

國立成功大學
110學年度碩士班招生考試試題

編 號：122

系 所：工程科學系

科 目：熱力學

日 期：0203

節 次：第 1 節

備 註：可使用計算機

※ 考生請注意：本試題可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

- As Fig. 1, 1-kg of water at 1 MPa fill a weighted piston-cylinder device whose volume is 0.1 m^3 . The water is then heated at constant pressure until the temperature reaches 300°C . Determine the resulting change in the water's total entropy and show the process on a T - s diagram with respect to saturation lines. (30%)
- As Fig. 2, a heat engine receives heat from a heat source at 1000°C and has a thermal efficiency of 50%. The heat engine does maximum work equal to 400 kJ. Determine the heat supplied to the heat engine by the heat source, the heat rejected to the heat sink, and the temperature of the heat sink. (20%)
- As Fig. 3, a 0.12 m^3 rigid tank is filled with saturated liquid water at 200°C . A valve at the bottom of the tank is opened, and liquid is withdrawn from the tank. Heat is transferred to the water such that the temperature in the tank remains constant. Determine the amount of heat that must be transferred by the time one-half of the total mass has been withdrawn. (30%)
- A piston-cylinder device initially contains 0.01 m^3 of liquid water at 100°C and 920 kPa. Heat is transferred to the water at constant pressure until the entire liquid is vaporized. (a) What is the mass of the water? (b) What is the final temperature? (c) Determine the total enthalpy change. (d) Show the process on a T - v diagram with respect to saturation lines. (20%)

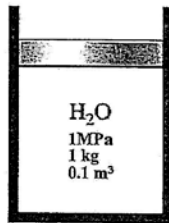


Fig. 1

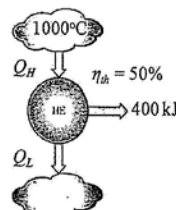


Fig. 2

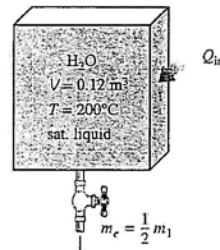


Fig. 3

Tables

TABLE A-4

Saturated water—Temperature table

Temp., <i>T</i> °C	Sat. press., <i>P</i> _{sat} kPa	Specific volume, m ³ /kg		Internal energy, kJ/kg			Enthalpy, kJ/kg		
		Sat. liquid, <i>v</i> _f	Sat. vapor, <i>v</i> _g	Sat. liquid, <i>u</i> _f	Evap., <i>u</i> _{fg}	Sat. vapor, <i>u</i> _g	Sat. liquid, <i>h</i> _f	Evap., <i>h</i> _{fg}	Sat. vapor, <i>h</i> _g
100	101.42	0.001043	1.6720	419.06	2087.0	2506.0	419.17	2256.4	2675.6
105	120.90	0.001047	1.4186	440.15	2071.8	2511.9	440.28	2243.1	2683.4
110	143.38	0.001052	1.2094	461.27	2056.4	2517.7	461.42	2229.7	2691.1
115	169.18	0.001056	1.0360	482.42	2040.9	2523.3	482.59	2216.0	2698.6
120	198.67	0.001060	0.89133	503.60	2025.3	2528.9	503.81	2202.1	2706.0
175	892.60	0.001121	0.21659	740.02	1839.4	2579.4	741.02	2031.7	2772.7
180	1002.8	0.001127	0.19384	761.92	1820.9	2582.8	763.05	2014.2	2777.2
185	1123.5	0.001134	0.17390	783.91	1802.1	2586.0	785.19	1996.2	2781.4
190	1255.2	0.001141	0.15636	806.00	1783.0	2589.0	807.43	1977.9	2785.3
195	1398.8	0.001149	0.14089	828.18	1763.6	2591.7	829.78	1959.0	2788.8
200	1554.9	0.001157	0.12721	850.46	1743.7	2594.2	852.26	1939.8	2792.0

