

# 國立臺北科技大學九十八學年度碩士班招生考試

系所組別：1431 能源與冷凍空調工程系碩士班丙組

## 第二節 熱力學 (選考) 試題

第一頁 共二頁

### 注意事項：

1. 本試題共五題，配分共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

一、(20%) Answer the following problems.

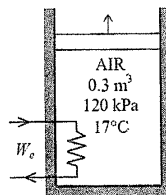
1. (10%) Consider two identical rooms, one with a refrigerator in it and the other without one. If all the doors and windows are closed, will the room that contains the refrigerator be cooler or warmer than the other room? Why?
2. (10%) What is the difference between energy, entropy and exergy?

二、(20%) An insulated piston-cylinder device initially contains 300 L of air at 120 kPa and 17 °C. Air is now heated for 15 min by a 200-W resistance heater placed inside the cylinder. The pressure of air is maintained constant during this process. Determine the entropy change of air by assuming (a) constant specific heats and (b) variable specific heats. (The gas constant of air is  $R = 0.287 \text{ kPa m}^3/\text{kg K}$ , the properties of air are shown in Table A1)

$$s_2 - s_1 = c_{v,avg} \ln \frac{T_2}{T_1} + R \ln \frac{v_2}{v_1}$$

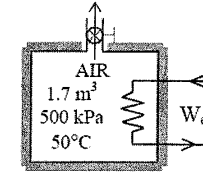
$$s_2 - s_1 = c_{p,avg} \ln \frac{T_2}{T_1} - R \ln \frac{P_2}{P_1}$$

$$s_2 - s_1 = s_2^e - s_1^e - R \ln \frac{P_2}{P_1} \quad (\text{kJ/kg} \cdot \text{K})$$

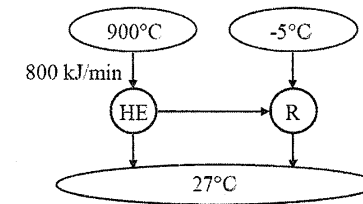


三、(20%) An insulated 1.7-m<sup>3</sup> rigid tank contains air at 500 kPa and 50°C. A valve connected to the tank is now opened, and air is allowed to escape until the pressure inside drops to 200 kPa. The air temperature during this process is maintained constant by an electric resistance heater

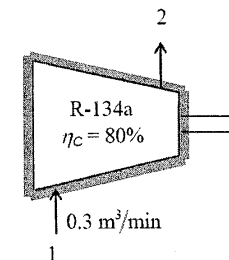
placed in the tank. Determine the electrical work done during this process.



四、(20%) A Carnot heat engine receives heat from a reservoir at 900°C at a rate of 800 kJ/min and rejects the waste heat to the ambient air at 27°C. The entire work output of the heat engine is used to drive a refrigerator that removes heat from the refrigerated space at -5°C and transfers it to the same ambient air at 27°C. Determine (a) the maximum rate of heat removal from the refrigerated space and (b) the total rate of heat rejection to the ambient air.



五、(20%) Refrigerant-134a enters an adiabatic compressor as saturated vapor at 120 kPa at a rate of 0.3 m<sup>3</sup>/min and exits at 1-MPa pressure. If the isentropic efficiency of the compressor is 80 percent, determine (a) the temperature of the refrigerant at the exit of the compressor and (b) the power input, in kW. Also, show the process on a T-s diagram with respect to saturation lines.



注意：背面尚有參考資料

