

國立臺北科技大學  
九十九學年度研究所碩士在職專班入學考試

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

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**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. Q&A :**

- (1) Please explain the meaning of "thermal mass effect"(5%)
  - (2) Please explain the meaning of shading coefficient (SC). (5%)
2. Please explain the environmental factors that affect a person's thermal comfort? (10%)
3. A building has a total cooling load of 500kW. The sensible portion of the load is 378 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%)
4. A standard vapor-compression cycle developing 100 kW of refrigeration using refrigerant ammonia operates with a condensing temperature of 40°C and an evaporating temperature of 0°C. Calculate (a) the refrigerating effect in kilojoules per kilogram, (b) the circulation rate of refrigerant in kilograms per second, (c) the power required by the compressor in kilowatts, (d) the coefficient of performance, (e) the volume flow rate measured at the compressor suction, (f) the power per kilowatt of refrigeration, and (g) the compressor discharge temperature. (30%)

5. What is the volumetric efficiency of an eight-cylinder Vilter 458XL ammonia compressor operating at 1200 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 590 kW. (30%)

Table 1 Properties of ammonia saturated liquid and vapor

Temp [C]	Pressure [MPa]	Volume (f) [m <sup>3</sup> /kg]	Volume (g) [m <sup>3</sup> /kg]	Enthalpy (f) [kJ/kg]	Enthalpy (g) [kJ/kg]	Entropy (f) [kJ/K-kg]	Entropy (g) [kJ/K-kg]
-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
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
40	1.5550	0.00173	0.08310	371.50	1471	1.3580	4.87

Table 2 Properties of superheated ammonia

Saturation = 0°C, p= 0.4294MPa

Temp [C]	Volume [m <sup>3</sup> /kg]	Enthalpy [kJ/kg]	Entropy [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=1.5554MPa

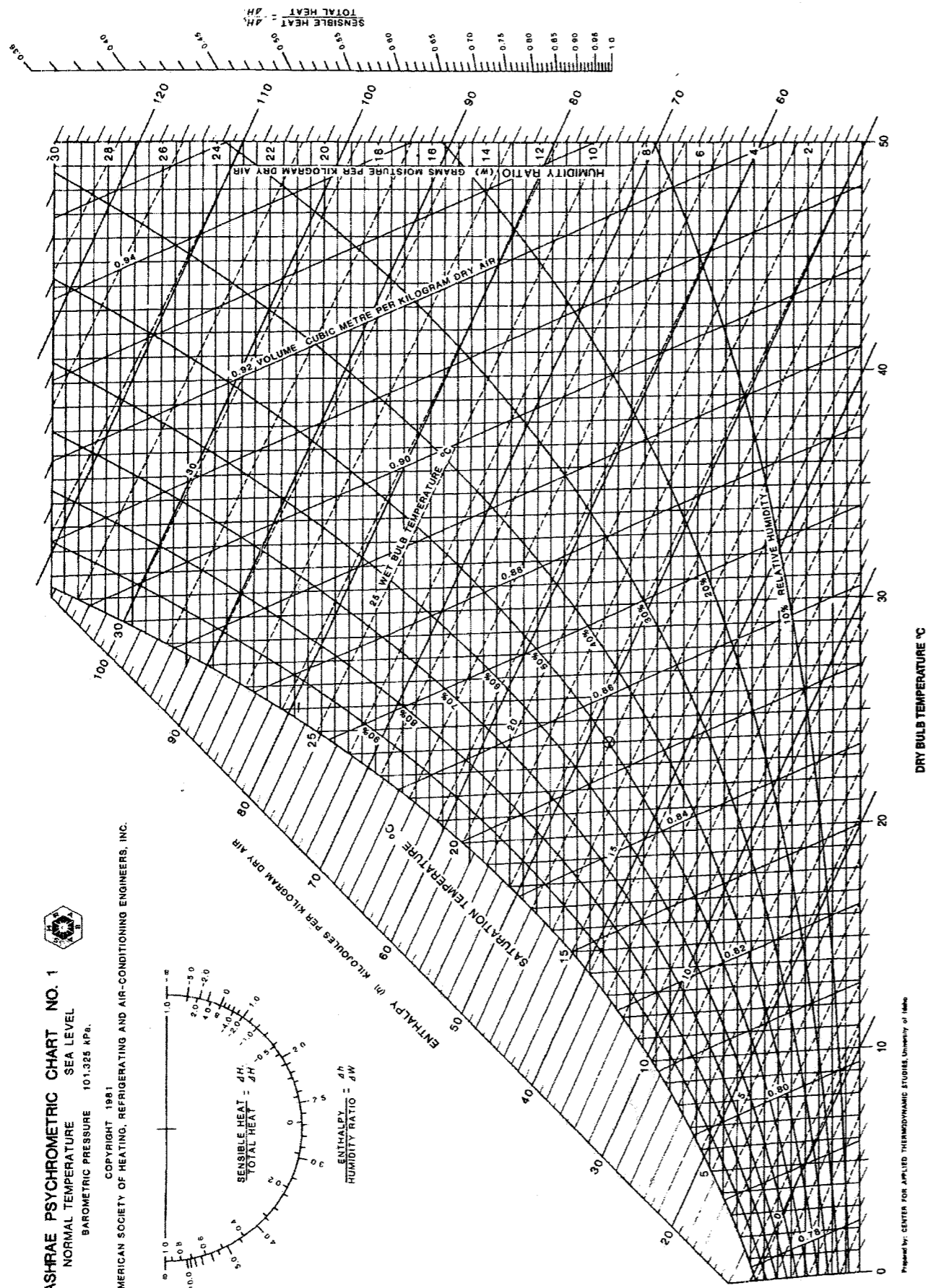
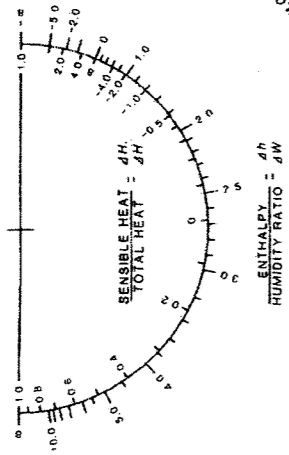
Temp [C]	Volume [m <sup>3</sup> /kg]	Enthalpy [kJ/kg]	Entropy [kJ/K-kg]
90	0.1048	1620	5.311
91	0.1052	1622	5.318
92	0.1056	1625	5.325
93	0.1060	1628	5.333
94	0.1064	1630	5.340
95	0.1068	1633	5.347
96	0.1072	1636	5.354
97	0.1075	1638	5.362
98	0.1079	1641	5.369
99	0.1083	1644	5.376
100	0.1087	1646	5.383

注意：背面尚有試題

**ASHRAE PSYCHROMETRIC CHART NO. 1**  
 NORMAL TEMPERATURE SEA LEVEL  
 BAROMETRIC PRESSURE 101.325 kPa



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Prepared by: CENTER FOR APPLIED THERMODYNAMIC STUDIES, University of Idaho

DRY BULB TEMPERATURE °C

Figure 1. Psychrometric chart at sea level