

國立中央大學 111 學年度碩士班考試入學試題

所別： 機械工程學系 碩士班 熱流組(一般生)

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科目： 熱力學

所有題目皆為問答題，需寫完整計算過程。請按題號順序作答，避免被漏改。若您要先做後面題目，請先在答案本預留空間。

1. (10 %) Plot the pressure-volume and temperature-entropy diagrams for a Carnot cycle and explain the unique characteristics of four processes.
2. (10 %) List and explain the four energy contributions to the total energy of a steady-flow system.
3. (10 %) Calculate and discuss the effect of decreasing the room temperature for an air-conditioner on the best coefficient of performance (COP) with the following information: outdoor temperature 37°C and room temperature varies from 27°C to 23°C. Hint: relate the best COP with the Carnot refrigeration cycle
4. (10 %) In thermodynamics, we have the principle of increase of entropy. Does this mean that the entropy change of a system during any process cannot be negative or zero? Discuss this statement is correct or not with explanation.
5. (10 %) Explain the difference between the Kelvin-Planck statement and Clausius statement for the second law of thermodynamics.
6. (20 %) 請說明 2 種處理真實氣體混合物焓變化之方法
7. For a Brayton cycle,
 - (10 %) (a) 使用再生器如何影響循環之熱效率？為什麼？
 - (10 %) (b) 當壓力比很大時，使用再生器反而會降低循環之熱效率嗎？為什麼？
8. (10 %) A refrigeration system uses R-134a as the working fluid. If this refrigerator is to operate in an environment at 26°C, what is the minimum pressure to which the refrigerant should be compressed? Why?

Saturated refrigerant-134a—Temperature table

Temp., <i>T</i> °C	Specific volume, m ³ /kg			Internal energy, kJ/kg			Enthalpy, kJ/kg			Entropy, kJ/kg·K		
	Sat. press., <i>P</i> _{sat} kPa	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
20	572.07	0.0008160	0.036012	78.85	162.19	241.04	79.32	182.33	261.64	0.30062	0.62192	0.92254
22	608.27	0.0008209	0.033867	81.64	160.45	242.09	82.14	180.55	262.69	0.31012	0.61168	0.92180
24	646.18	0.0008260	0.031869	84.44	158.68	243.13	84.98	178.74	263.72	0.31959	0.60148	0.92107
26	685.84	0.0008312	0.030008	87.26	156.89	244.15	87.83	176.90	264.73	0.32905	0.59131	0.92036
28	727.31	0.0008366	0.028271	90.09	155.08	245.17	90.70	175.03	265.73	0.33849	0.58117	0.91967
30	770.64	0.0008421	0.026648	92.93	153.24	246.17	93.58	173.13	266.71	0.34792	0.57105	0.91897
32	815.89	0.0008477	0.025131	95.79	151.37	247.17	96.49	171.19	267.67	0.35734	0.56095	0.91829
34	863.11	0.0008535	0.023712	98.67	149.48	248.15	99.41	169.21	268.61	0.36675	0.55086	0.91760
36	912.35	0.0008595	0.022383	101.56	147.55	249.11	102.34	167.19	269.53	0.37615	0.54077	0.91692
38	963.68	0.0008657	0.021137	104.47	145.60	250.07	105.30	165.13	270.44	0.38554	0.53068	0.91622
40	1017.1	0.0008720	0.019968	107.39	143.61	251.00	108.28	163.03	271.31	0.39493	0.52059	0.91552