

國立臺北科技大學  
九十七學年度研究所碩士在職專班(含 EMBA)入學考試

能源與冷凍空調工程系碩士班

甲組：冷凍與空調原理試題

填准考證號碼

第一頁 共二頁

--	--	--	--	--	--

**注意事項：**

1. 本試題共【5】題，配分共 100 分。
2. 請按順序標明題號作答，不必抄題。
3. 全部答案均須答在試卷答案欄內，否則不予計分。

1. A building has a total cooling load of 368kW. The latent portion of the load is 90 kW. The space is to be maintained at 25°C db and 50% relative humidity. Outdoor air is at 38°C and 50% relative humidity, and 10% by mass of the air supplied to the space is outdoor air. Air is to be supplied to the space at 18°C. Assume sea level pressure and find:
  - (a) The minimum amount of air supplied to the space in m<sup>3</sup>/s (10%)
  - (b) The capacity, apparatus dew point, by pass factor, and SHF of the cooling coil. (10%)
2. (1) Please sketch and explain the variable water system design concept that chillers with constant flow is arranged to share the load equally. (10%)  
 (2) Please explain the meaning of "shading coefficient" for window heat gain calculation (10%)
3. The flow rate, head, and shaft power are related to the new and old speeds. They may be stated as equation (1). What is the value of the exponent a, b, c in equation (1) and explain the reasons? (10%)

$$\begin{aligned}\dot{Q}_n &= \dot{Q}_0 \left[ \frac{rpm_n}{rpm_0} \right]^a \\ \dot{H}_n &= \dot{H}_0 \left[ \frac{rpm_n}{rpm_0} \right]^b \dots\dots\dots(1) \\ \dot{W}_n &= \dot{W}_0 \left[ \frac{rpm_n}{rpm_0} \right]^c\end{aligned}$$

4. What is the volumetric efficiency of an eight-cylinder Vilter 458XL ammonia compressor operating at 1440 rpm when the saturated suction temperature is 0°C and the condensing temperature is 40°C? The bore and stroke of the compressor are 114 by 114mm. The catalog lists the refrigerating capacity at this condition as 720 kW.(20%)
5. A two-stage ammonia system using flash-gas removal and intercooling operates on the cycle shown in Fig. 2. The condensing temperature is 40°C. The saturation temperature of the intermediate-temperature evaporator is 0°C, and its capacity is 100 kW. The saturation temperature of the low-temperature evaporator is -40°C, and its capacity is 150 kW. Calculate the power required by the compressors, the heat rejection of condenser and COP of the system? Assume that refrigerant enters the low-stage and high-stage compressors as saturated vapor and leaves condenser without subcooling. (30%)

