

air 2-1

國立臺北科技大學

九十四學年度冷凍空調工程系碩士班入學考試

熱力學試題

第一頁 共一頁

填准考證號碼

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注意事項：

1. 本試題共五題，配分共100分。
2. 請按順序標明題號作答，不必抄題。
3. 全部答案均須答在答案卷之答案欄內，否則不予計分。

1. (30%) Answer the following problems
 - a. (6%) What are the differences between Energy, Entropy and Exergy?
 - b. (6%) 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?
 - c. (6%) In a refrigerator, heat is transferred from a lower-temperature medium (the refrigerated space) to a higher-temperature one (the kitchen air). Is this a violation of the second law of thermodynamics? Explain.
 - d. (6%) Does a heat engine that has a thermal efficiency of 100 percent necessarily violate (a) the first law and (b) the second law of thermodynamics? Explain.
 - e. (6%) Is a process that is internally reversible and adiabatic necessarily isentropic? Explain.

2. (20%) A piston-cylinder device initially contains air at 150 kPa and 27°C. At this state, the piston is resting on a pair of stops, and the enclosed volume is 400 L. the

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mass of the piston is such that a 350 kPa pressure is required to move it. The air is now heated until its volume has doubled. Determine (a) the final temperature, (b) the work done by the air, and (c) the total heat transferred to the air. ($C_{p,air}=1.005$ kJ/kgK, $C_{v,air}=0.718$ kJ/kgK)

3. (20%) A Carnot heat engine receives heat at 750 K and rejects the waste heat to the surrounding at 300 K. The entire work output of the heat engine is used to drive a Carnot refrigerator which removes heat from the cooled space at -15°C at a rate of 400 kJ/min and rejects it to the same surrounding at 300 K. Determine (a) the rate of heat (kW) supplied to the heat engine and (b) the total rate of heat rejection (kW) to the surrounding.
4. (15%) A 50-kg iron block and a 20-kg copper block, both initially at 80°C , are dropped into a large lake at 15°C . Thermal equilibrium is established after a while as a result of heat transfer between the blocks and the lake water. Determine the total entropy change for this process. ($C_{p,iron}=0.45$ kJ/Kg.K, $C_{p,copper}=0.386$ kJ/Kg.K)
5. (15%) (a). Starting with the Tds relations, obtain the two relations for entropy change of ideal gases under the constant-specific-heat assumption. (b). Prove that the two entropy-change relations for ideal gases under the constant-specific-heat assumption are equivalent.