4674.3	5400.5	8.8100	0.16139	4673.1	5399.4	8.7549	0.14526	4672.0	5398.2	8.7055
<b>P = 6.0 MPa (275.64°C)</b>				<b>P = 7.0 MPa (295.99°C)</b>				<b>P = 8.0 MPa (295.06°C)</b>				
300	0.03244	2589.7	2784.3	5.8892	0.02737	2580.5	2772.1	5.8133	0.02352	2569.8	2758.0	5.7432
350	0.03616	2687.2	2884.2	6.0674	0.02947	2632.2	2838.4	5.9305	0.02426	2590.9	2765.0	5.7906
400	0.04223	2788.6	3043.0	6.3335	0.03524	2763.4	3016.0	6.2283	0.02985	2747.7	2967.3	6.1301
450	0.04739	2892.9	3177.2	6.5408	0.03933	2978.6	3158.1	6.4478	0.03432	2863.8	3138.3	6.3634
500	0.05214	2988.9	3301.8	6.7193	0.04416	2978.0	3287.1	6.6327	0.03817	2988.7	3272.0	6.5551
550	0.05665	3082.2	3422.2	6.8803	0.04814	3073.4	3410.3	6.7975	0.04175	3064.3	3398.3	6.7240
600	0.06101	3174.6	3540.8	7.0286	0.05195	3167.2	3530.9	6.9456	0.04516	3159.8	3521.0	6.8778
700	0.06525	3265.9	3659.4	7.1877	0.05565	3260.7	3650.3	7.0834	0.04845	3254.4	3642.0	7.0206
800	0.07352	3453.1	3894.2	7.4234	0.06293	3448.5	3888.3	7.3476	0.05481	3443.8	3882.4	7.2812
900	0.08160	3643.1	4132.7	7.6566	0.06921	3638.5	4128.2	7.5822	0.06097	3638.0	4123.8	7.5173
1000	0.08958	3837.8	4375.3	7.8727	0.07669	3835.0	4371.8	7.7991	0.06702	3832.1	4368.3	7.7351
1100	0.09749	4037.8	4622.7	8.0751	0.08350	4035.3	4619.8	8.0020	0.07301	4032.8	4616.9	7.9384
1200	0.10536	4243.3	4875.4	8.2661	0.09027	4240.8	4872.6	8.1933	0.07888	4238.8	4870.3	8.1300
1300	0.11321	4454.0	5133.3	8.4474	0.09708	4451.7	5130.9	8.3747	0.08489	4449.5	5128.5	8.3115
1300	0.12106	4669.6	5396.0	8.6189	0.10377	4667.3	5393.7	8.5475	0.09080	4665.0	5391.5	8.4842
<b>P = 9.0 MPa (303.40°C)</b>				<b>P = 10.0 MPa (311.06°C)</b>				<b>P = 12.5 MPa (327.89°C)</b>				
300	0.02045	2557.8	2742.1	5.6772	0.018026	2544.4	2724.7	5.6141	0.013485	2505.1	2673.8	5.4624
325	0.02327	2646.6	2856.0	5.8712	0.019861	2610.4	2805.1	5.7568				
350	0.02680	2724.4	2956.6	6.0361	0.02242	2699.2	2923.4	5.9443	0.016126	2624.6	2826.2	6.7118
400	0.02993	2848.4	3117.8	6.2854	0.02641	2832.4	3096.5	6.2120	0.02000	2789.3	3039.3	6.0417
450	0.03350	2955.2	3256.6	6.4844	0.02975	2943.4	3240.9	6.4190	0.02299	2912.5	3188.8	6.2718
500	0.03677	3055.2	3386.1	6.6576	0.03279	3045.6	3373.7	6.5966	0.02560	3021.7	3341.8	6.4618
550	0.03987	3152.2	3511.0	6.8142	0.03564	3144.6	3500.9	6.7581	0.02801	3125.0	3475.2	6.6290
600	0.04265	3248.1	3633.7	6.9589	0.03837	3241.7	3625.3	6.9029	0.03029	3225.4	3604.0	6.7810
650	0.04574	3343.6	3755.3	7.0943	0.04101	3338.2	3748.2	7.0398	0.03248	3324.4	3730.4	6.9218
700	0.04857	3439.3	3876.5	7.2221	0.04358	3434.7	3870.5	7.1687	0.03480	3422.9	3855.3	7.0536
800	0.05409	3632.5	4119.3	7.4596	0.04859	3628.9	4114.8	7.4077	0.03889	3620.0	4103.8	7.2965
900	0.05950	3829.2	4364.8	7.6783	0.05349	3828.3	4361.2	7.6272	0.04287	3819.1	4352.5	7.5182
1000	0.06485	4030.3	4614.0	7.8821	0.05832	4027.8	4611.0	7.8316	0.04658	4021.6	4603.8	7.7237
1100	0.07016	4236.3	4867.7	8.0740	0.06312	4234.0	4865.1	8.0237	0.05046	4228.2	4855.6	7.9165
1200	0.07544	4447.2	5126.2	8.2556	0.06789	4444.9	5123.8	8.2055	0.05430	4438.3	5115.0	8.0937
1300	0.08072	4662.7	5389.2	8.4284	0.07265	4660.5	5387.0	8.3783	0.05813	4654.8	5381.4	8.2717

八十五學年度 機械工程學系 (所)