注意：背面尚有試題

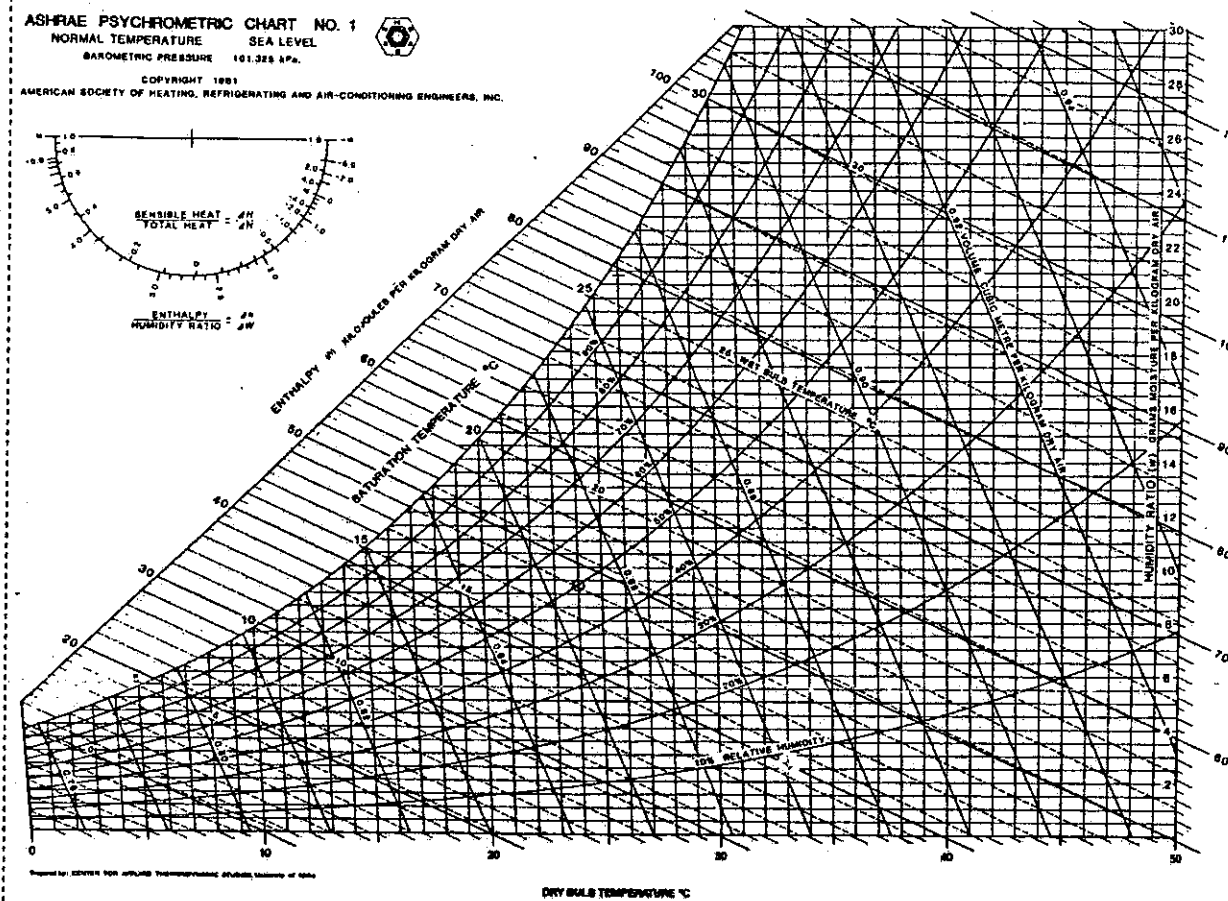


Figure 1. Psychrometric chart at sea level

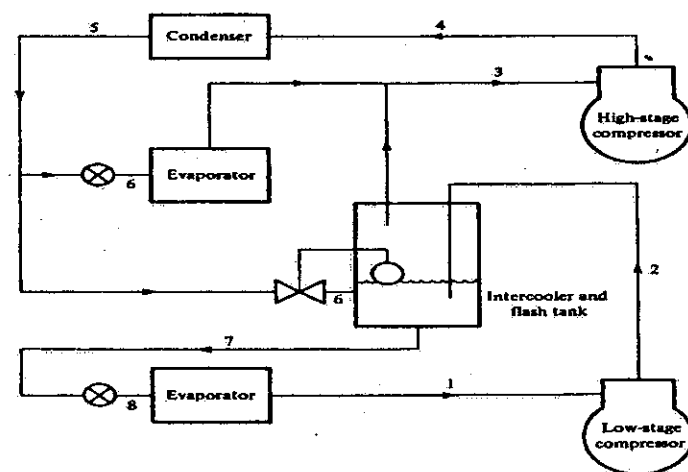


Figure 2 Two compressors and two evaporators operating with intercooling and flash-gas removal

Table 1 Properties of ammonia saturated liquid and vapor

Temp	Pressure	Volume (f)	Volume (g)	Enthalpy (f)	Enthalpy (g)	Entropy (f)	Entropy (g)
[C]	[MPa]	[m <sup>3</sup> /kg]	[m <sup>3</sup> /kg]	[kJ/kg]	[kJ/kg]	[kJ/K-kg]	[kJ/K-kg]
-40	0.0717	0.00145	1.55300	0.00	1389	0.0000	5.96
-35	0.0931	0.00146	1.21700	22.15	1397	0.0939	5.87
-30	0.1194	0.00148	0.96400	44.43	1404	0.1863	5.78
-20	0.1901	0.00150	0.62370	89.38	1419	0.3670	5.62
-15	0.2362	0.00152	0.50870	112.00	1425	0.4554	5.54
-10	0.2907	0.00153	0.41830	134.80	1432	0.5425	5.47
-5	0.3548	0.00155	0.34660	157.80	1437	0.6285	5.40
0	0.4294	0.00157	0.28930	180.80	1443	0.7133	5.33
5	0.5157	0.00158	0.24300	204.00	1448	0.7970	5.27
10	0.6150	0.00160	0.20540	227.40	1453	0.8796	5.21
15	0.7285	0.00162	0.17460	250.90	1457	0.9613	5.15
20	0.8575	0.00164	0.14920	274.60	1461	1.0420	5.09
30	1.1670	0.00168	0.11050	322.60	1467	1.2010	4.98
35	1.3510	0.00170	0.09563	346.90	1469	1.2800	4.92
40	1.5550	0.00173	0.08310	371.50	1471	1.3580	4.87

Table 2 Properties of superheated ammonia

Saturation = 0°C, p = 0.4294 MPa

Temp	Volume	Enthalpy	Entropy
[C]	[m <sup>3</sup> /kg]	[kJ/kg]	[kJ/K-kg]
75	0.3860	1624	5.922
76	0.3872	1627	5.929
77	0.3884	1629	5.935
78	0.3896	1631	5.942
79	0.3908	1633	5.948
80	0.3921	1636	5.955
81	0.3933	1638	5.961
82	0.3945	1640	5.968
83	0.3957	1643	5.974
84	0.3969	1645	5.981
85	0.3981	1647	5.987

Table 3 Properties of superheated ammonia

Saturation = 40°C, p = 1.5554 MPa

Temp	Volume	Enthalpy	Entropy
[C]	[m <sup>3</sup> /kg]	[kJ/kg]	[kJ/K-kg]
90	0.1048	1620	5.311
91	0.1052	1622	5.318
92	0.1056	1625	5.325
93	0.1060	1628	5.333
94	0.1064	1630	5.340
95	0.1068	1633	5.347
96	0.1072	1636	5.354
97	0.1075	1638	5.362
98	0.1079	1641	5.369
99	0.1083	1644	5.376
100	0.1087	1646	5.383
101	0.1091	1649	5.390
102	0.1095	1651	5.397