TABLE A-5

Saturated water—Pressure table

Press., <i>P</i> kPa	Sat. temp., <i>T</i> _{sat} °C	Specific volume, m ³ /kg		Internal energy, kJ/kg			Enthalpy, kJ/kg			Entropy, kJ/kg·K		
		Sat. liquid, <i>v</i> _f	Sat. vapor, <i>v</i> _g	Sat. liquid, <i>u</i> _f	Evap., <i>u</i> _{fg}	Sat. vapor, <i>u</i> _g	Sat. liquid, <i>h</i> _f	Evap., <i>h</i> _{fg}	Sat. vapor, <i>h</i> _g	Sat. liquid, <i>s</i> _f	Evap., <i>s</i> _{fg}	Sat. vapor, <i>s</i> _g
40	75.86	0.001026	3.9933	317.58	2158.8	2476.3	317.62	2318.4	2636.1	1.0261	6.6430	7.6691
50	81.32	0.001030	3.2403	340.49	2142.7	2483.2	340.54	2304.7	2645.2	1.0912	6.5019	7.5931
75	91.76	0.001037	2.2172	384.36	2111.8	2496.1	384.44	2278.0	2662.4	1.2132	6.2426	7.4558
100	99.61	0.001043	1.6941	417.40	2088.2	2505.6	417.51	2257.5	2675.0	1.3028	6.0562	7.3589
150	111.35	0.001053	1.1594	466.97	2052.3	2519.2	467.13	2226.0	2693.1	1.4337	5.7894	7.2231
175	116.04	0.001057	1.0037	486.82	2037.7	2524.5	487.01	2213.1	2700.2	1.4850	5.6865	7.1716
200	120.21	0.001061	0.88578	504.50	2024.6	2529.1	504.71	2201.6	2706.3	1.5302	5.5968	7.1270
225	123.97	0.001064	0.79329	520.47	2012.7	2533.2	520.71	2191.0	2711.7	1.5706	5.5171	7.0877
900	175.35	0.001121	0.21489	741.55	1838.1	2579.6	742.56	2030.5	2773.0	2.0941	4.5273	6.6213
950	177.66	0.001124	0.20411	751.67	1829.6	2581.3	752.74	2022.4	2775.2	2.1166	4.4862	6.6027
1000	179.88	0.001127	0.19436	761.39	1821.4	2582.8	762.51	2014.6	2777.1	2.1381	4.4470	6.5850
1100	184.06	0.001133	0.17745	779.78	1805.7	2585.5	781.03	1999.6	2780.7	2.1785	4.3735	6.5520
1200	187.96	0.001138	0.16326	796.96	1790.9	2587.8	798.33	1985.4	2783.8	2.2159	4.3058	6.5217

TABLE A-6

Superheated water (Concluded)

<i>T</i> °C	<i>v</i> m ³ /kg	<i>u</i> kJ/kg	<i>h</i> kJ/kg	<i>s</i> kJ/kg·K	<i>v</i> m ³ /kg	<i>u</i> kJ/kg	<i>h</i> kJ/kg	<i>s</i> kJ/kg·K	<i>v</i> m ³ /kg	<i>u</i> kJ/kg	<i>h</i> kJ/kg	<i>s</i> kJ/kg·K
250	0.23275	2710.4	2943.1	6.9265	0.19241	2704.7	2935.6	6.8313	0.05876	2624.0	2829.7	6.1764
300	0.25799	2793.7	3051.6	7.1246	0.21386	2789.7	3046.3	7.0335	0.06845	2738.8	2978.4	6.4484
350	0.28250	2875.7	3158.2	7.3029	0.23455	2872.7	3154.2	7.2139	0.08456	2927.2	3223.2	6.8428
400	0.30661	2957.9	3264.5	7.4670	0.25482	2955.5	3261.3	7.3793	0.09198	3016.1	3338.1	7.0074
500	0.35411	3125.0	3479.1	7.7642	0.29464	3123.4	3477.0	7.6779	0.09919	3104.5	3451.7	7.1593
600	0.40111	3297.5	3698.6	8.0311	0.33395	3296.3	3697.0	7.9456	0.11325	3282.5	3678.9	7.4357
700	0.44783	3476.3	3924.1	8.2755	0.37297	3475.3	3922.9	8.1904	0.12702	3464.7	3909.3	7.6855