國立臺北科技大學九十五學年度碩士班招生考試

系所組別：1421 能源與冷凍空調工程系碩士班乙組

第二節 熱力學（選考）試題

填 准 考 證 號 碼

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。

1.**(20%)** Answer the following problems

a、 **(10%)** It is common knowledge that the temperature of air rises as it is compressed. An inventor thought about using this high-temperature air to heat buildings. He used a compressor driven by an electric motor. The inventor claims that the compressed hot-air system is 25 percent more efficient than a resistance heating system that provides an equivalent amount of heating. Is this claim valid, or is this just another perpetual-motion machine? Explain.

b、 **(10%)** What mechanism can cause the entropy of a closed system to change? Is it possible for the entropy change of a closed system to be zero during an irreversible process? How about the case of an open system? Explain.

2.**(15%)** An insulated rigid tank is divided into two equal parts by a partition. Initially, one part contains 6 kg of an ideal gas at 800 kPa and 50℃, and the other part is evacuated. The partition is now removed, and the gas expands into the entire tank. Determine the final temperature and pressure in the tank.

3.**(20%)** During an experiment conducted in a room at 25℃, a laboratory assistant measures that a refrigerator that draws 2 kW of power has removed 30,000 kJ of heat from the refrigerated space, which is maintained at -30℃. The running time of the refrigerator during the experiment was 20 min. Determine if these measurements are reasonable.

4.**(20%)** A 50-kg copper block initially at 80℃ is dropped into an insulated tank that contains 120 L of water at 25℃. Determine the final equilibrium temperature and the total entropy change for this process. ($C_{p,\,water}$= 4.18 kJ/kg.K, $C_{p,copper}$= 0.386 kJ/kg.K)

5.**(25%)** Air is compressed steadily by a reversible compressor from an inlet state of 100 kPa and 300 K to an exit pressure of 900 kPa. Determine the compressor work per unit mass for (a) isentropic compression with k= 1.4, (b) ideal two-stage compression with intercooling with n= 1.3, (c) isothermal compression, and (d) ideal two-stage compression with intercooling with a polytropic exponent of 1.3.