組碩士班研究生入學考試

科目 工程熱力學

科號 3803  
3812

共 10 頁第 10 頁

\*請在試卷【答案卷】內作答

TABLE A-7  
Compressed liquid water

T °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)	v m <sup>3</sup> /kg	u kJ/kg	h kJ/kg	s kJ/(kg·K)
P = 5 MPa (283.99°C)				P = 10 MPa (311.06°C)				P = 15 MPa (342.24°C)				
Sat.	0.0012859	1147.8	1154.2	2.9202	0.0014524	1393.0	1407.6	3.3596	0.0016581	1585.6	1613.5	3.6648
0	0.0009977	0.04	5.04	0.0001	0.0009952	5.08	10.04	0.0002	0.0009823	0.15	15.05	0.0004
20	0.0009995	23.65	68.65	0.2956	0.0009872	83.36	93.33	0.2945	0.0009950	83.06	97.99	0.2934
40	0.0010056	166.96	171.97	0.5705	0.0010034	186.35	176.38	0.5686	0.0010013	165.76	180.78	0.5666
60	0.0010149	250.23	255.30	0.8285	0.0010127	249.36	259.49	0.8258	0.0010105	248.51	263.67	0.8232
80	0.0010268	333.77	338.85	1.0720	0.0010245	332.59	342.83	1.0686	0.0010223	331.48	346.81	1.0656
100	0.0010410	417.52	422.72	1.3090	0.0010385	416.12	426.50	1.2992	0.0010361	414.74	430.28	1.2955
120	0.0010576	501.80	507.09	1.5233	0.0010549	500.08	510.64	1.5189	0.0010522	498.40	514.19	1.5145
140	0.0010768	586.78	592.15	1.7343	0.0010737	584.68	595.42	1.7292	0.0010707	582.66	598.72	1.7242
160	0.0010988	672.62	678.12	1.9375	0.0010953	670.13	681.06	1.9317	0.0010918	667.71	684.08	1.9260
180	0.0011240	759.63	765.25	2.1341	0.0011199	756.05	767.54	2.1275	0.0011159	753.76	770.50	2.1210
200	0.0011530	848.1	853.9	2.3255	0.0011480	844.5	856.0	2.3175	0.0011433	841.0	856.2	2.3104
220	0.0011866	938.4	944.4	2.5128	0.0011805	934.1	945.9	2.5039	0.0011748	929.9	947.5	2.4963
240	0.0012264	1031.4	1037.5	2.6979	0.0012187	1026.0	1038.1	2.6872	0.0012114	1020.8	1039.0	2.6771
260	0.0012749	1127.9	1134.3	2.8800	0.0012645	1121.1	1133.7	2.8699	0.0012550	1114.6	1133.4	2.8576
280					0.0013216	1220.9	1234.1	3.0548	0.0013054	1212.5	1232.1	3.0493
300					0.0013972	1328.4	1342.3	3.2469	0.0013770	1316.6	1337.3	3.2360
320									0.0014724	1431.1	1453.2	3.4247
340									0.0016311	1567.5	1591.3	3.6546
P = 20 MPa (365.81°C)				P = 30 MPa				P = 50 MPa				
Sat.	0.002036	1785.6	1826.3	4.0139	0.0008950	0.25	28.52	0.0001	0.0009766	0.20	49.03	0.0014
0	0.0009904	0.19	20.01	0.0004	0.0009885	82.17	111.84	0.2899	0.0009804	81.00	130.02	0.2848
20	0.0009928	82.77	102.82	0.2923	0.0009951	164.04	193.89	0.5807	0.0009872	161.86	211.21	0.5627
40	0.0010064	247.68	267.86	0.8206	0.0010042	246.06	276.19	0.8154	0.0009962	242.98	292.79	0.8052
60	0.0010199	330.40	350.80	1.0624	0.0010156	326.30	352.77	1.0581	0.0010073	324.34	374.70	1.0440
80	0.0010327	413.39	434.06	1.2917	0.0010290	410.78	441.66	1.2844	0.0010201	405.86	456.89	1.2703
100	0.0010496	496.76	517.76	1.5102	0.0010445	493.58	524.93	1.5018	0.0010338	487.65	539.39	1.4657
120	0.0010678	580.69	602.04	1.7193	0.0010621	576.88	608.75	1.7098	0.0010515	589.77	622.35	1.6915
140	0.0010885	665.35	687.12	1.9204	0.0010821	660.82	693.28	1.9096	0.0010703	652.41	705.92	1.8891
160	0.0011120	750.95	773.20	2.1147	0.0011047	745.69	775.73	2.1024	0.0010912	735.69	790.25	2.0794
180	0.0011388	837.7	860.5	2.3031	0.0011302	831.4	865.3	2.2893	0.0011148	819.7	875.5	2.2634
200	0.0011695	925.9	948.3	2.4870	0.0011580	918.3	953.1	2.4711	0.0011409	904.7	961.7	2.4419
220	0.0012046	1016.0	1040.0	2.6674	0.0011920	1006.9	1042.6	2.6480	0.0011702	990.7	1049.2	2.6158
240	0.0012462	1108.6	1133.5	2.8459	0.0012303	1097.4	1134.3	2.8243	0.0012034	1078.1	1138.2	2.7860
260	0.0012965	1204.7	1230.8	3.0248	0.0012755	1190.7	1228.0	2.9996	0.0012415	1167.2	1229.3	2.9537
280	0.0013598	1306.1	1333.3	3.2071	0.0013304	1287.9	1327.8	3.1741	0.0012860	1256.7	1323.0	3.1200
300	0.0014437	1415.7	1444.8	3.3979	0.0013997	1390.7	1432.7	3.3539	0.0013388	1353.3	1420.2	3.2868
320	0.0015684	1539.7	1571.0	3.6075	0.0014920	1501.7	1546.5	3.5426	0.0014032	1452.0	1522.1	3.4557
340	0.0018226	1702.8	1739.3	3.8772	0.0016265	1626.8	1675.4	3.7484	0.0014838	1556.0	1630.2	3.6291
360					0.0018681	1781.4	1837.5	4.0012	0.0015884	1667.2	1748.8	3.8101