

國立成功大學

110學年度碩士班招生考試試題

編 號：136、164

系 所：航空太空工程學系  
能源工程國際碩士學位學程

科 目：熱力學

日 期：0202

節 次：第 1 節

備 註：不可使用計算機

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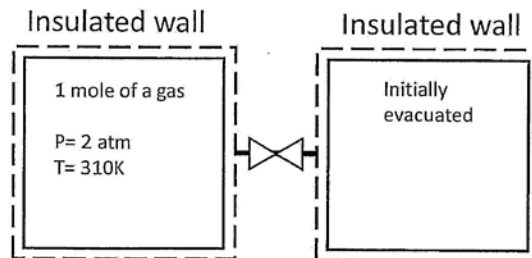
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第1頁，共 2 頁

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- Write out the meanings of the following terms: (10%)
  - Zeroth law of thermodynamics
  - Equilibrium state
  - Isentropic process
  - Isolated system
  - Enthalpy
  - Quasiequilibrium process
  - Second law efficiency
  - Extensive properties
  - Intensive Properties
  - Isobaric process
- Show that
  - A system undergoes a cycle in violation of the Kelvin-Planck statement of the 2<sup>nd</sup> Law. A violation of the Clausius statement of the 2<sup>nd</sup> Law is a consequence. (10%)
  - The efficiency of a reversible cycle will always be greater than the efficiency of an irreversible cycle operating between the same two thermal reservoirs. (10%)
- A rigid insulated tank has two equal-volume compartments separated by a valve. Initially, one is evacuated and the other holds a gas at a know condition. The valve is opened and the gas fills the entire volume. Determine the final temperature (5%), pressure (5%), and evaluate the exergy destruction (10%). ( $T_o=298.15\text{K}$ ,  $P_o = 1 \text{ atm}$ , and the Universal gas constant  $R=8.314\text{J/K-mole}$ )



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4. Consider a steam power plant that operates on an ideal reheat-regenerative Rankine cycle with one open feedwater heater, and one reheater. Steam enters the turbine at 15 Mpa and 600°C and is condensed in the condenser at a pressure of 10 kPa. Some steam is extracted from the turbine at 4 Mpa for the closed feedwater heater, and the remaining steam is reheated at the same pressure to 600°C. The extracted steam is completely condensed in the heater and is pumped to 15 Mpa before it mixes with the feedwater at the same pressure. Steam for the open feedwater heater is extracted from the low-pressure turbine at a pressure of 0.5 MPa. (a) Please show in both a schematic diagram of the system and a T-s diagram of the cycle with the temperature and pressure values. (b) Describe the difference between open and closed feedwater heaters. (20%)
5. Evaluate the isothermal changes in internal energy, enthalpy, and entropy for an ideal gas. (15%)

6. Consider the following EOS, expressed in terms of reduced pressure and temperature:

$$Z = 1 + \frac{P_r}{14 T_r} \left(1 - \frac{6}{T_r^2}\right)$$

What does this equation predict for enthalpy departure and entropy departure from the ideal gas value at the state  $P_r = 0.4$  and  $T_r = 0.9$ ? (15%)