

國立中央大學98學年度碩士班考試入學試題卷

所別：機械工程學系碩士班 丙組(熱流) 科目：熱力學 共 2 頁 第 1 頁

所別：能源工程研究所碩士班

\*請在試卷答案卷(卡)內作答

請按題號順序作答，避免被漏改。若您要先做後面題目，請先在答案本預留空間。

選擇題為單選或複選請自行判斷，必須全部答對才給分。

1. A worker pressurizes a rigid pipe (30 mm inside diameter, 20 m long) with dry air to check for leaks. The temperature and absolute pressure of the air in the pipe are 35 °C and 205 kPa. The worker returns 24 hours later and the absolute pressure has dropped to 183 kPa, while the air temperature inside the pipe has decreased to 21 °C. Universal gas constant is  $287 \text{ Pa}\cdot\text{m}^3/(\text{kg}\cdot\text{K})$ .  
(5 %) (a) Would we conclude that the pipe has leak merely because the pressure decreases fro 205 to 183 kPa? Why?  
(10 %) (b) If the pipe has leaked, calculate the mass of air that has leaked from the pipe.
2. (20 %) A closed container maintained at 25 bars is subdivided into two sections by an insulated partition. One section contains 0.5 kg of water at 20 °C, while the other contains saturated steam. Determine the amount of steam present if, on removing the partition, the final state of the system is a wet mixture with 20 percent quality. The following data for water may be helpful: (1) At  $P=25 \text{ bars}$ ,  $T_{\text{sat}} = 224 \text{ °C}$ ,  $u_{\text{g}} = 2603.1 \text{ kJ/kg}$ ,  $u_{\text{f}} = 959.11 \text{ kJ/kg}$ . (2) At  $T=20 \text{ °C}$ ,  $P_{\text{sat}} = 0.024 \text{ bars}$ ,  $u_{\text{g}} = 2402.9 \text{ kJ/kg}$ ,  $u_{\text{f}} = 83.95 \text{ kJ/kg}$ .
3. (3 %) Which isentropic relations are correct, where  $T$ =temperature,  $v$ =specific volume,  $P$ =pressure,  $k$ =ratio of specific heat (a)  $Tv^k = \text{constant}$  (b)  $Tv^{k-1} = \text{constant}$ , (c)  $TP^{1-k} = \text{constant}$ , (d)  $Pv^k = \text{constant}$
4. (5 %) Consider the entropy balance of a tank with open valve with outside, what will affect the entropy change of the tank?  
(a) tank volume, (b) heat transfer to the tank, (c) mass flow in/out through the valve, (d) entropy generation due to friction of the mass flow.
5. (4 %) Refrigerator is a cyclic device that \_\_\_\_\_ from a cold space and \_\_\_\_\_ to a warm space. The direction of heat transfer is from \_\_\_\_\_ to \_\_\_\_\_.
6. (5 %) Define and explain the first law efficiency and second law efficiency for a heat engine.
7. (6 %) What is the difference in thermodynamic process between spark-ignition and compression-ignition engines?
8. (12 %) Briefly describe the basic four processes in terms of each component and thermodynamic characteristics of the ideal Rankine cycle.
9. (6 %) Why do we need *cascade* or *multistage* refrigeration systems?
10. (4%) (a) Write down the definition of constant pressure specific heat  $c_p$  and constant volume specific heat  $c_v$ .  
(2%) (b) Is  $c_p \geq c_v$  or  $c_p \leq c_v$ ?  
(4%) (c) Explain physically the result of (b).
11. (4 %) (a) What is the working principle of evaporating cooling?  
(4 %) (b) Describe one application of evaporating cooling.

參考用

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12. (6%) Which statements below are correct?

- (a) The van't Hoff equation describes the dependence of the equilibrium constant on temperature.
- (b) The van't Hoff equation describes the dependence of the equilibrium constant on pressure.
- (c) For an exothermic reaction, the equilibrium constant decreases as temperature is increased.
- (d) For an exothermic reaction, the equilibrium constant decreases as pressure is increased.

參考用

注意：背面有試題